AN ANALYSIS OF INDIGENOUS AGRICULTURAL KNOWLEDGE SYSTEMS

IN THE ZIMBABWE SECONDARY SCHOOL AGRICULTURE

CURRICULUM: PROSPECTS AND OPPORTUNITIES

by

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DECLARATION

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An Analysis of Indigenous Agricultural Knowledge Systems in the Zimbabwe Secondary School Agriculture Curriculum: Prospects and Opportunities.

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

28 January 2020

SIGNATURE **DATE**

DEDICATION

This thesis is dedicated to my parents; my mother, Noria and late father, Jemitias Pedzisai, for inspiring this study. My beloved wife, Jesta, and daughters; Wedzerai, Simbiso, Chiedza, Nyaradzo and twin Paidamoyo, and my only son and last born, twin Paidashe all who should never be forgotten for exercising unrelenting patience during my commitment to this research study.

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ABSTRACT

This study sought to make an analysis of the representation of aspects of Indigenous Agricultural Knowledge Systems (IAKS) in the Zimbabwe secondary school agriculture curriculum with a view to explore prospects and opportunities for their inclusion in the curriculum. The study adopted a qualitative multiple case study research design to analyse components of IAKS (knowledge and practices) that were currently included in Zimbabwe's secondary school agriculture curriculum and investigate those that still existed within the communities studied but outside the curriculum. A comparison of curriculum coverage and community IAKS (knowledge and practices) revealed a curriculum gap which was then used to suggest those components of IAKS that still needed to be included in the Zimbabwe secondary school agriculture curriculum. The study then proposed approaches for the effective inclusion of IAKS before establishing the benefits of their inclusion in the curriculum in question. Lastly, the study examined the challenges that schools may face when including IAKS in the Zimbabwe secondary school agriculture curriculum.

The study adopted the multiple case study research design of five research sites in order to examine the relationships between the modern institutions and the Indigenous communities they work with. The cases included two high schools and local farmers from the areas surrounding them, and three tertiary institutions involved in agricultural eduation (training of teachers and agricutlural demonstrators). These different institutions, modern and Indigenous communities, were subunits which form a system whose parts were interrelated. Hence, in this study, structure and agency were linked by examining the interplay between them over time with respect to inclusion of IAKS Systems in the Zimbabwe secondary school agriculture curriculum.

The research methodology was underpinned by decolonial theory. The theory informed the choice and use of 'one on one' semi-structured in-depth interviews with Agriculture teachers, lecturers in tertiary institutions, Agriculture Extension Officers and local farmers from areas surrounding the two participating high schools. Intensity sampling was used to come up with the study participants except for local farmers who were selected using the snowball sampling technique. The study also employed 'on-the-spot observation' of farming activities as practiced at both high schools, by the local farmers and the tertiary institutions. Document analysis of the Zimbabwe Agriculture Policy, National Agriculture syllabi of the Secondary schools and tertiary institutions was done to sift the intended and transacted curriculum on

IAKS aspects. The document analysis extended to Agriculture teachers' schemes of work and students' written work to expose the transacted curriculum with respect to integration of IAKS aspectts into the agriculture curriculum.

The collected data were analysed by identifying, analysing and reporting patterns (themes) within data as per Braun and Clarke's (2006) thematic analysis approach. The study revealed that, although the indigenous communities studied are rich in aspects of IAKS, the Zimbabwe secondary school agriculture curriculum was deficient in Indigenous agricultural knowledge and practices due to the continuing hegemony of Western knowledge.

In an effort to decolonise the curriculum, I propose the need to incorporate more IAKS aspects into the current Zimbabwe secondary school agriculture curriculum to make it contextually relevant. This can be achieved through the application of a Participatory Curriculum Development model that I have designed which engages all stakeholders throughout the curriculum development process. I also suggest the need to develop a revised pro-Indigenous knowledge agricultural policy and to undertake further research into decolonising, indigenising and Africanising agricultural curricula beyond the secondary school (primary education as well as tertiary education) as well as doing the same across all subject disciplines. Indigenous small-scale farmers, who are the holders of Indigenous agricultural knowledge, should be utilised in both the formal education processes as well as in the demonstration of indigenous agricultural practices (practical application). Educational support materials on aspects of IAKS for use by educators in the classroom context should be produced since inclusion is not just about curriculum content but also about relevant teaching and learning resource materials. I further suggest research on the development and improvement of potential Indigenous crops, livestock breeds, fruit trees and forestry trees and on the application of Indigenous sustainable agriculture methods.

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CHAPTER ONE: INTRODUCTION AND CONTEXT OF THE STUDY

1.1 BACKGROUND OF THE STUDY

1.1.1 My source of inspiration

I am an Indigenous African academic born and bred in Chirumanzu District in the Midlands province in Zimbabwe, a country in Southern Africa. My initial source of inspiration for Indigenous farming knowledge originated from my father, Jemitias Pedzisai Manyerekete, and my interactions, relationships and experiences with the rural community of Chirumanzu district. I spent most of my childhood in our rural home where my father was an Agriculture Demonstrator (adulterated to *mudhomeni* in Shona), currently referred to as an Agriculture Extension (AGRITEX) Officer. Even during the years that I attended teacher training at Gweru Teachers College, I would spend my school holidays in our rural home further extending my observations and interactions with the community with regard to Indigenous Agricultural Knowledge Systems (IAKS). Through these initial experiences, I learnt that there are agricultural practices which Indigenous Africans have known and practised for generations before colonialism. These Indigenous land use and agricultural practices are dependent on centuries of experience, intimated understanding of the social and biophysical social environments of the Indigenous people and informed experiments (Buckridge, 2012; Mapara, 2009; Melchias, 2001).

The Agriculture Extension training which my father had received at Makoholi Alvord Training Centre in Zimbabwe basically emphasised Western farming methods, that is, the agricultural knowledge of the colonial masters, which according to Mapira and Mazambara (2013), despised Indigenous farming practices. His professional training obliged him to impart the Western farming knowledge he had received during his training to the local community under his charge. The community were forced to forgo their own Indigenous farming practices while adopting the farming practices of the British colonial masters. Mutekwe (2015:1295) observes that:

> *Modern forms of schooling were introduced and expanded phenomenally and with it came notions of cultural imperialism, which tended to denigrate many if not all forms of Indigenous knowledge education systems. Some Indigenous knowledge systems*

were regarded as primitive, pagan and heathenish. Some forms of such Indigenous knowledge were even de-campaigned as non-knowledge.

Despite his Western training, my father in defiance taught the communities he serviced some Indigenous agricultural practices. Some of the Indigenous farming practices my father imparted to the community included the exclusive use of organic manure in fields and gardens, use of grass buffer strips to control erosion in the fields and other economically sustainable Indigenous farming methods. Of note was his knowledge of Indigenous treatment of some livestock ailments using locally available traditional herbs. These included the use of the chisvosve (Sabi star/ *Adenium obesum*) and finely ground ashes of burnt chidhanana (rock lizard) to treat tsanga (opthalmia) and other eye infections, the use of gavakava (wild aloe species) to treat stomach ailments of livestock, the use of the muvengahonye (maggot killer plant/ *Canthium huillense*) as a screw-worm remedy and mutengeni (sourplum/ *Ximenia caffra*) to treat animal wounds. He would impart this knowledge to the community in addition to the Western agricultural knowledge that he was supposed to spread. His knowledge also effervesced among his workmates most who would constantly consult him. However, such teachings were against the expectations of the colonial masters such that they often referred to him as a 'rebel'. As a result, he became the enemy of the District Land Development Officer (LDO) resulting in him losing his job. He was later to become a political activist in support of the liberation struggle against colonialism in Zimbabwe.

As I grew up our teachers taught us gardening at primary and secondary school. Both the primary and secondary schools I attended were mission schools run by the Catholics. The clergy required us to learn Western farming practices as a way of improving food security in the communities we hailed from. However, the agricultural teachings conflicted with our home experiences. Today I recapitulate that their aim was to condemn and marginalise Indigenous farming practices.

After completing secondary school, I joined the then Gwelo (now Gweru) Teachers College in the Midlands province to train as an Agriculture teacher. The course was a split programme which required us to first receive a two-year practical skills course in Agriculture at Mlezu Agriculture College in Chiwundura District in the Midlands Province of Zimbabwe, before undergoing a third year of professional training at Gweru Teachers College. At Mlezu Agricultural College some of our lecturers, through the module 'Intermediate Technology', encouraged us to use some traditional farming practices, particularly Indigenous veterinary practices to treat animal ailments when we were deployed for teaching practice, especially to rural secondary schools.

After graduating from Gweru Teachers College I taught Agriculture in two rural Catholic mission high schools. Though there was meager representation of Indigenous Agricultural Knowledge Systems (IAKS) in the school curriculum, I had to apply IAKS in my teaching. My students, who came from various districts and urban areas, further exposed me to several IAKS practices. These were represented in their practical agriculture activities and all forms of written work in agriculture. The written work included practical reports, practical projects, theory tests and exercises. I also went through a similar experience as an Ordinary Level Agriculture examiner. My experience as an Agriculture examiner revealed that candidates' responses that acknowledged IAKS were often viewed as inappropriate and thus were rejected in the national examinations' evaluation criteria. Such responses were considered alien to the curriculum. That state of affairs evoked feelings of resentment in me. I considered the examination criterion to be flawed since the candidates were denied answers that applied to their lived experiences, some of which had been tried and tested over centuries.

My last source of inspiration to carry out this research came from a literature search. Since becoming a member of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) - Zimbabwe Chapter in the year 2011, the conferences introduced me to such prolific Indigenous Knowledge Systems (IKS) writers like Meshach Bolaji Ogunniyi, Catherine A.Odora-Hoppers, George J Sefa Dei, Gloria Emeagwali, Mishack T Gumbo, Joseph Zano Zvapera Matowanyika, Jerome Alvin Hammersmith, Soul Shava, Jacob Mapara, Edward Shizha, Olugbemiro J. Jegede and Glen S. Aikenhead among many others. It was also through personal interaction with Professor Joseph Zano Zvapera Matowanyika and Jacob Mapara, my colleagues at Chinhoyi University of Technology working in the field of Indigenous knowledge systems, that my interest to carry out this study blossomed to fruition.

I came to accept the assertions by Kaya and Seleti (2014), Tanyanyiwa and Chikwanha (2011), Mapara (2009), Eyong (2007), Odora-Hoppers (2006) and Emeagwali (2003) who concur that, although marginalised during the colonial and neo-colonial eras, some of the IKS practices still continue to be alive. This kind of resilience of IKS implies that the community and the students still uphold IAKS concepts and practices. Some teachers employ some of these in their teaching of the subject of Agriculture, even if they are not represented in the curriculum (Pedzisai, 2013).

Indigenous Knowledge Systems (IKS) encompass the skills, experiences and insights of people applied to maintain or improve their livelihoods (World Bank, 1998). It would appear that the prime component of the knowledge system of any country is its Indigenous knowledge. I came to the realisation that this could be the reason why the same Western ideologies that dominated and overshadowed IAKS are coming back having appropriated the same practices, clothed under the banner of Western sponsored non-governmental organisations, but labelling them as 'new innovations '. I am convinced that these were the same Indigenous innovative farming practices that were appropriated and repackaged as new knowledge and practices. This could be the reason why the World Bank (1998) has consistently valued and embraced IKS as a good thing stating that it should form part of Africa's development agenda (Seroto, 2014). I also got meditated by the assertion by Kayira (2013:1) who observes that:

> *Colonialism goes beyond territorial conquest: it affects one's epistemological stance, worldviews and perceptions ... with Education systems in many countries in southern Africa continue to be grounded in Western viewpoints, marginalising local Indigenous ways of knowing.*

In this study I question why those local farming practices which have stood resilient despite colonial and neo-colonial subjugation, domination and arrogance, should not be accorded equal status with Western practices in the Zimbabwe Secondary School Agriculture Curriculum (ZSSAC). This is especially significant given that the curriculum in question is an African school curriculum in the post-colonial era. I also question why one knowledge system, Western knowledge, can be so domineering to the extent that other worldviews, in this case the Indigenous science worldview of Zimbabweans, are forced to see knowledge through the Western eye. This state of affairs marginalises Indigenous knowledge, a knowledge that is based on tribal living experience (Chiang and Lee, 2015). However, unlike the Western worldview, Indigenous Knowledge Systems (IKS) are accommodative of other worldviews (Smith, 1999; Kincheloe and Semali, 1999) justifying the prospect of harmonising Western and Indigenous farming practices in the ZSSAC. I conclude this section by expressing my strong contention and conviction that the ZSSAC should recognise the richness of IAKS and their positive contribution to sustaining and making resilient Indigenous people's culture and instilling pride in the learners.

1.2 PHASES IN ZIMBABWE'S AGRICULTURE SYSTEM

Three phases aptly mark the developments in agriculture in the Zimbabwe education system. These phases are the pre-colonial (before 1890), colonial (1890-1980) and postcolonial (1980 to date) phases. Below I discuss IAKS representation and practices in the agriculture school curriculum in Zimbabwe.

1.2.1 Pre-colonial phase

Education has existed for as long as human beings started living in their societies in Africa (Mukandawire, 2011; Peresuh and Nhundu, 1999). Precolonial education is referred to as Indigenous African education or traditional African education (Mukandawire, 2011). This education existed in Africa before European colonisation. Education during the pre-colonial era was basically informal in nature and a life-long process whereby every individual acquired knowledge, attitudes, values and skills from daily experiences within one's lived environment for their own survival (Tanyanyiwa and Chikwanha, 2011; Peresuh and Nhundu, 1999). Hence, it was wholly characterised by IKS. The young received the informal curriculum in agriculture through observation and practice. Indigenous farming practices were taught to all young Indigenous Zimbabweans (Mapara 2009; Matowanyika 1999).

The young were equipped with skills on how to survive in life by adapting to the environment through experiences and instructions from the elders (Mukandawire, 2011). Agriculture was one such activity that gave survival skills to the young. The local farming practices taught to the young had been developed by the community after millennia of interacting with their environment (Buckridge, 2012; Mapara, 2009: 137; Melchias, 2001). The learning was holistic as it appealed to the metaphysical world also. Those with farming acumen would be developed into agriculture experts called hurudza.

Kramer (1987) claims that Indigenous farmers were farming extensively using a system of rotational farming called shifting cultivation and pastoralism. He regards these as low yielding extensive methods of crop and animal production. Beach (1983) and Bourdillon (1982) state that Indigenous Zimbabweans grew traditional grain crops and kept livestock for nearly 2000 years before colonisation. The major crops grown were mhunga (finger millet/ bulrush millet), and mapfunde (sorghum). The chief legume they grew was nyemba (cowpeas). Cultivation also included a several Indigenous vegetables such as manhanga (pumpkins) and magaka (cucurbits). Grain crops were the most important and most extensively grown crops. Life revolved around their production which contributed immensely both to food security and the nature of social relations among the Indigenous communities (Bourdillon in Tavuyanago, Mutami and Mbenene, 2010). Seed broadcasting, hoe tillage (a light scratching of the ground so as not to dislodge the topsoil), multiple cropping, growing of grain crops and use of herbs to treat plant and animal pests and diseases are some of the key aspects of Indigenous farming practices in Zimbabwe (Pedzisai, 2013).

The Indigenous Zimbabweans kept mombe (cattle), makwai (sheep), mbudzi (goats), mbongoro (donkeys) and huku (chickens) for food security and religious purposes (Beach, 1983). The presence of large tracts of land promulgated the farmers to use extensive agricultural methods. Hence, pastoralists moved freely in search of grazing land. Shifting cultivation became the order of the day. This means that the farmers did not use a lot of inputs to keep the land fertile. Once land was exhausted, or they wanted to increase yields, they would simply open a new field (Beach 1983; Bourdillon 1982; Tavuyanago, Mutami and Mbenene 2010). Shifting cultivation thus allowed cultivated land to return to bush and later woodland through ecological succession, thereby avoiding prolonged periods of bare soil.
Pre-colonial agriculture was characterised by farming techniques which controlled soil erosion. For instance, thick, mixed plantings of leafy crops ensured that the crops formed a vegetative layer over the ground surface, while roots of crops anchored the soil particles together to reduce soil erosion (Kramer, 1987).

1.2.2 Colonial phase

The colonial phase, which covers the period 1890 to 1980, saw the denigration of IAKS by Western farming practices in favour of the latter (Hill and Katerere, undated). Hill and Katerere (undated) went on to observe that, beginning with the invasion in 1890, British colonists enforced restrictive land legislation which dispossessed the Indigenous Zimbabweans of much of the land. According to Mapira and Mazambara (2013), the Western colonisers enforced laws which subjugated the Indigenous Zimbabweans and marginalised their Indigenous agricultural practices. IAKS were despised in order to promote Western farming practices. However, modern research has demonstrated that IAKS are neither inferior nor backward as they were derived from centuries of accurate observation and experiments (Mapira and Mazambara, 2013; Ward, 1989). Rarely did the colonisers consider the merits of IKS and they even neglected the fact that African children in the pre-colonial period learnt what they lived (Mukandawire, 2011).

During the colonial era, the agriculture curriculum in Zimbabwe emphasised Western farming practices. The colonial government viewed Indigenous farmers as children who had to undergo intensive farmer training programmes for them to achieve the status of adulthood (Mudege, 2008). The colonisers aimed at a total abandonment of Indigenous farming methods which they regarded as backward. For instance, the award of a Master Farmers Certificate to Indigenous Zimbabwean was based on their abandonment of native farming practices and to adopt Western farming practices. This is well specified in the contents of the certificate in Figure 1 below.

NATIVE AFFAIRS DEPARTMENT
SOUTHERN RHODESIA

Master of Tillage Certificate

This is to Certify that

PAUL 10530 GUTU UMTALI.

having abandoned Native methods of tillage on all his lands and having put his lands under a systematic Crop-Rotation Scheme using proper methods of tillage is awarded the Certificate and Badge of a Master of Tillage.

Director of Native Agriculture,
Native Affairs Department.

Certificate No. M.F./ 104/53.

Date 11/9/1953.

FIGURE 1.1: COPY OF MASTER FARMER CERTIFICATE

The colonial period was, thus characterised by the introduction of agriculture extension systems to teach Indigenous Zimbabweans the so called improved farming methods as advocated by Amory Alvord (Kramer, 1987). Alvord's main role was to spread the gospel of conservation agriculture to the 'natives'. Agriculture Extension workers, called demonstrators then, and a few 'progressive' farmers received extension training which they were expected to pass on to other farmers, through farmer-to-farmer dissemination and demonstration. As I alluded to earlier own, my own father was one such agriculture extension worker. This extension service was a dictatorial approach based on the "trickle-down" theory of extension aimed at taking and following the Western agricultural teachings and practices to the letter without question. The era also saw the introduction and cultivation of exotic grain crops like maize in place of Indigenous crops and the keeping of exotic livestock breeds in place of Indigenous breeds, all which were not acclimatized to Zimbabwean conditions. It was Henry Keigwin who made the Western tillage methods and animal husbandry techniques, brought by the British colonialists, find their way into the school curriculum (Kramer, 1987). However, Alvord's extension system tended to support some of the Indigenous farming practices like the cultivation of 'kaffir' beans (cowpeas), 'kaffir' corn (sorghum) and other millets, but in rotation.

To conclude this section, I draw from Matose and Mukamuri (1993:27) who observed that:

> *Official (Western) knowledge has a history of being considered as scientific and modern, developed as it was in European centres of knowledge during the colonial era; Farmers (Indigenous) knowledge had little room in scientifically tested and proven body of knowledge.*

However, Indigenous Africans continued (unlawfully though) to practice and pass onto their young those IAKS which they had known and practised for generations (Kaya and Seleti 2014; Mapara 2009; Tanyanyiwa and Chikwanha 2011). I note that some of the good Indigenous farming practices have proven to be resilient and are still being practised by the Indigenous community to date.

1.2.3 Postcolonial phase

The postcolonial phase is still characterised by the dominance of Western farming practices in the curriculum. However, post-colonial Africa witnessed a growing interest in the restoration of lost or dying IKS which had been marginalised by the colonial administrators.

Commenting on the Enhancing Indigenous Agricultural Knowledge in Africa (ENIAKA) initiative, Kisembo and Millar (2001) amplify that the majority of the rural people are still loyal to their own knowledge, beliefs and value systems and that decisions on farming and use of natural resources are to a large extent based on traditions. They further assert that the rural people have developed skills to speak the language of the officials, while maintaining their own traditions. This is evidence that the colonisers had imposed their farming practices on native tribes who often resisted their influence. The resilience of the Indigenous farming practices, despite colonial and neo-colonial subjugation, is clearly epitomic of their inclusion in the ZSSAC. Such resilience prompted me to establish prospects and opportunities for the inclusion of IAKS in the Zimbabwe secondary school agriculture curriculum (ZSSAC).

1.3 THE ZIMBABWE SECONDARY SCHOOL AGRICULTURE CURRICULUM: AN OVERVIEW

The ZSSAC is presented in three syllabus documents for different progressive levels, namely Junior Secondary Level, Ordinary Level and Advanced Level. The topics that are offered at the different levels include: General Agriculture, Crop Husbandry, Livestock Husbandry, Farm Machinery and Agricultural Economics (Biriwasha, 2012:4-9). The topics are thematically presented with a simple progressive continuance of issues introduced at the primary school level. Interestingly, the need to protect the environment is the main theme running through almost every topic in the curriculum. As such, it is notable that the curriculum is presented primarily through an ‘environmental’ lens. The curriculum is dominated by Western agricultural theories, concepts and practices at the expense of IAKS. In this study I want to make an analysis of the current coverage of IAKS in ZSSAC with a view to explore prospects and opportunities for their greater inclusion in the curriculum in question.

1.4 THE IKS POLICY OF ZIMBABWE

Zimbabwe has identified IKS as an aspect that demands inclusion in the school curriculum. This was one of the recommendations of the Presidential Commission on Education and Training (Nziramasanga, 1999). IKS issues are represented in several documents. The Ministry of Science and Technology has the Zimbabwe Second Science, Technology and Innovation Policy, which was launched in June, 2013. One of the policy document’s IKS related objects is ‘to develop courses on IKS that are suitable for inclusion in school curricula’ ... focusing ‘... on Indigenous fruits, animal breeding, herbal medicine and soil cultivation’ (Zimbabwe Government, 2012; Herald, 2012; Pan-African News, 2012).The Ministry of Education, Sport and Culture has The Zimbabwe Cultural Policy which originally was under the custodianship of the Culture Division of the then Ministry of Education, Sports, Arts and Culture. It is now a preserve of the newly formed Ministry of Culture and Sports. Section 2.1 of the policy spells out that “Our traditional knowledge systems should provide sources for the curriculum needs to our societies and such knowledge should be infused into the main school curricula (Zimbabwe Government, 2015:14). Section 7.8 of the draft Zimbabwe National Heritage Arts Culture Policy (2013) pronounces the need to promote “Some knowledge related to agriculture, animal husbandry and environmental interventions” (Zimbabwe Government, 2013:19). Zimbabwe also has the Zimbabwe Agriculture Policy as represented in the Zimbabwe Agriculture Investment Plan (ZAIP) 2013-17 (Zimbabwe Government 2011). I will again, through document analysis, examine the current extent of integration as well as prospects and opportunities for the inclusion of IAKS in Zimbabwe’s Secondary education agriculture curriculum.

1.5 THE RESEARCH SETTING

I used five research sites for this multiple case study. The sites comprised two high schools, one in Kwekwe District in the Midlands Province and the other in Makonde District in the Mashonaland West Province; three tertiary institutions (a university, agriculture college and teachers college) and the communities from the immediate catchment areas of both schools.

1.5.1 High schools as research sites

Both high schools were in Zimbabwe. The school in Kwekwe District in the Midlands Province teaches agriculture up to Advanced level, whereas the school in Makonde District in the Mashonaland West Province teaches agriculture up to Ordinary level and has plans to acquire Advanced level status and teach the subject Agriculture up to Advanced level soon. Both schools are in Zimbabwe’s Natural Farming Region 3 (See Fig 3 and Table 1).

The first high school is located in Kwekwe District in the Midlands Province in Zimbabwe. The school is some 60 kilometres West of Kwekwe town along the Kwekwe-Gokwe Centre road. This school was built in the mid-1970s by a mining company. The school was established in 1977. It was formally an F2 secondary school which emphasised the teaching of practical subjects such as Agriculture, Building, Metalwork, Woodwork, Food and Nutrition, Fashion and Fabrics. This was unlike F1 secondary schools which followed a purely academic curriculum. The school started teaching Agriculture in 1977.

The second high school which is in Makonde District in the Mashonaland West Province was opened in 1984 after Zimbabwe attained its independence in 1980. The school is in Zvimba District in the Mashonaland West Province in Zimbabwe. The school is located approximately 51 kilometres south of Chinhoyi town and 14 kilometres off the Chinhoyi-Chegutu road. The school teaches Agriculture up to Ordinary level. Plans are also at an advanced stage to teach the subject up to Advanced level.

The two schools are located in different Agro-ecological zones also known as Natural Farming Regions. Zimbabwe has five agro-ecological regions namely Natural Regions (NR) I to V.

The agroecological zones are shown in Fig 2 below.

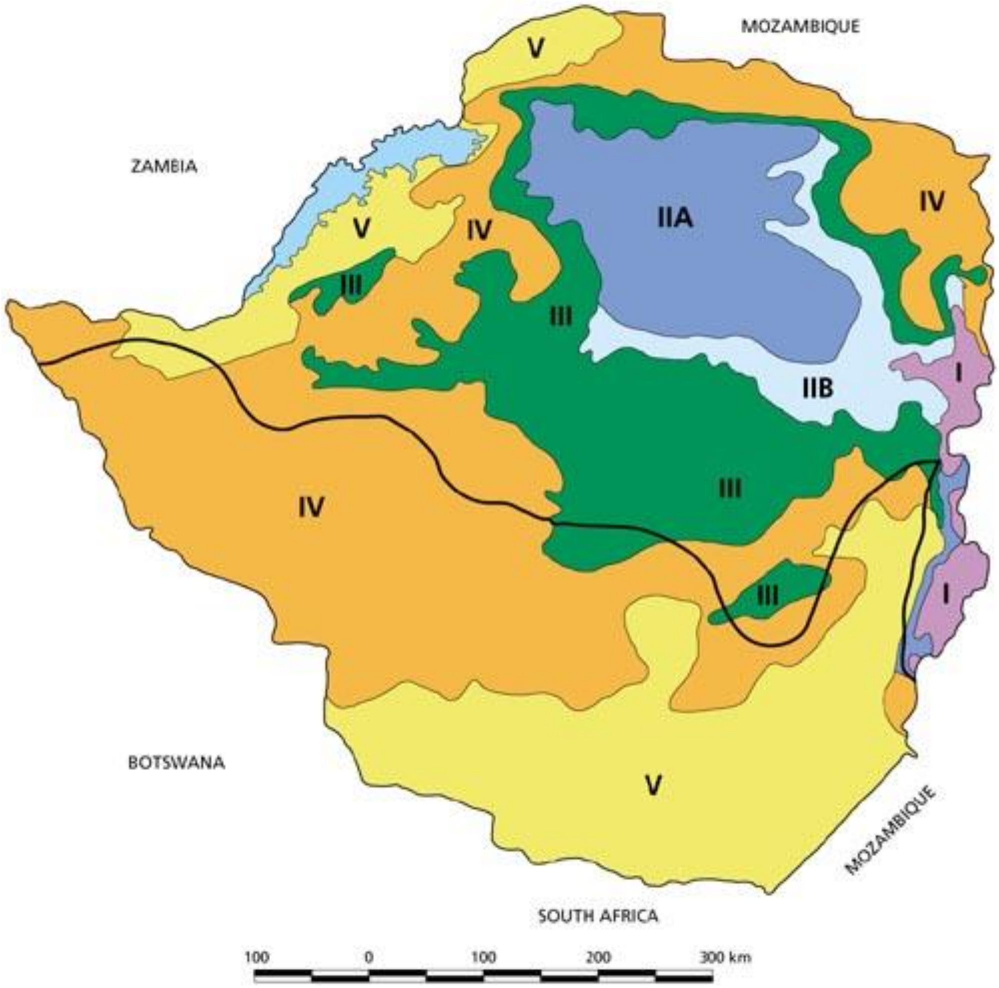

FIGURE 1.2: NATURAL REGION OF ZIMBABWE

The Natural Regions (NRs) are based on temperature, rainfall regimes and soil characteristics. Patterns of agricultural activities derive from these Natural Regions as shown in Table 1.

The high school in Kwekwe District in the Midlands Province is located in Natural Region III. However, due to climate variability, Mugandani, Wuta, Makarau and Chipindu (2012) reclassified the whole of Kwekwe under Natural Region IV. An annual rainfall of 500-750 mm, mid-season dry spells and high temperatures characterize NRIII while NR IV is characterised by an annual rainfall of 450-650 mm, severe dry spells during the rainy season, and frequent seasonal droughts (Vincent andThomas, 1960; Mugandani et al, 2012). Predominantly, the high school in Kwekwe district and its immediate community have dark clayey soils.

TABLE 1: DESCRIPTION OF THE NATURAL REGIONS OF ZIMBABWE (ADAPTED FROM MOYO, 2000 AND VINCENT AND THOMAS, 1960).

Natural Region	**Area (000 ha)**	**% of total land area (%)**	**Annual rainfall (mm)**	**Farming Systems**
I	613	1.56	> 1 000. Rain in all months of the year, relatively low temperatures	Suitable for dairy farming forestry, tea, coffee, fruit, beef and maize production
II	7 343	18.68	700-1 050. Rainfall confined to summer	Suitable for intensive farming, based on maize, tobacco, cotton and livestock
III	6 855	17.43	500-800. Relatively high temperatures and infrequent, heavy falls of rain, and subject to seasonal droughts and severe mid-season dry spells	Semi-intensive farming region. Suitable for livestock production, together with production of fodder crops and cash crops under good farm management
IV	13 010 036	33.03	450-650. Rainfall subject to frequent seasonal droughts and severe dry spells during the rainy season	Semi-extensive region. Suitable for farm systems based on livestock and resistant fodder crops. Forestry, wildlife/tourism
V	10 288	26.2	< 450. Very erratic rainfall. Northern low veldt may have more rain but the topography and soils are poor	Extensive farming region. Suitable for extensive cattle ranching. Zambezi Valley is infested with tsetse fly. Forestry, wildlife/tourism

The immediate community to this school is dominated by smallholder farming characterised by the cultivation of drought tolerant field crop varieties of chibage (maize), mapfunde (sorghum), mhunga (pearl millet), zviyo (rapoko), nzungu (groundnut) and maringazuva (sunflowers) and extensive production systems of cattle, goat, sheep and chickens (FAO, 2006, Falayi, 2014). Small scale horticulture is also practised.

The high school in Makonde District in the Mashonaland West Province is located in Natural Region II. In their reclassification based on climate variability, Mugandani et al. (2012) retained the classification of Zvimba District under the original NRII but accorded the place NRIIB status. Natural Region II receives 700-1 050 mm of rainfall. The rainfall is confined to summer. The soils are predominantly loam (sandy-clayey). The place is suitable for intensive farming of maize, tobacco, cotton and livestock (Moyo, 2000; Vincent and Thomas, 1960). It is also dominated by smallholder farming as evidenced by the cultivation of medium season to drought tolerant field crop varieties of chibage (maize), mapfunde (sorghum), mhunga (pearl millet), zviyo (rapoko), nzungu (groundnut), nyimo (bambara nut) and maringazuva (sunflowers) and extensive production systems of mombe (cattle), mbudzi (goat), makwai (sheep) and chickens (huku) (FAO, 2006, Falayi, 2014). Small scale horticulture is also practised.

The immediate communities of both High schools practise communal and small scale commercial farming. While the schools are immersed in predominantly communal farming areas, the small scale commercial farms are at least 5 kilometres and 3 kilometres from the schools, respectively. In this research I double-case studied the two high schools and their immediate communities with respect to prospects and opportunities for the inclusion of agricultural Indigenous knowledge systems in Zimbabwe's secondary school agriculture curriculum. I made sure that the data I collected was from both the communal and small scale commercial sectors of each school's surrounding community.

1.5.2 Tertiary institutions as research sites

The three tertiary institutions are located in NR11.They are all located in the middle of the north of Zimbabwe which falls under NRII. The area receives rainfall ranging from 750 to 1 000 mm/year (Mugandani et al., 2012; Falayi, 2014; Vincent and Thomas, 1960). Generally, the rainfall is reliable and soils are generally fertile (Mugandani et al., 2012). The reliable rainfall and the good soils make the agroecological zone suitable for intensive crop and livestock production (Mugandani et al., 2012; FAO, 2006; Moyo, 2000). Both dry land and supplementary irrigation of tobacco, maize, cotton, wheat, soybeans, sorghum, groundnuts and seed maize suffice. Wheat and barley are grown under irrigation. Availability of pastures and pen-fattening promote intensive livestock production and the major livestock husbandry systems include mombe dzenyama (beef), mombe dzemukaka (dairy), nguruve (pig) and shiri dzemumusha (poultry) with an increased focus towards production of sheep and goats (Mugandani et al., 2012; FAO, 2006, Falayi, 2014; Moyo, 2000).

The university is located in Mashonaland West province. The School of Agricultural Sciences and Technology in the university offers agriculture degrees in Animal Production and Technology, Agricultural Engineering, Food Science and Technology, Crop Science and Post Harvest Technology, Biotechnology as well as Environmental Science. Graduates from the School can be employed as AGRITEX workers and agriculture teachers in both tertiary institutions and high schools.

Agriculture training is offered by the Ministry of Agriculture through its Agriculture colleges, namely Chibero Agriculture College, Norton; Esigodini Agriculture College, Esigodini; Gwebi Agriculture College, Harare; Mlezu Agriculture College of Agriculture, Kwekwe and Rio Tinto Agriculture College, Kadoma. The college, included in the study, is situated in Mashonaland West province. The college offers a two year diploma for holders of Certificate in Agriculture (who are exempted from one year of practical attachment) and a three year Diploma in Agriculture for non-certificate holders (who have to do a compulsory one year practical attachment) respectively. Graduates from the college also work as AGRTIEX officers in the Ministry of Agriculture working with the communities, or as Agriculture educators in the Ministry of Education (in schools and colleges).

Teacher training is offered by the Ministry of Higher and Tertiary Education with the Department of Teacher Education at the University of Zimbabwe as the certifying institution. The Post Agriculture Diploma in Education programme is premised on the assumption that students who enrol for teacher training have already acquired the requisite agriculture content and skills. Hence, college work focuses on pedagogical skills training only. The University of Zimbabwe's Department of Teacher Education certifies the Post Agriculture Diploma in Education which is a teaching (pedagogical) qualification only that disregards the agriculture content and skills. Trainee teachers undergo a 20 months pedagogical training which is split into five terms on college campus and one term on teaching practice. The college trains secondary school teachers in both academic and technical subjects. Agriculture teacher training at the college is in the form of the Post Agriculture Diploma in Education. The students who enrol for agriculture teacher training must have a qualification in Agriculture, ordinarily a Diploma in Agriculture.

1.6 CONTEXT OF THE STUDY

1.6.1 Statement of the Problem

There is a dearth of Indigenous content in Zimbabwe's Secondary School Agriculture Curriculum (ZSSAC). Generally, the curriculum emphasises Western agricultural practices at the expense of local Indigenous content. The little IAKS that is presented in the curriculum tends to be marginalised as the curriculum teaches the crops and livestock with a Western science lens. In addition the curriculum places more emphasis on the demerits than the merits of local farming practices. Examples of such marginalised topics include farming systems like polyculture and land tenure systems such as communal and shifting cultivation (see Ministry of Education, Arts and Culture, 2015, Section 1.3, page 10). Such a scenario makes IKS play second fiddle to the alien mainstream science in ZSSAC.

While both the community and schools in Zimbabwe uphold some IAKS concepts, candidates' responses that acknowledge IAKS are often viewed as inappropriate and thus rejected in the national examinations evaluation criteria (Pedzisai, 2013). When confronted with an examination question, there is a tendency by candidates to refer to their lived cultural agricultural experiences. However, only those answers which are in sync with the curriculum's Eurocentric dictates are marked as correct in the public examinations (Pedzisai, 2013). It is my observation that this does not only negatively affect the students but leads to the erosion of the entire cultural values of the community which hinge on IKS. In addition, the preservation of the country's local farming practices is denigrated as learners are taught to see agricultural practices through the Western eye.

The marginalisation of local content does not auger well with the fact that ZSSAC is viewed and presented through an environmental lens. I opine that a curriculum for an Indigenous environment can only be taught more effectively from an Indigenous perspective in terms of content and methods. However, as I will argue, there is nothing wrong with combining the two epistemologies, IKS and Western science, in the curriculum. The two ways of knowing, Western science and IKS, can be regarded as complementary epistemologies in need of a dialogue that would result in meaningful learning (Shizha, 2009:139-154; Ogunniyi, 2007). In *Chara chimwe hachitswanyi inda: Indigenizing science education in Zimbabwe,* (the Shona proverb in the title translates to 'One thumbnail does not squash a louse,' meaning 'One person cannot do all things alone,') Shizha (2009:139-154) underscores the coexistence and complementary nature of IKS and Western science. Hence, no knowledge system should claim superiority over another in any curriculum, including science-related curricula such as Agriculture. The subject Agriculture itself is an applied science.

From the foregoing, there is compelling need to harmonise local and Western farming practices in ZSSAC. Relevant IKS components that can be incorporated in the science curriculum have to be identified (Zimbabwe Government, 2012; Maluleka, Wilkinson and Gumbo, 2006; Jegede and Aikenhead, 1999); to include Agriculture (Maluleka, Williams and Muchena, 1991). This contention challenges policy makers to speed up policy implementation with respect to the inclusion of more IAKS in ZSSAC. Hence, it was the object of this study to establish prospects and opportunities for inclusion of IAKS in ZSSAC.

1.6.2 Research Questions

1.6.2.1 Key research question

The overarching research question is 'What are the prospects and opportunities for inclusion of IAKS in Zimbabwe's secondary school Agriculture curriculum?'

1.6.2.2 The sub- research questions

To address the key research question, the study will employ the following sub-research questions:

- Which IAKS components currently exist in the Zimbabwe secondary school Agriculture curriculum?
- What IAKS (knowledge and practices) exist within the community?
- What components of IAKS can be included in the secondary school Agriculture curriculum?
- How can the IAKS be effectively included in the Zimbabwe secondary school Agriculture curriculum?
- What are the possible benefits of including IAKS components in the school curriculum?
- What challenges may schools and colleges face during the inclusion process?

1.6.3 Aim and Objectives of the Study

1.6.3.1 Research Aim

The main aim of the study was to explore prospects and opportunities of including IAKS in the Zimbabwe secondary school agriculture curriculum.

1.6.3.2 Research Objectives

The study sought to:

- Analyse components of IAKS currently included in Zimbabwe's secondary school Agriculture curriculum.
- Investigate IAKS (knowledge and practices) that exist within the community.
- Suggest components of IAKS that can be included in Zimbabwe's secondary school Agriculture curriculum.
- Propose the effective inclusion of IAKS in Zimbabwe's secondary school Agriculture curriculum.
- Establish the benefits of including IAKS in the curriculum in question.
- Examine the challenges schools may face when including IAKS in Zimbabwe's secondary school Agriculture curriculum.

1.6.4 Significance of the study

Infusing agricultural IKS into the existing school agriculture curriculum has potential to enable Indigenous peoples of Zimbabweans to reclaim, revitalize and renew their identity in terms of culture that has been denigrated, marginalised, despised or destroyed by colonialism (Hammersmith, 2007). In that way, unhealthy imbalances, distortion, trivialisation and neglect inflicted by Eurocentric education and governance can potentially be uncovered and redeemed. The learners, the future generation, can be empowered since IAKS are a resource that provides a firm foundation for sustainable and environmentally sound approaches to agriculture.

Inclusion of IAKS in ZSSAC has potential to give learners an opportunity for recognition of prior, home-grown, and local knowledge and experiences that yield intrinsic motivation, critical thinking, independent decision making, cultural empowerment and meaningful learning. The teaching/ learning processes has potential to, according to Pestalozzi (cited in Ozmon and Craver, 2011) and Ornstein and Levine (2011), proceed from the known to the unknown, from the near to the distant. Lemke (2001) underscores that student learning depends on community beliefs, acceptable identities, and the consequences for a student's life inside and outside the classroom. In his theory of pragmatism, John Dewey propounds that students must be subjected to an experiential continuum between the home and the school environments for meaningful learning to take place (Dewey, 1923). Against the above contentions, it is necessary for Zimbabwe to convincingly map out a clearer IAKS policy implementation process in the ZSSAC.

The findings of this research may be a basis for further research in IAKS. Further research could be one way of documenting the invaluable IAKS and promoting their application in the lived contexts of the local communities. Shava (2005:80) amplifies this when he aptly warns that:

> *Research on Indigenous knowledge should not only focus on its documentation and interpretation. However, it should extend to the application of this knowledge in participatory community development and education settings.*

Zimbabwe should map out a clearer IAKS policy in the school curricula so that IAKS would be included in ZSSAC for community development. The researcher envisages that this initiative can begin to inform the basis of more widespread inclusion of IKS in educational transformation processes.

1.6.5 Assumptions of the Study

- The problem of lack IKS inclusion is important since dominance of academia by one worldview is undesirable. Western farming practices should not be dominant over IAKS in the curriculum. The two knowledge systems should coexist in the ZSSAC.

- The population of the study, which comprises two selected schools and local farmers from their immediate catchment area as well as three tertiary institutions, is accessible.

- The current move towards reviewing the curriculum in Zimbabwe has emphasised the need for the incorporation of Indigenous content in the education curricula. I am therefore likely to get maximum cooperation and support from policy makers and curriculum implementers on this topical issue.

- The proposed research instruments, namely in depth interviews, observations and document analysis, will collect reliable data since a pilot study will be used to validate the instruments prior to administering them to the population.

- The use of a multiple case study approach will proffer an in-depth understanding of prospects and opportunities for the inclusion of IAKS in ZSSAC, thereby providing potentially ground breaking insights into the research problem.

1.6.6 Delimitations of the study

As has been alluded to, I chose two study sites for the study. These were two high schools, one in Kwekwe District in the Midlands Province and the other in Makonde District in the Mashonaland West Province. The two schools offered Agriculture as an examinable subject up to Advanced and Ordinary level respectively. The catchment area of the school in Kwekwe District comprised communal farms and small scale farms from Chemagora small-scale commercial farms. The school in Makonde District of Mashonaland West Province's catchment comprised small communal farms and Chitomborwizi small scale farms. Agriculture teachers at both schools, local farmers from the commercial farms and the rural peasantry and local AGRITEX officers formed the key participants. Other research participants included the Provincial Agriculture Education officer, lecturers from the three tertiary institutions, a university that teaches agriculture, an agriculture college and a teacher's college that trains agriculture teachers. The purpose of my study was to explore prospects and opportunities for the inclusion of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum. I did that by exploring components of IAKS currently included in the ZSSAC and determining those that exist in the community that can be included in ZSSAC. I went on to explore how the IAKS can be included in the curriculum. The study also explored the benefits of including IAKS in the curriculum and examined the challenges schools may face when including IAKS in Zimbabwe's secondary school Agriculture curriculum.

1.7 SYNOPSIS OF THE RESEARCH METHODOLOGY

This section provides a synopsis of the research methodology. The research methodology and theory are defined in greater detail in Chapter 3.

1.7.1 Theoretical Framework

1.7.1 Theoretical Framework

In order to inform this study I chose Decoloniality as the theoretical framework. The theory provided the analytical lenses for exploring the components of IAKS in ZSSAC in order to identify prospects and opportunities for including those excluded components of IAKS that still exist within the local communities in the ZSSAC.

I used Decoloniality as a meta-theory to explore the influence of coloniality on practice, knowledge structure and knowledge theory with respect to prospects and opportunities for the inclusion of IAKS in ZSSAC. De Lissovoy (2010:279) underscores that ‘‘decolonial theory is concerned with confronting, challenging, and undoing the dominative and assimilative forces of colonialism as a historical and contemporary process, and the cultural and epistemological Eurocentrism that underwrites it.” I find it worth noting, as I alluded to earlier on, that the curriculum in question is dominated by Western agricultural knowledge as a result of its imposition on Indigenous Zimbabweans by the colonial masters and the marginalisation of Indigenous farming knowledge and practices. Decoloniality challenges dominant knowledge views and advocates for the co-existence of multiple worldviews (plural knowledges) in curriculum practice. My use of the Decolonial lens as my locus of enunciation is thus to guide the ensuing discourse towards IAKS.

1.7.2 Data collection approach

In this qualitative study, I adopted the multiple case study research design to make an analysis of IAKS in ZSSAC and within the Indigenous communities, thereby enabling the exploration of prospects and opportunities for the inclusion of IAKS that still exists in the communities in the curriculum in question. The qualitative approach emphasises key subjective assessment of opinions, feelings, behaviour, attitudes, motive, reason and obligation (Creswell, 2013) so as to understand the meaning and essence of peoples’ lived experiences. The research case studied five sites. The sites comprised two high schools, one in Kwekwe District of Midlands Province and the other in Makonde District of Mashonaland

West Province; three tertiary institutions (a university, agriculture college and teachers college) and the communities from the immediate catchment areas of both schools.

The case study approach makes an intensive study of the phenomenon in its natural setting so that meaningful, relevant theory is generated from the understanding gained through actual practice (Hesse-Biber, 2011; Yin, 2009). It also promotes method crystallisation using multiple data sources: interview, observation, document analysis (Flyvberg, 2011; Rajasekar, Philominathanand Chinnathambi, 2013) to strengthen and validate research findings. I adopted the multiple case study design of five cases to reduce bias through cross verification of data yielded by the five cases.

The chosen theories informed the choice and use of:

- One on one, semi-structured In-Depth Interviews (IDIs) for Agriculture teachers at two high schools, lecturers in tertiary institutions, agriculture extension workers and local farmers from both school communities.

- On-the-spot observation of farming activities as practiced at both schools and by the local farmers from the schools' immediate catchment areas.

- Document analysis of the Zimbabwe Agriculture policy, the Zimbabwe IKS policy and the National Agriculture syllabi of the Secondary schools and tertiary institutions to sift the intended and transacted curriculum on IAKS. Document analysis extended to Agriculture teachers Schemes of work, students' written work and past examination papers to expose the transacted curriculum with respect to integration of IAKS in ZSSAC.

The above theories and data collection approaches are discussed in depth in the research methodology chapter.

1.7.3 Data analysis approach

In this study I used the thematic analysis approach to analyse the wholly qualitative data which I collected using in-depth interviews, non-participant observations and document analyses. Thematic analysis is a method of analysing qualitative data by "identifying, analysing and reporting patterns (themes) within data" (Braun and Clarke, 2006: 6). Fereday and Muir-Cochrane (2008:82) echo similar sentiments by stating that “thematic analysis seeks to unearth salient themes that emerge as being important to the description of the phenomenon’’. It moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas within the data, that is, themes (Alhojailan, 2012:10).

After failing to secure Atlas.ti software to analyse the large volumes of data which were yielded by In-Depth Interviews, observations and document analysis, I had to manually analyse the data. I analysed the qualitative data and interpreted it thematically by evaluative description of common themes and patterns permeating the main issues.The process consisted of reading through textual data, identifying themes in the data, coding those themes, and then interpreting the structure and content of the themes (Bogdan and Biklen, 2006; Guest, MacQueen, and Namey, 2012). That way the process of data analysis gradually changed from mainly inductive to become more deductive (Lodico et al., 2010; Merriam, 2009). The collected data was thus coded and categorised against emerging themes with respect to prospects and opportunities for inclusion of IAKS in the ZSSAC. After categorisation I first analysed the data, grouped and finally interpreted the data according to the research question that they related to. I then discussed the answers to the research questions to show how the main research question may have been answered.

1.7.4 Ethical considerations

Research has a moral obligation to build trust between the researcher and the participants (Creswell, 2009). First and foremost, I considered the issue of access to the research participants. In that respect, prior to data collection, I obtained Ethical Clearance to carry out from the UNISA’s College of Education’s Ethical Clearance Committee. Secondly, I successfully sought permission to carry out the research from the relevant Permanent Secretaries of Zimbabwe Government Ministries of Zimbabwe. These ministries were Ministry of Primary and Secondary Education, Ministry of Agriculture and Mechanisation and the Ministry of Higher and Tertiary Education and Technology Development. Permission was also sought from the school heads, school agriculture educators, AGRITEX officers and local farmers through prior informed consent. Lastly, I obtained parental consent for school children to participate in the research and assent letters for the same learners. I then guaranteed the issue of confidentiality through assuring the participants of anonymity. In that respect, I availed the participants with the right to knowledge privacy. prior to seeking their cooperation in the study I ensured the participants that their participation voluntary. Participants were not identified by name, institution and any other means. I presented the results as grouped data for purposes of confidentiality and anonymity. I explained the purpose of the study to the participants and assured them that the information they gave would be used for the purpose of the research only.

1.8 CONCEPTS USED IN THIS STUDY

1.8.1 Introduction

Before colonisation Indigenous Africans practised agriculture. They kept livestock and grew crops. The colonialists imposed their Western farming knowledge and practices among the Indigenous Africans. Indigenous Africans had to forego most of their farming practices and in the process adopt those of the colonial masters. This resulted in a shocking representation of Indigenous agricultural knowledge in the agriculture school curriculum wherein Indigenous knowledge plays second fiddle to Western farming knowledge and practices. Shava (2013:384) posits that "This concern is directly related to the processes and impacts of colonisatio". Hence the marginalisation, subjugation and primitivisation of IKS, evident even today, are attributed to colonisation (Shava, 2000; Hoppers, 2002; Hountondji, 1997). In this section I define key concepts in the study with respect to inclusion of IAKS in the school curricula.

1.8.2 Background terminology

1.8.2.1 Indigenous

The word **Indigenous** is etymologically derived from two ancient Greek words *endo* meaning inside or within and *genous*, meaning birth or born and also race meaning 'native' or 'born within.' It can be sifted that Indigenous means originating or occurring naturally in a particular place. It refers to people or anything living or existing naturally in a particular region or environment. Something that is Indigenous is, therefore, native to the locality in which it is found. The term *Indigenous* is synonymous with the words native, original, aboriginal, home-grown, natural, first (as in First peoples), autochthonous and local. Hence any given group of people, community, society or ethnic group including their cultural practices, traditions or sense of kinship may be described as *Indigenous* to a particular locality they naturally live in.

1.8.2.2 Indigenous Peoples

Indigenous peoples are the original people of a given geographical locality. "Indigenous peoples (first peoples, aboriginal peoples) are the generators (source) of Indigenous knowledges, imbuing them with Indigenous discourses emanating from experiences in their lived world contexts" (Shava, 2019:02). They are so much attached to their land such that their livelihood systems have a relational foundation with the land (Shava and Togo, 2019). The ways of life of Indigenous peoples have contributed to the use and protection of the natural environment on which they depend. In the context of this study, the preserved ways of life are the agricultural practices; the methods they used to cultivate crops and keep livestock. Some of these practices have remained resilient despite colonial and neocolonial subjugation, discrimination, marginalisation and primitivisation. In this study I acknowledge that before colonisation Indigenous Zimbabweans had their own agricultural knowledge and practices some of which are still alive today.

1.8.2.3 Indigenous Knowledge

Shava (2019:3) posits that:

> *Indigenous knowledge is the cumulative body of knowledge (understandings, meanings, interpretations/explanations, experiences, philosophies, pedagogies, methodologies, practices, skills, and strategies) of an Indigenous people, in its diverse representations, that has developed through their interactions with the land (lived environment) and is sustained over time through culture and practices.*

It is the understandings, skills and philosophies developed by a people with long histories of interacting, experimenting and experiencing their natural environment. This knowledge is gained through association or experience. The knowledge is unique and confined to the geographical location of a particular culture or society but is not homogenous within that culture or society (Dei, 2000). Local knowledge informs decision-making about fundamental aspects of day-to-day life (Mapara, 2009).

1.8.2.4 Indigenous knowledge Systems

It is difficult to define Indigenous knowledge systems but a description of the concept gives one an idea of what it entails. Everybody has their Indigenous origins and if we trace back there is Indigenous knowledge for each human group. Both Western and Indigenous Knowledge are Indigenous to different localities. However, wherever the term Indigenous Knowledge is mentioned it is usually associated with natives of a country or region whose history involves some kind of marginalisation at one point or another due to colonialism.

According to Mposhi, Manyeruke and Hamauswa (2013) the concept Indigenous knowledge Systems is referred to in different forms that includes terms like Indigenous knowledge (IK), Indigenous technical knowledge (ITK), ethno-ecology, local knowledge, folk knowledge, traditional knowledge and traditional environmental (or ecological) knowledge (TEK). Herman (2012) refers to it as ethno-science; the people's science. Indigenous knowledge systems refer to the sum total of local belief systems, knowledge and skills possessed by an individual community accumulated over centuries of living in a particular environment (Behera and Nath, 2000; Turner, Ignance and Ignance, 2000). "Indigenous peoples (first peoples, aboriginal peoples) are the generators (source) of Indigenous knowledges, imbuing them with Indigenous discourses emanating from experiences in their lived world contexts (Shava, 2019:2)". Horak (2005) and Mapara (2009) observe that Indigenous Knowledge is the basis for local level decision making in agriculture, health care, food preparation, education and natural resource management. Horak (2005) opines that IKS appears to be both community and individual knowledge, that is distinctive to every culture or society and strategies for solving the problems of that society. It consists of general knowledge and specialised knowledge of specific groups or individuals (Behera and Nath, 2000).

1.8.2.5 Indigenous Agricultural Knowledge Systems

Before colonisation, Indigenous Africans possessed agricultural knowledge and practices. Some of the Indigenous agricultural knowledge and practises are still alive. Indigenous agricultural knowledge includes knowledge of agrobiodiversity, Indigenous/traditional agricultural practices and Indigenous soil taxonomy (Shava et al., 2009; Shava, 2019). The distinct agriculture systems of Indigenous peoples are crop husbandry, livestock husbandry including the innovative agricultural technologies. The knowledge was acquired through centuries of interacting, observing and experimenting with the natural environment. This knowledge is passed on within and across generations orally, visually through careful observations, spiritually (through dreams and other revelations) and through practical experience and careful observations (Shava, 2019; Mapara, 2009; Matowanyika, 1999) and has resulted in farming systems that are relevant for the obtaining climatic conditions in the localities of the Indigenous people.

Indigenous agriculture is composed of two distinct systems, namely, crop production and livestock husbandry. The land use system comprises the homestead field, gardens, the main field and pastureland.

<u>1.8.2.5.1 Crop husbandry</u>

The munda wepamusha (homestead field) covers the area around the musha (homestead) wherein both winter and summer crops are grown. The homestead field is controlled and in most cases worked by the mother. Rarely do children, especially male children, enter and work in this munda (field). Hence, they do not tamper with the crops thereby avoiding food security and sovereignty. According to Maragelo (2008) most Indigenous crop husbandry activities are around the homestead which may include a home garden. The garden may also be a short distance from the homestead. The homestead fields are characterised by small plots of not more than 2 hectares of cultivated land. Here the wife grows early maturing chibage (maize) varieties, nyemba (cowpeas), makavhu (squash), manwiwa (melons) and magaka (cucumbers), both Indigenous and exotic mirivo (vegetables) in a mixed cropping system. Homestead fields boast of a high state of soil fertility maintained with livestock droppings, household waste and wood ash.

In this field the mother mainly grows mirivo (vegetables), both Indigenous and exotic, for use as relish including early maturing chibage (maize) varieties to be eaten as green mealies, ipwa (sweet reed) that looks like mapfunde (sorghum), madhumbe (yams), magwiri (Irish potatoes) and mbambaira (sweet potatoes). Those crops with exotic origin have been accepted into the traditional crop farming system. The women also target places with anthills, the fertile cone-shaped formations constructed from sediment and other available materials by ants or termites, to grow crops like tsunga (a vegetable), ipwa (sweet reed) and early maturing chibage (maize) varieties like Red cock and an eight or ten line variety they call Bhogwe. The homestead field supplies food to the family before the season's harvest. The field is characterised by kusanganisa mbesa (multicropping) as opposed to Western farming which is basically monoculture. Multicropping enhances food security by supplying the family with a variety of food. It also avoids the danger of total crop failure since if one crop fails the others may succeed. The homestead field also includes gardens where vegetables and sweet potatoes are grown. Some gardens are situated in wetlands or close to water sources so that the crops can grow throughout the year and therefore supply food to the family throughout the year. Matoro (wetland) farming is characterised by the growing of mupunga (African rice), in the main, and mabhanana (bananas) in addition to other crops mentioned earlier on.

The munda mukuru (main field) is situated away from the homestead and is controlled by the baba (father). The fact that the main field belongs to the father indicates that crop husbandry is his domain. In this field the major staple crops are grown although women and their children carry out most farming activities. A mixture of crops is planted every year on same fields (Maragelo, 2008). This cropping system is termed polyculture, multicropping or mixed cropping. The mixture of crops includes tsanga (cereals) such as chibage (maize), zviyo (rapoko), mhunga (pearl millet), mapfunde (sorghum); legumes such as ndumba (beans), nyemba (cowpeas), nyimo (Bambara nut) and nzungu (groundnuts); ground tubers such as mbambaira (sweet potatoes), madhumbe (yams) and magwiri (Irish potatoes); a variety of mirivo (leaf vegetables) which include Indigenous vegetables and exotic vegetables such as manhanga (pumpkins), magaka (cucumbers), makavhu (squash) and manwiwa (water melons), and other crops such as ipwa (sweet reed/ sorghum). The crops are grown under muzanganiswa (multicropping) system to avoid total crop failure so as to enhance food security, food variety and nutrition for the family. Muzanganiswa wembesa (multicropping/ polyculture) systems increase plant biodiversity and also offer resilience to crop zvimhutu (pests) and zvirwere (diseases).

Indigenous farmers begin land preparation by selective clearing of the land. Unlike the Western farming practice which clears all trees during opening of fields, Indigenous farmers practise kuchengetedza (selective conservation) of trees during land clearing. Shava (2005) avers that wild food plants, in particular fruit trees and shrubs, are left standing even when land is prepared for cultivation and that this might be a step towards their domestication, though they are usually left to a large extent untended compared to cultivated plants. In that respect mimvuri (shed) trees, michero (edible fruit trees), miti inoera (sacred trees), those with zvièrwa (spiritual) connotations like muhacha (Mobola plum/ *Parinari curatellifolia*) and those trees with kurapa (medicinal uses) are not cut from the fields. This practice, wherein trees and crops grow in the same field for climate change mitigation, adaptation, crop productivity and food security, is an agroforestry technology (Shava, 2005). The practice also enhances soil organic matter, agriculture productivity, carbon sequestration, water retention, agrobiodiversity and farmers' income (Altieri and Nicholls, 2005; Ferguson and Lovell, 2014).

After clearing the land for fields Indigenous farmers prepare the land for planting through jengetedzo (conservation tillage) methods kurima nechibhakera (zero and minimum tillage) using a badza (hoe). The jengetedzo (conservation tillage) methods are basically manual and they rely on human muscle as the source of energy (Maragelo, 2008**).** These jengetedzo (conservation tillage) techniques prevent overworking of the soil thereby promoting a good soil structure, reducing soil erosion and increasing water retention in the soil.

Indigenous farmers are confronted with the challenge of maintaining kudya kwevhu (soil fertility). Strict reliance on kuchinjanisa mbesa (crop rotation) and mufudze (organic farming) overcomes this challenge. Crop rotation involves growing crops of different types in a recurring sequence on the same piece of land (Norton et al, 1995). Crop rotation is also a traditional preventive strategy of plant protection against umhutu (pests), sora (weeds) and zvirwere (diseases). Zvemufudze (organic farming) is practised through incorporation of mufudze wezvipfuyo livestock (manure), durunhuru (compost manure) and ivhu rechuru (anthill soil) to maintain soil fertility. Kraal manure is a locally available resource. The manure, an organic material consisting of plant residues digested by livestock, contains potassium, phosphorus and nitrogen. Homestead fields are also so fertile due to household waste thereby promoting vigorous growth of crops. These methods of maintaining soil fertility are unlike those practised by Western farmers who rely more on chemical fertilizers which apart from being expensive, produce toxic substances which have deleterious effects on the ecosystem. Indigenous methods of maintaining soil fertility become sustainable, due to use of locally available resources. Mkhabela (2006) and Lim Li Ching (2006) posit that the use of mufudze (organic manures) is an old soil fertility technology and is more effective in producing yields higher than those from chemical methods.

Indigenous crops provide a genetic resource base of several major crops of the world. Hence, Shava and Togo (2019:313) posit that "the world's major crops have been derived from the crops of various Indigenous peoples across the world, with major staple foods coming from Asia, Africa, and Latin America". Indigenous peoples never looked for mbeu yakauchikwa (certified seed) for planting from the shops as done by Western farming methods. Their method of selecting crop seed and other vegetative planting materials promotes agro-biodiversity. People keep their own crop seeds and use vegetative planting materials such as mbambaira (sweet potato) stem cuttings also called stolons, gupi remubhanana (banana corms) and gupi redhumbe (yam tubers). Maragelo (2008) and Shava and Togo (2019) observe that Indigenous seed systems use local, traditional or landraces in their seed systems. The farmers produce their own seeds or acquire them from neighbours, relatives and other farmers (Shava, 2019; Chirwa and Aggarwal, 2000). The crops are generally mbeu dzisingateti zuva (drought resistant varieties) since their agriculture is rain fed. For this reason, they plant early maturing varieties such as mukadzi usaende (It is no longer necessary for the wife to run away from the husband because the harvest is almost ready) for chibage (maize), chizhara wanya (We have conquered the famine*)* for mapfunde (sorghum) and ndakupuka (I am releaved), a vegetable. The names literally denote the ability of the crops to beat drought and starvation**.**

Kudyara (planting), kusakura (weeding) and kukohwa (harvesting) of crops are done by using the hoe and the ox- drawn implements. This is unlike Western farming which uses heavy animal-drawn and tractor-drawn machinery (ploughs, planters, disc harrows, harvesters) for field operations. The traditional systems are low cost, locally and culturally adapted technologies based on Indigenous knowledge and thus sustainable (Maragelo, 2008).

Early planting is an Indigenous farming method practiced and is also preferred as it allows crops to receive enough rainfall and reduce incidents of pests and diseases. The rain-fed nature of the farming benefits from this practice. Hand weeding is the primary method of controlling sora (weeds) as opposed to Western farming which uses machinery and herbicides both which are expensive. Hand weeding is normally carried out by women and children and in some cases hired labour. Hand weeding involves using a hoe or weed pulling using hands.

Kukohwa (crop harvesting) is done by mawoko (hand). Grain crops and legumes are traditionally harvested manually by mawoko (hand), badza (hoe) or mapanga (knives) and stored in matura (granaries). Tubers (magwiri/ Irish potatoes, mbambaira/sweet potatoes, madhumbe/yams and mujimbura/cassava) are hand harvested by digging with a hoe and stored in dug pits called murirndi in the soil. The harvest is cleaned and stored in granaries for grains and legumes. During storage, losses are avoided by using mishonga (concoctions of herbs). These prevent them from being eaten by pests such as zvipfukuto (weevils) and zvitototo (beetles). For grain tsanga (cereals) such as mhunga (pearl millet), mapfunde (sorghum) and chibage (maize), farmers often hang these in the kitchen. Sheaves of grain crops are hung above the fire place inside the hut to accumulate smoke and soot or stored on roof tops (Chimbidzani, 2006). These traditional storage methods were tested and found to be successful in storing various grains (Kiruba et al, 2006).

During their growing period and storage, the crops can be attacked by pests and diseases. Indigenous farmers have devised some Indigenous concoctions derived from plant materials and locally available resources to protect their crops against pests and diseases. Some of these technologies have been practised ever since people started cultivating crops and are thought to be better compared to chemical pesticides. Some of the concoctions include ashes of Mutsviri (leadwood/ *Combretum imberbe)* and gum tree (*Eucalyptus spp*) dota (ashes) to control zvipfukuto (weevils), and mvumvu *(*lantana/ *Lantana salviifolia)* leaves against inda (aphids). Biological pest control is an Indigenous practice that has been in use for a long time. The methods include crop rotation and use of monzvowa inobaya (awned crop varieties) against shiri (birds).

1.8.2.5.2 Livestock husbandry

Indigenous farmers keep Indigenous breeds of mombe (cattle), mbudzi (goats), hwai (sheep), nguruve (pigs), huku (chickens), mbongoro (donkeys0 and mbira (rock rabbits). Exotic livestock such as hwai (sheep), tsuro (rabbits), ngarukuni (turkeys), madhadha (ducks) and kirimba (pigeons) have also been accepted into the Indigenous livestock production system. Interestingly, they have gone into domesticating hanga (guinea fowls), zvikwari (francolins) and zvihuta (quails). These livestock are kept mainly for meat except donkeys which provide draught power.

Indigenous farmers practise mafuro (rangeland) system of grazing for the grazers mombe (cattle), mbudzi (goats), makwai (sheep) and mbongoro (donkeys). Mafuro (rangelands) are situated away from fields to avoid destruction of crops by the livestock. The rangelands forage consists of Indigenous grass and legumes for grazing and trees for browsing by livestock as they roam about in open land (Gusha, Masocha and Mugabe, 2017; Tavirimirwa, *et al,* 2019). The roaming about naturally promotes crossbreeding of livestock. During the summer season the rangelands provide livestock with an abundance of grass and legume species that are palatable and nutritious.. Grazing is very selective in the rangelands and water is available in permanent and temporary surface water sources. The temporary water sources are makawa (aquifers) that supply livestock with water during the rainy season and they dry up a few weeks after rains have stopped. They are unlike nzizi (rivers) and some matsime (ponds) which hold water throughout the year. Water produced on rangelands, whether drawn from aquifers or from surface sources, is vitally important to support the livestock.

As they graze the livestock provide mufudze (manure) to the rangeland which fertilises the grass. During herding of the livestock, the villagers take turns to herd their livestock. This practice, called madzoro, gives each family a chance to work in the fields while another is looking after the livestock. The practice also ensures rotational grazing of livestock and crossbreeding of livestock..

During the dry season, the ruminant livestock are given supplementary feeding of mashanga (stover) of tsanga (cereal), groundnut, Bambara nut and cowpea hay to keep them in good condition. Those livestock that are non-grazers, like poultry, pigs and rock rabbits, are kept in pens where they are fed on greens and kitchen waste.

During the night the livestock are kept in kraals/pens which are situated just close to the homestead and fortified as security measures against thieves and predators. The manure from the livestock is used for fertilising the crops. This practice makes a holistic value of Indigenous farming.

The livestock are affected by a number of diseases, endoparasites, ectoparasites and other ailments. The farmers use maguchu (herbal concoctions) to control these. For instance, leaves of gavakava (aloe species), murumanyama (wing pod) and mufufu (violet tree) are used to control stomach ailments and ectoparasites. Nhudurwa (bitter apple) is used to treat running eyes and crushed stems of mukondekonde (rubber euphobia) are sprayed to control ticks (Pedzisai, 2013). This is unlike Western methods of using expensive chemicals to control these. This also advantages the Indigenous techniques as they are not costly, non-toxic and readily available hence sustainable.

1.8.3. Curriculum issues

Etymologically the word **curriculum** is derived from the Latin word *currere* which means to run. Literally, therefore curriculum is a course of action or race. Hawes (1979) sees a curriculum as the intention, plan, prescription or idea of what we would like to happen in the schools. Gatawa (1990:3) defines curriculum as ‘‘... the totality of the experiences of children which the schools are responsible, whether these experiences are for individual children or groups or take place in the classroom or school grounds or outside the school.” My own working definition for a curriculum is all the planned experiences that learners have under the auspices of the school. In educational terms, the word refers to a course or programme of study. This implies that curriculum refers to an aggregate of courses or simply a particular course of study in a school or college.

In the context of this study, I refer to the term curriculum to mean a course of study in one subject, Agriculture, at a school or college. This programme of study called the curriculum consists of syllabi. The ZSSAC refers to the three progressive levels of agriculture syllabi offered in Zimbabwe, namely the junior secondary, middle secondary and senior secondary levels. In Zimbabwe these levels are referred to as the Zimbabwe Junior Certificate (ZJC), Ordinary level (O level) and Advanced level (A level) syllabi respectively. However, the proposed curriculum (Chapter 6) should adopt a participatory curriculum development approach that involves all the relevant stakeholders from design to evaluation.

As sifted from Objective Model of Curriculum Planning, a brainchild of Ralph Tyler, any curriculum has a starting point; the objectives, has some set parameters; the content, a way of doing it; the methods and a winning point; the evaluation (Tyler, 1949). Also any curriculum has dimensions. These dimensions of the curriculum include the official curriculum, the actual curriculum and the hidden curriculum (Marsh and Willis, 2003). The official, also known as the intended curriculum, refers to the syllabi which are prescribed by the planners as a result of the intention of the official voice. The actual curriculum is the transacted curriculum. It refers to what actually happens in the classroom which could be a deviation from the official curriculum. The long and short of it is that the curriculum is for the learners hence it should meet their needs and aspirations. These needs should be a reflection of societal aspirations. However, the agriculture curriculum developed by the colonisers was geared towards meeting the needs of the colonial masters instead of meeting the aspirations of the Indigenous community. This spells out the reason why IAKS appears to play second fiddle to Western farming practices in the ZSSAC. Hence I find it worth noting that the ZSSAC is dominated by Western farming practices at the expense of the Indigenous ones.

The representation of agricultural knowledge refers to both their portrayal in the local community and mainly how it is represented in written agricultural discourse or literature (Shava, 2009). It is worth noting that before colonisation Indigenous Africans, Zimbabwe included, lived out of their own farming practices which have stood the test of time. They engaged and continue to engage in cultivation of crops and rearing of animals useful to their society using knowledge gained through centuries of interacting with their environment. They are part and parcel of the cultural life of the Indigenous people. The fact that they have stood the test of time is a sign of their resilience. They continue to be alive today despite their colonial denigration and subjugation by Western farming practices.

This study explores the **Prospects** and **Opportunities** for the inclusion of IAKS in the ZSAC. I find that there is a very thin dividing membrane between the two terms ‘prospects’ and ‘opportunities’. In this study I consider ‘prospects’ to mean the tenability, possibility or feasibility of the harmonisation of IAKS with the currently dominant Western farming practices in the curriculum in question. On the other hand ‘opportunities’ are the advantageous chances or set of circumstances under which IAKS can be included in the ZSSAC.

1.8.4 Summary on concepts in the study

Indigenous farmers produce food crops and keep livestock with subsistence orientation using locally available resources. This knowledge is passed from generation to generation thereby contributing to the sustainability of this mode of food production. Indigenous agricultural knowledge systems that are not to be contrasted with modern agriculture since the two systems hail from different production factors and needs. Generally Indigenous farming is agroecological since farmers uphold ecological processes through land preparation methods, multiple cropping patterns and use of local crop and livestock breeds. Crops that are commonly grown include; tsanga (cereals), njekenje (legumes), madamura (tubers) and murivo (vegetables) while livestock include mombe (cattle), mbudzi (goats), makwai (sheep), nguruve (pigs) and shiri dzemumusha (poultry).

Farmers practise mixed farming also referred to as Agropastoralism. In mixed farming, every farmer makes an effort cultivate crops and raise livestock simultaneously, thereby raising the food security and nutrient status of the household. There is an interrelationship between crops and livestock. Livestock produce manure which is added to the soil to keep it fertile. The crops supply food especially supplementary food, as hay, to livestock during the dry season when the abundance and nutritive level of grass are low.

Due to colonialism and neo-colonialism, Indigenous farming is viewed as backward, unproductive and non-commercial with more attention paid to Western borne large scale farmers that are largely commercial. All the same, Indigenous communities have not neglected their farming practices even when they have information about modern farming methods. Inclusion of Indigenous agriculture knowledge systems (knowledge and practices) into the school agriculture curriculum would make promote food sovereignty and food security among Indigenous communities.

1.9 CO-EXISTENCE OF WESTERN AND INDIGENOUS KNOWLEDGE SYSTEMS

There is evidence of the co-existence of IK and Western science. However, Western science has grown by cannibalising Indigenous knowledge (Hountondji, 2002). The coexistence of plural knowledge systems and their complementarity in school agriculture curricula should be emphasised for reciprocal valorisation (Odora-Hoppers, 2000a; Hountondji, 2002). Both IKS and Western knowledge are a major aspect of human experience (Matthews, 1998). Both are sciences. Ogunniyi (2007) posits that IKS are scientific. Science enables humans to acquire knowledge about the natural world based on truths learned through observing and experimenting and observing the natural environment. Alebiosu (2005) and Emeagwali (2003) suggest that the science in IKS emanates from questions about the interactions between people and their metaphysical world. Mutandwa and Gadzirayi (2007) observe that the presence of science in IKS is strongly bonded in agriculture. Since IKS's science component is relevant for inclusion in the ZSSAC (Pedzisai, 2013) There is need to identify the relevant IKS in agriculture and incorporate it into the ZSSAC.

Emeagwali (2003) and Ogunniyi (2007) concur that there exist intersections between IKS and mainstream science. Euroscience itself is an Indigenous knowledge system that is rooted in the Western tradition (Kyle, 1999). This argument illuminates the relationship between IAKS and Western agricultural knowledge and practices in the classroom as that between alternate

forms of Indigenous knowledge established in different cultural traditions. Dei (2000) argues that the interplay between different knowledge is one reason for incorporating IKS into school curricula. According to the Contiguity Argumentation Theory, propounded by Ogunniyi, the two worldviews are regarded as equipollent or complimentary (Ogunniyi, 2007; Vandeleur, 2010). Hence they are harmonisable in the ZSSAC. Dei (2011) supports the co-existence of IKS and Western knowledge in the curriculum in that each claim would make up for the inadequacies of the other. That way the current stance of according Western agricultural practices as the dominant and universal knowledge would be overturned.
Lack of a clearly defined policy on IKS by Zimbabwe, its broad nature, the presumed subjugation that IKS suffers from Western knowledge and Zimbabwe's multi-ethnicity are some of its implementation challenges (Matowanyika, 1999). My experience as an examiner for the Zimbabwe 'O' level Agriculture teacher-cum-examiner of the Agriculture Syllabus 5034, has witnessed a disgusting situation whereby some candidates'answers that are IKS related are not accepted in the public examinations.

1.10 ORGANISATIONAL STRUCTURE OF THIS STUDY

The following organisational structure of eight chapters was used to present the study and its findings.

Chapter 1 describes the research problem and places it into perspective by giving an outline of context, background, and key research questions. It also provides the rationale for the study as well as objectives, justification, scope and limitations of the study.

Chapter 2 consists of a review of related literature related to IAKS and its inclusion in the school curriculum as applied to the teaching and learning of Agriculture Syllabus. Literature review helps to gain insight into the problem and be acquainted with existing research so as to avoid duplication which may lead to reinventing the wheel.

Chapter 3 begins with an overview of the theoretical framework guiding the study. This framework comprises Decoloniality as the metatheory with respect to how it informed the methodology. The chapter then looks at research design and methodology that I used in the study. Hence, the way the research was carried out and how the results were analysed are clarified. The chapter describes how I used semi-structured interviews, non-participant on-the-spot observation and document analysis as research methods in this study. The chapter also describes the data analysis processes and trustworthiness (validity threats) considered and how I ensured that the research was conducted in an ethical manner.

Chapter 4 analyses and discusses emerging themes from findings on Components of Indigenous Agricultural Knowledge Systems currently included in Zimbabwe's Secondary School Agriculture Curriculum. The research techniques which I employed to obtain the required data were document analysis and one-on-one interviews with six (6) Agriculture teachers, 3 per high school, two Provincial Agriculture Education Officers one each for the Midlands and Mashonaland West Provinces, two local Agriculture Extension (AGRITEX) Officers, one per community, the Director- Agriculture Education and Training with the Ministry of Agriculture, and five (5) Agriculture lecturers in Tertiary Institutions comprising a crop and an animal specialist from the university and agriculture college and lastly a lecturer from the teachers college. I also collected the data through on-the-spot observation of farming activities in communities studied.

The documents that I analysed included the Zimbabwe Agriculture Investment Plan (ZAIP)(2013–2017) in conjunction with the Comprehensive Agricultural Policy Framework (2012-2032), the Zimbabwe IKS policy as spelt out by the Second Science, Technology and Innovation Policy of Zimbabwe (March 2012, National Agriculture syllabi, Agriculture teachers' Schemes of Work and students' written work.

Additional data analysed was collected through interviewing agriculture educators namely; six (6) agriculture teachers, two (2) Agriculture Education Officers, 2 university Agriculture lecturers, 3 college Agriculture lecturers and two (2) AGRITEX officers. In addition data were analysed from observing the farming activities of the interviewed local farmers of both high schools and of the three tertiary institutions.

Chapter 5 analyses and discusses data on Indigenous Agricultural Knowledge Systems (knowledge and practices) that existed within the communities studied. This chapter addresses the sub-research question 'What IAKS (knowledge and practices) exist within the community?' I collected data, in the main, from the responses of twelve (12) local farmers - six (6) each from the catchment areas of the two selected schools. Observation data was derived from observing the farming activities of the interviewed local farmers, the two high schools, and the three tertiary education institutions. Data were also collected through interviewing agriculture educators namely; six (6) agriculture teachers, two (2) Agriculture Education Officers, 2 university Agriculture lecturers, 3 college Agriculture lecturers and two (2) AGRITEX officers.

Chapter 6 analyses and discusses data consolidated and sifted from Chapters 4 and 5 to suggest components of IAKS that can be included in Zimbabwe's Secondary School Agriculture curriculum. The chapter also analyses data wherein the participants proposed approaches for the effective inclusion of the IAKS suggested for inclusion in ZSSAC.

Chapter 7 presents and discusses the findings on benefits of including IAKS in the ZSSAC and also examines the challenges schools may face when including IAKS in the same curriculum.

Chapter 8 gives a summary of the findings from which conclusions are drawn and recommendations of the study made. The chapter provides a summary of the study and reflects critically on whether the research questions have been answered. This chapter also reflects on the methodology and methods used to conduct the research. The chapter then makes recommendations for future research into prospects and opportunities for the inclusion of IAKS in the Zimbabwe Secondary School Agriculture Curriculum

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter I review literature on IAKS. The review covers IAK and existing practices, the influence of Western epistemologies on the Indigenous agriculture system and how it has impacted on the Indigenous agricultural system. The literature also looks at the benefits of the Indigenous agriculture practices to the community and how IAK have been represented in policy, practice and the curriculum. The representations reveal how IKS have been or have not been included in agriculture curricula for Indigenous peoples elsewhere and in Zimbabwe. The study further reviews literature on approaches that have been used globally and in Zimbabwe to include IAK in the agriculture curriculum and challenges that have been realised in trying to include IAK in the agriculture curricula. Basing on the reviewed literature, the chapter ends by identifying gaps in knowledge to justify the research.

2.2 INDIGENOUS AGRICULTURE KNOWLEDGE AND EXISTING PRACTICES

Africa is home to Indigenous cereals, vegetables, fruits, legumes, tuber crops and livestock. According to the National Research Council (1996: xiii), "These have a potential for expanding and diversifying African and world food … (despite Africa being viewed)… as a basket case; a vast region incorporating more than 40 nations that appears unlikely to be able to feed its burgeoning population in the coming years". According to National Research Council (1996) throughout that vast continent of Africa can be found more than 2,000 native grains, roots, fruits, and other food plants which have been feeding people for thousands of years but most are receiving negligible attention today. National Research Council (1996) refers to them as the 'lost crops of Africa.' They have been lost indeed because they have been almost entirely overlooked.

2.2.1 Indigenous crops

2.2.1.1 Cereals

There are more than 100 Indigenous grasses whose seeds are (or have been) eaten (National Research Council, 1996; Hobley, 1967; Leakey, 2007). Some of these crops are actually under cultivation in African communities. Okhimamhe (2018) and National Research Council (1996) concur that these crops include African rice (*Oryza glaberrima*), Finger millet (*Eleusine coracana*), Fonio or Acha (comprising two species, *Digitaria exilis* and *Digitaria iburua*), Pearl millet (*Pennisetum glaucum*), Sorghum (*Sorghum bicolor*), Tef (*Eragrostis tef*), and other cultivated grains like Guinea millet (*Brachiaria deflexa*), Emmer (*Triticum dicoccum*) and Irregular barley (*Hordeum irregular*). Also among these are wild grains which people in Africa have been gathering on a small, localised scale but eating them for perhaps 100,000 years. Examples of such untamed cereals are drinn, golden millet, kram-kram, panic grasses, wild rices, jungle rice, wild tefs, and crowfoot grasses (National Research Council, 1996; Pichop et al, 2014). These crops are adapted to the prevailing harsh climatic conditions of Africa (Hobley, 1967; Leakey, 2007; National Research Council, 1996; Pichop et al., 2014).

These cereal plants have much to offer, and not just to Africa. They have the potential for solving some of the greatest food production problems that may arise in the twenty-first century since the grains tend to tolerate extremes and can thrive where exotic grains produce inconsistently. National Research Council (1996:15) sums this up by stating:-

> *Some (tef, for instance) are adapted to cold; others (pearl millet, for example) to heat; at least one sorghum to waterlogging; and many to drought. Moreover, most can grow better than other cereals on relatively infertile soils. For thousands of years they have yielded grain even where land preparation was minimal and management poor. They combine well with other crops in mixed stands. Some types mature rapidly. They tend to be nutritious. And at least one is reputed to be better tasting than most of the world's well-known grains.*

There is, therefore, need to promote these Indigenous crops going by their local adaptability and their potential contribution to food security, sovereignty and diversity.

2.2.1.2 Vegetables

There exist several African Indigenous vegetable plants that provide food to millions of Africans. According to National Research Council (2006) these Indigenous vegetable crops include Amaranth (*Amaranthus* species), Bambara Bean or Round Nut (*Vigna subterranea*), Baobab (*Adansonia digitata*) and related species, Celosia (*Celosia argentea*), Cowpea (*Vigna unguiculata*), Dika (Irvingia species), African eggplant (Garden Egg) (Solanum aethiopicum), Egusi (*Citrullus lanatus*) and kindred plants, Enset (*Ensete ventricosum*), Lablab (*Lablab purpureus*), Locust Bean (Parkia biglobosa), Long Bean (*Vigna unguiculata*), Marama (*Tylosema esculentum*), Moringa (*Moringa oleifera*) and related species, Native Potatoes (*Solenostemon rotundifolius* and *Plectranthus esculentus*), Okra (*Abelmoschus esculentus*), Shea (*Vitellaria paradoxa*) and Yambean (*Sphenostylis stenocarpa*). These crops have edible leaves, fruits, seeds, roots stems, flowers and bulbs to provide various soups, stews, sauces, relishes, flours condiments which are boiled, roasted, fried, ground into flour and blended with many traditional dishes (Pichop et al., 2014).

The nutritional value of the vegetables highlighted in the foregoing is that they can be used for addressing Africa's most basic problems—food insecurity, malnutrition, rural poverty, environmental destruction (National Research Council, 2006). In actual fact there is a lot of untapped potential to be found among Africa's traditional vegetable plants.

