

**First Draft, June 2014**

**Report on Assessment of Level of Integration of Modern Biotechnology and Biosafety in Programmes and Practices in Institutions of Higher Education and Training in Swaziland**

**MESA Implementation Committee**

**UNIVERSITY OF SWAZILAND**

 

**ACKNOWLEDGEMENTS**

The Team of MESA audit team would like acknowledge the assistance provided by the leaders and respondents of the nine institutions that participated in the study. Members of the MESA Implementation Committee are also acknowledged for the guidance and support they accorded the audit team. The MESA audit team also acknowledges Dr Mucha Togo whose report on the audit of environment and sustainability of UNISWA programmes and processes provided the theoretical framework and informed the methodology for this study. Mr Bheki Thusi is also acknowledged for his creativity in formatting and editorial work of the draft report. Last but not least, the audit pays a special tribute to leaders and project coordinators at SEA and UNISWA for their patience as implementation of this activity overran its planned implementation timeline. It must be mentioned that funding for undertaking the audit was provided by the SEA-UNISWA MoA signed in June 30, 2014. The MoA formalized the SEA-UNISWA collaboration which is part of the larger UNEP-GEF capacity building for implementation of the NBF project currently implemented by SEA.

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**LIST OF ACRONYMS**

ADC Academic Development Centre

AIDS Acquired Immune Deficiency Syndrome

CBD Convention on Biodiversity

CCS Centre for Community Services

CS Community Service

CMU Christian Medical University

CPB Cartagena Protocol on Biodiversity

DNA Deoxyribonucleic Acid

EEC European Economic Community

FPE Free Primary Education

GDP Gross Domestic Product

GE Genetically Engineered

GEF Global Environmental Fund

GMOs Genetically Modified Organisms

HIV Human Immuno Virus

ICT Information and Communication Technology

IDE Institute of Distance Education

LMOs Living Modified Organisms

MITC Manzini Industrial Training Centre

NAHEC Nazarene Higher Education Consortium

NASTIC Nhlangano Agricultural and Skills Training Centre

NFBs National Framework on Biosafety

PTC Primary Teachers’ Certificate

PTD Primary Teachers’ Diploma

SACU Southern Africa Customs Union

SADC Southern African Development Community

SANU Southern African Nazarene University

SCOT Swaziland College of Technology

SEA Swaziland Environment Authority

SIMPA Swaziland Institute of Management and Public Administration

SITC Siteki Industrial Training Centre

SNL Swazi Nation Land

STC Secondary Teachers’ Certificate

STD Secondary Teachers’ Diploma

TVET Technical and Vocational Education and Training

UBLS University of Botswana Lesotho and Swaziland

UNEP United Nations Environmental Programme

UNISWAUniversity of Swaziland

UPC University Planning Centre

URC University Research Centre

USAT Unit-based Sustainability Assessment Tool

VOCTIM Vocational and Commercial Training Institute

VUT Vaal University of Technology

**EXECUTIVE SUMMARY**

The report presents findings of a study that was conducted to ascertain the level of integration of modern biotechnology and biosafety in programmes and practices in institutions of higher education and training in Swaziland. The study involved nine (9) tertiary institutions resident