2.2.1.3 Fruits

Many authors (Awodoyin et al., 2015; National Research Council, 2008; Haule, 2016; Hobley, 1967; Kalaba, Chirwa, and Prozesky, 2009; Leakey, 2007; Mashile, Tshisikhawe and Masevhe; 2019; Gomez, 1989; Shava, 2005 and Nembaware, 2017; Stone et. al, , 2011) identify numerous cultivated and Africa's wild traditional fruits that appear useful for diversifying food supplies and improving nutrition across the African continent. These fruit have already been incorporated into Indigenous farming systems for millennia.

Among the cultivated and wild fruits are Balanites (*Balanites aegyptiaca*), Baobab (*Adansonia digitata*), Butterfruit (*Dacryodes edulis*), Carissa (*Carissa species*), Horned Melon (*Cucumis metulifera*), Kei Apple (*Dovyalis caffra*), Marula (*Sclerocarya birrea*), Melon (*Cucumis melo*), Tamarind (*Tamarindus indica*) and Watermelon (*Citrullus lanatus*) while wild fruits include Aizen (Mukheit) (*Boscia spp.*, Chocolate Berries (*Vitex spp.*), Custard Apples (*Annona spp*.), Ebony (*Diospyros spp.*), Gingerbread Plums (*Parinari* and kindred genera), Gumvines (*Landolphia* and *Saba* spp.), Icacina (*Icacina* spp.), Imbe (*Garcinia livingstonii*), Medlars (Vangueria species), Monkey Oranges (*Strychnos spp.*), Star

Apples (*Chrysophyllum* and related genera), Sugarplums (*Uapaca spp.*), Sweet Detar (*Detarium senegalense*) and Tree Grapes (*Lannea spp.*).

Many sources (Abigaba, 1999; Akinnifesi et al, 2006; Kwesiga, Mhango, Mkonda, Chilanga and Swai, 2004; Cemansky, 2015) observe that Africa's Indigenous fruit trees can be propagated and domesticated. This domestication involves identification, capturing of germplasm from the wild and the incorporation into existing farming systems. Agea (2004) and Cemansky (2015) add that domestication is an interactive procedure involving the identification, production, management and adoption of desirable germplasm.

The Indigenous fruit trees could save millions of lives by providing children and adults vulnerable to malnutrition with a nutritious source of food as well as valuable vitamins and minerals particularly during times of potential household insecurity (Akinnifesi et al., 2006; Kwesiga, Mhango, Mkonda, Chilanga and Swai, 2004). Cemansky (2015) reports that the World Agroforestry Centre offers training programmes for communities which want to set up their own nurseries, cultivating and domesticating Indigenous fruit trees including value addition and processing. This would enable the communities to make the most of Indigenous fruits, both nutritionally and economically.

Within African farming contexts, even at a small-scale, fruit trees have always been left on the cultivated land due to their value as food. The same applies to semi-domesticated self-sowing wild leafy vegetables. They are a component of Indigenous agriculture, which actually forms the basis of the origins of sustainable agriculture practice such as permaculture. These cultivated and wild African fruits overcome malnutrition, boost food security, foster rural development and sustainable land care, not only in Africa but at global level (Pichop et al, 2014). Inclusion of Indigenous Africa's fruits in the ZSSAC may, by and large, realise their potential in terms of quality, production, and availability.

2.2.2 Indigenous livestock

Before colonisation, Africa had and still has a variety of genetically diverse breeds of livestock that have played a major role in the social, cultural and economic history of the continent (Marshall et al, 2019; Mason and Maule, 1960; Rege, 1994; Shava and Masuku, 2019). For instance, Indigenous breeds of livestock have fed and clothed humans for thousands of years and many of them have unique adaptations for survival in harsh environments and for tolerating specific diseases (Marshall, 2019; Yoder, 2012). The harsh environmental conditions under which they have undoubtedly proved to survive and produce include tolerance to heat and drought, genetic adaptation to thrive on poor quality forages and resistance to pests and diseases. Rege (1994) notes the superiority of the productive performance of Indigenous cows in terms of milk quality and calf weaning weight per cow under these harsh environments.

Indigenous livestock serve multiple social, economic, political, spiritual, as well as ecological functions among the Bantu people. Grace et al., (2018), Smith et al. (2013), Shava and Masuku (2019), Herrero et al. (2013), Marshall et al. (2014), ILRI (2019) identify these functions as savings and insurance, food and nutritional food security, income, source of wealth, livelihood diversification and thus risk reduction (such as in mixed crop-livestock systems), inputs to crop production (draught power, manure as fertilizer), transportation, various uses of hides and skin (such as for housing), allowing households to benefit from common-property resources (such as communal grazing areas), and fulfilling social obligations (such as being used in special ceremonies and for lobola payment), *inter alia*.
Regrettably, the diversity of Indigenous livestock is in danger of being lost forever as Western knowledge encouraged farmers to switch to exotic livestock and cross-breeds of Indigenous and exotic breeds (Yoder, 2012). FAO (2006) amplifies this when they say that approximately 20 percent of Indigenous animal breeds around the world are in danger of extinction. There is thus need to protect the genetic diversity of Indigenous breeds of livestock in Africa. Such breeds include those of cattle, sheep, goats, pigs, poultry and equines that have adapted over centuries to a range of natural and socio cultural environments (Macaskill, 2016). Table 2.1 shows some of the Indigenous livestock breeds.

TABLE 2.1: SOME INDIGENOUS LIVESTOCK BREEDS OF AFRICA

CATTLE	SHEEP	GOATS	PIGS	POULTRY	EQUINES
NubianMashona	Red Maasai	Xhosa Lobbed Ear Goat	Bantu	Mushunu	**Donkey breeds** Nubian, Somali, Native Ethiopian, Muscat riding donkey, white Egyptian hassawi, East African donkey
Nguni/Nkone	Afrikaner	Boer Goat	Kolbroek (in South Africa)	Naked Necks	
Afrikaner	Zulu	Kalahari Red Goat	Windsnyer (Zimbabwe)	Ovambo	
Drakensberger	Damara	Cape Skilder Goa	Mukota (Zimbabwe)	Potchefstroom Koekoek	**Horse breeds** Abssiynian (Ethiopia), Baladi Egyptian, Bandiagara (Mali, Niger), boerperd (South Africa), Tswana (Botswana) Algerian (Algeria)
Bonsmara	BaPedi	Mbuzi or Nguni Goat	Somo (Mali),)	Venda,	
Tuli	Swazi	Savanna	Bakosi (Gabon)	Natal Game.	**Mule (Jack Ass) breeds** There are no breeds for mules. Mating a male donkey with a female horse produces a mule while the progeny of a female donkey and a male horse is a hinny (The Editors of Encyclopaedia Britannica, 2018).
Ankole	Somali	Angora	West African Dwarf (Nigeria) -	Sola-Ojo	
Tuli		Saanen,	Bush pig (Togo)	Ayorinde	
Nganda		Alpine	Ashanti (Ghana)		
Boran		Toggenburg			
Angoni		Nyasa			
Barotse					

It is not a secret that the Indigenous breeds of livestock are adapted to periodic droughts, seasonal dry periods, nutritional shortages and an array of parasites and diseases experienced in Africa (Macaskill, 2016), all which make them hardy and well suited to the harsh African environment where they can survive without additional feed or medication. Incorporation of Indigenous breeds into the ZSSAC may realise the importance of their traits for sustainable livestock production and make them a viable alternative to imported breeds in Africa's harsh climate.

2.2.3 Indigenous agriculture practices existing in the community

According to McClean et al., (2005) and Chota et al., (2010) all the IAKS (knowledge and practices) which have something to do with animal and plant production need to be protected and continue to be used since they exhibit a lot of advantages over the Western farming knowledge and practices. Such Indigenous farming practices should find their way into the ZSSAC.

Notsi (2012) and Dlamini (2007) view mixed cropping as almost synonymous with traditional agriculture because of its significance in the production of food in traditional farming systems. Mixed cropping refers to ".... the growing of two or more plant species in the same field in the same year and, at least in part, at the same time" (Ramert, Lennartsson, and Davis, 2002:1). The practice improves soil management, suppresses pests and diseases, and permits an intensification of the farm system resulting in increased overall productivity and biodiversity in cropped fields (Norberg-Hodge *et al.*, 2001). In this way it promotes sustainable agriculture and food security.

Buthelezi, Hughes and Modi (2010:12) and Fenta (2006) observe that farmers in KwaZulu Natal and Dejen District of Ethiopia, respectively, use soil taxonomy and vegetation to determine the soil fertility and suitability of the soil for particular crops. Reijntjes, Haverkort andWaters-Bayer (1992) opine that farmers classify soils according to properties such as colour and texture. Notsi (2012:12) adds that the farmers in Tsitas Nek (Lesotho) and Mabeskraal Village (South Africa) have methods of evaluating soil moisture by hand-feel and appearance.

Common among Indigenous farming is the practice of organic farming to increase the yield of food crops. Agea, Lugangwa, Obua and Kambugu (2008) refer to the practice simply as ‘farming without chemicals’. Dlamini (2007: 30) defines organic farming as “a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives.” Lampkin in Dlamini (2007: 30) points out that:

> *To the maximum extent feasible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, and aspects of biological pest control to maintain soil productivity and tilth, supply plant nutrients and to control insects, weeds, and other pests.*

Notsi (2012), Reijntjes et al. (2012), Pedzisai (2013) and Agea et al. (2008) observe that Indigenous farmers engage in traditional pest management practices. Reijntjes et al. (2012) mention the traditional use of ducks, fish, frogs and snakes to biologically control insects in paddy rice cultivation in India. Altieri (1987) and Thurston (1990) opine that “Traditional crop selection, planting times and cultivation practices often reflect efforts to minimise insect damage (Reijntjes et al, 2012).

In Mukungwe, Central Uganda Agea et al. (2008:67) posit that:

> *Majority (77%) of the households reported to be using locally-made pesticides; red pepper, banana juice, wood ash, citrus lemon leaves, neem tree, tobacco and tephrosia leaves to control array of pests such as maize stem borers and cabbage diamondback moths that damage food crops while in the gardens and those such as rodents and bean weevils (bruchids) in storage.*

Farmers in Dejen district of Amhara, Ethiopia apply different Indigenous pest and disease control techniques. According to Fenta (2006) such techniques include:

> *... Spraying animal urine, dusting the seed with ash and pepper; mixing animal urine, donkey waste, poisonous plant leaves and ash and spraying it on the crop-land where disease and pest occur; repeated ploughing; cutting and getting rid of infected plants; crop rotation; burning and smoking; and use of resistant variety.*

A study carried out by Pedzisai (2013) in Zimbabwe, concurs with Notsi (2012) and Grenier (1998) that Indigenous Africans indulge in crop husbandry practices like selection of cultivation site, land preparation, organic manuring, mixed cropping, seed selection, Indigenous ways of propagating plants, Indigenous management of growing plants such as weeding, organic disease and pest control up to harvesting and Indigenous post-harvest storage and processing techniques (drying, grain storage methods, shelling). The studies further note that Indigenous animal husbandry practices like pasture management, grazing systems, traditional fodder and forage species and their specific uses; animal-disease classification; and traditional ethno-veterinary medicine as common among Indigenous farmers.

As observed by Reijntjes et al. (1992), Indigenous farmers in Southern Sudan and Zaire improve or maintain soil fertility by using soil from termite mounds for growing sorghum and cowpea. They further note that farmers in Zaachilla, Mexico, use ant refuse to fertilise high value crops such as tomatoes, chilli and onions to manage soil fertility.

Shifting cultivation, also called *swidden* agriculture, is another type of farming which has been and is still used all over the world by traditional farmers to maintain soil fertility (Reijntjes et al., 1992; Notsi, 2012). Shifting cultivation involves an alternation between crops and long-term forest fallow. Stephen and Chrisman in Notsi (2012) posit that in the shifting cultivation system ... forest is cut down and burned for soil fertility. There is a time when a piece of land is abandoned to restore its soil fertility and recover.

Fenta (2006) advances that in Dejen district, Amhara Region of Ethiopia, farmers employ Indigenous techniques for controlling soil erosion, including the use of traditional ditches (which farmers locally call *feses*), traditional waterways (*boi*), stone terraces (‘*yedengay erken’*), traditional cut off drains (*tekebkeb*), vegetative barriers (*Geta*) and contour ploughing.

Almost every Indigenous culture is characterised by traditions. Such traditions include traditional beliefs, myths, legends, folktales, rituals and rites. Chhetry and Belbahri (2009:9) identify one of these traditional practices in Northeast India in the following statement: “Rice grains in flat containers are placed uncovered in the rice field as peace offering to rodents while the farmers are talking to the rodents begging them not to attack his crop”. Similarly, Notsi (2012:12) notes that "Batswana and Basotho believe that an environmental cleansing ceremony needs to be performed before the first rains and the field preparation." While some scholars may lament the presence of myths, superstitions and beliefs in some IAKS practices, Magagula and Mazibuko (2004) say that these have scientific explanations which cannot be ignored. Chhetry and Belbahri (2009: 9) concur with Magagula and Mazibuko (2004) when they posit that "... these traditions may not hold any truth and practical value but are expected to hold some message and, therefore, need in depth observation in the light of empirical sciences to discover some of these beliefs as sound agricultural practices." The same applies to mukwerera (traditional rain asking ceremonies) in Zimbabwe which traditional farmers have used to ask for rains from the ancestors. Such a practice appeals to the spiritual realm.

Most Indigenous agricultural activities are closely linked to the weather. Svotwa, Manyanhaire and Makanyire (2007: 55-7) noted on the traditional prediction of heavy rains and an impending wet spell if ants emerge from their holes in large numbers to collect food from homes and the veld, the singing of large swarms of cicada in September to mark the beginning of the normal to above normal season and the abundance of certain wild fruits and berries as an indicator of abundant rains and the shooting of the sausage tree to signify the onset of the rain season. All these observations would trigger preparation for rain making ceremonies, land preparation, dry planting of millet begins or sourcing of draught power.

Jha (2008:1) posits that "even within traditional systems, gaps existed between 'good' and 'bad' farmers and practices. Both research and extension systems sought to exploit the 'good' practices." The need to exploit the good practices and to reorient the ZSSAC towards appreciation of effective Indigenous technologies and traditional farming practices cannot be overemphasised. This study explored whether the IAKS practices are already incorporated and identify and recommend those that still need to be incorporated in the ZSSAC.

2.3 BENEFITS OF THE INDIGENOUS AGRICULTURE PRACTICES TO THE COMMUNITY

2.3.1 Conservation of culture

Mawere (2014) contends that colonisation destroyed African cultures and Indigenous Knowledge, resulting in Africa depending on Western Knowledge for development. Mawere's argument is that reliance on Western knowledge alone will not lead to sustainable progress for Africa. Rather, Africa needs to revive her Indigenous cultures to guarantee her growth in a globalized world.

Generally culture is the way of life of a people. Agriculture is associated with many aspects of life, or in other words, agriculture has a close linkage with culture (Anggreni, 2017). Indigenous farming knowledge and practices thus becomes part of the way of life of Indigenous peoples. Customs, rituals and myths and sacred festivals concerning particular crops and livestock provide a close link between agriculture and a people's culture. Equally interesting is the intimate relationship between the natural physical environment, in which a certain type of agriculture has developed, and the Indigenous peoples' way of life, ethical values and social structures (Leander, 1995).

According to Anggreni, *(*2017) human existence, progress and welfare are strongly determined by the way humans interact with the surrounding natural environment. This human interaction with the surrounding natural environment maintains their existence and improves the quality of life through development of knowledge and technology systems. Knowledge of growing crops and keeping animals and related technologies gave birth to the culture of agriculture. Greek philosopher and historian, Xenophon (427-355 BC), in Sinjal, (2006) states that agriculture is the mother of all other cultures. Hence, agriculture is important in maintaining cultural heritage and cultural heritage is in turn influenced by active farming (Daugstad, Ronningen and Skar, 2006). Without agriculture a people would not have a culture.

"IKS represent both a national history and a national resource which should not only be protected, promoted, developed and where appropriate conserved; but which should be put into service for the present and succeeding generations (Odora Hoppers, 2000b: 289-290)". This contention should be applied for IAKS that are still pragmatic in solving the agricultural concerns of the Indigenous Zimbabweans.

"There is now a growing consensus that some of the solutions to the problems that currently plague African societies and communities must proceed from understanding the dynamics within the local context" (Owuor, 2007:21). Such dynamics include the role of Indigenous knowledge and practices in community development processes. Such an endogenous approach to education contextualises the school curriculum through integrating local farming practices with other relevant and useful knowledge. This is summed up in a UNESCO (2006:6) document as follows:

> *It is especially an attempt to promote education for sustainable development of African societies where cultures and ways of life are balanced with global and international pressures and demands.*

Zimbabwe's current move towards promoting IKS through education gravitates toward alternative approaches to school curricula. The dominating discourse on local farming knowledge in the Zimbabwean education context arises from the recognition of the need to address deficiencies of knowledge on development that is formulated in Western contexts. Inclusion of local knowledge in the ZSSAC can be viewed as appropriate to the needs of the Indigenous societies and communities of Zimbabwe. "Education is, therefore, acknowledged as being instrumental in harmonising the different forms of knowledge bases and creating a social fabric for societies that can engender social, economic, and political sustainability (Owuor, 2007:21)". It is hoped that local agricultural problems in agriculture can be addressed effectively by harmonising them with Western practices in the ZSSAC.

Indigenous knowledge has also been called local, folk, or people's knowledge as well as traditional wisdom. Some components of Indigenous knowledge are oral, and are passed down from generation to generation through word of mouth and rituals. According to the World Bank (1997), the ability of a group of people to grow their Indigenous knowledge, is as important as their financial resource because Indigenous knowledge represents a people's history, crafts and experiences, which can spur improved livelihood. Sarpong (2002) emphasized that knowledge should not be divorced from the cultural context it emanated from because a people's culture shapes a people's consciousness. Similarly, Asante (1987) concluded that all knowledge emanates from a cultural background, as such, it is inappropriate to place any form of knowledge above the other. Specifically, Asante (1987) insisted that all cultures and the knowledge systems arising from them should be respected.

Fafunwa (1994) defined education as the totality of ways a child develop capabilities or various forms of behaviours that are of positive value to his or her society. Fafunwa (1994) emphasizes that education is how a people or society transmit their culture to upcoming generations. However, education is viewed differently today by young adults of 21st century who tend to regard education as a means to an end. Technlogical advancement, especially media influence, tends to alienate them from the society.

We need to study both Western knowledge systems and Indigenous knowledge systems in order to ameliorate the negative impact of the dominant knowledge system and facilitate appropriate development among Indigenous communities (Studley,1998). An IKS study can contribute to an empowerment of these communities and result in societies that are more viable and sustainable (Gurung, nd).

2.3.2 Biodiversity conservation

Indigenous and local traditional knowledge of place-based biodiversity is perhaps the oldest scientific tradition on earth (Wilder, O'Meara, Monti and Nabhan, 2016). Indigenous knowledge can help promote biodiversity conservation by characterising resource uses that are appropriate for the particular local landscape. In fact, incorporating Indigenous knowledge into conservation and development activities is believed to be an important mechanism for ensuring the most efficient and productive use of natural resources in the short- term without jeopardising the long-term capacity of nature to continue producing these resources.

According to Sahai (2003:11)

> *The importance of Indigenous knowledge can be understood when one realises that there are no rice or wheat plants nor cotton or mustard found lying around in the forest. What are found in the forest are wild plants out of which communities of men and women over generations have bred races of several food and cash crops.*

The thousands of landraces which form the basis of the world’s agriculture have thus been bred out of the wild plants of the forests. These landraces are the foundation material of modern plant breeding and global food security (Sahai, 2003). These landraces are the same Indigenous varieties that plant breeders use to breed other varieties.

2.3.3 Food security

Food security is defined as the success of livelihoods to guarantee access to sufficient food at the household level (FAO, 2010; Moyo, 2011). The concept of food security is multidimensional in nature and includes food access, availability, use, stability and entitlement to food (Amejo, Gebere and Kassa, 2018). The emphasis is on food availability at all times and an active healthy life (Lunga and Musarurwa, 2016). However, Moyo (2011) and Zimbabwe Government and United Nations Development Programme (2011) lament food insecurity and poverty as a permanent feature in Zimbabwe due to persistent threats of drought.

The capability of nature to produce food needs to be understood and requires a food production system that demands human-nature interactions such as agro-ecology, Indigenous knowledge-based agriculture, conservation agriculture and organic agriculture (Wibowo, 2000). Obach (2007) reasoned that strategies that work in harmony with nature are becoming more preferable as society becomes aware of the benefits of purchasing products produced with less chemical inputs and living in harmony with nature. For this reason, the emergence of permaculture, organic farming and other sustainable agriculture systems charactertised by closed energy cycles modelled on natural ecosystems resulting in minimal use of primary inputs such as chemical fertilisers (Bambrey, 2006). This is due to a high degree of inter-linkage wherein the outputs from one part of the system become inputs for another part of the system, producing no waste products (Bambrey, 2006; Grayson, 2007).

In Africa, Indigenous Knowledge Systems also contribute to food security through post-harvest techniques used by local communities. Malawi, like other countries in Africa, has its own Indigenous ways and practices of storing food and preserving it for future use (Kamwendo and Kamwendo, 2014). These Indigenous food storage and food preservation practices were Indigenous measures of ensuring that the household did not suffer from food shortage during any part of the year. However, due to Africa's colonial past, such knowledge is treated as inferior to modern food preservation and storage technologies.

In Malawi, the practice of storing Indigenous grain and legume crops they used as staple food, which they call *msanja,* was very common in most Lomwe households (Kamwendo and Kamwendo, 2014). These crops include millet, sorghum, unshelled nuts and peas to protect them from weevils and other pests. Some even used the *msanja* to store maize cobs which are earmarked for seed for the next growing season. *Msanja* is common practice not only in Malawi but across southern Africa. The *msanja* is a structure fixed at the centre of the kitchen, right above the kitchen's fire place. However, the use of this technology, like other Indigenous technologies, is no longer common (Kamwendo and Kamwendo, 2014). The reason for storing harvested crops in this structure was to protect them from weevils, rodents and other pests as they got coated with bitter soot from the kitchen fire, which made the grains inedible to both insect pests and rodents, thereby ensuring food security in a very effective, priceless and cost-free technology.

Mafongoya and Ajayi (2017) observe that Indigenous Knowledge promotes food security and poverty alleviation through production and preservation of Indigenous food. They go on to give the example of the Maasai pastoralists in Kenya who rely on agro-pastoralism wherein they integrate food plants (maize and beans0 with endemic species with livestock (cattle, goats and sheep) and wildlife. This system of land use and management has assured them a stable livelihood for generations that enables them to optimise their utilisation of rangeland resources for maximum meat and milk production.

In Zimbabwe, the Zunde Ramambo or Isipahla SeNkosi (the chief's granary or land) is a traditional social security arrangement coordinated by chiefs to provide protection against food shortages to vulnerable families (Dhemba et al., 2002; Kaseke, 2006; Mararike, 1999; Ringson, 2017; Risiro *et al.*, 2012; Stathers *et al*. 2000). It is an informal, in-built social, economic and political mechanism commonly practiced by the Shona and Ndebele speaking people (Risiro *et al*. 2012; Stathers *et al*. 2000). The concept, which is as old as the Zimbabwean culture (Dhemba et al., 2002; Kaseke, 2006) is still practiced in some parts of Zimbabwe but not with the same vigour it used to have in ancient Shona times (Ringson, 2017). The concept is the communal storage of grain. Traditional custom requires the chief in any given locality to designate land, referred to as zunde in Shona or isipahla among the Shona and Ndebele communities respectively, for growing food crops especially staple cereals as protection against food insecurity in the community. Although all members of the community could benefit from the food reserves, priority was given to vulnerable families, the elderly, orphans, widows, and persons with disabilities in the community. Community members take turns to voluntarily participate in the entire crop production process from ploughing, sowing, weeding to harvesting (Mararike, 1999; Kaseke, 2006). The harvest is stored in granaries at the homestead of the chief or village head as food reserves, which will be distributed to the chief's subjects in the event of food shortages or even during normal times (Dhemba et al., 2002; Kaseke, 2006). This voluntary participation developed a community's sense of belonging and identity.

The Zunde raMambo scheme disappeared during the colonial period following the establishment of new power structures by the colonial regime which curtailed the powers and responsibilities of chiefs (Kaseke, 2006). However, in the mid-1990s, the government of Zimbabwe decided to revive the Zunde raMambo scheme due to concerns from traditional leaders over growing levels of malnutrition in rural areas and the HIV/AIDS scourge (Dhemba et al., 2002; Kaseke, 2006; Stathers *et al*. 2000). Inclusion of the concept in the ZSSAC could promote the reestablishment this social security concept.

2.3.4 Food sovereignty

The goal of simply having food security is not the ideal. The ideal is to have food sovereignty for all people. Food sovereignty, as defined by the Alliance, US Food Sovereignty (2018) is the right of people to choose what type of food they want to eat and also where and how they get that food. Demitz (2015) sees food sovereignty as the right to choose what food to eat, where it comes from and how it is grown**.** Food is a basic human need and no one should have to go without it. Indigenous people never struggled for food. They were self-reliant on food from growing their own food from own seed, keeping livestock and gathering food from the wild. They were both food secure and sovereign.

Muchenje and Goronga (2015) observe that in Zimbabwe, agriculture is a subject that is offered in primary and secondary schools and tertiary institutions. They further advance that a reformed education curriculum should emphasise the inclusion of Indigenous knowledge systems with regard to agricultural production. Shizha (2013) argues that in Sub- Saharan Africa postcolonial school knowledge continues to mirror colonial residues and these continue to imprison the actions, feelings, attitudes, beliefs and the conceptual capabilities of Indigenous people. Muchenje and Goronga, (2015) and Shizha (2015) concur that in order to meet these challenges, the school curriculum needs to be reformed so that Indigenous knowledge systems feature prominently across the curriculum in schools and tertiary institutions. This would generate local solutions to local food sovereignty problems. Through incorporation of IKS, the education curricula can become contextually relevant and epistemologically meaningful. This is also true for the agriculture curricula.

2.3.5 Adaptation to climate change

Most Indigenous livelihoods depend on agriculture for food security. These Indigenous livelihoods are increasingly being negatively affected by erratic rainfall coupled with increasing temperatures. “Agriculture is among the highly sensitive systems influenced by change in weather and climate (Singh and Singh, 2017:296)” and has been defined by Macholdt and Honermeier (2016) as the most weather-dependent human activity, with most production decisions either directly or indirectly affected by this factor. No person, country or region of the world is immune to climatic change (Kumar, 2014). According to Chanza and de Wit (2016:10) **“**the Intergovernmental Panel on Climate Change (IPCC), a brainchild of the United Nations Environmental Programme (UNEP) and the World Metrological Organisation (WMO), established to give the most comprehensive overview and fact base of climate science, recognises climate governance and Indigenous knowledge (IK) in the ongoing climate change discourse”. Most climate change and its effects, as per climate change reports from the IPCC, have been proven to be anthropogenic by science (Le Treut et al., 2007). There is, thus, broad scientific agreement that climate change is happening and that there is increasing evidence that it will play a significant role in shaping agricultural production (Wheeler and Kay, 2010).

Many highly respected IK holders in Indigenous communities are subsistence farmers with in depth knowledge of the weather, seasons, agriculture, environment including droughts and floods, identification of soils and nutrients, seeds, plants and animal diversity and maintain intricate relationships with their environment (Alcock, 2010). These communities have evolved many Indigenous coping strategies that are helping local populations to face this brunt of climate change. Because environmental change may be as old as the society itself, Indigenous Africans had lots of climate adaptive coping strategies which they applied with success (Makondo and Thomas, 2018). These coping strategies are visible in the daily crop and livestock production activities. Hence, many scholars of environmental change strongly argue for the inclusion of Indigenous knowledge into climate change policies and implementation (Ross, 2009; Etchart, 2017).

According to Mafongoya and Ajayi (2017) traditionally, rural subsistence farmers have relied on IK to understand weather and climate patterns in selecting crops and managing farming operations. Kabubo-Mariara (2011) views low, poorly distributed and unreliable rainfall, climate and ecological extremes as the major challenges to sustainable agricultural production in Kenya. This scenario is true for other African countries.

Srinivasan (2001) identifies the following crop husbandry coping strategies: intercropping, mixed cropping, mixed land use, cultivation of more than one type of grain staple, mixed farming, multiple cropping, cultivation of varieties adapted to flooding, cropping pattern decisions based on local predictions of climate, varying planting dates, terracing and re-terracing of collapsed slopes and Indigenous water harvesting techniques to cope with drought. With respect to animal husbandry are strategies that include using emergency fodder in droughts, Indigenous systems for selection and storage of nutritious tree fodder (to reduce drought risk on livestock), local knowledge on animal fattening during summer, the movement, sale and culling of livestock for food in drought and use of medicinal plants to treat livestock diseases (Kihila, 2018; Srinivasan, 2001). Farmers in Tanzania "... use traditional practices such as terracing (*matuta*), tree planting (*ngolo*) and construction of locally based water reservoirs (*nkunisa*), mixed cropping and crop diversification (Kihila, 2018:406)".

The coping strategies identified also encompass changing farm production practices such as planting and harvesting times, crop protection methods, tillage practices, and variety choice

(Eitzinger et al., 2009; Smit and Skinner, 2002; Macholdt and Honermeier, 2016). With respect to timing farming operations, a study by Okonya and Kroschel (2014) in Uganda indicated that local communities have twenty one distinctive indicators for forecasting the start of the dry season. These included the appearance of bush crickets (Ruspolia baileyi Otte), winds blowing from the east to the west and the appearance and movement of migratory birds such as cattle egrets (Bubulcus ibis Linnaeus). On the other hand, to predict the start of the rainy season, Okonya and Kroschel, 2014) mention twenty two indicators which included winds blowing from the west to the east and the starting to call of cuckoo birds (Cuculiformes: Cuculidae). All these would make the Indigenous farmers ready for certain farming operations as dictated by the weather forecast. Such use of Indigenous Knowledge in seasonal weather forecasting is useful in decision making at village level since it helps farmers to exploit the seasonal distribution of rainfall to maximise crop yields.

Agriculture activities in southern African countries are mainly rain fed such that productivity of crops to a large extent depends on the appropriate and effective decision on when, where and what to plant (Chang'a, Yanda and Ngana, 2010). This in turn depends much on the accuracy and reliability of seasonal rainfall forecasting. In Zimbabwe as elsewhere in Africa, local communities predict rainfall and cope with drought by integrating contemporary and Indigenous climate forecasting methods. These weather forecasting methods rely mainly on local environmental indicators and astronomical factors. In Tanzania, older generations especially in the rural areas, largely relied and still rely on Indigenous Knowledge to predict weather through observation and monitoring the behaviour of animals, birds, plants, insects and the atmosphere (Chang'a, Yanda and Ngana, 2010; Kihupi et al., 2002; Mhita, 2006). Observation is made on special plants, insects, birds and environment to reach a conclusion about the future weather conditions.

Several authors (Ajibade and Shokemi, 2003; Chang'a, Yanda and Ngana, 2010; Chikaire and Ajaero, 2018; Dube and Musi, 2002; Jiri, Mafongoya, Mubaya, and Mafongoya, 2016; Joshua et al., 2011; Mugabe et al., 2010; Kijazi et al., 2012; Mafongoya and Ajayi, 2017; Mogotsi et al., 2011; Muguti and Maposa, 2012; Ngenwi, 2010; Singh and Singh, 2017; Risiro et al., 2012; Roncoli, Ingram and Kirshen, 2002; Shoko and Shoko, 2013; UNEP, 2008; Zuma-Netshiukhwi, Stigter, *and* Walker, 2013) generally concur that in Africa, weather forecasting is broadly based on (a) knowledge of plant phenology (b) indicators from behaviour of animals, birds and insects (c) knowledge on local astronomical indicators based on the moon, sun and stars; and (d) weather related indicators like temperature, wind and air circulation. The weather forecasting knowledge and indicators point to heavy rains, drought or that it is about to rain.

There are lots of astronomical weather forecasting indicators. In South Africa, Malawi, Zambia and Zimbabwe the appearance of the moon crescent facing upwards signifies crop diseases and erratic rainfall as opposed to when it is facing downwards which indicates heavy showers in the next three days (Joshua et al., 2011; Mugabe et al., 2010; Shoko and Shoko, 2013; Zuma-Netshiukhwi et al., 2013). In Botswana, Malawi, Swaziland, Zambia, Zimbabwe and South Africa, the movement of a constellation of stars at night under clear skies from west to east mean rain will fall in 3 days (Dube and Musi, 2002; Joshua et al., 2011; Mugabe et al., 2010; Mogotsi et al., 2011; Shoko and Shoko, 2013; UNEP, 2008; Zuma-Netshiukhwi et al., 2013).

In Botswana, Malawi, Zambia, Zimbabwe and South Africa the onset of the rainy season is shown by budding of acacia species, Erythrina abyssinica (Lucky-bean tree), Brachystegia speciformis (Zebrawood), Ficus spp (Fig trees), Syzygium Cordatum (*Waterberry)* and Prunus persca (peach) trees (Joshua et al., 2011; Kolawole et al., 2014; Mapfumo et al., 2015; Mugabe et al., 2010; Risiro et al., 2012; Zuma-Netshiukhwi et al., 2013), appearance of many Ancistrotermes spp and Macrotermes termite species as observed in Botswana Malawi, Zambia and Zimbabwe (Joshua et al., 2011; Mogotsi et al., 2011; Mugabe et al., 2010; Muguti and Maposa, 2012), croaking of frogs in swampy areas especially at night as observed in Swaziland, Zambia, Zimbabwe, (Dube and Musi, 2002; Mugabe et al., 2010; Muguti and Maposa, 2012; UNEP, 2008), unusual squeaking of rock rabbit as the case in Zimbabwe (Muguti and Maposa, 2012; Risiro et al., 2012) and appearance of cicadas, day flying chafers and dragon flies in as happens in Malawi, Zambia, Zimbabwe (Joshua et al., 2011; Mugabe et al., 2010; Muguti and Maposa, 2012; Risiro et al., 2012).

Signs of good rains are indicated by calves jumping happily as observed in Eswatini, Tanzania and South Africa (Dube and Musi, 2002; UNEP, 2008; Zuma-Netshiukhwi et al., 2013), frequent swirling of winds as observed in Botswana, Malawi, Swaziland, Tanzania, Zambia, Zimbabwe and South Africa (Dube and Musi, 2002; Joshua et al., 2011; Kijazi et al., 2012; Mogotsi et al., 2011; Mugabe et al., 2010; Muguti and Maposa, 2012; Risiro et al., 2012; UNEP, 2008; Zuma-Netshiukhwi et al., 2013), mountains covered with mist in South

Africa (Zuma-Netshiukhwi et al., 2013), appearance of many nimbus clouds and red clouds in the morning as observed in Malawi, Eswatini, Tanzania, Zambia and Zimbabwe (Chang'a et al., 2010; Dube and Musi, 2002; Joshua et al. 2011; Kijazi et al., 2012; Mugabe et al, 2010; Risiro et al., 2012; UNEP, 2008) and a lot of heat in spring (Jiri et al., 2016).
Indicators of a potential drought season include heavy flowering of the trees *Parinari curatellifolia* (mobola-plum), *Lannea discolor* (Tree grape), *Uapaca kirkiana* (sugar plum); *Boscia albitrunca* (shepherd tree); *Adansonia digitata* (baobab) as observed in Botswana, Malawi, Zambia and Zimbabwe (Jiri et al., 2016), appearance of fog in the morning as observed in Malawi, Zambia and Zimbabwe (Joshua et al., 2011; Mugabe et al., 2010; Risiro et al., 2012), strong wind during spring (Chang'a et al., 2010; Jiri et al., 2016; Mugabe et al, 2010; Risiro et al., 2012), abundance of butterflies (Danaus plexippus) during the farming season, occurrence of more grasshoppers and presence of army worms (Spodoptera exempta) in Eswatini (Chang'a et al., 2010; UNEP, 2008), empty goat intestines at slaughter in Tanzania (Kijazi et al., 2012; UNEP, 2008) and increase in libido of donkeys in Tanzania during the months of August to October (Kijazi et al., 2012; UNEP, 2008).

Besides the weather forecasting methods indicated above, other Indigenous indicators include rainmaking ceremonies as established in Botswana and Zimbabwe (Mogotsi et al., 2011; Vijfhuizen, 1997) and the feeling of excessive heat by the human bodies during the night mean imminent rains in 1 to 3 days (Jiri et al., 2016; Risiro et al., 2012). Further, Jiri et al. observe that in Zimbabwe, asthmatic attacks and painful surgical scars indicate imminent cold weather and humid conditions. Understanding, predicting and anticipating changes in weather and other climatic variables is very important for rural communities, whose livelihoods rely directly depend on weather and climate conditions. Local communities in the world observe climatic changes taking place in their environment which affect their livelihood choices (Balehegn, Balehey, Fu and Liang, 2019).

According to Mafongoya and Ajayi (2017:188) **"**It is increasingly acknowledged that in weather and climate predictions, IK is found to be more rational, accurate and reliable than scientific (Western) knowledge at local scales''. In weather forecasting, IK exists in parallel to Western science (Kimmerer, 2002), and both are seen as complementary perspectives on the environment and natural resources (Whyte, 2013). In Tanzania, Chang'a et al. (2010) observe that both Indigenous and Western weather forecasting specialists correctly predicted the 2009/2010 rainfall season to feature normal to above normal rainfall. However, the implementation of climate change response programmes for adaptation and resilience appears to be anchored on Western scientific knowledge. This has marginalised Indigenous knowledge as it is considered unimportant (Belfer et al., 2017; Lesperance, 2017; Whitfield et al., 2015). Integration of unique and specific agricultural Indigenous knowledge systems in school agriculture curricula could be one of the best ways to promote effective and sustainable implementation of climate change adaptation strategies among target Indigenous communities. These Indigenous coping strategies, if incorporated in the ZSSAC may improve adaptation to climate change.

Since climate change alters the climatic conditions like drought and flooding which result in food insecurity, Indigenous communities have come up with various mitigatory and adaptation strategies to climate change. For instance "... farmers in Tanzania use traditional practices such as terracing (*matuta*), tree planting *(ngolo*), and construction of locally based water reservoirs (*nkunisa*), mixed cropping and crop diversification. Pastoralists use strategies such as rain water harvesting (*ngitiri),* in ditches (*malambo)* (Kihila, 2018:406)".

Cooper, Dimes, Rao, Shapiro, Shiferaw and Twomlow (2008) noted that in Sub-Saharan Africa, Indigenous farmers practise intercropping and they also plant their crops with earlier maturing varieties. Ozor, Urama,and Mwangi, (2012) identify green manure application and mulching while Ofoegbu, Chirwa, Francis and Babalolan (2016) mention rainwater harvesting using dwalas as a method of conserving rain water for use to irrigate crops.

Dietz et al. (2004) say that farmers cope with drought by moving to fields that are less water stressed while Mukheibir, (2008) observed changes in planting dates, row spacing and planting density as measures against drought. Balehegn, Balehey, Fu and Liang (2019.) posit that women gather wild plants to supplement family diets and diversify their crops as common methods of coping with drought. Manandhar, Vogt, Perret and Kazama, (2011) report of minimum tillage methods like zero tillage and surface seeding as practices to conserve soil moisture. Crop diversification is advantageous because with a single crop there is the danger that a particular hazard or environmental pressure will destroy nearly everything while with many different crops, there is a better chance that some will survive. Good harvests can also be made possible by cultivating near wells and in *vleis* (Snorek, Renaud and Kloos, 2014).

Livestock get supplementary food like hay and crop stover during the dry season (Yan, Wu and Zhang, 2011) to keep them in good condition. However, the animals are slaughtered during fodder scarcity (Schilling, Freier, Hertig and Scheffran, 2012). Mixed crop-livestock systems, like the Kenyan Agropastoralism practised by the Maasai help restore soil fertility for luxuriant crop growth and to provide livestock with fodder in order to keep them in good condition (Mafongoya and Ajayi, 2017).

There are a lot more Indigenous coping strategies against climate change. Coping and adaptation strategies have been practised by Indigenous farmers for centuries with success.

2.3.6 Innovative technologies

The major innovative technologies, permaculture and agroforestry, uphold agrological principles. Agro-ecology or ecological agriculture stands at the interface of several disciplines, its name being based on two fundamental disciplines: ecology and agronomy. The primary focus of ecology is on natural systems, while the focus of agronomy lies in the research and application of scientific knowledge relevant to agricultural practice (Moudrý, 2018). It focuses on research into the use and functioning of fields and generally farmed ecosystems. Agro-ecology is the holistic study of agro-ecosystems, including all of their environmental and human elements (Altieri and Nicholls, 2005). It deals with relationships among plants, animals, microorganisms, and agricultural soil, as well as its relationships to these organisms in the landscape and it also evaluates the impact of agrotechnology on the ecosystems of farmed land (Fițiu, 2003). The main objective is to optimize farm and landscape management practices. Several approaches, including integrated pest management, a polycultural farming system, conservation agriculture, and agroecology combine traditional agriculture practices with modern science (Bruinsma, 2003).

Increasing worries about the negative influences of industrial agriculture have created vigorous debate over the achievability of transition to alternate forms of agriculture, that are able to provide a broad set of ecosystem services at the same time producing yields for human use. The change to diversified, ecologically benign, lower production systems is addressed in the works of agroecology (De Schutter, 2010), diversified farming systems (Kremen et al., 2012), and multifunctional agriculture (Wilson, 2008). Agroecology is a promising alternate to industrial agriculture, with the prospective of avoiding the negative ecological and social consequences of the Western input-intensive production.

Traditional agricultural systems, such as those identified as Globally Important Agricultural Heritage Systems (GIAHS), offer a wealth of knowledge, principles, practices, and biodiversity that cannot be replaced by modern science (Moudrý, 2018). The utilisation of Indigenous agricultural knowledge systems promotes agroecological innovative technologies like permaculture and agroforestry. These so-called 'new' sustainable farming practices actually derive from appropriating Indigenous farming practices that the colonial past failed to acknowledge. Such agroecological practices offer sustainable farming. ''Agroecology is a promising alternative to industrial agriculture, with the potential of avoiding the negative social and ecological consequences of input-intensive production (Ferguson and Lovell, 2014:251)''. However, taking agroecological production on board is a complicated move which requires enormous and varied contributions from IAKS. According to Ghana Permaculture Institute (2013), ecological agriculture is truly sustainable as it can regenerate and restore the fertility of the degraded and damaged agricultural soils thereby allowing us to continue producing food on that land indefinitely. The Ghana Permaculture Institute (2013) further observes that ecological agriculture outyields industrial agriculture, reduces environmental and social costs and unlike industrial agriculture it does not degrade or deplete the soil.

2.3.6.1 Permaculture

The word 'permaculture' was coined in 1978 by Bill Mollison, an Australian ecologist, and one of his students, David Holmgren. Permaculture (PERMAnent agriCULTURE or PERMAnent CULTURE) is one such agroecological practice, with a broad international distribution and a unique approach to system design. The term Permaculture thus originated as a portmanteau or rather a contraction of 'permanent agriculture' or 'permanent culture' (London, 1998). Permaculture is an agroecological practice. While the Westerners erroneously view permaculture as a new technology that offers a unique approach to the practice of sustainable farming, ranching, gardening and living, the practice has always been part of Indigenous African farmers.

Emphasised in permaculture are standard organic farming and gardening techniques utilizing cover crops, green manures, mulching, trellising, crop rotation and mulches. Also included are conservation tillage practices like zero tillage and minimum tillage (Pilarski, 1994; London, 1998; Mollison and Slay, 1991). Permaculture does not spare sustainable farming practices like mixed cropping and rotational grazing (Pilarski, 1994). Gardening and recycling methods that are common to permaculture include edible landscaping, keyhole gardening, companion planting, trellising, sheet mulching, chicken tractors, solar greenhouses, spiral herb gardens, swales, and vermicomposting. London (1998) goes on to state that water collection, management, and re-use systems like Keyline, greywater, rain catchment, constructed wetlands, aquaponics (the integration of hydroponics with recirculating aquaculture), and solar aquatic ponds (also known as Living Machines) play an important role in permaculture designs.

Pilarski (1994:450.) identifies the following as the characteristics of permaculture:

- Permaculture is one of the most holistic, integrated systems analysis and design methodologies found in the world.
- Permaculture can be applied to create productive ecosystems from the human-use standpoint or to help degraded ecosystems recover health and wildness. Permaculture can be applied in any ecosystem, no matter how degraded.
- Permaculture draws from traditional knowledge and experience. Permaculture incorporates sustainable agriculture practices and land management techniques and strategies from around the world. Permaculture is a bridge between traditional cultures and emergent earth-tuned cultures.
- Permaculture promotes organic agriculture which does not use pesticides that pollute the environment.
- Permaculture aims to maximize symbiotic and synergistic relationships between site components.
- Permaculture is urban planning as well as rural land design.

2.3.6.2 Agroforestry

It is common practice among Indigenous farmers to leave behind fruits trees and shade trees in their cultivated fields. This is where the concept agroforestry and ‘new’ sustainable agriculture practice are derived from. Agroforestry is another farming system that conforms to agroecological principles and is not new to Indigenous farming. It is a land-use system that combines agriculture and forestry technologies to create a more integrated, diverse, productive, profitable, healthy, and sustainable land-use system especially beneficial to the small scale farm (FAO, 2015). It is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence (Hoffner, 2018; FAO, 2015).

Nair (1985), and Tiburcio (2010) outline the three main types of agroforestry systems as 'agrisilvicultural' systems which are a combination of crops and trees, such as alley cropping or homegardens, 'silvopastoral' systems which combine forestry and grazing of domesticated animals on pastures, rangelands or on-farm and 'agrosylvopastoral' which combine the three elements, namely trees, animals and crops systems and are illustrated by homegardens involving animals as well as scattered trees on croplands used for grazing after harvests.

Indigenous peoples have practiced agroforestry for millennia (Alemu, 2016; Ortolani, 2017). Ortolani (2017 adds that agroforestry integrates trees, shrubs, and crops in a system that functions well together and that it mitigates climate change through carbon sequestration and also benefits biodiversity, water cycling, food security, *inter alia*. Tiburcio, (2010) and Walker, Sinclair and Thapa (1995) further underscore the positive link between Indigenous knowledge in agroforestry development. Since societies have lived for long periods of time in a specific area, Indigenous knowledge has been transferred from generation to generation by building on new inventions on what has been inherited across years (Nair, 1985; Alemu, 2016). The practice has served communities to find Indigenous medicinal plants; edible fruits, leaves, roots and stem; fuel; feed for livestock; shelter; construction materials; ameliorating micro climates, among others (Alemu, 2016).

To conclude this subsection, it is worth pointing out that since agroecology is the invention of Indigenous peoples which works towards land protection and conservation, it results in more effective protection of stock, control of soil erosion, salinity and water tables and a higher quality control of timber. Such a practice should thus be included in the school curriculum.

2.3.7 Other benefits

IK can play a vital role in educating the learners about the local area. In most societies, Indigenous people have developed lots of knowledge over the centuries by directly interacting, experiencing and experimenting with their environment: knowledge about the soil, water, climate, forest, wildlife, minerals etc., in the locality. This ready-made knowledge system could easily be used in education.

Use of Western farming practices in the ZSSAC poses lots of economic, social, political and environmental challenges. Challenges confronted by agriculture that are attributed to Western agricultural practices are evident in issues to do with:

- Their cost ineffectiveness
- Deleterious effects on the bio-physical environment such as climate change and environmental pollution by agricultural chemicals
- Pest and disease build up due to these vices building resistance to chemical protection methods and
- Western agricultural practices' general lack of sustainability.

In her 1962 book *Silent Spring* Rachel Carson takes a look at the implications of using chemicals like DDT to all life. Griswold (2012), propounds that these dangerous chemicals are broken down into dangerous poisons which are then passed through the food chain leaving plant, animal and human life at risk of disease, destroying the harmony in the ecosystem and creating a decline in the Earth's natural defences against insect populations. In addition, massive spraying with these chemicals causes insects to build resistance to chemical sprays leading to insects increasing to epidemic proportions.

Rachel Carson's observation forced the banning of DDT and other pesticides and insecticides and spurred revolutionary changes in the laws affecting the air, land and water (Lawlor, 2012). The analysis of DDT and other synthetic pesticides by Carson resulted in a deeply worrying conclusion that these chemicals have deleterious effects on the environment and the ecological system. Carson examined the chemical composition of pesticides resulting in the revelation that synthetic pesticides kill their intended targets and also move right up the food chain, eventually affecting humans. The pesticides then build up in the tissues of the body, rarely breaking down but often building in intensity through continued exposure or changing into forms that are even more toxic by interacting with other ingested chemicals. Even worse, these chemicals cause cancer, paralysis and tremors, and a number of other ailments.

It is for the reasons cited in the preceding paragraphs that one can argue that harmonising Indigenous and Western agricultural knowledge can provide a powerful basis for IAKS management of natural resources. Indigenous knowledge technologies and know-how have an advantage over Western science in that they rely on locally available skills and materials and are thus often more cost-effective than introducing exotic technologies from outside sources (International Institute of Rural Reconstruction 1996a). They are also usually environmentally friendly. Also local people are familiar with Indigenous farming practices and so do not need any specialized training.

Barnhardt and Kawagley (2005) call for the reintegration of Indigenous people's own knowledge systems into the school curriculum as a basis for connecting what students learn in school with life out of school. This process would restore a traditional sense of place while at the same time broadening and deepening the educational experience of all students. This study explores the extent of the representation of IAKS in the ZSSAC.

There are also some areas of philosophical similarities between IAK and Western education. For example, there are times when teachers in both platforms (i.e., IAK and Western education) subscribe to the student-centred approach to teaching. A study by Ukwuoma (2016) used qualitative interviews to evaluate the teaching of philosophical perspectives of select-lecturers in teacher preparatory colleges in the Niger Delta region of Nigeria. The study sought to understand whether the lecturers would integrate popular but unofficial languages such as Nigerian creole into instruction to facilitate student engagement. The findings from the study indicated that lecturers who lean towards IAK and those leaning towards Western education gave primacy to student-centred teaching. Thus, the study participants indicated willingness to integrate any language of instruction to facilitate student engagement.

2.4 REPRESENTATION OF INDIGENOUS AGRICULTURAL KNOWLEDGE IN POLICY, PRACTICE AND THE CURRICULUM

According to Battiste (2002:6), ‘‘the acceptance of Indigenous knowledge by scholars and policy makers generated an explosive growth in the number of publications on the relevance of Indigenous knowledge in a variety of policy sectors and academic disciplines.’’ However, Kawagley et al. (1998) observe that universally school science curricula projects (Agriculture curricula included) witness the dominance of one worldview, a Western worldview, which claims superiority to other forms of knowledge. This Westernised curriculum does not take cognisance of the value of the Indigenous worldview in curricula (Ogunniyi, 2007; Odora, 2000b; Jegede, 1999; Onwu and Mosimege, 2004).

International and local literature suggests that the use of Indigenous knowledge (IK) contexts in science education provides motivation, self-esteem (Mckinley, 2005); relevance (Manzini, 2000); more peer interaction (George, 1999; Clark and Ramaphale, 1999); and positive learning experience (Machingura and Mutemeri, 2004). This prompts the need to identify the relevant components of IKS that can be included in the science curriculum (Jegede and Aikenhead, 1999; Maluleka, Wilkinson and Gumbo, 2006), including Agriculture (Williams and Muchena, 1991). All the same there is also literature that continues to debate the pros and cons of the place of different worldviews endemic species and food plants (maize and beans, such as for instance, Indigenous Knowledge and Western Science in curricula (Purcell and Onjoro, 2002). In spite of this, the decoloniality lens challenges dominant knowledge views and advocates for the co-existence of multiple worldviews (plural epistemologies) in curriculum practice.

Canada has not given IKS much priority in the curriculum but instead has often treated Indigenous knowledge as though it were a matter of multicultural and cross-cultural education (Battiste, 2002). In the same vein Snively (2018) adds that even books and materials in Canadian schools do not accurately depict the history, cultural diversity, worldviews, and philosophies of Indigenous peoples. Indigenous peoples should rise up and fight such injustices.

Corollary, Govender, Mudaly and James (2016) state that the South African government adopted an Indigenous Knowledge Systems Policy in 2004 and that the policy served to strengthen collaboration among government departments, tertiary institutions, scientific councils and Indigenous knowledge holders. Naidoo (2010:vi) observed that ‘‘In the new National Curriculum Statement in South Africa (referred to as New South African Curriculum 2005), there has been a strong drive towards recognising and affirming the critical role of Indigenous knowledge (IK), especially with respect to science and technology education’’. This heralded an excellent means of promoting a culturally sensitive and relevant curriculum, catering especially for the diversity of all learners in South Africa. South Africa’s Curriculum 2005 prescribed Indigenous Knowledge (IK) for inclusion in schools. This kind of gesture which accommodates IKS in the curriculum and accords IKS the same status with Western science is ideal as it is in line with decoloniality.

In some industrialised nations that have minority Indigenous populations such as Australia, New Zealand, Canada, United States of America, Michie (2005) underscores that Indigenous knowledge has been recognised as a valuable teaching resource. However, the extent to which this has been done is not satisfactory (Smith, 1999) as agriculture curricula continue to be dominated by Western farming practices. In spite of this move, the curricula of the developing world have not offered IKS the same representation as Western knowledge (Battiste, 2002). Bell (2003) amplifies this by observing that even though initiatives in the developed world such as the Maori Science curriculum in Aotearoa, New Zealand, have been initiated, their uptake by students, teachers and schools has still been eclipsed by the Western curriculum. Battiste (2002) further states that in North America, there have been calls from several Indigenous people to include IKS in science disciplines.

Snively (2018) in the Book 2 on braiding Indigenous Science with Western Science noted that books and materials in Canadian schools do not accurately depict the history, cultural diversity, worldviews, and philosophies of Indigenous peoples. He underscored the need by educators to ensure that science textbooks and curriculum resources accurately acknowledge the contributions of Indigenous Knowledge to the body of knowledge referred to as science. He further laments that it is bizarre to never witness one’s ancestral heritage in the classroom and to never learn about the richness of Indigenous Science (IS) in the same. With the curriculum taking a place-based approach, learners would develop place-based knowledge about the areas in which they live, learning about and building on Indigenous knowledge and other traditional knowledge aspects.

A study by Sakayombo (2014) in Zambia established that Indigenous knowledge is sparingly presented in the agricultural science syllabus because of technology and mass production, and the need for a lot of food for the growing population. That dearth of the IAKS in the syllabus concur with Shukla, Barkman and Patel's (2017) reference to the Green Revolution of the mid-twentieth century which aimed at increasing yields and homogenise crops through supporting large-scale, high-input-driven agricultural policies. The Green Revolution focused on increasing yields of wheat, rice and certain vegetables thereby placing little value on Indigenous crops. Consequently, the negative outcomes of the Green Revolution have far outweighed the benefits, and monoculture has increased production instability (Shiva, 2000). The Indigenous Zambians despise their traditional agriculture practices due to commercialisation of agriculture in that country (Sakayombo, 2014). This study thus revealed that much work needs to be done in order to integrate IKS into the Zambia agricultural science curriculum given the importance and publicity bestowed on IK and Indigenous ecological knowledge in the present era.

A doctoral study by Moloto (2013) which analysed representations of Nature of Science and Indigenous knowledge systems in South African Grade 9 Natural Science textbooks, highlighted that representations of IKS in the textbooks was very minimal and mainly naïve and implicit. The study concluded that selected science textbooks did not respond well to the South Africa's National Curriculum Statement mandate of integrating Nature of Science and IKS into mainstream science education. The study further made recommendations for textbook authors, curriculum developers and science educators to improve the integration of Nature of Science and IKS into the school science curriculum.

Abah, Mashebe and Denuga (2018) report that in Namibia, the Ministry of Education announced a dramatic review of the country's curricula which recognises integrating Indigenous knowledge systems so as to improve teaching and learning outcomes since until recently, Indigenous knowledge was assumed to be irrelevant, unscientific and outdated.

According to Snively (2018), Michie (2005), Ninnes (2000), the representation of Indigenous knowledge in science disciplines (Agriculture included) tends to be piecemeal with most governmental jurisdictions across Canada falling seriously short in providing teachers with adequate examples of prescribed learning outcomes that integrate IKS examples, procedures and teaching strategies to include IKS in the classroom. Consequently, the teacher has to work hard to find materials to supplement lessons. Success on most topics continues to rely on teacher creativity, resourcefulness and endurance (Snively, 2018).

In a study to determine representations of Indigenous knowledge in secondary school science textbooks in Australia and Canada, Ninnes (2000) observed that the recent growing recognition that presenting principally Western perspectives in science texts is a form of ethnocentrism, racism or cultural imperialism. A number of science-related texts have appeared which attempt to incorporate greater diversity of knowledge types. Similarly, Ninnes (2000) and Ninnes and Burnett (2001), after reviewing Canadian, Australian and New Zealand textbooks, identified the masking of diversity within the Indigenous population, the representation of Indigenous people as ‘traditional’ and the location of indigeneity through past tense when describing Indigenous Knowledge as the three main issues undermining the process. For instance, as observed by Ninnes (2003), the Dynamic Science series and the Australian Secondary Science series refer to Western knowledge as ‘most’ and ‘often’ while Indigenous practices are referred to using modifiers such as ‘some’. The present tense was used to describe Western knowledge while the past tense described Indigenous beliefs and technologies (Ninnes and Burnett, 2001). This system by textbooks of emphasising Indigenous practices and beliefs from the past with no coverage of contemporary identities results in misrepresenting Indigenous identities. Also, Indigenous practices are referred to as ‘traditional’ clearly subjugating them as unscientific (Ninnes and Burnett, 2001; Ninnes, 2000, 2003). This kind of misrepresentation depicts cultural imperialism.

Kim (2015) observed neocolonialist representations of Indigenous perspectives in the Ontario science curricula. Neocolonism, in the context of curriculum, is a new form of colonisation which Ryan (2008: 673) aptly posits as “a process that undermines the cultural values of a society.” The results from a textual analysis on two textbooks used in grade 7-9 classes suggested that these textbooks covered a substantial amount of Indigenous Knowledge. However, there were issues of essentialism and misrepresentation of Indigenous identities (Kim, 2015; Ninnes, 2000). Textbook content that was Indigenous-related was often associated with antiquity or primitive terms and was subordinated to or treated as peripheral in relation to Western knowledge (Ninnes, 2000). This same contention was shared by

Kimmerer (2002) who pointed out that IK are unknowingly or knowingly ignored in curricula. The neocolonialist curricula, therefore, evoke the idea that Indigenous cultures and knowledges are primitive, inferior, inadequate for solving current scientific problems and superseded by Western Knowledge (Ninnes, 2000).

When seen through a postcolonial lens, such a representation creates “fragmented, negative, and distorted” pictures of Indigenous peoples, whereby knowledge and technologies are characterized as “primitive, backward, or superstitious” (Battiste and Henderson, 2000: 86). Such representations of IK also evoke condescension from Western observers and the subjugation of IK in curriculum (Battiste and Henderson, 2000; Ninnes, 2000). While promoting the supremacy of Western ideologies, which are based on the notion that European cultures, knowledge, and practices are superior to Indigenous knowledge, from a decolonial sense, the curricula nevertheless ironically convey the idea that Western science has been, and continues to be, the answer to problems.

Despite the growing concern by Westerners to recognise the value of IK in curricula, Western Knowledge has been criticised for dismissing and attempting to supplant IK (Ma Rhea, 2002). Particularly troubling are the ways in which curricula and textbooks invite students to participate in the perpetuation of colonial modes of thought and action (Schaefli, Godlewska and Lamb, 2019). Research to date has shown that these educational systems are all colonial and work to marginalize Indigenous peoples, though they employ subtly different strategies of exclusion (Schaefli, Godlewska and Lamb 2019; Shear, Knowles, Soden, Antonio and Castro; 2015).

In a study by Schaefli et al. (2015) that investigates the frequency of and kinds of Indigenous Peoples-related content in K–12 U.S. it emerged that the textual and non-textual curriculum materials represent Indigenous cultures in various negative ways thereby favouring and preserving a Eurocentric narrative. Teachers perpetuate the misrepresentations in the classrooms, and what is taught in schools may not be in sync with policy pronouncements. With respect to inclusion of IKS in curricula, it can be concluded that postcolonial educational systems are all colonial and work to marginalise Indigenous peoples, though they employ subtly different strategies of exclusion. Postcolonial curricula for Indigenous peoples portray Europeans as the accomplishers, achievers, and makers of history (Shui, 2013). Their knowledge still dominates curricula for Indigenous people. The curricula subtly legitimate colonial interests. The curricula nevertheless convey the idea that conventional Western science has been, and continues to be, the answer to societal problems. However it is worth asking, despite the misrepresentations of IKS in policy, practice and the curriculum, why Western dominated education systems now want to incorporate aspects of IK, including IAKS, into their curricula. Indigenous peoples might welcome this interest as a chance to preserve their knowledge systems under international legal protocols.

Generally, literature depicts that Indigenous cultures are misrepresented in policy, practice and the curriculum. While there is growing concern through educational policies for more representation of IKS in the curricula, the transacted curricula reflected Western cultural values rendering the policy pronouncements piecemeal. This study sought to investigate the extent to which IAKS were represented in the ZSSAC.

2.5 APPROACHES THAT HAVE BEEN USED TO INCLUDE INDIGENOUS AGRICULTURAL KNOWLEDGE IN THE AGRICULTURE CURRICULUM

Inclusion of IAKS in the curriculum constitutes a curriculum change. There are curriculum development models that are used to manage curriculum change. Two contrasting curriculum development frameworks or models are the classical model and the participatory model (Van Crowder, 1998). The classical model is also referred to as the ‘rational’ approach while the participatory model is also called the ‘interactive approach’.

The classical/rational approach to curriculum development is objectivist hence product-oriented. According to this paradigm, it is the duty of the professionals and experts to set the aims and objectives of the curriculum (Van Crowder, 1998; Drawson, Toombs and Mushquash, 2017).These professionals and experts believe that they have sufficient technical knowhow to produce the desired curriculum package (Taylor and Beniest, 2003; Van Crowder, 1998). The model assumes that all stakeholders (teachers, students, communities, employers and so forth) agree on common educational goals and, therefore, dialogue and consensus-building among stakeholders are not required. On the other, the participatory/interactive approach follows a ‘subjectivist’, process-oriented paradigm. It puts emphasis on participation and interaction among the various interested groups (Gasperini, 2000). The goal is to stimulate different actors to participate in a dynamic, interactive process that allows their perceptions of the 'ideal curriculum' to be made explicit and compatible with the needs of the user system (Taylor, 2000; Van Crowder, 1998).

One of the most celebrated curriculum change models, which emerged in recent years, is Participatory Curriculum Development (PCD), the brainchild of Brazilian language educator, Paulo Freire. This approach to curriculum development, which has emerged in recent years, is unlike the traditional approaches to curriculum development which are largely expert-led and hierarchical (Taylor, 2000). The PCD model emphasises active participation of all stakeholders throughout the entire curriculum development process (Bovill and Bulley, 2011; Drawson, Toombs and Mushquash, 2017; Gasperini, 2000; Hodgkin, 2007; Taylor, 2000; Taylor and Beniest, 2003; Van Crowder, 1998), that is, from situational and needs analysis to aim and goal formation, planning, implementation and evaluation of the programme. Figure 2. shows the Participatory Curriculum Development cycle.

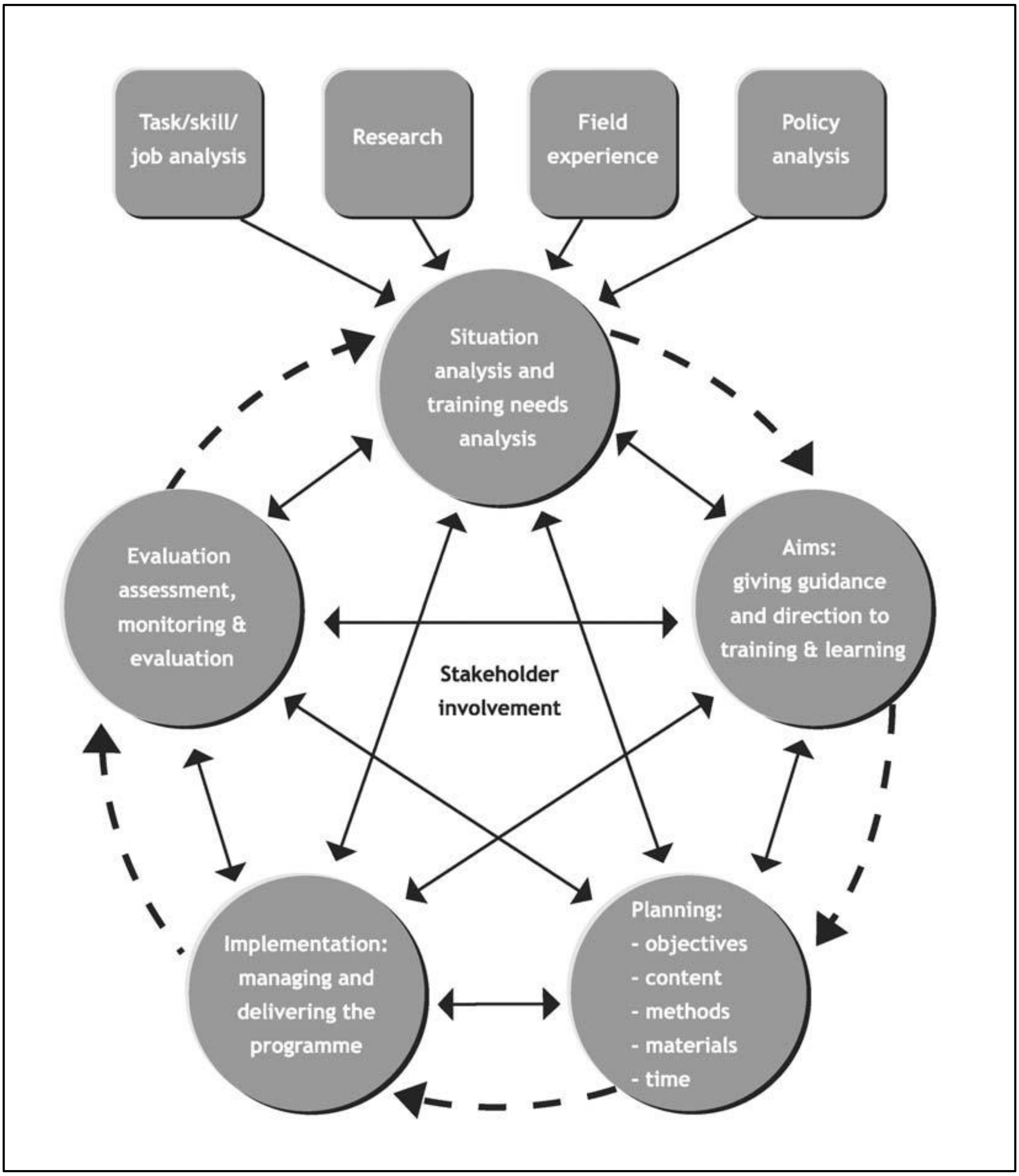

FIGURE 2.1: THE PARTICIPATORY CURRICULUM DEVELOPMENT CYCLE (ADAPTED FROM RUDEBJER, TAYLOR, AND DEL CASTILLO, 2001:18).

As alluded to, the Participatory Curriculum Development model emphasises the involvement of all the stakeholders throughout the curriculum development process. These stakeholders include policy makers, administrators, experts, employers, clients or 'end-users' such as community members, researchers, farmers, donors, parents, materials or book producers, trainers, learners, institutional managers, subject matter specialists, technical and support staff (Hodgkin, 2007; Taylor, 2000; Taylor and Beniest, 2003). As such, each context would have its own specific list of stakeholders. The stakeholders for this study would include:

- Policy makers from the Ministry of Primary and Secondary Education, Ministry of Agriculture and Mechanisation, the Ministry of Higher and Tertia ry Education and Technology Development,
- Curriculum specialists
- IAKS scholars and academics
- Traditional leaders and the local community
- Agriculture lecturers in higher education institution lecturers
- Agriculture teachers
- Women
- The youth (in and out of school)
- AGRITEX Officers
- Agriculture related Industry and Commerce
- Non-governmental organisations,
- Representatives from Commerce and Industry

All stakeholders are taken on board throughout the five interconnected stages of the PCD cycle at whose heart is stakeholder involvement. The five stages are:

- Situational analysis
- Aim and goal formation
- Planning
- Implementation and
- Evaluation.

Situational analysis entails needs analysis about the education system, the learners, teachers, communities, and parallel systems. The information pertaining to situation analysis is collected through job analysis, research, field experience and policy analysis.

The next step, formation of curriculum aim and goals, is derived from situation analysis. Aims guide the direction in which a programme of learning will take place. The aims are continually modified.

The fourth stage focuses on development of curriculum materials which are first trialed in pilot schools before implementation on a larger scale. This large scale implementation is monitored and evaluated to assist in the final iimplementation of the new look curriculum initiative. Obanya (1987) contends that monitoring and evaluation must be carried out at every stage to determine deficiencies so as to take corrective action.

Participatory Curriculum Development is regarded as an acceptable approach to Indigenous research (Drawson, Toombs and Mushquash, 2017) and should be the predominant approach within Indigenous research (FNIGC, 2014) as it enables ordinary people, the less powerful in society such as women, underprivileged, learners or children, to actively influence curriculum decisions which affect their lives. Most of the ordinary people are in rural areas, who are involved very little in the development of education and training programmes which, nevertheless, affect them directly.

Through the model, ordinary people are listened to and heard. Their voices shape the outcome of the curriculum package. The knowledge and experiences of especially of the ordinary people, the less powerful in society, are respected. Moreover local people are the custodians of IK hence their involvement in the curriculum development process is paramount and should be the starting point. The end result would be interventions that reflect local realities, often leading to a better supported and robust curriculum package (Taylor, and Beniest, 2003).

Apart from seeking local knowledge, Participatory Curriculum Development brings about diversity. It thus recognises that there are always different perspectives and realities within communities, with every individual bringing their own unique experiences and interpretations. It promotes lively opportunities for discussion and reflection with people and groups who have an interest in the curriculum (Drawson, Toombs and Mushquash, 2017; Taylor and Beniest, 2003). All stakeholders imbibe the spirit of the curriculum that is necessary in creating a sense of ownership of the curriculum innovation (Obanya, 1987). This results in all stakeholders spearheading the spirit of the envisaged change. Participatory Curriculum Development is a gradual process which takes place over time thereby giving the innovation enough time to gain acceptance before implementation on a large scale (Bishop, 1995; Bovill and Bulley, 2011; Obanya, 1987).

Zimbabwe is an agricultural country. A focus on teaching agriculture should connect school with the everyday life of the pupils in rural areas (Engler and Kretzer, 2014:224). This will lead to greater involvement and commitment of pupils and their parents and a kind of ownership of the educational process. There are IKS-related teaching approaches such as storytelling, mimicking and group work. Such methods, whose custody is the local farming community, enable students to learn an ecologically sustainable way of agricultural production. This study will analyse IAKS in the ZSSAC to explore prospects and opportunities for incorporating some IAKS teaching approaches for the ZSSAC.

2.6 CHALLENGES THAT HAVE BEEN REALISED IN TRYING TO INCLUDE INDIGENOUS AGRICULTURAL KNOWLEDGE IN THE AGRICULTURE CURRICULUM

Inclusion of Indigenous knowledge systems in the school curriculum faces a number of challenges. This section highlights some of the challenges of incorporating Indigenous knowledge systems into the content of the school curriculum.

Some Western scholars regard IKS as being unscientific. Defining IKS from a positivist perspective by Western scholars poses one of the prime challenges of harmonising IKS with Western farming practices in the curriculum (Seroto, 2014). Western scholars view Indigenous people as backward and not contributing to the development of scientific knowledge (Budden, 2014). In a way the Indigenous people have through acculturation sunk into the inferiority complex that their local farming practices are inferior to Western ones. The positivist paradigm does not embrace multiple knowledge systems. The paradigm views Indigenous knowledge as backward and not contributing to the development of scientific theories in the global context (Budden, 2014). IAKS thus becomes marginalised. At this juncture it is worth remarking that both Western and Indigenous theorists should avoid placing the two knowledge systems as binaries. Seroto (2014: 430) maintains that “The call for the existence of different kinds of knowledge in academia, especially in Africa, is something that can no longer be swept under the carpet”.

Another challenge as observed by Matowanyika (1994) is contemporary neglect of IKS by governments. Most governments in Africa feel that development lies in the extensive use of

Western forms of knowledge (Matowanyika, 1994). The education system promotes the belief in the inadequacy of IKS and the superiority of Western technology, thereby allowing racist attitudes to erode cultural pride to the detriment of reducing the interest of youth in learning IK (Branden, 2008). In agriculture, Western farming knowledge is regarded highly due to colonial and neo-colonial subjugation. That way, Indigenous peoples themselves despise IAKS as they view IKS as inferior to Western knowledge. IKS continue to suffer the same fate it suffered during the colonial period. It becomes apparent that governments in Africa and other Third World countries need to promote the use of IKS. Education is one such institution that could be used to promote the use of IKS in general and IAKS in particular.

The other challenge of including IKS in the curriculum rests on lack of documentation of IKS. This is evidenced by the fact that IKS rely on oral tradition hence are not recorded (Ilutsik, 2002). Documentation of Indigenous knowledge systems enables them to be readily accessible to a wider section of the society in order to facilitate their transmission from generation to generation (Muchenje and Goronga, 2015). Through documentation, the knowledge would not get lost. It is worth noting that the old people are the custodians of IKS and without documentation the saying that "When a knowledgeable or old person dies, a whole library disappears (Sarkhel, 2017: 428.)" will apply. However, this does not mean that transfer of knowledge within Indigenous communities by traditional methods of teaching and learning is inexistent.

Warren and Michael, (1999) have observed that the documentation of vast amounts of unrecorded, often rapidly disappearing Indigenous knowledge could provide the basis for many effective development interventions if this knowledge could be shared. Documentation of these systems needs to be made available, at say ward, district, provincial and national levels in the Zimbabwean context. Tertiary institutions such as teachers colleges, technical colleges, polytechnic s and universities should set the pace in the documentation of Indigenous knowledge systems (Muchenje and Goronga, 2015).

It is undisputable that Indigenous knowledge is part of the global knowledge system (Worldbank, 2015). Therefore, African Indigenous knowledge should be a respectable part of the global knowledge system. However, African Indigenous knowledge systems seem to be facing the possibility of becoming extinct due to changes in the physical and social environment of the African landscape (Worldbank, 2015; United Nations Environmental Programme, 2008). However, in a multi-country study on the application and use of Indigenous knowledge in environmental conservation and disaster management, the United Nations Environmental Programme (2008:33) found that Kenya, South Africa, Swaziland and Tanzania "use a variety of innovative, effective, and in some cases unique Indigenous knowledge approaches to environmental conservation", which drive development.

Another reason that raises a red flag is the negative perceptions of younger generations of Africa towards Indigenous knowledge. As a result Western education, which students are exposed to in schools in Africa, is making students think less of African Indigenous knowledge (Owusu-Ansah and Mji, 2013). However, Asante (1987) indicates that Western thoughts are inadequate to explain all the ways of knowing because it is based on a particular cultural setting, which does not have general applicability. In other words, one size does not fit all in terms of knowledge.

In a study carried out in Zambia, Sakayombo (2014) cites the following as challenges faced by schools in trying to integrate IAKS into the school agriculture curriculum:

- Lack of respect for IAKS by the school and the community,
- Centralised examination pressure which places little if any IAKS,
- Negative attitude by teachers and students towards IKS,
- Lack of IAKS knowledge by teachers who are the implementers of the curriculum concepts in the proposed curriculum,
- Lack of literature on IAKS in textbooks,
- Lack of social and financial support on IKS from government and
- Limited research on IKS in the subject Agriculture Science.
-

In this research I established challenges that may be realised in trying to include IAKS in the ZSSAC.

2.7 GAPS IDENTIFIED

From the literature reviewed, I identified gaps in knowledge which need to be filled. These research gaps are burning isuues which need to be resolved by this research. Every research project must, in some way, address a gap ,that is, attempt to fill in some gaps in knowdge in the scientific literature (Hoogenboom and Manske, 2012).

There are agriculture practices which Indigenous people have known and practised before colonisation. Some of the Indigenous agriculture practices have stood resilient and continue to be practised despite colonial and neo-colonial subjugation. Because they are based on years of interaction of Indigenous people with their physical environment, they should thus be included in school agriculture curricula.

Due to colonialism, Western agricultural knowledge has cannibalised Indigenous agricultural knowledge. This domineering effect of Western agricultural knowledge and practices has resulted in the curriculum placing more emphasis on Western agricultural practices at the expense of local content. This scenario of having an alien knowledge system marginalising an Indigenous curriculum would be unethical. The dominance of Western knowledge was exacerbated by colonial imperialism, research that is pro-Western, inferiority complex of Indigenous people, the sacred nature of IKS, the orality of IKS and development which is associated with Western knowledge. This marginalisation of local content does not auger well with the fact that agriculture curricula are environmental (Biriwasha, 2012). A curriculum that addresses the Indigenous environment can only be taught more effectively from an Indigenous perspective in terms of content and methods.

Many crops and animals are receiving inadequate scientific or institutional support, despite their significance in addressing food security, nutrition and rural development. There is a lot of untapped promise to be found among Africa's traditional crops and livestock. It has been created because within that huge mass of land South of the Sahara exists several thousand Indigenous plant species, already selected for food production, that still fall outside the ambit of modern research and economic development. Some provide life for thousands of communities. Lack of research attention to these and others is a disgrace of our times.

IK and Western knowledge are two distinct worldviews developed in different environments. Ideally intersections exist between IK and Western knowledge. The two knowledge claims, Western science and IKS, can be regarded as complementary epistemologies in need of a dialogue. Shizha (2009) underscores the coexistence and complementary nature of IKS and Western science. No knowledge system should claim superiority over another in any curriculum, including a science related curriculum such as Agriculture. Their harmonisation would surely result in meaningful learning.

Most Indigenous agriculture curricula do not seem to take heed of National policies that dictate that IKS should be included in the curricula yet literature indicates its paucity in the curricula. There is compelling need for policy makers to speed up policy implementation of IKS policies in agriculture curricula.

Just like the scientific tradition, generation of Indigenous knowledge uses different methods of collecting data, storage, analysis and interpretation. Regretably those who subscribe to the scientific tradition fail to acknowledge the validity of data generated in non-Western ways. Even those scholars who acknowledge that Indigenous knowledge exists generally verify and validate Indigenous knowledge using scientific methods. They surprisingly recognise their categories in Indigenous systems, and apply their typologies to what they think Indigenous knowledge systems are. Few Western scholars and researchers accept Indigenous knowledge as valid in and of itself. They have great difficulty rethinking groupings so as to uncover basic organising principles which are unfamiliar, and to identify and affirm the integrity of Indigenous systems. Currently efforts are being made to think through the implications of recognising fundamentally different knowledge systems (Colorado, 1988; Watson and Chambers, 1989; Banuri and Marglin, 1993).

There is need to establish whether the schools would face similar and other challenges.

2.8 CHAPTER SUMMARY

This chapter reviewed literature related to IAKS. The literature review covered IAK and existing practices, the influence of Western epistemologies on the Indigenous agriculture system and how it has impacted on the Indigenous agriculture system. The literature also looked at the benefits of the Indigenous agriculture practices to the community and how IAK have been represented in policy, practice and the curriculum. The representation showed how IKS have been or have not been included in agriculture curricula for Indigenous peoples elsewhere and in Zimbabwe. The study further reviewed literature on approaches that have been used globally and in Zimbabwe to include IAK in the agriculture curriculum and challenges that have been realised in trying to include IAK in the agriculture curriculum.

Basing on the reviewed literature, the chapter ended by identifying gaps in knowledge to justify the research.

CHAPTER THREE: THEORETICAL FRAMEWORK AND METHODOLOGY

3.1 INTRODUCTION

As I indicated earlier on in Chapter 1, the purpose of this study was to explore the current representation as well as prospects and opportunities for the inclusion of Indigenous Agricultural Knowledge Systems in Zimbabwe's secondary school agriculture curriculum (ZSSAC). I was motivated by my experiences of colonial and neo-colonial subjugation of IAKS by Western agricultural knowledge and practices in Indigenous rural community contexts as well as in colonial and postcolonial agriculture curricula in Zimbabwe.

In this chapter I cover an overview of the theoretical framework and methodology I used in the study. My discussion in the chapter is structured around Decoloniality as the theoretical framework and how it informs the methodology; research design, sample and its description, methods of data collection and data analysis. Under methodology I also discuss measures to provide trustworthiness as well as the ethical considerations.

3.2 THEORETICAL FRAMEWORK

I have selected Decoloniality as the theory which I deemed to be appropriate to enable me to study the phenomenon. My choice of Decoloniality as the theoretical framework was influenced by the need to critically explore the possibility of including IAKS in the ZSSAC. I find it worth noting at this juncture that the curriculum in question appears to be dominated by Western agricultural knowledge as a result of its imposition to Indigenous Zimbabweans by the colonial masters.

In this chapter I look at Decoloniality as the meta-theory that informs my research, specifically in the analysis of the influence of coloniality on practice, knowledge structure and knowledge theory with respect to Indigenous agricultural knowledge systems in Zimbabwe. While the main focus of my study is on the ZSSAC, I also consider the broader historical aspects of Indigenous agriculture which were not necessarily curriculum-oriented but practice-oriented and yet still had an influence on the curriculum. Paterson, Thorne, Canam and Jillings (2001:1) view a meta-theory as "... a critical exploration of the theoretical frameworks or lenses that have provided direction to research and to researchers, as well as the theory that has arisen from research in a particular field of study”. In this context, theory is understood as “… a system of interrelated propositions that should enable phenomena to be described, explained, predicted and controlled” (Du Toit and Griffin, 1985:1). My use of the Decolonial lens is thus to guide the discourse on Indigenous agriculture and serves as my locus of enunciation (where I am speaking from).

Decoloniality challenges dominant Western Anglo-Saxon knowledge views and advocates the co-existence of multiple worldviews in curriculum practice (De Lissovoy, 2010; McCardle and Berninger, 2014; Chilisa, 2012; Baker, 2012; Nakata, Nakata, Keech and Bolt, 2012). That way it gives voice to subjugated knowledges in a context where Western knowledges and epistemologies have been imposed and are hegemonic resulting in marginalising and excluding local knowledges; a legacy of our colonial history.

As I elaborate the Decolonial theory below, I make every effort to show how it informs this study on prospects and opportunities for the inclusion of IAKS in the ZSSAC.

3.2.1 Decoloniality; the meta-theory and how it informs the study

De Lissovoy (2010:279) underscores that ‘‘Decolonial theory is concerned with confronting, challenging and undoing the dominative and assimilative force of colonialism as a historical and contemporary process, and the cultural and epistemological Eurocentrism that underwrites it.” Hence, decoloniality or decolonialism is a school of thought which focuses on untangling the hegemony of knowledge production from a primarily Eurocentric episteme. Decoloniality, thus, critiques the perceived universality of Western knowledge and the superiority of Western culture (de Souza Santos, 2015). More plainly said, decoloniality refers to doing away with the logic, metaphysics, ontology and matrix of power created by the massive processes and aftermath of colonisation and settler-colonialism (Castro-Gomez, 2007). This matrix and its lasting effects and structures is called ‘coloniality.’ Decoloniality is a way for us to re-learn the knowledge that has been pushed aside, forgotten, buried or discredited by the forces of modernity, settler-colonialism, and racial capitalism (de Souza

Santos, 2015; Quijano, 2000). The decolonial theory emphasizes the on-going process of resistance to colonialism. This process goes on long after direct Imperial rule (political rule) is abolished (Joseph, 2017; de Souza Santos, 2015; Ndlovu-Gatsheni, 2015; Asher, 2009; Castro-Gomez, 2007; Quijano, 2000).

This research sees colonialism and imperialism as remaining pervasive in reaching the roots of education and knowledge. Colonialism still continues to construct the ZSSAC despite the fact that some of the Indigenous farming practices have stood the test of time. This implies that an anti-dominative approach to the ZSSAC has to do more than just opening alternative spaces against the dominant, or creating classroom conditions that are more welcoming to diverse perspectives by including IAKS in the curriculum in question. De Sousa Santos notes that "the affirmation of diversity marks a turning opoint in Western exceptionalism."

Joseph (2017), de Souza Santos (2015) and Ndlovu-Gatsheni (2015) concur that decoloniality reveals 'the dark side of modernity' and how it is built 'on the backs' of 'others,' others that modernity racialises, erases, and/or objectifies. Decoloniality is, therefore, not a singular thing but a method and paradigm of restoration and reparation that depends on context, historical conditions, and geography. It aspires to restore, elevate, renew, rediscover, and acknowledge and validate the multiplicity of lives, life-experiences, culture and knowledge of Indigenous people, people of colour, and colonised people as well as to decentre the hegemony of Western knowledge and practices.

Ndlovu-Gatsheni (2015) observes that Eurocentric modernity has created modern problems of which it has no modern solutions and that theories generated from a Eurocentric context have become exhausted, if not obstacles to the understanding of contemporary human issues. In essence, decolonization is about shifting the way Indigenous Peoples view themselves and the way non-Indigenous people view Indigenous Peoples. It is against this background that de Souza Santos (2015:18) posits that "We are all Indigenous peoples because we are where we have always been, before we had owners, masters, or bosses, or because we are where we were taken against our will and where owners, masters, or bosses were imposed on us". Hence, all indigenous groups (Europeans included) have always had unique cultural practices like agriculture in their places of origin.

Nakata, Nakata, Keech and Bolt (2012:120) observe that “decolonising knowledge focuses on emancipating colonised peoples and reinstating Indigenous worldviews”. They further assert that, in that respect, a decolonial way of thinking recognises that the colonial era is indeed not over. Hence the theory is based on critical mindfulness of the effects of colonialism of the past and the neo-colonialism of today (McCardle and Berninger, 2014; Chilisa, B. 2012; Baker, 2012). As far as as mindfulness to neo-colonialism is concerned “the aim is, in sum, to prevent the weapons of the once oppressed from becoming the weapons of the new oppressors (de Sousa Santos, 2015: 26).” For instance, the ZSSAC currently tends to place Western farming practices as central and IAKS as peripheral. This runs counter to decolonising theory which “... values the voices of the students’ Indigenous backgrounds as bases of knowledge” (French and Harper, 2014:58). Surely, the understanding of the world far exceeds the Western understanding of the world (de Sousa Santos, 2015). Hence, Dei (2000) recommends the use of IKS for the political purpose of academic decolonisation. That way the hegemony of imperialist ideologies, which continue to shape the character of academic practices in general and the ZSSAC in particular, would be done away with. According to de Sousa Santos (2015: 18) “We are widely diverse human beings united by the idea that the understanding of the world is much larger than the Western understanding of the world”. Hence, there is need to explore the inclusion IAKS in the ZSSAC as an academic decolonising tool in Zimbabwe.

From a decolonising perspective, research on Indigenous knowledge should be participatory in nature to produce qualitatively different research that identifies community problems and needs (Zavala, 2013; Smith, 1999). Participatory research deconstructs Western scholarship on research which treated Indigenous people as the researched ‘Other’. Smith affirms that:

> *When Indigenous peoples become the researchers and not merely the researched, the activity of research is transformed. Questions are framed differently, priorities are ranked differently, problems are defined differently, and people participate on different terms* (Smith, 1999: 193).

This study employed observations and document analysis and semi-structured interviews to provide platforms for the participants to ‘speak’ for themselves about themselves with respect to current coverage as well as prospects and opportunities for the inclusion of IAKS in the ZSSAC.

Decoloniality suggests both resistance to colonialism and coloniality, given that the colonial effects and their hegemonic discourses continue to shape Indigenous cultures in the post-independence era. Historically, the colonisers disregarded the native social, political and cultural ways of life and acculturated the natives (Mapara, 2009: 137). The natives then reluctantly accepted the self-ascribed superiority of the colonisers' culture. However, viewed from the perspective of the excluded and discriminated against, the historical record of colonialism, global capitalism and patriarchy is full of lies that are institutionalized and harmful. Hence, there is need to depart from this Eurocentric critical tradition by proposing "… a *teoria povera,* a rearguard theory based on the experiences of large, marginalised minorities and majorities that struggle against unjustly imposed marginality and inferiority, with the purpose of strengthening their resistance (de Souza Santos, 2015: 9)."

Decolonial philosophy advances that the decolonised seek to remove the so called 'civilised' values of the West which were forced on them (Gluck, 2010; Battiste, 2013). Such a removal and its replacement with the previously colonially denigrated Indigenous cultural values would enable the Indigenous people to establish an emancipatory national cultural identity that would foster national transformation. That way, the formerly colonised Indigenous peoples would reclaim their lost intellectual, social, political, economic, linguistic and cultural values in order to reconstruct a body of knowledge based on their Indigenous knowledge reservoir (Sutcliffe, 2011). The theory explicates that this Indigenous knowledge, specifically IAKS in this study context, carries hope and promotes transformation and social change among the historically oppressed Indigenous people. It therefore makes Indigenous peoples speak for themselves, in their own voices, for a return to their cultural roots demonised by colonialism. Rigney (1999: 114) avers that:

> *Indigenous Peoples must look to new anticolonial epistemologies and methodologies to construct, rediscover, and/or reaffirm their knowledges and cultures. Such epistemologies must ... carry within them the potential to strengthen the struggle for emancipation and the liberation from*

oppression. If we understand this, we understand the need to seek other examples of liberatory epistemologie.

Against the background above, I have observed that the colonisers forced their Western agricultural practices on Indigenous Africans in Zimbabwe. However, some of the denigrated local agricultural practices have stood the test of time. Interestingly the West, as I have observed is the case in Zimbabwe, are coming in with the same practices they demonised but renaming them 'new technologies' or 'new systems'. Conservation Agriculture is a case in point. The same rebranding of IAKS applies to permaculture, organic agriculture, ecological agriculture and sustainable agriculture. All this serves to justify the cry of this research for the inclusion of IAKS (knowledge and practices) in the ZSSAC. Such a reconstruction of the curriculum would reflect Indigenous traditions, social change and cultural empowerment of the Zimbabwean indigenous society through the learners and educators.

I am of the opinion that decoloniality emphasises the Indigenous knowledge's power as the conduit for viable scientific advantage. It propounds that IKS and mainstream science are complementary cosmologies in need of a dialogue for meaningful learning (Alebiosu, 2006; Ogunniyi, 2004). The dominance in the academy of a single knowledge system (such as what Western agricultural practices tend to be doing in the curriculum in question) "… is deplorable because it advances and promotes a particular worldview" (Seroto, 2014: 430); a Western worldview in an African curriculum. de Souza Santos (2015: 33) advances the notion that "borrowed weapons are efficacious only when used together with our own weapons". This research likens the 'borrowed weapons' to Western agricultural practices and 'our own weapons' to IAKS. Neither IKS nor Western science is more superior to the other. Harmonising the two worldviews in the ZSSAC is consistent with Freire's (1996) critical pedagogy , which observed that oppression and domination of one worldview by another can only be overcome by dialogue and critical consciousness. This is supported by the fact that between different worldviews there are both complementarities and contradictions. The complementary nature of Western knowledge and IAKS is aptly captured by de Souza Santos (2015:36) who observes that:

What cannot be said, or said clearly, in one language or culture may be said, and said clearly, in another language or culture. Acknowledging other kinds of knowledge and other partners in conversation for other kinds of conversation opens the field for

> *infinite discursive and nondiscursive exchanges with unfathomable codifications and horizontalities.*

I concur with Ozmon and Craver (2011:134) and Ornstein and Levine (2011:124) who contend that there is need to reconstruct education and to use education in the reconstruction of society. I have a strong conviction that this can only be done through adequate representation of IAKS in the national agricultural curricula. Joseph (2017) underscores that decolonisation restores the Indigenous world view; culture and traditional ways and replaces Western interpretations of history with Indigenous perspectives of history.

Indigenous Zimbabweans have developed, tried and tested Indigenous agricultural practices through interactions with their lived environment. Shizha (2006:32) argues that "Knowledge is a product of people's everyday experiences and is particular to societies as it takes meaning from forms of life within which it is constructed." Such knowledge has immediate links with their culture and is relevant in giving solutions to the community's lives. Shava (2005:80) underscores that:

> *Formal education usually suffers the setback that it is usually out of context with the learners' lived environment'. This sets-up and creates two separate worldviews for the learner: the school world and the world in which they live in. Indigenous knowledge should be integrated into mainstream education to enrich the learning environment and put learning processes into context with the learners' living environment.*

The situation where learners are exposed to and grapple with Western agricultural practices at the expense of their IAKS is contextually irrelevant. I likewise contend that learning that is dominated by familiar, local, home-grown knowledge and practices from students lived experiences is more meaningful and decolonising as it makes the subordinated cultural beings not to struggle to make sense and understand themselves in relationship to their natural environment and how they organise [their] folk knowledge of flora and fauna, cultural beliefs and history to enhance their issues (Semali and Kincheloe, 1999). In this way it therefore enables epistemological access for indigenous learners in formal education processes.

The decolonisation 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" (Smith, 1999: 39). Smith refers to those purposes of Indigenous peoples as 'our purposes', and 'our perspectives', as the Indigenous approaches that empower Indigenous scholars to decolonise theories, develop Indigenous methodologies and use Indigenous epistemologies. It is worth noting that these Indigenous purposes and the accompanying approaches enable Indigenous researchers and scholars to make evident what is special and expected, what is significant and logical with reference to how Indigenous peoples understand themselves and the world. Such a process makes Indigenous researchers to free themselves from the yoke of Western epistemologies, which, in most cases are very different from the Indigenous ones and are undeniably well- matched to Western academic thought, but which are, nevertheless, foreign to Indigenous ways of thinking. de Souza Santos Santos (2015) succinctly states that decoloniality also criticises present day order where knowledge is still being dictated by the Euro-North academy.

Decolonialisation is not just concerned with unveiling colonial practices/legacies, but rather it aims at freeing the colonised mind from epistemology profoundly affected by the history of colonisation (Castro-Gomez, 2007). The need for the representation of IAKS in the ZSSAC is strengthened by the sentiments of Battiste (2013:23)) who says:

> *Consider that for more than a century, Indigenous students have been part of a forced assimilation plan—their heritage and knowledge rejected and suppressed, and ignored by the education system*.

Basically, schools need to consider whose knowledge and ways of knowing are given priority. Ideally, decolonised education is rooted in connections to place. By nature of being place-based, the representation of IAKS in the curriculum would empower Indigenous students and help restore cultural knowledge. Such a curriculum would re-establish links to the community by contextualising knowledge, deepening understanding, encouraging community involvement, and reconnecting students with a vital support system.

3.3 RESEARCH METHODOLOGY

3.3.1 Definition of Research Methodology

Polit and Hungler (2004:233) refer to research methodology as "... ways of obtaining, organising and analysing research data." According to Holloway (2005:293), methodology means "... a framework of theories and principles on which methods and procedures are based." Rajasekar, Philominathan and Chinnathambi (2013) view research methodology as a systematically designed approach to solve research problems. This implies that research methodology is used to give a clear-cut idea on what and how to do the study depending on the target population and ease of access to it. Methodology decisions depend on the nature of the research question. Methodology in research can be considered to be the theory of correct scientific decisions (Mouton and Marais, 1996). In this study methodology refers to how the research was done and its logical sequence. The main focus of this study was to analyse the representation of IAKS in the ZSSAC. The qualitative research approach was used.

As indicated earlier in this study, I make efforts to explore the representation of agricultural Indigenous knowledge systems in an African curriculum, the ZSSAC. In this section I describe the following research methodology aspects: the research paradigm, research design, sample and its description, methods of data collection, data analysis procedure, issues of trustworthiness and ethical considerations.

3.3.2 Research paradigm

3.3.2.1 What is a research paradigm?

Thomas Samuel Kuhn (1922 to 1996) who is known for coining the term 'paradigm' characterises a paradigm as: "... an integrated cluster of substantive concepts, variables and problems attached with corresponding methodological approaches and tools…" (Dash, 2005:1). Weaver and Olson (2006: 460) observe that paradigms "… are patterns of beliefs and practices that regulate inquiry within a discipline by providing lenses, frames and processes through which investigation is accomplished." Kovach (2010: 41) asserts 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." On a similar note, Wilson (2008: 175) amplifies that a paradigm 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." In this study, I view a paradigm as the underlying assumptions and intellectual structure upon which research and development in a field of inquiry is based. A paradigm, thus, comprises both theory and practice. This research employed the Indigenous research paradigm which challenges the hegemony of Western knowledge in the academy. This research interpreted data collected through qualitative methods. It is thus qualitative, interpretive and decolonial.

3.3.2.2 The Indigenous research paradigm

There has been a paradigm shift amongst Indigenous peoples and researchers about how research with Indigenous peoples is conceived, implemented, and articulated. The result has been referred to as the Indigenous research paradigm (Wilson, 2003) and has taken the shape of Indigenous theories, research methodologies and processes. The purpose of this section is to discuss the tenets of the Indigenous research paradigm in relation to its practical application to this study on exploring the representation, prospects and opportunities for the inclusion of IAKS in the ZSSAC.

Specifically, Indigenous communities, Indigenous researchers, and non-Indigenous researchers who work with knowledge production and knowledge systems of formerly colonised, historically marginalised, and oppressed groups, which today are most often represented as "the Other". These groups fall under broad categories of non-Western, third world, developing, underdeveloped, First Nations, Indigenous peoples, third world wo/men, African American wo/men, and so on have been changing how research is being conducted with respect to the generation of the research idea, the research design and implementation, through to research dissemination (Walker, 2015). This process is part of what Wilson (2003) calls an Indigenous research paradigm (IRP), which represents the diversity of Indigenous research processes that are grounded in Indigenous knowledges, cultures, and protocols in relationship to place and nation within whose territory the research is undertaken. The proponents of this paradigm, therefore, strive to bring to the forth the voices of the oppressed people in knowledge creation and production. This means that Indigenous knowledge which is currently undermined by the dominant Western knowledge should be seen as having equal value with Western or scientific knowledge. Indigenous research paradigm, thus, becomes a decolonizing process of conducting research with Indigenous communities that places Indigenous voices and epistemologies in the centre of the research process (Battiste and Henderson, 2000; Smith, 1999). Simonds and Christopher (2013: 103) observe the following about the decolonising process:

> *It critically examines the underlying assumptions that inform the research and challenges the widely accepted belief that Western methods and ways of knowing are the only objective, true science. Holding Western beliefs and methods as "the" true science marginalizes Indigenous methods and ways of knowing by denigrating them as folklore or myth. In Smith's view of decolonising research, the researcher should centre Indigenous values and follow Indigenous protocols. This does not mean researchers should reject all Western methods and theories, as they may be adapted if deemed appropriate and beneficial by the local community.*

The legacies of colonisation have shaped a great deal of formal academic research in ways which have appropriated Indigenous knowledge, misrepresented Indigenous people and damaged Indigenous communities. It is worth noting that "Worldviewing activities take place in dialogue with the context within which people live" (Docherty, 2001: 51). Therefore, an Indigenous paradigm is a culturally specific discourse based on Indigenous peoples' premises, values and worldview. Hence, an Indigenous research paradigm is structured within an epistemology that includes a subjectively based process for knowledge development and a reliance on Elders and individuals who have or are developing this insight. In this research local farmers and the elderly in society were recognized as the custodians of IAKS. The research was also a multiple case study which explored prospects and opportunities of including IAKS in the ZSSAC.

Concepts of relationship with the natural world as a living system are reflected in Indigenous paradigm research (Deloria, 1995; Little Bear, 2000) and many examples of decolonizing research involve articulation of live participation with the natural world (Cajete, 2000). This reseach thus considered the lived agricultural experiences of the local farming communities in their environments.

For Indigenous peoples, decolonisation is about shifting the way Indigenous peoples view themselves and the way non-Indigenous people view Indigenous Peoples (Hart, 2010). Indigenous knowledge is non-Western and peripheral, and it operates with the values and belief systems of the historically colonised (Snow et al., 2015). The attempt to decolonize research is well complemented by a community-based participatory research (CBPR) approach (Simonds and Christopher, 2013). IRP respects and values the idea of those being researched, and directly benefits them.

Any scholar who conducts research on, with or about Indigenous peoples should pose and answer the following questions, which are directly connected Indigenous research methodological issues (Porsanger, 2004: 113):

> *Whose research is this? Who owns it? Whose interests does it serve? Who will benefit from it? Who has designed its questions and framed its scope? Who will carry it out? Who will write it up? How will the results be disseminated?*

This proffered the interests of Indigenous peoples of Zimbabwe who would be the beneficiaries of a decolonised education system through inclusion of IAKS in the ZSSAC. The study was planned and carried out by myself, an Indigenous Zimbabwean academic.

McGuire-Adams (2020), Smith (1999) and Lavallée (2009) recognise that while 'Indigenous research is not qualitative inquiry the methods used (within Indigenous research) may be qualitative. Kovach (2009) recommends research methods such as stories or narratives, Smith suggests research/sharing circles, interviews, and even dreaming. Le Grange (2018) adds that data in the form of words (narratives) or visual images are qualitative. The qualitative approach emphasises key and subjective assessment of opinions, feelings, behaviour, attitudes, motive, reason and obligation. In this manner it is unlike the quantitative approach which involves the collection of quantitative data, which are put to rigorous quantitative analysis in a formal and rigid manner.

Le Grange (2018) justifies use of (post)qualitative research in Indigenous research on the grounds that it resonates with values of Indigenous peoples such as Ubuntu (in the southern African context) and similar values in the broader Indigenous world and that it does not separate epistemology, ontology and axiology. In this research epistemology (knowledge creation), ontology (the environment) and axiology (values) of the local communities with respect to inclusion of IAKS in the ZSSAC were found to have commonalities.

The qualitative approach asserts that there are no general rules about human behaviour, hence behaviour is only understood in the natural context in which it occurs (Raselimo and Wilmot 2013; Dash 2005). Hurtado (2014:24) underscores that "Qualitative research and evaluation aim to understand the meaning and essence of lived experiences." The qualitative approach essentially views knowledge as subjective and it emphasizes understanding and interpretation of phenomena and deriving meaning out of this process (Dash, 2005).

In this research I employed a multiple-case study research design in order to gain understanding of the representation of IAKS from five cases. I used interviews, observations and document analysis to collect data. Case study research is qualitative in nature and is one possible method of doing research on Indigenous knowledge. Case study research will be discussed in detail in a later section.

To conclude this section I envisage the need, significance and objectives of an Indigenous paradigm as a way of both decolonising Indigenous minds by 're-centring' Indigenous values and cultural practices and placing Indigenous peoples and their issues into dominant, mainstream discourses which until now have relegated Indigenous peoples to marginal positions. I argue that the main objectives of the Indigenous knowledge paradigm include the criticism of Western dualistic metaphysics and Eurocentrism as well as the return to the Indigenous peoples' holistic philosophies in research. Employing the Indigenous paradigm aims at enabling children to learn their cultural practices and culture-based knowledge.

3.3.3.3 Ontology

According to Strega (2005) and Mertens (2005), ontology is a theory or set of beliefs about the world. The Indigenous research paradigm is based upon aspects of a particular ontology. There is an apparent interrelationship between ontology and the Indigenous worldview (Hart 2010; Wilson 2008). "How people see the world will influence their understanding of what exists, and vice versa" (Hart, 2013:7). From this perspective, there are many views of being. For instance, Indigenous worldview recognises the interconnectedness of the spiritual realm with the physical realm (Meyer, 2008; Rice, 2005; Cajete, 2000). With such a connection, it is accepted that influences between the physical and the spiritual realm exist. For example, Cajete (2000) views Indigenous science as integrating the spiritual orientation that human beings have an imperative role in continuation of natural processes in the world, and that acting in the world must be sanctioned through ritual and ceremony. Spirituality is a key element of an Indigenous ontology and as well an important aspect in the Indigenous research paradigm. Indigenous farming practices per se cannot be divorced from cultural practices which in their own right have a spiritual underpinning that influences these Indigenous farming practices. The extent to which this ontological element affects the representation of IAKS in ZSSAC will be one of the objects of this study.

3.3.2.4 Epistemology

Epistemology has its aetiology in Greek, where the word episteme means knowledge (Kivunga and Kuyini, 2017: 26). Put simply, in research, epistemology is used to describe how we come to know something; how we know the truth or reality; or as Cooksey and McDonald (2011) put it, what counts as knowledge within the world. It is concerned with the very bases of knowledge, its nature and forms and how it can be acquired, and how it can be communicated to other humans. It focuses on the nature of human knowledge and deepens understanding in one's field of research. Kivunga and Kuyini (2017: 26) advance that:

> *And in considering the epistemology of any research one should ask questions like: Is knowledge something which can be acquired on the one hand, or is it something which has to be personally experienced? What is the nature of knowledge and the relationship between the knower and the would be known? What is the relationship between me, as the inquirer, and what is known?*

The above questions are important because they made me to position myself in the research context so that I could discover what else is new, given what is known. As the basis of investigating the 'truth' I asked myself the very questions of 'how we know what we know?' How do we know the truth? What counts as knowledge? I considered these as particularly important questions because one of the criteria by which higher degree research is judged is its contribution to knowledge.

According to Davidson (2000) the sources of knowledge can be divided into the following four categories:

- **Intuitive knowledge** which is based on intuition, faith, beliefs etc. Human feelings plays greater role in intuitive knowledge compared to reliance on facts.
- **Authoritarian knowledge** which relies on information that has been obtained from books, research papers, experts, supreme powers etc.
- **Logical knowledge** which is a creation of new knowledge through the application of logical reasoning.
- **Empirical knowledge** which relies on objective facts that have been established and can be demonstrated.

In this research intuitive knowledge was exhibited during interviews wherein I was able to probe into the feelings, beliefs and attitudes of the participants. Authoritarian knowledge was yielded by document analysis of policy documents, teachers schemes of work and students written work. The same knowledge was got from reviewing relevant literature sources and interviewing agriculture educators and local farmers. Logical knowledge was generated as a result of analysing primary data findings, and conclusions of the research can be perceived as empirical knowledge. Similarly empirical knowledge was generated from observing Indigenous farming practices of the local communities, schools and tertiary institutions under study as these had been developed through centuries of intimated understanding of the environmental conditions. Specifically, epistemology is concerned with possibilities, nature, sources and limitations of knowledge in a field of study. Hence, the way one goes about collecting and interpreting data is strongly influenced by how one interprets knowledge and truth. In simple terms, epistemology is the theory of knowledge and deals with how I gathered knowledge and from which sources.

Within epistemology there are several approaches and branches (Merriam, 2009), such as for example positivism and interpretivism. These two are, by far, not the only branches within epistemology since one may consider such valid approaches of looking at the world like feminism or postmodernism, or critical enquiries. However, the two philosophical approaches; positivism and interpretivism, are situated at the most extreme ends of a spectrum and so help us to see the relationship between the different branches and the impact this may have on your research (Kivunga and Kuyini, 2017). The underlying principle for positivism is a scientific outlook on knowledge and the world. Data collection is undertaken on the basis of statistics and large numbers of participants. A positivist approach to research means that the research moves on through a hypothesis and deductions and attempts to look at the data objectively. Positivist research therefore is quantitative and looks at high levels of generalisability. On the other hand, the underlying idea of the interpretivist approach is that the researcher is part of the research, interprets data and as such can never be fully objective and removed from the research. Interpretivists are interested in specific, contextualised environments and acknowledge that reality and knowledge are not objective but influenced by people within that environment (Merriam, 2009)).

This research took an interpretivist approach. It considered subjective meanings and non-quantifiable data as knowledge. This philosophical outlook is more subjective and subject to biases, thus cannot be generalised in the way that positivist research can be. However, in qualitative research we do not generalise the results but the knowledge (Lewis, et al., 2014; Gheondea-Eladi, 2014; Hallberg, 2013; Delmar, C., 2010; Myers, 2000). Hence, subjective meanings and social phenomena can provide acceptable knowledge dependent upon the research question. The use of multiple data sources, namely interviews, observations and document analysis enhanced credibility by enabling triangulation of the findings from which I then drew conclusions and made recommendations.

To express the Indigenous worldview, Indigenous scholars and researchers view epistemology as knowledge nested within the social relations of knowledge production (Ermine, 1995; Meyer, 2001; Wilson, 2008). It most closely approximates what Graveline (2000:361) terms of “self-in-relation.” In this research I collected and analysed the data in person. As this could produce biased results, I had to keep audio tapes for comparison with the transcribed data and to appendix some of the transcribed data. During data presentation and analysis of data, I used direct quotations of the participants, again, to avoid biased reporting. As alluded to earlier on, I triangulated the data to shun biases.

3.3.2.5 Methodology

Mertens (2005) describes methodology as the knowledge gathering process by stating methodology by asking “How can the knower go about obtaining the desired knowledge and understandings” (Mertens, 2005: 8)?" An Indigenous research paradigm is decolonising. One could argue that such a decolonising perspective is essential within Indigenous research given the existing social inequities that Indigenous peoples continue to experience. A decolonising philosophy is of importance to Indigenous research because it focuses on Indigenous-settler relationships and seeks to question the dominant social relationships that marginalise Indigenous peoples (Nicoll, 2004). Interrogating the power relationships found within the Indigenous-settler dynamic enables a form of praxis that seeks out Indigenous voice and representation in research that has historically marginalised and silenced Indigenous peoples (Smith, 1999).

Decoloniality aims to represent and resuscitate Indigenous knowledges. While Indigenous research derives its origins from Indigenous approaches to investigation, it is also linked to the decolonial research paradigm and critical theory as it is critical to Western hegemony. Decoloniality can thus never be separated from Indigenous knowledges because decoloniality paves way for the resuscitation of Indigenous knowledges. Indigenous methodologies are decolonial methodologies. The epistemologies that emerge from decoloniality are Indigenous epistemologies.

The decolonial paradigm affects choice of research methods, how those methods are employed and how the data are analysed and interpreted. Neuman (2006) reminds us that a paradigm is a basic alignment to theory and therefore impacts method. Within this approach, weighty attention is paid to assumptions about knowledge. This is differentiated from a more pragmatic approach (or applied research) which is "... not committed to any one system of philosophy and reality" (Creswell, 2003:12). In a paradigmatic approach to research, be it Indigenous or otherwise, I note that methods ought to be congruent with the philosophical orientation identified in the research framework to show internal methodological consistency. Hence, in my choice of an Indigenous methodological framework, the methods selected should be sensible from an Indigenous knowledges perspective.

3.3.2 Research design

By research design I refer to the overall strategy that I chose to integrate the different components of the study in a coherent and logical way in order to ensure I effectively address the research problem. A research design stands for advance planning of methods to be adopted for collecting the relevant data keeping in mind the technique to be used in their analysis. Kothari (2004) posits that a research design constitutes the blueprint for the collection, measurement, and analysis of data. It is, thus, the conceptual structure within which I conducted my research.

In this qualitative study I adopted the multiple-case study research design to provide scope for intensive study into the representations of IAKS. A case could be an individual, a group, a school, a community (Hesse-Bibber, 2011; Yin, 2009), or could also include "... a program, events, or activities" (Creswell, 2012:485). Yin (2009:18) sees a case study as “... an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.” The phenomenon can be studied in its natural setting so that meaningful and relevant theory is generated from the understanding gained through actual practice (Yin, 2009). A case study research design is composed of a single case or multiple cases. If the same study contains more than a single case, it is called a multiple-case study. This means that more than two cases should be included within the same study in order to make comparisons and draw patterns across the cases and obtain more reliability in the overall results (Yin, 2004) as was the case in this study.

Stephens (2009:46) underscores that:

> *Case studies are a step to action. They begin in a world of action and contribute to it. Their insights maybe directly interpreted and put to use.*

This multiple-case study therefore helped me in analysing the representation of IAKS in ZSSAC. My idea of using this method is supported by Hesse-Bibber (2011) and Yin (2009) who point out that case studies allow the researcher to get in-depth understanding of the phenomena.

Creswell (2012) and Yin (2009) posit that case studies are preferred when answering questions that start with ‘how’, ‘who’ and ‘why’ to unravel and fully understand the nature and complexity of the contemporary phenomenon. They go on to opine that by using case study research, the researcher would gain particular understanding or insights into a chosen research area which usually is a contemporary phenomenon. In my current study the phenomenon is an analysis of the representation of IAKS in the ZSSAC. I used the multiple case study approach to dig deep, look for explanations and gain understanding of the phenomenon through multiple data sources (Hesse-Bibber, 2011; Yin, 2009). The data collection methods I chose were in-depth interviews, non-participant observations and document analyses.

Inherent in the case study design is the advantage of method triangulation for validation of findings. By using several different data collection methods, I aimed at strengthening research findings through triangulating the evidence, thereby validating the findings.

This multiple-case study research concerned itself with studying the representation of IAKS in ZSSAC in context. Studying the phenomenon in its natural setting made me generate meaningful insights from actual practice. The case study approach is also used when the researcher has little control over events (Creswell, 2012; Yin, 2009) as is the case in this research.

A frequent criticism of case study methodology is its dependence on a single or few cases which renders it incapable of providing a generalizing conclusion (Shuttleworth, 2008). Even ZSSAC has options for crops and animals studied in line with the geographical location of a school. I would thus find it hard to generalise the findings of this study since they evolved from five cases. My study only provides insights into the phenomenon under study, the representation of IAKS in the ZSSAC. Yin (2009:10) posits that:

> *... Case studies ... are generalisable to theoretical propositions and not to populations or universes. In this sense, the case study ... does not represent a 'sample', and in doing a case study, your goal will be to generalize theories (analytical generalization) and not to enumerate frequencies (statistical generalization).*

Case studies also suffer from possible biases in data collection and interpretation since a single person gathers and analyses the data (Yin, 2009; Shuttleworth, 2008) as was the case in this study. There is a possibility that my intense exposure to the study could bias the findings thereby compromising the validity of the study results.

However, a case study has the advantage of richness of its descriptive examples that result from the intensive study of one or a few units. Thus, a lot can be learnt to augment what is already known with respect to the representation of IAKS in the curriculum under study. The use of the case design provides more realistic responses compared to a purely statistical survey (Flyvberg, 2011; Shuttleworth, 2008). Further, while a quantitative researcher is trying to prove or disprove a hypothesis, a case study might introduce novel and unexpected findings during its course, and cause research to take new directions, because it is flexible. Other advantages of case study are its applicability to real-life, contemporary, human situations and its public accessibility through written reports (Chabongora, 2011). Case study results relate directly to the participants' everyday experience and facilitate an understanding of complex real-life situations. I undertook this case study research in a way that incorporated the views of the participants and their immediate farming communities with respect to the representation of IAKS in ZSSAC.

Flyvberg (2011), a strong supporter of the case study research approach, defends it on the grounds that it produces the type of context-dependent knowledge. He views context-dependent knowledge and experience to be at the very heart of expert activity. He goes on to say that, in the study of human affairs, there appears to exist only context-dependent knowledge, which as a result presently rules out the possibility of epistemic theoretical construction. In this study, the case study is well suited to produce context-dependent knowledge on prospects and opportunities for the inclusion of IAKS in ZSSAC.

This study adopted a multiple case study design of five cases: two high schools and their immediate communities and three tertiary institutions. My motive was to explore similarities and differences within and between cases. Yin (2003) avers that the fact comparisons will be drawn, it is important that the cases are selected carefully to enable the researcher to predict similar results across cases, or predict contrasting results based on a theory.

In using multiple cases I was guided by Miles and Huberman (1994: 29) who observe that this promotes "confidence to findings". The evidence from multiple cases is often considered more compelling and the overall study is therefore regarded as more robust (Herriot and Firestone, 1983). Multiple case studies allow for exploration, description and explanation within each case, as well as across the cases to help provide "… lessons learned… " (Creswell, 1998:249). It is claimed that the use of multiple cases yields more robustness to the conclusions from the study.

According to Robson (1993), multiple case studies are not conducted with the purpose of gathering samples for generalization. Instead, the goal is to get material for the analytical generalization. Yin (2003) avers that using multiple data sources triangulates the data to develop converging lines of inquiry and to strengthen construct validity. That way a chain of evidence is maintained. Yin (2003:47) goes on to observe that multiple case studies can be used to either predict similar results: “(a) literal replication, or (b) to predict contrasting results but for predictable reasons (a theoretical replication)”. That way, the explanatory power of and generalisability of data collection process (Miles and Huberman, 1994) were increased. Hence, when selecting multiple-case studies, each case must be carefully selected so that it predicts similar results (literal replication) or it predicts contrasting results but for predictable reasons (theoretical replication).

Cases may form a purposive but non- probability sample. Merriam (1998) indicates that a non-probability sample is effective when the research is exploring what is occurring. Patton (1990:169) suggests that such a purposive sample has a logic and power and provides rich information as was the case in my study. This collection of cases is selected so that it provides a *structural representation* that matches the purpose of the study (Baxter and Jack 2008). In my study I used this approach to maximise the depth of information and increase the transferability of the findings. The process of triangulation involves corroborating data from multiple perspectives to enhance the depth of understanding of a particular theme and to provide verification (Atkinson and Delamont, 2005; Creswell, 1998).

3.3.4 Sample

Creswell (2012) and Mugo (2013) view the target population as that group about which the researcher is interested in gaining information and conclusions. The target population of my research comprised secondary school Agriculture educators, AGRITEX officers, lecturers of Agriculture Education in tertiary institutions and local farmers representing the communities in commercial and the communal sectors around the two high schools.

Mugo (2013) defines sampling as the selection a suitable sample, or selecting a representative part of a population in order to determine characteristics or parameters of the whole population. I used purposive sampling, also referred to as judgemental sampling, to select the research participants. I view purposive sampling as the deliberate choice of an informant due to the qualities the informant possesses. In essence, purposive sampling is a non-random sampling technique wherein the researcher elects what needs to be known and sets out to find people who are willing and able to provide the data by virtue of experience or knowledge (Denzin, 2006; Lewis and Sheppard, 2006).

Case studies may use a purposive but non-probability sample. Merriam (1998) states that a non-probability sample is effective when research is exploring what is occurring as was the case in this study. Patton (1990:169) goes on to posit that such a purposive sample, ‘‘... has a logic and power - and provides rich information’’. I chose the sample based on who I thought would be appropriate for the study. I judged that such participants were rich with information with respect to the phenomenon under study (IAKS). The use of purposive sampling enabled me to take a decision about the individual participants who would most likely contribute appropriate data, both in terms of relevance and depth. I used two forms of purposive sampling: intensity sampling and snowball sampling.

3.3.4.1 Intensity sampling

Intensity sampling is a purposive sampling technique whereby participants are included in the study on the basis of having rich information and experience that manifest the phenomena intensely (Creswell, 2012). I used the technique to select or search for rich or excellent examples of the IAKS phenomenon of interest under study. These participants were not, however, extreme or deviant cases. Intensity sampling allowed me to select a small number of rich cases that provided in-depth information and knowledge of the phenomenon of interest; prospects and opportunities for the inclusion of IAKS in ZSSAC. The participants I selected through use of intensity sampling included:

- Six (6) Agriculture teachers - 3 from each of the two participating schools,
- Two Provincial Agriculture Education Officers - each from the Midlands and Mashonaland West Provinces where the two schools are located, respectively,
- Two local Agriculture Extension (AGRITEX) Officers from the surrounding communities
- The Director- Agriculture Education and Training in the Ministry of Agriculture,
- Five (5) Agriculture lecturers in Tertiary Institutions.

As Patton (2001) points out, intensity sampling requires prior information and exploratory work to be able to identify intense examples.

3.3.4.2 Snowball sampling

Snowball sampling is a non-probability method of developing and expanding a purposive sample by asking one participant to recommend others (Babbie, 2013). Snowball sampling is also referred to as chain sampling, chain referral sampling or referral sampling (Willis, 2014). The technique works like a referral chain system whereby existing study subjects identify and recommend additional subjects from their contact groups. This causes the sample group to grow just like how a snowball grows. Once the original subject has been studied, the researcher asks that subject to identify other people rich in the required experiences, thereby expanding the sampling group. In this study I used the snowball sampling technique to recruit the twelve local farmers, six from each of the high schools, as interviewees. The first farmer participant helped me identify the next potential farmer participant who fitted in my study. This method of requesting referrals was repeated until I had identified the said six farmers.

The use of the technique made it easy for me to locate farmers who were knowledgeable about IAKS and employed the Indigenous farming practices. While snowball sampling targets information-rich people and is cost effective, it has the potential challenge of targeting participants who may exhibit the same traits and characteristics, leading to sampling bias.

In this research I justified the engagement of the participants as not only due to their availability as participants but also rich sources of information with respect to the criteria under study (as shown in Table 3.1).

TABLE 3.1 RESEARCH PARTICIPANTS AND THEIR JUSTIFICATION

Participant(s)	Justification
Agriculture teachers- from the two participating high schools	They are implementers of the Agriculture curriculum
The Provincial Agriculture Education Officers	They are tasked with the monitoring, supervision and evaluation of the teaching of the subject Agriculture in the Midlands and Mashonaland West provinces in which the two participating schools are located
Local farmers	They are the custodians of IAKS knowledge and practices in the school community
AGRITEX officers	They provide agriculture extension services in the communities around the participating schools
Lecturers in tertiary institutions	They produce Agriculture teachers and AGRITEX officers who work in the schools and community

3.3.5 Methods of Data Collection

The methods I used to collect the required data include:

- One-on-one, semi-structured, in-depth interviews were done with the Agriculture teachers in the two participating schools, the Provincial Agriculture Education Officers (PAEOs) of the Midlands and Mashonaland West provinces, local AGRITEX officers, Provincial AGRITEX officers, Agriculture Education lecturers in tertiary institutions and with local farmers representing the commercial and the communal sectors of the two high schools' surrounding communities.

- Non-participant observation of farming activities practiced by communities surrounding both participating schools.

- Document analysis of the Zimbabwe Agriculture policy, the Zimbabwe IKS policy and the National Agriculture syllabi to sift the Government's IAKS intended curriculum on IAKS. Document analysis of Agriculture teachers' Schemes of work and students' written work of the two high schools exposed the transacted curriculum with respect to IAKS.

3.3.5.1 Interviews

I undertook semi-structured in-depth interviews of secondary school Agriculture teachers, AGRITEX officers, lecturers of Agriculture Education in tertiary institutions, local farmers around the participating schools, and the Provincial Agriculture Education Officers (PAEOs) of the Midlands and Mashonaland West provinces. The interviews consisted of several key guiding questions developed from the research questions that helped analyse the representation of IAKS in ZSSAC. These questions also allowed the interview process to be undertaken through probes in order to pursue an idea or response in more detail. The flexibility of this approach, particularly compared to structured interviews, enabled the discovery and elaboration of information that was important but that I may not have thought of as pertinent to the research (Gill, Stewart, Treasure, and Chadwick, 2008).

The main advantage of in-depth interviews is that they enabled me to obtain detailed information about personal feelings, perceptions, opinions, beliefs and/or motivations of individuals with respect to aspects of the study. Castillo (2009) adds that interviews allow more detailed questions and probes to be asked. However, it was difficult for me to standardise the interview situation so that I did not influence the participants to answer questions in a certain way.

Semi-structured in-depth interviews provided a 'deeper' understanding of the representation of IAKS in ZSSAC where detailed insights were required from individual participants. McCracken (1988) underscores that:

> *The purpose of qualitative interview is not to discover how many, and what kinds of people share some characteristic but rather it is to gain access to the cultural categories and assumptions according to which one culture construes the world. How many and what kinds of people hold these categories and assumptions is not...but*

> *rather qualitative research does not survey terrain but mines it* (McCracken, 1988: 17).

in-depth interviews are also particularly appropriate for exploring sensitive topics, where participants may not want to talk about such issues in a group environment (Gill, Stewart, Treasure, and Chadwick, 2008). The respondent would feel much more comfortable sharing this information confidentially in a face-to-face interaction with the researcher (Hagglund, 2010) as is the case with IAKS issues which are often regarded as sacred. I used a voice recorder to capture the interviews.

3.3.5.2 Observation

Robert Wood Johnson Foundation (2008) views observation as a systematic data collection approach which involves:

- prolonged engagement in a setting or social situation clearly expressed
- self-conscious notations of how observing is done
- methodical and tactical improvisation in order to develop a full understanding of the setting of interest
- imparting attention in ways that is in some sense 'standardized' and
- recording one's observations

Observation can either be participant or non-participant. While participant observation is the process enabling researchers to learn about the activities of the people under study in the natural setting through exposure to and active involvement in their day-to-day or routine activities, non-participant observation is one where the researcher is an ‘eavesdropper’; someone who attempts to observe people with limited interaction with the people observed. In both cases, researchers use all of their senses to examine people in natural settings or naturally occurring situations (McLeod, 2015). In this research I used non-participant observation to collect data on the Indigenous farming activities of the local farmers and the school. The observations were structured, by way of an observation guide, to enable me look for and acknowledge particular types of Indigenous farming activities in the schools’ immediate community.

Observation can provide the foundation for theory and hypothesis development. Riviera (2010) notes that non-participant observation is a useful approach when one has access to large amounts of information collected over long periods of time. In this study I observed the farming activities from preplanting through to harvesting and storage of the farm products.

Choudhury (2015) and Patrick (2015) advance that purely non-participant observation is extremely difficult since one cannot penetrate the heart of a matter without proper participation in it. This implies that one really cannot imagine a kind of relationship, when the researcher is always present but never participates. From the foregoing, some combination of both participant and non-participant method is sometimes selected, though leaning more towards the latter. Patrick (2015) warns that though it is possible to observe particular participants even if they agree to ones presence, the fact that one is observing them can make them behave differently from the normal, and one is never sure that they would do the same things if they were not being observed.

3.3.5.3 Document analysis

In this study I also employed document analysis as a method of data generation. I used document analysis to complement data which were gathered through the one-on-one interviews and observations. Document analysis is a social research method that refers to various procedures involved in analysing and interpreting data generated from the examination of and reviewing existing documents and records relevant to the study (Magwa and Magwa, 2015; Bryman, 2008). In this research I found document analysis benefited my study since I was able to eliminate bias that could have come with interviews and observations.

Official documents such as the Zimbabwe Agriculture Policy, the National Agriculture Curriculum and IKS Policy constitute the intents of the Zimbabwe government on the representation of IAKS in the ZSSAC. In addition, document analysis of Agriculture teachers’ schemes of work, students’ written work and past examination papers were used to reveal any difference between the intended curriculum and the transacted curriculum.

3.3.6 Triangulation

I basically employed multiple qualitative techniques to collect data. The approaches ensured methodological and data triangulation in order to validate the results. I ensured triangulation through the use of more than one data collection approach to investigate a research question thereby enhancing confidence in ensuing findings. That way I avoided the findings from suffering the limitations associated with one method. Creswell (2012) views triangulation as an important concept in case study research when he opines that ''... an investigation of the phenomenon from different perspectives provides robust foundations for the findings and supports arguments for its contribution to knowledge'' (Creswell, 2012:7).

3.3.7 Pilot study

A pilot study, also called trial study, trial run, trying out, feasibility study or pre-test, is defined as a small-scale, preliminary study conducted as a prelude to a larger scale study (Arnold et al., 2009; Kim, 2011; Polit and Hungler, 2003). It therefore becomes not only part but also a rehearsal of the larger, preceding study. A pilot study is a version of the main study that is run in miniature to increase the likelihood of success in the actual study.The major aim of the pilot study is to investigate the feasibility of crucial components of the main study. Pilot studies are a crucial element of a good research study.

Before scaling for full research, I conducted a pilot study at one high school in Mashonaland West Province of Zimbabwe. I interviewed two agriculture teachers, one local AGRITEX officer and two local farmers from the school's surrounding community. I also carried out observation of the farming practices at the school and of the two interviewed local farmers. Lastly I analysed student's written work and teachers' schemes of work. The first pilot study was undertaken with 2 agriculture teachers at the school.

The pilot study helped me to optimise the research process in order to minimise unforeseen events. From the pilot study I was able to determine whether the preliminary data I collected were speaking to the research objectives. I was also able to discover and correct unclear, deleterious and expensive mistakes in my data collection instruments and the overall process of collecting data. I thus modified the research instruments for reliability and content validity before safely administering them. The pilot study therefore gave me advance warning about where and how the main research project could fail. However, a pilot study does not guarantee the success of the main study. It however, increases that likelihood (Kim, 2011). De Vaus (1993:54) aptly advises that ''Do not take the risk. Pilot test first'' to guarantee a well oiled research process.

3.3.8 Data analysis

Thematic analysis has been identified as an appropriate method to analyse transcribed texts of interviews and data generated by observation and document analysis as was the case in this study. Thematic analysis is a method of analysing qualitative data by "... identifying, analysing and reporting patterns (themes) within data" (Braun and Clarke, 2006:6). Fereday and Muir -Cochrane, (2006:82) echo similar sentiments by stating that "Thematic analysis seeks to unearth salient themes that emerge as being important to the description of the phenomenon''. ''It moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas within the data, that is, themes (Alhojailan, 2012:10). A theme "captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set" (Braun and Clarke, 2006:82). Braun and Clarke (2006: 81) go further to explain that thematic analysis can be an essentialist or realist method, which reports experiences, meanings and the reality of participants. Alternatively, it can be a constructionist method, which examines the ways in which events, realities, meanings and experiences are the effects of a range of discourses operating within society. The latter is consistent with the interpretive assumption informing this study that is not geared to identifying causes but provide a different way to explain social phenomena. Therefore, the intuition is that thematic analysis entails close attention to individuals thus providing insight into the cultural beliefs and values that instil powerful experiences and motivations of Indigenous people and how they make sense of, and respond to their environment. Moreover, locating themes would most readily honour the concept of letting the participants' words and intention emerge as intact as possible. In the context of this study, Braun and Clarke (2006)'s step -by-step guide of conducting thematic analysis was used. The initial step involved familiarising oneself with the data through transcribing, reading and rereading the transcriptions and segmenting data into manageable units for analysis.

After failing to obtain Atlas.ti software to analyse the large volumes of data I obtained from in-depth-interviews, observations and document analysis, I analysed that data manually. Firstly, I made sure all data were in place. Chamberlain et al. (2004) emphasises the need to collect all the data before analysing it. Where interviews were done in a language other than English, in this case in ChiShona, I translated the original dialogue into English. For the observations, I had recorded notes in observation guides during the fieldwork. I also generated notes on document analysis guides after skimming (superficial examination), reading (thorough examination) and interpretation (Bowen, 2009). In so doing, this iterative process combined elements of content analysis and thematic analysis.

The second step involved generating initial codes from the data. The purpose of coding was to make connections between different parts of data as derived from participants' responses (Alhojailan, 2012:12). By generating and categorising codes, I utilised both inductive (data driven) and deductive (informed by interpretive theory and prior research findings) approaches. In the third step, I searched for themes and this involved sorting the different codes into potential themes. The forth step involved reviewing and refining the participants' themes. At this stage I set validity of individual themes in relation to data. The fifth step was done once a satisfactory thematic map of the data had been created. This consisted of defining and naming themes that were presented so as to analyse the data within them (Braun and Clarke, 2006). In the final step I produced the report accompanied by enough data extracted which captured the essence of main point.

In a nutshell, I reiterate that I analysed and interpreted the data manually and thematically by evaluative description of common themes and patterns permeating the main issues.The process thus consisted of reading through textual data, identifying themes in the data, coding those themes, and then interpreting the structure and content of the themes (Bogdan and Biklen, 2006; Guest, MacQueen, and Namey, 2012).That way the process of data analysis gradually changes from mainly inductive to become more deductive (Lodico et al., 2010; Merriam, 2009). The collected data were thus coded and categorised against emerging themes with respect to prospects and opportunities for inclusion of IAKS in the ZSSAC. After categorisation data were interpreted according to the research question that they related to. The answers to the research questions were then discussed to show how the main research question may have been answered.

3.4 ISSUES OF TRUSTWORTHINESS

Trustworthiness in research affirms that the research is systematic and principled (Denzin and Lincoln, 2011; Brown, 2015). It is judged in terms of its dependability, credibility, confirmability and transferability, unlike quantitative research which is judged in terms of its reliability, validity, replicability, and generalisability.

3.4.1 Dependability

Dependability involves accounting for all the changing conditions in whatever is being studied as well as any changes in the design of the study that were needed to get a better understanding of the context (Kothari, 2011; Denzin and Lincoln, 2011, Gray, 2009). In this research I enhanced dependability by using multiple data gathering procedures: interviews, observations and document analysis for cross-validating the data. My use of such overlapping methods fostered crystallisation of the findings. Dependability was also ensured by trialingg the research instruments on purposively selected participants, the rich sources of data, who did not participate in the actual study. These were from a selected school in Mashonaland West province in Zimbabwe. Feedback from the trial study helped me to improve the instruments and hence produce the final documents through removing any ambiguities that were inherent in the research instruments.

3.4.2 Credibility

Credibility requires demonstrating, in one or more ways, that the research was designed to maximize the accuracy of identifying and describing whatever is being studied, especially as judged by the groups of people being studied (Brown, 2015). Denzin and Lincoln (2011) posit that credibility in qualititative research can be enhanced by using prolonged engagement, persistent observation, methodological crystallisation, peer debriefing and member checking among the various other approaches. Prolonged engagement with the study sites and persistent observation meetings and interviews warranted sufficient time for the study to learn the culture of the key participants, test for false information and build trust central to the case study. I had to consult appropriate documents to ensure credibility of the study. In addition, I made a preliminary visit to the participating schools and their communities to familiarise myself with both study sites. All the above made the key research participants gain enough confidence and trust in me. This also allowed for adequate study of the cultural context and adequate checks for misinformation.

The use of multiple data sources, namely interviews, observations and document analysis enhanced credibility of the findings from which I drew conclusions and made recommendations.

I also conducted a pre-exercise interview to identify participants who met the research criteria. The study also ensured credibility by collecting data from informed participants.

3.4.3 Confirmability

Confirmability entails full revelation of the data upon which all interpretations are based, or at least the availability of the data for inspection (Brown, 2015). This implies that the readers of my thesis should be able to examine the data to confirm the results/interpretations. Confirmability is sometimes enhanced by using audit trails; a residue of records stemming from inquiry (Lincoln and Guba, 1985). In this study I archived raw data in the form of written field notes, visual, audio and video sessions, process notes (procedures and design techniques), study proposal and research instruments. I employed thorough record keeping and preservation of data in the External Hard Drive for future inspection. Some of the data is attached as appendices to the thesis. If the reader can inspect the data, the interpretations and results will be maximally confirmable (Brown, 2015). I also made the participants to freely verify the recorded information from observations, interviews and document analysis so as to validate the findings. Such member checks occur when the researcher asks participants to review both the data collected by the interviewer and the researchers' interpretation of that interview data (DeVault, 2016). In addition, I, where appropriate, included direct quotations of participants' responses in my write up. This allows readers to examine the data I collected and analysed, to understand the findings of the analysis, and to evaluate the plausibility, credibility or face validity of the researchers' claims (Robert Wood Johnson Foundation, 2008). That way I was able to crystallise and strengthen narrative data to avoid it appearing as a collection of random, unconnected statements. I also found it helpful to employ reflexive analysis to guard against my influence on the data.

3.4.4 Transferability

Transferability involves demonstrating the applicability of the results of the study in one context to other contexts (Brown, 2015). It is the degree to which the results of a research can apply or transfer beyond its bounds. It implies that results of the research study can be applicable to similar situations or individuals (Universal Teacher, 2015). Hence, transferability ensures that the knowledge which was obtained in my study context would be relevant in another study and the investigators who carry out research in another context would be able to utilize certain concepts which were initially developed. Guba and Lincoln

(2011) posit that as the naturalist cannot specify the external validity of an enquiry, it is crucial that adequate thick description of the phenomenon under study is given to allow audience to have a proper understanding of it. I find this would enable other researchers and audiences to compare the instances of the phenomenon explained in my research document with those that they have seen emerge in their situations.

In this study I provided thick descriptions to the phenomenon to enable prospective readers to decide for themselves if the results are transferable to their own contexts. Added to this was my indication of the boundaries of the study with respect to the geographical, population, concept and methods delimitations (See Chapters 1 and 3).

3.5 ETHICAL CONSIDERATIONS

Research has a moral obligation to build trust between the researcher and the participants (Creswell, 2009; Stephens, 2013). Ethics or ethical considerations are rules or principles of conduct that govern a professional group (Kumar, 2011). Resinic (2013:1) defines ethics as "…norms and values that separate acceptable and unacceptable behavior". In that respect, Quinlan (2011) urges researchers to know what is right and what is wrong so as to strive to do what is right. Hence research ethics are the rules or standards of conduct that distinguish between right and wrong when carrying out research. They mainly focus on the behaviour towards other people and their work (Fraenkel and Wallen, 1996 and Zimbabwe Government, 1996).

First and foremost, the issue of access to the participants was considered. In that respect I obtained Ethical Clearance to carry out from the UNISA's College of Education's Ethical Clearance Committee prior to data collection. Secondly, I successfully sought permission to carry out the research from the relevant Zimbabwean ministries, namely the Ministry of Primary and Secondary Education, the Ministry of Agriculture and Mechanisation and the Ministry of Higher and Tertiary Education and Technology Development.

Permission was also sought from participants through prior informed consent. I had to provide essential information to the participants for informed consent. Each questionnaire and interview had a consent form seeking permission from the potential participants in the study. Each interview was aimed to be conducted within 30 minutes to avoid unnecessary retention of the participants. Interviews were held in private and comfortable rooms where possible to ensure privacy of participants. I then guaranteed the issue of confidentiality through assuring the participants of anonymity. In that respect, I availed the participants with the right to knowledge and privacy. The consent was explaining the reasons for carrying out the research and emphasized on voluntarism of participants and being free to decline or withdraw participation. Thus, the participants had the right to withdraw their responses and they were not coerced for responses during the study and participation in the study was voluntary. Participants were not identified by name, institution and any other inhuman means. I presented the results as grouped data for purposes of confidentiality and anonymity. This was necessary so that the researcher would not get biased responses. I explained the purpose of the study to the participants and assured them that the information they gave would be used solely for the purpose of the research. Also critical to ethics in this research was that there was no use of bribery to get information. Also, plagiarism and academic fraud was avoided by the researcher, hence all sources of data were acknowledged.

3.6 CHAPTER SUMMARY

In this chapter I covered an overview of the theoretical framework and methodologies I used in the study. My discussion in the chapter is structured around the theory of Decoloniality and and how it informed the methodology; research design, methods of data collection and data analysis. Under methodology I also discussed measures used to provide trustworthiness, namely: dependability, credibility, confirmability and transferability. I also gave an overview of the ethical considerations in this study.

CHAPTER FOUR: COMPONENTS OF INDIGENOUS AGRICULTURAL KNOWLEDGE SYSTEMS CURRENTLY INCLUDED IN THE ZIMBABWE SECONDARY SCHOOL AGRICULTURE CURRICULUM

4.1 INTRODUCTION

The previous chapter focused on the theoretical framework and methodological issues adopted in exploring the representation of IAKS in the Zimbabwe Secondary School Agriculture Curriculum. This chapter focuses on analysing components of IAKS currently included in Zimbabwe's secondary school Agriculture curriculum to answer the first research question: 'Which IAKS components currently exist in the Zimbabwe secondary school Agriculture curriculum?' The research techniques which were employed to obtain the required data in order to answer the research question were document analysis, one-on-one in-depth interviews and on-the-spot observation of farming activities. The documents which were analysed included the Zimbabwe Agriculture Investment Plan (ZAIP) (2013–2017) (Zimbabwe Government, 2011) in conjunction with the Comprehensive Agricultural Policy Framework (2012-2032), the Zimbabwe IKS Policy as spelt out by the Second Science, Technology and Innovation Policy of Zimbabwe (March 2012), the National Agriculture syllabi, Agriculture teachers' schemes of work and students' written work. Data collected through interviewing agriculture educators, namely, six (6) agriculture teachers, two (2) Agriculture Education Officers, 2 university Agriculture lecturers, 3 college Agriculture lecturers and two (2) AGRITEX officers, were also analysed. In addition, data from observing the farming activities of the interviewed local farmers in the areas around the high schools and the three tertiary institutions were analysed.

4.2 ANALYSIS OF POLICY DOCUMENTS

The agriculture related policy documents that were analysed to explore the representation of IAKS were the Zimbabwe Agriculture Investment Plan (ZAIP) (Zimbabwe Government 2011), the Comprehensive Agricultural Policy Framework (2012-2032) Executive Summary (April 2012) and the Second Science, Technology and Innovation Policy of Zimbabwe (March 2012).

4.2.1 Zimbabwe Agriculture Investment Plan (2013 – 2017)

According to the Zimbabwe Government (2014), the Zimbabwe Agricultural Investment Plan was the shared national framework for coordinating public, private and development partners' investment into the agriculture sector aimed at enhancing the realisation of the objectives of the Zimbabwe Comprehensive Agriculture Policy Framework (2012-2013) and the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) (2013 – 2018). An analysis of the policy document revealed that, although it was a commercial farming model and a business model, it also promoted IAKS, thereby indicating prospects for inclusion of IAKS in the ZSSAC.

The ZAIP emphasised commercial production of maize and irrigated wheat as staple food crops. Both crops are not Indigenous but originated from the West. However, the document had Indigenous agricultural aspects for potential inclusion in the agriculture curricula. For instance, the document encouraged small scale farmers to produce small grains; (mapfunde (sorghum), zviyo (finger millet), and mhunga (bulrush millet), especially in relatively low rainfall areas. The document further promoted widespread adoption of jengetedzo (conservation agriculture) and the consumption of wild foods. These included wild vegetables, edible insects, wild fruits and other wild edible plants. ZAIP considered 'Conservation Agriculture', a sustainable agricultural technology that increases crop productivity while at the same time preserving and conserving the environment.

The ZAIP document further advocated the production of major livestock products namely mombe dzenyama (beef cattle), mombe dzemukaka (dairy cattle), shiri dzemumusha (poultry), nguruve (pigs), mbudzi (goats) and makwai (sheep) to reduce poverty and food insecurity. Here it was not clear whether it places emphasis on Indigenous or exotic livestock or both.

4.2.2 Comprehensive Agricultural Policy Framework (2012-2032): Executive Summary (April 2012)

Section 2.2 of the Agricultural Sector Policy addressed issues concerning crop and livestock production, marketing and trade. This executive summary gave the situation analysis of the agricultural sector, highlighted the vision, goals, objectives and detailed policy statements and strategies for the development of the Zimbabwean agricultural sector during the period 2012 to 2032.

According to the policy document, the major food crops included chibage (maize), mapfunde (sorghum), mhunga (pearl millet), zviyo (finger millet), nzungu (groundnuts), gorosi (wheat), nyemba (cow peas), nyimo (Bambara nuts) and mbambaira (sweet potatoes). Of these, mapfunde (sorghum), mhunga (pearl millet), rapoko (finger millet), nyemba (cow peas) and nyimo (Bambara nuts) are Indigenous crops while nzungu (groundnut) and mbambaira (sweet potato) are tradtional crops and gorosi (wheat) is exotic. While the document promoted production of Indigenous crops namely mapfunde (sorghum), mhunga (pearl millet), zviyo (finger millet), nyemba (cowpeas) and nyimo (Bambara nuts) in cropping patterns, it clearly stated that chibage chichena (white maize), an exotic crop, remained the main staple food. The document on page 27 stated that government will prioritise provision of output subsidies by guaranteeing floor prices for the 'strategic' crops: chibage (maize) and gorosi (wheat). Included in the list were the small grains which are Indigenous crops. It further viewed the exotics namely tobacco, cotton, tea, coffee, sugarcane, soya bean, sunflower and horticultural products as cash crops. The document lamented that production and productivity of grain crops had been on the decline since the early 1990s.

From the document it could be sifted that Zimbabwe had a well-developed livestock sector, catering for the needs of both domestic and export markets. The livestock sector comprised beef, dairy, poultry, pigs, goats and sheep. Livestock Sector Policy Issues and Statements Section 7.2 (i) promoted preservation, improvement and expansion of existing pedigree herds; especially Indigenous breeds. Section 7.2.4 (ii) promoted appropriate manure management practices in all farming sectors while Section 7.3.3 (ii) promoted Indigenous knowledge for the development of irrigation. However, the document was silent on the implementation of these IKS pronouncements.

4.2.3 Second Science, Technology and Innovation Policy of Zimbabwe (March, 2012)

In the preface of the document the then President of the Republic of Zimbabwe, His Excellency R. G. Mugabe, proffered that ''For a nation to be able to develop sustainable solutions to pressing developmental challenges and to grow in a competitive global marketplace, there is need to be innovative and make use of the dynamic new technologies that create the ability to generate its own solutions while it adapts outside technical knowledge to suit the local environment (Zimbabwe Government, 2012: vi)". Hence the primary goals of the policy document were to:

1. Strengthen capacity development in science, technology and innovation (STI)
2. Learn and utilise emergent technologies to accelerate development
3. Commercialisation of research results
4. Search for scientific solutions to emergent environmental challenges
5. Mobilise resources and popularise science, technology and innovation
6. Foster international collaboration in science, technology and innovation

All the above goals can be utilised to promote IKS even though none of them directly refers to IKS. For example, under Goal 4, using Indigenous crops that are adapted to local conditions can be a way to address emergent environmental challenges such as climate change effects.

With specific reference to IKS, the Science and Technology policy document states that:

> *Traditionally, IKS has played an important role in daily life and development in Zimbabwe. Aspects such as the value of Indigenous fruits, animal breeding, soil cultivation, herbal medicines, etc have been well known and applied and are gradually phasing out of living memory in various localities. Many of these traditions and products can still play an important role in the future development of Zimbabwe particularly in the rural areas. Researching on relevant IKS for current and future needs would help compliment other existing and emerging technologies* (Zimbabwe Government, 2012:8).

The policy (Zimbabwe Government, 2012:10) also stated that the following specific objectives would help Zimbabwe to benefit from the Indigenous Knowledge Systems:

2.13 Develop a database on IKS with a view to identifying aspects that can be exploited using modern Science and Technology, for example synthetic biology for national benefit.

2.14 Promote research on potential applications of IKS to future national developmental challenges.

2.15 Develop courses on IKS that are suitable for inclusion in the school curricula.

2.16 High level technologies that are yet to emerge and are deemed relevant to the needs of Zimbabwe will need to be adopted in a related manner with the appropriate risk assessment.

4.3 TERTIARY AGRICULTURE SYLLABI

Document analysis of the syllabi of the three tertiary agriculture institutions studied, namely T1, T2 and T3 revealed that the syllabi aims and objectives did not directly address IAKS issues. While the syllabi of Chinhoyi University of Technology and Gwebi Agriculture College taught agriculture content, that for Belvedere Technical Teachers was according to its preamble designed for holders of a National Diploma in Agriculture pursuing a pre-service sixteen months Diploma in Education course. It was meant to expose the student teachers to the pedagogics of Agriculture at secondary school level and related vocational training institutions. The learners had already been exposed to agricultural content and only needed to be equipped with teaching skills for these.

Section 4.2.0 titled 'Trends in World Agricultural Education' the Pedagogics of Agriculture Syllabus for T3 indicated under Subsection 4.2.1 that 'The role of Agriculture education in national development emphasising sustainable food production system, food aid and Indigenous knowledge systems. The syllabus in question did not directly mention the content on Indigenous knowledge to be taught. However, one can sift that it was extremely deficient in IAKS issues. The syllabi of T1 and T2 covered Indigenous small grain crops, namely mapfunde (sorghum), mhunga (pearl millet), and zviyo (rapoko) including nyemba (cowpeas) and nyimo (Bambara nuts). These were however taught within a Western science orientation.

From the syllabi, the exotic crops studied were a leaf vegetable (cabbage or rape), a fruit vegetable (tomato or eggplant), a cucurbit (cucumber or sweet melon), a leguminous vegetable (peas or green bean), a bulb crop (onion or leek or garlic), a root crop (carrots or sweet potato) and a tuber crop (potato). While some cucumber varieties and eggplant could be Indigenous, discussions with the lecturers yielded that it was the exotic varieties which were studied at the tertiary institutions.

In the three institutions the topic on 'Soil fertility' included organic fertilizers, which can be related to Indigenous fertilisation methods. However, most of the content placed more emphasis on inorganic fertilisers. The curricula also provided students with knowledge and practical skills required in the production of exotic tsanga (cereals) (commercial and seed maize), wheat and barley, oil seed crops (soya beans, groundnuts and cotton), tropical fruits (banana and mango), subtropical fruits (citrus and granadilla) and deciduous fruits (grapes and apples) and tobacco.

In Animal Husbandry, the tertiary institutions kept exotic and Indigenous breeds of mombe (cattle), nguruve (pigs), mbudzi (goats) and makwai (sheep) (Sabi). The Indigenous breeds studied and reared were mombe (cattle): Mashona, Nguni, Afrikander and Tuli, nguruve (pigs): Mukota, mbudzi (goats): South East African goat which has since been named Mashona), makwai (sheep): Sabi and mixed breeds of huku (chickens). Generally, there was very little direct representation of IAKS in the curricula as it emphasised Western-oriented animal husbandry practices at the expense of the IAKS, especially in how the livestock were raised.

4.4 SECONDARY SCHOOL AGRICULTURE SYLLABI

When this research started, schools were using the Zimbabwe ‘O’ level Agriculture syllabus 5034. However, as the study progressed the government of Zimbabwe developed and adopted the New National Curriculum (New Curriculum Framework, 2015), the Zimbabwe Agriculture Syllabus Form 1 - 4, which was introduced in schools from January 2017. This study, therefore, analysed both syllabi with respect to the presence of IAKS.

4.4.1 Zimbabwe ‘O’ Level Agriculture Syllabus 5034

The aims and objectives of the old Zimbabwe ‘O’ Level Agriculture Syllabus 5034 did not directly refer to IAKS. However, the content contained some IAKS concepts, as highlighted in Table 4.1 .

TABLE 4.1: IAKS IN THE ZIMBABWE 'O' LEVEL AGRICULTURE SYLLABUS 5034

TOPIC	IAKS RELATED CONTENT
1.3 Kushandisa minda (General principles of land use)	• Kushandisa minda (Land tenure); kurima pamwechete (communal) and garisapatsva (resettlement) tenures (p 10)
1.5 Matondo (Forestry)	• Kukosha kwemiti (Importance of Indigenous timber species)
1.6 Mhuka (Wildlife)	• Kuchengetedza zviwanikwa (Indigenous knowledge systems in the management of natural resources) (p13) • Kuchengetedza mhuka (Natural control of wildlife populations) (p14)
2.1.7 Godzaivhu (Soil fertility)	• Mufudze (Organic manures) such as girinhi mufudze (green manuring), durunhuru (compost) and mufudze (farmyard manure) • Zvazvinobatsira (Importance of incorporating organic manures) (p 21)
2.4.1 Gadziriro yemunda (Land Preparation)	• Jengetedzo (Conservation or minimum tillage) (p 34)
2.4.2 Tsanga (cereal) crop	• Tsanga (cereal) crop which is of major importance in local agriculture such as chibage (maize), or mapfunde (sorghum), or gorosi (wheat) must be studied (p 35)
2.5.1 Pests and pest control	• Kudzivirira zvipembenene (Cultural control of pests) (p 37)
2.5.3 Weeds and weed control	• Kusakurira (Cultural weed control) (39)
3.1 Types of livestock	• Zvipfuyo zvinodzeya (ruminants): mombe (Cattle), makwai (sheep), mbudzi (goats) • Zvipfuyo zvisingadzeyi (Non ruminant): mabhiza (horses), mbongoro (donkeys), nguruve (pigs) • Shiri dzemumusha (Poultry): huku (chickens), madhadha (ducks)
6.2.1 Livestock breeds and housing	• Mhando (Indigenous and exotic breeds) (p 64)

Generally, these IAKS aspects were designed to be taught with a Western lens, the so-called improved farming methods. This had an impact on the representations of IAKS in the Zimbabwe ‘O’ Level Agriculture Syllabus 5034.

4.4.2 The New ‘O’ Level Agriculture Syllabus: Form 1-4

Unlike the Zimbabwe ‘O’ Level Agriculture Syllabus 5034, evident in the new syllabus were aims and objectives that addressed IAKS. Aim number 6 on page 3 reads “To develop the ability to solve agricultural problems through the application of Indigenous knowledge, scientific skills and new technology” while Objective 4.12 on page 4 reads ‘’To apply scientific principles and Indigenous knowledge systems to improve nutritional value and food security”. However, IAKS-related topics in the syllabus in question revealed a low coverage of Indigenous agricultural practices.

TABLE 4.2: IAKS IN THE NEW ‘O’ LEVEL AGRICULTURE SYLLABUS: FORM 1-4

TOPIC	CONTENT
Godzaivhu (Soil fertility)	• Mufudze (Organic fertilisers)
Matondo (Forestry)	• Kudoma miti (Identifying Indigenous timber trees and exotic timber trees) grown in Zimbabwe • Kudoma miti yenzvimbo yavo (Identifying Indigenous … trees in their locality using common names; -Labelling identified Indigenous … trees • Ruzivo rwekuchengetedza zviwanikwa (Indigenous knowledge systems in management of natural resource)
Zvemamiriro ekunze (Environmental Factors)	• Practising kuisa bvute (shading), kuisa pevhu (mulching), kuchera makomba (pot holing), kuisa mufudze (manuring), matai (tie ridging), kudiridzira (watering), growing mbeu dzisingagetei ivhu (growing drought tolerant plants), mbeu dzewareware (cover crops), dzivirira mhepo (wind breaks) and jengetedzo (conservation tillage) (p36)
Zvipfuyo (Types of Livestock)	• Zvipfuyo zvinodzeya (ruminants): mombe (Cattle), makwai (sheep) and mbudzi (goats) • Zvipfuyo zvisingadzeyi (non-ruminants): Mabhiza (horses), mbongoro (donkeys), nguruve (pigs), tsuro (rabbits), shiri dzemumusha (poultry) (p48)

While the content in Table 4.2 above addresses IAKS issues, albeit it was not elaborate enough. The syllabus did not indicate the content of IAKS and practices which were supposed to be taught under each topic. With respect to real classroom engagements, the teachers, the implementers of the official curriculum, indicated that they did not know what exactly to teach. They lacked the relevant content. This was exacerbated by the fact that teachers are not the custodians of IAKS. It is the old people who really are.

4.4.3 Advanced Level Agriculture Syllabus (9159)

This syllabus had neither aims, objectives nor topics that directly referred to IAKS. Only Western agriculture practices were evident in the syllabus. The syllabus therefore had a Eurocentric flair since it emphasised Western agricultural practices.

4.5 SCHOOL AGRICULTURE TRANSACTED CURRICULUM

The actual engagement of the students with their curriculum, the transacted curriculum, was deduced by analysing the teachers' Agriculture Schemes of work, students written work and past examination papers. The teachers' Agriculture schemes of work, past examination papers and students' class work in form of written exercises and tests showed lots of relationship with the official syllabi from which they were extracted. The work emphasised Western agricultural practices. However, students' Fieldwork books, also called Practical books, revealed IAKS concepts taken from the communities where they came from. For instance, use of herbs to control crop pests of chicken parasites and diseases was evident in students' Practical books.

4.6 DATA FROM RESEARCH PARTICIPANTS

When asked to comment on the view that the Zimbabwe secondary school agriculture syllabi or curriculum is dominated by Western farming practices the research participants gave the following responses.

Generally, the research interviewees agreed that the ZSSAC was dominated by Western farming practices. They argued that these foreign practices did not tap into students' lived home experiences. The participants further indicated that students were not acquainted with Western knowledge itself and terminology. The following comments were made by some of the research participants:-

AGRIC TEACHER B: *Definitely it is dominated by Western farming practices but we are saying that it doesn't put into consideration the culture of the child or children which is very important in learning.*

AGRIC TEACHER C: *My comment is that the syllabus content and teaching methods are not Indigenous but dominated by Western worldview. The alien nature makes students struggle to grasp the concepts.*

AGRITEX OFFICER A: *Yeah it's very true that it's dominated by Western practices. The students or the people are not aware of most of those things because they are foreign. For example the issue of machinery is Western so people and will not benefit our communities very much.*

AGRITEX OFFICER D: *There is more Western than African agriculture taught. It is at par with our Africaness.*

LOCAL FARMERF: *Generally I would say yes the Western type dominates the curriculum at the expense of students lived experiences.*

LOCAL FARMER L: *Yeah it's true. The agriculture our children learn is European and it has no relevance to our culture.*

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As such, the curriculum catered for those who have a Western orientation.

4.7 SYNTHESIS OF IAKS IN THE ZSSAC

The aims and objectives of both the Zimbabwe 'O' Level Agriculture Syllabus 5034 and the Zimbabwe 'A' Level Agriculture Syllabus 9159 made no direct reference to IAKS. In fact, the latter mainly teaches Western agriculture practices. However, the old Zimbabwe 'O' Level Agriculture Syllabus 5034 made some reference to IAKS, with more IAKS mentioned in the New Zimbabwe 'O' Level Agriculture syllabus, whose teaching was effective from 2015. A glance at the contents of IAKS in the New Zimbabwe 'O' Level Agriculture syllabus revealed that more IAKS practices could be included in the ZSSAC. Table 4.3 gives a list of the IAKS that existed in the ZSSAC.

TABLE 4.3: IAKS THAT EXIST IN THE ZSSAC

Old Zimbabwe 'O' Level Agriculture Syllabus 5034	**New Zimbabwe 'O' Level Agriculture syllabus**	**Zimbabwe 'A' Level Agriculture Syllabus 9159**
Kushandisa minda (Land tenure); murimo mumwechete (communal) and resettlement tenures	Land tenure systems: murimo mumwechete (communal farming) and shifting cultivation	**NIL**
Kukosha kwemiti (Importance of Indigenous timber species)	Kudoma miti yemunzvimbo (Identifying Indigenous … trees in their locality using common names)	**NIL**
Mufudze (Organic …. Fertilisers)	Mufudze (Organic manures such as girinhi mufudze (green manuring), durunhuru (compost) and mufudze (farmyard manure); kukosha kwemufudze(Importance of incorporating organic manures)	**NIL**
Kurima kwejengetedzo (Conservation or minimum tillage)	Jengetedzo (Conservation agriculture)	**NIL**
Practising kuisa bvute (shading), kuisa pevhu (mulching), kuchera makomba (pot holing), mufudze (manuring), matai (tie ridging), kudiridzira (watering), Kudyara mbeu dzisingateti zuva (growing drought tolerant plants), mbesa wareware (cover crops), dziviriramhepo (wind breaks) and jengetedzo (conservation tillage)	Kuisa bvute (Practising shading), kuisa pevhu (mulching), kuchera makomba (pot holing), kuisa mufudze (manuring), matai (tie ridging), kudiridzira (watering), Zvirimwa zvisingateti zuva (growing drought tolerant plants), mbesa wareware (cover crops), dzivirira mhepo (wind breaks) and jengetedzo (conservation tillage)	**NIL**
A tsanga (cereal) crop of major importance in local agriculture mapfunde (sorghum) is optional		**NIL**
Kudzivirira kuzvipembenene nemasora (Cultural pests and weeds control)		**NIL**
Mombe (Cattle), makwai (sheep) mbudzi (goats), mabhiza (horses), mbongoro (donkeys), nguruve (pigs) and shiri dzemumusha (poultry)	Indigenous mombe (cattle), makwai (sheep) mbudzi (goats), mabhiza (horses), mbongoro (donkeys), nguruve (pigs) and shiri dzemumusha (poultry)	**NIL**
Mafuro (Grazing systems area); mafuro mamwechete (communal grazing)- natural grazing		**NIL**
	Ruzivo rwekuchengetedza zviwanikwa (Indigenous knowledge systems in the management of natural resources)	**NIL**
	Kuchengetedza Mhuka (Natural control of wildlife populations)	**NIL**

4.8 DISCUSSION OF FINDINGS

The national policy documents, namely, the Zimbabwe Agriculture Investment Plan (ZAIP) (2013- 2017) (Zimbabwe Government 2011), the Zimbabwe Comprehensive Agricultural Policy Framework (2012-2032) and the Second Science, Technology and Innovation Policy of Zimbabwe encouraged the adoption of IAKS in the ZSSAC. However, the documents were silent in their objectives and more so on how their pronouncements should be implemented. At the same time, these documents tended to favour Western farming practices at the expense of the Indigenous ones. For instance, the ZAIP emphasised commercial production of chibage (maize) and gorosi rokudiridzira (irrigated wheat) as staple food crops, yet for centuries Indigenous Zimbabweans relied on mapfunde (sorghum), mhunga (pearl millet) and zviyo (rapoko) as tsanga (staple cereals). The Zimbabwe Comprehensive Agricultural Policy Framework (2012-2032) merely noted that the major food crops included chibage (maize), mapfunde (sorghum), mhunga (pearl millet), zviyo (finger millet), nzungu (groundnuts), gorosi (wheat), nyemba (cow peas), nyimo (Bambara nuts) and mbambaira (sweet potatoes). Of these crops, mapfunde (sorghum), mhunga (pearl millet), zviyo (finger millet), nyemba (cow peas), nyimo (Bambara nuts) are Indigenous crops. While the same document promoted production of Indigenous crops, namely mapfunde (sorghum), mhunga (pearl millet), zviyo (finger millet), nyemba (cow peas) and nyimo (bambara nuts), in cropping patterns, it clearly stated that white chibage (maize), an exotic but traditional crop, remains the main staple food. It further views the exotics tobacco, cotton, tea, coffee, sugarcane, soya bean, sunflower and horticultural products as cash crops. In that regard, the policies could be considered as simply paying lip service to the inclusion of IAKS in the curriculum. Hence, the documents gave more emphasis to the adoption of colonial farming systems.

The policy documents thus reveal Kayira’s (2013:1) observation that:

> *Colonialism goes beyond territorial conquest: it affects one’s epistemological stance, worldviews and perceptions ... with Education systems in many countries in southern Africa continue to be grounded in Western viewpoints, marginalising local Indigenous ways of knowing.*

For instance the Zimbabwe Agriculture Investment Plan (ZAIP) (2013 – 2017) (Zimbabwe Government 2011) and the Zimbabwe Comprehensive Agricultural Policy Framework (2012-2032) encouraged small scale farmers to produce small grains (sorghum, finger millet, and pearl millet), especially in relatively low rainfall areas and the adoption of IAKS. However, at the same time they emphasised widespread production of exotic crops and livestock. On a positive note, the same documents also promoted widespread adoption of jengetedzo (conservation agriculture) and the consumption of wild foods which include wild vegetables, edible insects, wild fruits and other wild edible plants. The documents did not state the implementation strategies of their pronouncements on IAKS. Similarly, the Second Science, Technology and Innovation Policy of Zimbabwe simply urged the development of an IKS database for exploitation, promotion of research on potential applications of IKS to future national developmental challenges and development of courses on IKS that are suitable for inclusion in the school curricula. However, this document does not show how such a relevant policy pronouncement should be put into practice.

Generally, the dominant farming practices throughout the documents are colonially derived. However, it is only the Second Science, Technology and Innovation Policy of Zimbabwe which urges the development of courses on IKS that are suitable for inclusion in the school curricula.

What really obtains in the documents is attributed to colonialism. Jary and Jary (1995), Ngulube (2016) and Ajayi and Mafongoya (2017) concur that colonial rule in many parts of the world led to the destruction or marginalisation of some cultural norms and values as colonial administrators imposed their authority on native tribes who often resisted their influence. Laws were passed in order to subjugate these people and marginalize their cultural heritage. The colonial government viewed Indigenous farmers as children who had to undergo intensive farmer training programmes for them to achieve the status of adulthood (Mudege, 2008). That intensive training was meant to make Indigenous people forego their farming practices and adopt those of their colonial masters. Hence the colonialists aimed at a total abandonment of local farming methods which they erroneously regarded as backward.

It is worth underscoring that there are resilient Indigenous agricultural and land use practices based on centuries of experience, informed experiments and intimated understanding of the biophysical and social environments of the Indigenous people (Buckridge, 2012; Mapara, 2009; Melchias, 2001). However, colonialism and neo-colonialism forced Indigenous communities to forgo their own Indigenous farming practices while adopting the farming practices of the British colonial masters. Mutekwe (2015:1295) observes that:

Modern forms of schooling were introduced and expanded phenomenally and with it came notions of cultural imperialism, which tended to denigrate many if not all forms of Indigenous knowledge education systems. Some Indigenous knowledge systems were regarded as primitive, pagan and heathenish. Some forms of such Indigenous knowledge were even de-campaigned as non-knowledge.

Agriculture course outlines for tertiary institutions did not address IAKS in the objectives sections save for the scanty mention of IAKS in the course outline of T3. The agriculture curriculum of T1 and T2 included Indigenous small grain crops (sorghum, pearl millet, and rapoko), nyemba (cowpeas) and nyimo (Bambara nuts). However, the management of these crops borrowed heavily from Western agricultural practices. Similar to the policy documents discussed earlier, the curricula of tertiary institutions mainly provides students with knowledge and practical skills required in the production of exotic crops. These crops included maize, wheat and barley, oil seed crops (soyabeans, groundnuts and cotton), tropical fruits (banana and mango), subtropical fruits (citrus and granadilla) and deciduous fruits (grapes and apples) and tobacco. The courses also covered exotic vegetable crops to be studied by the students. These included a leaf vegetable (cabbage or rape), a fruit vegetable (tomato or eggplant), a cucurbit (cucumber or sweet melon), a leguminous vegetable (peas or green bean), a bulb crop (onion or leek or garlic), a root crop (carrots or sweet potato) and a tuber crop (potato). While there are Indigenous cucumber varieties and eggplant, discussions with the lecturers revealed that only exotic varieties were studied at the tertiary institutions. This was considered a sad development as potential for the inclusion of Indigenous crops was there.

The tertiary institutions included exotic and Indigenous breeds of mombe (cattle), nguruve(pigs), mbudzi (goats) and makwai (sheep) in their course outlines. The Indigenous breeds studied and/or reared were as follows: mombe (cattle) -Mashona, Nguni, Afrikander and Tuli;, nguruve (pigs) - Mukota;, mbudzi (goats) - South East African goat which has since been named Mashona;, makwai (sheep) -Sabi; and huku (chickens). This was a positive representation of Indigenous agricultural knowledge although the management of these Indigenous livestock was taught from a Western perspective.

From the foregoing discussion, it can be observed that Western knowledge was so dominant such that other worldviews, in this case the Indigenous agricultural worldview of

Zimbabweans, was seen through the Western eye. This Eurocentric view neglected and still neglects Indigenous knowledge that is based on Indigenous living experiences (Chiang and Lee, 2015). Mapira and Mazambara (2013:90) observe that

> *... European settlers who colonised the continent in the late 19th century sought to destroy, denigrate or marginalise IKS and replace them with Western views and approaches, which were in line with their goals of imperialism.*

The postcolonial era in Zimbabwe, as indicative of the analysed documents, is still characterised by the dominance of Western farming practices in the curriculum. However, despite this scenario, post-colonial Africa is witnessing a growing interest in the restoration of the so called 'lost' or 'dying' IKS that was marginalised by the colonial administrators (Mapira and Mazambara, 2013:90).

The 'O' level Agriculture syllabi, especially the New 'O' Level Agriculture Syllabus: Form 1-4, includes some IAKS concepts though they were not given prominence. For instance, in this syllabus are aims and objectives that address IAKS. However, these concepts were taught from a Western agricultural slant through the so-called improved farming methods. Although the Zimbabwe agriculture curriculum was developed by Zimbabweans in the post-independence era, due to colonialism, Western farming practices dominate it. Unlike the Western worldview, IKS are accommodative of other worldviews (Smith, 1999; Kincheloe and Semali, 1999), hence justifying the prospective harmonisation of Western and Indigenous farming practices in the ZAAC. This view is in line with Decoloniality, a theory which challenges dominant knowledge views and advocates the co-existence of multiple worldviews (plural epistemologies) in curriculum practice (Alebiosu, 2005; Ogunniyi, 2004). De Lissovoy (2010:279) underscores that ''decolonial theory is concerned with confronting, challenging, and undoing the dominative and assimilative forces of colonialism as a historical and contemporary process, and the cultural and epistemological Eurocentrism that underwrites it." Decoloniality empowers the learners through adoption of a home grown curriculum, one that addresses the Indigenous people's knowledge and practices.

From the points of view of the research participants, the ZSSAC was dominated by Western farming practices. They argued that these foreign practices were not relevant as they did not tap into students' lived home experiences.

Dewey (1923), Ozmon and Craver (2011) and Ornstein and Levine (2011) note that there must be a continuum between what is taught at school and students' lived experiences. In the reviewed literature, Shava (2005:80) underscores that:

> *Formal education usually suffers the setback that it is usually out of context with the learners' 'lived environment'. This sets-up and creates two separate worldviews for the learner: the school world and the world in which they live in. Indigenous knowledge should be integrated into mainstream education to enrich the learning environment and put learning processes into context with the learners' living environment*.

Indigenous African communities continue to practice and pass onto their young those IAKS which they had known and practiced for generations (Kaya and Seleti, 2014; Mapara 2009; Tanyanyiwa and Chikwanha, 2011). The ZSSAC does not totally neglect these IKS aspects. Rather these aspects are poorly represented in the curriculum. Education still falls short of doing away with the prejudice and discrimination targeted at 'natives' by school curricula. Aikenhead, (1996, 2001, 2007) observes that Western Science, the science taught in most schools, is neither personally meaningful nor useful to students' everyday lives. With respect to deficiency of IAKS in the ZSSAC, Indigenous students experience Agriculture as a foreign culture and may even become alienated by their school experiences. There are, however, prospects in the curriculum for the inclusion of IAKS.

Study results explicitly reveal that there is no interrelationship between agricultural policy makers, higher education institutions, schools and the Indigenous farming communities with respect to the inclusion of IAKS into the ZSSAC. Agricultural policy documents pay lip service to IAKS issues in their policy pronouncements. Higher education institutions emphasise Indigenous crops and livestock but teach the management practices with a Western lens. They overlook the great potential for the inclusion of IAKs through these curricula. Of late some IAKS concepts have seen their way into the ZSSAC. This is a step in the right direction as it increases higher potential for more IAKS to be included in the curricula. The community is pregnant with IAKS which is not being tapped into the school curriculum. Engagement of the all stakeholders who include the community, the custodians of IAKS would go a long way into taping the IAKS (knowledge and practices) into both Zimbabwe's agriculture policy and agriculture curricula. This is of significance since it further presents lots of prospects for the inclusion of IAKS into the ZSSAC.

The subunits that include IAKS policy makers, tertiary institutions, schools and local farmers were not operating in harmony to promote IAKS in the ZSSAC. Each was doing its own thing. Yet, each subunit has to operate towards a common goal (Bellack, Hersen, Morris and Van Hasselt, 2013) of incorporating IAKS into the ZSSAC. There is thus need to centralize issues to do with inclusion of IAKS in all curricula for the sake of uniformity in policy adoption and implementation. Uniformity of action is possible when decision-making authority is centralised and cascaded downwards. Decisions taken at the top would then be implemented at every level. On the other hand, if the units take their independent decisions then uniformity of action will not be achieved. Under such situations centralised decision-making will enable unity of action.

4.9 CHAPTER SUMMARY

Generally, there was very little IAKS represented in the ZSSAC. The little that was there was taught through the Western lens. This kind of scenario is attributed to the subjugation of Indigenous knowledge by colonialism and neocolonialism. In the reviewed literature, Hountondji (2002) avers that Western science has grown by cannibalising Indigenous knowledges. The situation where Western science dominates IK in an Indigenous African culture is regrettable hence needs redressing. In his Contiguity Argumentation Theory, Meshach Ogunniyi posits that the two worldviews are considered as equipollent or complimentary (Vandeleur, 2010; Ogunniyi, 2007), hence they can be harmonised in the ZSSAC. Dei (2011) supports the co-existence of IKS and Western knowledge in the curriculum in that each claim would make up for the inadequacies of the other. That way the current stance of according Western agricultural practices as the dominant and universal knowledge would be overturned.

The next chapter looks at IAKS that exist within the communities studied with a view to determining the gap which can be filled in the curriculum under study.

CHAPTER FIVE: INDIGENOUS AGRICULTURAL KNOWLEDGE AND PRACTICES THAT EXISTED WITHIN THE COMMUNITY

5.1 INTRODUCTION

The previous chapter focused on the analysis and discussion of the components of IAKS that were currently included in the ZSSAC to provide answers to the first research question: Which IAKS components currently exist in the Zimbabwe secondary school Agriculture curriculum? This chapter analyses the IAKS that existed within the communities studied at the time the research was undertaken. The chapter looks at the resilient IAKS in the communities. These IAKS include the knowledge and practices on tsanga (cereals), mirivo (vegetables), michero (fruit trees) and zvipfuyo (livestock) kept by the communities including the management practices. The chapter also covers knowledge on michero (wild fruits) to IAKS and proposes ways of domesticating and improving their status.

To address the research question "What IAKS (knowledge and practices) exist within the community?" collected data from interviewing the twelve (12) local farmers (six (6) from each of the catchment areas of the two high schools) and observing the farming activities of the interviewed local farmers and the three tertiary institutions were analysed. Data were also collected through interviewing agriculture educators, namely, six (6) agriculture teachers, two (2) Agriculture Education Officers, 2 university Agriculture lecturers, 3 college Agriculture lecturers and four (4) AGRITEX officers for triangulation purposes.

5.1 RESILIENCE OF IAKS AND PRACTICES THAT EXISTED IN ZIMBABWE BEFORE COLONISATION

As a way of probing interviewees on IAKS (knowledge and practices) existing in the community, research participants were first asked whether IAKS existed in Zimbabwe before colonisation. There was a consensus by the research participants that before colonisation Indigenous Zimbabweans practised farming prior to colonisation. Local Farmer D summed it all when she said:

We were farmers before colonisation. When the colonialists came we were growing our own Indigenous crops and keeping Indigenous livestock. We still practice most of these farming activities

Therefore, there existed in Zimbabwe crop and livestock production before the colonial era. Indigenous Africans continued (unlawfully though) to practice and pass onto the following generations those IAKS they had known and practised for generations (Kaya and Seleti, 2014; Mapara, 2009; Tanganyika and Chikwanha, 2011). These Indigenous agricultural and land use practices are based on centuries of experience, informed experiments and intimate understanding of the biophysical and social environments of the Indigenous people (Buckridge 2012; Mapara 2009; Melchias 2001). Most of the Indigenous farming practises have stood the test of time. They are still practised today despite colonial and neo-colonial subjugation. In support, Kaya and Seleti (2014), Tanyanyiwa and Chikwanha (2011), Mapara (2009), Eyong (2007), Odora-Hoppers (2006) and Emeagwali (2003) concur that though marginalised during the colonial and neo-colonial eras, some of the IKS practices still continue to be practised.

This kind of resilience of IKS implies that Indigenous Zimbabwean communities and the students still uphold IAKS concepts and practices and teachers utilised some of these in the teaching of Agriculture, even if they are not represented in the curriculum (Pedzisai, 2013). Jha (2008: 1) posits that “Even within traditional systems, gaps existed between ‘good’ and ‘bad’ farmers and practices”. According to Chota et al. (2010) and McClean et al. (2005) IAKS and practices which have something to do with plant and animal production should be protected and continue to be used since they have a lot of advantages over Western farming practices.

In Zimbabwe, both research and extension systems should exploit the ‘good’ Indigenous farming practices and include them in the ZSSAC. Hence, those IAKS that have shown resilience are, perhaps, the good farming practices. There is, therefore, need to exploit the good farming practices which have stood the test of time. This will also prevent the same IAKS from getting lost. This then calls for the need to exploit and emphasise the good farming practices and to reorient the ZSSAC towards appreciation of IAKS and traditional farming practices.

5.2 INDIGENOUS CROPS GROWN

5.2.1 Tsanga (cereals)

Research participants indicated that they grew the tsanga (cereals). A summation of participants' assertions was given by Local Farmer C who said the following:

> *These crops finger or pearl millet (mhunga), rapoko (zviyo), sorghum (mapfunde) and African rice (mupunga) are Indigenous to Zimbabwe. These crops have been grown by our people way before colonisation. Maize is not an Indigenous crop.*

These cereals are shown in the Table below.

TABLE 5.1: INDIGENOUS TSANGA (CEREALS) IN THE COMMUNITY

Botanical name	English name	Shona name	Ndebele name
Pennisetum glaucum	Pearl millet/ Bulrush millet	Mhunga	Inyauti
Eleusine coracana	Rapoko/ finger millet	Rukweza/ zviyo	Uphoko
Sorghum bicolor	Sorghum	Mapfunde	Amabele
Oryza glaberrima	African rice	Mupunga	Irayisi
Zea mays	Maize	Chibage	Umumbu

Some of these crops are shown in Figures 5.1a, 5.1b and 5.1c.

FIGURE 5.1A: MHUNGA (PEARL MILLET) CROP

FIGURE 5.1B: ZVIYO/RUKWEZA (RAPOKO) CROP

FIGURE 5.1C: MAPFUNDE (SORGHUM) CROP

Participating local farmers stated that chibage (maize) was an Indigenous tsanga (cereal) crop. This is represented by Local farmer E who added maize to the list of Indigenous cereals as seen in the following quotation.

> *They grew maize, rapoko, sorghum and especially here in Makonde district they grew a lot of mhunga they would dig the land and broadcast these crops*

However, agriculture educators knew that chibage (maize) was actually a traditional crop, but of Central American origin, introduced to Zimbabwe. Their remarks were shared by Agriculture Teacher B and AGRITEX Officer D respectively who said:

- *Our forefathers started growing chibage (maize) after it had been introduced by early traders… I think the Arabs. But maize is Indigenous to Central Africa.*
- *No. Chibage (maize) is not an Indigenous crop. It is an American crop and is called corn in America.*

Chibage (maize) is one of the exotic crops which were introduced to Zimbabwe by early Arab traders before Zimbabwe was colonised. Bedoya, Dreisigacker, Hearne, Franco, Mir, Prasanna, et al. (2017) and Mann (2018) posit that chibage (maize) is Indigenous to America. The crop was developed in America from a wild grass called teosinte (Doebley, 1990; Wilkes, 1967). It is therefore not Indigenous to Africa but a naturalised crop which originated from America. The reason for the belief by some local farmers that chibage (maize) is an Indigenous crop is because it was introduced very early on and was thus believed to be Indigenous. This in itself is an indication of pre-colonial introduction, something which should be cherished. To most Indigenous people there is no differentiation between Indigenous and traditional crops. Such a misconception needs to be corrected in our students. Surely if misconceptions are not catered for in the ZSSAC, there will come a time where the future generations think all crops grown in Zimbabwe are Indigenous. However, three local farmers in Kwekwe district grew some of the very earliest varieties of chibage (maize). These original chibage (maize) varieties include the coloured corn, which has about any colour including yellow, purple, black, red, orange and white grains, and are still grown in Central and South America, where they originated (Mann, 2018). Some of these varieties are shown in the Fig 5.2.

FIGURE 5.2: ORIGINAL CHIBAGE (MAIZE) VARIETIES

Other earlier varieties of chibage (maize) which most local farmer participants indicated they still grow were an 8 or 10 line variety called Hickory King (Bhogwe or Garabha), a yellowish variety they call Kenya and the red-cobbed corn they call Red Cock. The other variety is Karufonya, one of the maiden chibage (maize) species that could have been developed in California in America. One participating farmer, Local Farmer G, shared the same knowledge with most farmers when she made the following reponse:

> *Our forefathers started growing chibage (maize) after it had been introduced by early trader. I remember the varieties Kenya, Karufonya and the 8 or 10 line variety also called Hickory King, Bhogwe or Garabha.*

Bhogwe and Kenya are shown in the Figures 5.3

FIG 5.3A: HICKORY KING (BHOGWE OR GARABHA IN SHONA)

FIGURE 5.3B: KENYA, A YELLOWISH CHIBAGE (MAIZE) VARIETY

Literature has it that there are more than 100 Indigenous African grasses whose seeds are (or have been) eaten (National Research Council, 1996; Hobley, 1967; Leakey, 2007). The list of these tsanga (cereals) as provided by Okhimamhe (2018) and National Research Council (1996) includes those that are Indigenous to Zimbabwe. This implies that before colonisation Indigenous Zimbabweans cultivated tsanga (cereals) and also gathered tsanga (cereals) from the wild.

According to the participants, these tsanga (cereals) provide the community with staple food and all, except chibage (maize), are temperature, drought, disease and pest tolerant. This is represented in the following quotation by Local Farmer A:

> *Our own Indigenous crops mhunga (finger/ pearl millet), zviyo (rapoko), mapfunde (sorghum) and mupunga (African rice) are our staple food. They are adapted to our environmental conditions.*

Hence, these crops are adapted to the prevailing harsh climatic conditions of Africa (Hobley, 1967; Leakey, 2007; Lupande, 2018; Okhimamhe, 2018; National Research Council, 1996; Pichop et al., 2014). Interestingly, mhunga (pearl millet) was found to be more popular in the more drought prone Kwekwe than Makonde district. A call has been made by the Zimbabwean government to adopt small grains since they are drought resistant in the wake of rising temperatures and low rainfall in the area related to climate change (Lupande, 2018). There is thus need to include these climate change tolerant crops in the ZSSAC for food and nutritional security.

Two local female farmers, one married in Kwekwe and the other in Makonde District indicated that mupunga (African rice) is grown in matoro (vleis, also called wetlands) in their maiden homes, Chirumanzu and Rusape, respectively. One of the female farmers, Local Farmer G, made the following pronouncement:

> *In my maiden home in Chirumanzu we had a significant large portion of land that had a spring beneath, we used to grow rice 'mupunga'.*

Local farmers in Makonde also grow mupunga (African rice) in the vleis. However, Kwekwe district, which was drier and had no matoro (wetlands), could not support the growing of mupunga (African rice).

5.2.2 Indigenous vegetables

Research participants pointed out that their communities used leaves and flowers of some Indigenous crops as vegetables. Local Farmer E summed it all by saying:

> *Young tender baby manhanga (pumpkin), munganjo (marrow), makavhu (squash), manwiwa (watermelon), mushamba (horned melon), magaka (cucumber), mbambaira*

(sweet potato), nyemba (cowpea) are boiled as vegetables together with their young tender leaves. In addition, the ripe fruits are cut into pieces with a knife and boiled to provide delicious dishes.

Pichop et al. (2014) support this contention when they say these crops have edible leaves, fruits, seeds, roots stems, flowers and bulbs to provide various soups, stews, sauces, relishes, flours condiments which are boiled, roasted, fried, ground into flour and blended with many traditional dishes.

The general sentiment of participants on extinction of some Indigenous vegetables was aptly put by Local Farmer J who indicated that:

The Indigenous vegetable marenge or chiribwiriribwi (ragwort/ Senecio erubescens), which grew on the banks of rivers, had since gone extinct. These were a delicacy.

Some participants could not even remember how this vegetable looks like. However, this Indigenous vegetable is found in other areas of Zimbabwe. To my knowledge, the vegetable still grows in some parts of Zimbabwe such as Manicaland, as well as in other African countries such as Malawi, Zambia, Botswana and South Africa. Table 5.2 shows the Indigenous vegetables found in the communities studied.

TABLE 5.2: INDIGENOUS VEGETABLE CROPS IN THE COMMUNITY

COMMON NAME	BOTANICAL NAME	SHONA	NDEBELE
Pumpkin	*Cucurbita pepo*	Muboora	Ibhobola
Cowpeas	*Vigna unguiculata*	Nyemba	Indumba
Green bean	*Phaseolus vulgaris*	Munyemba	Indumba
Sweet potatoes	*Ipomoea batatas*	Mbambaira/Mabura	Imbambayila
Horned melon	*Cucumis metuliferus*	Muchacha	Umhlagahlaga
Watermelon	*Cucumis melo*	Mushamba	Ikhabe
Cucumber	*Cucumis sativus*	Mugaka	Amagake
Jute/ Jew's Mallow	*Corcorus olitorius*	Derere/Nyenje/Gusha	Idelele
African Spider Flower	*Gynandropsis gynandra*	Nyevhe/Nyovhi,	Ulude
Spindle Pod	*Cleome monophyla*	Mutsvandimire/ Mujakari	Ulude
Thorny pigweed	*Amaranthus hybridus*	Mowa/ Mowaguru	Imbuya
Poor man's spinach	*Amaranthus thumbergii*	Bonongwe/ Mowadiki	Imbuya
Black jack	*Bidens pilosa*	Mutsine	Ucucuza
Smooth sow-thistle	*Sonchus oleraceus*	Dzvengetsvenge	
Milkweed	*Asclepias densiflora*	Munhenzva	
Garlant soldier	*Galinsoga parviflora*	Teketera	
Fat hen/ Wild spinach	*Asclepias densiflora*	Mubvunzandadya	
Baobab	*Adansonia digitata*	Muuyu	Umkhomo
African eggplant	*Solanum aethiopicum*	Makuzvungu	Amatamatisi
Horse-radish tree	*Moringa oleifera*	Moringa	Umoringa
Ragwort	*Senecio erubescens*	Marenge /chirevereve/ chiribwiribwi	

According to National Research Council (2006), the great thing about the vegetables is that they can be used for addressing the heart of Africa’s most basic food-related problems like food insecurity, malnutrition, rural poverty and environmental destruction. In actual fact there is a lot of untapped promise to be found among Africa’s traditional vegetable plants, hence the need to include them in the ZSSAC.

Agriculture educator participants were not happy with the use of demeaning names on Indigenous crops like cowpeas. Pekeshe (2014) observes that Europeans derogatorily named nyemba as cowpeas by likening the crop to their peas (*Pisum sativum*) but condemning it to fodder for mombe (cattle/cows) hence unfit for human consumption. The same condemnation was made to Bonongwe/ Mowadiki (*Amaranthus thumbergii)* and Mubvunzandadya *(Asclepias densiflora)* which were named poor man's spinach and wild spinach, respectively. In addition, some vegetable crops like mbambaira (sweet potato), manhanga (pumpkins) and makavhu (butternut) as well as the tsanga (cereal) crop chibage (maize) are termed traditional crops because they were introduced into Zimbabwe.

5.2.3 Other crops

AGRITEX officer D represented the views of local farmer participants, agriculture educators and other AGRITEX officers on other Indigenous crops when he said:

> *They grew runinga (sesame) and nzungu (groundnut) as the oilseed crops. They also grew the legumes nyemba (cowpeas) and nyimo (Bambara nut).*

The images of these crops are shown in Fig 5.4

FIGURE 5.4A: NYIMO (BAMBARA NUT)

FIGURE 5.4B: DRY NYEMBA (COWPEA) PODS

FIGURE 5.4C: RUNINGA (SESAME) CROP IN FLOWER

FIGURE 5.4D: LOCAL FARMER AND HER NZUNGU (GROUNDNUT) CROP

Nyimo (Bambara nut) was derogatively called ‘monkey nuts’ by the British colonialists, literally meaning they were nuts for Indigenous Africans whom they referred to as ‘monkeys’. The use of such demeaning and marginalising names was echoed by Local Farmer H in Kwekwe District when he said:

> *Marginalising of crops through naming was one method used by colonialists to discourage growing of runinga (sesame) and nyimo (Bambara nut) in favour of the exotics chibage (maize) and nzungu (groundnuts) for commercial production.*

This is supported by Hill and Katerere (undated) who posit that during the colonial era IAKS were denigrated by the colonialists in favour of Western farming practices. In the same vein, Mapira and Mazambara (2013) observe that the Western colonisers enforced laws which marginalised Indigenous agricultural practices in Zimbabwe. It is once again good to note that these crops, though marginalised, are still grown in Zimbabwe.

One participating local female farmer who grew up in Gutu and partly in Rusape, but was married in Kwekwe district, also indicated tsenza (Livingstone potato/*Plectranthus esculentus*) as one of the Indigenous crops grown for their root tubers as food.

5.3 INDIGENOUS FARMING PRACTICES

5.3.1 Land preparation

According to participants from the local farming community of both participating high schools, land preparation begins with the males cutting trees and shrubs and burning them. The burning is usually a communal job to prevent veldfires. They also stated that the actual tilling of the land is done by all members of the family. However, the mother and her daughters do most of the tillage in the homestead field and garden while the whole family works in the main field which is also wholly controlled by the father in terms of what to grow and where. Local Farmer K posited the following:

> *The homestead field and the garden are for the mother while the main field is for the father. The whole family works in both fields and the garden except the father who only works is the main field.*

The study found that some Indigenous community members, despite the invention of the plough, still use kurima nechibhakera (zero and minimum tillage) practices to prepare land for their crops, preferring the hoe instead of the plough. In zero-tillage they dig planting holes into which crop seed is planted while minimum tillage entails digging the field with a hoe. These practices are known in the local Shona language as 'kurima nechibhakera' literally meaning 'ploughing with the fist'. Conservation agriculture in form of zero or minimum tillage is popular among both Kwekwe and Makonde participants and known by the moniker timba ugute (meaning dig and get a bumper harvest). The practice is NGO funded and meant for those Indigenous farmers in both Kwekwe and Makonde districts without mombe dzekurimisa (cattle for draught power).

Pilarski (1994), London (1998) and Mollison and Slay (1991) concur that 'Conservation Agriculture' promotes soil and moisture conservation. It is worth observing that for some time now Non-Governmental Organisations (NGOs) operating in Zimbabwe have come back with the same Indigenous innovative conservation practices they despised and now labelling them 'new technologies'. This could be the reason why the World Bank (1998) has consistently valued and embraced IKS as a good thing stating that it should form part of Africa's development agenda (Seroto, 2014).

Indigenous farmers also practise mbesa dzewareware (cover cropping) whereby they use cover crops like nyemba (cowpeas) and manwiwa (melons) to reduce soil erosion especially raindrop erosion. The same crops promote moisture conservation by acting like a canopy that reduces evaporation.

Kuwundukura (winter ploughing) is one of the methods used by the communities studied to conserve soil moisture and to facilitate early planting of crops before or with the rains. Kuwundukura (winter ploughing) was practised by most local farmers in both the Kwekwe and Makonde research sites. Those who did not do it indicated that it was because they had no mombe dzekurimisa (cattle for draught power). Kuwundukura (winter ploughing) increases infiltration and moisture retention and reduces soil erosion. In addition, it enables early planting of crops before or with the rains.

FIGURE 5.5: MUNDA WAKAWUNDUKURWA (WINTER PLOUGHED LAND) IN KWEKWE DISTRICT, MIDLANDS PROVINCE

At times the community members work together to till the land through a long-standing Indigenous collaborative work system practice called nhimbe in Shona or ilima in Ndebele. Such Indigenous farming practices promote community cohesion and, above all, help in fighting food insecurity. The local Indigenous farmers who participated in the study also indicated the traditonal practice of the Zunde raMambo or Isipahla SeNkosi (the king's granary reserve) concept is in place among the Shona and Ndebele speaking people, respectively. In Kwekwe District both terms are used since both Shona and Ndebele speaking are found in the area. In Makonde District, most of whom are Shona speaking, call it Zunde raMambo. Local Farmer B indicated the following general view of the participants:

> *Zunde raMambo practice is lauded for ensuring food security to vulnerable groups in the traditional community who include the elderly, the poor, those with chronic illnesses and child-headed families.*

These practices can only be preserved into the future if they find their way into the ZSSAC.

5.3.2 Seed selection

According to participants, kusarudza mbeu (seed selection) was guided by phenotypic characteristics of the crop. It is the women who play a key role in seed selection. Farmers select planting seed basing on crop performance. Hence, high yielding crops are selected based on crop size. Crops with big and plump seeds are preferably selected for planting in the following season. Chibage (maize) with big cobs, small tsanga (cereal) crops like mhunga (pearl millet) with big spikes and double spikes are selected for planting. One local farmer, Local Farmer C, had this to say:

> *Naturally if, for instance, one sees a big melon or pumpkin one envies it and takes its seeds for planting. Generally, this practice is based on phenotypic characteristics of the crop.*

For tsanga (cereals), like mhunga (pearl millet), mupunga (African rice) and mapfunde (sorghum), awned varieties are preferred for protection against birds. Also considered are yield characteristics like poor shattering, big fruit and so forth. Basically the better the crop performance the greater the chances of it being selected for sowing in the next planting season. Most seed selection takes place either in the field before harvesting or just before threshing at the threshing place which is normally a flat whaleback rock (dwala in Ndebele or ruware in Shona). There is reliance on other desirable varietal characteristics. In addition yield characteristics, like low shattering, are considered when selecting crops to be planted during the following season. The selected seed are treated against pest attack by hanging on mbariro (kitchen rafter) or rwodzi (bark rope) above the choto (fireplace) to accumulate chin'ai (soot). The farmers availed to the researcher some of the seed selected for planting. Because such inexpensive and innovative methods and techniques of seed selection and preservation sustained the Indigenous communities for millennia they should be sustained by incorporating them into the ZSSAC.

Participants also mentioned that traditionally a newly married woman is provided with planting seed by adult members of her nuclear and extended family so that she would become food secure and food sovereign in her new homestead. 'Feminine' crops like nzungu (groundnuts), nyimo (Bambara nuts), manwiwa (watermelons), mavise (sweet melon) manhanga (pumpkins), nyemba (cowpeas), magaka (cucumber) and mbambaira (sweet potato) are some of the crops used for this purpose. The staple food crops are treated as 'masculine' crops but could also be given to the newly married couple. The AGRITEX officers in the study stated that this kind of headstart promoted Indigenous agrobiodiversity conservation, food security and sovereignty.

5.3.3 Planting systems

Participants mentioned that the best yields are obtained from kudyara muvhu rakaoma (dry planting). This traditional practice enable seeds to germinate and emerge with the first effective rains. Participants lamented the effects of climate change which has caused poor rains. Local Farmer E, in Kwekwe district, had this to say:

> *When we grew up there used to be a lot of rain. From mid- October we were assured of rains. And for those who had dry planted we were assured of good harvest. This 'animal' called climate change was not existent then.*

However, literature has it that Indigenous Africans developed several mitigatory measures against drought (Eitzinger et al., 2009; Kihila, 2018; Macholdt and Honermeier, 2016; Mafongoya and Ajayi, 2017; Smit and Skinner, 2002; Srinivasan, 2001). This applies to Indigenous Zimbabwean farmers also. Hence, most planting is done before the rains to take advantage of the early rains during the growing season. Some farmers take advantage of matoro (vleis or wetlands) to plant their crops early. Planting with the early rains is done to capitalise on the growing season for bigger harvests. Such methods enable increased yield and double cropping for household food security. Growing mbewu dzisingateti zuva (drought tolerant crops) and musanganiswa wembewu (multicropping) are also practised to enhance food security. The practices could be a remedy for the deleterious effects of climate change which according to participants has caused poor rains which leads to food insecurity.

Research participants stated that they rely on some weather forecasting strategies. The researcher then grouped the weather forecasting indicators based on:

- plant phenology
- behaviour of animals, birds and insects
- local astrological indicators based on the moon, sun and stars and
- weather-related indicators like temperature, wind and air circulation.

The indicators pertained to the onset of the rain season, that it is about to rain, prospects of a good season and lastly a looming drought. The Table below highlights the indicators of the onset of the rain season as well as those that show that it is about to rain which are employed by the research participants.

TABLE 5.3: INDICATORS OF ONSET HE RAIN SEASON AND IMMINENCE

Onset of the rain season	Indicators of imminent rains
• Budding of muunga (*acacia* species), munhondo *(Julbernardia globiflora*), musasa (*Brachystegia spiciformis*), mutiti (*Erythrinaabyssinica*), Mukute (*Syzygium Cordatum*) • Budding of exotic trees such as peach tree (*Prunuspersca*) and mango (*Mangiferaindica*) ▪ Arrival of migratory birds such as mukwasumukwasu (secretary birds) and nyenganyenga (swallows) ▪ Hanga (Guinea fowls) laying eggs ▪ Appearance of many mujuru (termite) and mateza (white ant) species sealing off holes into mounds ▪ Croaking of matatya (frogs) in matoro (swampy areas) especially at night ▪ Presence of mazongororo (millipedes) and matatya (frogs) ▪ Central position and movement of gwara rakurumbi (the Milky Way)	• Unusual squeaking of mbira (tailless rock rabbit) • Appearance of nyenze (cicadas), and mikonikoni (dragon flies) • Sound of dzvotsvotsvo/ haya (the rainbird) • Appearance of the moon facing downwards • Mwedzi wafa (Quarter moon or its absence) • Appearance of dziva remvura(moon/sun halo) • The movement of a constellation of stars at night under clear skies from west to east mean rain will fall in 3 days • Spiders running around • Smell of rain

The research participants also stated some of the Indigenous indicators of a good year and an imminent drought. These are shown in the Table below.

TABLE 5.4: INDICATORS OF GOOD AND DROUGHT SEASONS

Indicators of good season	Indicators of drought
• Calves jumping happily • The coming of baboons, monkeys, leopards, and antelopes into the village during dry season • Frequent swirling of winds • Mountains covered with mhute (mist) • Presence of insects on mugaranyenze (Albizia trees) with water dripping from them • Appearance of many nimbus clouds and red clouds early in the morning • A lot of heat in spring	• Appearance of the moon crescent facing upwards signifies crop diseases and erratic rainfall • Easterly winds • Heavy flowering of some trees like Muhacha (Mobola-plum, *Parinari curatellifolia*), Mukute (Tree grape (Lannea discolor), Mushuku (*Uapaca kirkiana*, Sugar plum)/); Muuyu (*Adansonia digitata*, baobab) • Appearance of fog in the morning • Presence of army worms (Spodoptera exempta) and grasshoppers

Seeds of small grains are broadcast on ploughed land. Planting was never done in straight lines as all crops would be broadcasted. The broadcasted seed are covered by pulling tree branches on the ploughed land or allowing a big herd of mombe (cattle) or mbudzi (goats) to move up and down in the field thereby shallowly burying the broadcasted seed. Shallow burying increases plant emergence. Crops with big seeds like chibage (maize), Bambara nuts and groundnut are dropped in planting holes which are dug using a hoe. Seeds of small grains are mixed with sand before broadcasting. This saves seed and avoids dense populations.

The research participants indicated that farmers practised kusanganisa zvirimwa (mixed cropping). Monoculture was introduced later by the colonialists**.** Local Farmer Officer A had this to say:

> *We plant many crops in one field so that we have a variety of food. Also, if one crop fails the other crops will feed the family. We are unlike the colonialists who introduced monoculture.*

Kusanganisa zvirimwa (mixed cropping) refers to ".... the growing of two or more plant species in the same field in the same year and, at least in part, at the same time" (Ramert, Lennartsson, and Davis, 2002:1). Notsi (2012) and Dlamini (2007) viewed kusanganisa zvirimwa (mixed cropping) as almost synonymous with Indigenous agriculture because of its significance in the production of food in traditional farming systems. Kusanganisa zvirimwa (mixed cropping) reduces total crop failure since if one crop fails the farmer will have other crops to lean on. The practice improves soil management, suppresses pests and diseases, and permits an intensification of the farm system resulting in increased overall productivity and biodiversity in cropped fields (Norberg-Hodge *et al.*, 2001). It thus ensures sustainable agriculture and food security.

Below are images of mixed cropping captured from the studied rural communities.

FIGURE 5.6A: KUSANGANISA ZVIRIMWA (MIXED CROPPING) OF CHIBAGE (MAIZE)) AND MANHANGA (PUMPKIN)

FIGURE 5.6B: KUSANGANISA ZVIRIMWA (MIXED CROPPING) OF CHIBAGE (MAIZE)), IPWA (SWEET REED), MANHANGA (PUMPKIN) AND NYEMBA (COWPEAS)

Participants further stated methods they employed to promote moisture conservation. One local farmer, Local Farmer I, made the indication that:

> *We practise mbesa dzewareware (cover cropping) whereby we grow crops like nyemba (cowpeas), and manwiwa (melons) to reduce gukura ivhu (soil erosion), especially raindrop erosion. The same crops promote moisture conservation by acting like a canopy that reduces evaporation.*

5.3.4 Farming systems

Both participants and on the spot field observations revealed that kutema musasa (shifting cultivation), mhanje (fallowing) and kusanganisa zvirimwa (mixed cropping) are rampant among both farming communities studied. Kutema musasa (shifting cultivation), also called *swidden* agriculture, is a traditional type of farming which has been and is still used all over the world by Indigenous farmers to maintain soil fertility (Reijntjes et al., 1992; Notsi, 2012). Kutema musasa (shifting cultivation) involves an alternation between cropping and long-term forest fallow. Notsi (2012) posits that in the Kutema musasa (shifting cultivation) system, forest is cut down and burned for soil fertility. There is a time when a piece of land is abandoned to restore its soil fertility and recover. Through kutema musasa (shifting cultivation) the soil restores its fertility. The presence of large tracts of land promulgated the farmers to use extensive agricultural methods. Thus, as pastoralists moved freely in search of grazing land, kutema musasa (shifting cultivation) became the order of the day. This means that the farmers did not use a lot of inputs to keep the land fertile. Once land was exhausted, or they wanted to increase yields, they could simply open a new field (Beach 1983; Bourdillon 1982; Tavuyanago, Mutami and Mbenene, 2010). Kutema musasa (shifting cultivation) thus lets the land revert back to bush thereby avoiding prolonged periods of baring the soil. AGRITEX Officer B made the observation that;

> *However, shortage of arable land and the expanding population no longer allows communities to practise kutema musasa (shifting cultivation).*

While this practice no longer suffices, it can still be included in the ZSSAC so that at least the young generation get exposed to Indigenous farming methods that were used by previous generations.

5.3.5 Soil fertility management

According to the participants, Indigenous Zimbabweans have their way of managing fertility. Of note were the indications made by two local farmers and one AGRITEX Officer respectively that:

- *We add ndove (animal manure), murakwani (humus) and ivhu repachuru (anthill soil) to the fields to increase soil fertility.*
- *We also plant crops like manhanga (pumpkins) on places with ash or organic domestic waste dumps.*
- *Farmers also grow tsunga (mustard) on anthills.*

Such places are fertile. Most crops have prolific growth in such places. Tsunga (mustard vegetable) does well on anthill soil as does ipwa (sweet reed).

Reijntjes et al. (1992) observed that Indigenous farmers in Southern Sudan and Zaire improved or maintained soil fertility by using termite mounds for growing mapfunde (sorghum) and (cowpea).

FIGURE 5.7A: COMPOST MANURE

FIGURE 5.7B: MUFUDZE WEMOMBE (DRY CATTLE MANURE) IN THE FIELD BEFORE SPREADING

FIGURE 5.7C: NDOHWA (DRY COW DUNG) IN FIELD

FIGURE 5.7D: DOTA RECHIBAGE (BURNT CHIBAGE (MAIZE) STOVER FOR ASH)

FIGURE 5.7E: IVHU REPACHURU (ANTHILL SOIL)

They further note that farmers in Zaachilla, Mexico, use ant refuse to fertilise high-value crops such as tomatoes, chilli and onions.

Through kutema musasa (shifting cultivation), mhanje (fallowing)) and kupindura munda (burying crop residues with a plough soon after harvesting) or by kuwundukura (winter ploughing), the soil regained its fertility. Crops had vigorous growth. One AGRITEX officer had this to say on fertility management:

> *Fertility management was mainly through applying manure from the animals they kept. There were no inorganic fertilizers then. The land had to rejuvenate itself. In some cases where the land degraded they would leave the piece of land to regain fertility. There was plenty of land then. Apart from organic farming they would grow cowpeas to restore soil fertility. There were no chemical fertilisers then.*

Indigenous farmers practise what is now referred to as zvemufudze (organic farming). Organic farming entails use of manure of plant and animal origin to fertilise crops. Agea, Lugangwa, Obua and Kambugu (2008) refer to the practice simply as 'farming without chemicals'. Dlamini (2007: 30) defines organic farming as "… a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives." Organic farming is a sustainable practice. It is cheap and should agreeably continue to be practised.

Thanks to extension services, almost all the local farmers knew that growing legumes like nyemba (cowpeas), nyimo (Bambara nuts) and nzungu (groundnuts) help to restore soil fertility. Local farmer D added that:

Where these were used in mixed cropping, the soil restored its fertility.

All the agriculture educators, namely AGRITEX officers, Agriculture teachers, Agriculture Education Officers and Agriculture lecturers were quick to say these leguminous plants had nodules on their roots in which nitrogen fixing bacteria operate that enrich the soil.

5.3.6 Crop pest and disease control

Most participants indicated that before colonisation plant pests and diseases were rare if at all they existed. One local farmer stated that:

> *I do not believe the problem with pests and diseases was like what it is today. Pests and diseases were brought into the country by the colonisers.*

Smith (1999) shared the same view that colonisation introduced crop and livestock diseases. The participants further pointed out that the advent of crop pests and diseases triggered natural pest and disease control methods. This view may not be true although Smith (1999) shares the same. However, if this assertion is valid there would have been no Indigenous methods of crop pest and disease in Zimbabwe before colonisation.

The Indigenous communities studied have their own traditional ways of dealing with crop pests and diseases. While a few of the participants confessed ignorance of Indigenous methods of dealing with crop pests and diseases, others, especially the local farmers and AGRITEX officers, knew a number of herbs and trees which successfully control crop pests and diseases. The majority of the local farmers and AGRITEX officers who were interviewed stated the use of wood ash from Mopani *(Colophospermum mopane)*, mutsviri or leadwood (*Combretum imberbe*), mutukutu/ musekesa (*Bauhinia thonningii*) and Gumtree (*Eucalyptus spp*.) as well as tsanga (cereal) chaff to control weevils in granaries during storage. In addition, the farmers used repellent herbs like mumvumvu **(***Cadaba farinosa*), zumbane (Shona), umsuzwane (Ndebele) or lemon bush twigs (Lippia javanica), Mukuvazviyo/mushozhowa tree (*Pseudalachnostylis maprouneiflolia*) and Mexican marigold (*Tagetes minuta*) as repellents for inda (aphids), muchenje/mujuru (termites) and umhutu (red spider mites). Notsi (2012), Reijntjes et al. (2012), Pedzisai (2013) and Agea et al. (2008) observe that Indigenous farmers engage in Indigenous crop pest and disease management practices. Reijntjes et al. (2012) mention the traditional use of ducks, fish, frogs and snakes to biologically control insects in paddy rice cultivation in India. Traditional crop selection, planting times and cultivation practices often reflect efforts to minimise insect damage (Reijntjes et al., 2012). In Mukungwe, Central Uganda, Agea et al. (2008:67) posit that:

> *Majority (77%) of the households reported to be using locally-made pesticides; red pepper, banana juice, wood ash, citrus lemon leaves, neem tree, tobacco and tephrosia leaves to control array of pests such as* chibage (maize) *stem borers and cabbage diamondback moths that damage food crops while in the gardens and those such as rodents and bean weevils (bruchids) in storage.*

The findings by Agea et al (2008) are just a tip of the iceberg with respect to Indigenous sustainable methods to control crop pests and diseases.

The other natural pest control methods are hand picking then squashing the pests and also roguing infested plants. They also rogue diseased plants as a cultural method of controlling crop diseases like smut. Indigenous communities studied also store their mbambaira (sweet potatoes) with wood ash in clay pots or in murindi/pfimbi (dug pit). Local Farmer B, in Makonde district, said the following about this practice:

> *In murindi (dug pit) wood ash (madota) acts as a protection against eelworm. This storage technique is very cheap and sustainable.*

Indigenous communities studied dress planting seed by hanging seed selected on a line above the kitchen fireplace so that the seed could gather soot as protection against weevils. The local farmers of Kwekwe and Makonde districts regarded this as their way of 'certifying' seed for planting. Local Farmer C indicated that:

> *There is no chemical seed dressing but mere hanging of seed selected for planting on a line above the fire place so the seed could gather soot as a measure against weevils. This is their own way of certifying seed for planting*

The image below shows a local farmer in Kwekwe district holding a mapfunde (sorghum) seedhead (panicle) covered with kitchen soot.

FIGURE 5.8: A LOCAL FARMER HOLDING KITCHEN SOOT COVERED BVUNDE (SORGHUM) SEEDHEAD (PANICLE)

5.3.7 Crop weed control

The study established that the Indigenous farmers practise kusakurira (hand weeding) with a hoe. Besides hand weeding and kudzurira (weed pulling), masora (weeds) are also controlled by mbesa dzewareware (cover cropping) which smother weeds. A second and/or third weeding is done to leave the land clear of weeds without using cultivators as is the case under commercial farming today. Weed pulling is also practised especially in wetlands. These practices are very economic and sustainable and should ideally be infused into the ZSSAC.

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5.3.8 Crop harvesting and storage practices

Tsanga (cereals) like mhunga (pearl millet), zviyo/rukweza (rapoko) and mapfunde (sorghum) are harvested using knives to cut the heads. Chibage (maize) is harvested by simply cutting the stalks using hoes. As regards harvesting Local Farmer E said that:

> *The harvesting is done leaving stalks which would then be cut and burnt to provide ash which improves the nutrient status of the soil.*

Those crops that are harvested by cutting using hoes are left in masitaki (stooks/stacks) for some weeks in order to dry. Tsanga (cereals) are left to dry on a dara (Shona) or ingalane (Ndebele), a raised platform on stilt leg poles. Drying harvested crops avoids crop rotting. Thereafter the dry harvested crops are threshed with threshing sticks on a dwala (Ndebele) or ruware (Shona) flat rock surface that is made pest resistant by smearing cow dung. Before threshing and storage, the farmers make sure that the crop is dry to prevent rotting. Grain is stored in a dura/tsapi (Shona) or isiphala (Ndebele) – a raised traditional granary. The granaries are sealed with mixed ndove (cow dung) that is mixed with chinamwe (clay) until the grain is needed. This ensures food security and food sovereignty. Local farmer H, in Kwekwe district, had this to say:

> *We store manhanga (pumpkins), makavhu (squashes), manwiwa (melons) and mavise (sweet melons) below the tsapi or dura (stilt granaries) or on dara or mutanho or ingalani (stilt pole platforms) to drain water and avoid the crop rotting. We also store potatoes mixed with wood ash either underground in a murirndi (dug pit) or in hari (clay pots) for weeks.*

All the aforementioned Indigenous crop storage practices are economic, non-toxic and sustainable in comparison to the modern extensive use of pesticides during storage which was introduced by colonialists (Pedzisai, 2013). Hence, such methods need to be preserved by adding them to the ZSSAC.

5.3.9 Post harvest processing

Both communities surrounding the participating schools regarded their Indigenous tsanga (cereals) as staple crops. They posited that the seed of mupunga (African rice), mapfunde (sorghum), pearl millet, zviyo/rukweza (rapoko) and chibage (maize)) is boiled whole or ground and used as flour. The flour is used to prepare sadza (stiff porridge) and bota (thin porridge). The sadza is praised for its flavour and aroma. The tsanga (cereals) are used to prepare malt for brewing traditional beer. In the case of rice, a special beer is made from the rice malt and honey. This is because their amylase enzymes readily convert starch to sugar (National Research Council, 2006). The flour Is also used to make bread and various other baked products. The flour makes unleavened bread after first soaking it in water overnight. The Indigenous Zimbabweans also prepare chimodho, which is a deep-fried pancake prepared from the leavened batter of tsanga (cereal) flour, as a favourite snack. The tsanga (cereal) seeds could also be popped and eaten as maputi or the popped grains could be ground into mbwirembwire (salted flour) which was eaten as a snack while travelling. Of note was that the zviyo/rukweza (rapoko) grain could also be malted and a flour of the malted grain used as a nourishing food. The sprouted tsanga (cereal) seeds are a nutritious and easily digested food that is recommended for infants and the elderly.

Some of the local farmers nostalgically remembered eating mapfunde (sorghum) as if it was sweet corn, whereby the whole hupi (seed head or panicle) is harvested while the grain is still soft (dough stage) and roasted and eaten. Nzungu (groundnut), nyimo (Bambara nut), shelled and unshelled, and runinga (sesame) are eaten boiled or roasted. Nzungu and runinga also provide butter or oil for use in preparing relish.

The participating communities use tsanga (cereal) straws as fodder for their livestock during the dry season. The straws of mapfunde (sorghum) and mhunga (pearl millet) are also used for fencing, roof thatching, fuel and for making mhasa (sleeping mats) and matengu (baskets). The vegetables are used as animal fodder as green grazing. They also have lots of medicinal value. The muriwo (vegetables) are eaten as relish in their fresh or dried form. The mufushwa (dried vegetables) are stored in pots and of late in sacks and plastic bags. Drying is the major method of processing leafy vegetables to make them available during periods of scarcity. However, whilst drying solves the problem of perishability, some nutrients get lost during storage (National Academy of Sciences, 1996). Drying though is an advantageous storage method to refrigeration since refrigerated food loses both nutrients and perishability over time.

5.4 INDIGENOUS FRUITS

The rural communities studied are rich in wild fruit trees. Most of these Indigenous fruits have the potential of being domesticated (Abigaba, 1999; Akinnifesi et al., 2004; Kwesiga et al., 2004; Cemansky, 2015), thereby justifying their inclusion in the ZSSAC. Indigenous fruits are those which are native to Africa where they have originated and evolved over centuries. These are different from exotic fruits, such as citrus and mango, which have been imported from other continents, although they may now be quite commonly grown in many areas.

Before colonisation, most Indigenous people relied on wild fruits as major constituent of their diet (Gomez, 1989). Several authors (Awodoyin et al., 2015; Edia, 2018; Gomez, 1989; Goredema, 2013; Haule, 2016; Hobley, 1967; Kalaba, Chirwa, Prozesky, and Ham, 2009; Leakey, 2007; Mashile, Tshisikhawe and Masevhe, 2019; National Research Council, 2008; Nembaware, 2017; Shava, 2005; Stone et. al., 2011) identified numerous cultivated and wild traditional fruits that appear useful for diversifying food supplies and improving nutrition across the African continent. According to the research participants these fruits are mainly eaten by young boys as they go kunofudza mombe (to herd cattle) in the bushes and by girls when they go to look for firewood. They would also collect and bring them home to be consumed by other family members.

The Indigenous fruit trees could save millions of lives by providing children and adults that are vulnerable to malnutrition with a nutritious source of food (Akinnifesi et al., 2006;) as well as valuable vitamins and minerals, particularly during times of potential household food insecurity (Shava, 2005; Akinnifesi et al., 2006; Kwesiga, Mhango, Mkonda, Chilanga and Swai, 2004). Cemansky (2015) reports that the World Agroforestry Centre offers training programmes for communities which want to set up their own nurseries for cultivating and domesticating Indigenous fruit trees, including value addition and processing. This would enable the communities to make the most of Indigenous fruits, both nutritionally and economically. These cultivated and wild African fruits overcome malnutrition, boost food security, foster rural development and sustainable land care not only in Africa but at a global level (Gomez, 1989; Pichop et al., 2014). Some of the wild fruits in both studied rural communities are shown in Table 5.2. However, both chokochiyana (Lantana) and madhorofiya (prickly-pear) are introduced invasive alien plants, though edible.

Indigenous fruit trees such as mupfura (marula), mugan'acha/mushamba (Tree grape), muonde (fig tree), munhunguru (African plum) and mutohwe (snot apple) are mostly found wild, although some are now planted, but they all evolved in the African environment. As alluded to earlier on, Africa’s Indigenous fruit trees can be domesticated and also propagated (Abigaba, 1999; Akinnifesi et al., 2004; Kwesiga et al., 2004; Cemansky, 2015). Agea (2004) and Cemansky (2015) add that domestication is an interactive procedure involving the identification, production, management and adoption of desirable germplasm. This implies that we could have Indigenous fruit orchards that could potentially nourish Zimbabwe and also meet export needs. In addition Akinnifesi et al. (2004) strongly advise that the value of Indigenous fruits could increase if they are packaged in the same way as exotic fruits such as strawberries, oranges and nectarines.

While there is no doubt that our Indigenous fruit trees take longer to fruit, with more research invested into domesticating and developing them, they have the potential of surpassing exotic fruit crops (Agea, 2004). However, this is not necessarily true for all Indigenous fruit trees since domestication is about developing varieties, improving yields, increasing size, enhancing uniformity, and so forth. From the foregoing there is need to ensure that these wild fruits be infused into the ZSSAC including methods of improving and propagating them. The Indigenous fruit trees are shown in Fig 5.6

Generally all participants, especially the local farmers of both participating high schools, felt forestry lessons should include identification and uses of Indigenous trees. They remembered with nostalgia how they learnt to identify trees in the wild through singing the Shona lyric 'De de zengere uyo mutii' (What is the name of that tree?". Agriculture teacher E indicated that through learning forestry, the learners would know the following traditonal uses of the trees:

> *Trees promote food security when we eat their fruits, flowers, sap, leaves, barks and roots. Most trees and shrubs in the forests have a medicinal value to humans, livestock and crops. Some trees provide very good shade hence they are not cut in fields and the forest; generally trees are used for firewood and construction purposes, we harvest edible insects such as mandere (chaffer beetles) from Munhondo (Brachystegiaspiciformis) and amacimbi/madora (mopane worms) from mopane (Colophospermummopane) trees and that trees such as muhacha (Mobola plum) and chizhuzhu (Confetti tree) are sacred hence should not be cut.*

TABLE 5.6A: INDIGENOUS WILD FRUITS IN THE STUDY

English name	Botanical name	Shona name	Ndebele name	Picture
Large Sour plum	*Ximenia caffra,*	Nhengeni	Umthunduluka	
Small Sour plum	*Ximenia americana.*	Nhegeniruhwa	Umswantsha	
African plum	*Flacourtia indica*	Nhunguru	Umqokolo	
Smelly-berry fingerleaf,	*Vitez mombassae,*	Hubvu/Tsubvu	Umtshwankela	
Jujube	*Ziziphus abyssinica*	Masawu	Amasawa/ Umphafa/ Umlahlabantu	
African sweets	*Berchemia discolour*	Nyii	Umnyi	
Mobola plum	*Parinari curatellifolia,*	Hacha/Chakata	Umkhuna	
Snot-apple,	*Azanza garckeana,*	Matohwe	Uxakuxaku	
Monkey-orange	*Strychnos spinosa and other Strychnos spp.*	Matamba	Umkhemeswane	
Wild grape	*Lannea edulis*	Tsambatsi	Intakubomvu	

TABLE 5.6B: INDIGENOUS WILD FRUITS IN THE STUDY

English name	Botanical name	Shona name	Ndebele name	Picture
Prickly-pear	*Opuntia ficus*	Madhorofiya	Amadolofiya	
Monkey-bread	*Piliostigma thonningii*	Masekesa	Ihabahaba	
*Wild loquat/*Sugar plum	*Uapaca kirkiana*	Muzhanje/Mushuku	Umhobohobo	
Live-long/ Tree grape	*Lannea discolour*	Mugan'acha/ Mushamba	Isigangatsha	
Snowberry tree	*Flueggea virosa*	Musosoti/Muchagauwe/ Mushagahuye	Umhagawuwe	
Sugar-Apple/ Sweetsop	*Annona squamosal*	Muroro	Ububese	
Marula	*Sclerocarya birrea*	Mupfura	Umganu	
Water berry	*Syzygium cordatum* and/ *Syzygium guineense*	Muhute	Umtshwankela	
Fig tree	*Ficus capensis*	Muwonde	Umkhiwa	

The knowledge about indigenous fruit trees from the Indigenous school agriculture curriculum would instil a positive attitude towards trees and promote their management through Indigenous methods.

5.5 INDIGENOUS LIVESTOCK

5.5.1 Indigenous Livestock kept

The participants stated that before colonisation their communities kept Indigenous mombe (cattle) breeds: Mashona, Tuli and Nguni; mbudzi (goats): Mashona and Ndebele breeds; nguruve (pigs): Mukota breed; mbongoro/madhongi (donkeys), huku (chickens): which include the breed that looks like hanga (guinea fowl), musvuu (the naked neck), mushayabesu (the tailless breeds) and many others); hanga (guinea fowls), kirimba (pigeons) and mbira (tailless rock rabbits) and had domesticated makwari (francolins) and zvihuta (quails). They still keep these livestock. However, their breeds are no longer pure breeds but crossbreeds of Indigenous and exotic strains. There were more donkeys in Kwekwe than Makonde district.

With respect to domestication of some livestock, whose images are shown below, Local Farmer L in Kwekwe district stated in jubilation that:

> *We started by domesticating mbira (Shona) or imbila (Ndebele), the tailless rock rabbits. We then threw other successes when we domesticated zvihuta (quails) and makwari (francolins). This improved our food security and nutritional status.*

FIGURE 5.9A: MBIRA (TAILLESS ROCK RABBITS)

FIG 5.9B: ZVIHUTA (QUAIL BIRDS)

FIG 5.9 C: MAKWARI (FRANCOLIN BIRDS)

Both participating communities also keep makwai (sheep), madhadha (ducks) especially Muscovy type and they also keep turkeys. These are traditional livestock which were naturalised from other regions of the world. Sheep are Indigenous to Europe and Asia while turkeys are native to America. Muscovy Ducks are a wild tropical duck species native to Mexico as well as Central and South Americas.

Genetically diverse breeds of livestock have played a major role in the social, cultural and economic history of the continent. For instance, Indigenous breeds of livestock have fed and clothed humans for thousands of years and many of them have unique adaptations for survival in harsh environments and for tolerating specific diseases (Yoder, 2012). Shava and Masuku (2019) further observe that for Indigenous communities, livestock are not only a means of subsistence but had other socio-politico-economic functions. They identify some of these as signifying wealth and food security, use as an alternative currency in place of money, payment of lobola and appeasing spirits.

Regrettably, the diversity of Indigenous livestock is in danger of being lost forever as colonialism and neo-colonialism encouraged farmers to switch to exotic livestock and crossbreds of Indigenous and exotic breeds (Yoder, 2012). FAO (2006) amplifies this when they say approximately 20 per cent of Indigenous animal breeds around the world are in danger of extinction. There is thus need to protect the genetic diversity of Indigenous breeds of livestock which they still keep. Such breeds include those of mombe (cattle), makwai (sheep), mbudzi (goats), ngurve (pigs), shiri dzemumusha (poultry) and mbongoro and mabhiza (equines) that have adapted over centuries to a range of natural and sociocultural environments (Macaskill, 2016). More research should be carried out to improve the Indigenous breeds as this area has been neglected in favour of Western livestock. This is despite these livestock being naturally adapted to the environmental conditions in Zimbabwe. It goes without saying that their inclusion in the ZSSAC is worthwhile.

5.5.2 Breeding and breed selection

Selection of breeding stock is based on performance, wherein phenotypic characteristics like tameness or temperament, carcass conformation, milk yield, egg yield, mothering ability, draught power, health and fertility were considered.

Livestock farmers have a saying, ‘The bull is half the herd’ (Tan, 2002), meaning the bull comprises half the genes of the herd. Choosing a breeding male is done carefully because it has long term consequences. Each homestead has its own selection of males for breeding purposes. The farmers also choose breeding females based on most of the desired characteristics stated above. Indigenous communities practiced cross-breeding, allowing breeding across different herds. This was one purpose of madzoro (group herding).

Indigenous breeds of livestock kept are locally adapted to periodic droughts, seasonal dry periods, nutritional shortages and an array of parasites and diseases experienced in Africa (Macaskill, 2016), which make them hardy and well suited to the African environment. Hence, they need to be preserved through including them in the ZSSAC.

Interviews held with research participants revealed that there are no specialised breeding methods. AGRITEX Oficer C made the indication that:

> *The communities basically practise line breeding. Chirimo (spring) was stated as the natural breeding season during which the animals, except the small livestock, freely roam about feeding on crop stover in the fields. This kusairira (free roaming), as is the case with madzoro (group herding), encourages crossbreeding hence should be part of the ZSSAC.*

5.5.3 Animal grazing systems

The communities studied indicated that they have dedicated mafuro (grazing areas) and they practise migratory grazing when one area gets depleted, similar to the more extensive cattle migration of Eastern Africa. One lecturer, Lecturer B, who was an animal production specialist interviewed posited that:

> *This migration grazing system was an improved type of the Indigenous nomadic pastoralism practised in Eastern Africa. The grazing system is lauded for promoting rotational grazing of the pastureland. The herders have to go to places with good pastures.*

FIGURE 5.10: KUSAIRIRA (FREE GRAZING) ANIMALS IN MAFURO (RANGELAND)

The same participant lamented lack of large tracts of pastureland for the effective utilisation of shifting grazing.

The Indigenous farmers studied supplement grazing pastures with tsanga (cereal) and groundnut stover. The stover is sprinkled salty water to encourage appetite. During the dry season the grass becomes dry and will be very low in protein. Feeding livestock with stover during the dry season caused mombe (cattle), mbudzi (goats), makwai (sheep) and mbongoro (donkeys) to return home in anticipation of food. The communities do not encourage grazing in fields before harvesting is completed. But nowadays the young people mischievously herd livestock in the fields.

5.5.4 Indigenous veterinary practices

Participants in this study unanimously agreed that, as was the case with crop pests and diseases, livestock parasites and diseases were non-existent before colonisation. This view may not be true although Smith (1999) shares the same. If this assertion is valid there would be no Indigenous veterinary practices, an indication that there were livestock parasites and diseases in Zimbabwe before colonisation.

According to the research interviewees, the livestock ectoparasites in the communities studied are madari (ticks), umhutu (mites) and utata (fleas) while the endoparasites were tapeworms, roundworms and liver flukes. The parasites suck blood of livestock causing anaemia, emaciation and diseases resulting in reduced production. Some of the local farmers displayed knowledge of Indigenous veterinary services. The herbal medicines are shown in the Table 5.7.

The farmers also drench their mombe (cattle) with doro (home brewed beer) to treat Babesiosis (Redwater) and Sweating sickness (Theileriosis/ January disease/ sweating sickness). They also treat their livestock with chidhambakura (ground gecko) for opthalmia. For managing Black leg they pour boiled water on the leg for the gas gangrene to escape. Livestock are also affected by foot rot, especially during the rainy season. According to Local Farmer F:

Footrot is managed by changing matanga (kraals) to prevent dampness of feet which causes foot rot.

Most Indigenous veterinary practices are cost effective and sustainable. The young need to be taught these practices at school so that the Indigenous skills are preserved. The Indigenous veterinary services should find their way into the ZSSAC.

TABLE 5.7: INDIGENOUS HERBAL REMEDIES FOR LIVESTOCK AILMENTS

ENGLISH NAME	BOTANICAL NAME	SHONA NAME	NDEBELE NAME	FOR THE MANAGEMENT OF
Horsewood/ Maggot killer	*Clausena anisata*	Muvengahonye/ Muvhunambezo	umlahlampethu	Deep wounds Spraying as repellent for fleas
Boot protectors/ Devil's thorn	*Dicerocaryum zanguebarium*	Ruredzo or soso	Inkunzane/ Intekelane	Foetal dystocia
Aloe vera plant,	*Aloe greatheadii*	Gavakava		Stomach ailments
Prince of Wales' feathers	*Brachystegia boehmii*	Mupfuti	Itshabela	Snakebites
Snot apple	*Azanza garckeana*	Mutohwe	Uxakuxaku	Foetal dystocia Removal of retained afterbirth
Wing pod	*Aganope stuhlmannii*	Murumanyama	Umthundulu	Stomach ailments
Rubber euphorbia	*Euphorbia tirucalli*	Rusungwe	Ingotsha	Diarrhoea treatment Spraying against ticks and mange mites
Violet tree	*Securidaca longepedunculata*	Mufufu	Umfufu	Red water control Stomach problems like diarrhoea
Monkey orange	*Strychnos spinosa*	Mutamba,	Umngono	Running eyes and opthalmia
Monkey bread,	*Bauhinia thonningii*	Musekesa,	Ihabahaba	Wounds
Thornapple/ Jimsonweed	*Datura stramonium*	Zavazava		Screw worm remedy
Bitter apple	*Solanum incanum*	Nhundurwa	Umdulukwa	Running eyes and opthalmia
Long-tail cassia,	*Cassia abbreviate granitica*	Muremberembe	Isihaqa	Stomach problems like diarrhoea
Sourplum	*Ximenia caffra*	Mutengeni	Umthunduluka	Open wounds
Sabi star	*Adenium obesum*	Chisvosve		Opthalmia

5.5.5 Animal products

The communities studied get both primary and secondary products from their livestock. The primary products of livestock refer to those products that come directly from the slaughtered animals such as fresh meat, milk, hides and skins. Examples of secondary products indicated are salted meat, lard (fats), skins and salted hides which are derived from the processing of primary products. However, some of the processed products have since been phased out due to colonialism in favour of colonially biased products. Examples of such phased out Indigenous agricultural practices are the eating of mvumvira (meat that got bad without maggots) and processing of madaunha (leather blankets) and leather clothes called nhembe (animal skin aprons) from skins and hides. Makushe (feathers) of poultry, namely huku (chickens), madhadha (ducks) and kirimba (pigeons) arre used to make traditional head gear for the communities. Some still make a traditional musical instrument called hwamanda (horn trumpet) from the horns of cattle.

Local Farmer E succinctly narrated the use of the livestock aas follows:

> *We keep livestock for nyama (meat), except donkeys which are mainly kept for draught power and as a means of transport. The meat is eaten fresh or dried into chimukuyu (biltong) which is processed by either salting or smoking. From cattle and some goat breeds the we get milk. We also collect mutuvi (whey) from curdled and sour milk and use all these as relish. We also get ruwomba (cream) from mukaka (milk) and mafuta (lard) from meat and use them in the preparation of relish. All the livestock animals provide us with manure which is necessary in providing nutrients to their crops.*

Some of the processed products have since been replaced with Western products. These Indigenous animal products and by-products are facing extinction and are part of the Indigenous heritage that should not be lost. Preservation of such a heritage can only be achieved through incorporating these practices into the ZSSAC.

5.6 SYNTHESIS OF FINDINGS

Tables 5.8 and 5.9 show the syntheses of IAKS and practices related to crop and animal production respectively.

TABLE 5.8: SYNTHESIS OF CROP RELATED IAKS IN THE COMMUNITY

TOPIC	CONTENT
Zvirimwa (Crops Grown)	• Indigenous field crops: mapfunde (Sorghum), zviyo/rukweza (rapoko), mhunga (pearl millet), nyimo (Bambara nut), runinga (sesame) and nyemba (cowpeas). • Naturalised field crops: chibage (maize) and nzungu (groundnut) • Indigenous (mirivo) vegetable crops • Indigenous michero (wild fruits)
Kusarudza mbeu (Seed selection)	• Masarudziro (Basing on crop performance and other desirable characteristics, agrobiodiversity).
Marimiro (Farming systems)	• Kutema musasa (Shifting cultivation) • Muzanganiswa wembesa (Mixed cropping) • Mhanje (fallowing) • Kurima zvinokwana mhuri (Subsistence farming)
Gadziriro yeminda (Field crop preparation)	• Jengetedzo (Conservation agriculture practices): kurima nechibhakera (zero tillage, minimum tillage), kuchera makomba (potholing)), kuchera (digging)
Madyariro (Planting systems)	• Kudyara muvhu rakaoma (dry planting), Kukusha (broadcasting), matoro (utilisation of wetlands), kuchera makomba (potholing) and kufushira mbeu (covering broadcasted by moving animals or drawing tree branches)
Mamirio ekunze (Environmental influences)	• Kutondera mamiriro ekunze (Indigenous methods of weather forecasting and coping strategies)
Godzivhu (Soil fertility management)	• Mufudze (Organic manures), ivhu repachuru (anthill soils), kufushira majanga pasi (trash farming) and dota (use of ash)
Kudzivirira mbeu (Crop protection)	• Kudzivirira masora, zvipembenene nezvirwere (Indigenous methods of weed, pest and disease control)
Kukohwa (Crop harvesting)	• Kukohwa (Indigenous methods of recognition of crop maturity and harvesting crops)
Ruzivo takohwa (Post-harvest technology)	• Kuchetedza nokushandisa zvirimwa (Indigenous methods of storage and processing crops and their products)
Chengetedzo yemvura (Water conservation)	• Kuchengetedza mvura (Indigenous methods of conserving water)
Matondo (Forestry)	• Miti nekukosha kwayo (Indigenous trees; identification and uses) • Kuchengetedza miti (Indigenous methods of managing forests)

TABLE 5.9: SYNTHESIS OF LIVESTOCK RELATED IAKS IN THE COMMUNITY

TOPIC	CONTENT
Zvipfuyo (Indigenous livestock breeds)	• Mombe (Cattle): Mashona, Tuli and Nguni breeds, • Mbudzi (Goats): Mashona and Ndebele breeds, • Nguruve (Pigs): Mukota breed, • Makwai (Sheep): Sabi breed • Huku (Chickens): a breed that looks like hanga (guinea fowl), musvuvu (naked neck), mushayabesu (tailless) breeds and many others), • Hanga (Guinea fowls) • Kirimba (Pigeons) • Domestication of domesticated makwari (francolins) and zvihuta (quails) and mbira (tailless rock rabbits)
Mhukauya (Naturalised Livestock)	• Makwai (Sheep): Sabi • Madhadha (Ducks)
Sarudzo yemhando (Selection of breeding)	• Sarudzo yezvipfuyo (Indigenous methods of selecting breeding stock on the basis of crop performance and other desirable characteristics).
Vukosho hwezvipfuyo (Value of livestock)	• Kukosha kwezvipfuyo (Social, cultural and economic importance of Indigenous animals)
Mafuro (Animal grazing systems)	• Mafuro mamwechete (communal grazing) system • Kururira zvipfuyo (Supplementary feeding during the dry season)
Zveutano (Veterinary services)	• Kudzivirira umhutu nezvirwere (Indigenous methods of controlling livestock parasites, diseases and other ailments)
Zvinowanikwa kubva muzvipfuyo (Animal products)	• Kukohwa, kuchengeta nokushandisa zvipfuyo (Indigenous methods of harvesting, storage and processing of animal products)

5.10 CHAPTER SUMMARY

The chapter established that prior to the colonisation of Zimbabwe by the British, the Indigenous communities studied practised farming. They grew and still grow Indigenous crops and kept Indigenous livestock. They grew the tsanga (cereals), mapfunde (sorghum), mhunga (pearl millet) and zviyo/rukweza (rapoko) which provide staple food. They also grew Bambara nut, cowpeas and sesame. With time the communities began to grow introduced crops that include chibage (maize) and nzungu (groundnuts). The management of these crops are characterised by several Indigenous farming practices. All the crops, save for the naturalised crops, are adapted to the climatic environment obtaining in Zimbabwe. The same communities feed on several Indigenous vegetables, most of which they domesticated, or harvested from the wild. They also fed on wild fruits which, through domestication and propagation, have the potential of fighting food insecurity. The communities studied also keep livestock, namely, mombe (cattle), mbudzi (goats), makwai (sheep), huku (chickens), mbira (rock rabbits), nguruve (pigs) and mbongoro (donkeys). These animals are naturally adapted to the local environmental conditions. The animals have several uses, chief among them being providing food security. Likewise, the participating communities use Indigenous livestock husbandry methods to manage their livestock.

The study also found out that IAKS possessed by the participating communities has stood the test of time. Indigenous communities continued (unlawfully though) to practice and pass onto the next generations IAKS they had known and practised for generations despite colonial and neo-colonial subjugation (Kaya and Seleti, 2014; Mapara, 2009; Tanganyiwa and Chikwanha, 2011). The practices were found to be sustainable. Hence, such resilient practices should not only be preserved but also improved through research like Western agricultural practices.

CHAPTER SIX: COMPONENTS OF INDIGENOUS AGRICULTURAL KNOWLEDGE SYSTEMS THAT COULD BE INCLUDED IN ZIMBABWE'S SECONDARY SCHOOL AGRICULTURE CURRICULUM AND APPROACHES FOR THEIR EFFECTIVE INCLUSION

6.1 INTRODUCTION

Chapter 4 analysed components of IAKS that are currently included in the Zimbabwe Secondary School Agriculture Curriculum. Chapter 5 investigated IAKS (knowledge and practices) that existed within the participating communities surrounding the two selected schools. This Chapter analyses and discusses data to suggest components of IAKS that can be included in the Zimbabwe Secondary School Agriculture Curriculum. These IAKS aspects were arrived at by making a comparison between components of IAKS currently included in the ZSSAC (Chapter 4) and those in the IAKS (knowledge and practices) that existed within the participating community (Chapter 5) to identify gaps and opportunities for inclusion. Besides comparing the findings of the two chapters to establish the gap, the research participants also stated, during interviews, the IAKS that could be included in the ZSSAC. In addition, the chapter proposes approaches for the effective inclusion of the IAKS in the ZSSAC.

6.2 COMPONENTS OF IAKS THAT CAN BE INCLUDED IN THE ZSSAC

Research participants generally suggested that it was the good aspects of IAKS (knowledge and practices) that needed to be included in the ZSSAC. One of the two interviewed Agriculture Education Officers maintained that:

> *When we make an analysis of the Indigenous agricultural knowledge and practices, we find that most are sustainable hence good for our farmers. It is the good ones that should find their way into the school agriculture curriculum. There is no going back.*

These practices have stood the test of time and continue to be practised despite negative colonial influences. The IAKS which were proposed for inclusion in the ZSSAC related to both Crop Husbandry and Livestock Production. Chota et al. (2010) and McClean et al. (2005) opine that all related IAKS aspects which have something to do with plant and animal production should be protected and continue to be used since they have a lot of advantages over the Western farming practices. According to Mapira and Mazambara (2013), the Western colonisers enforced laws which subjugated the Indigenous Zimbabweans and marginalised their Indigenous agricultural practices. IAKS were despised in order to promote Western farming practices. The colonialists considered IAKS to be inferior to their Western farming practices. However, recent research has demonstrated that IKS are neither inferior nor backward as they were derived from centuries of accurate observation and experimentation (Mapira and Mazambara, 2013; Ward, 1989). Relevant components of IKS that could be included in the science curriculum should be identified (Zimbabwe Government 2012; Maluleka, Wilkinson and Gumbo 2006; Jegede and Aikenhead, 1999), including Agriculture (Maluleka, Williams and Muchena, 1991). Agriculture, being an applied science, has relevant aspects of IAKS that should be included in the curriculum. Jha (2008:1) posits that “Even within traditional systems, gaps existed between ‘good’ and ‘bad’ farmers and practices.

In Zimbabwe, both research and extension systems should exploit the ‘good’ Indigenous farming practices, like those shown in Tables 6.1 and 6.2 and include them in the ZSSAC. Hence, those IAKS aspects that have shown resilience are perhaps the good farming practices. The inclusion of these resilient IAKS in the ZSSAC would avoid the hegemony of Western agricultural knowledge in the ZSSAC. This is in line with decoloniality which challenges dominant knowledge views and advocates for the co-existence of multiple worldviews (plural knowledges) in curriculum practice. No knowledge view should claim superiority over the other, more so in an African curriculum, as was the case with Western knowledge in ZSSAC.

Ogunniyi (2007) and Emeagwali (2003) project that intersections between IKS and mainstream science exist. Western science itself is an Indigenous system, rooted in Western philosophies and culture (Kyle, 1999) and it has grown by borrowing from several Indigenous knowledges (Hountondji, 2002). Hence, the two knowledge claims, Western science and IKS, can be regarded as complementary epistemologies in need of a dialogue that would result in meaningful learning (Shizha, 2009:139-154; Ogunniyi, 2007). In *Chara chimwe hachitswanyi inda: Indigenizing science education in Zimbabwe,* Shizha (2009: 139-154) underscores the coexistence and complementary nature of IKS and Western science. However, Indigenous knowledge and Western knowledge are not always complementary to each other. They can be contradictory and even parallel alternatives. For example, Western agriculture is chemical intensive and characterised by monocultures, land degradation and pollution, while Indigenous agriculture is organic, multispecies based, sustainable and based on a circular economy. Indigenous agriculture practices are thus a contradictory and sustainable alternative to Western intensive agriculture. All the same, the two knowledge claims can be incorporated in a curriculum to enrich the knowledge base of the learners.

6.2.1 COMPONENTS OF IAKS FOR INCLUSION IN CROP HUSBANDRY SECTION OF ZSSAC

Table 6.2 shows a summary of proposed components for inclusion in the Crop husbandry section of the ZSSAC. These were arrived at by comparing data analysed in Chapters 4 and 5.

Under land use, the idea of murimo mumwechete (communal farming) needs to be added to the curriculum. Culturally and historically, a piece of land is owned and distributed among the group members through the relevant authority, sabhuku (village head). For Indigenous Africans the land belongs to the community. The fields are communally owned by the entire community under the sabhuku (village head) who allocates farmland to his subjects. For instance, the village head sits down with his subjects and they together decide on who can offer land to a newly married couple so that they become food secure. Any man who feels his field is no longer adequate for his family reports to the sabhuku (village head) who will then convene a meeting to resolve the plea. The mafuro (grazing area) is also communally owned. Any family is free to graze their mombe (cattle), makwai (sheep), mbudzi (goats) and mbongoro (donkeys) in the mafuro (grazing area) and care for it. For instance, the community enforces laws to protect the mafuro (rangeland) such as discouraging cutting of shade, fruit and sacred trees and indiscriminate cutting of trees in general and the use of trees with medicinal properties without destroying them.

TABLE 6.1: PROPOSED IAKS PRACTICES FOR INCLUSION IN THE CROP HUSBANDRY CURRICULUM COMPONENT

SUB TOPIC	CONTENT
Kushandisa Ivhu (Landuse)	• Murimo mumwechete (communal farming) • Kutema musasa (Shifting cultivation)
Matondo (Forestry)	• Zvemiti (Indigenous tree species; identification and uses) • Kuchengetedza miti (Indigenous methods of managing forests)
Mamiririro ekunze (Environmental Factors)	• Nzira dzekutondera mamiriro ekunze (Indigenous methods of weather forecasting)
Godzaivhu (Soil Fertility)	• Girinhi mufudze (green manuring), application of ivhu rechuru (anthill), kufushira majanga pasi (trash farming) and use of dota (ash) • Kukosha kwemufudze (Importance of incorporating these)
Mvura (Water)	• Mbeu dzisingateti zuva (Growing drought tolerant crops) • Mbesa dzewareware (cover cropping) • Practising kuisa bvute (shading), matai (tie ridging), kuisa pevhu (mulching), dziviriramhepo (windbreaks) • Kudiridzira (Indigenous methods of management of irrigation)
Zvirimwa (Crops Grown)	• Indigenous field crops: Mapfunde (Sorghum), zviyo (rapoko), mhunga (pearl millet), nyimo (Bambara nut), runinga (sesame) and nyemba (cowpeas). • Zvirimwauya (Naturalised field crops): chibage (maize) and nzungu (groundnut). • Murivo (Indigenous vegetable crops) • Michero (Indigenous wild fruits) • Study of Indigenous crops; tsanga (cereals), manjekenje (legumes), murivo (vegetable crops) of major importance in local agriculture • Kudyara miti (Propagation of Indigenous fruit trees)
Kusarudza mbeu (Seed Selection)	• Masarudziro (Basing on crop performance and other desirable characteristics).
Marimiro (Farming Systems)	• Muzanganiswa wembesa (Mixed cropping) • Mhanje (Fallowing) • Kurima zvinokwana mhuri (Subsistence farming)
Kugadzirira kurima (Field Crop Preparation)	• Marimiro anochengetedza ivhu (Conservation agriculture practices) sekurima nechibhakera (zero tillage/ minimum tillage), Kuchera mumakomba (kuchera makomba (potholing)), kuisa pevhu (mulching), kushandisa mbesa dzewareware (cover cropping), dziviriramhepo (windbreak) and mbeu dzisingateti zuva (growing drought tolerant crops), kuwundukura (winter ploughing),
Madyariro (Planting Systems)	• Kudyara muvhu rakaoma (dry planting), broadcasting, utilisation of wetlands, kuchera makomba (potholing) and covering broadcasted seed by moving animals or drawing tree branches
Kuchengetedza Mbesa (Crop Protection)	• Indigenous Methods Of Weed, Pest And Disease Control
Kukohwa Mbeu (Crop Harvesting)	• Indigenous Methods Of Harvesting Crops
Kuchengetedza Goho (Post Harvest Technology)	• Indigenous Methods Of Storage And Processing Crops And Their Products

Still on kushandisa ivhu (land use), kutema musasa (shifting cultivation) which had since been scrapped from the curriculum needs to be reinstated. In support of research participants' call to include the practice in the curriculum Agriculture Teacher B had this to say:

> *While the practice no longer suffices, due to shortage of land, students should have knowledge of it as part of our culture.*

This study makes the observation that the practice of kutema musasa (shifting cultivation) is, however, still there in some parts of Manicaland in Zimbabwe and also in Zambia.

Matondo (Indigenous forests) are a natural resource that should be included in the curriculum. As alluded to earlier on, students should be taught identification of miti (forest trees) and describe the various uses of trees and shrubs such as provision of food from trees, roots and bark; as well as forest trees as a source of medicine. This would make the learners develop a positive attitude towards managing the forests since they provide food from fruits, roots and bark, are a source of medicine; and that some are sacred. Included would be Indigenous methods of preserving forests.

Under the topic 'Environmental influences' of agriculture, participants were of the idea that Indigenous methods of weather forecasting be added to the curriculum. AGRITEX Officer D opined that:

> *The use of these methods would help students to forecast the approach of the rain season, determine that it is about to rain and forecast a good season and or drought. Such knowledge would enable the farmers plan farming activities, determine which crops to grow and when, and devise coping strategies against drought, floods and strong winds.*

Though organic manures were covered under 'Soil Fertility', participants expressed the view that other Indigenous methods of improving soil fertility be taught in schools. According to Agriculture Education Officer B:

> *Such methods include girinhi mufudze (green manuring), burying of crop residues with a plough called kufushira majanga pasi (trash farming) and use of both ivhu*

repachuru (anthill soil) and madota (ash). The benefits of these techniques to the soil should also be taught.

Generally, the two participating schools received low rainfall. Hence, there is need to teach methods of kuchengetedza hunyoro (moisture conservation) in fields and gardens. Agriculture educators proposed that growing mhando dzembeu dzisingateti zuva (drought resistant crop varieties) be accorded space in the curriculum. In addition, methods of kuchengetedza hunyoro (conserving moisture) in the soil such as mbesa dzewareware (cover cropping), kuisa bvute (shading), matai (tie ridging), kuisa pevhu (mulching) and use of dziviriramhepo (windbreaks) warrant consideration for inclusion in the curriculum.

The study found that schools should seriously teach Indigenous and traditional crops that are of major importance in promoting food security and nutrition. Such crops include the Indigenous field crops mapfunde (sorghum), mhunga (pearl millet), zviyo (rapoko), nyimo (Bambara nut) and runinga (sesame) and the traditional crops maize and groundnuts. In addition, Indigenous vegetables and fruit trees including appropriate methods of domesticating and propagating them need to be taught also. Agriculture Teacher B convincingly stated the teaching of Indigenous crops when he said;

They are adapted to the climatic conditions obtaining in Zimbabwe. They are also resistant to drought, pests and diseases.

Absent in the curriculum were Indigenous methods of kusarudza mbeu (seed selection) as well as the marimiro (farming systems), muzanganiswa (mixed cropping), mhanje (fallowing) and kurima zvinokwana mhuri (subsistence farming) and the following ‘Field crop preparation methods’; jengetedzo (conservation agriculture) methods; kurima nechibhakera (zero and minimum tillage), kuchera makomba (potholing), kuisa pevhu (mulching), mbesa dzewareware (cover cropping), dziviriramhepo (windbreak), kuwundukura (winter ploughing) and growing mhando dzembeu dzisingateti zuva (drought resistant crop varieties). Further, planting systems such as kudyara muvhu rakaoma (dry planting), kukusha mbeu (broadcasting), kushandisa matoro (wetland utilization), kuchera makomba (potholing) and moving animals or pulling branches or trees kufushira (to cover) broadcasted seed were viewed as worth including in the ZSSAC. All these practices are sustainable and cultural.

Kusarudza mbeu (seed selection) would consider varieties that are resistant to drought, pests and diseases, those that are easy to harvest and those with poor shattering ability.

Crop protection methods that make plants resistant to sora (weeds), vudyi (pests) and zvirwere (diseases) in order to avoid losses could also be considered. These include the use of maguchu (herbal concoctions) and various cultural methods which protect crops against pests and diseases.

There is also need to include Indigenous methods of kukohwa (crop harvesting) and post harvest technology. The use of the maoko (hand), banga (knife) and badza (hoe) to harvest crops, compared to use of machinery, is very sustainable. Indigenous methods of processing crops such as kupura (threshing), kurudza (winnowing) and kuchengetedza (post-harvest storage) in simple structures like matura (granaries) and murirndi (dug pits) for sweet potatoes and yams are very sustainable. During storage the crops are treated with maguchu (herbal concoctions) against pests like zvipfukuto (weevils) and zvipembenene (snout beetles). All these techniques are sustainable and were deemed to be relevant to the curriculum.

The methods of processing these crops into several products were the other notable topic. Examples of the products are upfu (mealie meal), zvinwiwa (beverages) like mahewu, doro (liquor) and tudyo (snacks) from tsanga (cereals); manyuchi (jams) from the Indigenous fruits such as nyii (African sweets) and tsvubvu (Smelly berry); porridge (mutandabota) from muuyu (baobab), musekesa (monkey bread) and matamba (monkey orange).

6.2.2 Components of IAKS for Inclusion in Livestock Husbandry Section of ZSSAC

Table 6.2 gives a consolidated summary of proposed IAKS for inclusion in the Livestock husbandry section of the ZSSAC. These were arrived at by making a comparison of data analysed in Chapters 4 and 5.

The teaching of types of livestock made lots of reference to exotic breeds at the expense of Indigenous ones. Hence, Indigenous breeds of mombe (cattle) such as Mashona, Tuli and Nguni breeds, the Mashona and Ndebele mbudzi (goat) breeds, the Sabi makwai (sheep) breed, the Mukota nguruve (pig) breed, mbongoro (donkeys), huku (chickens) such as a breed that looks like hanga (guinea fowl), musvuvu (naked neck) breed and mushayabesu (tailles breeds and also hanga (guinea fowls), kirimba (pigeons), domesticated makwari (francolins) and zvihuta (quails) and tailless rock rabbits. The Indigenous breeds are adapted to prevailing climatic conditions which makes them climate, disease and parasite tolerant. As such, they are inexpensive to manage, hence sustainable. Besides Indigenous livestock, traditional livestock such as ducks and turkeys should also be included in the curriculum. Their inclusion would boost nutrition and food security.

TABLE 6.2: PROPOSED IAKS PRACTICES FOR INCLUSION IN THE LIVESTOCK HUSBANDRY CURRICULUM COMPONENT

TYPES OF LIVESTOCK	• **Indigenous breeds of livestock:** ➢ Cattle: (Mashona, Tuli and Nguni breeds) ➢ Goats (Mashona and Ndebele breeds), ➢ Pigs (Mukota breed) ➢ Donkeys ➢ Chickens (a breed that looks like guinea fowl, naked neck, tailless breeds and many others), ➢ Guinea fowls ➢ Quail ➢ Francolin ➢ Pigeons ➢ Tailless rock rabbits. • **Naturalised breeds** ➢ Sheep (Sabi) ➢ Ducks ➢ Turkeys • Social and economic importance of Indigenous livestock
ANIMAL IMPROVEMENT	• Indigenous methods of selection of breeding stock • Indigenous breeding systems
ANIMAL FEEDING	• Mafuro (Mafuro mamwechete (communal grazing) systems) • Supplementary feeding during the dry season
ANIMAL HEALTH	• Indigenous methods of remedying livestock udyi (parasite), zvirwere (diseases) and zvimwe zvinetsiwa (other ailments)
ANIMAL PRODUCTS	• Indigenous methods of harvesting, storage and processing of livestock products

Under the topic 'Animal Improvement', participants stated that Indigenous methods of livestock selection and breeding systems, selection of breeding stock based on performance characteristics such milk production, carcass conformation, as well as draught power use and docility could also be incorporated. Additionally, promotion of crossbreeding through practices like madzoro (group grazing) need inclusion in the ZSSAC.

Historically, Indigenous African culture practises mafuro mamwechete (communal grazing) of the mafuro (rangeland). No one owns the mafuro (rangeland). As alluded to, this practice conserves ufuro (grazing), miti (trees) and enhances cross breeding. Ndove (animal dung) and weti (urine) fertilise the grass. During the chirimo (dry season), livestock roam about feeding on stover in the fields fertilising the fields with their ndove (dung) and weti (urine). Both the nutritive value and the abundance of grass decrease. Livestock are, thus, given supplementary food using sheaves of groundnut, Bambara nut and cowpeas and tsanga (cereal) stover to maintain their health. Such sustainable concepts need to be integrated into the curriculum.

The study found quite a number of animal health practices of remedying livestock vudyi (parasites), zvirwere (diseases) and other ailments. These sustainable methods include use of concoctions prepared from readily available leaves, barks and roots of trees and shrubs. Some of the treatments are shown in Table 5.3.

Indigenous livestock have lots of products and by-products. It is vital to incorporate Indigenous methods of kukohwa (harvesting), kuchengetedza (storage) and kugadzira (processing) of livestock products and by-products. Harvesting of most products is mainly done manually. The products include nyama nyoro (fresh meat) or chimukuyu (biltong); mukaka (milk) from which we get fresh milk and by-products such as sour milk, hodzeko (curdled milk), ruwomba (butter) and mutuvi (whey); eggs from poultry; Makushe (feathers) for decorations and matehwe (skins) for making nhumbi (clothes) and madaunha (blankets) and tambo (rope).

6.3 APPROACHES TO EFFECTIVE INCLUSION OF IAKS IN ZSSAC

The research participants concurred that for effective inclusion of IAKS in ZSSAC, there is need to identify the relevant stakeholders who would lead in the designing, planning,

TABLE 6.3 STAKEHOLDERS AND THEIR JUSTIFICATION

STAKEHOLDER GROUP	JUSTIFICATION
Ministry of Ministry of Primary and Secondary Education	Policy makers as owners of the syllabi
Ministry of Higher and Tertiary Education and Technology Development	Policy makers and trainers of teachers and AGRITEX officers
Ministry of Agriculture and Mechanisation	Responsible for production of National Agriculture Policy makers on Agriculture and training of AGRITEX officers
Curricularists	Provide specialist and practical guidance on curriculum development process
Indigenous farmers and elders in the community	The actual holders of the IAK
Women	Are important players in seed bank creation, management and food security
Youths (including students)	Future generation
AGRITEX officers	Extension services in the community
High school agriculture teachers	Implementers if the curriculum
Tertiary agriculture lecturers	Trainers of Agriculture teachers and AGRITEX officers
IAK scholars and academics	IAK lecturers or researchers
Relevant Non-Governmental Organisations	They are promoting Indigenous sustainable agriculture practices in the communities
Commerce and industry	Absorbers of agriculture graduates

implementation and evaluation of the curriculum. Eduaction Officer A, himself a curricullarist, hinted that:

> *The only way to go about it is to identify relevant stakeholders to spearhead the designing, planning, implementation up to evaluation of the new- look curriculum project.*

According to the participants, these stakeholders would be drawn from the following groups:

The stakeholders would be active participants throughout the entire curriculum development process. The participatory model of curriculum development, which has emerged in recent years, emphasises active participation of all stakeholders throughout the entire curriculum development process from design, planning, development of materials to implementation and evaluation of the programme (Bovill and Bulley, 2011; Drawson, Toombs and Mushquash, 2017; Gasperini, 2000; Hodgkin, 2007; Taylor, 2000; Taylor and Beniest, 2003; Van Crowder, 1998). Participatory Curriculum Development is an acceptable approach to Indigenous research (Drawson, Toombs and Mushquash, 2017).The use of the model would enable the less powerful in society such as Indigenous farmers, the poor and the learners, regardless of gender, to actively influence curriculum decisions which directly affect their lives. Most of these ordinary people live in rural areas and they have had very little involvement in the development of education curricula which, however, affects them directly. Engagement of the local farming community in the curriculum development as well as implementation processes would be key since they are the custodians of IAKS.

Stakeholder consultations throughout the curriculum development process are aimed at promoting a common cause. This leads to a successful curriculum development process. In addition, the stakeholders develop a sense of ownership of the curriculum so necessary for its successful implementation (Obanya, 1987).

Agriculture educator participants concurred that there would be need to carry out research to compare IAKS aspects currently included in the curriculum with those existing in all the communities of the ten administrative provinces of Zimbabwe in order to determine aspects of IAKS (knowledge and practices) that could potentially be included in the ZSSAC.

The agriculture teachers and AGRITEX officers lamented their lack of knowledge of IAKS aspects, hence the need to transform agriculture education curricula in tertiary institutions (universities that teach agriculture, Agriculture colleges and teacher training colleges) to train Agriculture teachers and AGRITEX officers in line with the demands of the new curriculum. Those agriculture teachers and AGRITEX officers who are already practising would be retrained to equip them with the requisite knowledge, skills, values, attitudes and methodologies for the teaching of IAKS aspects in the ZSSAC.This is because they were exposed to Western agricultural practices during their initial training and, according to Bishop (1995), need retraining to reskill them in line with the curriculum change. The

Indigenous farming community would also be used to impart the requisite IAKS aspects to teacher and AGRITEX trainees.

The researcher gathered from the research participants that it is the duty of the stakeholders to develop a curriculum framework, an organised plan or set of learning outcomes that defines the content to be learnt by the students and the parameters on which students will be assessed (Obanya, 1987; Bishop, 1995). There is need to identify the curriculum aim, content, learning materials and methods. Such an exercise would make the curriculum planning phase easier.

Research participants concurred that once all the preparatory modalities had been accomplished, the curriculum package would then be developed. While this would be done by curricularists, extensive consultation with all stakeholders, especially with the farming community who are holders of the knowledge, would continue.

The research participants expressed the opinion that after the development of the curriculum plan, there would be need to trial it in selected schools and evaluate it before implementation in all schools. Trialing guarantees successful implementation of an envisaged curriculum initiative (Bishop, 1995; Kim, 2011; De Vaus, 1993) since the trial would be evaluated and recommendations from the evaluation used to polish it up. All stakeholders would continue to be consulted in the processes.

Any teaching programme needs to be evaluated to determine its worth. Hence, the research participants concurred that once implementation is over, the curriculum should be evaluated to determine the achievement of the learning outcomes and make adjustments as appropriate. Agriculture Education Ofiicer A opined that:

> *Evaluation of the curriculum would help the stakeholders in deciding whether particular aspects of the curriculum should be adopted, altered or eliminated. The overall motive of evaluation is to determine whether the curriculum is producing the expected results.*

Obanya (1987) contends that monitoring and evaluation must be carried out at every stage of the curriculum development process to determine deficiencies and take corrective action.

Basing on the contribution of the research participants, this research proposes the model in 6.4 for the successful development and implementation of the ZSSAC that incorporates aspects of IAKS. The model borrows from the contributions of the research participants and literature.

6.4 THE PROPOSED CURRICULUM DEVELOPMENT MODEL FOR INCLUSION OF ASPECTS OF IAKS IN THE ZSSAC

The process of developing the envisaged curriculum will be marked by eight stages and the suggested activities for each phase. These are shown in the Table 6.4.

The model, which is gender sensitive, involves the entire stakeholders throughout the eight stages of the curriculum development process. It is, thus, a Participatory Curriculum Development model.

6.4.1. Identification of stakeholders

Identification of stakeholders will be carried out in two stages. The initial stage involves the researcher listing the groupings from which the stakeholders are drawn. In this case the stakeholders are representatives from Ministry of Ministry of Primary and Secondary Education, Ministry of Higher and Tertiary Education and Technology Development, Ministry of Higher and Tertiary Education and Technology Development, Ministry of Agriculture and Mechanisation, Curriculum specialists, the elderly and Indigenous farmers in the community, Women, Youth (including students), AGRITEX officers, high school agriculture teachers, Tertiary agriculture lecturers, IAK scholars and academics, Relevant Non-Governmental Organisations, Commerce and industry. Each organisation is contacted to provide its interim representative(s). This was well captured by the following captions:

> Agriculture teacher B: *There should be involvement of all those people who have a stake in the curriculum process. These stakeholders should represent all beneficiaries of the new-look curriculum initiative.*

> Local farmer D: *Previously we were ignored in the development of curricula yet we are the direct beneficiaries of the education system. The government should take cognisance of our knowledge of Indigenous knowledge throughout the curriculum development process*.

In the second stage of determining the stakeholders, the interim stakeholders convene a meeting in which they co-opt additional members on merit. The established stakeholder body validates specific stakeholders. The stakeholder body has power to add or subtract members from the list until they have a final list. AGRITEX officer C stated that:

> *It is incumbent upon the initially established interim body of stakeholders to validate and co-opt specific stakeholder members. This is followed by outlining the role of each stakeholder in the development of the curriculum.*

Therefore,, the second phase of determining the stakeholders witnesses the interim stakeholders convene a meeting in which they co-opt additional members on merit.

The roles are shown in the Table 6.4.
The members are then apprised on the potential of the Participatory Curriculum Development. The inclusion of aspects of IAKS in the ZSSAC is demystified. When the stakeholders are clear about what the inclusion entails, they help identify organisational challenges they may confront with respect to inclusion of IAKS in the curriculum. The first stage ends with stakeholders delineating the main steps of action in the curriculum development process. Agriculture teacher A opined that:

> *The stakeholders would be active participants throughout the entire curriculum development process.*

TABLE 6.4: THE PCD CURRICULUM DEVELOPMENT MODEL

STAGES	ACTIVITIES
1. IDENTIFICATION OF STAKEHOLDERS	• Identification of the stakeholder groups • Validating specific stakeholders and their roles in the development of the curriculum • Appraising stakeholders on the potential of the Participatory Curriculum Development • Demystifying the inclusion of IAKS in the ZSSAC • Identification of organisational issues with respect to the new look ZSSAC • Delineating the main steps of action
2. ANALYSIS OF COMPONENTS OF IAKS CURRENTLY INCLUDED IN THE ZSSAC	• Analysis of policy documents on agriculture • Analysis of the existing ZSSAC; aims, content, materials, methods and assessment instruments • Analysis of tertiary agriculture curricula; universities, agriculture colleges • Analysis of primary school agriculture curriculum
3. INVESTIGATING ASPECTS OF IAKS EXISTING WITHIN THE COMMUNITIES	• Identification of aspects of IAKS in the community through interviews and the spot observations • Use of IAK scholars and specialists
4. SUGGESTING COMPONENTS OF IAKS THAT STILL NEED TO BE INCLUDED IN THE ZSSAC.	• Comparing IAKS in the curriculum and IAKS in the community • Development of a gap in knowledge, skills, values and attitudes required for the new curriculum • Determining training and retraining needs of agriculture teachers
5. DEVELOPING CURRICULUM FRAMEWORKS	• Development of curriculum aims • Development of general IAKS topics for the curriculum • Development of main areas of content
6. DETAILED CURRICULUM PLANNING TO INCLUDE ASPECTS OF IAKS THAT STILL NEED TO BE INCORPORATED INTO THE CURRICULUM	• Development specific learning outcomes for the new look curriculum • Including Development of detailed curriculum content • Preparation of learning materials • Identification of learning methods • Development of assessment instruments • Retraining teachers to reskill them on their deficiencies
7. IMPLEMENTATION OF THE IAKS CURRICULUM IN SCHOOLS	• Trialing new curriculum with groups of students • Application of active and experimental teaching methods • Using learner- centred teaching and learning materials • Evaluation of the teaching and learning materials and adjust as required • Delivering the new curriculum on a wider scale
8. EVALUATION OF THE PROGRAMME	• Developing and refining the monitoring and evaluation system with respect to stakeholder participation, teacher performance and student performance • Determining the impact of curriculum

TABLE 6.5: STAKEHOLDERS' ROLES IN CURRICULUM DEVELOPMENT

Stakeholders/Types	Functions and Contributions
Curriculum specialists	Designing curriculum Writing lectures
Teachers of subjects	Participating in writing and developing teaching-learning materials Teaching
Higher education lecturers	Participating in developing and writing teaching material Teaching
Youths (including students)	Evaluating the curriculum
Women	They are important in food security
IAK academics and scholars	Carrying out research Consulting the content Participating in teaching
Policy makers (Policy Officers in the respective government ministries)	Participating in curriculum design
AGRITEX officers	Participating in development of teaching material Participating in training needs assessment
Non-governmental organizations	Consulting Signing training contracts Participating in training course design
Local farmers and the elderly	Providing IAK knowledge Participating in research activities Participate in teaching and reskilling of teachers

6.4.2 Analysis of aspects of IAKS currently included in the ZSSAC

Led by policy makers, IAK scholars and academics, the stakeholders analyse policy documents on agriculture, agriculture curricula, the existing ZSSAC with respect to aims, content, materials, methods and assessment instruments. They also analyse agriculture curricula in tertiary institutions, namely, universities, agriculture colleges, teacher training colleges and vocational training centres that offer agriculture education. The agriculture curriculum of primary education may also be analysed to determine continuity.

6.4.3 Investigating aspects of IAKS existing within the communities

Through research and consultation with the elderly in society and local farmers, aspects of IAKS in the community are identified. The elderly and local farmers are interviewed and on the spot observations carried out led by IAK academics and scholars. Local farmer G justified reliance on IAKS from the elderly in society and local farmers when he said:

> *We are the elders in the community. We have seen it all. We know our Indigenous farming methods. It is only us who can lead in the curriculum development process not only for the benefit of our children, but for Zimbabwe as a whole.*

This justifies their role As custodians of IAKS.

6.4.4 Suggesting components of IAKS that still need to be included in the ZSSAC

In this stage, a comparison of data obtained through analysing of aspects of IAKS currently included in the curriculum and those aspects of IAKS existing in the community, a gap in Indigenous agricultural knowledge, skills, values and attitudes required for the new curriculum is identified. This identified gap determines the training and retraining needs of agriculture teachers. Hence, policy documents and agriculture curricula for tertiary institutions are revised in line with the new curriculum initiative.

6.4.5 Developing curriculum frameworks

Stakeholders guide the setting of aims of the curriculum. The aims are used to articulate what the curriculum intends to achieve. Aims give shape and direction to the curriculum. The development of aims is followed by the development of the general IAKS topics for the curriculum from which the main areas of content are derived.

6.4.6 Detailed curriculum planning

At this stage specific learning outcomes, for the new look curriculum, are developed followed by development of detailed curriculum content. Learning materials, in the form of textual and non-textual materials are prepared and learning methods identified. This stage also sees the development of assessment instruments and the retraining of teachers to reskill them. This stage is often a lengthy and intensive process that involves all stakeholders to make various contributions.

6.4.7 Implementation of the IAKS curriculum in schools

When a detailed curriculum plan has been developed, the new curriculum should be trialed with groups of students or in selected schools. The Agriculture Education officer who himself was a curriculum specialist posited that:

> *Any curriculum initiative which is not pilot-tested cannot have its tenability guaranteed. We need to guard against failure of initiatives by trialingg them in selected pilot schools.*

During the trialing, active and experiential teaching methods are applied using learner-centred teaching and learning materials. The teaching and learning materials are evaluated and adjusted as required. When the stakeholders are satisfied that the curriculum is polished after the necessary adjustments have been made, the new curriculum is then delivered on a wider scale to cover all the ten provinces of Zimbabwe. The local farmers, teachers and students are the main stakeholders involved at this stage. Other resource people may also play key roles. For instance, farmers and AGRITEX officers may make important contributions where field practice is involved.

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6.4.8 Evaluation of the programme

Evaluation determines whether the curriculum is producing the expected results. A wide range of stakeholders is involved in the evaluation process. For instance, students who were taught the curriculum, lecturers and local farmers who taught the programme and other participants are involved in the evaluation of the programme to determine its impact. The evaluation helps in developing and refining the monitoring and evaluation system with respect to stakeholder participation, teacher performance and student performance. Hence, representing other research participants one AGRITEX Officer who was also a curricularist posited that:

Once implementation is over, the curriculum should be evaluated to determine its worth with respect to the achievement of the learning outcomes in order to make adjustments as appropriate.

Local farmer J who was also a local councillor made the observation that:

Evaluation of the curriculum would help the stakeholders in deciding whether particular aspects of the curriculum should be adopted, altered or eliminated.

The overall motive of evaluation is to determine whether the curriculum is producing the expected results. Obanya (1987) contends that monitoring and evaluation must be carried out at every stage of the curriculum development process to determine deficiencies and take corrective action.

6.5 CHAPTER SUMMARY

A careful comparison of IAKS content contained in the ZSSAC and those that existed in the studied communities revealed a huge gap of rich IAKS components that still need to be included in the ZSSAC. Those that still need to be included are shown in Tables 6.1 and 6.2. These IAKS aspects are part of those that have stood the test of time and still continue to be practised despite colonial and neo-colonial subjugation. Their resilience is an indication that they are good farming practices which should add to those that are currently included in the ZSSAC.

The research designed a Participatory Curriculum Development model that would be used to incorporate those aspects of IAKS that still need to be included in the ZSSAC. Identification of relevant stakeholders would be followed by analysing aspects of IAKS currently included in the ZSSAC. This stage would be followed by investigating aspects of IAKS existing in the community. A comparison of aspects of IAKS currently included in the ZSSAC and those existing in the community may establish a gap of IAKS aspects that still need to be incorporated into the ZSSAC. Then, curriculum frameworks are developed by stating the curriculum aims followed by the development of the general IAKS topics and main areas of content; after which a detailed curriculum is planned. This is done by developing specific learning outcomes for the new look curriculum, followed by the development of detailed curriculum content, learning materials, identification of learning methods, development of assessment instruments and the retraining of teachers to reskill them.The detailed curriculum is trialed with groups of students or in selected schools, evaluated and relevant adjustments made. The polished curriculum is then implemented on a larger scale in all schools. Lastly, the curriculum is evaluated to determine whether it is producing the expected results.

CHAPTER SEVEN: BENEFITS AND CHALLENGES OF INCLUDING ASPECTS OF INDIGENOUS AGRICULTURAL KNOWLEDGE SYSTEMS IN THE ZIMBABWE SECONDARY SCHOOL AGRICULTURE CURRICULUM

7.1 INTRODUCTION

The previous chapter analysed data to identify components of IAKS that could be included in the ZSSAC and the approaches that could be adopted for their effective inclusion in the curriculum in question. This chapter concerns itself with analysing data to establish the benefits of including IAKS in the ZSSAC and to examine the challenges schools may face when including IAKS in the same curriculum. Hence, the chapter intends to answer the two sub-research questions: 'What are the possible benefits of including IAKS components in the school curriculum?' and 'What challenges may schools and colleges face during the inclusion process respectively.

Data analysed were from interviews with agriculture educators namely, six (6) agriculture teachers, two (2) Agriculture Education Officers, 2 university Agriculture lecturers, 3 college Agriculture lecturers and two (2) AGRITEX officers. Data were also analysed from the responses of twelve (12) interviewed local farmers, six (6) each from the catchment areas of the two high schools.

7.2 BENEFITS OF INCLUDING IAKS IN THE ZSSAC

7.2.1 Contextual relevance of agricultural education

Asked to state the benefits of including IAKS in the ZSSAC, one of the agriculture teachers, Agriculture Teacher E, who participated in the study opined that:

> *If something that is taught at school is what is practised at home, it makes a lot of sense to the students. It's a question of doing things that make a lot of cultural sense to the learners.*

The same benefit was raised by most other participants. I infer that what they meant was that infusion of IAKS into the ZSSAC would result in contextually relevant and meaningful learning by students. The inclusion of IAKS aspects (knowledge and practices) should proffer contextual relevance through tapping into students' lived experiences. That way an experiential continuum will be realised whereby students relate home experiences with what they learn at school. The teaching and learning process would proceed from the known to the unknown, from the concrete to the abstract (Ozmon and Craver, 2011; Ornstein and Levine, 2011). Lemke (2001) underscores that student learning depends on community beliefs, acceptable identities and the consequences for a student's life inside and outside the classroom.

In his theory of pragmatism, John Dewey propounds that students must be subjected to an experiential continuum between the home and the school environments for meaningful learning to take place (Dewey, 1916). What students learn at school should be related to their home experiences if learning is to be meaningful. This would give learners opportunity for recognition of prior, home-grown, local knowledge and experiences that yield intrinsic motivation, critical thinking, independent decision making, cultural empowerment and meaningful learning. Hence, a focus on teaching agriculture should develop connections between what is taught at school and the everyday life of the pupils (Engler and Kretzer, 2014). This would lead to a higher involvement and commitment of pupils and their parents and a kind of ownership of the educational process. The concepts students learn at school should thus be related to the learners lived experiences as foreign knowledge itself is not in sync with students' home backgrounds.

7.2.2 Nutrition, food security and sovereignty

Most agriculture educators to local farmers claimed that students learn a variety of nutritious and healthy foods got from the Indigenous crops and livestock. The variety of the crops grown and livestock reared are for feeding the family with surplus for sale. Through musanganiswa (mixed cropping) and storage of food during the dry season for later consumption, the communities were also ensured of food security and food sovereignty. Local Farmer G supported this assertion when he said the following:

The inclusion of IAKS aspects in the curriculum would truly work towards promoting food security and food sovereignty.

In Africa, IAKS contribute to food security through post-harvest techniques used by local communities. These food storage and food preservation practices are measures by local communities of ensuring that the household does not suffer from food shortage during any part of the year. However, due to Zimbabwe's colonial past, such knowledge has been treated as inferior to modern food preservation and storage technologies. Mafongoya and Ajayi (2017) observe that IK promotes food security and poverty alleviation through production and preservation of Indigenous food. They go on to give an example of the Masaai pastoralists in Kenya who rely on a system of land use and management that has assured them a stable livelihood for generations, enabling them to optimise their utilisation of rangeland resources for maximum meat and milk production. Similarly, Pichop et al. (2014) opine that these cultivated food crops and wild African fruits have the potential for overcoming malnutrition, boosting food security, fostering rural development and sustainable land care not only in Africa but at a global level.

To ensure food security, vegetables such as leaves of nyemba (cowpea), nyevhe (African spider flower), and bonongwe (poor man's spinach) are sundried or parboiled first then sun-dried for some days prior to storage. These practices and other post-harvest techniques enable Zimbabwean communities to be food secure and sovereign. In Zimbabwe, the Zunde Ramambo (Isipahla Senkosi) concept, commonly practiced by the Shona and Ndebele speaking people, respectively (Risiro *et al*. 2012), has been revived to ensure adequacy of food especially to the vulnerable members of the community (Stathers *et al*. 2000). The practice ensures food security to vulnerable groups in society such as orphans, the handicapped, widows and those with chronic illnesses.

Linked to food security and sovereignty was the provision of nutrients from crops and livestock to the diet. The crops and livestock are highly nutritious and even potentially valuable in global trade, making them a great ally for a Zero Hunger future (FAO, 2019). For instance, mhunga (pearl millet) and zviyo (rapoko) are the only tsanga (cereals) rich in the amino acid methionine (FAO, 2019; National Research Council, 2006). Besides being nutritious mapfunde (sorghum), though Indigenous to Africa, has proved to be an excellent of locomotive fuel in the United States of America where it is widely grown (National Research Council, 2006; Durst and Bayasgalanbat, 2014).

7.2.3 Fodder

The participants indicated that some of the crops provide fodder for livestock. This is captured in a contribution of Local Farmer L who said:

> *The straws of tsanga (cereals) and sheaves of nyimo (Bambara nuts), nzungu (groundnuts) and nyemba (cowpeas) provide special fodder to their livestock namely mombe (cattle), makwai (sheep), mbudzi (goats) and mbongoro (donkeys), especially during the dry season when grazing is less abundant and low in nutrients.*

According to Tabuti (2009) and Kaholongo (2016) there are seasonal variations in fodder availability. Tabuti (2009) and Kaholongo (2016) further note that fodder is abundant in the wet season, but becomes scarce in the dry season, thereby causing the livestock to attain a healthy look and gain weight in the wet season and lose weight in the dry season.

7.2.4 Indigenous sustainable agriculture

The interviewed participants noted the sustainability of IAKS, especially to communal and small scale farmers. They concurred that IAKS practises are cheaper in terms of production that even the poor can afford. In addition, the IAKS resources were said to be locally available, hence easily accessible. For instance, Local Farmer F held the sentiment that:

> *Ivhu repachuru (anthill soil), dota (ash) and mufudze (organic manures) like durunhuru (compost) and murakwani (leaf mould) are readily available and cheap..*

Participants lamented the high cost of machinery like tomato harvesters, groundnut shakers and many other tractor drawn implements that were currently used, especially in commercial farms, at the expense of Indigenous management practices crops and livestock. This was appropriately captured by AGRITEX Officer B when he said:

Like the question of mechanization we may want to use those advanced machinery but we don't have money then we use the cheap Indigenous methods

Indigenous crops and livestock are locally adapted. They adapt to the harsh conditions of Africa as opposed to exotic crops and animals. Hence, they offer tolerance against drought, diseases and parasites. They are also considered easy to manage. The study found out that the local communities were more into the use of Indigenous knowledge than Western farming practices. The participating local farmers attributed this, not only to lack of capital to mechanise, but also to the sustainability of the IAKS. This applies especially to communal and small scale farmers who lack capital to mechanise (FAO, 2015; Rankoana, 2017; Chaudhry, 2011). However, even the commercial farmers use lots of Indigenous knowledge in their day to day farming practices. Several authors (Sakayombo, 2014; Rankoana, 2017; UNESCO 2006, Chaudhry, 2011; Otzen, 1995) observe that IAKS are affordable because the resources and knowledge are available locally, and easy to manage and are drought, disease and parasite resistant.

In the study, Conservation Agriculture evolved the commonest Indigenous tillage practices. Such jengetedzo (conservation tillage) practices like zero and minimum tillage, mbesa dzewareware (cover cropping), zvemufudze (organic farming), all which are based on agroecological principles, featured in participants responses. These techniques promote soil and moisture conservation (Hoffner, 2018; London 1998; Mollison and Slay, 1991; Pilarski, 1994) and improve the nutrient status of the soil (Hoffner, 2018; Mollison and Slay, 1991) and reduce soil erosion.

Participants concurred that IAKS practices pose no destruction to the ecosystem since there is no use of chemical sprays and inorganic fertilisers which have a toxic effect on the ecosystem. The non-toxic nature of Indigenous farming practices is an agroecological principle. In a multi-country study on the application and use of Indigenous knowledge in environmental conservation and disaster management, the United Nations Environmental Programme found that Kenya, South Africa, Swaziland and Tanzania "… use a variety of innovative, effective, and in some cases unique Indigenous knowledge approaches to environmental conservation" (United Nations Environmental Programme, 2008:33) which drive development.

7.2.5 IAKS as cultural heritage

According to most interviewees, IAKS are a cultural heritage to be passed on from generation to generation. They claimed that inclusion of IAKS in the curriculum would familiarise the students with the 'whys' and 'hows' of the agricultural operations of their forefathers. That way the inclusion was found to be very acceptable as it fostered cultural preservation. There are no people without a culture. Hence, there is need to maintain our sound cultural practices. Generally, the participants opined that, while they got acculturated to Western farming methods, their own IAKS slowly disappeared due to colonialism and neo-colonialism. IAKS like all IKS are a cultural heritage of a people. One Agriculture educator revealed that:

> *Inclusion of IAKS aspects into the ZSSAC would be one way of spearheading cultural preservation of Zimbabwe*.

It would enable Indigenous Zimbabweans to reclaim, revitalise and renew their cultural identity that has been denigrated, marginalised, despised or destroyed by colonialism (Hammersmith, 2007). That way the unhealthy imbalances, distortion, trivialisation and neglect of IKS inflicted by Western education and governance would be uncovered and redeemed. The learners, the future generations, will be empowered since IAKS are a resource that provides a firm foundation for sustainable and environmentally sound approaches to agriculture.

According to Anggreni *(*2017), agriculture is associated with many aspects of life. In other words, agriculture has a close linkage with culture. Indigenous farming knowledge and practices thus become part of the way of life of Indigenous peoples. Customs, rituals, myths and sacred festivals concerning particular crops and livestock provide a close link between agriculture and a people's culture. Equally interesting is the intimate relationship between the natural physical environment, in which a certain type of agriculture has developed, and the way of life, ethical values and social structures of the people (Leander, 1995). Sinjal (2006) cites the Greek philosopher and historian, Xenophon (427-355 BC), who opined that Agriculture is the mother of all other cultures. That is why agriculture is important in maintaining cultural heritage and that cultural heritage is influenced by active farming (Daugstad, Rønningen and Skar, 2006). Without agriculture a people would not have a culture. For this reason, the inclusion of IAKS aspects into the ZSSAC is more than a requirement that is long overdue.

Mawere (2014) contends that colonisation destroyed African cultures and Indigenous Knowledges resulting in Africa depending on Western Knowledge for development. Mawere's point is that reliance on Western knowledge alone will not lead to sustainable progress for Africa. Rather, Africa needs to revive her Indigenous cultures, knowledges and practices to guarantee her growth in a globalised world. Sarpong (2002) emphasises that knowledge should not be divorced from the cultural context it emanated from because a people's culture shapes a people's consciousness. Similarly, Asante (1987) argues that all knowledge emanates from a cultural background, as such, it is inappropriate to place any form of knowledge above the other. Specifically, Asante (1987) insists that all cultures and the knowledge systems arising from them should be respected. Fafunwa (1994) emphasises that education is how a people or society transmit their culture to upcoming generations. Infusing of IAKS aspects into the ZSSAC would make learners acquire true knowledge based on their cultural practices thereby preserving Zimbabwe's agricultural culture would be preserved.

The participants heralded the furtherance of cultural practices like growing crops and keeping livestock for nyikadzimu (spiritual) purposes, the use of cattle to pay roora (lobola) inclusive of mombe youmai (a heifer for the bride's mother), a married daughter being given planting seeds of crops like nzungu (groundnut), nyimo (bambara nut), mhunga (pearl millet), mapfunde (sorghum), nyemba (cowpeas), manwiwa (melons), manhanga (pumpkin) and zvipfuyo (livestock) like huku (chickens) and mbudzi (goats) to rear and start a new married life. One local farmer, Local Farmer E, from Makonde mentioned the practice of barter trade as captured below:

> *Ane nzungu dzakawanda tochinjana ndomupawo mbudzi* (meaning ''One with a good groundnut harvest would barter trade it for a goat'').

The agriculture educators were generally of the opinion that inclusion of IAKS aspects into the curriculum would bring old proven principles into the Western agriculture curriculum, thereby making students richer in agricultural knowledge.

7.2.6 Ecological agriculture

Both Agriculture educators and AGRITEX officers stated that use of chemical sprays and inorganic fertilisers has a toxic effect on the ecosystem. This destruction of the ecosystem by agricultural chemicals is well spelt in Rachel Carson's 1962 book *Silent Spring*. In the book, Carson discusses the implications of using chemicals like DDT to all life. Griswold (2012) propounds that these dangerous chemicals are broken down into dangerous poisons which are then passed through the food chain leaving plant, animal and human life at risk of disease, destroying the harmony in the ecosystem and creating a decline in the Earth's natural defences against insect populations. In addition, massive spraying with these chemicals causes insects to build resistance to chemical sprays leading to insects increasing to epidemic proportions. Rachel Carson's observation forced the banning of DDT and other pesticides and insecticides and spurred revolutionary changes in the laws affecting our air, land and water (Lawlor, 2012). The problem can only be overcome by spraying maguchu (herbal concoctions) against pests and practising organic farming.

7.2.7 Climate change adaptation

According to the interviewed agriculture educators, IAKS promoted adaptation of agriculture systems to climate change. Macholdt and Honermeier (2016) underscore that Agriculture has been defined as the most weather-dependent human activity and that most agriculture production decisions are either directly or indirectly affected by this factor. Kumar (2014) adds that no person, country or region of the world is immune to climatic change and that it is now widely accepted that earth's climate tends to change over time due to natural causes and also partly due to human activities. There is broad scientific agreement that climate change is happening. There is also increasing evidence that climate change will play a significant role in shaping agricultural production (Ash et al., 2007; Wheeler and Kay, 2010). It is worth noting that many highly respected IK holders in Indigenous communities are subsistence farmers with in-depth knowledge of the weather, seasons, agriculture, environment including droughts and floods, identification of soils and nutrients, seeds, plants and animal diversity and they maintain intricate relationships with their environment (Alcock, 2010).

Basing on the above facts Indigenous communities have evolved many Indigenous agricultural coping strategies that are helping local populations to face this brunt of climate change. Since environmental change may be as old as the society itself, Indigenous Africans had lots of climate adaptive coping strategies which they applied with mixed success (Makondo and Thomas, 2018). These coping strategies are visible in the daily crop and livestock production activities. Some of the coping strategies encompass changing farm production practices such as planting and harvesting times, crop protection methods, tillage practices, as well as crop diversity and variety choices (Eitzinger et al., 2009; Smit and Skinner, 2002; Macholdt and Honermeier, 2016), weather forecasting (Svotwa, Manyanhaire and Makanyire, 2007). From the foregoing, many scholars of environmental change strongly argue for the inclusion of Indigenous knowledge into climate change policies and implementation (Ross, 2009; Maldonado et al., 2016; Etchart, 2017). According to Mafongoya and Ajayi (2017) traditionally, rural subsistence farmers have relied on IK to understand weather and climate patterns in selecting crops and managing farming operations. Integration of unique and specific aspects of agricultural Indigenous knowledge systems into the ZSSAC could be one of the best ways to promote effective and sustainable implementation of climate change adaptation strategies among target Indigenous communities. These Indigenous coping strategies, if incorporated in the ZSSAC will promote food security sovereignty.

AGRITEX Officer C mentioned that:

> *Incorporation of IAKS in the ZSSAC was viewed as a way of bringing back the old previously marginalised Indigenous farming principles, such as jengetedzo (conservation tillage), agroforestry and multiple cropping, into the world of agriculture.*

It is worth noting that these same Indigenous innovative farming practices which were denigrated and overtaken by colonial events are proving to be worth practising. This could be why the World Bank (1998) has consistently valued and embraced IKS, stating that it should form part of Africa’s development agenda (Seroto, 2014:429). Of significance is also the fact that the NGOs are coming back with the same Indigenous technologies they denigrated rebranding them as “new technologies’. Such include conservation agriculture, agroforestry, permaculture, organic agriculture, terracing and so forth. There is now a growing consensus that some of the solutions to problems that currently plague African societies and communities must proceed from understanding the dynamics within the local context (Owuor, 2006).

7.3 CHALLENGES OF INTEGRATING IAKS CONTENT IN THE SCHOOL CURRICULUM

Ideally, no knowledge claim should be segregated to the extent that it plays second fiddle to another as was the case with IAKS aspects in this study due to the hegemony of Western knowledge and practice in the ZSSAC. The interplay between different knowledges is one reason for incorporating IKS into school curricula (Dei, 2000). According to Ogunniyi's The Contiguity Argumentation Theory (Ogunniyi, 2007) Indigenous knowledge systems and Western science can be harmonised in the ZSSAC. Dei (2011) supports the co-existence of IKS and Western knowledge in the curriculum in that each claim would make up for the inadequacies of the other. That way the current stance of according Western agricultural practices as the dominant and universal agricultural knowledge would be overturned. De Lissovoy (2010: 279) underscores that ''decolonial theory is concerned with confronting, challenging, and undoing the dominative and assimilative forces of colonialism as a historical and contemporary process, and the cultural and epistemological Eurocentrism that underwrites it." In fact, there is evidence of the co-existence of IK and Western science. Western science has, itself, grown by cannibalising Indigenous knowledges across different disciplines (Hountondji, 2002). The coexistence of plural knowledge systems and their complementarity in school agriculture curricula should be emphasised for reciprocal valorisation (Odora-Hoppers, 2000a; Hountondji, 2002).

Muchenje and Goronga (2015) observe that in Zimbabwe, Agriculture is a subject that is offered in primary and secondary schools and tertiary institutions. They further advance that a reformed education curriculum should emphasise the inclusion of Indigenous knowledge systems with regard to agricultural production. Shizha (2013) argues that in Sub-Saharan Africa postcolonial school knowledge continues to mirror colonial residues and these continue to imprison the actions, feelings, attitudes, beliefs and the conceptual capabilities of Indigenous people. Muchenje and Goronga (2015) and Shizha (2015) concur that in order to meet these challenges, the school curriculum needs to be reformed so that Indigenous knowledge systems aspects feature prominently across the curriculum in schools and tertiary institutions. This reformation should extend to the agriculture curricula of both the primary and tertiary levels and covering all subject disciplines. That incorporation of IK content in all curricula across disciplines and levels would generate local solutions to local problems as the curricula become more relevant and meaningful.

Research participants indicated the question of attitude as the biggest challenge of including IAKS into the ZSSAC. They stated that both the teachers and the communities were now used to Western farming methods which had been forced on the Indigenous people by the colonialists. University lecturer C made the observation that:

> *Some of us were made to think that anything brought by whites, that Western farming practices were superior to our own Indigenous farming practices. They attribute this to the fact that the previous generation went through the colonial education mill which regarded anything Indigenous as inferior, outdated and uncivilised.*

This belief could result in them resisting inclusion of IAKS in the ZSSAC. The interviewees were, thus, of the view that this unacceptability of IAKS was exacerbated by the top hierarchy decision and policy makers as well as implementers in the education system who already despised IAKS. Sakayombo (2014) views the lack of respect for IAKS as influenced by an inferiority complex entrenched by colonisation. Hence, Western farming methods that were enforced on Indigenous peoples by the colonialists made Indigenous peoples develop an inferiority complex as they regarded everything Western as superior. The continued exposure of Indigenous students to Western education is making these students think less of their African Indigenous knowledge. Hence, this negative perception by the younger generation of Indigenous students towards IAKS needs to be reversed through awareness activities and the inclusion of IAKS aspects in the curriculum to enable them to take pride in their own Indigenous cultures, knowledges and practices.

Most governments in Africa erroneously feel that development lies in the extensive use of Western forms of knowledge (Alebiosu, 2005). Their Westernised education systems promote the belief in the inadequacy of IKS and the superiority of Western technology thereby allowing racist attitudes to erode cultural pride, to the detriment of reducing the interest of youth in learning IK (Branden, 2008). In formal agriculture, Western farming knowledge is regarded highly due to the effects of colonial and neo-colonial subjugation. That way, Indigenous peoples themselves despise IAKS as they view IKS as inferior to Western knowledge. IKS continue to suffer the same fate they suffered in the colonial period. Hence, governments in Africa and other Third World countries need to promote the use of IKS. Education is one such institution that could be used to promote use of IKS in general and IAKS in particular.

To make matters worse, African Indigenous knowledge is often disregarded, not only by Western scholars, but also by African scholars (Nsamenang, 1995). Defining IKS from a positivist perspective of Western scholars poses one of the prime challenges of harmonising IKS with Western farming practices in the curriculum (Seroto, 2014). Western scholars regard IKS as being unscientific. They view Indigenous people as backward and not contributing to the development of scientific knowledge (Budden, 2014). As alluded to, Indigenous people have, through acculturation, sunk into an inferiority complex that perceives their local farming practices as inferior to Western ones. The positivist paradigm also does not embrace multiple knowledge systems. IAKS has thus become marginalised. At this juncture it is worth remarking that both Western and Indigenous theorists should avoid placing the two knowledge systems as oppositional binaries. Seroto (2014: 430) maintains that "The call for the existence of different kinds of knowledge in academia, especially in Africa, is something that can no longer be swept under the carpet". Asante (1987) adds that Western thoughts are inadequate to explain all the ways of knowing because it is based on a particular cultural setting which does not have generalised applicability. In other words, one size does not fit all in terms of knowledge.

Agriculture educators, namely agriculture teachers and AGRITEX officers, also learnt Western farming methods at college and university. Aspects of IAKS were not in their Agriculture curriculum when they were students. This could make them to not readily accept the innovation to include IAKS content in the ZSSAC. In addition, the participating agriculture educators stated that the inclusion of IAKS content in the curriculum is currently dominated by Western farming practices, would deskill them hence the need to be reskilled through training programmes. One Agriculture education officer went on to opine that there might be a tendency by teachers to remain in that old comfort zone of teaching Western farming methods if they are not retrained. Bishop (1985, 1995) and Gatawa (1990) observe that innovation begets incompetence. Reskilling would include workshops, seminars and other forms of training courses on IAKS. The curriculum of tertiary agriculture institutions also should be revised so that it caters for the new look school curriculum. Sakayombo (2014) underscores the lack of IAKS content among teachers who are the implementers of the curriculum concepts in the proposed curriculum. Teachers are likened to assault troops. The more trained and experienced they are, the sweeter the victory. Similarly, if they are knowledgeable of IAKS (knowledge and practices) they will make a positive and successful implementation of the prospective curriculum innovation. Gatawa (1990) argues that curriculum innovation or renovation requires expertise to avoid the likelihood of the status quo to persist.

Another, but unconvincing, challenge raised by most participants, that could be realised when trying to include IAKS in the ZSSAC was that most Indigenous crops and livestock had not yet had received international recognition and attention from scientists and others interested in helping food production and agriculture. Participants stated that IAKS continue to suffer neglect although they could go a long way in helping humankind. This research does not subscribe to this assertion because if this was true we would not be having any Indigenous crops or Indigenous livestock breeds. Also, the fact that mapfunde (sorghum), an Indigenous African crop, is used to produce fuel in America helps to further refute this assertion. There are many other examples which include processed African foods such as snacks, meal, flour, beverages, liquor, pastries, spices and so forth dominating the markets in the West.

All the same, Sakayombo (2014) underscores that there is limited research on IKS in the subject Agriculture Science in Zambia. Hence IAKS continue to suffer neglect although they could go a long way in helping humankind. For instance, the participants noted in error that most of the crops and livestock have been abandoned in favour of their exotic counterparts in commercial agriculture. This is supported by the National Research Council (2006) who observed that international research efforts have made exotic crops like maize more productive than its Indigenous tsanga (cereal) counterparts, mhunga (pearl millet) and zviyo (rapoko). Pichop et al. (2014) add that lack of investment in research has slowed wider cultivation of Indigenous fruit, vegetables and other crops. Nevertheless, in the communities studied, there are lots of IAK practices which is an indication that the IAKS are not dying.. In addition, the fact that there has been great interest even by white commercial farmers on Indigenous crops and livestock breeds disqualifies the assertion of non-recognition of IAKS. These farmers emphasised Indigenous crop and livestock practices. Kramer (1987) underscores that Master Farmer training at Makoholi under Amory Alvord's extension system tended to support some of the Indigenous farming practices like the cultivation of nyemba ('kaffir' beans/cowpeas), sorghum ('kaffir' corn) and conservation agriculture. In addition, though a few members of the white community may have marginalised some Indigenous crops and livestock, the Indigenous communities continued to rely on them, hence their survival to date.

Agriculture educators expressed the opinion that Indigenous crops and their by-products have low processiability which could pose as a snag to the inclusion of IAKS in the ZSSAC). Yet, their processiability is not low. It has limited commercial processing through neglect, marginalisation and exclusion that is affecting the popularity of ‘some’ Indigenous agricultural products. The potential is still there and needs to be explored through research and innovation (FAO, 2019). Many are highly nutritious, adapted, and even potentially valuable in global trade, making them a great ally for a Zero Hunger future. Experience has shown that Zimbabwe, Botswana and South Africa have processed sorghum meal, and Indigenous herbal teas from moringa *(Moringa oleifera)*, mufandichimuka (*Myrothamnus flabella folius*), muremberembe (*Cassia granitica*) and zumbane (Lippie javanica) which are very popular due to their medicinal properties. In Zambia, South Africa and Mozambique there is processed liquor from mupfura (marula), the Amarula cream. Sour milk, itself an Indigenous product, is a popular relish. Likewise mahewu, an Indigenous beverage, is similarly popular. These foods are even found in supermarkets. The three degree programmes Hospitality and Tourism, Biotechnology, and Food Science being offered at Chinhoyi University of Technology promote the production of Indigenous foods from Indigenous crops and livestock. For instance in Biotechnology, they process mutandabota (a porridge) from baobab and matamba (monkey orange), manyuchi (jam) from nyii (African sweets) and tsvubvu (Smelly-berry fingerleaf), breakfast food from a mixture of nyimo (Bambara nut), nzungu (groundnut), tsanga (cereals) and uchi (honey), chimukuyu (biltong) and, mbudzi (goat) sausages and prosotic fermented sausages from mbudzi (goat) products.

Research participants lamented the lack of literature on IAKS (knowledge and practices) for the successful implementation of the proposed ZSSAC initiative of including Indigenous content into the agriculture curriculum in Zimbabwe. They stated that the current textbooks embrace Western farming practices. Sakayombo (2014) and Pedzisai (2013) found that lack of textual and non-textual materials and other forms of documented literature on IAKS stall harmonisation of IKS and Western knowledge in agriculture curricula. Surprisingly, participants and even the authorities cited above were not aware that there is a lot of research and literature on Indigenous agriculture. What is lacking is application in the curriculum and in agricultural practice. All the same the participants thought the lack of literature was worsened by the fact that the transmission of IAK from one generation to the other relies on oral tradition hence are not recorded (Agrawal 2004; Ilutsik, 2002).
In support one agriculture teacher indicated that:

You see you find in some areas communities practise Indigenous farming methods because they got it from their ancestors who had the knowledge. However they didn't pass it on to the next generation. After all IAKS are not recorded but depend on oral tradition which makes the knowledge easily forgotten.

However, it is not just oral, it is cultural and it is practised in the everyday lives of Indigenous communities. Recording does not only mean writing about something. Hence IAK are documented in the day- to-day practices of the Indigenous people and passed on from generation to generation through practice. Textual documentation is a Western practice on representations in text and written forms. However, documentation is not the only way of conserving Indigenous knowledge. Documentation is a Western practice that has served the purpose of cannibalisation and appropriation of Indigenous knowledges and practices by the west. Documentation has dangers of appropriation of intellectual property that has dogged Indigenous communities. Documentation should be accompanied with rights to the knowledge by Indigenous communities from which it is derived. This study takes note of the loss through translation and the importance of Indigenous ways of transferring knowledge across generations verbally, through practice and through the conservation of Indigenous agrobiodiversity.

It would thus appear that the participants were not aware that documentation was actually taking place. For instance, the Chinhoyi University of Technology Intangible Cultural Heritage project, a UNESCO funded platform, to which the researcher is a member, was currently inventorying some of the Intangible Cultural Heritage including Indigenous foodstuffs of the Korekore tribe in Hurungwe district in Zimbabwe. One would also question how the current overwhelming Indigenous agricultural practices that were observed in the communities under study have been informed or sustained. It is because IKS are passed on from generation to generation, by the elders, a clear indication of capacity to pass them to the next generation. It is only that that capacity has not been utilised in formal education contexts which rely on Western written/textual information.

Those who felt challenged by that lack of documentation should ask themselves the following questions: How are IAK practices and knowledge sustained within Indigenous communities such as those studied? Are oral and practical knowledge not really transferrable? How have IAK survived within communities all along if textual documentation is a necessity? How then is the knowledge sustained within these communities? Consequently the study suggests the need for the inclusion of knowledgeable practising elders as educators and demonstrators/instructors of Indigenous knowledge practices in formal education contexts. The curriculum development process should capitalise on the existence of elders as custodians of IAK thereby realising" that "When a knowledgeable or old person dies, a whole library of indigenous knowledge disappears'' (Sarkhel, 2017: 428).

Some agriculture educators noted that the urge to include IAKS content in the ZSSAC would be greatly stifled by the obtaining poor economic situation of Zimbabwe. In support of the participants, Sakayombo (2014) calls lack of social and financial support from government as a drawback. Matowanyika (1994) refers to this as contemporary neglect of IKS by governments when he posits that this neglect breeds lack of respect for IKS by the school and the community. This is not true in community contexts that are actually practising it. However this knowledge is, in actual fact, more appropriate during such periods as a source of food security and sovereignty because IAKS practices are not costly.

Research interviewees in tertiary institutions felt IAKS were suited to communal and small-scale agriculture hence could not be promoted for commercial farming. One of Deputy Education Directors opined that commercial farming needed mechanisation. However, there are lots of instances where even under commercial farming IAKS function. DeWalt, (1994:123) posits that "Scientific knowledge systems have received increasing criticism within the social science literature while Indigenous knowledge systems are often over-optimistically presented as viable alternative ways of knowing". For instance, it would be sustainable for commercial farmers to use Indigenous methods of controlling diseases and pests of crops and livestock (Reintjies, Haverkort and Waters-Bayer, 1993). DeWalt (1994) reports that commercial farmers set aside some areas for mixed cropping, practise organic farming and mixed farming, and give their cattle stover or sheaves of tsanga (cereals) and legumes as supplementary feeding. A study by Akullo et al. (2007) states that farmers use millet and maize as food supplements for hens to encourage the hens to lay more eggs and these eggs are removed regularly so that the eggs increase in number. Akullo et al.(2007) further assert that many commercial farmers prefer to plant root crops in plots that originally had tobacco to specifically control pests, introduce black ants into sweet potatoes fields to eat the caterpillars, use soil characteristics and vegetation (trees and weed types) as soil fertility indicators and practise early plating to allow crops to receive enough rainfall and reduce incidences of pests and diseases. Pedzisai (2013) observed that all categories of farmers use mutohwe (*Azanza gackeana*) leaves to induce rupturing of the retained placenta of female ruminants instead of the expensive uterine pessaries. A study by Akullo et al. (2007) revealed that IAKS are used by all farmer categories including commercial farmers.

7.5 CHAPTER SUMMARY

The data analysed in this chapter revealed that inclusion of IAKS content in ZSSAC has many benefits to the learner and the Zimbabwean community at large. IAKS content provide contextual relevance to the learning encounters as students would connect with their lived experiences at home. This would preserve the country's heritage since what the students learn will be in sync with what is obtaining in their communities. Their learning experiences would therefore not be alien. Such Indigenous agricultural experiences would lead to solving their communities' social and economic problems such as nutrition, food security and sovereignty, as well as agricultural sustainability. However, the endeavour to include IAKS content in the ZSSAC would meet many challenges chief among them is its unacceptability due to the inferiority complex amongst decision makers and policy makers as well as agricultural educators who consider Western agricultural systems to be superior. Moreover the inclusion should ensure stakeholder involvement and rigorous in-servicing of the teachers so that they gear up for the new curriculum initiative.

CHAPTER EIGHT: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

This chapter concludes this study by providing summative perspectives based on the principal findings of the study from which conclusions are drawn and recommendations made. The chapter also discusses the contribution of the study to new knowledge. Finally, it provides insight into the limitations of the study and presents recommendations for further research.

8.2 BRIEF SUMMARY OF THE STUDY

As indicated in Chapter One, this study set out to explore IAKS content (knowledge and practices) in the ZSSAC with a view of identifying its current representation as well as prospects and opportunities for its inclusion in the curriculum. This was done by analysing components of IAKS that were currently included in the ZSSAC before investigating those IAKS aspects that still existed within the communities studied. A gap was identified from the comparison of IAKS content currently included in the ZSSAC and those aspects that existed in the community, resulting in the study suggesting those components of IAKS that still needed to be included in the ZSSAC. The study then proposed approaches for the effective inclusion of IAKS content in the ZSSAC before establishing the benefits and challenges of their inclusion in the curriculum in question.

This Interpretivist Indigenous research adopted a multiple case study design comprising five research sites in order to examine the relationships between the modern institutions and the Indigenous communities they work with. These different institutions, modern agricultural education institutions and Indigenous communities, are subunits which form a system whose parts are interrelated. This study considered the interplay between modern agricultural education institutions and local communities’ agriculture practices with regard to the inclusion of IAKS in the ZSSAC. The cases included two high schools, one in Mashonaland West and the other in the Midlands, and their immediate communities, and three tertiary institutions: a university that teaches agriculture, an agricultural college and a teacher training college that trains agriculture teachers.

The research methodology was underpinned by Decoloniality as the meta-theory which provided the analytical lens for the study. The theoretical framework informed the choice and use of one-on-one, semi-structured in-depth Interviews with 6 Agriculture teachers; 3 from each of the participating high schools, 5 lecturers in tertiary institutions, 2 agriculture extension workers and 12 local farmers; 6 from each of the two communities surrounding the participating high schools; on-the-spot observation of farming activities as practised at both schools and by the local farmers from the communities in schools' immediate catchment areas; and document analysis of the Zimbabwe Agriculture policy, the Zimbabwe IKS policy and the National Agriculture syllabi (curricula) for secondary schools and tertiary institutions to deduce the intended and transacted curriculum on IAKS. Document analysis was also extended to include Agriculture teachers' schemes of work, students' written work and past examination papers to explore the transacted curriculum with respect to integration of IAKS in ZSSAC.

Intensity sampling was used to come up with the study participants. Intensity sampling is a purposive sampling technique whereby participants are included in the study on the basis of having rich information and experiences that manifest the phenomena intensely (Creswell, 2012). The 16 participants who were selected through use of Intensity sampling included:

- The six (6) Agriculture teachers; 3 each at the two selected high schools,
- Two Provincial Agriculture Education Officers; one each for Midlands and Mashonaland West Provinces,
- Four local Agriculture Extension (AGRITEX) Officers, 2 per community surrounding the two high schools,
- The Director- Agriculture Education and Training within the Ministry of Agriculture,
- Five (5) Agriculture lecturers in Tertiary Institutions: two from a university (one crop and another animal specialist), two from an agricultural college (one crop specialist and one animal specialist), and one from a teacher training college.

The snowball sampling technique was used to select the twelve local farmers, six each from the catchment areas of the two participating high schools, as interviewees. In the snowball sampling technique, the first farmer participant helped the researcher to identify the next potential farmer participant who fitted in with my study. This method of requesting referrals was repeated until the six local farmers from the catchment areas of each of the two high schools were identified.

Generally, the study found out that while the communities had IAKS (knowledge and practices) that had stood the test of time despite colonial and neo-colonial subjugation, there was surprisingly a serious dearth of IAKS content in the ZSSAC. The dearth was due to lack of relevant policies on IAKS developed by the policy makers in the Zimbabwean government. This lack of properly laid out policies, if any, resulted in lack of coordination and discord between the institutions, namely policy makers, modern agricultural education institutions (universities that teach agriculture, agriculture colleges and agriculture teacher training college), high schools that teach agriculture and local communities, towards the inclusion of IAKS content in the curriculum, leading to each institution doing its own thing. Hence, there is need to carry out necessary research on IAKS, engage stakeholders through consultations as well as conducting awareness campaigns and training workshops to develop a draft secondary school agriculture curriculum package that has IAKS content before pilot testing prior to its nationwide institutionalisation. The benefits of incorporating more IAKS in the ZSSAC were that apart from the practices being sustainable, they would gainfully ensure student learning taps into their lived experiences. Chief among the challenges schools would face included acceptability of IAKS by the communities especially among the young generation and in-servicing the teachers to reskill them in line with the new initiative.

The study would contribute to new knowledge by initiating the inclusion of resilient IAKS content into the Western knowledge dominated ZSSAC, thereby promoting contextually relevant and sustainable home grown Indigenous agricultural practices. Such an inclusion would, in line with Decoloniality, challenge the dominant Western knowledge view by advocating for the co-existence of plural epistemologies in curriculum practice. The study also considered the extend of the possible interplay between schools and local communities' agriculture practices with regard to exploring the sustainability of such an endeavour.

This chapter presents a summary of the findings, conclusions, recommendations and actions that should be taken with regard to the inclusion of IAKS content in the ZSSAC. It also presents some critical reflections on the limitations of the study. Finally, the study makes some recommendations for further research.

8.3 SUMMATIVE PERSPECTIVES

The summative perspectives do not intend to repeat the main findings of the study related to an analysis of Indigenous agricultural knowledge systems in the Zimbabwe secondary school agriculture curriculum: prospects and opportunities. Rather, the summative perspectives derive from principal findings of the study, organised on a research question by research question basis, and draw conclusions from the findings. They are, therefore, oriented towards broader insights from the study.

8.3.1 Components of IAKS currently included in the Zimbabwe Secondary School Agriculture curriculum

There was very little coverage of IAKS aspects in the analysed documents. These documents included the Zimbabwe Agriculture Investment Plan (ZAIP) (2013–2017) (Zimbabwe Government 2011) in conjunction with the Comprehensive Agricultural Policy Framework (2012-2032), The Zimbabwe IKS policy as spelt out by the Second Science, Technology and Innovation Policy of Zimbabwe (March 2012), National Agriculture syllabi, Agriculture teachers' Schemes of Work and students' written work. Ideally, the policy documents and the agriculture syllabi exposed lack of commitment on the part of the government as regards incorporation of IAKS aspects in school curricula. In actual fact, Zimbabwe has no IKS policy. However, the available documents paid lip service to Indigenous farming practices. This was exacerbated by discord and lack of interplay among the policy makers, universities, agriculture colleges, extension services, schools and the local Indigenous communities. The content and learning activities showed lack of uniformity and standardisation hence the need by Zimbabwe to develop a revised agricultural policy which clearly addresses IKS issues. There was, thus, need for a centralised IKS policy by government to promote a harmonious interplay between the schools and the Indigenous communities they work with for the production of a robust ZSSAC package.

The teaching of a tsanga (cereal) crop of major importance in local agriculture, mapfunde (sorghum) was optional in the former O' level syllabus. Surprisingly, tsanga (cereal) crops are missing in the new 'O' level syllabus yet Zimbabwe relies on them as staple food. Indigenous mombe (cattle), makwai (sheep), mbudzi (goats), mabhiza (horses), mbongoro (donkeys), nguruve (pigs) and shiri dzemumusha (poultry) appear in the new 'O' level syllabus but the management practices for rearing them are exotic.

With respect to land tenure systems, while murimo mumwechete (communal farming) and shifting cultivation appear in the syllabus, they are, however, taught with a colonial lens that belittles and colonises them.

While the previous syllabus contained aspects of the importance of local timber species, the new ‘O’ level syllabus only teaches students identification of Indigenous trees in their locality using common names only.

Both the previous and the new ‘O’ level syllabi have mufudze (organic manures) such as girinhi mufudze (green manuring), compost and farmyard manure including the importance of incorporating them. These are not the only methods of applying organic matter to the soil.

The previous and the new ‘O’ level syllabi contain Conservation agriculture. The approach to the teaching of Conservation Agriculture needs to be decolonised. In addition, the two syllabi recommend kuisa bvute (shading), kuisa pevhu (mulching), kuchera makomba (potholing), manuring, matai (tie ridging), kudiridzira (watering), growing drought tolerant plants, cover crops, wind breaks and jengetedzo (conservation tillage) as measures for conserving moisture.

Mafuro mamwechete (communal grazing) appears in the previous syllabus but was removed from the new ‘O’ level syllabus. Added to the new syllabus is the topic ‘Indigenous knowledge systems in the management of natural resources’ such as natural control of wildlife populations.

In summing up, though there are very few aspects of IAKS in both the previous and the new syllabi, the Advanced level Agriculture syllabus contains virtually no aspects of IAKS. This syllabus is exclusively Western.

8.3.1 IAKS that existed within the participating communities

Land use in the communities is composed of the main field, homestead field, gardens and rangeland. The community grows the tsanga (cereal) crops mhunga (pearl millet), zviyo (rapoko), mapfunde (sorghum), mupunga (African rice) and ipwa (sweet reed) which are Indigenous to Zimbabwe. Traditional field crops grown by the communities are the tsanga (cereal) crop, chibage (maize) and the legume, nzungu (groundnut). The other field crops grown by the communities are nyimo (Bambara nut), nyemba (cowpeas), the oil seed crop runinga (sesame) and the tuber crop mbambaira (sweet potato). All these crops are Indigenous except maize and groundnut which are traditional crops.

There are several Indigenous vegetables in the communities studied. These include manhanga (pumpkin), munganjo (marrow), makavhu (squash), manwiwa (watermelon), mushamba (horned melon), magaka (cucumber), nyemba (cowpea), marenge or chiribwiriribwi (Senecio erubescens), derere (Jew's Mallow), nyevhe (African Spider Flower), mutsvandimire (spindle pod), bonongwe (Poor man's spinach). However, marenge or chiribwiriribwi (Senecio erubescens) was becoming extinct in the areas studied maybe due to prolonged droughts. It is one of the crops that favours wet conditions hence, it predominantly grows on river banks. However, the fact that the vegetable is becoming extinct in the communities studied does not mean that it is no longer available in Zimbabwe as a whole. In addition some participants could not remember Indigenous storage facilities such as murindi (storage pits) for tubers opting for exotic ones.

Land preparation involves clearing of land wherein selective cutting of miti (trees) in muminda (arable land) is done. The males cut trees and shrubs and burn them into dota (ash). The burning is usually a communal job to prevent kupisira (veldfires). The communities practise Conservation Agriculture in the form of zero and minimum tillage, mbesa dzewareware (cover cropping), kuchera makomba (potholing), kuisa bvute (shading), matai (tie ridging), kuisa pevhu (mulching) and use of dziviriramhepo (windbreak), kudyara muvhu rakaoma (dry planting), utilisation of matoro (wetlands) and kuwundukura (winter ploughing).

Crops are planted by kukusha (broadcasting) seed and covering broadcasted seed by moving zvipyufo (livestock) in the field to bury the seed especially of Indigenous tsanga (cereals), or pulling tree branches along the ploughed land to bury the broadcasted seed.

Families engage in nhimbe (an Indigenous collaborative work system) whereby they work together in fields to help each other in ploughing, weeding, carrying manure to the fields and harvesting crops. There is also the traditonal Zunde raMambo or Isipahla SeNkosi (the king’s granary reserve) concept led by the chief. The practice ensures food security to vulnerable groups in the community.

Kusarudza mbeu (traditional seed selection) is guided by phenotypic and other varietal characteristics of crops such as resistance to pests, diseases and drought, crop size, length of growing period and for tsanga (cereals), shattering ability. Seed selection is done at the threshing place which was normally a ruware in Shona or dwala in Ndebele, a flat whaleback rock. The selected seed are treated against pest attack by hanging on mbariro (kitchen rafter) or rwodzi (bark rope) above the choto (fireplace) to accumulate chin'ai (soot). A family gives a newly married daughter crop seed as a way of promoting food security and crop agrobiodiversity. Agrobiodiversity is also ensured when farmers share crop seed. The farmers do not buy crop seed but use seed from the previous harvest.

Planting systems include kudyara muvhu rakaoma (dry planting), early planting and planting with the rains. Soil fertility management is done by addition of ndove (animal manure), murakwani (humus) and ivhu repachuru (anthill soil) to the fields to increase soil fertility. Kutema musasa (shifting cultivation), mhanje (fallowing)) and kupindura munda (burying crop residues with a plough soon after harvesting) or by kuwundukura (winter ploughing) and growing legumes like nyemba (cowpeas) and nyimo (Bambara nuts) and nzungu (groundnuts) help to improve soil fertility.

Farmers rely on Indigenous methods of weather forecasting to plan their farming activities. The weather forecasting indicators relate to onset of the rain season, imminence of rain, a promising good season or drought. Weather forecasting also helps farmers to devise coping strategies. Children learn identification and importance of trees as well as Indigenous methods of managing the forests when they are herding cattle.

Local farmers use Indigenous methods to control weeds, pests and diseases of crops. To control weeds they use a hoe or hand pulling. Maguchu (Herbal concoctions) and cultural methods are used to control pests and diseases both in the field and during storage. Indigenous methods of harvesting, storage and processing of crops feature in the communities studied.

Communities keep Indigenous mombe (cattle): Mashona, Tuli and Nguni breeds; mbudzi (goats): Mashona and Ndebele breeds; nguruve (pigs): Mukota breed; mbongoro/madhongi (donkeys), huku (chickens): breed that looks like guinea fowl, naked neck, tailless breeds and many others), guinea fowls, pigeons and tailless rock rabbits. They also domesticate makwari (francolins), zvihuta (quails) and mbira (tailless rock rabbits). Communities have their own Indigenous methods of selecting breeding stock based on desirable characteristics. Utilisation of mafuro (rangelands) ensures crossbreeding and biodiversity through mafuro mamwechete (communal grazing), madzoro (group herding) and migratory grazing. During the dry season, farmers supplement their livestock food using maize stover and sheaves of groundnut, cowpeas and Bambara nut.

There are a number of Indigenous veterinary practices for protecting livestock against diseases and against internal and external parasites. The practices involve the use of maguchu (herbal concoctions) to control livestock diseases and parasites. Social, cultural and economic importance of Indigenous animals are emphasised by the communities.

Some of the colonial masters denigrated and discouraged Indigenous farming knowledge and practices. This marginalisation of IAKS resulted in the Indigenous peoples developing an inferiority complex. The colonisers gave derogatory and demeaning names especially to Indigenous crops. Mapfunde (sorghum) was named 'Kaffir corn' to mean chibage (corn/maize) for the Kaffirs (a derogatory name for the Africans). Nyemba (cowpeas) were regarded as peas for the mombe (cows), hence not fit for human consumption. Bambara nut were named monkey nuts; nuts for monkeys, the Indigenous peoples. Bonongwe (Amaranthus) was named poor man's spinach. It is the Indigenous people who were referred to as poor. This was despite the delicacy, and the medicinal and nutritive value of Amaranthus. The list of such belittling and offensive names is endless. It is high time we revised the so many demeaning names given to such delicacies that is in most of our Indigenous crops.

Most Indigenous fruit trees were growing wild in the areas of the participating communities. However, there was selective conservation of Indigenous fruit trees on cultivated land. A considerable number of Indigenous vegetables were domesticated. Through research, more, if not all, Indigenous fruits and vegetables could be domesticated to enhance food security and sovereignty for the Indigenous peoples.

8.3.2 Aspects of IAKS for inclusion in the curriculum

A comparison of components of IAKS currently included in the ZSSAC and those that exist in the communities studied revealed a huge gap to be uncovered. This section focuses on summarising aspects of IAKS that still need to be included in the ZSSAC.

The Indigenous field crops namely sorghum, rapoko, pearl millet, bambara nut, sesame and cowpeas and traditional field crops maize and groundnut should be taught as compulsory components of the curriculum. Methods of domesticating and propagating Indigenous vegetables and fruit trees should be devised. Communities heavily rely on these for nutrition and food security.

Indigenous methods of seed selection and the farming systems, namely, mixed cropping, fallowing and subsistence farming as well as Indigenous methods of land preparation, including conservation agriculture, need to be incorporated into the curriculum and their teaching decolonised. The same decolonisation should be done to planting systems such as kudyara muvhu rakaoma (dry planting), broadcasting, utilisation of wetlands, kuchera makomba (potholing) and covering broadcasted seed by moving zvipyufo (livestock) or drawing tree branches.

Indigenous methods of weather forecasting guide the farmers to plan farming activities such as determining which crops to grow and when to grow them. In addition, they are used to devise coping strategies against drought, floods and strong winds. As a result, they should be included in the curriculum.

While organic manures were covered under soil fertility, other Indigenous methods of improving soil fertility such as use of liquid manure, ash, anthill soil and kufushira majanga pasi (trash farming) should also be taught in schools also. Furthermore, methods of conserving moisture in the soil such as mbesa dzewareware (cover cropping), kuisa bvute (shading), matai (tie ridging), kuisa pevhu (mulching) and use of dziviriramhepo (windbreak) need to be taught with a decolonial orientation.

Families practise nhimbe (an Indigenous collaborative work system) whereby they work together in fields to help each other in ploughing, weeding, carrying manure to the fields and harvesting crops. They also practise the traditonal Zunde raMambo or Isipahla SeNkosi (the king's granary reserve) concept led by the chief practice for ensuring food security to vulnerable groups in the traditional community. These need to be considered for inclusion in the curriculum.

Also, for inclusion in the ZSSAC are Indigenous methods of recognition of crop maturity, harvesting, storage and processing of crops and their by-products as well as Indigenous methods of crop protection both in the field and during storage. In forestry, students should not only be taught identification of Indigenous trees, but also their various uses as well as the Indigenous methods of managing forests.

There are Indigenous methods of controlling weeds, pests and diseases both in the field and during storage. These together with harvesting, storage and processing of crops could be included in the curriculum.

Communities uphold mafuro (rangeland) management communities practise mafuro mamwechete (communal grazing), madzoro (group herding) and migratory grazing. During the dry season, farmers practise supplementary feeding of their livestock using maize stover and sheaves of groundnut, cowpeas and Bambara nut. These practices are sustainable and warrant inclusion in the curriculum.

The communities studied domesticate makwari (francolins), zvihuta (quails) and mbira (tailless rock rabbits). These, together with the social, cultural and economic importance of Indigenous livestock, should be incorporated into the curriculum. Also, the farmers have their own Indigenous methods of selecting breeding stock, ensuring crossbreeding and agrobiodiversity are befitting additions to the curriculum.

There are a number of Indigenous veterinary practices for protecting livestock against diseases and both internal and external parasites. The practices involve the use of maguchu (herbal concoctions) to control livestock diseases and parasites. It is befitting that these practices, together with social, cultural and economic importance of Indigenous livestock emphasised by the communities be added to the curriculum.

8.3.4 Harmonisation of IAKS and Western Science in the ZSSAC

In this study, IAKS are an Indigenous preserve of Africa in general and Zimbabwe in particular, while Western agricultural practices were developed in Europe and North America. Each was developed in a separate environment. Though they originate from different localities, Ogunniyi (2007) and Emeagwali (2003) are in support of the harmonisation of IAKS and Western farming practices in the curriculum.

The research proposes a Participatory Curriculum Development model that would be used to incorporate those aspects of IAKS that still need to be included in the ZSSAC. The model takes all the stakeholders on board throughout the curriculum development process. The first stage is 'Identification of relevant stakeholders'. The stakeholders are to include officials from the Ministries of Primary and Secondary Education, Agriculture and Mechanisation, Higher and Tertiary Education and Technology Development. Among the stakeholders will also be curriculum specialists, Indigenous farmers and the elderly in community, women, youths (including students), AGRITEX officers, high school agriculture teachers, tertiary agriculture lecturers, IAK scholars and academics, relevant Non-Governmental Organisations and representatives from Commerce and industry. The second stage is an analysis of aspects of IAKS currently included in the ZSSAC. This stage is followed by an investigation of aspects of IAKS existing in the community. A comparison of aspects of IAKS currently included in the ZSSAC and those existing in the community leads to establishing a gap of IAKS aspects that still need to be incorporated into the ZSSAC. Then curriculum frameworks are developed by stating the curriculum aims followed by the development of the general IAKS topics and main areas of content. After that a detailed curriculum is planned. This is done by developing specific learning outcomes for the new look curriculum, followed by development of detailed curriculum content, learning materials, identification of learning methods, development of assessment instruments and the retraining of teachers to reskill them. The detailed curriculum is trialed with groups of students or in selected schools, evaluated and relevant adjustments made. The finalised curriculum is then implemented on a larger scale in all schools. Lastly, the curriculum is evaluated to determine whether it is producing the expected results.

8.3.5 The perceived benefits of including IAKS in the curriculum in question

8.3.5.1 Contextual relevance of agricultural education

Infusion of IAKS into the ZSSAC would result in contextually relevant and meaningful learning by students. The inclusion of IAKS aspects (knowledge and practices) proffers contextual relevance through tapping into students' lived experiences. If something that is taught at school is what is practised at home, it makes a lot of sense to the students. That way an experiential continuum will be realised whereby students relate home experiences with what they learn at school. Student learning depends on community beliefs, acceptable identities and the consequences for a student's life inside and outside the classroom. This gives learners opportunity for recognition of prior, home-grown, local knowledge and experiences that yield intrinsic motivation, critical thinking, independent decision making, cultural empowerment and meaningful learning. Hence, a focus on teaching agriculture should develop connections between what is taught at school and the everyday life of the pupils leading to a higher involvement and commitment of pupils and their parents and a kind of ownership of the educational process.

8.3.5.2 Nutrition, food security and sovereignty

Students learn a variety of nutritious and healthy foods from the Indigenous crops and livestock. For instance, mhunga (pearl millet) and zviyo (rapoko) are the only tsanga (cereals) rich in the amino acid methionine. The variety of the crops grown and livestock reared are for feeding the family with surplus for sale. Through mixed cropping and storage of food during the dry season for later consumption, the communities were also ensured of food security and food sovereignty. In Africa, IAKS contribute to food security through post-harvest techniques used by local communities. These food storage and food preservation practices are measures by local communities of ensuring that the household does not suffer from food shortage during any part of the year. However, due to Zimbabwe's colonial past, such knowledge has been treated as inferior to modern food preservation and storage technologies. To ensure food security, vegetables such as the leaves of nyemba (cowpea), nyevhe (African spider flower), and bonongwe (poor man's spinach) are sundried or parboiled first then sun-dried for some days prior to storage. These practices and other post-harvest techniques enable Zimbabweans communities to be food secure and sovereign. In Zimbabwe, the Zunde Ramambo (Isipahla Senkosi) concept, commonly practiced by the Shona and Ndebele speaking people, respectively has been revived to ensure adequacy of food especially to the vulnerable members of the community. The practice ensures food security to vulnerable groups in society such as orphans, the handicapped, widows and those with chronic illnesses.

The inclusion of IAKS aspects in the curriculum would truly work towards promoting food security and food sovereignty.

8.3.5.3 Fodder

Some of the crops provide fodder for livestock. For instance, straws of tsanga (cereals) and sheaves of nyimo (Bambara nuts), nzungu (groundnuts) and nyemba (cowpeas) provide special fodder to their livestock namely mombe (cattle), makwai (sheep), mbudzi (goats) and mbongoro (donkeys), especially during the dry season when grazing is less abundant and low in nutrients. Fodder is abundant in the wet season but becomes scarce in the dry season. This causes livestock to look healthy and gain weight in the wet season and lose body condition in the dry season.

8.3.5.4 Indigenous sustainable agriculture

Local communities are more into the use of Indigenous knowledge than Western farming practices due to their sustainability. Even the commercial farmers use lots of Indigenous knowledge in their day-to-day farming practices. They are easy to use and manage.

IAKS are a sustainable resource that is locally available and at the disposal of even the poor in society. For instance, ivhu repachuru (anthill soil), dota (ash) and mufudze (organic manures) like durunhuru (compost) and murakwani (leaf mould) are readily available. Indigenous crops and livestock are locally adapted. Unlike exotic crops and animals, they are adapted to the climatic conditions of Africa. They are tolerant to drought, diseases and parasites.

Conservation Agriculture like kurima nechibhakera (zero and minimum tillage), mbesa dzewareware (cover cropping), organic farming, all which are based on agroecological principles, promote soil and moisture conservation and improve the nutrient status of the soil and reduce soil erosion. They pose no destruction to the ecosystem since there is no use of chemical sprays and inorganic fertilisers which have a toxic effect on the ecosystem.

8.3.5.5 IAK as cultural heritage

IAKS are a cultural heritage to be passed on from generation to generation. Inclusion of IAKS in the curriculum would familiarise the students with the 'whys' and 'hows' of the agricultural operations of their forefathers. That way, the inclusion was found to be very acceptable as it fostered cultural preservation. There are no people without a culture. Hence, there is need to maintain our sound cultural practices which were denigrated, marginalised, despised or destroyed by colonialism. Inclusion of IAKS in the ZSSAC would correct the unhealthy imbalances, distortion, trivialisation and neglect of IKS inflicted by Western education and governance. The learners, the future generations, will be empowered since IAKS are a resource that provides a firm foundation for sustainable and environmentally sound approaches to agriculture.

Agriculture is associated with many aspects of life. In other words, agriculture has a close linkage with culture. Indigenous farming knowledge and practices thus become part of the way of life of Indigenous peoples. Customs, rituals, myths and sacred festivals concerning particular crops and livestock provide a close link between agriculture and a people's culture. Equally interesting is the intimate relationship between the natural physical environment, in which a certain type of agriculture has developed, and the way of life, ethical values and social structures of the people (Leander, 1995). Sinjal (2006) cites the Greek philosopher and historian, Xenophon (427-355 BC), who opined that Agriculture is the mother of all other cultures. That is why agriculture is important in maintaining cultural heritage and that cultural heritage is influenced by active farming (Daugstad, Rønningen and Skar, 2006). Without agriculture, a people would not have a culture.

8.3.5.6 Ecological agriculture

The use of chemical sprays and inorganic fertilisers has a toxic effect on the ecosystem. These dangerous chemicals are broken down into dangerous poisons which are then passed through the food chain leaving plant, animal and human life at risk of disease, destroying the harmony in the ecosystem. This creates a decline in the Earth's natural defences against insect populations. In addition, massive spraying with these chemicals causes insects to build resistance to chemical sprays leading to insects increasing to epidemic proportions. The problem can only be overcome by spraying herbal concoctions against pests. The adoption of ecological farming techniques which include organic farming, selecting crops and varieties that are resistant to local pests, multiple cropping, crop rotations, fallowing, mbesa dzewareware (cover cropping), kuisa pevhu (mulching) and minimum tillage, could also reduce these problems. Agroecological practices prevent soil erosion, reduce soil compaction, promote water infiltration and retention, increase carbon sequestration in the form of humus, increase biodiversity, promote nutrient availability to crop uptake improve and increases the soil habitat.

8.3.5.7 Climate change adaptation

IAKS promote adaptation of Indigenous agriculture systems to climate change. Agriculture is the most weather-dependent human activity and that most agriculture production decisions are either directly or indirectly affected by this factor. There is broad scientific agreement that climate change is happening. Surely, no person, country or region of the world is immune to climatic change. It is worth noting that many highly respected IK holders in Indigenous communities are subsistence farmers. They have in-depth knowledge of the weather, seasons, agriculture, environment including droughts and floods. They have, thus, evolved many Indigenous agricultural coping strategies that are helping them face this brunt of climate change. These coping strategies are visible in the daily crop and livestock production activities. For instance, they change farm production practices such as planting and harvesting times, crop protection methods, tillage practices, as well as crop diversity and variety choices (Eitzinger et al., 2009; Smit and Skinner, 2002; Macholdt and Honermeier, 2016). All these are dependent on the weather forecasting methods which Indigenous people have developed over time.

8.3.5.8 Bringing back the old previously marginalised Indigenous farming principles

Incorporation of IAKS in the ZSSAC is a way of bringing back the old previously marginalised Indigenous farming principles, such as jengetedzo (conservation tillage), agroforestry and multiple cropping into the world of agriculture. These same Indigenous innovative farming practices which were denigrated and overtaken by colonial events are proving to be worth practising. This could be why the World Bank (1998) has consistently valued and embraced IKS, stating that it should form part of Africa's development agenda

(Seroto, 2014). Even NGOs are coming back with the same Indigenous technologies they denigrated rebranding them as “new technologies’. Such include jengetedzo (conservation agriculture) agroforestry, permaculture, organic agriculture, terracing, among others. There is now a growing consensus that some of the solutions to the problems that currently plague African societies and communities must proceed from understanding the dynamics within the local context (Owuor, 2007).

8.4.1 Challenges schools may face when including or teaching IAKS content in Zimbabwe’s secondary school Agriculture curriculum

8.4.1.1 Dominance of Western science in the academy

In this study, there was the hegemony of Western agricultural knowledge and practices in the ZSSAC, in communal and small-scale commercial farming. No knowledge claim should segregate another. The interplay between different knowledges is one reason for incorporating IKS into school curricula (Dei, 2000). According to the Contiguity Argumentation Theory (Ogunniyi, 2007), Indigenous knowledge systems and Western science can be harmonised in the curriculum. This research advocates the co-existence of plural knowledges in the curriculum so that each makes up for the inadequacies of the other. That way the current stance of according Western agricultural practices as the dominant and universal agricultural knowledge would be decentred and emphasised for reciprocal valorisation. Sadly, Western science has, itself, grown by cannibalising Indigenous knowledges across different disciplines (Hountondji, 2002).

8.4.1.2 Inferiority complex

Agriculture is a subject that is offered in primary and secondary schools and tertiary institutions of Zimbabwe. Shizha (2013) argues that in Sub-Saharan Africa postcolonial school knowledge continues to mirror colonial residues and these continue to imprison the actions, feelings, attitudes, beliefs and the conceptual capabilities of Indigenous people. Muchenje and Goronga (2015) and Shizha (2015) concur that in order to meet these challenges, the school curriculum needs to be reformed so that Indigenous knowledge systems aspects feature prominently across the curriculum in schools and tertiary institutions. A reformed education curriculum should emphasise the inclusion of Indigenous knowledge systems with regard to agricultural production. This reformation should extend to the agriculture curricula of both the primary and tertiary levels and covering all subject disciplines. That incorporation of IK content in all curricula across disciplines and levels would generate local solutions to local problems as the curricula become more relevant and meaningful.

8.4.1.3 Teacher inadequacies

Agriculture teachers, lecturers, AGRITEX officers and policy makers are now used to Western farming methods which had been forced on the Indigenous people by the colonialists. Some of them think that Western farming practices are superior to their own Indigenous farming practices. They regard anything Indigenous as inferior, outdated and uncivilised. This belief could result in them resisting inclusion of IAKS in the ZSSAC. The continued exposure of Indigenous students to Western education is making these students think less of their African Indigenous knowledge. Hence, this negative perception by the younger generation of Indigenous students towards IAKS needs to be reversed by reviewing the education curricula so that it includes IAKS at primary, secondary and tertiary levels. Agriculture educators and AGRITEX officers need retraining to reskill them in line with the envisaged curriculum initiative. The Indigenous farmers, who are the Indigenous knowledge holders, should be utilised in formal education processes as well as in the demonstration of practices (practical application). They would be utilised in the retraining the teachers and AGRITEX officers. These educators would also be exposed to delivery skills for the new look curriculum.

8.4.1.4 Wrong notion of development

Most governments in Africa erroneously feel that development lies in the extensive use of Western forms of knowledge (Alebiosu, 2005). Their Westernised education systems promote the belief in the inadequacy of IKS and the superiority of Western technology. In formal agriculture, Western farming knowledge is regarded highly due to the effects of colonial and neo-colonial subjugation. IKS continue to suffer the same fate they suffered in the colonial period. Zimbabwe should revise its policies on agriculture and come up with a policy that embraces IKS. Currently, Zimbabwe has no IKS policy. Education is one such institution that could be used to promote IKS.

8.4.1.5 Defining IKS from a positivist perspective

African Indigenous knowledge is often disregarded, not only by Western scholars, but also by some African scholars (Nsamenang, 1995). Scholars define IKS from a positivist perspective. This could pose as one of the prime challenges of harmonising IKS with Western farming practices in the curriculum (Seroto, 2014). Western scholars regard IKS as being unscientific. The positivist paradigm also does not embrace multiple knowledge systems. Western thoughts, alone, are inadequate to explain all the ways of knowing. This is because it is based on a particular cultural setting which does not have generalised applicability. Indigenous or traditional knowledge is a knowledge system refined from generations of scientific work that is anchored in tribal and rural tribal communities. It is very different to the empirical lab-based Western system. It is as equally valid and efficacious as Western science. It is high time we recognise the existence of of different kinds of sciences and their scientific expertise for development and problem-solving.

8.4.1.6 Lack of teaching materials

Participants noted that the urge to include IAKS content in the ZSSAC would be greatly stifled by the obtaining poor economic situation of Zimbabwe which may militate against development of teaching materials. These materials include textual and non-textual materials. However, once commitment has been cultivated towards the new look curriculum, the materials would be produced cheaply under the guidance of the elderly and local farmers, who are the knowledge holders.

8.5 RECOMMENDATIONS

In this section I provide recommendations emerging from the study. These recommendations are based on insights gained from the five case study sites. As is the tradition with case study research, the recommendations are not meant to be generalised to the broader population but may be drawn on for further analysis, proposition development and further research. However, as again is the tradition in qualitative studies, the emerging theory can be inferred in the broader context, in this case the national ZSSAC.

The study makes the following recommendations:

- The communities studied were rich in aspects of IAKS. However there was hegemony of Western farming practices in the ZSSAC for Africans. Ideally, no knowledge claim should be segregated so that it plays second fiddle to another as was the case with IAKS aspects in this study. Hence, more aspects of IAKS need to be incorporated into the curriculum in question to promote plural epistemologies in the curriculum.

- Indigenous crops and animals have to be promoted by including them in the curriculum since they adapt to the environmental conditions of Africa as opposed to exotic crops and animals. They offer tolerance against drought, diseases and parasites. They pose no destruction to the ecosystem. IAKS practises are cheaper in terms of production hence even the poor can afford. In addition IAKS resources are locally available hence easily accessible. They are a cultural heritage. Above all they are sustainable. This is why in this study local communities were more into the use of Indigenous knowledge than Western farming practices.

- Adoption of an agriculture curriculum that includes more aspects of IAKS would provide contextual relevance to the learning encounters as students would connect with lived experiences at home. This would preserve the country's heritage since there would be a continuum between what students learn at school and their lived home experiences. Such Indigenous agricultural experiences would assist in solving their communities' social and economic problems such as nutrition, food security and sovereignty as well as providing an agriculturally sustainable agriculture.

- Currently Zimbabwe relies on the top down approaches to curriculum development and evaluation. There is need to adopt the Participatory Curriculum Development approach that involves all the relevant stakeholders and in the process forefronting the local farming communities who themselves are IAKS custodians and the principal beneficiaries from the envisaged curriculum. This would breed in them a sense of ownership of the educational process.

- There is need for the government to have a centralized IKS policy for the sake of uniformity in policy adoption and implementation. Uniformity of action is possible when decision-making authority is centralised and cascaded to downwards. Decisions taken at the top would then be adopted by all government ministries and implemented at every level. On the other hand, if the units take their independent decisions then uniformity of action will not be achieved. Under such situations centralised decision-making will enable unity of action.

- There is need to develop a revised agricultural policy since the current policy downplays IKS. That way the current discordant relationship between agriculture policy, tertiary and school curricula and Indigenous agricultural practices would be uncovered. In addition, an overview summary of the representation of IAKS across all relevant policies relating to agriculture and agricultural research should be developed in order to act as a datum peg that guides the development of the curriculum.

- There is need for policy reform guided by Indigenous policies developed elsewhere and support for Indigenous research through such institutions as the South African National Research Foundation and linking the country to other countries with interest in Indigenous research initiatives. The role of Indigenous farmers who are the holders of Indigenous agricultural knowledge must be utilised in both the formal education processes as well as in the demonstration of practices (practical application).

- Education support materials on IAKS for use by educators in the classroom context should be produced since inclusion is not just about curriculum content but also about teaching and learning resource materials. The production of the materials will be led by the elderly and Indigenous local farmers since they are the custodians of IAKS.

- The establishment of important links with Institutions such as Department of Research and Specialist Services, the Agricultural Research Council, international agricultural research organisations, and even seed companies to develop an IKS policy.

8.6 LIMITATIONS OF THE STUDY

This study was conducted in five case study sites. These were the two high schools and their surrounding communities as major research sites and three tertiary institutions as minor research sites. There were more similarities than dissimilarities between the IAKS prevalent in both major participating communities surrounding the two high schools. Mapara (2009) attributes the dissimilarity to the fact that IKS originate naturally within a specific culture, society and location. IAKS therefore vary from one geographical location to another. This further exacerbates the problem of generalising the results to the whole country. The cases only provide insights into the problem namely a dearth of IAKS in the ZSSAC. Hence, there is need for a nationwide research project to inform the curriculum review process, and the development of IAK resource materials.

8.7 RECOMMENDATIONS FOR FURTHER RESEARCH

The study recommends:-

- Carrying out of further research into decolonising, indigenising and Africanising agricultural curricula beyond the secondary school (primary education as well as tertiary education) as well as doing the same across all subject disciplines.
- That research is carried out on the development and improvement of potential Indigenous crops, livestock breeds, fruit trees and forestry trees and on Indigenous sustainable agriculture methods.
- More initiatives on policy reform guided by Indigenous policies developed elsewhere and support for Indigenous research through such institutions as the South African National Research Foundation and linking the country to other countries with interest in Indigenous research initiatives.
- That further research should be carried out at national level. This research only covered five research sites in two different provinces, Midlands and Mashonaland West, yet Zimbabwe has a total of ten (10) unique provinces which are located in five agroecological zones. Results from the research cannot, therefore, be generalised to the whole of Zimbabwe. IAKS vary from one province to another and within provinces.

8.8 CONCLUSION

This study tried to answer six research questions related to making an analysis of the representation of IAKS aspects (knowledge and practices) in the ZSSAC with a view of exploring prospects and opportunities for their inclusion in the curriculum in question. The research firstly concerned itself with analysing components of IAKS currently included in

Zimbabwe's secondary school Agriculture curriculum. Thereafter, the study investigated IAKS (knowledge and practices) that existed within the communities studied. A comparison of components of IAKS currently included in the ZSSAC and those that existed within the participating communities revealed a huge gap which led to suggesting components of IAKS that could be included in ZSSAC. The study then proposed approaches for the effective inclusion of IAKS in the ZSSAC. Last but not least, the study established the benefits of including IAKS content in the curriculum in question and examined the challenges schools may face when including IAKS aspects in the ZSSAC.

The study revealed that although the participating communities were rich in IAKS, the ZSSAC was deficient in IAKS content (knowledge and practices). IAKS played second fiddle to Western agricultural knowledge and practices in the curriculum in question. There was, therefore, compelling evidence to uncover the gap between IAKS currently included in the ZSSAC and those IAKS aspects that exist in the Indigenous communities. This would enable the incorporation of more IAKS content in the review of the current ZSSAC. Inclusion of more IAKS content in the ZSSAC is supported by evidence that IAKS are sustainable and have, through research, the potential of increasing global food security, food sovereignty and nutrition. The inclusion would, apart from promoting meaningful contextualised learning in schools, help preserve IAKS from extinction. However, there is need to carry out nationwide intensive consultations in order for the stakeholders to identify the content and that awareness is raised for educators and policy makers to more receptive to and supportive of the inclusion of IAKS aspects in the proposed new curriculum package.

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APPENDIX A - PERMISSION TO CARRY OUT RESEARCH

UNISA university of south africa

COLLEGE OF EDUCATION RESEARCH ETHICS REVIEW COMMITTEE

17 August 2016

Ref:2016/08/17/53776674/01/MC
Student . Mr C Pedzisai
Student Number : 53776674

Dear Mr Pedzisai

Decision: Ethics Approval

Researcher: Mr C Pedzisai
Tel: +263 22203 ext 354
Email: pedzisaic@gmail.com

COLLEGE OF EDUCATION
2016 -08- 24
Office of the Executive Dean

Supervisor: Prof. S Shava
College of Education
Department of Science and Technology Education
Tel: +27 12 429 4782
Email: shavas@unisa.ac.za

Proposal: Prospects and opportunities for inclusion of agricultural indigenous knowledge systems in Zimbabwe's secondary school agriculture curriculum

Qualification: D Ed in Curriculum Studies

Thank you for the application for research ethics clearance by the College of Education Research Ethics Review Committee for the above mentioned research. Final approval is granted for the duration of the research.

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the College of Education Research Ethics Review Committee on 17 August 2016.

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is relevent to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the College of Education Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

All correspondence should be addressed to the Director
Department of Agricultural Technical and Extension Services

AGRITEX

MINISTRY OF AGRICULTURE, MECHANISATION AND IRRIGATION

Head office
No. 1 Borrowdale road
Ngungunyana bldng
Harare

P.O. Box CY 2505, Harare, Zimbabwe Tel: (+263) 04-794381-2

Ref:

12 October, 2016

Provincial Agricultural extension Officer-
Midlands
Mashonaland West

REQUEST FOR PERMISSION TO CONDUCT RESEARCH INZHOMBE (KWEKWE DISTRICT) AND ZVIMBA DISTRICT

Mr. Constantino Pedzisai is seeking assistance of your local extension worker in conducting his PHD Reasearch in Zhombe and Zvimba areas of Midlands and Mashonaland West provinces.

Attached is a letter giving details of his research.

Kindly assist him.

A. Mudhefi

A/Director

Department of Agricultural Technical and Extension Services

12 OCT 2016

? All communications should be addressed to
"The Secretary for Primary and Secondary
Education"
Telephone 799914 and 795153
Telegraphic address : "EDUCATION"
Fax: 791923

ZIMBABWE

Reference: C/426/3 Mashonaland
West/Midlands
Ministry of Primary and Secondary Educ
P.O Box CY 121
Causeway
Harare

12 October 2016

Constantino Pedzisai
Chinhoyi University of Technology
P.Bag 7724
Chinhoyi

RE: PERMISSION TO CARRY OUT RESEARCH AT ZHOMBE HIGH SCHOOL IN MIDLANDS AND KANYEMBA SECONDARY SCHOOL-MASHONALAND WEST: PROVINCES

Reference is made to your application to carry out a research at the above mentioned schools in Mashonaland West and Midlands Provinces on the research title:

"PROSPECTS AND OPPORTUNITIES FOR INCLUSION OF AGRICULTURAL INDIGENOUS KNOWLEDGE SYSTEMS IN ZIMBABWE'S SECONDARY SCHOOL AGRICULTURE CURRICULUM "

Permission is hereby granted. However, you are required to liaise with the Provincial Education Directors, Mashonaland West and Midlands Provinces who are responsible for the schools which you want to involve in your research. You should ensure that your research work does not disrupt the normal operations of the schools. You are also required to seek consent of the parents/guardians of all learners who will be involved in the research.

You are required to provide a copy of your presentation and a report of what transpired to the Secretary for Primary and Secondary Education by December 2017.

F. Fundira

F. Fundira
Acting Director: Policy Planning, Research and Development
For: **SECRETARY FOR PRIMARY AND SECONDARY EDUCATION**
cc: PED –Mashonaland West and Midlands Provinces

MIN. OF PRY & SEC. EDUCATION
POLICY PLANNING RESEARCH
AND DEVELOPMENT
12 OCT 2016
P.O. BOX CY 121, CAUSEWAY
ZIMBABWE

APPENDIX B - AGRICULTURE POLICY DOCUMENTS

ZIMBABWE AGRICULTURE INVESTMENT PLAN (ZAIP)

2013-2017

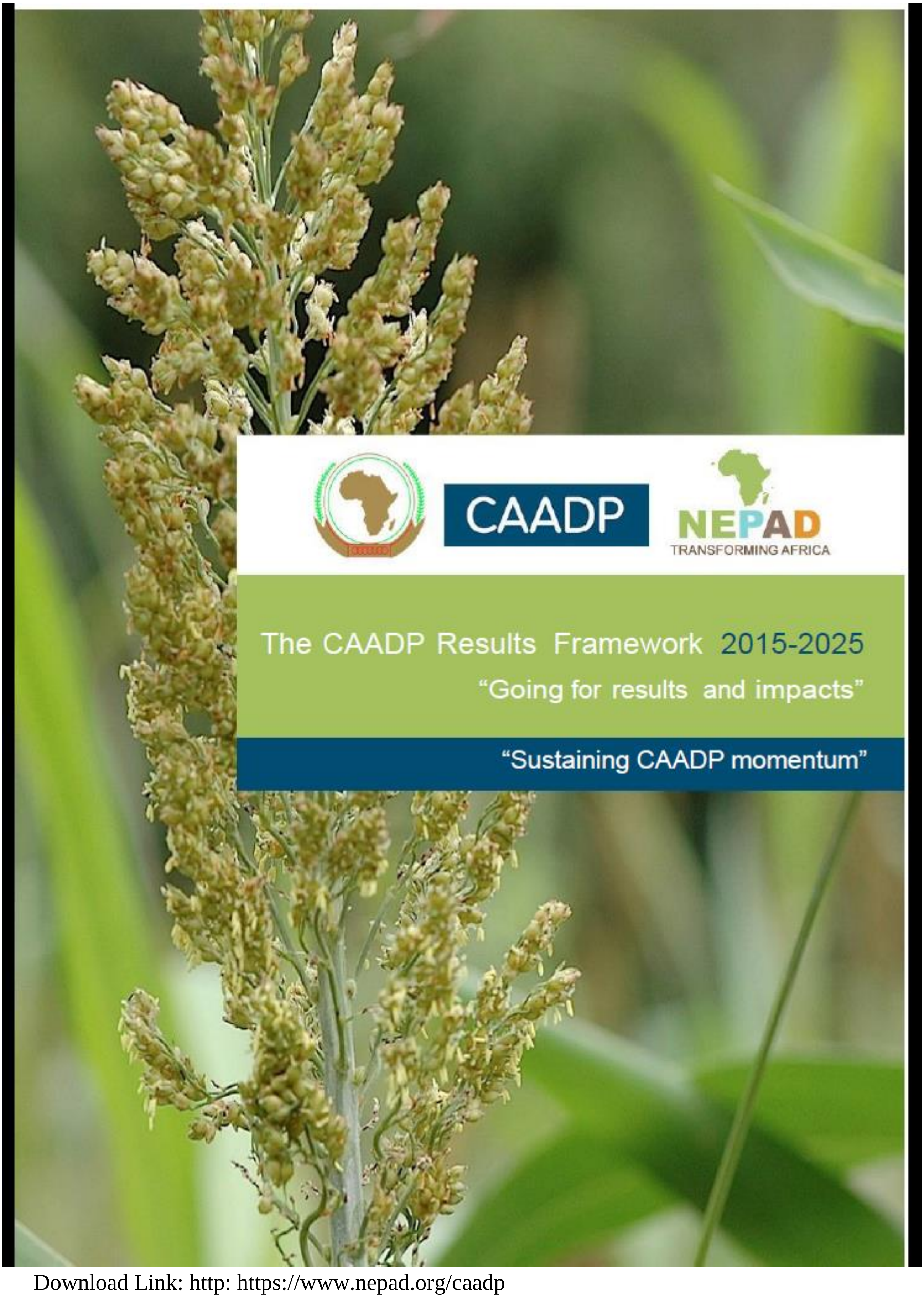
A COMPREHENSIVE FRAMEWORK FOR THE DEVELOPMENT OF ZIMBABWE'S AGRICULTURE SECTOR[1]

[1] Zimbabwe Agricultural Investment Plan (ZAIP 2013-2017) is the sector plan for implementing the Agricultural Policy Framework and contributing to the attainment of the Zimbabwe Medium Term Plan (MTP 2011-2015) in line with core CAADP principles, such as broad stakeholder consultation and participation, accountability, and coordination.

ZIMBABWE

SECOND
SCIENCE, TECHNOLOGY AND INNOVATION POLICY OF ZIMBABWE

MARCH 2012



Download Link: http: https://www.nepad.org/caadp

APPENDIX C - AGRICULTURE SYLLABI

UNIVERSITY OF ZIMBABWE
DEPARTMENT OF TEACHER EDUCATION
BELVEDERE TECHNICAL TEACHERS' COLLEGE

DIPLOMA IN EDUCATION (SECONDARY)

PEDAGOGICS OF AGRICULTURE SYLLABUS

CONVENTIONAL COURSE (1 YEAR 4 MONTHS)

1.0 PREAMBLE

This syllabus is designed for holders of a National Diploma in Agriculture pursing a pre- service sixteen months (16 months) Diploma in Education course. It is meant to expose the student teacher to the pedagogics of Agriculture at secondary school level and related vocational training institutions. This sixteen month (16 months) programme is structured such that the first two terms are residential phase, followed by one term teaching practice and lastly one term residential phase (2.1.1).

2.0 AIMS

The course aims to:

2.1 develop in student teachers theoretical knowledge and practical skills that are expected of a qualified teacher;

2.2 inculcate in student teachers an understanding of the value of Agriculture in serving the needs of the society and sustainable agricultural rural development;

2.3 address gender disparities in serving the needs of society;

2.4 create in student teachers an awareness of the fundamental principles and the philosophy of entrepreneurial skills for self sustenance;

2.5 ensure students acquire requisite skills for Information Computer Technology (ICT) competence.

3.0 OBJECTIVES

During and at the end of the course students should be able to:

3.1 demonstrate appropriate teaching skills that will enable them to adapt the changing needs of the immediate communities and the environment they will work in;

3.2 design and implement teaching programmes that will cater for the changing needs of the community/ country and environment;

3.3 present sustainable agriculture programs and projects appropriate for secondary schools, vocational institutes and related industries;

3.4 utilize available teaching resources sustainably to the best advantage under the prevailing circumstances;

3.5 conduct Agricultural researches and guide pupils as well as communities in problem identification and offer possible solutions;

3.6 respond to sensitive needs of gender imbalances of the communities they work in;

3.7 organize and empower communities to initiate and manage community projects for their betterment;

3.8 demonstrate the dignity of labour and entrepreneurial skills through various disciplines of Agriculture and

3.9 handle data using Information Computer Technology.

4 CONTENT

4.1.0 History of Agriculture education in Zimbabwe.

4.1.1 Pre-colonial

4.1.2 Colonial

4.1.3 Post - colonial

4.2.0 Trends in World Agricultural Education

4.2.1 The role of Agriculture education in national development (sustainable food production system, food aid, Indigenous knowledge systems **IKS**).

4.2.2 Changing policies in agricultural education.

4.2.3 Gender issues in agricultural education.

4.2.4 Small and large scale Agriculture development.

4.3.0 Curriculum Design

4.3.1 Meaning of the term curriculum.

4.3.2 Organization of traditional knowledge in curriculum design through CDU, teacher and parents associations, politicians, professionals and local authorities. National curriculum design process.

4.3.3. Syllabus and its components.

4.3.4 Designing of school syllabi.

4.3.5 Syllabus interpretation.

4.4.0 Teaching Methods and Techniques

4.4.1 Lectures

4.4.2 Discussions

4.4.3 Demonstrations

4.4.4 Invite resource personnel

4.4.5 Field trips

4.4.6 Simulation and games

4.4.7 Role playing

4.4.8 Discovery learning

4.4.9 Projects

4.4.10 Poetry/song

4.5.0 Schemes and Record of Work.

4.5.1 Types of schemes

4.5.2 Scheme components and their significance

4.5.3 Drawing up schemes of work

4.6.0 Lesson Planning

4.6.1 Types of lesson plans

4.6.2 Components of a daily lesson plan

4.6.3 Teacher – pupil planning

4.6.4 Making notes from given resource materials on guided learning objectives.

4.6.5 Planning to use learning media.

4.7.0 Questioning Techniques

4.7.1 Principles of questioning

4.7.2 Types of questions

4.7.3 Question sequencing

4.7.1.0 **Evaluation /Assessment**

4.7.1.1 Meaning of evaluation/assessment

4.7.1.2 Setting theory tests, practical tests and examinations.

4.7.1.3 Reliability and validity of tests/examinations

4.7.1.3 Preparing pupils for assessment.

4.8.0 Reinforcement Techniques

4.8.1 Types of reinforcement applicable to Agriculture education

4.8.2 Schedules of reinforcement and effectiveness in behaviour change

4.9.0 Motivation

4.9.1 Motivation and the Teacher

4.9.2 Approaches to intrinsic motivation and extrinsic motivation

4.9.3 Motivation and learning experience

4.10.0 Peer group teaching

4.10.1 Theory lesson presentation

4.10.2 Practical lesson presentation

4.11.0 Management of agricultural department

4.11.1 Procurement

4.11.2 Marketing

4.11.3 Management styles of Agricultural production unit

4.11.4 Assessment and evaluation of theory and practical work

4.11.5 Marking of pupil's books

4.11.6 Practical book, project guidelines for 'O' level Agriculture

4.12.0 Professionalism

4.12.1 Qualities of an Agriculture teacher

4.12.2 Job description

4.12.3 Code of conduct

4.12.4 Appropriate dressing

4.12.5 Proficiency in ICT

4.13.0 Entrepreneurship

4.13.1 Project proposal

4.13.2 Establishing and managing income generating projects

4.13.3 Marketing

4.13.4 Evaluation (students to undertake a specific project of their choice at college).

4.14.0 Curriculum Depth Study (CDS)

4.14.1 Topic Selection

4.14.2 Introduction

4.14.3 Literature review

4.14.4 Research methodology

4.14.5 Results analysis and discussion

4.14.6 Recommendations

4.14.7 Summary/conclusion

4.14.8 List of appendices

4.15.0 Experimental Research

4.15.1 Topic selection

4.15.2 Introduction

4.15.3 Literature review

4.15.4 Research methodology

4.15.5 Results, analysis and discussion

4.15.6 Recommendations

4.15.7 Summary/conclusion

4.15.8 List of appendices

5.0 STRATEGIES

5.1 Lectures

5.2 Project work

5.3 Practical activities and field trips

5.4 Peer group teaching

5.5 Demonstration

5.6 Discussions

5.7 Problem solving and discovering learning

5.8 Role playing

5.9 Assignments/tests

6.0 ASSESSMENT

6.1	Coursework	2 written assignments	10%
		1 entrepreneurship	10%
		1 experimental project	10%
6.2	Examination	1 written paper 3 hours	70%
6.3	Weighting	Coursework	30%
		Examination	70%

In order to pass a candidate must score 50% or better in coursework and 50% in examination. Each component of the coursework and examination should be passed separately. If a candidate fails one component of the subject will repeat the course.

Revised May 2016

CROP PRODUCTION

Overview

The crop production course outline is designed for training students undertaking the Diploma programme in Agriculture. The courses covered are divided into two, that is, first year and final year. The courses are covered through theory, practicals, educational tours, and a project for final year. The first year courses are meant to introduce the students to the science of crop production while the final year focus more on sustainable production of major crops to enhance food security and contribute to national economy. Theory courses are covered in 193 hours for first year and 175 hours for final year. .

The main objective is to produce a competent Diploma graduate who is sound in science and practices of crop production. The specific objectives are to:

1. Produce a Diploma graduate who has a basic understanding of crop physiology, botany, microbiology, genetics and soil science..
2. Produce a Diploma graduate who is sound in principles and practices of agronomy , and marketing of crops.
3. Produce a Diploma graduate who is competent in project management and evaluation.
4. Produce students who are able to identify, analyse and provide solutions to challenges in crop production.

Assessment of theory courses is done through examination (40%) and continous assessments (10%). Practicals are assessed during the course (continuous assessment) 35% and through examinations (15%). .

PART ONE COURSES

A. PRINCIPLES OF SOIL SCIENCE

Name of course	**Principles of Soil Science**
Course code	**CP101**
Programme and level	**Diploma in Agriculture, Part 1**
Course units	**10**

Contact hours: Lectures = 33 hours (3hrs per week for 11weeks)

Practicals = 33 hours (3hours per week for 11 weeks)

1. Course Description

This course is designed to provide students with the basic understanding of the soil as a medium for plant growth and how it can be manipulated to suit plant requirements. Topics covered include soil forming processes, soil physical and chemical properties, soil classification, soil sampling and soil manipulation through addition of inorganic and organic fertilizers. This course provides the basic principles which are fundamental in the production of individual crops and in soil conservation practices.

2. Learning Outcomes

Students should be able to:

- Explain the importance of soil in agriculture and how different soils are formed.
- Explain the six physical properties of the soil and how they can be manipulated to satisfy the farmer's needs.
- Explain the terms; colloid, flocculation, cat ion exchange capacity, base saturation and give their significance in agriculture.
- Describe the structures of the different groups of clays and relate them to their properties.
- Describe the nutrient uptake mechanism in plants and their implications in agriculture.
- Describe the carbon cycle and explain the importance of C: N ratio.
- Describe the classification system of soils used in Zimbabwe giving the location of the classified soils within the country
- List the macro and micro elements, describe their functions and deficiency symptoms in plants, understand and describe their chemistry in soil and how to implement an effective soil fertility management regime in crop production.

3. Teaching Methods

Course will be covered using lectures, assignments, in-class tests, tutorials, seminars, practicals, educational tours and outreach programs

4. Course Content

4.1 Introduction [3 hours]

Definitions of soil, Importance of soil in Agriculture, Soil components, The soil forming processes. Types of Parent rocks: Igneous rocks, Sedimentary rocks and Metamorphic rocks. Rock minerals: Quartz Feldspar, Olivine, Pyroxenes, and Apatite / calcium phosphate

4.2 Weathering and soil formation [3 hours]

Weathering: physical, chemical and biological weathering processes. Soil formation factors. Soil catena. Soil profile and horizons.

4.3 Physical properties of the soil [5 hours]

Soil texture, Soil structure , Soil aeration, Soil color, Mottling, Concretions, Soil temperature, Soil water relations: Field capacity, Classification of soil water and Water movement in soil

4.4 Chemical properties of the soil

4.4.1 Clay colloids [5 hours]

causes of negative charges in clay colloids. Flocculation. Cation Exchange Capacity. Percentage base saturation. Importance of CEC in agriculture. Clay minerals; silicate clays (kaolinite group, montmorillonite group, the mica group) and the hydrous oxide clays.

4.4.2 Organic colloids [1 hour]

their structures, sources of negative charges and properties.

4.4.3 Soil acidity, salinity and alkalinity [4 hours]

Soil acidity, Causes of soil acidity, Effects of acidity on crop growth, Correction of soil pH. The chemistry of liming, determining lime requirement, methods of lime application. Soil salinity, Causes of salinity, Effects of saline soils on plant growth, management of saline soils. Alkaline or sodic soils. Soil sampling, principles of soil sampling, methods of soil sampling, preparing the samples for analysis.

4.5 Nutrient Uptake Mechanisms [1 hour]

massflow, root interception, diffusion and active uptake**.**

4.6 Soil classification [2 hours]

Orders, groups, families and series.

4.7 Soil Manipulation

4.7.1 Organic matter [3 hours]

Its sources and importance in the soil, Carbon Cycle, and Carbon: Nitrogen Ratio.

4.7.2 Plant nutrients [3 hours]

Macro nutrients (Nitrogen Phosphorous Potassium Calcium Magnesium Sulphur) and micro nutrients (boron, molybdenum, iron, chlorine, zinc, cobalt, and manganese). Their occurance, availability, physiological functions and importance in plants, deficiency and toxicity symptoms in plants,

4.7.2.1 Fertilizers [3 hours]

Inorganic and organic fertilizers, straight fertilizers, blends and compound fertilizers. Formulations. Methods of fertilizer application.

5. Practicals

1. Identification of parent rock samples and resultant soils

   Parent rock samples and soil samples are provided. Students observe and identify the different types of parent rock samples and the resultant soil type.

2. Identify the colours of different soils at the college using a munsell colour booklet.

   Various soil samples are collected by students. Using the munsell colour chart they determine the soil colour

3. Analysis of the soil catena of the college area.

   Students observe the variation of soils down a slope in terms of soil profile and colour. Samples are collected for further actual colour determination using the munsel colour chart. Students account for the depth and colour changes down the slopes in form of write-ups.

4. Identify the textures of different soils at the college using the feel, sedimentation sieve and the hydrometer method.

   Various soil samples are collected by students. Sudents determine the propotion of sand silt and clay using sedimentation, sieve and the hydrometer methods. Textural triangles are then used to determine the textural classes. Using the feel method the students are directed to the textural classes following instructions on the provided manual.

5. Soil Sampling

   Using various sampling patterns students collect soil making use of the hoe spade, trowel, and auger methods. Follow the principles of soil sampling and observe the necessary precautions.

6. pH determination

   Students collect various soil samples. Using a pH meter students determine the pH of the college soils following appropriate procedure.

7. Field Trip

   Tour to the Chemistry and Soil Research Institute of the DR and SS

6. Assessment

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Barred from writing final exam if coursework (practical plus theory) mark is less than 40%.

7. Reading Materials

Bear F. E., 1964, **Chemistry of the Soil.** Oxford and IBH Publishing, India.

Brady...

Buckman H.O and Brady N.C., 2003, The Nature and Properties of Soils. Macmillan Publishers, London.

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Ross A., 1996, **The Nature of Soils**. Lakeland University Press, USA.

White R.E., 1997, **Principles and Practice of Soil Science**. Blackwell Publishers, USA

Wild A., 1996, **Soil and the Environment**. Cambridge University Press, UK.

Hussein. J. Principles of soil science Module 1. ZOU

Name of course	**Principles of Crop Science**
Course code	**CP102**
Programme and level	**Diploma in Agriculture, Part 1**
Course units	**10**

1. Course Description

This course is designed to provide students with the basic understanding of the plant structure, processes which takes place within the plant and the biology of microorganisms important in agriculture. It is composed of three sections. Section 1 covers some basic topics on botany which include cytology, plant organs (roots, stems, leaves and flowers), reproduction and seed structure and dormancy. Section 2 covers the physiology of plants which includes plant water relations, plant energy relations and plant growth regulators. Section 3 covers the biology of microorganisms which include bacteria, fungi and viruses. This course provides the basic knowledge on how plants relate to the biotic and abiotic factors which will apply in the production courses of individual crops.

2. Course Content

1. **Botany**

Introduction: terms commonly used in botany, evolution, plant taxonomy, comparison of plant and animal structure

Cytology: Plant cell structure, plant cell organelles and functions, comparison of animal and plant cell, growth by cell division (mitosis) and cell enlargement.

Roots : Structure, function and development of plant roots, effect of water stress on root system, uses of roots

Stem: Structure, function and development of plant stem for Dicotyledon and Monocotyledon plants.Modified stems.Ring barking.Uses of stems.

Leaves: Structure, function and development of plant leaf for Dicotyledon and Monocotyledon plants.Shape and arrangement of leaves. Uses of leaves.

Flowers: Structure, function and development of plant flowers**.** Types of inflorescence with reference to graminaceous and leguminous plant

Reproduction: Sexual reproduction**,** Process**,** Advantages and disadvantages.Vegetative Reproduction, Process**,** Advantages and disadvantages

Seeds: Types of fruits**:** Structure of monocotyledon and dicotyledon seeds**.**

Germination. Seed dormancy**.** Types of seed dormancy**.**Importance. Mechanisms to overcome seed dormancy**.** Germination testing.

2 . **Plant Physiology**

Water: Properties of water, Functions, Absorption and transport of water

Plant water relationship: Diffusion and osmosis, Components of water potential, effect of water stress in plants

Transpiration and wilting: Factors affecting transpiration, Importance of transpiration**.** Types of wilting**,** Effects of wilting

Photosynthesis: Description of process- C3, C4 and CAM pathway**,** Comparison of C3 and C4 plants**,** Importance of photosynthesis

Respiration: Description of process**,** Importance of respiration

Growth hormones and regulants: Growth regulators**,** Application of growth regulators in agriculture

3. **Microbiology**

Structure, growth, reproduction and function of bacteria, fungi and viruses and importance to agriculture

Parasitism, symbiosis, saprophytes, autotrophy and heterotrophy

PRACTICALS

1. Microscopy: plant cell structure.
2. Microscopy: mitosis
3. Microscopy: plant part structures- root, stem, leaves, flowers and seed.
4. Weed identification
5. Germination testing
6. Osmosis
7. Photosynthesis – tests for starch
8. Use of growth regulators.
9. Microscopy: bacteria, and fungi
10. Disease diagnosis

REFERENCES

Dalta, S.C., 1994. **Plant physiology.**Wiley Estein Limited, New Dehli, India.

Street, H.E. and Opik, H., 1984. **The Physiology of Flowering Plants:their growth and development.** Edward Anorld Publishers, London.

Wilkins, M.B.1984. **Advanced Plant Physiology.**Longman Scientific and Technical, Essex.

Agrios G.N. 1998. ***Plant pathology*.** 3rd Ed. Academic Press, Inc., New York.

Atlas R.M. 1984. ***Microbiology: Fundamentals and applications*.** MacMillan Publishers

Berrie G.K., Berrie A, and Eze, 1987. ***Tropical plant science***. Longman Scientific and Technical, UK.

Geta S.1970. ***The Biology of Fungi, Bacteria and Viruses*.** 2nd Ed.

Green N.P.O., Stout G.W., Taylor D.J. 1990, ***Biological Sciences.*** 2nd Ed. Cambridge University Press, New York, USA. Pg 13-16.

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Heritage J, Evans G.V, Killington R.A. 1996. ***Introductory to Microbiology***. Cambridge Press, U.K.

Matthews D. 1991. ***Plant Virology***. 3rd Ed. Academic Press, New York.

Schlegel H. G. 1993. ***General microbiology***. 7th Ed. Cambridge University Press. London.

Thottappilly G, Monti L. M, Mohan Raj and Moore A. W. 1992, ***Biotechnology enhancing research in Tropical Africa.*** CTA/IITA co- publication. IITA, Idadan, Nigeria. Pg 211.

Walkey 1991. ***Applied Plant Virology.*** 2nd Ed. Chapman and Hall, UK.

GENERAL AGRONOMY (CP 103)

COURSE SYNOPSIS

General agronomy is a course that is designed to provide students with basic understanding of ideal management practices of field and horticultural crops. This course is composed of two sections. Section one will cover the general agronomic practices which include cropping systems, land preparation, crop establishment, pests and diseases management and agrochemicals. Section two covers agroforestry which include topics such as agroforestry tree species propagation and management, agroforestry systems and practices. It forms the foundation of production courses.

OBJECTIVE

By the end of the course, students should be able to adopt and apply agronomic and agroforestry practices important in crop production.

TEACHING METHODS

The course will be covered using lectures, practicals and educational tours. Students will be provided with lecture notes. Teaching aids will include the chalkboard, power point project and samples where possible. Participatory group approach will also be used.

COURSE CONTENT

Classification of crop plants: Classify plants according to agronomic and botanic classification.

Land selection for cultivation: Discuss factors consider when selecting land for cultivation

Land preparation for cultivation: Discuss how land is cleared for cultivation and tilled for crop establishment.

Planting: Discuss the time of planting, plant population, methods of planting and planting depth of various crops.

Agro-ecological classification of Zimbabwe: Identify the agro-ecological regions and their intensive use.

Weeds and their control: Identify common arable weeds and choose best control measure

Pests and their control: Identify common crop pests, their life cycle, their damage and how they are controlled.

Diseases and their control: Identify common crop diseases, discuss their causative organism, predisposing factors, symptoms and disease control.3hrs

Agrochemicals: Discuss different groups of agrochemicals, their formulation and their safe use. 3hrs

Definition of agroforestry and its importance in agriculture

Agroforestry species, propagation and management: Discuss agroforestry tree species, their propagation and management.

Agroforestry systems and practices: Discuss the various agroforestry systems and practices

Post-harvest handling and marketing of Agroforestry products

PRACTICALS

1. Land clearing: stumping and ring barking
2. Planting various crops e.g maize, cotton, soyabeans, sunflower, sorghum, tobacco etc.
3. Moisture conservation techniques.
4. Weed identification
5. Manual and mechanical weed control
6. Knapsack calibration
7. Herbicide application
8. Safe use of pesticides
9. Pest identification and control
10. Disease identification and control
11. Identification of agroforestry tree species
12. Establishing agroforestry tree nursery

ASSESSMENT

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Students will not be allowed to sit for final exam if coursework (practical plus theory) mark is less than 40%.

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- Agritex (1988 Han) **Horticulture handbook**. Agritex, Harare.
- Agritex (1993) **Farm management handbook** Agritex Harare.
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- Mabveni A.R.S, (2000) **Entomology,** Zimbabwe Open University, Harare, Zimbabwe.
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- Richards O.W. and Davies R.G. (1993) Imms **General Textbook of Entomology**. Volume 2: classification and biology (10^{th}ed.) Chapman and Hall London New York.

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- Sherf Arden F and Alan A. Macnab, (1996) **vegetable disease and their control** second addition, A Wiley Interscience Publication Canada.
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GENETICS (CP104)

COURSE DESCRIPTION

This course is designed to provide students with the basic understanding of genes, how they can be manipulated in crop and animal improvement. Topics covered include the nucleus and cell division, Mendelian laws and ratios and their derivatives, mutations and plant breeding methods. This course provides the basic principles for plant and animal breeding.

OBJECTIVES

Students should be able to:

- Explain the role played by genetics to agriculture
- Mention some of the successful breeding programmes in Zimbabwe
- Describe all parts of cells and their functions.
- Illustrate the structure and morphology of the chromosome.
- Describe the process and roles of mitosis and meiosis in agriculture
- Explain the genetic terms; Dominant and recessive Homozygous and Heterozygous
- Explain the law of segregation and the law of independent assortment and their derivatives
- Explain sex linkages, sex limited and sex-influenced genes
- Discuss the types of mutations which include morphological, lethal, bio-chemical, regulatory and conditional mutation.
- Explain mutations such as gene mutations, and chromosomal mutations such as euploidy and aneuploidy.
- Explain how sex is determined in various species of animals.

- Explain the various mechanisms of plant resistance to pests and diseases such as tolerance, antibiosis, preference and non preference, escape mechanism
- Explain how hybrids are produced in plant breeding
- Discuss the problems associated with plant breeding
- Explain the steps of cultivar development and seed classes available in Zimbabwe.

COURSE CONTENT

Introduction

Roles of genetics to agriculture**,** genetic mechanism, the cell and its components, the nucleus, chromosomes and genes**.**

Cell division

mitosis, meiosis, segregation and linkage

Mutation and sex determination

Types of Mutation; morphological lethal, biological, regulatory and conditional

Gene mutations and chromosomal mutations , euploidy and aneuploidy.

Sex determination: Sex Chromosomes X-Y , sex Chromosomes X-O, sex Chromosomes Z-W, parthenogenesis, and the environment. Sex linkages, ratios, sex limited and influenced characters and Free martinism.

Character determination

Dominant, recessive, Co-dominant, Incomplete/ Partial /semi dominance and multiple alleles. Heterozygosity and homozygosity, phenotype and genotype.

Mendelian ratios

Laws of Heredity Monohybrid inheritance and dihybrid inheritance, ratios; 3:1, 1:2, 1:1, 9:3:3:1 and their derivatives.

Production characters

Characters of plants limiting production such as yield, pests and disease resistance, height, drought tolerance etc.

Gene/ environment interaction

Lethal genes, variation -discontinuous and continuous variation, genetic sources of variation.

Plant Breeding

Hybrids, monohybrids, dihybrids, testing, introduction of new varieties and legislation.

Principles of crop cultivar development, and problems of cultivar development.

Methods of crop improvement

Selection: Mass selection and Pure line selection

Hybrbribeation: Certain steps taken during hybridization, Types of hybrids; Conventional hybrids and open pollinated varieties.

PRACTICALS

1. Microscopy(mitosis and meiosis)
2. Plant breeding techniques(selfing, emasculation, and controlled hand cross pollination).
3. Maize detasseling
4. Tours to plant breeding institutes and seedhouses.

REFERENCES

Day P. R. 1998., Genetics of Post – Parasite interaction. Freeman and Company, United States of America.

Frankel O. H., Hawkes J.G.,1995. Crop Genetics Resources for Today and Tomorrow, University Printing House, Cambridge, Great Britan.

Reed J.D., Capper B.S. and Neate P.J.H, 1988. Plant breeding and nutritive value of crop residues, proceeding of a workshop held at ILCA, Addis Ababa, Ethiopia, 7-10 December 1987. ILCA, Addia Ababa

Strickberger.M.W., 1968, Genetics, The University of Missouri- St Louis. MaccMillan , New York.

VEGETABLE PRODUCTION (CP1O5)

COURSE DESCRIPTION

This course is designed to provide students with the basic understanding of principles of vegetable production and the production technology of individual vegetable crops. The vegetable classes covered include brasiccas, solanaceous crops, cucurbits, legumes, bulb crops and root crops. This course is aimed at equipping students with knowledge and skills in vegetable production.

OBJECTIVES

Students should be able to:

- Discuss horticulture and its branches, classify vegetable crops into different classes and select a good garden site.
- Implement the relevant nursery practices in the garden.
- Name the common vegetables using both common and scientific names and appreciate their nutritional contribution to the diet.
- Describe all the necessary management practices of individual crops starting from the nursery up to harvesting including their post harvest handling.
- Describe the maturity indices of individual crops and methods of harvesting.

COURSE CONTENT

Principles of horticulture

Horticulture and its branches, Importance of horticulture, Classification of vegetable crops, Cultivars, seed and storage.

Production systems of horticultural crops, Economics of market gardening, Garden site selection, preparation and propagation

Nursery practices and management, Vegetable crop rotation, Compost and fertility trench making, Fertilizer Management of vegetable crops.

Susceptibility to nematode, weed, Pest and Disease and management, Irrigation of vegetable crops and Post harvest handling of vegetables

Production Technology of Individual Crops

- Leaf vegetables – cabbage or rape(6 hours)
- Fruit vegetables – tomato or egg plant
- Cucurbits – cucumbers or sweet melons
- Leguminous vegetables – peas or green beans
- Bulb crops – onions or leeks or garlic
- Root crops – carrots or sweet potatoes
- Tuber crops- potato

All the 7 crops above should be studied under the following headings

- Scientific name of crop
- Nutrient value and part eaten
- Brief history and origin

- Climatic and soil requirements
- Land preparation
- Fertility management
- Cultivars and propagation
- Field planting
- Irrigation
- Crop protection (weeds, pests and diseases)
- Maturity indices and harvesting
- Post harvest handling of vegetables
- Marketing

PRACTICALS

1. Vegetable nursery establishment
2. Vegetable crop planting
3. Vegetable pests, diseases and disorders identification and control
4. Pruning, trellising and training
5. Vegetable frost protection methods
6. Tours to vegetable producers

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Barred from writing final exam if coursework (practical or theory) mark is less than 40%.

REFERENCES

Agritex (1993) **farm management handbook** Agritex Harare.

Floyd .M. Ashton, Thomas, J. Manaco (1991) **Weed Science Principles and Practices**, John wiley and sons Inc.

Julia Sibiya (1999) **Crop Physiology and Crop Protection, Plant pathology**, Zimbabwe Open University, Harare, Zimbabwe.

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Wien.H. C.,1997, **The Physiology of Vegetable Crops**. Department of fruit and vegetable Science .Cornell University, Ithaca NY. USA. CAB International.

SMALL GRAINS AND MINOR CROPS (CP106)

COURSE DESCRIPTION

This course is designed to provide students with the basic understanding of principles of small grains and minor crops production. The crops covered include sorghum, millets, tea, coffee, sugar cane, cow peas and sunflower. This course equips students with knowledge of small grains and minor crops production which they can apply practically during production work and as consultants.

TEACHING METHODS

The course will be covered using lectures, practicals and educational tours. Students will be provided with lecture notes. Teaching aids will include the chalkboard, power point project. Participatory group approach will also be used.

OBJECTIVE

By the end of the course, students should be able to:

Plant and manage the crops to be covered.

Identify the crops, plant, manage and harvest them timely.

COURSE CONTENT

Each crop would be covered under the following topics:

Origin and history

Botany of the crop

Adaptation- climate and soil requirements

Uses and importance

Land preparation

Cultivars and cultivar selection

Planting

Fertility management

Land preparation

Crop protection (weeds, pests, diseases and their control)

Harvesting and processing/curing

CROPS TO BE COVERED

1. Sorghum and millets
2. Sugar cane

3. Sunflower
4. Tea and Coffee
5. Paprika
6. Cowpeas
7. Bambara nuts
8. Cassava

PRACTICALS

1. Planting of sorghum and minor crops (sunflower, sugar cane)
2. Thinning of sunflower
3. Herbicide application
4. Top dressing
5. Disease identification and control
6. Pest identification and control
7. Harvesting

REFERENCES

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- RacemaekersRomain H. (2001) **Crop Production in Tropical Africa**, Brussels, Belgium.
- Onwueme I C and Sinha T D (1991) **Field Crop Production in Tropical Africa**, Technical Centre for Agriculture AND Rural Co-operation.

- Rene Coste (1993) **Coffee the Plant and the Product**, Phil Brodact 2 pover publications INC Landon.
- Sibiya Julia, (1999) **Crop Physiology and Crop Protection, Plant pathology**, Zimbabwe Open University, Harare, Zimbabwe.

PART THREE

CEREAL PRODUCTION (CP 301)

COURSE DESCRIPTION

This course is designed to provide students with knowledge and practical skills required in the production of cereal crops which include maize (commercial and seed maize), wheat and barley. It covers all agronomic practices from crop establishment up to harvesting. It also extend to postharvest handling of these cereals.

TEACHING METHODS

The course will be covered using lectures, practicals and educational tours. The source of information would be reference books, internet and publications from seed houses.

OBJECTIVES

By the end of the course students should be able to:

Plant, manage and harvest maize, wheat and barley crops.

COURSE CONTENT

1. Maize production

    Introduction

    Growth stages

    Adaptation

    Varieties and their choice

    Land preparation

    Planting

Fertility management

Plant protection (weeds, pests, diseases and their control)

Irrigation

Harvesting

Drying and storage or marketing

Seed maize production

2. Wheat production

Introduction

Growth stages

Adaptation

Varieties and their choice

Land preparation

Planting

Fertility management

Plant protection (weeds, pests, diseases and their control)

Irrigation

Harvesting

Marketing

3. Barley production

Introduction

Growth stages

Adaptation

Varieties and their choice

Land preparation

Planting

Fertility management

Plant protection (weeds, pests, diseases and their control)

Irrigation

Harvesting

Marketing

PRACTICALS

1.0.Planting of maize, wheat and barley.

2.0.Selfing maize plants

3.0.Detasselling seed maize

4.0.Weed management in maize, wheat and barley.

5.0.Top dressing the maize, wheat and barley crop.

6.0.Identification of cereal pests.

7.0.Identification of cereal diseases.

8.0.Determination of moisture in cereal grains.

9.0.Harvesting the maize, wheat and barley crop.

10.0. Control of grain storage pests

REFERENCES

- AfricCOMMS (Pvt) Ltd 2002 **Open pollinated maize seed production handbook** SADC/GTZ Harare, Zimbabwe.
- Commercial Grain Producers Association Zimbabwe (1983), **Grain Handbook**, Screenlitholk(Pvt) Ltd, Harare Zimbabwe.
- National breweries Barley handbook
- Onwueme I C and Sinha T D (1991) **Field Crop Production in Tropical Africa**, Technical Centre for Agriculture AND Rural Co-operation.
- Winter cereal handbook

TOBACCO PRODUCTION (CP 302)

COURSE DESCRIPTION

This course is designed to provide students with knowledge and practical skills required in tobacco production. It covers all practices as from seedbed establishment for both the conventional and float bed systems, agronomic practices and all post harvest handling up to marketing.

OBJECTIVES

Students should be able to:

- List all types of tobacco grown in Zimbabwe.
- Explain the factors to consider before choosing a tobacco variety to grow.
- Evaluate and give recommendations on the types of seedbeds used in tobacco nursery production.
- Undertake all the management practices which are carried out in the seedbed inorder to produce ideal tobacco seedlings. undertake the agronomic practices like land preparation, transplanting, fertilizer application and ridging as required by the crop
- Manage weeds, major pests and diseases of tobacco
- Describe the different stages of curing tobacco specifying the environmental characteristics of each stage.
- Relate barn capacity to the area a farmer can grow sustainably
- Describe tobacco storage methods, grading, tying of hands, baling and TIMB classifications.
- Describe and discuss the marketing systems of tobacco in Zimbabwe.

COURSE CONTENT

Introduction

Botanical classification, types of tobacco i.e. Virginia, burley and oriental, Use of cured product and world production.

Varieties and choice of varieties.

Seedbeds

Types of Seedbeds (conventional and float bed systems), Site selection and selection factors, Site preparation, Seedbed hygiene, Nematode control in seedbed, Fertilizer application, Sowing, Mulching, Watering and watering systems, Clipping, Hardening, Pulling, Precautions against overgrowth in seedbeds, Precaution against hail damage to seedlings, Diseases and pest control in seedbeds.

Lands

Choice of soils, Rotation Timing and methods of ploughing, liming requirements, Ridging and fertilizer placement, Nematode control in lands.

Transplanting

Timing, Precautions, Spacing, Water requirements, Choice of ideal seedlings.

Weeds and weed Control

Types of weeds, Effects of weeds, and Methods of weed control.

Pests and their control

Major pests, their damage and their control and Integrated pest control

Diseases and their control

Major diseases and their control, and integrated disease control

Topping and sucker control

Effects of topping and sucker control, Timing of topping and sucker control, Methods of sucker control (advantages and disadvantages).

Reaping

Time of ripping, Methods of ripping and Barn loading.

Curing

Curing process, Curing systems and Curing problems.

Barn capacity calculations and yield estimation

Tobacco storage, grading, tying of hands and baling

Marketing

Systems of marketing, Tobacco Industry Marketing Board(TIMB) classifications of tobacco leaf.

PRACTICALS

- Nursery establishment
- Clipping
- Transplanting
- Topping
- Sucker control
- Tobacco pest control
- Tobacco fertiliser application
- Reaping and barn loading
- Curing
- Grading and baling
- Tour to Tobacco Research Board- Kutsaga
- Outreach programmes to farmers.

Assessment

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Barred from writing final exam if coursework (practical plus theory) mark is less than 40%.

Reference

- Flower K C, (1994), **Cured leaf disorders of flue cured tobacco**, Technical Bulletin No.2, Tobacco Research Board, Harare.
- Ministry of Agriculture, Mechanisation and Irrigation Development, (2010) ***Farm Management Handbook: Horticultural crops*,** Volume 2, (pages 5-6) Harare, Zimbabwe.
- Tobacco Research Board (1992), ***Flue- cured recommendations*,** Tobacco Research Board, Harare.
- Tobacco Research Board (1994), **Hand Book of Burley *Recommendations***, Tobacco Research Board, Harare.

0ILSEEDS CROP PRODUCTION (CP 303)

COURSE DESCRIPTION

This course is designed to provide students with knowledge and practical skills required in the production of oil seed crops. Crops covered include soyabeans, groundnuts and cotton. It covers all agronomic practices from crop establishment up to postharvest handling of these oil crops.

TEACHING METHODS

The course will be covered using lectures, practicals and educational tours.

COURSE CONTENT

1. **Introduction to Legumes**

Uses of legumes, Advantages and disadvantages of legumes, Classification of legumes, Nodulation and factors affecting efficiency of nitrogen fixation, Kinds and distributing of nodules, Rhizobia species/ strain and host specificity, Inoculants and inoculation methods, inoculants compatibility with fungicide, seed dressing and insecticides.

2. **Groundnuts**

Introduction

Uses, Botany, Varieties and their classification, Adaptation, Climatic requirements, Soil requirements, Rotations,

Land preparation, planting and fertilizer management

Time, Methods, Planting Dates, Seed rates, Spacing, Depth, Seed dressing, inoculation and fertilizer application.

Crop protection

Weeds and their control, Disease and their control- Causal agent, symptoms and the control of major diseases: Pod diseases, Root diseases, Stem diseases, Leaf disease. Pests, damage and their control: African bollworm, Semi loopers, Aphids, Snout beetles, Hilda

Irrigation

Pre-planting, Post –planting

Harvesting

Lifting time, Methods of harvesting, Curing, Plucking, Shelling, and Marketing.

3. **Soyabeans Production**

Introduction

Origin and distribution, Botany, Uses and nutritive value of soyabeans, Advantages of growing soyabeans including rotation.

Varieties

Description of varieties, factors affecting choice

Adaptation

Soil requirements, Climate requirements

Land preparation

Time of land preparation, Method of land preparation.

Fertilizer application

Nutrient requirements, Types of fertilisers, Methods of application, Time of application.

Planting

Time of planting, Depth of planting, Seed rates, Spacing, Seed preparation and inoculation Methods of planting

Weeds and their control

Effects of weeds, Methods of weed control.

Pests and their control

Semi-looper and caterpillars, African bollworm, Cutworm, Aphids, Snout beetles.

Diseases and their control

Causal agent, symptoms and control of major diseases- Leaf diseases, Stem diseases, Root diseases and Pod diseases

Harvesting and Marketing

Maturity indices, Methods of harvesting (advantages and disadvantages of methods), and marketing.

4. **Cotton**

Introduction

Origin, uses, Botanic classification and main groups according to the staple length.

Adaptation:

Climatic requirements, Soil requirements

Land Preparation

Time of land preparation, Methods of land preparation

Rotations

Moisture conservation and management

Fertilizer management

Nutrient requirements, Type of fertilizer, Methods of fertilizer application, Time of application

Planting

Dates of planting, Seed rates, Depth of planting, Methods of planting, Spacing, Gap filling, Thinning.

Crop protection

Weeds and their control: Effects of weeds, Methods of weed control

Pests and their control including IPM : Leaf eaters, Sucking pests, Root pests, Scouting for pests, Pesticide application ,

Diseases and their control: causal agents, symptoms and control of major disease

Harvesting

Maturity indices, Methods of picking, Cleaning, Grading , Baling

Marketing

PRACTICALS

1. Soyabean seed inoculation and planting

2. Nodule identification
3. Pests and disease identification and control
4. Groundnut maturity indices and harvesting
5. Soyabean harvesting
6. Cotton planting
7. Thinning
8. Weeding
9. Pest identification
10. Scouting
11. Disease identification
12. Yield estimation
13. Picking

ASSESSMENT

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Barred from writing final exam if coursework (practical plus theory) mark is less than 40%.

REFERENCES

Agritex (1993) farm management handbook.Agritex Harare.

Ministry of Agriculture Mechanization and Irrigation Development (2010) Farm Management Handbook, Horticulture Crops volume 2. Ministry of Agriculture Mechanization and Irrigation Development, Harare.

Sibiya Julia, (1999), Crop Physiology and Crop Protection, Plant pathology, Zimbabwe Open University, Harare, Zimbabwe.

Sheppard. S and Ndebele. D, 2010, Zimbabwe Crop Chemical Handbook Volume 1: Insecticides, Fungicides, Growth Regulants, Fumigants and Public Health Products, CropLife Zimbabwe.

Cotton Training Centre ,Cotton course handbook 2007, Zimbabwe.

Ministry of Agriculture, Mechanization and Irrigation development. Farm Management Handbook- Field crops ,Volume 1 , 2010.

RacemaekersRomain H., Crop Production in Tropical Africa , 2001,Brussels, Belgium.

Purseglove J.W. 1984, Tropical crops, dicotyledons, volume 1 and 2 combined, ELBS,England.

FRUIT PRODUCTION (CP 304)

COURSE DESCRIPTION

This course is designed to equip students with basic knowledge and practical skills required in the production of tropical, subtropical and temperate fruit trees. It covers three main groups of fruit trees which include banana and mango (tropical), citrus and granadilla (subtropical) and grapes and apples (temperate). It emphasises on all agronomic practices from propagation upto harvesting. It also offers the post harvest handling technology of each fruit crop.

OBJECTIVES

Students should be able to:

- Discuss fruit production and its potential as a commercial enterprise to any economy.
- Explain the distribution of fruit trees throughout the world
- Practice the various propagation techniques for fruit trees
- Explain the orchard care practices involved in production of each fruit crop.
- Practice techniques used when training, trellising and pruning fruit trees.
- Describe the maturity indices, harvesting and different postharvest methods of fruits.

TEACHING METHOD

Lectures , tutorials, seminars, practical demonstrations and educational tours.

COURSE CONTENT

Introduction

Importance of fruit in the diet

General characteristics of tropical, sub tropical and deciduous fruits.

Orchard establishment, general orchard care and propagation techniques.

Production technology of fruit crops

- Tropical fruits – Banana and Mango
- Subtropical fruits – Citrus and Granadilla
- Deciduous fruits – Grapes and Apples

Description of agronomic practices for each of the fruit crops according to the following subheadings;

Botany and ecology

Name of fruit crop (botanical name), Tree (plant) characteristics, Cultivars, Adaptation, Soil requirements, Climatic requirements, Propagation, Vegetative propagation, Seed propagation.

Planting

Time of planting, Spacing and Depth of planting

Orchard care

Water management, Fertilizer management, Pruning and training, Crop protection (Pest and disease control), Weed control and Frost protection.

Harvesting

Maturity indices, Methods of harvesting (advantages and disadvantages), Post harvesting practices and Marketing.

PRACTICALS

1. Vegetative propagation techniques
2. Identification of planting material and establishment
3. Propping, bunch covering, desuckering, leaf trimming and bell removal
4. Artificial ripening of bananas
5. Fertilizer application on fruit crops
6. Pruning and training
7. Tree basin construction
8. Spraying of chemicals to break dormancy (Apples) and for pests disease control
9. Harvesting of fruits
10. Tours to fruit producers(nurseries and orchards).

ASSESSMENT

Final exam mark: 40% theory exam, 10% theory coursework, 35% practical coursework and 15% practical exam. Barred from writing final exam if coursework (practical or theory) mark is less than 40%.

REFERENCES

1. *Agritex (1993)* farm management handbook *Agritex Harare.*
2. Bally. I. S. E., 2006, Species Profiles for Pacific Island Agroforestry- *Mangifera indica* (mango), Permanent Agriculture Resources (PAR), Hawai‘i.

3. Birgit. B., 2013, The Tropical Permaculture Garden. [Online], www.tropicalpermaculture.com/growing-bananas.html.
4. Evans .E and Frank. A., 1999, Plant Propagation by Layering, Instructions for the Horticulture Gardener, Cooperative Extension Services, North Carolina.
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11. Richard A, Hamman I, Savage S. D and Larsen H. J, 1998, The Colorado Grape growers' Guide, Colorado State University, Colorado.
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14. Sheppard. S and Ndebele. D, 2010, Zimbabwe Crop Chemical Handbook Volume 1: Insecticides, Fungicides, Growth Regulants, Fumigants and Public Health Products, CropLife Zimbabwe.
15. *Sibiya Julia, (1999),* Crop Physiology and Crop Protection, Plant pathology, *Zimbabwe Open University, Harare, Zimbabwe.*
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FLORICULTURE AND LANDSCAPING MANAGEMENT (CP 305)

COURSE DESCRIPTION

This course is designed to equip students with the cutting edge knowledge and practical skills required in the production of flowers and the basic principles and elements of landscaping and landscape designs..

TEACHING METHOD

The course will be covered using lectures, practicals and educational tours.

OBJECTIVES

Students should be able to:

- Identify lawns, hedges and shrubs as well as flowers (roses, protea and chrysanthemums).
- To propagate ornamental plants
- Manage ornamentals (flowers, lawns, shrubs and hedges)
- Improve the aesthetic value of a given land

COURSE CONTENT

1. **Landscape design**

Factors considered when designing a garden/landscape, Landscaping goals, Basic principles of landscape design, Steps in developing a landscape, Maintenance of landscapes, Identification of lawns and turf grasses, Management of lawns and turf grasses, Identification of hedges and shrubs, Management of hedges and shrubs.

2. **Ornamentals**
    1. Roses
    2. Chrysanthemum
    3. Protea

All the above to be discussed under the following headings

Origin

Adaptation

Climatic requirements, Soil requirements

Fertilizer application

Nutrient requirement, Type of fertilizers, Methods of fertilizer application,

Land preparation

Time, Methods,

Planting

Spacing, Time, Methods (vegetative and seed), Care and management

Water requirements

Pruning and training

Pest and disease control

Weeds and their management

Harvesting

Timing, Methods of harvesting

Marketing

PRACTICALS

1. Identification of flowers, lawns, shrubs and hedges.
2. Propagation of flowers, lawns, shrubs and hedges.

REFERENCES

Bettina Gollnow (1996) Getting started in native flower production, NSW Agriculture

Hortguide (1997) Information guide for horticultural industry, Rural Press

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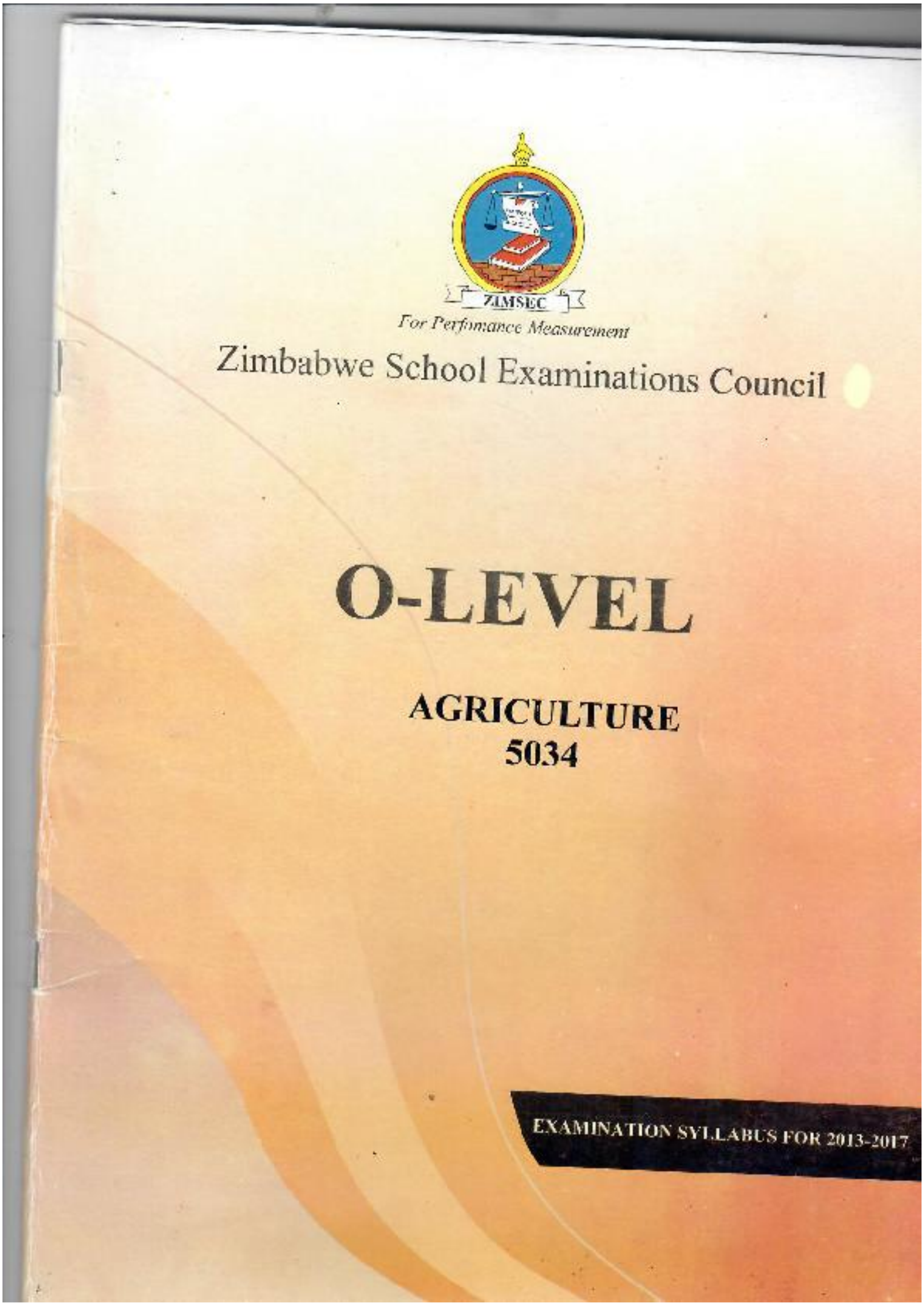
https://en.wikipedia.org/wiki/shrub

Jenkins VS (1994) the lawn: A history of an American obsession. Smithsonian Books

Pollard E, Hooper MD and Moore NW (1974) Hedges, London: Collins

SUGAR CANE, TEA AND COFFEE PRODUCTION (CP306)



ZIMSEC

For Perfomance Measurement

Zimbabwe School Examinations Council

O-LEVEL

AGRICULTURE
5034

EXAMINATION SYLLABUS FOR 2013-2017

CONTENTS

AGRICULTURE (ZIMBABWE)

5034

GCE ORDINARY LEVEL/SCHOOL CERTIFICATE

A. PREAMBLE

This syllabus is designed to provide a two year course of study which will culminate in the '0' level examination. It provides a foundation for the 'A' level Agriculture course and alternative specialised training for pupils who wish to pursue a career in agriculture. The syllabus consists of **core** and **four** options. All candidates must study the core topics and one of the options.

The specific concepts, skills and attitudes introduced at pre-vocational level will be reinforced and expanded on through theory and practical activities. Only those schools with adequate facilities to cover the syllabus should include the subject in their curricula.

B. AIMS

The syllabus aims to:

1. promote an appreciation of agriculture as an applied science;
2. stimulate an interest in and create an awareness of existing problems and opportunities in agricultural and rural development;
3. stimulate positive attitudes by showing that efficient farming can be a rewarding occupation;
4. develop initiative and problem-solving abilities, so as to encourage resourcefulness and self-reliance;
5. encourage the teaching and learning, in a practical manner, of basic principles and skills in agriculture and farm business management;
6. demonstrate the value of agriculture to the family and community, so as to show how improved agriculture can contribute to the world-wide campaign for freedom from hunger;
7. provide a basis for more advanced studies in agriculture;

8. ensure that schools take an active part in rural development by integration of agricultural activities into the school curriculum;

9. develop a school farm and to ensure that students actively participate in the farming events throughout the course;

10. develop positive attitudes towards the country's natural resources so as to conserve and use them wisely.

C. ASSESSMENT OBJECTIVES

The following assessment objectives describe the knowledge, skills and abilities which candidates are expected to demonstrate at the end of the course. They reflect those aspects of the aims that will be assessed.

1.0 KNOWLEDGE WITH UNDERSTANDING

Candidates should be able to:

1.1 use terms, symbols, quantities and units of measurement correctly;

1.2 recognise, recall and show understanding of specific agricultural (scientific) facts, terminology, principles, relationships, concepts and practical techniques;

1.3 make correct reference to facts, concepts and principles;

1.4 select, organise and present relevant information clearly and logically;

1.5 draw on existing knowledge to show understanding of ethical, social, economic, environmental and technological implications of agricultural science.

2.0 APPLICATION OF KNOWLEDGE AND UNDERSTANDING

Candidates should be able to:

2.1 use information in various forms such as written, graphs, diagrams and tables;

2.2 solve agricultural problems theoretically and practically;

2.3 carry out relevant calculations;

2.4 plan and implement the management of an agriculture enterprise.

3.0 PRACTICAL SKILLS AND INVESTIGATION

Candidates should be able to:

3.1 devise and plan experimental and investigative activities, selecting appropriate techniques;

3.2 choose suitable techniques, equipment and materials for safe and correct application or use;

3.3 follow instructions by acting accordingly;

3.4 make and record observations and measurements accurately;

3.5 interpret and evaluate methods, observations and data relating to the investigation;

3.6 maintain accurate physical and financial records of an agricultural enterprise.

4.0 RELATIONSHIP BETWEEN ASSESSMENT OBJECTIVES AND ASSESSMENT COMPONENTS

	Assessment Objectives	Weighting	Assessment Components
Knowledge with Understanding	1.0	25%	Paper 1, 2
Application of knowledge with Understanding	2.0	50%	Paper 1, 2
Practical skills and Investigation	3.0	25%	Paper 3

upon the resoluteness and dedication of the Agriculture Department and Schools' Administration.

Farm Practice Diaries should be compiled by each candidate for every practical activity, including field trips, carried out during the two years of study. Greater emphasis should be placed on why any given activity was carried out, at this level. Teachers should ensure that Farm Practice Diaries are kept up-to-date and marked regularly during the first five terms.

The Farm Practice Diaries are compiled in a Practical Book. The diaries are used to write comprehensive reports on each enterprise to explain what was done, how it was done and why. Physical and financial records have to be tabulated for each enterprise. The reports in the Practical Book should reflect syllabus coverage as far as possible and should be marked continuously during the first terms.

It is suggested that the problem-solving approach be employed in the teaching of the subject. Case studies, field trips, discussions and demonstration should be used wherever possible as these are bases for anchoring abstract ideas.

Candidates should carry out and write a detailed report on a practical project. The practical project report should be problem focussed. The teacher has to evaluate and mark the project continuously during the first five terms. The assessed project reports will be required for scrutiny and moderation by Zimbabwe Schools Examinations Council (ZIMSEC).

F. PRESENTATION OF CONTENT

This syllabus consists of a core and four options.

The core is made up of five sections which all candidates must study. The core sections are:

Section 1	General Agriculture
Section 2	Crop Husbandry
Section 3	Livestock Husbandry
Section 4	Farm Structures and Machinery
Section 5	Agricultural Economics

Of the **four** options, candidates must study only **one.** Schools are advised to select options for which they have adequate resources and facilities. The **four** options are:

Option 1	Crop Husbandry
Option 2	Livestock Husbandry
Option 3	Decorative Horticulture
Option 4	Wildlife Management

The learning objectives are presented in behavioural form. The content column serves to limit the extent to which the learning objectives should be covered.

The notes and activities in the last column are in no way exhaustive. Teachers are encouraged to use their own additional examples so as to assist pupils in understanding concepts and acquiring skills.

SECTION 1 - GENERAL AGRICULTURE

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
1.1 Environmental factors	- list environmental factors influencing agricultural activities.	Environmental factors: wind, temperature, rainfall and humidity.	Conduct experiments on water loss through evaporation and evapo-transpiration.
	- define each of the environmental factors;	Effects of temperature on plant growth.	
	- explain the effects of temperature on water loss;	Loss of water through evaporation.	Carry out an experiment to illustrate transpiration.
	- define forms of wilting and explain causes;	Evapo-transpiration and wilting of crops.	
	- explain the effects of humidity on agricultural activities;	Effects of humidity on water loss and fungal disease attack.	
	- describe and illustrate the water cycle;	The water cycle.	Draw a diagram to illustrate the water cycle.
	- describe distribution, effectiveness, reliability and intensity of rainfall in Zimbabwe;	Distribution, effectiveness, reliability and intensity of rainfall.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- explain the affects of distribution and intensity of rainfall on agricultural activities;	Agricultural activities in relation to distribution and intensity of rainfall.	Discuss how agricultural activities in Zimbabwe are influenced by rainfall.
1.2 Natural farming regions	- identify natural farming regions on a map of Zimbabwe; - relate environmental factors to natural farming regions; - describe suitable farming systems and activities for each region; - state differences between the natural farming regions.	Agro-ecological zones of Zimbabwe. Agricultural activities suitable for each zone. Differences between zones.	Drawing a map of Zimbabwe showing the Agro-ecological zones. Identify the agricultural activities carried out in each of the natural farming region.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- state solutions for population related problems;		
	- describe the importance of physical farm planning;	Physical farm planning.	
	- define crop rotation, mixed farming, mono-culture, inter-cropping.	Principles of crop rotation, mixed farming, mono-culture. Inter-cropping.	
1.4 National agriculture programmes	- identify government and non governmental agencies responsible for agricultura extension and describe functions of each;	Existing Government and non-governmental agencies in Agriculture.	Conduct an outreach programme involving Agritex officers serving the local community.
	- explain the role of Agriculture education in schools and colleges;	Role of Agritex and Non-Governmental Organisations in extension, education, rural development.	Carry out a case study of a selected National agriculture programme.
	- describe resettlement models;	Agriculture research and its value.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
1.3 General principles of land use	- describe forms of land use;	Forms of agriculture such as forestry, wildlife management, crop and livestock husbandry. Protected areas.	Calculate population density of the local community.
	- identify protected areas in Zimbabwe;		
	- describe factors limiting land use;		In-corporate a simple four-year crop rotation system into the cropping programme.
	- define land tenure;	Land tenure	Carry out community land use survey, to determine the main agricultural activities.
	- describe each land tenure system;	Free hold, leasehold, communal and resettlement tenures.	
	- define shifting cultivation;	Shifting cultivation	
	- state advantages and disadvantages of shifting cultivation and settled farming;		
	- explain the effects of population on land use;	Population growth and land use.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- state livestock and crop improvement programmes; - explain the contribution of research to agriculture; - explain the roles of rural development programmes.	Rural development programmes: District Development Fund (DDF), Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), Reafforestation, District Environmental Action Planning Programme (DEAPP).	
1.5 Forestry	- explain the importance of forests; - identify local indigenous timber trees and others of ecological importance; - identify exotic timber trees growing in Zimbabwe; - distinguish between soft and hard wood; - establish and manage tree seedlings in nurseries; - demonstrate methods of plant propagation;	Importance of forests. Importance of indigenous timber species. Important exotic species. Choosing a nursery site. Soft and hard wood. Preparation of a nursery site. Raising seedlings in a nursery. Tree planting, thinning and harvesting.	Identify and label indigenous and exotic tree species growing in the locality. Collect planting materials and establish a woodlot nursery. Manage a woodlot nursery and an established woodlot. Harvest and treat timber. Design and implement an agro-forestry project at the school.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- thin and harvest mature forests; - describe methods of treating timber; - define deforestation; - explain causes and problems of deforestation and suggest solutions; - define and identify agro-forestry components;	Methods of treating timber. Deforestation: causes, problems and solutions. Agro-forestry practices and their importance.	
1.6 Wildlife	- describe the value of wildlife; - explain how cultural values and beliefs affect the management of natural resources; - discuss possible conflicts between humans and wildlife;	Value of wildlife: social, economic, cultural and ecological importance. Sustainable use of wildlife resources. Indigenous knowledge systems in management of natural resources. Human and wildlife conflicts. Protection of resources.	Conduct a survey to find out the social, cultural, economic and ecological importance of wildlife to the local community; Discuss results of the survey carried out to determine sustainability. Conduct class/school census based on totems that relate to animals found in the community.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- explain the existing legislation affecting wildlife in Zimbabwe;	Government Policy on wildlife.	Identify culturally preserved areas.
	- discuss the role of Government and Non-Governmental Organisations in wildlife management;	Government and NGOs in wildlife management.	Role play depicting/showing conflict between humans and wildlife. Conduct visits to game parks (safaris/ conservancies and sanctuaries to find out relevant information on Government Policy on wildlife.
	- explain the difference between conservation and preservation of wildlife; - explain how principles of conservation and preservation of wildlife affect trading.	Biodiversity and Convention on International Trade in Endangered Species (CITES) Conservation and preservation.	Debating/role plays on wildlife trade at local and international levels to show different views of consumers and welfarists.
	- define biodiversity and ecology;	Biodiervisity: genetic, species and ecosystem diversity.	Establish a nature reserve to encourage biodiversity.
	- describe the habitats of wild animals and why they differ;	Ecology. Habitats such as water (aquatic), forests, underground;	Field study of a habitat(s) to determine animal and plant species composition. Labelling habitats for specific wildlife species.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- illustrate food chains and webs;	Food chains and webs	Collect and analyse dung samples to explain food chain.
	- explain the food chain in an ecosystem;	Survival skills such as feeding habits, camouflage, sentinels.	Identify hiding places for wildlife species in the locality.
	- describe how wild animals adapt to the environment for survival;	Effects of exceeding carrying capacity.	Field survey to observe effects of overstocking/understocking.
	- explain the effects of exceeding the carrying capacity of habitats;	Overstocking, understocking, natural control of wildlife populations, changes in habitats.	
	- explain factors affecting breeding patterns of wildlife.	Factors affecting breeding patterns such as breeding seasons, food and protection.	

SECTION 2: CROP HUSBANDRY

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.1 Soil Science 2.1.1 Soil formation	- define the terms: soil, weathering and parent material	Weathering	Identify and sample rock types Observing weathering in action: - exfoliation and - action of plants on rocks.
	- describe the types of rocks from which soil is formed;	Types of rocks: Igneous, metamorphic and sedimentary.	
	- explain agents of weathering;	Soil formation: physical, chemical and biological weathering agents.	
	- describe the role of weathering in soil formation;	Factors influencing soil formation.	
2.1.2 Soil profile	define soil profile;	Soil profile.	Dig a profile pit and identify the horizons up to the maximum depth of 1.5m.
	- state the horizons of a soil profile;	Horizons of the soil profile: top-soil, sub soil, gravel and hard rock.	

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
	- describe the appearance and composition of each horizon;	Characteristics of each horizon.	
	- discuss the significance of each horizon to crop growth;	Importance of soil profiling.	
	- explain the importance of soil profiling.		
2.1.3 Soil texture and structure	- define soil texture;	Soil texture;	Feeling different soil samples to determine texture.
	- identify soil particles according to increasing order of size;	Particle sizes: gravel, sand, silt and day.	Carry out a sedimentation experiment.
	- explain the significance of texture to crop growth;	Importance of good texture	Conduct an experiment to determine the effect of texture on emergence of seeds.
	- state the eight textural classes in Zimbabwe.		
	- define soil structure;	Soil structure	Field observations of different soil structures.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- distinguish between texture and structure; - describe the types of structures; - explain methods of improving and maintaining good structure; - explain factors affecting soil structure; - explain the importance of soil structure.	Difference between texture and structure Types of soil structure: Single grain and crumb; Improvement and maintenance of good soil structure. Destruction of soil structure and oxidation of organic matter. Importance of soil structure.	Sample soils and determine humus content. Carry out experiments on the characteristics of structured and structureless soils.
2.1.4 Soil types	- dentify the different soil types; - explain and compare the compositions of sandy, loam and clay; - compare the properties of the different soil types;	Soil types: sandy soils, loam soils and clay soils; Composition and properties of each.	Collect different soil samples and Identify their types. Conduct experiments to verify the properties of different soil types e.g. water holding capacity, capillarity and moisture retention.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe methods of improving the properties of different soil types;	Improvement of sand and clay soils.	
	- explain the distribution of soil types in Zimbabwe.	Distribution of soils.	
2.1.5 Soil constituents	- describe the composition of an agriculturally viable soil;	Composition of a viable soil.	Conduct experiments to determine percentage composition of air, water, organic matter and Inorganic matter in soil.
	- explain the importence of each component of soil;	Importance of soil components	
	- describe the types of water in soil;	Types of soil water: Free or gravitational, hygroscopic water and capillary water.	Collect macro organisms from the soil and identify them.
	- explain movement of water in soil;	Movement of water.	
	- define field capacity;	Field capacity.	
		Soil macro and micro organisms.	
	- explain the role of living organisms in the soil.	Importance of living organisms.	

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
2.1.6 Soil temperature	- explain the influence of temperature on plant growth;	Influence of temperature on the rate of plant growth.	Refer to section 1.3 Factors limiting land use.
	- state the optimum soil temperature range for growth of most crops;	Dangers of excessive heat to seedlings.	Conduct field experiments on mulching and shading.
	- explain the dangers of extremes of temperature on various stages of growth of crops;	Dangers of frost to some crops.	Carry out experiments to show effects of temperature on seed germination.
	- outline the measures which can be taken to reduce effects of extremes of soil temperature.	Methods of reducing effects of extreme temperature; such as mulching of seed beds and shading of transplanted seedlings.	Compare the growth rate of plants in summer and winter.
2.1.7 Soil fertility	- state the major and minor plant food elements;	Major and minor plant food elements.	Collect and prepare soil samples for dispatch.
	- explain the functions of individual food elements to crop growth;	Functions of plant food elements.	Test soil samples for pH.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe the effects of over supply and shortage of elements;	Availability of nutrients.	Apply organic and inorganic manures using different methods.
		Inorganic manures or fertilizers.	*Limit study of nutrients to compounds of calcium, magnesium, nitrogen, phosphorous, zinc, molybdenum potassium, and sulphur.*
	- explain the effects of crop rotation, rest periods and perennial crops on soil fertility;	Fertilising practices.	
	- describe the nitrogen cycle;	Nitrogen cycle.	*Study of fertiliser to be limited to one example of each fertiliser containing nitrogen, phosphorous, potassium, and a compound fertiliser.*
	- describe types organic manures found on a farm;	Organic manures such as green manuring, compost and farmyard manure.	
		Importance of incorporation of organic manures or fertilisers.	
	- define soil sampling;	Soil sampling.	
	- explain the importance of soil sampling;	Importance of soil sampling.	
	- sample soil using at least one method;		
	- define pH;	Soil pH the pH scale and its use.	

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
	- describe how soils are tested for pH; - discuss the influence of soil PH;	Influence of soil pH;	
	- distinguish between compound and straight fertiliser; - define liming; - identify types of lime; - explain the importance of liming materials; - explain the difference between lime and fertiliser.	Straight and compound fertilisers. Liming Types of lime. Importance of liming.	Demonstrate the different methods of applying lime.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.2 Soil and Water Conservation			Conduct field tours to observe land degradation.
2.2.1 Land degradation and soil erosion	- define land degradation; - explain the causes of land degradation; - define soil erosion; - identify types of erosion; - describe the causes and consequences of soil erosion; - describe the prevention and control of soil erosion;	Land degradation. Causes of land degradation. Types of erosion. Causes, agents, prevention and control of erosion.	Identify signs and types of erosion. Conduct experiments to demonstrate effects of soil erosion on different soil types. Construct or maintain conservation works.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.2.2 Soil conservation	- define soil conservation; - describe methods of soil conservation on arable and grazing lands; - construct basic conservation structures.	Soil conservation. Soil conservation on arable and grazing lands. Dimensions of basic mechanical conservation structures.	Maintain conservation structures. Reclaim eroded areas in and around the school. Practise biological conservation e.g. use of vertiver grass.
2.2.3 Water loss and soil drainage	- explain causes of water loss; - describe drainage and waterlogging; - explain the effects of waterlogged soils on crop growth; - describe methods of improving drainage; - explain the effects of drainage on loss of plant nutrients.	Wind, temperature, run-off and seepage. Drainage and waterlogging. Effects of waterlogging on plant growth; Methods of drainage such as ditches and underground pipes. Leaching. Methods of controlling leaching.	Field tour to identify signs of run off. Identify drainage structures on land. Maintain and construct drainage structures.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.2.4 Water conservation	- define water conservation; - explain the importance of water conservation; - describe methods of conserving water on arable land; - describe methods of harvesting and storing rainwater; - define water pollution; - explain causes of water pollution; - describe the effects of water pollution on agricultural production; - discuss water use legislation.	Water conservation. Importance of water conservation. Methods of water conservation on arable land. Rainwater harvesting and storage. Ground water sources. Water pollution: definition and causes. Effects of water pollution. Water legislation	Implement water conservation measures on arable land. Maintain water harvesting structures.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.2.5 Irrigation	- define irrigation; - state advantages and disadvantages of irrigation; - describe methods and types of irrigation; - distinguish between flood, overhead and drip irrigation; - state the advantages and disadvantages of each method of irrigation; - list sources of water suitable for irrigation; - identify irrigation equipment.	Irrigation. Reasons for irrigation. Problems associated with irrigation. Methods of irrigation. Flood and overhead irrigation Sources of water suitable for irrigation. Irrigation equipment: structures and functions.	Apply water to crops using at least one method of irrigation. Discuss and select sites and soils suitable for irrigation. Plan a simple layout of an irrigation scheme. **Agritex officers can be consulted as resource persons.* **Details of irrigation schedules for individual crops are not necessary.*

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.3 Crop science 2.3.1 Absorption of plant requirements from the soil	- list nutrient requirements of plants;	Plant requirements: mineral elements and water.	Carry out germination tests and calculate percentages. Demonstrate diffusion and osmosis by means of simple experiments *To be studied in sufficient depth to allow understanding of other parts of the syllabus.*
	- describe the structure of a root;	Structure of a root.	
	- state the basic functions of a root and root hairs;	Functions of root tissues and root hairs.	
	- define and explain imbibition, diffusion and osmosis;	Plant physiological processes: imbibition, diffusion and osmosis.	
	- describe the movement of water and mineral salts within the plant.	Water and dissolved mineral salt uptake.	
	- describe the effect of water gain and loss on plant cells.		

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.3.2 Gaseous exchange in a leaf	- identify parts of the internal structure of a leaf; - describe how leaf structure is adapted to gaseous diffusion;	Anatomy of a leaf, palisade and spongy mesophyl, vascular bundles, cuticle, epidermis and stomata. Carbon dioxide and oxygen relations within the plant leaf.	Conduct experiments to demonstrate gaseous exchange in plants.
2.3.3 Respiration	- define respiration; - state the word equation for aerobic respiration; - distinguish between aerobic and anaerobic respiration; - identify the sites of respiration; - explain the importance of respiration.	Respiration Glucose + oxygen $\rightarrow$ carbon dioxide + water + energy. Aerobic and anaerobic respiration. Energy and its functions.	Conduct experiments on respiration to show the release of energy and carbon dioxide from plants or germinating seeds. *Details of ATP production not required*

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.3.4 Photosynthesis	- define photosynthesis; - describe how plants photosynthesise;	Photosythesis. Roles of chlorophyll, light and carbon dioxide.	Conduct experiments to demonstrate the need for carbon dioxide, light and chlorophyll during photosynthesis.
	- state the word equation for photosynthesis;	Equation for photosynthesis.	
	- explain the differences between photosynthesis and respiration;	Photosynthesis and respiration.	
	- list the conditions necessary for photosynthesis to take place;	Effects of light intensity, carbon dioxide concentration and chlorophyll on rate of photosynthesis.	
	- state the composition of carbohydrates.	Carbohydrates.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.3.5 Translocation	- define translocation; - explain the process of translocation; - explain the role of translocation in the plant.	Translocation. Distribution of food for utilisation. Building up reserves.	Demonstrate the role of translocation through the ring barking experiment.
2.3.6 Food storage	- identify plant food storage organs; - list specific plants and state where they store plant food; - state nature of food stored by plants.	Storage organs: leaves, roots, tubers, stems, fruits or seeds. Food nutrients: carbohydrates, proteins, salts, vitamins, oils.	Sample plant storage organs. Select plants in the locality and identify where they store plant food.
2.3.7 Transpiration	- define transpiration; - explain the transpiration stream; - describe how the leaf structure is adapted to transpiration;	Transpiration. Transpiration stream Role of stomata in transpiration.	Carry out simple field experiments to demonstrate transpiration. Field observations and identify plants which are drought resistant.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe how wilting occurs; - relate transpiration to drought resistance in crops; - state factors affecting rate of transpiration.	Wilting Drought resistence. Factors affecting transpirat on.	
2.3.8 Tropisms	- define tropism; - describe each of the tropisms; - demonstrate the responses cf roots and shoots to light, water and gravity.	Plant response to growth stimulus. Tropisms: negative and positive; Response to light, gravity and water; Importance of plant response.	Demonstrate each tropism through simple experiments. Identify examples of tropisms in the locality.
2.3.9 Reproduction	- defferentiate between sexual and asexual reproduction; - state advantages and disadvantages of a sexual reproduction;	Propagation through seed. Vegetative propagation. Advantages and disadvantages of sexual and asexual reproduction.	Assess seed viability by carrying out simple germination tests; Observe and differentiate maize and bean flowers;

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- draw and label the structure of maize and bean flowers; - describe the functions of a flower in reproduction; - defferentiate between fertilisation and pollination; - describe the pollination of maize and been flower; explain the different methods of asexual reproduction.	Monocotyledon (maize) and dicotyledon (bean) flower. Functions of a flower. Pollination and fertilization. Methods of asexual reproduction.	Grow potatoes or cassava or sweet potatoes: Demonstrate the following methods of asexual reproduction: budding grafting layering cutting truncheon
2.3.10 Crop improvement	- define hybrid; - explain heterosis; - distinguish between open pollination and controlled pollination;	Hybrid. Heterosis in plant breeding. Open and controlled pollination.	*(Study of plant breeding should be with reference to maize.)* Identify hybrids grown in the locality

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- state the three types of hybrids;	Single, double and three way hybrids.	Visit a plant breeding station and observe how hybrids are produced.
	- describe the breeding of different types of hybrids.		
2.4 Crop Production 2.4.1 Land Preparation	- state five reasons for land preparation;	Reasons for land preparation.	Prepare land for the growing of one of the following: maize, sorghum, or wheat.
	- describe the steps taken during land preparation;	Stumping, clearing, ploughing discing and harrowing.	
	- describe methods of stumping;	Methods of stumping.	
	- explain the advantages of stumping;	Advantages of stumping.	
	- describe primary and secondary tillage methods;	Primary and secondary tillage.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe conservation or minimum tillage techniques;	Conservation or minimum tillage.	Demonstrate different conservation tillage techniques.
	- identify the machinery, equipment and tools used in land preparation;	Tillage machinery, equipment and tools.	
	- state the advantages and disadvantages of mechanized farming and draught animals in land preparation.	Advantages and disadvantages of mechanised farming.	
2.4.2 Cereal crop	- explain the social and economic importance of the crop;	Social and economic importance of the crop.	Clear and prepare land for planting a cereal.
	- describe the soil and climatic requirements of the crop;	Soil and climatic requirements. Seed bed preparation.	Apply lime and organic matter.
	- state the time of planting and the importance of timing;	Sowing/planting time and method.	Identify common pests and weeds. Sample foliage showing signs of nutritional deficiencies.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- state the planting depth and the significance of correct planting depth;		Apply fertilisers using different methods.
	- select suitable cultivars and fertilisers;	Choice of suitable cultivars	Keep production and financial records.
	- calculate seed, manure, fertiliser and lime requirements;	Inorganic, organic manures/fertiliser. Rates of application.	Carry out management operations.
	- calculate plant population;	Seed rate, spacing and plant population.	**A cereal crop which is of major importance in local agriculture such as maize, or sorghum, or wheat must be grown and studied.**
	- identify and control common pests, weeds and diseases;	Prevention and control of common pests, weeds and diseases.	
	- store and prepare the crop for marketing;	Recognition of maturity. Harvest, yield and storage.	
	- market the crop;	Marketing.	
	- calculate loss/profit of production;	Profit/loss.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- list by-products and uses of each;	By-products and their use.	
	- describe relevant legislation relating to production and marketing of the crop;	Legislation.	
2.5 Crop protection 2.5.1 Pests and pest control	- explain the effects of pests on crops;	Effects of pests on crops.	Collect samples and Identify pests.
	- identify and classify pests according to their feeding habits.	Biting and chewing pests: grasshoppers, locusts, termites, leaf miners and beetles.	Identify chemicals for pest control.
		Piercing pests and sucking pests: aphids, mealy bugs and scale insects.	Control pests in growing crops. Draw diagrams to illustrate the life cycle of pests.
		Boring pests: weevils, stalk borer and American boll worm (helicthis spp)	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe the life cycle of one pest with a complete metamorphosis and another with incomplete metamorphosis;	Nematodes (eelworms).	*One pest must be selected from each of the following four groups: biting and chewing; piercing and sucking; boring pests and nematodes.*
	- describe nematodes (eelworms) as a class of pests;	Chemical biological and cultural control methods.	*All safety precautions should be adhered to during use of pesticides.*
	- explain methods of pest control;		
	- describe the integrated pest management methods;	Integrated pest management.	
	- describe the mode of action of the main groups of pesticides and nematicides;	Contact and systemic pesticides, stomach poisons and fumigants.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.5.2 Diseases and disease control	- define disease; - classify diseases according to their causes;	Bacterial diseases: bacterial wilt of tomatoes and bacterial blight of cotton. Fungal diseases: damping off of cereals and powdery mildew of beans. Viral diseases: maize streak and rosette of groundnuts.	Sample crops showing signs of attack by different diseases. Use chemicals safely to control diseases in growing crops. ***One plant disease to be studied from each of the three groups under the following:*** ***mode of infection;*** ***harmful affects;*** ***prevention;*** ***control.***
	- describe the prevention and control of plant diseases.	Prevention and control of plant diseases.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
2.5.3 Weeds and weed control	- define weed;		Collect and identify weeds common in the locality.
	- explain the harmful and beneficial effects of weeds;	Harmful and beneficial effects of weeds.	Demonstrate methods of applying herbicides.
	- describe mode of spread of weeds;	Mode of spread of local weed species.	***One named local weed species to be studied in detail under the following:***
	- differentiate annual, and perennial weeds;		***Morphology;*** ***Persistence;*** ***Propagation;*** ***harmful effects;*** ***control;***
	- describe methods of weed control;	Methods of weed control: principles of cultural mechanical, chemical controls.	
	- compare effectiveness of different methods of weed control and choose the most suitable method.	Cost effectiveness of weed control methods.	
2.5.4 Handling and use of agro-chemicals	- describe the types of chemicals and their use;	Pesticides, fungicides, acaricides, arboricides, herbicides, nematicides.	Identify chemicals of varying degrees of toxicity.
	- explain the toxicity levels of agro-chemicals;	Toxicity levels and the use of colour triangles: green, amber, red and purple.	Read instructions on chemical labels inorder to:

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- explain the precautions taken when using and storing chemicals;	Safe use and storage of agro-chemicals. Protective clothing. Precautions during application. Avoidance of pollution during use and disposal.	. identify the formulation of the pesticide; . determine the strength of the formulation; . identify the application rate and method of application; . check for compatability and safety precautions to be followed.
2.5.5 Causes of damage and low yields to crops	- identify causes of damage and low yields to crops; - describe the precautions and control measures against each cause.	Causes such as livestock, vermin, nutritional deficiencies, drought, hail and waterlogging. Capping, soil pans, fire, frost and wind. Fencing, management and insurance.	Carry out management practices to reduce damage to crops. Carry out a survey and identify wild animals that cause damage to crops in the locality.

SECTION 3: LIVESTOCK HUSBANDRY

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
3.1 Types of livestock	- describe characteristics of ruminants and non-ruminants; - classify livestock into ruminants, non - ruminants, poultry and fish; - name examples of each type of livestock; - explain the major importance of each type of livestock;	Types of livestock reared on the farm: ruminants, and non-ruminants, poultry, fish. Ruminants: cattle, sheep and goats. Non ruminants: horses, donkeys, pigs, rabbits. Poultry: chickens, ducks, geese and turkeys. Fish: tilapia, carp and trout. Importance of livestock.	Identify and classify types of livestock.
3.2 Anatomy and physiology	- define anatomy and physiology; - identify internal and external features of a named ruminant;	Anatomy and physiology of the digestive system of a named ruminant.	Draw and label the digestive and reproductive systems of a named ruminant. Conduct a study tour of a slaughter pole or abbattoir.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- identify parts of the digestive system of a named ruminant;	Anatomy and physiology of the reproductive system of a named ruminant male and female.	
	- identify and explain the functions of the parts of the digestive system of a ruminant;	Functions of the parts.	
	- explain the difference between the digestive systems of ruminant and non ruminant;	Differences between ruminant and non-ruminant digestive systems.	
	- identify and explain the functions of the parts of the reproductive systems of the ruminant male and female.	Male and female reproductive systems of a ruminant.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
3.3 Animal improvement 3.3.1 Genetics	- define breeding;	Breeding	Discuss how environmental factors are likely to have influence on genetic variations. *The study of this section should be with reference to either cattle, sheep, pigs or poultry.*
	- state the importance of breeding;	Livestock breeding and its importance;	
	- define basic terms in genetics;	Basic genetic terms such as chromosomes recessive, dominant. genotype, heterosis. and phenotype.	
	- explain the basic structure of a gene;	Chromosomes in reproduction: structure and functions of chromosomes.	
	- explain the stages in mitosis and meiosis;	Mitosis and meiosis.	
	- describe the functions of genes in life;	Genetic diagrams in test cross problems.	
	- explain the effects of the environment on genes;	Natural selection: effects of the environment. Importance of artificial selection.	
	- distinguish cross-breeding from in breeding;	Advantages and disadvantages of cross breeding and in breeding.	
	- select animals for breeding.		

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
3.3.2 Nutrition	- name the main nutrients required by farm livestock;	Livestock nutrients such as carbohydrates, proteins, fats, minerals, water and vitamins.	Simple tests for nutrients in available feedstuffs.
	- explain the functions of each of the nutrients;	Functions of nutrients.	Identify symptoms of deficiency.
	- describe the symptoms of deficiency of each of the nutrients;	Livestock nutrients deficiency.	Identify sources of nutrients.
			Prepare balanced rations.
	- identify the sources of the main nutrients;	Sources of nutrients.	*Apply the Pearson's Square method to calculate a simple production ration.*
	- classify feedstuffs;	Roughages and concentrates	Detailed study of mineral deficiencies such as calcium, phosphorus and iron.
	- calculate maintenance and production rations;	Maintenance and production rations.	
	- prepare rations for both ruminants and non - ruminants.		

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TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
3.4 Animal health	- define animal health;	Animal health.	Isolate and care for unhealthy animals.
	- distinguish between healthy and unhealthy farm livestock;	Signs of health and ill-health.	Identify natural predators of parasites.
	- explain causes of diseases;	Disease causing organisms such as protozoa, viruses, fungi and bacteria.	*One disease from the following groups to be studied:* *Bacterial diseases: Anthrax or fowl typhoid.*
	- recognise signs and symptoms of common and notifiable diseases;	Common and notifiable livestock diseases: causes, symptoms, prevention, treatment and control	*Viral diseases: Foot and Mouth or New Castle.* *Protozoan diseases: Coccidiosis or Trypanosomiasis.*
	- explain the importance of hygiene in the prevention and control of diseases;	Hygiene: cleaning, disinfection, ventilation, clean feedstuffs.	
	- describe other methods of preventing and controlling diseases;	Natural and artificial immunisation.	
	- identify and classify common parasites of farm livestock;	Internal and external parasites.	*The following external and internal parasites to be studied:* *External parasite: one host tick.* *Internal parasite: roundworm.*

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe the life cycles of one internal and one external parasite; - prevent and control parasites.	Common parasites: description, host, life cycle, symptoms, prevention, treatment and control. The Animal Health Act.	
3.5 Small livestock – Rabbits or layers	- explain economic importance of rabbits or layers; - name and recognise different breeds of rabbits or layers; - choose a suitable site for a rabbitry or poultry unit; - design and construct housing for rabbits or layers according to specification; - describe nutritional requirements of rabbits or layers;	Importance of rabbits or layers: economic and social. Characteristics of breeds. Suitable housing. Nutritional requirements: feedstuffs and their nutritional content.	Carry out all the necessary management practices. Maintain health of rabbits or layers Calculate maintenance and production rations. Plan, manage and implement a breeding programme. Handle and sex bunnies. Prepare and market rabbits or eggs. Maintain accurate physical and financial records.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
		Feeding practices: rationing, balanced ration as affected by age and stage of development.	
	- mate mature rabbits;	Calculation of maintenance and production rations.	Prepare rations and feed for rabbits or layers.
	- test for pregnancy in rabbits;	Hygiene: importance of adequate and clean water supply.	
	- prepare nest for kindlings or brooders for chicks;		
	- look after the doe and litter or chicks;		
	- wean rabbits at the right age;		
	- identify signs of ill health in rabbits or layers;	Signs of ill health.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- relate symptoms of specific rabbit or layers diseases;	Spread of contagious and notifiable diseases.	
	- treat and control diseases of rabbits or layers;		
	- identify and control internal and external parasites;	Internal and external parasites	
	- nail clip rabbits or debeak layers;	Reasons for nail clipping and debeaking.	
	- slaughter and dress rabbits or off layers;		
	- prepare pelts or eggs for market;		
	- keep financial and production records.	Record keeping: diary of events, production and financial records.	

SECTION 4 FARM STRUCTURES AND MACHINERY

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
4.1 Fencing	- identify different types of fences;	Types of fences:	Select suitable fencing materials. Treat fencing materials.
	- describe the purposes of constructing fences;	Purposes of fencing.	Make measurements and estimates.
	- identify fencing materials and tools for fencing;	Fencing materials and tools.	Use tools safely and correctly.
	- discuss the advantages and disadvantages of fencing materials;	Advantages and disadvantages of materials.	Establish and maintain a live fence. Construct both internal and external fences using appropriate methods.
	- describe ways of treating fencing posts;	Methods of treating fencing materials.	
	- determine the appropriate spacings between fencing posts;	Spacing of posts such as straining posts, anchor posts, standards, droppers. Strand spacing.	
	- calculate quantities of materials needed to fence a given area;	Quantities of fencing materials.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- explain the role of anchors and construct different anchors;	Types and functions of anchors.	
	- discuss the advantages and disadvantages of different anchors;	Advantages and disadvantages of different types of anchors.	
4.2 Farm Buildings	- identify common farm buildings;	Common farm buildings.	Design buildings suitable for farm use;
	- identify and describe properties of materials used for the construction of farm buildings;	Properties of building materials.	Conduct a survey of building material costs. Determine the costing of construction of an ideal farm building.
	- explain the most suitable use of different materials;	Types of materials and their use.	Construct and maintain farm buildings.

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
	- draw simple designs of buildings suitable for livestock;	Designs for livestock buildngs.	Study should be limited to two of the following: fowl runs, pig sties, rabbitry, cattle pens, storerooms, barns, granaries.
	- calculate costs of construction;	Costs.	
	- determine the cost effectiveness of using different materials to construct farm buildings.		
4.3 Farm Roads	- discuss the factors to be considered when siting a farm road;	Factors to be considered when siting a farm road.	Maintenance: grading and clearing drains.
	- list the equipment needed when siting farm roads;	Siting equipment: level and its accessories, pegs, hand axe, axe, mattock, pruning saw.	Site a farm road.
	- describe the characteristics of well sited farm roads;	Characteristics of good farm roads.	Construct and maintain a farm road.

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- state the dimensions of different features on a farm road;	Farm road features and dimensions such as width, shape, height, (metre) drains bolsters and culverts	
	- describe the ideal shape of a farm road;		
	- identify the materials required for construction of a farm road;	Road construction materials such as cement coarse sand, concrete, stones, gravel, laterite.	
	- describe the construction of a farm road.	Construction, timing, clearing, ploughing and grading.	

TOPIC	OBJECTIVES Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
4.4 Appropriate Technology			
4.4.1 Irrigation pumps	- identify hand or power operated irrigation pumps;	Types of irrigation pumps.	Maintain a hand or power operated irrigation pump.
	- name parts of a hand or power operated irrigation pump;	Parts of hand or power operated pump.	
	- describe the routine maintenance of the pump;	Routine maintenance.	
	- maintain the irrigation pump.	Replacement of worn parts.	
4.4.2 Maize and groundnut shellers	- identify parts of a sheller;	Parts of sheller.	Use and maintain a sheller.
	- explain operational principles of a sheller;	Operation principles.	
	- describe routine maintenance of a sheller;	Routine maintenance	
	- use a named sheller appropriately.		

TOPIC	OBJECTIVES **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
4.4.2 Harnessing	- describe methods of harnessing draught animals; - illustrate types of harnesses; - describe materials used for harnesses; - use a suitable method of harnessing specific draught animals to specific implements.	Methods of harnessing: use of yokes and breast bands. Types of yokes. Breast bands, collar harnesses and sadle harnesses. Materials for making harnesses.	Harness oxen or donkeys. Attach to and use specific implements with harnessed animals. Make harnessing equipment.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- interpret law of diminishing returns using schedules and graphs.		
5.1.3 Risk and uncertainty	- explain the terms risk and uncertainty; - distinguish between a risk and uncertainty; - outline ways of countering risks and uncertainties.	Risks and uncertainties. Differences between risks and uncertainties. Risks and uncertainties in production. Avoiding risks and uncertainties.	Conduct surveys to identify risks and uncertainties on the school farm and the community.
5.1.4 Opportunity costs and choices	- explain the concepts of opportunities and choices. - discuss the opportunities and choices facing farmers in selected enterprises; - explain the concept of opportunity costs.	Opportunities available and the need to choose on the part of the farmer. Opportunity costs as real costs. Foregoing alternatives.	Make informed choices on activities to carry out on the school farm.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
5.1.5 Decision Making	- define decision making; - discuss the influence of economic factors on decision making; - explain the importance of decision making;	Decision making Economic factors influencing decision making. Importance of decision making.	Practise decision making by attending to selected problem situations.
5.2 Farm records and accounts 5.2.1 Types of farm records	- identify different types of farm records; - discuss the importance different types of farm records;	Types of farm records. Physical and financial records.	Keep enterprise records.
5.2.2 Profit and loss	- explain the difference between profit and loss; - explain the difference between costs and returns; - compile simple farm accounts;	Profit and loss. Costs and returns.	Compile income and expenditure for an enterprise. Calculate gross margin. Calculate profit and loss for an enterprise.

TOPIC		OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
		- explain the concepts of variable costs, fixed costs and gross margin; - state the differences between variable and fixed costs; - calculate gross margins of two enterprises.	Gross margin. Variable costs of returns. Fixed costs. Profit and loss account layout. Gross margin analysis.	
5.3	Farm budgeting	- define the term budget; - distinguish between partial or enterprise and whole farm budget; - explain the importance of budgeting; - discuss sources of information for budgeting.	Budget. Partial and whole farm budgets. Importance of budgeting. Sources of information such as prices of inputs and outputs, farm records, neighbours, banks, Agri-business, Agritex and other departments.	Draw up a partial or enterprise budget.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
5.4 Marketing	- define marketing; - explain the functions of marketing; - distinguish between controlled and uncontrolled marketing; - describe formal and informal marketing of major crops and livestock in Zimbabwe; - explain marketing legislation for agricultural produce and commodities; - state factors affecting agricultural marketing.	Functions of marketing such as grading, financing, risk bearing, storing, processing, packaging, transporting and assembling. Controlled and uncontrolled marketing. Marketing of major crops and livestock. Changes in marketing legislation. Factors affecting Agricultural marketing.	Study the marketing of any two of the following farm products: Maize, Cotton, Tobacco, Fruits, Vegetables, Beef cattle, Pigs, Poultry, Milk
5.5 Agricultural Co-operatives	- define agricultural co-operative; - explain the principles of co-operatives; - state the types of co-operatives.	Agricultural Co-operatives. Principles of co-operatives. Types of cooperatives.	Study the constitution of a local co-operative and suggest improvements. Role play on the formation, problems and benefits of cooperatives.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- explain the benefits of cooperating; - identify problems associated with cooperatives.	Benefits and problems associated with cooperatives.	

6.0 **OPTIONS:** There are four options of this syllabus. Candidates should STUDY only ONE option

6.1 **OPTION 1: CROP HUSBANDRY**

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
6.1.1 Tillage Implements	- list and explain the functions of animal or tractor drawn implements;	Implements such as mouldboard plough, cultivator, harrow, planter and ridger.	Use a named implement while carrying out the necessary adjustments.
	- name the working parts of the drawn implements;	Parts of implements.	Carry out maintenance work on specific implements.
	- carry out adjustments on drawn implements;	Adjustments: depth, width of cut for mouldboard, width for cultivator, seed size and rate for planter.	
	- maintain the drawn implements.		
6.1.2 Crop Management	- describe the soil and climatic requirements of selected crops;	Soil and climatic requirements.	
	- describe appropriate tillage techniques;	Seedbed preparation.	
	- state the correct seed rate and spacing for each crop;	Sowing/planting time and method.	

TOPIC	OBJECTIVES: **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
	- calculate plant population;	Seed rate, spacing, thinning and plant population.	*One crop from each of the groups A, B and C should be selected for study.*
	- identify and select suitable cultivars;	Selection of cultivars. Inorganic and organic fertilizer application.	*Group A: Legumes - Groundnuts, field beans and soya beans* *Group B: Roots and Tubers - cassava sweet potatoes and Irish potatoes* *Group C: Other cash crops - Cotton, sunflower and sugar cane*
	- describe management practices and carry them out;	Prevention and control of common diseases and pests.	
	- detect signs of maturity;	Signs of maturity.	
	- describe and carry out harvest operations	Harvesting, yield and storage.	Select and prepare land for planting. Sow/plant at the right time using appropriate methods.
	- calculate yield;		
	- store the harvest appropriately;		Keeping a diary of all production and financial activities as they are carried out.
	- identify ways of marketing the selected crop;	Marketing.	
	- market produce;		
	- describe how the produce is processed;	Uses/processing.	

TOPIC	OBJECTIVES: **Pupils should be able to:**	CONTENT	NOTES/ACTIVITIES
	- list by-products and their uses;		
	- keep records for a full production cycle;	Record keeping.	
	- explain the legislation related to the production of the crop.	Legislation.	

6.2 OPTION 2 LIVESTOCK HUSBANDRY

[One animal from each of the groups 1 and 2 should be selected for detailed study]

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
6.2.1 Breeds and housing	identify and describe exotic and indigenous breeds;	Exotic and Indigenous breeds Characteristics of breeds.	*Group 1: Non-ruminants* *Pigs or donkeys.* *Group 2: Ruminants* *Cattle (Leef or diary) Sheep, Goats*
	- describe housing systems and types;	House systems.	
	- raise and handle livestock to maturity:	Rearing of young stock to maturity.	

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
6.2.2 Nutrition	- provide suitable and adequate nutritional requirements for livestock; - list suitable food materials that meet nutritional requirements;	Nutritional requirements. Housing systems and types. Food or feed materials and their nutritional content.	Calculate maintenance and production rations; Keep a diary of all production and financial activities as they are carried out.
	- describe appropriate feeding practices;	Feeding practice: balanced ration, maintenance and production rations.	
6.2.3 Diseases and parasites	- describe common diseases; - explain the legislation related to notifiable diseases.	Diseases: type, name, cause, symptoms, prevention, treatment and control; Legislation Laws governing notifiable diseases, importing, exporting and quarantine.	*One disease from each of the following groups should be studied in detail:* **Tick born:** red water, heartwater **Protozoan:** trypanosomiasis, **coccidiosis.** **Viral:** foot and mouth swine fever. **Bacterial** - mastitis, contagious abortion, anthrex.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe common internal and external parasites;	External and internal Parasites: Name, description, host(s), life cycle, symptoms, prevention, treatment/control.	*One external and internal parasite to be studied.* *External parasite: two host tick.* *Internal parasite: tape worm.* X - reference 3.4
6.2.4 Animal products	- identify livestock products; - market livestock products; - explain relevant legislation related to the marketing of animal products. - keep records for a full production cycle.	Livestock products. Processing and use. Legislation	
6.2.5 Animal handling facilities	- describe the types of animal handling facilities; - state the factors to be considered when selecting a site for constructing handling structures;	Types of animal handling facilities: Crushes, sorting pens, crates, gathering and dispersal pens. Siting crushes and sorting pens.	Conduct field tours to identify structures on the school farm and local community.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- list the materials required for the construction of specific animal handling structures; - describe the two types of dipping structures; - state the advantages and disadvantages of each dipping structure.	Construction of sorting pens, crushes and crates. Structure of a plunge dip: capacity, slopes, drain channels, floors, roof, foot bath, steps. Structure of a spray race: nozzles, foot bath. Advantages and disadvantages of a plunge dip and spray race.	

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
	- describe and carry out management operations from planting to maturity.	Use of organic and inorganic fertiliser in relation to type of plant, age and stage of growth, potting mixture, basal and top dressing, application rates.	Study diseases and pests under: name, cause, description, symptoms,prevention and control.
	- market ornamentals;	Management operations such as weeding, clipping, staking, spiking, mowing and harvesting.	
	- keep accurate production and financial records.	Preparation for marketing: packaging, storage, transportation and display.	

6.4 OPTION 4 WILDLIFE MANAGEMENT

Schools should select **one** animal from each of the groups A, B and C for a detailed practical study.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
6.4.1 Wildlife biology/ ecology	- describe the behaviour and characteristics of the animals being studied; - discuss breeding patterns of selected animals; - explain the nutritional requirements of selected animals; - describe how animals adapt to their environmental conditions.	Behaviour and characteristics in terms of: Breeding patterns: mating ratios/seasons, gestation periods, living space, protection of young; Nutritional requirements: Adaptation to: diseases, parasites, mortality, other adverse conditions, human settlements.	*Group A* *Insects: Bees* *Group B* *Birds: Ostrich, Quelea, Wild ducks* *Group C* *Mammals: Impala, zebra* *The selected animals should be studied under the following:* *behaviour and characteristics; breeding patterns; nutritional requirements; adaptation to environmental conditions*
6.5.2 Monitoring	- identify aspects of wildlife to be monitored; - identify factors influencing each of the aspects to be monitored; - explain management tools in monitoring; - describe ways of dealing with problem animals;	Monitoring aspects: animal improvement, animal numbers, species diversity, trophy quality. Management tools: fencing, ground and aerial counts, Problem animal control.	Observe movement of animals/wildlife being studied. Use the quota setting manual kit to estimate animal populations; Survey existing fences to determine: siting, justification, effectiveness, maintenance and related problems.

TOPIC	OBJECTIVES: Pupils should be able to:	CONTENT	NOTES/ACTIVITIES
6.4.3 Harvesting	- describe ways of harvesting wildlife;	Harvesting wildlife. Safari hunting. Cropping.	Collect data on harvesting strategies and contracts with hunters;
	- describe factors and procedures considered when setting quotas and entering contracts;	Quota setting and utilization.	Determine suitable quotas from given data;
	- describe how hunting concessions are set, paid and administered.	Contracts; hunting concessions, fees, tenders.	Role play or dramatise on awarding of hunting contract;
6.4.4 Marketing	- identify wildlife products and by - products;	Wildlife products.	Collect wildlife products and by-products or specimens for display;
	- describe factors which influence the quality of wildlife products;		Conduct harvesting and marketing surveys and determine viability levels;
	- describe the processing of wildlife by-products;	Processing of by-products.	Prepare products from wildlife being studied for marketing.
	- explain factors affecting trophy quality;	Trophy quality.	
	- identify local and international markets for wildlife products.	Trading and markets: local, international.	

APPENDIX D - INTERVIEW SCHEDULES

UNISA college of education

INTERVIEW GUIDE FOR SECONDARY SCHOOL AGRICULTURE EDUCATORS

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

1. What Indigenous farming practices existed in Zimbabwe before colonisation?
2. Which of the Indigenous farming practices continue to be practised today?
3. What is your comment on the view that the Zimbabwe secondary school agriculture curriculum is dominated by Western farming practices?
4. Which Indigenous agricultural practices currently exist in the Zimbabwe secondary school Agriculture curriculum
5. What Indigenous agricultural practices still need to be included in the secondary school Agriculture curriculum?
6. How can the Indigenous agricultural practices be included in the Zimbabwe secondary school Agriculture curriculum?
7. What could be the benefits of including Indigenous agricultural practices in the Zimbabwe secondary school Agriculture curriculum?
8. What challenges may schools face in trying to infuse Indigenous agricultural practices in Zimbabwe's school Agriculture curriculum?
9. What else can you say about inclusion of Indigenous farming practices in the Zimbabwe secondary school agriculture curriculum?

END

INTERVIEW GUIDE FOR AGRICULTURE EXTENSION OFFICERS

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

1. What Indigenous farming practices existed in Zimbabwe before colonisation?
2. Which of the Indigenous farming practices continue to be practised in Zimbabwe today?
3. What is your comment on the view that the Zimbabwe agriculture extension practices are dominated by Western farming practices?
4. Which Indigenous agricultural practices currently exist in the Zimbabwe agriculture extension curriculum?
5. What Indigenous agricultural practices still need to be included in the Zimbabwe agriculture extension curriculum?
6. What is your comment on the view that the Zimbabwe secondary school agriculture curriculum is dominated by Western farming practices?
7. How can the Indigenous agricultural practices be included in the Zimbabwe secondary school Agriculture curriculum?
8. What could be the benefits of including Indigenous agricultural practices in the Zimbabwe secondary school Agriculture curriculum?
9. What challenges may schools face in trying to infuse Indigenous agricultural practices in Zimbabwe's school Agriculture curriculum?
10. What else can you say about inclusion of Indigenous farming practices in the Zimbabwe secondary school agriculture curriculum?

END

INTERVIEW GUIDE FOR THE LOCAL FARMERS

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

1. What Indigenous farming practices existed in Zimbabwe before colonisation?
2. Which of the Indigenous farming practices does the local community continue to practise in Zimbabwe today?
3. What is your comment on the view that the Zimbabwe secondary school agriculture curriculum is dominated by Western farming practices?
4. Which Indigenous agricultural practices currently exist in the Zimbabwe secondary school Agriculture curriculum?
5. What Indigenous agricultural practices still need to be included in the Zimbabwe secondary school agriculture curriculum?
6. How can the Indigenous agricultural practices be included in the Zimbabwe secondary school Agriculture curriculum?
7. What could be the benefits of including Indigenous agricultural practices in the Zimbabwe secondary school Agriculture curriculum?
8. What challenges may schools face in trying to infuse Indigenous agricultural practices in Zimbabwe's school Agriculture curriculum?
9. What else can you say about inclusion of Indigenous farming practices in the Zimbabwe secondary school agriculture curriculum?

END

INTERVIEW GUIDE FOR AGRICULTURE EDUCATORS IN TERTIARY INSTITUTIONS

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

Name if Institution: ....

1. What Indigenous farming practices existed in Zimbabwe before colonisation?
2. Which of the Indigenous farming practices continue to be practised in Zimbabwe today?
3. What is your comment on the view that the Zimbabwe agriculture curriculum for tertiary institutions is dominated by Western farming practices?
4. Which Indigenous agricultural practices currently exist in the Zimbabwe agriculture tertiary institutions curriculum?
5. What Indigenous agricultural practices still need to be included in the Zimbabwe agriculture tertiary institutions curriculum?
6. What is your comment on the view that the Zimbabwe secondary school agriculture curriculum is dominated by Western farming practices?
7. How can the Indigenous agricultural practices be included in the Zimbabwe secondary school Agriculture curriculum?
8. What could be the benefits of including Indigenous agricultural practices in the Zimbabwe secondary school Agriculture curriculum?
9. What challenges may schools face in trying to infuse Indigenous agricultural practices in Zimbabwe's school Agriculture curriculum?
10. What else can you say about inclusion of Indigenous farming practices in the Zimbabwe secondary school agriculture curriculum?

END

TRANSCRIPTION 1

Q What crops were grown by Indigenous farmers before colonisation

A They grew maize rapoko sorghum especially here they grew a lot of mhunga they would dig the land and broadcast these crops and drive animals like goats or pull tree branches especially thorn branches to bury the seeds they also grew crops like groundnuts which they would plant using the small hoe called chimwango but groundnuts were grown mainly on virgin land called nhivi African rice would be grown in wetlands , these crops you would be given by your parents or other relatives even from faraway and that would promote diversity, in chirumhanzu a lot of rice was grown in wetlands, maize varieties like califonya and gogwe and those that have a lot of colours were also grown especially on virgin land , they also grew vegetables both Indigenous and traditional in the homestead field , these crops were drought resistant and we had varieties for maize like mukadzi usabva and chizhara wanya, they also grew sorghum especially the one with red seeds called tsveta

Q How did they select crops for planting

A they had to look for desirable characteristics like short season varieties the big crops and for mhunga varieties that had spikes to protect against birds, mhunga has double panicles which means it was a high yielder .Seed for planting were selected soon after harvesting or just before thrashing and they would target those with big heads, after harvesting which was mainly done by hand the crops would be put on a ngarani for further drying. After threshing they would be stored in a granary called dura or tsapi which was corn shaped facing downwards to drain water. I had forgotten that we harvest rice using a sickle and other cereals using a knife and leave the stems in the field which we would burn in spring to ash, and these places with ash were very good for growing Indigenous and traditional vegetables and we would also manage fertility by fallowing and adding livestock manure. Most of the crops were planted in a mixed cropping system so that if a particular crop fails we would still be food secure from other crops which means they was no total crop failure

Q What are the uses of the crops

A The cereals were and are still used as staple food, we use them to cook sadza and thin porridge and also to brew beer, they were other foodstuffs from the cereal meal like cakes and mbwire mbwire the seeds of these crops could also be boiled to produce mangai mutakura and manhuchu (samp). Groundnuts and Bambara nuts ould also be boiled and eaten,they could also create butter from sesame and groundnuts which were added to relish. From groundnuts again we would also prepare dakataka and chinhanzvirwa

Q How were they protecting their crops against pest, diseases and weeds

A Weeding was done using a hoe and had pulling, we would also practise early planting so that crops would out compete weeds, and the crops were disease and pest resistant however during colonialism the number of pests and diseases in crops increased. For diseases we would uproot and burn diseased for instance ground nuts attacked by rossete by a concoction prepared from zumbani. The most dangerous pests are weevils and these were controlled in the granary using ash from trees like mutsviri and gumtree leaves during storage and also mix the cereals with chaff from the cereals. Seeds selected for planting would be hung on a kitchen line r inside the roof to accumulate soot for protection against weevils

Q How were they preparing land for planting

A They used hoes to dig holes and plant the seed or dig the whole place and broadcast the seed and use thorny branches to cover the seeds like mupangara. Mixed cropping was practiced by sparingly for rapoko field which was apical field in the main field.

Q Now let's turn to livestock production

A They kept cattle, goats, sheep and donkeys and reared poultry such as chickens, ducks and pigeons they also domesticated guinea fowls and zvihuta. They were so many breeds of these animals like mashona cattle, Ndebele cattle, angora goat, naked neck chickens and guinea fowl like chickens, chickens for examples and samples of some crops were given to a newly married coupled to start a new family this would increase nutrition and food security. Each family had a bull for appeasement of spirits, the animals were grazing in range land and in fields after harvesting during the dry season we supplement them with cereal stover and stems of groundnuts, cowpeas and Bambara nut so that they remain healthy

Q What were the uses of the animals

A They provided meat, clothes from goat and cattle skins and blankets called madaunha, we could also make musical instruments like drums (ngoma), trumpets(hwamanda) from horns of cattle, we also got milk from cattle from the meat we could get cooking oil as well as from the milk

Q Any information to do with the control of diseases and parasites

A For stomach ailments they used murumanyama, and the aloe plant leaves for alpthalmea they used chisvosve, we would also get manure to fertilize the crops, they were so many dishes that were prepared from crops like nhopi and rupiza from cowpeas, mashazhare from sorghum, mhunga and maize. Most crops were eaten after grinding them or whole after boiling.

Q How about Indigenous vegetables

A These were used as vegetables and many grow in the wild, for most of them we ate leaves and flowers, these also had medicinal properties such that such that we were always health looking examples of such vegetables include mutsine, derere, marenge dzvengetsvenge, mowa, bonongwe and mubvunzandadya.

Q Do you think these practices should be taught to our practices in school

A Yes the foods are heathy and the crops are adaptable to our conditions and are inexpensive hence sustainable, there's interdependence of crops and animals crops provide food to animals and the animals provide manure to the crops, they don't buy seeds from the shops and the inputs are readily available, there's no danger of destroying the ecosystems through use of poisonous chemical. These are their advantages which make them be taught to our children. The practices preserve our culture and make our children know the practices of our forefathers' maybe they may not acceptable especially to the young due to colonisation

Q I s there anything else that you want to add to our discussion

A I think I am done

Q Than you for participating in this interview

TRANSCRIPTION 2

Q We can start , you ca come closer as I have said I am researching on the Indigenous knowledge farming practises that existed in our country before colonisation and the practices that are still being practiced and …those that are being done at school , that's what I am really looking for especially the crops that were grown by our elders during that time

A they grow zviyo mhunga nyemba running and chibage, they also grow nzungu nyimo mbambaira in wetlands and tsenza

Q Are you from Rusape because that's where you can find tsenza and Mutare too

A Yes I am from mutare and partly grew up in Gutu

Q Did you say maize was not a common crop

A No They grow it

Q which varieties

A I remember the variety kenya, bhogwe and califonya

Q How about the red cobbed maize

A Yes these crops were selected soon after harvesting and placed on the line in the kitchen to accumulate soot as protection against weevils

Q how about sorghum

A sorghum was not certified and we would grow the ones we harvest straight from the field the seed would be kept in a gourd

Q Today I had the experience of one farmer showing me maize and sorgum which was hanging on the kitchen line

A Yes that is the actual practice we take big cobs of maize and big pannicles of sorghum and uprooted groundnuts and hang them on the kitchen line

Q How about preparation for planting

A My mother would plant groundnuts and Bambara nuts on virgin land first we would clear the land to remove crop residues and burn them into ash

Q What would they grow on soil with ash

A They would grow seed of pumkins and watermellons and sweet reed and sweet potatoes

Q How about on wet lands

A On wetlands, my grandmother grew and still grows African rice

Q How about weeding

A Weeding was by hand using a hoe we had no cultivators we would also hand pull some of the weeds

Q How big were the fields

A They were not so big it was more of intensive farming such that we would be able to give a second or third weeding to clear all the weeds

Q Was also African rice weeded

A No rice was weeded by hand pulling, we will simply pull and hip the weeds

Q How about post harvests operations

A We would harvest maizeby simply removing the cobs using hands but for mhunga mapfunde and rapoko we would use a knife to cut the heads while maize would be put in starks then taken and placed in a ngarani mhunga mapfunde and rapoko were carried straight to the ngarani and never put in starks

Q Which production practises of these are still practised

A The cereal crops would be put on the ngarani for further drying after that thy would be threshed using thrashing sticks then winnowed and stored in granary

Q How were the crops protected against the pests

A They were no chemical sprays but they would use ashes of trees like mutsviri, gumtree leaves and chaff from cereals for protection against storage pests like weevils and chaffer beetles. But our own Indigenous cereals like mhunga mapfunde and rapoko were not treated against storage pests since they are resistant to those pests however they would also add chaff for some protection against these storage pests

Q What were the uses of those crops

A For cereals would provide stiff porridge called sadza thin porridge called bota for brewing beer, snacks populary known as chimodho and mbwire mbwire Ground nuts and runinga(sesame) were used as oil crops and they would also be used to flavour relish. Chimodho was good because our childrens stomach will be full throughout the day. Runinga was very good if put in termites

Q How about vegetables

A Yes they are so many of them the grow wild, and others have been domesticated we grow the in our fields fro instance marenge, baobab grow wild and used for their leaves but crops like nyevhe mbhuya mutsvandimire and mowa have been domesticated and are grown in the fields most crops most vegetables are dried for use during the dry season they maybe sun dried or boiled then sundried

Q May we now tur to the livestock

A they keep cattle goats sheep pigs and rockrabbits , here where I got married they also have donkeys but in gutu where I grow up in a village they could have one donkey that they could use to go to a grinding mill but in this area they are many donkeys which have several uses like for instance they are used for draught mainly

Q How about chickens

A Yes we keep a lot of chickens guinea fowls and turkeys but we have since domesticated zvihuta and makwari

Q Do you know of any breeds of chickens

A Yes we have breeds called hanga which look like the guinea fowl, then we also have the naked neck hens which are very good at laying many eggs and incubating almost all of them to produce chickens and they have very good mothering ability

Q How were choosing breeding stock

A They would target animals that have big bodies for breeding not the small ones because they don’t have a lot of meeat , the bull had to be big to produce big calves, cows were selected for high milk production for instance heifers from a cow that produces a lot of milk would be selected including those that were docile and would also choose steers that could work in the fields

Q How were about when you were newly married were you given crops and animals to start a new family with

A Yes we will be given chickens especially female and staple cereal crops , groundnuts Bambara nuts and Indigenous vegetable seeds and when we were given these crops your parents and relatives would encourage you to work hard in the fields so that you and your family would be food secure. The other uses of the animals were that they provided draught power, meat, milk and milk fat. All animals would provide manure for the fields, goats, pigs, sheep and chickens would provide meat also. Some goat like the angora goat were used to provide milk which could also be used to treat a special cough called chidembwe. Skins of cattle and goats were used to make clothes and the mbereko to carry the baby on the back but I never used that mbereko (apron) but my grandmother used it, chickens provided eggs also

Q Lets turn to the control of animal diseases and pests

A They did not use chemicals to control diseases and pests rather they used concoctions of herbs like from the bark leaves and roots of trees , I remember we still used chisvosve to treat opthalmea, gecko which is ground to treat ophthalmia a tree called ngocha in ndebele to control ticks and mites

Q Can these practices farming practices be introduced in schools for our children

A Yes we should practice mixed cropping we broadcast the seed and bury them buy pulling aa tree branch actually all practices that were done by our forefathers have to be practiced so that we preserve our culture . The farming system is very sustainable the crops and animals are adapted to our environment, I remember preparing sadza from rapoko meal and my children and their children would say I have prepared sadza that look like mujuru, they should know our culture not scorn our culture

Q How acceptable are our traditional crop and livestock to the present generation

A It will be affected by the Western styl of life which we have adopted, our children are not used to eat sadza from Indigenous cereals not maize and also Indigenous vegetables in actual fact they look down upon our culture due to urbanisation but we can reverse this by introducing these things in school

Q Thank you very much fro taking your time to share your knowledge with me

TRANSCRIPTION 3

Q What crops were grown in the community

A we grow rapoko, mhunga mapfunde and nyemba, runinga, maize, groundnuts, nyimo, sweet potatoes infields. In wetlands they grow sweet potatoes and tsenza. For maize the varieties were the yellow seeded variety called kenya, an eight or ten lined variety called gogwe, a tall variety called hickoking. They also grew maize with numerous seed colours on one cob. For groundnuts they grow kasawaira and chimhandara. Mapfunde they were varieties like tsveta and mukadzi usaenda. Crops were protected against weeds pests and diseases. Weeding is done to avoid competition for nutrients using hoes and hand pulling. Pest and diseases are mainly for stored products in the granary. They used herbs from trees and shrubs like mutsviri to control weevils. For diseases they uproot the diseased plants and burn or bury them. They also hang groundnuts plants maize sorghum and mhunga panicles on the kitchen line or place them inside the roof, these were the seeds which they planted they never bought seeds from shops and supermarkets during this period. Crops were selected basing on desired characteristics like high yielding, big crops, and drought resistance, pests and disease resistance. The fields were not very big like we have these days and mixed cropping was practised unlike nowadays where people practice mono-cropping to enhance food security by having a variety of food and helping in controlling pests and diseases . The crops were harvested threshed and stored and processed into a variety of foods. Harvesting and threshing were done by hands and the latter on a dwala. Selection for planting for the next season was done on the dwala just before threshing or on the fields. Storage was done first on a ngarani for further drying awaiting thrashing and then in a granary called tsapi or dura.

Q What were the uses of the crops

A Indigenous farmers used crops to provide food to their families, they practiced subsistence farming and yield surplus for sale, they also buy other commodities through barter and trade using their grains for instance trade a goat for grain. They also used the crops for various food stuffs, cereals are staple food, groundnuts and runinga provide oil. The crops are either boiled and eaten or ground into pulp for preparing thin and thick porridge. They are also processed into many delicious food stuffs

Q Now let’s turn to animals

A They kept cattle, goats, sheep, donkeys, chickens and they also domesticated rock rabbits. These are kept for meat, some like cattle for milk, chickens for eggs and skins of ruminants are used to make clothes and blankets. Cattle and donkeys were used to provide draught power. We also get cooking oil from milk and meat.

Q What was the management of animals like?

A Animals graze the range land during the wet season and rare supplemented with food from crop residues during dry season to maintain their condition. Farmers treat their animals for diseases and parasites using Indigenous herbs and shrubs. They use crushed roots, leaves and tree bucks to prepare the medicines

Q Do you think these practices should be taught in schools

A Yes so that our children can respect our culture in addition the agricultural approaches are sustainable, the crops and animals are adapted to our climate and the inputs are readily available and the ecosystems cannot be destroyed. The inputs ca be afforded by anyone within the community, however they will be a danger of them being accepted by our children leading to erosion of our culture

Q Thank you for participating in the discussion

TRANSCRIPTION 4

Q: As it was mentioned earlier by Mr Ndlovu, I am a lecture at Chinhoyi University of Technology. Im conducting a research here in conjunction with a secondary school and farmers surrounding the school. In Zvimba district I worked with Kanyemba and Chivhere Secondary School and the farmers in the vicinity of these schools.i am optimistic by end of this week I will conclude my research.

My research is mainly focused on the methods of farming and animal rearing that were practised and those which we carried forward to this modern era of farming earlier before the white settlers came in Zimbabwe. I am trying to identify the gap between the methods of farming that are being practised by the community and those that are being taught in the schools and suggest the gap be bridged by teaching the pupils our own culture of farming

A: OK

Q: My first question is; what are the methods of farming specifically in the field and the main crops back in the day before the colonial settlers?

A: we were still young boys at that time before the introduction of schools, most families owned large herds of cattle so draught power was used to plough using 'magejo' and those that had none would use 'mapadza' to dig and plant the fields.to add on that, 'nzungu' we planted using 'zvimwango' for speed because they are very small and light to use.

Q: oooh you mean 'mbezo'

A: Yes

Q: it is also used for carving wooden objects, right?

A: You are right; they were also used for digging small holes on the ground then use tree branches to cover the seeds

Q: Ok, so they pulled the branches?

A: yes, with bare hands without any use of drought power (cattle) so that the seed would be covered by the soil very well. Nzungu, chibage and zviyo was grown in Zvimba but mhunga and mapfunde was not grown around here I can't recall the other crop.

Q: we are discussing crops that would be were stored in silos in bulk, the ones u mentioned were for proper meal like sadza. Are there any crops that were considered......?

A:I never saw those or even mapfunde…. mostly chibage and zviyo in large quantities such that after harvesting from the field for them to be stored in silos the whole village would gather and grab sticks for 'kupura'.

Q: mupuro or nhimbe

A: Exactly so there will hit chibage cobs in groups forming a circle around an assigned heap.

Q: even zviyo?

A: Yes, men would hit and the women would be churning chaff known as 'kurudza'

Q: I'm familiar with 'kurudza'

A: Women after kurudza would pack in sacks because the grain would be in large quantities. After that household 'nhimbe' would be announced by the other villagers but mostly on 'zviyo'

Q: What about 'ipwa' and 'mavise' at least those are the names we use in Chirumanzu

A: Ipwa we also call it mapfunde

In Zvimba it was not grown that much, ipwa seeds would just be thrown on an anthill and let them grow on their own. ipwa was not important to them, their focus was on food grains like zviyo and chibage

Even today I don't think it has changed, focus is just fixed on chibage….ipwa is just thrown on the anthill 'pachuru' and let them compete with chibage because it's very fertile on 'pachuru'

Q: What about those wet places, in Masvingo we call them 'matoro'

A: You mean the water logged areas? back home we had a significant large portion of land that had a spring beneath, we used to grow rice 'mupunga'

Q: Our own mupunga

A: Yes, that's the other crop

Q: How did they classify the seeds to sow during the farming season that this is the right type of chibage or rukweza depending on the type of land?

A: only chibage was selected because there is this yellowish chibage which was in very small quantities

Q: Is that chekenya? Is it bold or garapa? Which is which?

A: Retro king

Q: So 'bhogu' is the same as 'garabha'?

A: Yeah it had many names

Q: In Zvimba they call it garabha

A: It produced very large cobs

Q: The cob would have about 8-10 lines of grain but not more than 12

A: Exactly

Q: I have it, I was given it when I was in Zvimba!

A:It came along but kenya was the one ,the bhogu one came later kenya came first but the white chibage im not sure how it got here, it was there when I was born, I don't know.

Q: Was there types of zviyo/rukweza

A: hmmm it's a bit tricky I don't know if my fathers and forefathers knew the types…as a kid I would just hear of 'zvatandara' and others names not sure if there were names or just descriptions. There are other which bulb, some straight but no specific names.

Q: I have a field with bhogu,the other of zviyo and the other mavise …we call the 'madhireni' or 'gandiwa'. For the nest farming seanson how do I select the seeds to plant?

A:like what we are doing today?

Q; yes

A: it's the same as what we are doing today, just before 'kupura' we select the big cobs. I hope you understand the category of being big that I'm trying to protrude.

Q: yes, I understand

A:when we select 'miguri' we select the cobs for seed and the ones for food

Q; so you don't ever go to the farmer's shop?

A: farmer's shop? Maybe

Q: **Yeah we end up going because of the seasonal changes we hear and notice as well, and also the advice from the government on early maturity varieties…you won't pick the late ones because you really know rainfall is not enough to sustain for late varieties. We end up going to the farmer's shops and hardware like everyone because following our old ways will land us into regrets and failure.**

Q: If I recall well, you mentioned that zviyo you would use the broadcast method then drag branches to cover the seeds with soil and chibage you dig holes then cover the seeds?

A: ooh yeah they don't dig, it was the thing of the past to dig holes and add manure/mufudze from the cattle kraal, there were no fertilisers back then

Q: So Mufudze was the real deal?

A: Yes, it was, they would just dig holes for chibage, nzungu, nyimo then insert mufudze… if there is enough manpower they would dig again such that weed control using 'kusakura' would be easy later as there will be less weeds.

Q: What was used for weed control/kusakura

A: Hoes

Q: you mean using hoes to remove weeds

A: yes

Q: the plants, were they ever attacked by diseases

A: Which ones?

Q: chibage, zviyo or others

A: In the past there was no such thing as crop diseases, it only started in these recent times

Q: How did they go about during harvest time

A: It was different from time to time

Q: before the introduction or machinery….

A: before the machines others detached miguri by hand line by line, others would cut the stem and stark them

Q: yes! Starks.

A: Others would just walk line by line that how we did it.

Q: after harvest and kupura, what methods were used to prolong the life of the grains so as to sustain us for long periods of time?

A: We would build what we call 'hozi'

Q: where I came from we call them 'matura'

A: Here we call it hozi, we construct it with many compartments for different grains, and the the entrance would be very very small then we close it. Zvipfukuto are of this age we never noticed them int the past because of the hozi

Q: with the whites?

A: yes, there was no such thing as zvipfukuto on chibage

Q: and zviyo?

A: Yes even zviyo

Q: hmm 10 years?

A: true, you would even forget that you still have chibage in the dura

Q: they say dura would be plastered and sealed completely?

A: yes! Completely…nothing would never gain entry. Its a shock nowadays chibage rots whilst in the field.

Q: even during kufunura you would notice zvipfukuto

A: certainly…. Especially this type of seed called 'tsoko'

Q: This place I recall that mbambaira is grown a lot

A: Yes, mbambaira is not grown much here in Zhombe, they just grow it for consumption. However, going towards Bomba people from here go there to hoard and sell them here otherwise in Zhombe a few take mbambaira seriously

There used to be 3 people who were serious about it these past 2 years, there is this teacher from the mission school who got a stand near the shops, then my friend Mr Madzivire otherwise it's just for consumption

Q: Now let's look at the livestock, what animals did they keep?

A: They kept mombe, hwai, mbudzi

Q: Nehuku?

A; yes, and huku, its part of livestock?

Q: yes, huku also called road runner, I don't know why? Maybe it's because it is always running around looking for food

A: Maybe We had a large herd of cattle,hwai and mbudzi. Madhongi came later

Q: madhongi came with the ndebele

A: Yaah if you say so, I first saw them in Bulawayo on ‘ngoro’. We only knew mombe, hwai, mbudzi and huku.

Q: mombe in terms of grazing and stock feed for the winter, how did you go about it?

A: there were a few people during those times, homesteads were far away from each other meaning more grazing land. Mombe would grow to full potential because of availability of grazing lands as compared to today.

Q: on livestock were there any specific breeds on mombe, hwai, mbudzi and huku? And how did they select the best?

A: huku there were the featherless heads ‘dzemusvuu’ and they had bigger bodies from the others. On mombe the Brahman is of recent we only differentiated by the body size.

Q:in the past, how would one do to make sure his kraal would of consist of large bodied cattle?

A: One would keep the biggest bull in his kraal so as to give offspring of the same size to the owner. On specific type of names, I can’t recall, just mashona type only.

Q: Was there any form of food for mombe kept aside?

A: Yes, they kept quite a lot in form of zviyo mixed with salt or dried stems of chibage to supplement the feed during august to October before the gukurahundi rains.

Q: rains had names?

A: yes, gukurahundi are the first rains mainly during the start of October

Q: How did you dealt with diseases, ticks and flies on mombe, huku and other livestock?

A: I never experienced such problems, ticks and flies were few to affect the herds.

TRANSCRIPTION 5

I am a lecturer at Chinhoyi University of Technology. I am a doctoral student with the University of South Africa. I am here to interview you and I am Constantino Pedzisai. My topic is prospects and opportunities for the inclusion of Indigenous agricultural systems in Zimbabwe agriculture

When I talk about Indigenous knowledge systems in agriculture we are saying before we were colonised by the white man we had our own farming practices, so despite colonialism, rejecting some of our farming practices there are a lot of those that we continue to practice up to today. Are there any prospects and opportunities for including them in the school curriculum? Which means the study will look at those local farming practices in the community and those in the school to establish a gap. After establishing the gap we will say from those that are in the community and school, are there any that can find their way into the school curriculum.

Q: what Indigenous farming practices existed in Zimbabwe before colonialization

A1 we had mixed crop, where by at times we have our main crop that is maize and we plant crops like mapudzi, melons, ipwa

Q: Why would we do that?

A: We tried to make sure we have new trends

If one crop fails the farmer will get one to eat

We are trying to make a diversification

Q: Wouldn't that also promote variety of food?

A: Definitely

Q: Any additions

A: We can also talk about conservation farming because some of these crops e.g. melons, cow peas can also assist in moisture retention, erosion control by reducing direct impact of rainfall, improve nutrient status of the soil e.g. cow peas.

Q: Maybe if we could look at the crop itself from preparation as a farming practice which ones were practiced before colonialization?

A: Land was prepared using minimum tillage to reduce soil structure disturbance. After preparing land using tillage at times sweet sorghum (ipwa) and crops like melons

Q: How were they doing the selection of the seed?

A: You find that … at times ukaona zivise zihombe and maseeds acho or zipwa zihombe umotoda maseeds acho. We are looking at performance of our crops within the region...that's how good to get our seeds. Kana urumuguri wechibage wototi uyu unoita uyu.

Q: How would when the crop is growing. Management of crops

A: In terms of controlling weed

We are now talking of the use of chemicals, but kudhara we are just controlling our weeds by the hand hoe and removal with minimal disturbances because we are saying some of these crops are good cover crops they can suppress… saka weeds may not be a problem we could use manure from animals to do away with… For irrigation we relied with rain and by then kwainaya.

Q: There was no climate change

A: ehe

Q: How about pest control and diseases control

A: Natural remedies like…

Smart yakazouya nevarungu

Q: How about when they crops are now harvested, how were they harvesting?

A: Harvesting was done by hand, and generally all crops were grown specifically for feding the family.

Selling was done once a year through batter trade, ane nzungu dzakawanda tochinjana

Crops were done for food purposes

Harvesting was done by hand harvesting starting from the point when we are cutting where we cut our rapoko head usung sharp objects and tonoisawo pathreshing dwala kumaareas aya ane dwala… kunanaNgezi monoisa pathreshing duala

There was a certain time where we tested moisture, hameno yaitestiwa sei.

The crop was threshed toisa mudura kumunda ikoko uko then we usually control the grain using wood ash

Harvesting tinenge tapedza

Mukukura kwangu tainzi you can keep rapoko or sorghum for more than 10 years

Q: What were the type of trees used for wood ash?

A: Mutsviri wewhite unoburitsa very white ash kudarika paint yewhite

Even mopani

Q: Which one of the Indigenous farming practices existed on animal husbandry?

A: There was Indigenous road runner bird, we also had some of the Indigenous pigs, Indigenous Mashona cattle and the Indigenous goat

Q: I heard one domain in Zvimba and knows all of them by mabreeds acho

A: Angora goat

Q: Of these farming practices, still on animals, they were attacked by some diseases or parasites, how did you manage these?

A: I remember of black leg. I don't know how the concept worked but we would find kuti after animals suffer from black leg pobhoiliswa mvura yodigwa pagumbo painongodaiso yatoita then we had ruredzo for dystocia problems or retained after birth then we also had inonzi… handichazivi inonzii nechiShona… iwo muti wacho unongorembuka rembuka seruredzo

Then pests like vana nhata…repellent spray yekuti vanosasa sasa muchirugu

Q: Repellent herbicides

A: Then aloe vera

And wounds

Wounds, ah handichazivi mashizha acho ekukacha kacha, unosvinira mashizha egreen paronda pacho

Q: I know it, yesterday one of the parents showed me the tree wekuti kana yarumwa nenyoka ndinoshandisa like this and this

And of these that they were practicing, it appears we have not touched on preservation of animals, how were they doing it?

A: For example beef or pork we could preserve it through sun drying, salt and toita midzonga yedu.

Q: All of those that maybe we have mentioned, which ones, are there any you can say are still being practiced today

A: It all depends with the availability of resources, in some areas they are still practising that control measure for black leg but most people nowadays are going for vaccines

They don't have financial resources

They are still there

Q: They are still being practiced

Generally you are saying most of them are still being practices

A: Yes most of them

And maybe it could be to the fact that maybe people especially those...

Q: What is your comment on the view that the Zimbabwe secondary school agriculture syllabi or curriculum is dominated by Western farming practices?

A: Definitely it is dominated by Western farming practices but we are saying that it doesn't put into consideration the child or children which are coming from different backgrounds. Mind you we are saying that within a school situation we have different pupils coming from different backgrounds.

We are saying that those coming from poor background are not catered for. At home you would find that at times he or she would tell that this is how we control black leg at home. And we will be telling you that we use we use black leg simple control and that is what is there in our text books.

Q: My father uses mufufu. That is one student told me. Mufufu to control red water.

A: By the end of the day as a teacher you are going to tell that child its wrong

Q: So it's unfair

A: It's wrong but we are using it

At home it's working. Kumba tinozvishandisa. They are having positive results from that

Q: Kumba we get for sweet potatoes we dig a hole, we put dota and we store our sweet potato for weeks, tozodya zvedu. Now you want to store the meat in the fridge

A: What is a fridge by the way since curriculum doesn't cater for pupils coming from poor backgrounds.

Q: It caters for those who have a Western orientation, or the elite class

Now you have been teaching for quite a long time and we are not saying we don't have any African methods or ways of farming or cultural practices, Indigenous agricultural practices. Are there any, which ones would you say exist in the curriculum? Is it purely when we say its dominated maybe we are not saying, its wholly Western there could be certain things?

A: You see what happens with curriculum is that, even if we have some of the concepts, our traditional Indigenous farming practices for example we may talk of the concept of conserving moisture through mulching. Nowadays they are no longer talking about mulching but conservation, they are coming from a different angle but the truth is we have let the crop remains on the land and these crop remains are acting as mulching to conserve moisture. And they are…lets go for conservation mulching, it seems as a new concept

Saka it was…but nowadays conservation what. It's not a new concept anymore

Q: Any other concepts that we find

A: We also have mixed cropping. But there is mixed cropping practice has been modified

Q: How about anything to do with pests, diseases, parasites control that is purely from…in the syllabus

A: We have cultural methods of controlling pests. There are there in the syllabus ad this is…from the…in the controlling of

Q: You slaughter broilers

A: Yes

Q: Do you slaughter them the traditional African way?

A: They are delicate

Q: I would like them to be slaughtered the African way

A: They are delicate

Motongotsika mawings

Q: Is there anything like vana land tenure, communal…free range?

A: Housing systems there are very

There are no longer there

We just mention them in passing

Q: And thus they live it, experience it. That what they live at home is now removed from the syllabus

A: The free range housing is no longer there…

Okay, how about grazing

We talk about grazing on the land tenure systems, where we talk of communal farmers grazing area, natural grazing

Q: Which maybe of these farming systems from the crop production…would you think should be included in the curriculum?

A: Right mixed cropping and fallowing

Q: Pests and diseases control

A: Natural remedies of killing pests and diseases

Q: What else

The storage maybe, we store our products

A: Storage and processing of food

Q: Storage tend to be more Western and we want to teach something that…

And what could be the benefits of including these in the curriculum

A: Like saying the use of chemicals normally…on our health and then we go for natural remedies like what is happening nowadays chihuta chihuta is something natural therefore we have discovered that these Western food, Western farming practices and were health hazards where we are saying for us to stay healthy we need to natural remedies they are not poisonous and zvihuta are not there in the syllabus. Saka chero ukachengeta even if you want to keep them how are you going to marry those zvihuta with theory work. Zvihuta are not in syllabus

Q: They are just proposing that is what I am saying which ones do you want to be included like the production of zviuta. I heard some saying the production of our own Indigenous chickens, handiti kuneprograme yema Indigenous chickens

A: Indigenous goods

Q: Any other benefits or advantages of having these Indigenous…besides

A: They are cheaper in terms of production costs and they are locally available

Q: Now what challenges may schools face in trying to integrate the Indigenous farming practices into the current school curriculum?

A: I think maybe the greater challenge may come from attitude so maybe our pupil were colonised towards getting 100% product and then they use minimum products means you're not business minded

Q: So you are saying maybe for those who have got commercial agriculture orientation into…the majority of the people would be saying they will be advantaged

A: They will be

Q: Okay

How do you think will then go about this process of trying to or including integrating

A: We are saying we should not forget the commercial practices

We should meet half way. Maybe we can use both for example in crop production we are using both the use of manure and fertilizers we are just meeting cost challenges with fertilizers

Q: Okay, so we refuse

A: Yes we refuse

And this is going to cut down on costs

Q: What else

A: Maybe also awareness and education can also assist

Q: Yes

The new curriculum

A: Maybe something would open

Q: So you are saying in our discussion maybe we could have left out some of the things maybe you want to talk about

A: I think I have done justice to this discussion

Q: I think we can end here unless you still have something to add

A: You are welcome.

TRANSCRIPTION 6

A: I think we can start now our interview .The questions we are looking at a my PhD studies are on the possibilities of Indigenous farming methods in the curriculum of secondary school syllabus in agriculture .We are saying that before colonisation we the Indigenous had our own local African framing practices maybe my first question now look at

The farming practices that existed in Zimbabwe in particular before colonisation which means we are looking at both crops and animals maybe we look at crops which crops did they grow .The Indigenous crops which were grown before colonisation .Some of which I believe still continues to be grown

B: Green crops mhunga rapoko sorghum these were the main ones they also grew some other like what do they call them manhanga they say pumpkins melons they grew those they also grew some Indigenous vegetables like what do they call them ana muboora and their own legumes nyemba cowpeas they also grew some part of the vegetables .Some of them were linked to possessing medicinal powers and so it was like cultural those kind of vegetables

A: when growing these crops which you have talked about they say the small grain crops and other vegetable crops in the fields have alluded to and some legumes like the cowpeas .How were they selecting seeds for cultivation?

B: In the first place they didn't monoculture was not very common it was more of mixed cropping they select the seeds from the that mixed cropping if we are saying beans they would pick those seeds which were what would I say they well-formed seeds healthy seeds and the kind of selection which goes medicinal what do we call them treatment they also some medicinal plans to protect their seeds so they would grow for vegetables and grow some for food and those would be stored in what were called matura which were

A: That information we can talk about it maybe later now we can talk about how they prepared their lands for cropping

B: Lands for cropping in most cases they use the ridges one of the areas they used the ridges they also used the hoe to dig some holes where they would plant some seeds could be somewhere in lands somewhere just mixed not proper lines some kind of broadcast but using a hoe then they would plant their seeds that will cover all their crops the groundnuts rukweza using the hoe

A: We have already talked about inter cropping as one of the planting systems would there be any other?

B: Mono cropping was not common inter cropping was chosen because it has benefit that if one crop fails the other will not fail. So in a bad season they would harvest something there was some kind of guarantee to say that we have not worked for nothing so that means that cropping will assist them particularly the use of legumes cranes that combination is not new current one where they say let's rotate the legumes and the grain maize I think it's in the old system they would put the same crops in the same piece of land and then the maize crop will benefit from the nitrogen from the cowpeas

A: Anything to do with fertility management they can be used

B: There is they would use the idea of using manure it's not a new thing organic farming some could even use the decomposed leaves just to leaf moulds murakwani I think the idea of saying there is something in the leaves manure I think people had that idea you only probably think what they didn't know what exactly like that we talk of nitrogen phosphorus and they knew was promoting soil fertility

A: About the management of crops how they manage them for fertility

B: In most cases yes there was a stage when they left the plants in the fields to be eaten by animals and take more manure and put it in their fields yes at some stage they will burn it and they will burn it in the field

A: Todays problem with pests

B: Pests I want to believe yes but not as common as it is now in most cases it was most of mixed cropping they would find some insects some would attack one crop an would not attack the other one in most cases they would not mix some crops which had some odour which could affect the insects some sort of repellents which is very common and that even at home you would find the repellents planted along the homesteads and they would kill those ones some would say they wanted to chase away the snakes

A: Related to crop pest control anything to do with crop pest control

B: These control I know that mixed cropping was practised. And when mixed cropping that would mean that one crop if it was near to the other one which was easily attacked and that which is near was not attacked was a repellent most cases the level of the pest damage would not be that bad.

A: Now their crops have grown they have managed their crops, how would they harvest the crops?

B: The harvesting they would remove grain part of it was not like the current one when we harvest the whole crop and carry home the seed alone it will be like rapoko for example would take that and store it for some time and then after probably after even the cold season then they will dry and is dried for and probably it was possible because also the seeds were not as big as the current ones

A: If we look at post-harvest storage how I think you said something about it where they store the grains the small grains

B: The small grains in most cases they would build what they call the dura and in the maturas they had special herbs. I'm now forgetting on the type of herbs but they would keep then there the herbs or the leaves maybe roots to protect it against the pests like weevils and chffer beetles. It was not serious. They would use mutsviri and the ashes form mutsviri. They also apply hundi. Hundi was burnt and mixed that would not allow the small creatures to reach to come and feed on the seed.

A: How did they use the grain crops for like mhunga

B: Number of issues as food as for preparing their beer in most cases they use it to for consumption but also some of the grains were special like rapoko it was in some cases it was very important for them to when they do spirit worshipping they would use the grain from that because it was associated and if you use that and the you brew beer and that and then you start talking to the rest of others

A: So for cultural practises

B: Yes

A: How about the legumes we have talked about the groundnuts what about the cowpeas

B: The cowpeas in most cases was used as relish and these also could be used as quite a number of kind of relish type could be eaten as it is after cooking it or prepare what was called rupiza and they will use that for their consumption so in terms of the balanced diet the is this thing was called more or less balanced they will have then carbohydrates then proteins were there fats also because of the part of the animals for meat production

A: Sweet potatoes the crop was it there

B: Yes Sweet potatoes were there was important for the

A: How do they let's say store it

B: In most cases One of the... which they use they would harvest they would allow it to harvest part of it as they consume it I missed this one cause I think they would take some of it and store it in their sort of big pots keep it in there yes we think of it today the lifecycle in short they would store it in what they call big clay pots makate and they keep it there closed I think those part was probably for cases of lower and evaporation of water so drying will take longer

A: How animals' which animals did they keep

B: They keep quite a number of cattle kept goats they kept chickens or hens they also kept it depends goats sheep then the cattle some people also kept some donkeys but each one was kept apart from for food it had also some ways that it was used it was most of them was involved in spiritual activity system was such that when you have a case for example a case could be saisd you get paying a mombe like in lobola systems the mombes were actually special type to say mombe yehumai mombe yababa it was well defined and even to the extent yekuti there kind of cattle numbers number of them which were called danga these were more than some could say 5 some could go up to 10 fo lobola so we would say the animals paid number of thinhs roles it was not just for consumption but also for cultural practices mombe dzekupira it was specific if mombe yekupira either it's a bull or its for lobola if it was a female one for the mother and some other so it was very specific so they had a roles

A: Still on that lets maybe lppk on the peoducts that we got from the animals like mombes

B: Mombes had a quite number of uses. Has meat milk hides hides were very important some could…back the hides as clothes and blankets madahunha so it was like if you had many mombes you were likely to lead upon someone who is very up….because you were not going seen walking with half naked something because you had all the material available for you to walk around it was even in terms of ratio issues it was easier to say someone it also affected their maize someone would say I got enough cattle and probably have 1 wife ….and they would pay for the lobola part with crops to their tezvaras and the like.

A: What about products from goats?

B: Products from goats Goats 1 it was as meat also 2 also its also used for part of the clothing nhembe and the like and mbereko so it was like a system which was self-contained sort of and meat it was even the meat it was well defined these ones eaten by those people who had skinned the animals this will go the mothers the things like that so it was a system which was well respected

A: How useful was the milk from the goat?

B: Milk from goat it was the some goods which are like food was medicinal some would use it as a medicine to treat chitembwe or chikosoro am not ver sure how. If you look at it now people are still doing that some of those things which were not attacking them then are not attacking them.

A: Any breeds of cattle that you remember that were Indigenous?

B: At that time there was Mashona was a we now call it I think this one is what they call the hard Mashona it was a strong animal if you looked at it was a much smaller average types but it was resistant to quite a number of diseases it could do the work that they wanted.

A: When we are talking about the Mashona it's about Mashonaland how about if we go to the Matebeleland

B: It had also the type I don't know if they had a different type but they had their own breed but also they had it was also a bit smaller

A: If you remember there is a Tuli and Ngoni

B: There is Tuli theres a Ngoni that has black and white or brown and white colours and it was like they had some kind of Indigenous breeds and if we look at them now people are still looking for them those were also disease resistant it was for mombe the Indigenous group

A: Were they also parasite resistant?

B: Compared with the Europeans ones it was parasite resistant

A: How were they grazing there animals?

B: Grazing of the animals in most cases they had no what we call now as paddocks but they had number of systems they would just graze the surround in the small piece of field or they would group a number of homesteads grouped together so they a distance away from the but they would work as a group they will not send the animals alone because also there was a challenge of wild animals so they would work as group and then try to control the animals and also to chase away the hyenas and other animals

A: Which food…. species maybe were there more concerned with?

B:The number of them apart from the grass there had specialties which they get some kind of the fruits that for the pods they would get but pane these what do we call it this manjekenje.

A: From the tree?

B: Yes.

A: Are they from the pods

B: Yes the pods mhunga then kune ma what do we call these one ine mazivara anenge mazigaka mahombe so its still there today and people feed on it zvakanyanyisisa it was told to be medicinal and contain quite a number of mineral content will think about it

A: How about disease control of animals

B: The disease control they would manage it they had the only challenge im now having is some of the kind of herbs but they had some herbs, the roots the roots the leaves and some of them even the fruits and they would crush them mix them with the water and give their animals to drink that were some of the disease would actually done with

A: About pests parasites they had number of areas one of them they would actually grow some herbs around their homestead or around the kraal and those herbs would actually passed some smell which actually been chase away the snakes even some flies and also some herbs will actually use to treat even the wound and the animal will be ok

A: Did you remember any trees that they used to treat wounds?

B: The wounds I am now forgetting the names but there were quite a number of them. I have to confirm but there were quite a number of them

A: mutandahonye

B: There is mutandahonye yes that was the very common but also would use some of the herbs in drinking water and the animal will heal without any problem

A: To cure the wounds

B: The wounds yeah they were so many some of them would be used even for this one but even for those mombes dzinosvodza they would give them that medicine

A: Herbal medicine

B: And they may end the day next time when its browsing on heat they will,,,,,so it was like a more self-contained system but it was not everyone who knew all the herbs they will selected who could then be asked to provide those information about the herbs

A: The products how were they processing and storing the animal products?

B: The nyama, meat. The processing part of it was dried after drying it they would either they would use the clay pots bi clay pots or they would use what we call it what do we call them mostly clay pots but that was after drying it they would the keep it in that one and only open it when taking some part to use because that some also would actually some herbal plants I'm now forgetting the plant I was mambuya ….talking about some herbs to which they have to use so that they will place on the pot so that they had to chase away the flies that would come. The practice is fading away I think we should revive it..

A: How about milk

B: Milk they had a keep them also in their pots clay pots they would milk the cow keep it there say after about a day or a day and half they would what we call kukuna they would remove the mutuvi the water part then they would mix now wasara mukaka chaiwo chaiwo with the fresh milk and then vokodzeka what they call hodzeko (milk curdle) kukodzeka that one now would now taste very good

A: And other products we have now talked about the sour milk and the mutuvi they use a r relish. What else?

B: The mutuvi the sour milk the some of it were some kind of fat which was found at the top of the milk that one was used as mafuta ekubikisa cooking oil that would actually give the good taste in muriwo and the like vegetables

A: Still the extent to which Indigenous farming are being practised

B: Indigenous farming systems some of it had refused to go like the mixed cropping it is still there people grow their chibage yes but the is still also put their mavise imomo they also put some muriwo wemanhanga imomo

A: Which means you are saying you will find one particular crop but a number of crops in the same field

B: Yes people now some have tried to grow one crop at a time but if you check properly you will find that very few are it will be a special area were one grow one crop but for the general the small farmers they do mixed cropping for food security sovereignty if one fails the other will not fail I have seen one guy who is mixing the chibage yes its there but there is also rukweza which is stanging by you find actually when maize fails the rukweza will not fail its still there probably what is its difficult to eradicate that one probably for those who have a guaranteed system to say if I grow this crop probably those with the irrigation and probably maintain one crop for those who sre which is more of dry land they normally mix the crop for that they don't lose both ways

A: What is your comment on the due that the Zimbabwe agriculture curriculum for tertiary institution where you are working as a lecturer yourself is dominated by Western farming practices what's your comment?

B: Generally I would say yes the Western type is dominated but of late I have seen the mixed cropping is slowly coming back as more cropping there are people accepted it but I have seen quite a number of small farmers they do mixed cropping they have their many crops yes but they also have some other like they have some maize like they have a field of maize right to be single crop but when they grow their groundnuts in most cases they put some here and there is some maize and also there is what they call ipwa also found there so

A: You are talking about the practises in the community I'm asking about the curriculum which you teach yourself me at Chinhoyi University that it is dominated by Western farming practises

B: It's true but

A: Do you have anything Indigenous in the curriculum? Like you talked about the you teaches them about mixed cropping

B: We teach it mixed cropping because it has been found that it it's like you are guaranteeing something if the season is not good you will not lose

A: Are they any other practises that are Indigenous in your curriculum at CUT? Besides mixed cropping

B: In the area where Indigenous practises yes there is an issue it's only the matter of scale like let's look at the issue of water harvest area of water harvesting when people look at it now it look like its wasted but there was a lot of water harvesting that was taking place other from the roof or even from the old maruware people will do water harvest and that one we are promoting it because it's something that we the people always get something even we go to our house yemarata and the like we are promoting water harvesting only that we are harvesting it using small containers may failed big containers but the idea of water harvesting which was using the roof ye ,,,, there are even doing it on their so it's like yes there is a mix for a mixture of Indigenous in the curriculum in the syllabus in the course outline

A: But you are saying you have more of Western than Indigenous

B: Western it's like its dominating. That was my question. It's difficult to complete to eradicate some of practices of whites

A: Is it only mixed cropping and water harvesting encourages some Indigenous methods of controlling parasites pests and diseases

B: Yes in our case we are saying you may say recommend the Western type but people also at home who knew the Indigenous

A: I'm talking mainly about the course outlines

B: In my course outline they are few.

A: What could be the benefits of say including or integrating them into the curriculum say of high school kids of secondary school kids in agriculture?

B: Let's look at mixed cropping for this year probably someone will say mixed cropping is no… but when we have a season that is dry and have mixed two crops one that needs a lot of rain water the other one that needs poor or minimum you won't fail to harvest you always get something that is one thing I noted about mixed cropping you always get something and also the other thing is that when you have a said when infection of some sort you may find that about others will also probably what is needed proper ratio say if I'm going for mixed cropping let me work with this proportion so that you won't lose completely but for people who are saying they want to for commercial purposes we all normally grow for mono cropping probably its advantages in terms of harvesting which maybe trick with the small….farmers I think the only thing I think is required for them to work using proper ratio say which one is the main one which one is the minor one so that you get the proper ratios I think that is the best one that is lacking to say what proportions if I say 25% is it really 25% so that I get the full benefits but the what I have seen in most cases is that there is some kind of advantage if you work with proportion you won't lose out control you will get something so mixed cropping I think it's an area that should go into the curriculum.

A: The use of herbs to control parasites pests and diseases

B: Use of herbs for medicinal is I think it's important and it's still being practised I saw at home people have got special verbal plants we actually use even now for their even chicken for their goats for their sheep even for their cattle they are still using those Indigenous and they are doing well in fact

A: Like aloe for stomach ache chisvosve for tsanga muziso

B: The only challenge that we have is that knowledge maybe at the moment left with very few people who know it.

A: So you saying we will be left with few people then you are saying our children should know our own agricultural knowledge so therefore let's have them in our curriculum

B: I have seen there is these guys veku Roman Catholic they have a number of herbal plants which actually they are giving now to give people but our area yechivanhu there are trees also which were used but there are not coming out opening which I think we are losing out on that and I know there was this doctor at U.Z aive ku pharmacy systems zvemushonga izvi he would actually go out meet the nángas meet ana sekuru nana mbuya nema gwenzi aya ataitaura kuti anorapa zvakati and chii chii and then they would take those trees come to the lab work on them on the labs get the product they want and use it as tablets so I think it's unfortunate now we are losing out on the part of the Indigenous knowledge systems we should do something.

A: Now that there are advantages you are saying the methods are sustainable. And how do we then go about integrating our Indigenous farming practises into the school agriculture curriculum

B: I think they should be

A: How can we do it

B: One thing is just like we teach the Western type about the practises and we also need to teach also about the Indigenous. In our practical's and do some testing for them if we take thing herbs and mix with water we need more research now like even our lab should work on that very well so that we in fact some of the tablets the formula was taken from an original tree then they also work some chemistry now but otherwise the original medicinal properties is from trees

A: You are saying give more meaning there need to find the ingredients in roots

B: Yes. And then when we get that one we must…and we could also do some garden chaiwo chaiwo or lands dzema herbal plants because I'm afraid kuti if we completely lose that gap then I think it's a disadvantage on our part unlike the doing they are keeping those inform their herbs from them some of them are even selling them so I think our education system should also look for that and start doing it demonstrating that actually if you take these leaves mutema ukamedza muto wacho musoro unonyarara

A: What challenges may schools fail as in trying to infuse Indigenous African farming practises into the curriculum if already dominated by Western practises?

B: The challenge is they are people who had accepted the Western type as a standard this is a big challenge so we may face challenge it's like when you give someone a tablet remosoro anonwa without asking if you say this is the herb herbal tree take the roots

A: You mean they despise the on the

B: They despise it and they think it's unchristian

A: Unchristian is also

B: They associate it with the some spirits but when I read the bible I find it vachitsenga midzi then I start getting to be surprised that what will be the problem I think there is need for some quite a lot of us even at university level to accept that these herbs are…then we have an advantage of having a some labs here our people here have ma lab ngavatore ma roots ma fruits get the active ingredients then they find out kuti is it not the same as the one that is being used by these guys vakutengesa because ini I think the chemical yacho is the same chemical but kungoti these ones were quickly wise enough to change them into tablets so ini I think universities can do quite a lot to manufacture the medicine from the Indigenous trees so that they because some knowledge's there the people who manufacture the herbs it can't be the herb just the whole plant nut it will have an active ingredient when we suck it.

A: Is there anything else maybe that you want to say about this integration of Indigenous farming practises into the secondary school agriculture curriculum anything else that we could have left out or certain things that you still think are burning and you want to bring them to the floor

B: Probably its just the attitude which I think kuti the universities should be open minded they should not be like closed minds to say just hazviite

A: And they still resist the heritages that is being included in the curriculum when talking about Indigenous we are talking about the heritages…….is emphasising a lot

B: So I think people should change their view on the knowledge systems ….knowledge systems they work yes pane zvimwe zvemashiripiti zviri more spiritual like but physically chaiyo chaiyo inoshanda lets give it a chance lets research more let's look at it kuti kana vachiti drinking at mvura yemu….and if we look at it musonga uya it's the same umwe unoto bholiwa umwe unoda kutora wakadaro these always believe there is some evaporation that take place for that period they know the period kuti ngairare yakadaro pamwe kuitira kuti extraction idii itike ikaita very short inenge isina kudii ku extractika I think more knowledge should be …..then people that is I know quite of ma certain countries akawanda they like very much on ma herbal nhingirikini and they don't look like people vari ….so I think ours….the bible does not completely say don't use them people would be asking them to use mai herbs so I think we had a some to learn from the….people so that we benefit from the our own systems it is an advantage if some trees are found to be to produce proper herbs medicine its industry on its own

A: Thank you very much for participating in the interview. Maita tatenda

<u>TRANSCRIPTION 7</u>

A The topic of my PhD research is prospects and opportunities for the inclusion of Indigenous farming knowledge in Zimbabwe secondary school agriculture curriculum. My argument is before we were colonized and of cause by the white man we had our own ways of farming our own agriculture practices some of which were denigrated by the whites but despite that denigration we continued to practice those ways of farming then from your own knowledge before we were colonized which farming practices existed in Zimbabwe

B We used to practise some shifting cultivation, hunting gathering of fruits and subsistence before the coming in of the whites

A How about how I think they grow crops and crops and kept animals which crops do they grow

B they used to grow maize, rapoko millet, small grain actually

A Small grain crops

B Small grain crops

A as staple food and they also have other crops smaller crops how were they selecting the varieties the crops to grow seed selection we are talking about

B Seed selection I don't think they were varieties they were not there if they was there it was variety its was there maybe for wheat they knew of one variety not they are so many varieties I meant for millet not wheat for millet that where they it's a variety with thay had on kind of millet that they were growing

A And the millet are different cause we have tsveta we have got zvimukadzi usabva I am talking about when we look at mapfunde for example we have several tsveta ,musoro mutsvuku, chimwe chipfude chavanoti chizhara wanya . The early maturing, short season one, the names of those varieties

B just know we have got millet

A But selection was more natural use of open pollinated varieties and no such thing like cross breeding

B That's what I was trying to say there was no cross breeding of crops but natural strains

A If you want a certain variety and you have it in another place you will be given just like yesterday and Zvimba there one of the ladies I was interviewing was talking of growing this groundnut variety yavanoti chimhandara vamwe voti tumbe and I was given that chienda unodzvara mwanangu How about management practices when the crops are growing anything that they used to do

B Weeding they used to use in fact they was no use of chemicals they used to use our ….the hoe ma hoes metal hoes and

A and weeding I think hand pulling how about control of pests

B talking of what used to be done. Control of pests I don't think they were able to they didn't use ma chemicals to control pests they did not have they had no knowledge about chemicals but they use natural herbs to control pests by growing different crops what we call crop rotation this year millet next year groundnuts for controlling the weeds that's how they did

A How about harvesting

B harvesting

A how were they harvesting their crops

B Harvesting no use of machines for

A and also when they have their crops after they have harvested process or store the crops how were they doing it

B They would not processing as such they store the crops for family consumption it was meant for family consumption

A Where and conditions

B They used some what we for millets they use what we call ngarani.

A Yes I knew it how about maize

B Of course they had matura which were made of dagga and poles

A Pole and dagga

B thatching grass

A Okay

B rakagadzikwa pamatombo 4 those type of huts

A How were they preparing for land for planting?

B long ago they did not have they did not use animals for field ploughing so they used those they do these days what we call timba ugute it was there long before so that's what they used for preparing land to plant crops

A Conservation farming

B Conservation farming yes

A Now we shift to the animal side which animals do they keep

B The Shonas used to have what are called the hard Mashona type and then the ndebeles they is the Nguni and Tuli

A I hope they also have Indigenous breeds for other animals for other animals for pigs for goats for chickens I don't know kuti pane ma breeds here

A Indigenous fowls ndinodawo huku idzo huku une musvuu

B of course pane musvuu

A Ndoinobereka stereki

B Ehe it's a good breed

A It's a breed yeah

B They have Okavango kana dziri dzega dzichingomitisa dziri dzega dzinoramba dzichibuditsa that same breed but uka crosser unoona zvichiita so it's a good breed

A It's a breed so they would also look after their animals or manage them yes the Indigenous were less prone to diseases and parasites yet we had some diseases how were they controlling some of those

B They used some traditional herbs to treat diseases for example for eyes animals that have got eye problems they could what are called chisvosve crush them into powder and then the powder is then put in the eyes

A This tree the shrub they call chisvosve

B chisvosve

A How about stomach ailments anything

B Many trees, they use bark roots or leaves

A what is your comment on the view that the syllabus that you used to teach Agriculture syllabus are dominated by Western farming practices

B Yeah its true the syllabus. Its dominated by Western culture of course why we are mostly interested in this culture is because of a lot of nhingi when you are using this Western type of farming there is an improvement in terms of production

A But when we are saying it's dominated by Western farming practices we are also saying there are some Indigenous farming practices

B Yes

A Which ones

B For example the conservation agriculture, kurima nechibhakera and a lot others

A Conservation farming which ones from all those that you have been saying do you think should also find their way into the syllabus to all of them or some of them to which ones like this I think

B I think to all of them because our students need to know what was happening way before so that they compare so all of them should be in the syllabus shifting cultivation monoculture

A Especially those practices that are still there they practice at their home

B …….in Zimbabwe who is still practicing shifting cultivation

A and it also won't be very alien to say students will therefore when they come to school they actually learn ma livid experiences that they live how would you think we can go about integrating Indigenous knowledge systems and the local farming practices into the curriculum

B we can make use of in fact we can make use of the AGRITEX department those are the people who are always

A With the community they know what is happening

B They know what is happening

A So that could be one step forward. Who else because the AGRITEX people will consult the parent, and the parents will also be the stakeholders?

B The parents yes

A So there is need to consult the community

B To consult the community yes

A and the AGRITEX and the other people and the other stakeholders who may have the knowledge

B Even teachers from the department

A IF we integrate them into the curriculum some of them our good farming practices not all of them of course the good ones of what benefit would that be to the student to the society what would be the benefits of having such endeavour

B when we talk of the good ones like the conservation technique we are saying we are able to control our natural resources like soil erosion we are also able to keep the soil reach in terms of fertility

A What challenges may schools face in trying to include some of the Indigenous farming practices into the curriculum they would meet some challenges just to be smooth flowing

B vanhu vanombo resister, I mean resistance to include hem because people are acculturated

A Kana chikomana chinomboramba kuti handichade chisikana icho how about acceptability

B people will accept

A so you won't face challenges

B I don't see any challenges

A Thank you very much we are also coming to the end of our interview and my last question is do you think there is something else about Indigenous framing practices in the school curriculum that you think we could have left out

B Kurima miti inozoshandiswa zvema…..izvi vanongoiziva asi vanongoziva kune miti but kuti tivati pave ne education yazvo mhani dai zvaiwana zvichinyoreka zvichipinzwa muma books….zvaizobatsira ka

A We should have a database of Indigenous knowledge so that it becomes a treasure for our future generations thank you very much for participating in the interview your views will work together with others and you will not be identified.

<u>TRANSCRIPTION 8</u>

Q: I think we can start now I don't know be very comfortable where you can use shona use shona more shona than Ndebele and English specially I think as I indicated to you before we went out to look at the first farmer looking at prospects and opportunities for the inclusion of Indigenous agricultural knowledge in Zimbabwe the African knowledge our way of farming some of the methods or practises have stood the test of time they still continue to be practised despite colonial and …colonial …..What Indigenous farming practises what African farming practises existed in the Zimbabwe before colonisation?

A: Before the colonial era our fore fathers used to …the land using hoes and they were certain types of crops which they used to select and grow like small grains and they had a reason for growing such crops one is being those were not affected by the pests one they were drought resistant and to they were nutritious so that's why they used to grow those small crops the small grain crops

Q: Otherwise they were used to the locality because they have tried and tested

A: Yeah the locality yeah the environment they were tried and tested though they were not recorded

Q: You just said small grains maybe you could give examples of those

A: They used to have rapoko sorghum and millet round nuts those are Bambara nuts actually then groundnuts also and then nyemba cowpeas

Q: How did they grow them not like what the white farmers would want the whole field to have maize and nothing else

A: Also the small grains were used to broadcast and after broadcasting they were to use something to cover up like branches trees yes which they use to cover up and then for large grain crops like maize they use to have some planting stations which they use to dig then they could put manure or could put humus so that what they used to do but those were on Indigenous crops and those were resistant also to diseases

Q: How ..Indigenous maize

A: They had about three which I could remember they call red crook is a kind of maize which has got red tips the seed is not red and the cob is red then we had that….which we called bokwa these are two different ones they are different they are not the same but resistants' they were just the same

Q: …………originate from are they African

A: Yes they are African and the

Q: Not the maize that we got from are America

A: No not one then we had another another….types of maize we used to call califonye ….which had small grains they used to say califonya

Q: It's not from California?

A: I don't know whether it was California but it was a short season variety two months

Q: And how ere they selecting the seeds for the

A: It was selected before thrashing after harvesting some used to harvest some used to select during harvesting bigger grains and better which are mature they could put it aside and leave those ones which are not so good so after doing that they could put them in a kitchen where it is hot and this was to enhance the hardness of this crop so that they cannot be attacked by by some pests though they are some pests

Q: Like …..

A: Ehe and they used to grind I mean to use them during the rainy season towards the season that's when they take them and thrash them

Q: Which means when after harvesting so they take those with the qualities the big one

A: Then they could ….remove the husk then they tie on the line which is on the kitchen

Q: The same for what about the nzungu-?

A: Yes yes they could pull the whole knot and they could taste after testing they could just select those which are good and put them aside those were not at …they leave with the husks to protect them from the …

Q: For maize I can see the ones that you are talking about are the open pollinated

A: Yeah they were open pollinated variety so they were used again and again so the same so the same with nzungu the same with….any crop they use …

Q: Any planting system that they used?

A: Yeah usually maize was planted they were sometimes used the intercropping maize was planted let's say with nyemba or we could say a line of maize three four lines of maize then two lines 0of groundnuts another three for lines of maize groundnuts or they could say line of maize then with the cowpeas on planting station of maize so that they could climb

Q: This system of putting lines is seemed is it African I remember sometime some people could even broadcast the maize

A: we can say it is African they could broadcast the maize yeah why they did that there is a reason why they did that they said it is easy to control weeds because when they grow up they shared the ground they shared up the ground so it will not be easy for the weeds to come up

Q: ……the for the weeds

A: and they used small hoes to cover up the groundnuts when they are about to mature because you could not use the bigger one when you broadcast because they will just packed on one place some could use a small hoe which could get inside so that it could cover up the

Q: How about field crop preparation?

A: Preparation usually they used to dig especially on maize they usually dig some holes right with groundnuts they usually dig the whole area just cultivate the whole area

Q: Not deep

A: Not so deep so that when they could broadcast especially with the small grains or even groundnuts and this was done to reduce weeds and also to be easy for the crops to penetrate the ground because there will be soil but at the same time you could see that by so doing that was there was a sort on conservation and maintenance

Q: Soil fertility management how were they managing the fertility of the soil

A: They used to use manure or they could use humus which they could get from the bush or they could use what we call those hands…. those were usually used to add fertility into the soil

Q: How about a place where there is a lot of …on instance big crops would they grow there

A: They used to grow maize because they could get bigger cobs and even the sorghum as it was chosen as the second crop for human consumption

Q: My mother would also grow tsunga

A: Yes tsunga could be grown and what we call these old vegetables

Q: The old vegetables like what?

A: Vana mowa and then ana nyevhe those were just chosen place where there is fertile where they usually put the ashes they could just broadcast there or even in the field they don't grow…and pull them out

Q: Pest and disease management

A: Well long back im sure there was no so much but usually they used the traditional methods of usuing local available materials like ashes and even after vapedza kupura zviya what they used vavsingabvise hunde vaitoisa nehunde yacho kuitira kuti zvipfukuto zvisa kwanisa ku penetrator then vaigona futi kushandisa hunde yemhunga kana kuchengetedza chibage ndoyovoisa mukati kana mashizha e mimwe miti yakaita sema gumtree though panguva iyoyo anga ari mashoma

Q: Which means the pests that you are talking about are for the stored products but in the fields

A: Kazhinji on the fields during my time hatina kumbo kwaingovakuti hazvo kwakusina kashoma kuti uwane iyi manje what we call army worm nezvimwe zviudyi zvakazouya kumasure haa handina kumbonzwa vachimbotaura nezvazvo even kuma training andaimboita ah ah izvo zvakazouya kwauya varungu

Q: Army worm inibva nemu rift valley handiti

A: Ehe asi zvavaitaura nezvazvo ishiri pest damage

Q: How were they

A: Vaive nenzira dzavodzekudzivirira shiri vaigona kuti vaite zvekudzinga or kudzvara padhuze nepamba panogara paine noise sa kutoti shiri dzikauya dzinogona kudzingika nekuti pamba hapagare paine munhu asi kana kuri kuti vadyara kumba vainoita sekurinda because dzaive ne time yekusvika in the morning kana zuva rovira sak they could put somebody ainda kuseni kunodzinga shiri also kana zuva rovira in the afternoon kwakusina shiri

Q: Okay remind me of my boyhood days where in the morning we could go kunorinda shiri todzoka kuchikoro tainzi endai kunorinda shiri Do you have some varieties which maybe were bird free

A: From my experience from my own extension which I have conducted so far pama varieties ainzi kwai resistant to pest damage handina kunge ndambosangan nawo though aivepo handisati ndasangana na farmer akambondiudza kuti kwaive ne nembeu yaigona kunge iri resistant but what they said tikadyara tese takawanda dzinoguta

Q: birds?

A: Yes birds

Q: Hadzizopedzi

A: Hadzipedze asi ukaita uri wega dzinouya kwauri asi tikadyara tiri pamwe chete takati wandei

TRANSCRIPTION 9

A I think we can start I have already introduced myself I think all these…maybe my first question would be what Indigenous farming practices existed in Zimbabwe before our colonization by the whites do we have any

B First we say the level of our technology determined the farming practices which we had the types of instruments we didn't have so much advanced so we used to use very primitive instruments simply hoes a plough came a bit later that will determine the kind of crops we would grow in some parts of the country

A How do they prepare the land for planting?

B Yes using hands and the hoes so we are saying is basically digging but like what I witnessed in some parts other parts of the country where it is easier to do it they had to use a hoe before the rains come in planting like rapoko sorghum in the hills it was so easy using hoes instead of using plough then saying they concentrate on small grains because of the nature their nature in preservation the thing like rapoko like mhunga it will take years without being affected by food shortage, So it was a measure against hunger

A We call it food sovereignty

B Yes food sovereignty

A What else in crops again planting of course and seed selection

B Obviously on top of seed selection and seed preservation normally like maize they would select good cobs put them in the kitchen where it will be smoked to preserve. They were not using commercial chemicals and we are saying they were just natural breeds which would grow nearly after a year selecting natural method of selecting

A Natural selecting method

B Ehe selection and preservation and then obviously planting like I said earlier most of the small grains they would plant before the rains in some other area they will call it kubvukuta varikubvukuta zviyo mvura inozonaya then zvine zvatova bho kudhara zvongomererana like for zvaiitwa ma small grains some other parts of the country they would do it to nzungu they will grow as early as July, August wait for the rains then as soon as the rains come they germinate

A How about when the crops are now in the fields when they are growing what kind of management practices were they

B right were are saying in the first place we are just weeding or hand pulling using a hoe and

A Not highly mechanized

B Not highly mechanized there were no planters but very simple machinery very simple hoes no chemicals no chemical herbicides just using hand pulling and like they do crop rotation, they use a strategy like nzungu I said early planting before the rains by the time they emerge they outgrow weeds

A They now outcompete weeds

B Yes they could outcompete the weeds even pests

A How about suppose pests. Any management of pests and diseases of plants

B Normally people would go around they would use hands to squash the pests like hwiza you kill and may have relish

A They will take the hwiza and eat them

B Ehe eat them. If there are diseases ….the diseased plants are uprooted and burn them or bury them.

A How about when the crops have been harvested or harvesting methods

B Obviously hand harvesting manure no machinery combine harvester even most areas like today its still foreign to us to use those mechanized methods we are using what the hands just a hoe if it is maize using a knife if it sorghum and rapoko using a knife to cut there is

A How about fertility management soil fertility management

B Normally it's putting manure compost so basic yes people may talk of fertilizer now but still people discourage the use of fertilizer because of the soil structure I heard someone saying it actually destroy the soil the fertilize so they would prefer manure organic manure

A I think they have herbs they would use against pests and diseases

B Herbs I don't remember herbs I don't remember but only saying it will control a pest like mbambaira you just do crop rotation because and yes pongwe (eelworm) by crop rotation

A What was the use of ash

B Yes ash that one is very common use ash to protect against pongwe in mbambaira, sweet potato.

A Now then they have harvest they need to store them and process them can you shed more light on that how they would do it

B Yeah there are many ways of preserving mbambaira mufimbindofimbi and that fimbi obviously vanga vasina vaitosarudza zvavanoda to select dzisina zvirwere dzisina kurumwa then they would select dzisina kutemwa dzakanaka. Then like I said chibage obviously mbeu vaichengeta mu kitchen then zvakaita zviyo they would build kana tsapi then vovhura vonama nemadhaka such that ma wolves….haapinde mukati until time vanogona kuti preserver sezvakaita zviyo ne mhunga it will take 4 years

A How about control of pests and diseases

B They seal the granary for years waiting for difficult times yes they were strategic grains for fod security When you go and open pane panongova nehunde pamusoro (mhunga chaf) to protect againsweevils so that it is preserved for a long time and protect for a long time. Vegetables like drying munyemba (cowpea leaves) they dry it wait for difficult times

A They had their own Indigenous vegetables

B Yes it was derere, mowa and many others it was so easy to preserve them by drying

A How about are there some of these practices that you have been talking about are they still being practiced and if so which ones

B Yeah some of these things are practiced maybe sometimes maybe not by choice or by choice we are saying by choice also actually chose the way we want to preserve but sometimes you don't have the alternative …to run with technology like preservation of food we want to use a refrigerator but because we don't have those refrigerator we are forced by the circumstances to dry roast

A Instead you are saying those methods are cheap sustainable

B Yes they are cheap and sustainable so we even if we want to run to other we find ourselves running back because of the outstanding the society

A Going by the economic level the society

B Like the question of mechanization we may want to use those advanced machinery but we don't have money then we use the cheap Indigenous methods

A We have tomato harvester

B But we don't have

A Which can sense that this one is ripe this one is not

B We can't do it because we don't have money. We may want to use the planter but where can we get it we can't afford even the land which we had even if you have the money you cannot waste the money on a very small piece of land

A What is your comment on the view that the Zimbabwe secondary school agriculture curriculum itself is dominated by Western farming practices

B Yeah its very true that its dominated by Western practices for very first part states the syllabus you would see most of these are Western practices. Most of the things the students or the people are not aware of those things because they are foreign for example the isuue of machinery which we talked about most of it its Western so people are not aware of it where even if the things which we have ourselves they are given names which are foreign then it becomes foreign and…not difficult to accept for the people it would appear foreign yet we have they are some things which are there already

A Like what can you give examples

B Like in the agriculture syllabus there is what to call technology. We are saying whatever technology you have should fit the people of the particular area and we are saying that affected technology which we have should be catered for using hand and a hoe its appropriate technology a plough even ambuya can tie the nuts because it's appropriate mu situation iripo of cause iripo isiri appropriate because ine yava advanced so in that specially in types of appropriate technology it's there it suits us because we take what we want then again we find kuti yes distributed in terms of saying the option part that some are doing animal husbandry crop husbandry but those categories you have to choose pick and choose what is very appropriate in your particular situation but sometimes we are limited to a particular situation like in terms of options we are limited to one option crop production because that's what we have the other part we are not like horticulture it's not part of us surely if you give me flowers today I can appreciate as a flattering no I thank you very much actually they dint make sense to me you see so we are saying there is horticulture but what about it there is agriculture engineering but it's already foreign. So the most part of it in terms of option its foreign maybe only one part of us so we are forced to just concentrate on one part that's crop production and for crop production we have to select very carefully so that you pic what is appropriate to the particular area

A from your experience as a teacher of agriculture yourself what can you are there any aspects of the content in the syllabus where we can say this is Indigenous these are Indigenous agricultural processes

B Yeah I can take an example on what we do here actually we don't have cattle we don't machinery. So actually we use what we have the hoes so in terms of planting we use hoes which is conservative tillage that's what we do and we use we can use fertilizer but most of the time we pick cow dung around the area and when we are done with cow dung then we can use fertilizer but first we use cow dung when we use broilers we use manure from the broilers you see and we make composts like now already when we are trying to do our vegetables unfortunate we couldn't manage. Using our composts which we made last year so we are trying to do what is available and in terms of crop selection we are trying to implement something which is already familiar to the people like in my first years we used to do …potatoes but you see that this is actually very foreign to the people so we resorted to sweet potatoes because its their everyday life sweet potatoes so even when learning its very difficult even if you don't teach them they actually….you see

A Because they have experience

B They have experience it's actually part of their life

A They use experience

B So it's very easy in terms of maize then we are forced to go with the current times

A How about when you teach land tenure. Anything Indigenous

B Sorry

A Land tenure

B yes we can talk of land tenure when we talk of say the communal its Indigenous shifting cultivation part of us its only that like shifting cultivation is very difficult to talk about it now appears to be foreign again to them because of the space they don't practice it they don't hear about it shifting cultivation is foreign to them now because its long gone cause of space when we talk of communal farming yes they understand it because its part and parcel of their life

A In animals

B Yes in animals we talk about cattle is obvious that they are their everyday life but some of the breeds now which we talk about them because we are saying yes to given breeds to study. Most of them don't know of cattle they own so yes they own cattle but the information they have is so foreign we had out Indigenous cattle but for now that Indigenous cattle is no longer there they can't point that yes we have Afrikander we have Tuli

A Which of those farming practices would you like maybe included in the curriculum yourself

B Firstly at one of those in selection of crops we say if ma grains …limited we say maize sorghum millet but we have important crops like rapoko is very strategic in terms of food security so if that one is part of the curriculum it may take a long way then like fowls our own Indigenous it's easier to manage than the what is happening that the people over emphasize on broilers but we are saying its inly a very few people who can manage to tame those things cause they are so artificial but if we take of Indigenous fowls yes this…of road runners all over the place but the idea is very good but we are saying it's not say part of the O level syllabus. If we can mention in passing but not part and parcel of the syllabus just talk of layers but where are the so called road runners in the syllabus

A You are saying generally the syllabus is Western

B More to the Western we are talking of eggs its layers so it's very difficult for them to actually understand or actually to go and do the layers but if you do road runners its easy you can buy two then you are done but when you talk of layers it's now extensive lot of money to start a business but when we talk of real life for a person to live he needs what those things to have you see but you can actually save those things because they are easy to manage

A So you are talking of Indigenous breeds animal breeds how about management of pests parasites

B yes they are so Western yes we have something in terms of the ……

A Herbs

B Indeed something which is like crop rotation early planting yes its ok but you that emphasis now herbicides pesticides it's even by then what we have because we are over using it some of the soil because of herbicides is very difficult to plant something profitable because of the overuse of herbicides but if we go back the way we manage our soils using organic manure you would find that the soil were maintained but we say let's use herbicides let's use fertilizers if we overuse fertilizer we have overused herbicides we have destroyed the soil not only the soil even the rivers because we are saying

A The fluoride

B Yes so we are saying we are not only destroying the soil. We disturb the fish because of….even when we are doing the irrigation then the pipes we are overusing these we should use organic manure surely that little patience is very limited because it does feed the rivers but actually it improves the soil if we all minimize the use of herbicides we reduce the danger of destroying the soil even pesticides by the end of the some of this pests we consume them because some of those things we just take we don't even understand how they operate. We just take to ease our work but if we use natural methods which we are used to we can preserve different crops

A Now we have become so much Western in the way we do our agriculture in Zimbabwe and how our discussion has yield that maybe it's possible for us to include some of our Indigenous practices into the curriculum how do you think we would go about doing it

B it's very possible to include some of those things into the curriculum the only…that we have made ….it is very difficult for us to reverse for us we say let's go to the so called rural you find people primitive so people will not want to appreciate yes resist but if you include those into the curriculum it means we are putting the idea to the right person if the pupil appreciates first it means the future is prepared but if we go right round to the farmers they also most of them are doing those things but they will say because they don't have tis but they want to go forward the so called Western things if we say teach a child now these new these ways old ways and he appreciates we have a future because once the child appreciates we can implement

A So that will be some of the challenges that it may have lower acceptance from some of the people that maybe the community maybe matter more or less and the child issue something is taught at school and the same thing is practiced at home it makes a lot sense and so they would grasp it's easier for them to grasp the information the concepts than learning alien things

B Like most of these things it's a contradiction we talk of compound d ammonia nitrate at home they don't afford compound d ammonium nitrate so we are teaching how to use compound D how to use ammonium nitrate when the child goes home he/she is using organic manure compost so it's a contradiction we are teaching one thing here and he is practicing another so it becomes so relevant if we teach them to use organic manure how do you use it becomes so relevant because they are doing it home

A We buy chemicals instead of getting herbs from the bush and it does not cost anything

B But you see the problem is write into something new and we have forgotten how that will happen to the seed if you rush to embrace all the foreign seed they shall come a time when we had forgotten our own to come back to what we already know it becomes very difficult because if we could have people to follow that new thing it becomes expensive so will be in a dilemma so it's better we want to have already

A So you are saying that they are a lot of benefits that will derived from including or integrating Indigenous knowledge's

B Yes they are a lot of benefits because that's what we already do its only that in terms of the curriculum now it teaches something else that's why it is difficult

A For the student to pass

B Yeah its difficult because people are learning foreign things in their learning the things they already know they already practiced it's a question just formalizing what you already know like the crops we were talking about mbambaira sweet potatoes it is you don't even say a word they can still do it they can still write something because

A They are used to they practiced it at home

B You see so we are saying that is just the same so what's so easy for us

A Are they any other benefits of including the Indigenous practices we talked about sustainability that the resources they use are locally available and adaptable hence sustainable …sustainability

B Even if we start from what we have if we are to progress we progress in our own direction which is relevant to us but if we take other post technology practices we are forced to move in a different direction which will not be able to manage

A IN other ways you are saying let's start with our own then if we want to exploit all other avenues other knowledge's we can explore

B Yes those knowledges we can but what we have so we improve in our own direction we take others technology but we use what we have

A That may apply to our situation

B Yes you see if you follow other technology we are likely to follow the Western knowledge

A Is there anything else that you may way to say about the inclusion of Indigenous farming practices in the Zimbabwe secondary school curriculum maybe anything that come to your mind when we were talking

B I think I have said all I should have said

A Okay thank you very much for taking part in this study

B You are welcome

A I hope when the results come out you will have site of the results

TRANSCRIPTION 10

A I am sure we can start our interview now as I said earlier on as a way of introduction I am a lecture at Chinhoyi University of Technology at the same time I am also a PhD student with University of South Africa UNISA so my study is on prospects and opportunities for the inclusion of Indigenous agricultural practices in the Zimbabwe secondary school Agriculture curriculum the reason why I targeted this institution for the, the agriculture college that's where we also produces agriculture extension workers and agriculture teachers for schools so the influence has the knowledge they impart. That's why I targeted the institution my first question would be to establish the Indigenous farming practices that existed in Zimbabwe before colonization which means we were colonized of course but before colonization we were farmers ourselves we had our own farming practices our own crop production practices our own animal production practices and maybe the first one will be trying to look at which crops did they grow

B I think before colonization I find farmers were mainly it was mainly the small grains the rapoko the millets the of course sorghum then they also ate wild fruits mainly t…they were not growing them but with respect to growing the millet that dominated and also had the other things like that we call minor crops now like roundnuts the cowpeas I think those were the major crops that I can remember of some of the things are minor

A So the two main leguminous crops were the cowpeas and the

B Roundnuts

A Nyimo

B Ehe I am not sure about groundnuts

A Its also Indigenous that's why they are varieties like Makulu red and other cops more crops pumpkins

B The pumpkins that's for sure sweet sorghum that's correct sweet potatoes I am not sure because considering the issue of potato is not Indigenous. But cassava I am sure it's quite Indigenous

A They are also Indigenous but not to Zimbabwe. But madhumbe (yam) and magaka

B I remember magaka eminzwa those were the most common then

A are there any varieties that we can think of that were Indigenous rapoko for instance

B Rapoko there is I remember they are too main ones that I but I can't remember their real name there is kwedu they call it what hanzi ruzanga waya something like that in Shona there is the one that opens up and it has got a bigger head and then the other one that produces something like a fist I can't remember the one I remember my mother used to tell me the one inoita like a fist it can be handled quite well it doesn't lose the grain easily so when you are harvesting its easier to handle it whereas the other one they were saying it threshes easily so the other one handling the grain is lost along the way I remember that that's way back

A My Dean says they are over 200 Indigenous varieties of rapoko

B Yeah they would be even if you look at the colour

A How about mhunga

B Mhunga I am not sure of the variety names

A Maybe other crops that have varieties that you know

B Of course

A Thank you

B For groundnuts I know there is the other one with smaller grain then the other one like it should be the called the makuru red now but I have known it for some time as well mhunga I know only the one type with two heads. I can't distinguish all by name they are quite different

A They are some waned varieties of mhunga for birds……all the same how they were selecting the seeds for planting

B Long back

A Yes

B I Know they would at things like I said for the finger millet they were looking at the issue of handling of course even the issue of yield they also looked at it especially looking at the size to be made they consider that then also I think the issue of birds may not be quite clear but to a certain extend I know they also looked at that some varieties favoured by birds more than others do with their experiences they also were factoring in that to a certain extend

A How about how were they preparing the field for planting

B For the field crops you mean before way back

A Yes, even now

B I know in our home area they talk of like the miller were grown on those rocky areas so they were using hoes they what they do is they move it to an area they broadcast the seed they weed while they weed also mix the seed and the soil then

A Sub-zero tillage which we still teach. Zero or minimum tillage

B That's correct then of course when they were ploughs they had to plough then they come in either they can drop the seed and cover them the seed after ploughing the whole land is ready they move over the they drop the seed and cover with the feet or they can broadcast and pull branches of trees or move animals

A I remember especially goats feet covering seed

B Yeah

A Those so preparation of the land was mainly use of the hoe and later the plough also had our own plough pakaita discovery of mhangura kuti we had our own plough I think the systems of planting we had already talked about broadcasting and also dropping the seeds in holes what else

B Planting of course the broadcasting the dropping those were the major ones also for some if where they had holes in some cases they would use holes making holes planting extensions and drop the seed

A Like kukavira nzungu were are talking about that

B Ehe that's correct so maybe the setup may not be the same I remember for groundnuts in some cases way back they would plant without having straight rows they will just plant then also they discovered it's a bit problematic when it comes to weed management when we don't have lines

A How about how they managed soil fertility

B The fertility management it was mainly the manure from animals they kept they were no fertilizers the land had to rejuvenate itself in some cases where the land degraded they would leave the piece of land since they were plenty of land then

A Shifting cultivation

B Yes they move to another piece of land while the other one rejuvenate but in worst case scenario where the land could not they…manure

A Okay

B In some cases that was going to be my next issue would use the…they would dig the …and they plant some places and then of course also the issue of

A Murakwani

B Murakwani they move around mountains collecting it

A So it was mainly organic means

B Yes

A No fertilizers have not been discovered then

B No

A they only be…the coming of colonization

B Yes

A Any pests and if so how were they managing the pests

B They had some problems with pests but in terms how they managed them then I am not sure they sprayed herbs possibly they were hand picking where they could meet the pests for those bigger pests like the locust and others that can be handled but I would like to believe the problem of pests may not be like what we have nowadays possibly kuti it could be different….the alternatives since the land was still vast maybe in a while the pests could still feed on something else

A And mixed cropping

B Yeah that would have crops that repelled pests

A Crops would repel pests

B Would help yes that might have been the other situation that helped

A Is it the same scenario with the crop diseases

B Yeah possibly with crop diseases they was very little knowledge but I remember they didn't have much problems with them

A I do agree with you that maybe they had not have very many problems with crop diseases and pests but later on we had diseases and crops diseases and pests and animals of crops but how were they managing them and how do they managing them from an Indigenous perspective

B from with respect to pests and diseases possibly they had major practices that they did was the issue of selection where they would know I had with this type or variety problem last year possible …..and of course they would also in the selection of seeds they would look for better seeds from what they had but they would consider maybe varieties which were less prone from their experiences

A And to weed control

B weed control they had to use the hoe the hand pulling

A lets go to harvesting of the crops hoe were they harvesting the crops

B The millets they had to cut the head they carry the heart…where they would thresh using the….then they…and had the grain

A How about the legumes the cowpeas the nyimo the nzungu

B for the cowpeas I know they had to pick the pods then they can thresh using sticks in some cases they can even shell the pods using hands especially where they would want to use the grains when they are still green on the mbambaira and the nyimo they would harvest them when they are almost dry them up and they can thresh also using sticks

A Very interesting the storage of the post-harvest storage they used

B For the postharvest they had to build a mainly what they call tsapi and such as that they could use what they were in various forms what I remember well was a some cases they had to build structures that they would completely cover and leave small holes or some structures where at some point they had to cover completely and they keep the grains there when they want that they open and take a significant quantity that they can use and they cover back for some time they are eating this after some time they take in some cases they had to leave a small hole where the grain had to come out some of the structures I have forgotten

A They had to process the small grains into various products can you

B Yeah for the small grains especially the rapoko the maize it's like after hand threshing they had the grain then when they want to mealie meal they wound take the grain then they thresh them yeah to remove extra chaff. When it's clean now they had to roast it and after roasting they had to grind using guyo

A What were the uses of the small grains

B They had to they had to produce porridge sadza this small grains they mainly use them for that but possibly for sorghum we had some cases where you could boil them and produce something almost like zvakada kuita kunge manhuchu like those cases

A Mobva kupi

B From Masvingo

A Okay tatowirirana ndobvawo kwa Chirumhanzu and mbwire mbwire

B Mbwirembwire I remember that one everyone ask to remain quite

A Koti how about we do some cultural values of the millets

B That's correct those were very important beer maheu as well those were very important of course traditional practices they had to use they said like kwedu they preferred rapoko more than

A Especially when they are mixing with the ma herbs kurapa munhu now we have all these farming practices some of which still continue to be practiced maybe in your own area what is your comment on the view that the Zimbabwe agriculture curriculum for tertiary institution or agriculture colleges even universities is dominated by Western farming practices what's your comment about that how we

B That's very correct but also what I noted is people tend to look at what give them money it's like those practices which are Western inclined they have got almost something like a ready market or the processing is easier that's what I noted as well but if we look at our own it's like the issue of processing was not yet possibly refined quite well such that even the end product which might be good and marketable people tend to shun it the processing is a bit cumbersome at what most secondary schools and tertiary institutions are teaching is mainly Western

A Which means they are some Indigenous practices also which

B Yeah they are there

A Like what in crop production

B some Indigenous practices

A Maybe in your own courses of curriculum here which ones do you emphasize on

B Things of mixed farming and some cases we emphasize them when we feel like these are important but at some times when you look at commercial production especially looking at the issue problem of labor you would want to go the way of using herbicides so when you want the issue of mixing becomes a bit complex there that's where the challenge is otherwise the issue of mixed farming will still…that

A and organic farming

B that's where especially we look at mixed farming we look at maize and common mixes

A SO those are some of those you find in your own syllabuses

B yeah they also even we look at the issue where we teach the small grains I think most of the practices are still even used now you find the plant the we have planters nowadays but some cases where we don't have planters people still broadcast those things are still being done you find in some areas where we broadcast and use hoes to weed

A And see that if we look at our rural areas which make up about 78% of the entire population of Zimbabwe they are not that mechanized

B They are not

A Do you think that they should continue to have their Indigenous practices

B In some areas they don't have an option I give you an example I come from Bikita are a bit rocky even if you have got the machinery you can't access that you definitely need to continue using those practices those can't be changed then even the issue of when you plant even in some areas where you can use plough but the issue of dropping and covering with a feet and that I think people are still practicing that quite a lot especially you find when at times when you tries to use a planter possibly might be it actually tend to be slower because let's look at a situation I ploughed maybe a hectare if I have got six people to do that in a short space of time if I have got a planter those which are drawn by animals those may want to plant say rapoko you may not find something which really suits that

A So I am agreeing with you that some of those can also go into the curriculum what will be the benefits of integrating some of those Indigenous farming practices which are not already which are not yet in the curriculum what will be the advantages

B Integrating those practices into the curriculum

A They say they are certain practices that are Indigenous that you envy that they should be in the curriculum then I am saying what would be the advantages of having them in the curriculum on people

B I think we that can help to introduce possibly to improve especially on the science part you find when it's done to rural areas they just use their experiences but when we do proper studies we can actually improve the way they are doing to say yes this what they are doing but we can improve how they do it or we can improve the benefits they get from them so if we introduce them we try and help them to make the practices more user friendly or

A Sustainable

B Yes to them other than for them to just decide say how the situation let us do this.

A sustainable you mean they are less costly not expensive

B To them looking at a small family with a small piece of land for them to just go and look for machinery might be complex to them they can manage the land with what they have with the hoes

A Suppose we want to integrate Indigenous farming practices which are not yet in the curriculum we put them in the curriculum how would we go about

B I think what is important is to go and see how they are doing it now and see the gaps and other areas where we feel like they is need for improvement then we polish them up

A Doing some research

B Yes we research on them once we have got a finished product then we can now bring it to the curriculum so that we try and improve on what they are doing

A And in doing so what challenges do you think school or even colleges would face when trying to include those into the curriculum

B The challenges are possibly on if we look at some practices they are done because they the farmers have no option like we look at those rocky areas you find if you move to other areas in Mashonaland we got vast land is almost flat why do I need to practice this where I don't have any problem I can still use the machinery people is those cases people tend to chose

A You are talking about attitude

B Yes the issue of attitude where some people still think why should I go for this when I can still do it this way then the other challenge might be maybe of course after research some there is need for experience some of the practices are mainly done in certain areas of the country and they are not practiced almost everywhere so they might be need for the teachers who are going to be exposed to those and also interact with those farmers who are currently using that so that they get a good picture of how they are doing and why they are doing this some of the challenges I think

A The knowledge

B Yeah

A If ran out of we don't have old people who still….

B You see you find in some areas they practice it because they got it from their ancestors who had better knowledge but they didn't pass it on its only that

A and if we continue our practices

B We tend to forget them

A They say when an old man dies the whole knowledge, cultural knowledge goes is there anything else maybe you would want to say about possibility of integrating some of Indigenous farming practices into the curriculum

B I think it's a very good idea its quite fortunate that we got people who think along those lines you find especially looking at proportion of those communal farmers and at times we tend to say they are failing to produce enough there is only need to improve on what they are doing so that they can produce what is enough for them so feel like this is a very good idea that can help our those farmers in the communal areas to improve on what they are doing

A Thank you very much interviewees

INTERVIEW WITH AGRIC TEACHER

I am a lecturer at Chinhoyi University of Technology. I am a doctoral student with the University of South Africa. I am here to interview you and I am Constantino Pedzisai. My topic is prospects and opportunities for the inclusion of Indigenous agricultural systems in Zimbabwe agriculture

When I talk about Indigenous knowledge systems in agriculture we are saying before we were colonised by the white man we had our own farming practices, so despite colonialism, rejecting some of our farming practices there are a lot of those that we continue to practice up to today. Are there any prospects and opportunities for including them in the school curriculum? Which means the study will look at those local farming practices in the community and those in the school to establish a gap. After establishing the gap we will say from those that are in the community and school, are there any that can find their way into the school curriculum.

Q: what Indigenous farming practices existed in Zimbabwe before colonialization

A1 we had mixed crop, where by at times we have our main crop that is maize and we plant crops like mapudzi, melons, ipwa

Q: Why would we do that?

A: We tried to make sure we have new trends

If one crop fails the farmer will get one to eat

We are trying to make a diversification

Q: Wouldn't that also promote variety of food?

A: Definitely

Q: Any additions

A: We can also talk about conservation farming because some of these crops eg melons, cow peas can also assist in moisture retention, erosion control by reducing direct impact of rainfall, improve nutrient status of the soil e.g. cow peas.

Q: Maybe if we could look at the crop itself from preparation as a farming practice which ones were practiced before colonialization?

A: Land was prepared using minimum tillage to reduce soil structure disturbance. After preparing land using tillage at times sweet sorghum (ipwa) and crops like melons

Q: How were they doing the selection of the seed?

A: You find that … at times ukaona zivise zihombe and maseeds acho or zipwa zihombe umotoda maseeds acho. We are looking at performance of our crops within the region...that's how good to get our seeds. Kana urumuguri wechibage wototi uyu unoita uyu.

Q: How would when the crop is growing. Management of crops

A: In terms of controlling weed

We are now talking of the use of chemicals, but kudhara we are just controlling our weeds by the hand hoe and removal with minimal disturbances because we are saying some of these crops are good cover crops they can suppress… saka weeds may not be a prolem we cold use manure from animals to do away with… For irrigation we relied with rain and by then kwainaya.

Q: There was no climate change

A: ehe

Q: How about pest control and diseases control

A: Natural remedies like…

Smart yakazouya nevarungu

Q: How about when they crops are now harvested, how were they harvesting?

A: Harvesting was done by hand, and generally all crops were grown specifically for feding the family.

Selling was done once a year through batter trade, ane nzungu dzakawanda tochinjana

Crops were done for food purposes

Harvesting was done by hand harvesting starting from the point when we are cutting where we cut our rapoko head usung sharp objects and tonoisawo pathreshing dwala kumaareas aya ane dwala… kunanaNgezi monoisa pathreshing duala

There was a certain time where we tested moisture, hameno yaitestiwa sei.

The crop was threshed toisa mudura kumunda ikoko uko then we usually control the grain using wood ash

Harvesting tinenge tapedza

Mukukura kwangu tainzi you can keep rapoko or sorghum for more than 10 years

Q: What were the type of trees used for wood ash?

A: Mutsviri wewhite unoburitsa very white ash kudarika paint yewhite

Even mopani

Q: Which one of the Indigenous farming practices existed on animal husbandry?

A: There was Indigenous road runner bird, we also had some of the Indigenous pigs, Indigenous Mashona cattle and the Indigenous goat

Q: I heard one domain in Zvimba and knows all of them by mabreeds acho

A: Angora goat

Q: Of these farming practices, still on animals, they were attacked by some diseases or parasites, how did you manage these?

A: I remember of black leg. I don't know how the concept worked but we would find kuti after animals suffer from black leg pobhoiliswa mvura yodigwa pagumbo painongodaiso yatoita then we had ruredzo for dystocia problems or retained after birth then we also had inonzi… handichazivi inonzii nechiShona… iwo muti wacho unongorembuka rembuka seruredzo

Then pests like vana nhata…repellent spray yekuti vanosasa sasa muchirugu

Q: Repellent herbicides

A: Then aloe vera

And wounds

Wounds, ah handichazivi mashizha acho ekukacha kacha, unosvinira mashizha egreen paronda pacho

Q: I know it, yesterday one of the parents showed me the tree wekuti kana yarumwa nenyoka ndinoshandisa like this and this

And of these that they were practicing, it appears we have not touched on preservation of animals, how were they doing it?

A: For example beef or pork we could preserve it through sun drying, salt and toita midzonga yedu.

Q: All of those that maybe we have mentioned, which ones, are there any you can say are still being practiced today

A: It all depends with the availability of resources, in some areas they are still practising that control measure for black leg but most people nowadays are going for vaccines

They don't have financial resources

They are still there

Q: They are still being practiced

Generally you are saying most of them are still being practices

A: Yes most of them

And maybe it could be to the fact that maybe people especially those...

Q: What is your comment on the view that the Zimbabwe secondary school agriculture syllabi or curriculum is dominated by Western farming practices?

A: Definitely it is dominated by Western farming practices but we are saying that it doesn't put into consideration the child or children which are coming from different backgrounds.

Mind you we are saying that within a school situation we have different pupils coming from different backgrounds.

We are saying that those coming from poor background are not catered for. At home you would find that at times he or she would tell that this is how we control black leg at home. And we will be telling you that we use we use black leg simple control and that is what is there in our text books.

Q: My father uses mufufu. That is one student told me. Mufufu to control red water.

A: By the end of the day as a teacher you are going to tell that child its wrong

Q: So it's unfair

A: It's wrong but we are using it

At home it's working. Kumba tinozvishandisa. They are having positive results from that

Q: Kumba we get for sweet potatoes we dig a hole, we put dota and we store our sweet potato for weeks, tozodya zvedu. Now you want to store the meat in the fridge

A: What is a fridge by the way since curriculum doesn't cater for pupils coming from poor backgrounds.

Q: It caters for those who have a Western orientation, or the elite class

Now you have been teaching for quite a long time and we are not saying we don't have any African methods or ways of farming or cultural practices, Indigenous agricultural practices. Are there any, which ones would you say exist in the curriculum? Is it purely when we say its dominated maybe we are not saying, its wholly Western there could be certain things?

A: You see what happens with curriculum is that, even if we have some of the concepts, our traditional Indigenous farming practices for example we may talk of the concept of conserving moisture through mulching. Nowadays they are no longer talking about mulching but conservation, they are coming from a different angle but the truth is we have let the crop remains on the land and these crop remains are acting as mulching to conserve moisture. And they are…lets go for conservation mulching, it seems as a new concept

Saka it was…but nowadays conservation what. It's not a new concept anymore

Q: Any other concepts that we find

A: We also have mixed cropping. But there is mixed cropping practice has been modified

Q: How about anything to do with pests, diseases, parasites control that is purely from…in the syllabus

A: We have cultural methods of controlling pests. There are there in the syllabus ad this is…from the…in the controlling of

Q: You slaughter broilers

A: Yes

Q: Do you slaughter them the traditional African way?

A: They are delicate

Q: I would like them to be slaughtered the African way

A: They are delicate

Motongotsika mawings

Q: Is there anything like vana land tenure, communal…free range?

A: Housing systems there are very

There are no longer there

We just mention them in passing

Q: And thus they live it, experience it. That what they live at home is now removed from the syllabus

A: The free range housing is no longer there…

Okay, how about grazing

We talk about grazing on the land tenure systems, where we talk of communal farmers grazing area, natural grazing

Q: Which maybe of these farming systems from the crop production…would you think should be included in the curriculum?

A: Right mixed cropping and fallowing

Q: Pests and diseases control

A: Natural remedies of killing pests and diseases

Q: What else

The storage maybe, we store our products

A: Storage and processing of food

Q: Storage tend to be more Western and we want to teach something that…

And what could be the benefits of including these in the curriculum

A: Like saying the use of chemicals normally…on our health and then we go for natural remedies like what is happening nowadays chihuta chihuta is something natural therefore we have discovered that these Western food, Western farming practices and were health hazards where we are saying for us to stay healthy we need to natural remedies they are not poisonous and zvihuta are not there in the syllabus. Saka chero ukachengeta even if you want to keep them how are you going to marry those zvihuta with theory work. Zvihuta are not in syllabus

Q: They are just proposing that is what I am saying which ones do you want to be included like the production of zviuta. I heard some saying the production of our own Indigenous chickens, handiti kuneprograme yema Indigenous chickens

A: Indigenous goods

Q: Any other benefits or advantages of having these Indigenous…besides

A: They are cheaper in terms of production costs and they are locally available

Q: Now what challenges may schools face in trying to integrate the Indigenous farming practices into the current school curriculum?

A: I think maybe the greater challenge may come from attitude so maybe our pupil were colonised towards getting 100% product and then they use minimum products means you're not business minded

Q: So you are saying maybe for those who have got commercial agriculture orientation into…the majority of the people would be saying they will be advantaged

A: They will be

Q: Okay

How do you think will then go about this process of trying to or including integrating

A: We are saying we should not forget the commercial practices

We should meet half way. Maybe we can use both for example in crop production we are using both the use of manure and fertilizers we are just meeting cost challenges with fertilizers

Q: Okay, so we refuse

A: Yes we refuse

And this is going to cut down on costs

Q: What else

A: Maybe also awareness and education can also assist

Q: Yes

The new curriculum

A: Maybe something would open

Q: So you are saying in our discussion maybe we could have left out some of the things maybe you want to talk about

A: I think I have done justice to this discussion

Q: I think we can end here unless you still have something to add

A: You are welcome.

TRANSCRIPTION 11

A we can start our interview if I can have the paper I am Pedzisai lecturer at Chinhoyi University of Technology in Curriculum and instruction and also a PhD student with UNISA pursuing a curriculum topic Prospects and opportunities for the inclusion of Indigenous agricultural knowledge systems in Zimbabwe secondary school curriculum in my studies I am trying to look at Indigenous curriculum at Indigenous curriculum knowledge's that are in the community and also those that are in the school syllabus and then try to find the gap and find out whether those that are not yet included in the school curriculum can also find their way into the curriculum So my first question to ask you deputy director is What before we had our own agricultural knowledge we were farmers as Africans before the coming of the white man What Indigenous farming practices existed from your own knowledge in Zimbabwe before the colonization

B Thank you very much M r Pedzisai there were many practices Indigenous agricultural practices that our communities used to improve or increase their agricultural production different systems they used maybe I will start with field crop production

A Food crop preparation

B you find that they would open up land maybe land that has been left fallow for some time a long period they just open up either using a hoe opening up or planting hoes then they clear at times they used to have a hot burn if it grass just have a hot burn then start digging planting holes then put their seeds in but you would find out that the types of food were mixed crop you have your grains you have your vegetables you also have you sugabeans your beans in legumulus crops all those practices were meant to actually safe guard them from loss in terms of food security. from one piece of land you find that their maximum production of different crops that will be providing food security to the family so there will be maize there will be ……again you would find that there was a lot of mulching that took place with the loss of leaves when the crop is maturing mulching would help maintain and protect the loss of moisture from the soil which kept the crop growing and kept the well shaded the roots well shaded and protected it increased development of underground what do you call them some beneficial worms that develop underneath they also help in the aeration of the soil so there are a lot of then if we go to the livestock you will find again that our communities used to keep range of stock from the largest stock the cattle to the smaller stock the goat the sheep and the poultry the Indigenous poultry they had ducks were kept at the farm so you find their maturity differed again from time to time and helped protect the community in terms of food security the other animals were used as draughter animals …animals to provide the meat for larger gatherings the smaller stocks were again providing ready meat for smaller communities there's quite a range you would find again these animals get sick used to get some herbs from the bush they would use particular type of herbs trees which need to continue to protect that were used either to treat the animal that would have wounded or a particular diseases or skin diseases

A we will have more detail about that maybe for now we could maybe look at which crops do they grow

B they used to grow the mhungas the rapokos madhumbes mbambaira the tubers they also grows the pumpkins vegetables the cowpeas the leguminous vegetables some of them were grown on their own in the vallies the marange type of vegetables which they were just going to collect there and eat they were protecting the….because they grew the….which they were going to harvest

A any varieties that you know of mhungas small grains

B the mhungas used to there is the what they called the …tail which got long speared that protected against attacks from birds a lot of…the other ones were the short ones the other ones were the tall varieties that some were red some were white it was quite a mixed variety the red ones were used to brew bear white ones for making the food making a relish making food like sadza and making some mainly for porridge and the leguminous crops were mainly the cowpeas which were either …some of them were bush types some were the inteminatile…..that continues to grow that spread along the piece of land those were the types of crops that I can remember

A so you are talking about the small grain crops

B rapoko mhunga the millet and the sorghum varieties they had all those varieties either those that matured early some that mature and especially when there is a long days…more long spare of moisture all those varieties all they spread them according to time and they knew when the prospects of drought they new the types of crops…when the is prospects of very good long season they knew the types of crops to grow

A so they had varieties like chizhara wanya mukadziusabva

B yes they have them ana mukadzi usabva the short term varieties they mature early in two months

A what were the advantages mainly of growing these especially smalls grain crops

B the small grains had advantages 1 they were not easily attacked by pests and they make sure there food security in the family and they were not demand for higher fertilizations of the seeds those could sustain on their own with the natural fertility of the soil so they were a lot of advantages

A how were they selecting the seed for planting

B their selection criteria they used to pick most of the big heads of the seeds they select natural selection they would pick those that perform very well and then dry them under the small…try to protect them against ….and protect them against other pests those are stored and placed where there will be secure for the next season that's the selection they used and their process continued from time to time they were selecting those that they see as high performers every season

A Now you have a daughter getting married you would give some crops

B yeah if you have a daughter getting married there is also the crops that come from one family to the other and those daughters will also protect the legacy and continue to grow according to what they got for their parents so the tradition continued from family to family it was handed over so that tradition continued and the education was maintained

A Okay How about the planting systems that they used for the crops we touched about mixed cropping

B some of them it depends they just the spread using a basket spread across the breath of the land casting and casting the seed , seed drilling. Normally had to prepare the land and mark the planting lines….cover using a brush those were the other systems or using a handle hoe just to. There was a lot of shifting cultivation during that time were land was plenty …limiting factor would leave the land to rejuvenate then go to the next fertile land with the lot of compost manure all those things and they would just repair that

A how were they managing the fertility of the soil

B Yeah fertility they would use the like….the crop residue was used to make up compost and the compost will be turned back into the land and also mix the compost with cattle dung livestock manure that is the manures dried was prepared and left to dry for at least two weeks or so that it burns all the unnecessary weed seeds that will be inside when the manure is mature it is taken to the fields for applying to the land and it is turned over and that land prepared land will be well fertilized

A so it was more for organic

B mostly organic farming systems were used there was very little of chemical that was brought in it was mostly organic type

A Were the crop pest

B the crop pest was using also Indigenous types of weeds like the blackjack and the ….some other weeds which were identified which were very effective even…very effective to protect crops against pests' gestation they are also things like

A so they were

B yeah some kind of repellents were used to apply in the crops which were found locally from their vicinities so they had no problems with issues the plants that were protected with the were very beneficial when it comes to plant protection

A So you mean they were a lot of pests of crops so they …control were limited

B they were limited because they knew how to protect them they had Indigenous ways to protect them like I mentioned that mixed cropping helped…other pests from attacking other crops and also to improve soil fertility that was the issue and it ensured food security

A so you're saying they had repellents and mixed cropping as a measure to control pests and were also some herbs

B yes herbal verbal vegetables which were used to repel pests and also to control some diseases

A can you give an example of herbal vegetable that were used to repel

B the blackjack it is a very good very good vegetable and it is also a repellent to repel some pests about control of diseases there was a plant called muvengahonye

A I am talking about crops

B about crops very few diseases were found during those days but some were using what we call….dota they just spread it ashes to their plants it could clear things like rusty I don't know how they get to know the chemical composition in the ashes they could burn ashes of a particular tree and used them to spray in the vegetables and in the plants and they get rid of moulid copper of rust something we could

A any weed control measures

B yeah mostly uprooting hoes it was manual

A use of the hoes use of……how were they harvesting their crops

B harvesting is just cutting using a cutting then drying the crop and then thresh depends on which type of crop thresh it and then grade it using the …..hoe …selecting the proper grains which they want so mostly most crops were prepared using the sun…and then no major chemicals were used mostly it was hand hoes

A for harvesting first method…then let's look at crops the small grains for instance how they were stored after harvesting

B after harvesting they were these Indigenous granaries where they will construct using earth manure or stone and earth which were airtight granaries which were airtight that would not allow entry of pests that would not allow any other entry of other that will allow any pests to survive inside they would put their grains inside there and mix with some ash and then store and close with the some soil that is mixed with cattle dung because cattle dung was also a repellent for some pests and the ash was also a repellent weevils so they would mix with that

A any particular ash from particular trees

B I think so there was p……they maybe in a position to know the actual name but I know of the kuvengahonye type of tree and the mutsviri type used to make ash the repellents to pests those can be identified they're quite a number of…were used

A on the processing of

B grains were cooked and eaten that way and some of them were used to cook rice mealie rice some of them will be used to make to brew beer mbwire mbwire you mix the mealie meal with a bit of salt you eat and have water

A How about nzungu

B the ground nuts used to make a lot of things peanut butter dry them boil them dry them put some salt and eat them straight mukangirwa

A the salted ground nuts mukangirwa or zvihwatara

B just make them peanut butter eat them straight like that and boil them other makes them some maize grains make very good meal out of that

A you talked about mbambaira how were they stored

B the same the mbambairas some of them were just stored you would just dig a pit put them underground cover them with some soil so wherever you want them you just go and open up the pit and bring out the tubers then prepare them for a meal boil them put some salt and then dish them out to family members and they are ok

A our ancestors had special way of process of growing their crops ……chibage chepachuru we talk of nhivi doro

B nhivi we had particular crops that were grown on under clay areas those water loving crops then the crops that required fertile soil could be grown on the…..your bigger grains the maize the rapokos the sorghum and the ….would grow your vegetables the tsungas the pumpkins the cowpeas all those were grown on the…area where there is….to provide red vegetables there were quite aware of. They would survive the long season grow the varieties grown under…area

A now which animals do they keep

B quite a lot chickens the guinea fowls all mixed…also kept things like they had donkeys were also used to drought where they require to pull require a lot of energy donkeys

A do you remember any breads of cattle

B yeah they were the mashona ones had the tuli had the ngoni had the Afrikander one were the bigger animal those ones

A how about goats any breeds or sheep

B they had mashona the blackhead but those mostly were the not the wooly type mostly those ones were mostly Indigenous that could withstand the heat here ….

A any special breeds for chicken

B those ones there is some of those musvuu bare-naked breeds very fertile and then the other ones the short ones very short ones short breeds zvi india those indian type breed red the red…………..

A just like the crops we talked about how they were selecting the crops the varieties for…now we could also talking about breed and breed selection for animals how were they doing it

B they either selecting for originality either the breed maintained a particular color maintained was of high production and could produce lot of milk produce more young kids so there was a selection was resistant to attack by diseases and all those things so they was quite a variety of selection that was used

A so it was based on desirable traits you say this chicken is a very egg producer higher layer producer its offspring should continue the same with the cattle maybe

B high producer of milk meat and all those nekudhonza quickly mature early and provide required meat and milk to the farmer

A so in animals they mind about the size in the breed did the body size of the animal or they could just choose any

B obviously the size of the animal matters maintain the size of the animal when you know the requirements of food requirements

A the animals the grazing

B grazing was readily available there was a lot of shifting grazing they could move from………..they would maintain

A the so called nomadic pasture

B had particular area where they graze at a particular time per year they just move from one place to the other

A do their animals have problems with diseases and

B not really diseases would happen because these people were moving and change their…very little track from

A I understand cattle could be attacked have problems with…wounds maybe some diahorea

B they were using some Indigenous types of herbs trees tree leaves and some other products like aloe they could use aloe to treat the…..use some tree leaves just….mix with water then treat all the different method of by our traditional….

A how were they what products do we get let's say from cattle

B quite a number cattle mats your mats you have milk meat you got your mates your skins were used to make drums make blankets to make their shoes to make hats all those quite q variety of things the bones were used to make knives make knives out of the bones prepare spears from the bones for hunting all those quite a number the manure from the cattle was also used as fertilizer

A how about goats

B goats were used as meat skins as mates blankets all those things also manure was used to apply as fertilizer to the fields and at times as food for fish farming

A if you've the meat from the cattle from the goat sheep understand it could also be processing drying

B they could be dries as dried meat for future use because …they could eat it fresh or dry it and store it for future use cattle and goats were also used in marriages to pay as bride price lobola so the very useful animals all to use special

A you could also get oil

B yes ruomba from the fat from the milk oil which was used to protect their skins

A now how what could be the your take on the fact that some of these Indigenous farming practices still continue to be practiced today

B I think that's the way to go we need to go back to basics because currently if we are to maintain the Indigenous crops and then treat, value I think we should continue to maintain value the traditional Indigenous, farming systems because it has its own advantages in terms of pollution they are ……chemical application they have nutritive value that is very good …..human body and the taste of those crops is so natural and good unlike crops that have been fertilized they have helped environment in terms of provide the nutritive value required by the human body I think we need to encourage that the traditional way of growing crops

A even the animals

B the same with our animals they have been a lot of cross breeding but if we could maintain the Indigenous breeds and study their trends and maintain those select from the resistant disease resistant and Indigenous breeds and continue to maintain them would see there is an assured food security and assured income for the families if we keep those Indigenous breeds

A what is your comment on the view that the agriculture curriculum in Zimbabwe for tertiary institution Gwebi…..is dominated by Western farming practices what's your take

B yeah the those practices we are now slowly moving away from them because it's a system that was….into our students because that came from the Western and European ideas on the farming methods but revelations that are coming from our Indigenous knowledge systems we are finding that we need to go back to basics where incorporate the Indigenous farming practices where we practiced mixed cropping or practiced ….and were practiced crop selection seed selection and storage systems that had very little pollutants the same with our animal production we need to maintain and get value out of the old practices move away from the current commercialized Western knowledge farming system

A curriculum of tertiary systems for instance do we still have Indigenous practices that are existing in the curriculum in the syllabus in the courses in tertiary institution that are Indigenous

B very little but I think that's the way we are going we are encouraging now that we now to encourage Indigenous knowledge system like composting minimum tillage which is now called conservation agriculture that's what they are now saying smart agriculture its actually going back to basics lets go back to basics where we do mulching mixed cropping selection of drought tolerant selection of animals that can sustain. Be sustainably kept using the available resources breeds that would require a lot of care a lot of feeding that would require a lot of disease protection that would require lot of vaccinations we want to maintain breeds that can survive in their own environment

A how we can go about including or incorporating some of those Indigenous farming practices you indicated are good and are not in the curriculum

B we continue to do research localized research capture information from the current communities our local communities we capture that we do experimentation and demonstrations' at the colleges and sharing with the local communities that we do comparative analysis of the difference systems and see which is the best system that could be maintained that will be able to then,…..include the Indigenous knowledge systems in the curriculum for our tertiary institutions

A I think you talked a lot on the benefits of including them in the curriculum we resolved that but as we try maybe to include them to incorporate them into the curriculum which at present seems to be dominated by Western farming practices what challenges do you think ….tertiary institution and agricultural collages could face in trying to infuse Indigenous agricultural knowledge into the curriculum

B there is this belief that catch them young we can start from the primary level that we introduced a system in the primary level…develop and when they go the tertiary level they would have developed appreciated

A I also understand that agriculture in the primary school is compulsory in the secondary is compulsory and heritage studies is also compulsory maybe that catching them young you are talking about

B will suffice because already we are moving in that direction we know the nziramasanga commission has also recommended that we will go back to basics where our students are inculcated with hands on knowledge things that are practical not only theoretical byt practical means that incorporate the Indigenous knowledge

A leaving experience

B yes

A …say about this idea of trying to include infuse to incorporate Indigenous agricultural knowledge into Zimbabwe's curriculum maybe some will…be left out

B not much but we …more, in terms of tolls to areas centers that practiced Indigenous practices so that students are by seeing the productive sectors in action they will be able to also develop and interest and when it is taught at college grade school they will have an idea of what is being talked about and they will be able to carry out some demonstrations

A it was nice to interview you I gained a lot of incites problems that ..trying to solve if I want to think of coming to reinter view you I will still come even phone thank you very much for giving me your time to interview you I know you're a very busy man director thank you very much

<u>TRANSCRIPTION 12</u>

A I think we can start I don't need to reintroduce myself my study is on the prospects and opportunities for incorporating some of the Indigenous agricultural knowledge practices the local farming knowledge the Indigenous African way of farming into the Zimbabwe secondary school maybe my first question would be before colonization before the coming of the white man we had our own methods African methods of farming in terms of crop production in terms of animal production and then my question is like if we look at crop production what crops did they grow

B in that era they had those drought resistant small grains like rapoko mhunga and things like rapoko nyemba cowpeas and those were the main for protein they had cowpeas and pumpkin a bit of protein vegetables and other wild plants were collected

A now these crops how were they selecting the seed for

B its interesting their selection process was based on the size they would actually move around in the field check ok those crops which were big enough collect these when they were ripe they would make sure that they don't have any pathogenic defect or diseases effects and collect these and store them either in the eves of their homes of their huts not homes so that it there are treated through smoking against weevils

A so it was mainly looking at the size

B of course the type and its yield

A some of those good qualities okay

B yes were considered

A how did they prepare the crops for fields for planting?

B they didn't have tractors like we have nowadays they would use hoes it was actually like zero tillage they will only dig holes where they would planting holes…seed and they would mostly they would broadcast their seeds and these….areas or they would drive cattle first through the small field small patch then broadcast their seed then drive cattle again back to make sure that the seed is covered

A what was the advantage of growing those small grain crops

B they have got so many attributes drought resistant they were actually very easy to store and the only available before the coming in of high breeds crops like maize and …

A what you talked about broadcasting the seed or the patch hoeing or sero tillage how about crops like mbambaira they were also grown

B yeah mbambaira at later stage...On the turn of the 19th century they were actually growing these on mounts….they would actually dig mounts plant the….along the mounts either using like. Small amount of ridges in any shape they would grow

A okay planting systems generally

B for the like for mbambaira or

A all of our Indigenous crops

B usually they would the systems what do you mean

A I am not very clear I am talking about things like mixed cropping shifting cultivation

B they had present day we are calling it….culture actually mixed farming you would have your maize your rapoko mixed with a little bit of sweet sorghum then you have mhunga on its own as it was mixed cropping

A what were the advantages of mixed cropping

B right in case there was a drought there were some crops which would obviously succumb to…of whether they would remain with at least one or two crops like for example rapoko would actually survive so they would have food while food security most it was a lot of people who were actually farming in the mountainous areas so once they have harvested they would store that in caves to ensure that future seasons will be having food

A how were they managing the fertility of the soil

B right they were actually doing what we can call the shifting agriculture they would ensure that after planting leave an area for a year or two they move on onto the next patch they would use a humus from you know surrounding area also they would earn after cutting up…new area cutting down trees those the ash will provide…which is a..fertility of the next season so that is how and were manure they would use a bit of manure although they were having cattle ….all over free ranch that they would get humus and some …soil

A now when their crops are growing in the management of the crops was there any pest control

B there was they used to use number of plants to control let's say if they have some aphids so whatever some of these crops they would use for example blackjack would use as a repellent would actually…spray or they would use other plants as repellents against some pests like flies like

A they have lot problems with pests' crop pests

B the notable problems pests notable pests used to be experienced were locusts the army worm was it camo later on locusts and rodents these were main pests baboons monkeys but they would actually go around their areas scare baboons and monkeys rodents they would actually trap them in order to wild animals they would actually build fire around their fields keep a lot of stocks to scare animals of cause hunt them down

A how about diseased crop

B diseases control I think the method of shifting cultivation was actually helping out the control of diseases because if they were to be diseases in one season obviously the next season they will be growing the crops anywhere so they will be no disease problem unless of cause it's the seed but during that time there was a lot of movement of grains from one country to another it was within the small provinces or small area

A I think the do they also have problems ……how were they managing tem

B weeds they were actually weeding hand pulling but in most cases you find …burnt area the weed seed would have been destroyed by the fire so weeds were not much of the

A harvesting the crops let's start with the small grains the cereals

B they had they didn't have combine harvesters in case one had large area planted crops they would actually invite members through a system it was well coordinated system called nhimbe cooperative and one would do some traditional beer have some food ask people to come and work harvesting and harvesting these and put them in safe places like….and a make sure that it dries out …as a group store this these they are some clay pots then also …as curved like….actually have some binlike mortars to store the grain some were made of reeds

A so we have already talked about storage cereals and then how about sweet potatoes

B sweet potatoes they within their residential they would dig a big hole in that hole they would put either grass dried grass then put their sweet potatoes in their get some ash sprinkle it in ash or sand depending on ….you cover it with soil then leave it for some time now underneath the potatoes will be actually …so that the levels would go high they would that in certain times of the year especially later parts of the winter before the rain season actually they would be enjoying the sweet potatoes and when the rains are starting they would be using part of these stored sweet potatoes as food while they are waiting for

A what were the products of the cereal the….

B yes they would actually pound it or grind it using stone and have their maheu have sadza they would also have porridge and beer

A would they cook them or just boil

B sweet potatoes would boil or they would roast or they would dry it then they pound it then prepare it into some porridge

A how about anything else about some of the food stuffs that you remember the types of food that come from cereals

B I think crop like mhunga example ….these were really the most important …grains which they would value….those they could keep it over a period of time and to them if one had several maybe you know types of these would keep for future seasons to help other families unfortunate and they would also use this for marriage purposes find somebody would have a number of wives will give the grains it was part of food security …some of the extra food to other people so that these people who have been given this donation would retain when they have harvest that was harvest as a form of food security while these several times you actually posts other food who in turn give back when they harvested enough maintain food security

A now we can turn to animals the breeds

B right other animals would maybe I will start with the cattle we had our own hard mashona type depending on the area they would have the Indigenous breeds in the area the very interesting thing they would actually cross breed their animals example in a village would have one selected bull which was used to service the local ….when this bull is old a replacement would be look for outside the village in order to avoid so the conscious of…..breeding we want a bull coming from a certain area to upgrade the herd which means there is no the required….goats would do the same and chicken they would also get to their formal barter trading they would actually this coming…from other areas to…that…local….cross breeding …………………………….

A what about breeds mashona then other cattle breeds nguni tuli

B depends on the region

A how about goats any breeds

B goats yes we had really the breeds maybe were really due to lack of …whatever they were having they would select from the herd select those big enough those resistant to diseases using exotic breeds but these were coming mostly came from east Africa east African breeds and when of cause

A they were using breeds are African from other African countries within the same region locality you could get what were how about chicken

B chicken they were also using local breeds but when they could ….and so on

A I am talking about before the Portuguese

B they were using their own breeds

A can you name some of the breeds…

B I can't remember of any but these were usually very you know big in size and resisted to lot of diseases they were

A how about breeds that look like guinea fowl chickens

B No feathers in the neck those that were coming in as they were trading that's when you would usually colours were black brownish reddish those others maybe were a result of genetic …what do we call it they were usually coming as what we call surprises

A okay many genetic mutation

B maybe I didn't want to call it mutation but changes brought about by herbs where weather patterns

A okay now is the…kept animals generally most of them were grazers we look at the goats the sheep the donkeys the cattle what was the grazing system like

B it was you know open they didn't have any…it was communal wherever there was particular grass and no predators so they would actually it was like…move from one area to the other without really…certain areas they would

A nomadic pastoralism

B yes areas where there was plenty of water

A how about…for the animals

B there are quite a number …you would have an area where there is a lot of leguminous plants there will be certain types of like clover….plant they would actually encourage their cattle to go there they will obviously before and also…cattle a lot of that…in times of drought

A which parasites and how were they controlling them

B ticks they would use trees like for example they would use aloe different types of alloys to actually they would prepare some spray on the …make sure that look for other plants for example several depending now on the areas some areas they have different types of trees which they would use to try and

A you remember saying like this one

B they would call want to put in shona

A no problem

B muvenga honye the traditional once would actually use that also they had I had forgotten one point they could also control things like ticks through burning of the area..The main one if there is any occurrence of that

A hand picking

B yeah if there is no any practices they would also rely on natural settings like birds …actually pick and the experience they would actually use their hand to handpick and then treat using different types of herbs like for example ….they would also use pepper those wounds the plants for treating of the wounds and they are quite a number some of these

A eye problems

B eye problems they could use matamba for example and in some areas you would find they would use different plants in areas like matebeleland masvingo Mashonaland and part of manicaland they would use matamba to treat eye sight or they would use some plants like ….they would use that to treat called…….that to treat animals against eye problems and the other one is a very interesting plant it's in the it's like it's in the….tomato THEY ACTUALLY EXTRACT leaves and pound it they …it and then the soup …and treat their animals against next problems

A any diseases you touched a bit on do they suffer from

B not a lot of diseases of cause in that time when we have a lot of animal movement from one areas like rinderpest…..also like rain season would have foot and mouth like being passed from wild animals so they used to have their own ways of to treat them or moving cattle to higher ground and giving them some herbal treatment

A is it true that some of the diseases were parasite of both animals and crops came with colonialists

B yeah when we had movement of cattle especially exotic breeds coming in so the later part the first part of the…when we had a lot of movement of cattle coming from all over we had different breeds with different diseases and pests were coming when they blended with our own local conditions and quality that developed certain resistance…later on tend to destroy own …

A the products their processing and the products

B products like meat they would slaughter cattle ….they would dry it sundry it or they would boil it first then dry it

A on the sun

B yes or they would actually dry it on fire depending on where the. But if they were say in an area where they were you know few trees they would actually sundry it of if it's during the…sun dry and or they would use pepper and salt that is for meat then for milk they would Chan..it into some butter there way of preparing butter and store their milk in pots so it becomes sour and they would either eat it sour or fresh and their butter

A we have looked at most of the practices that are Indigenous are there any of these practices that you feel or what is your opinion …some of these practices of crop production animal production still contribute to be practices

B in some areas people are still using traditional methods I for one would go I prefer to have people maintain traditional kind of production if its crop production because they are not using some people are actually against using fertilizers and using a lot chemical and I for one using natural instead of no many involved and I am not bringing in complications in terms of food poisoning some of the chemicals which are used they actually may…their residual effect will not completely…into the within an animal so natural control systems help because you ….whatever you have treated soon after if they are vegetables you can spray pepper spray organic

A basically…sustainable what is your comment on the view that the Zimbabwe agriculture curriculum for tertiary institutions for your institutions for agricultural collages for universities that the curriculum are dominated by Western farming practices

B yeah actually that has been a worrisome kind of thing that we have adopted Western type of agriculture at the expense of our own now we have realized that and we have tried to incorporate permaculture and Indigenous practices so that our students are in the ….of the traditional systems because they also work equally well only that perhaps we need a bit of research into the…

A so research is needed

B yes research is needed

A now I don't know when you is there anything Indigenous in terms of crop production in terms of animal production in the curriculum agriculture curriculum like yours in tertiary education

B yeah I can speak of one because we actually have an area which we have indicated like ….and here we encourage our students to try and use Indigenous tillage systems when they are controlling pests and their research so we can actually go out there on some experiments research experiments these students are carrying out where they are controlling pests using Indigenous knowledge system so we have actually taken it upon ourselves that we need to reintroduce this although it maybe slowly being taken in school but we want our students to be aware of that at the same time we encourage the growing of crops using the minimal amounts of fertilizers because we are trying use a lot of organic matter while we have compost here we also use tobacco trash for example tobacco companies are actually bringing tobacco trash here if we are using these manure at the same time we use that tobacco we put it in water and then ..That residual water use that for spraying that is actually a case

A so you feel they should be included we should include more

B that should be a must when they go out of schools or in the villages people don't have money and its expensive if they can use the local plants within the vicinity it will go a long way in helping our to avoid even these cancerous diseases which are…because they will be using quite credible chemicals

A is the curriculum at present saying of the secondary schools we look at the o level syllabus the a level syllabus would you say is dominated by Indigenous farming practices

B well they are having a bit of chemistry in there I would want to see a lot of real Indigenous knowledge system being included in a bigger way those are we had having a lot of pharmacists using…..to control diseases and so on so if it can be not smuggled in curded into the syllabus

A You talked about we talked about the fact that the Indigenous methods themselves are sustainable and they are local in terms of sustainable in terms of temperature in terms of climate food in terms of money but….those what could be the other benefits of including them in the curriculum

B well first and far most…the rural setup before and they can there is only …from other regions they can be found within and they're easily identifiable by the local authority a…some of the…and they cause the cheap….and they are information is easily transferrable from one generation to the other within the local centres of cause disadvantages is that we don't have enough research

A so that was going to be my next question how can we go about including them in the curriculum which we have agreed is dominated by Western practices you have already talked about research

B what I would want to say I would want a lot of research happening perhaps ….research within the locality following the Chinese kind of approach or indian kind of approach that will…those local plants would be researched on see the ….within the plants which will be of benefit to…any information can be transferrable to other…when we know what is …plant

A what about you said we are trying to I know the current minister of education Dr Lazarus Dokora trying to infuse a lot of culture…knowledge heritage studies agriculture everyone from grade zero to o level are what challenges now do you think schools may face in trying to infuse agricultural Indigenous knowledge systems into the curriculum

B there are positives and negatives the way the minister is trying to have these……causes…being done horribly what I would want to see is development of the agricultural Indigenous systems within the schools at an early stage that to me will ensure that future research will actually be relevant to our systems because we have got the plants here and the future generation is schooled into accepting the local knowledge systems it will be better for the improvement of pharmacological…the

A so in the approach

B the approach is different I don't agree with the approach I want a gradual kind of approach

A do some pilot school do some research and the likes

B yes I am a product of the system where we were doing agriculture from primary school but the curriculum was not overloaded there's need to actually have students or pupils having ten subjects or whatever we used to have basic sciences of cause the other social support subjects included so that we don't overload the small

A so you are saying this policy of compulsory agriculture up to o level and the heritage studies component in schools you're saying if properly done may yield positive results

B but my approach would have been that in every subject there is some kind of heritage

A it should be there you mainly infusing heritage into every subject not having heritage studies as a

B yes it should be spread across because for example in agriculture there has been agriculture for as long as many…starting from the pioneers in the garden of Eden…so if we were to …our pupils from …to respect plants at an early age that's heritage to me part of the heritage so when they grow up they would actually be in the now to separate to make to put these separate entity to me it's really not fair for the subject

A is there anything else that you may want to say about the inclusion of traditional farming practices in the curriculum at O level

B I would really want to see our politicians and again speaking in terms of the developing like ….i would take for example trees we are having a lot of Indigenous trees some imported exotic trees sorry some imported from Australia like the eucalyptus which is destroying our wet lands I would like traditional trees Indigenous trees being advocated for growing in those wetlands so that we remain with our wetlands rather planting eucalyptus which drain up all the eucalyptus tree can drain as much as one hundred more than hundred litres of water per given area when its grown up that's to me is dangerous when we don't have enough water storage facilities our Indigenous trees actually can help to save these wetlands they will have water that's I would expect our own people to be also be encouraged to go back to traditional crops like rapoko mhunga and so on for food security and keeping Indigenous breeds which have got less diseases

A thank you very much Sir for the interview which I think was very fruitful I will try incorporate some of the ideas into my study thank you very much

UNISA college of education

APPENDIX E – OBSERVATION SCHEDULES

OBSERVATION GUIDE OF AGRICULTURE IAKS OPERATIONS

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

OPERATION	**COMMENTS**
Field crop preparation	
Crops grown	
Seed selection	
Planting systems	
Soil fertility management	

Crop pest control

Crop disease control

Crop weed control

Crop harvesting

Post-harvest storage

Post harvest processing

Other crop production practices

Animal grazing systems

Breeding and breed selection

Fodder species

Animal disease control

Animal parasite control

Harvesting of animal products

Processing of animal products

Storage of animal products

Other animal production

practices

APPENDIX F – DOCUMENT ANALYSIS GUIDE

DOCUMENT ANALYSIS GUIDE FOR THE ZIMBABWE IAKS POLICY AND AGRICULTURE SYLLABI

Research Topic: *An analysis of Indigenous agricultural knowledge systems in Zimbabwe's secondary school agriculture curriculum: prospects and opportunities*

NAME OF SYLLABUS DOCUMENT: …….…………………………………………….

ANALYSIS ISSUE	**OBSERVATION**
Syllabus objectives on IAKS	
Presence of IAKS in document	
Topic coverage	
Emphasis	
Implementation/ Strategy	
Other (specify)	
Strengths	

Weaknesses

Observed gap
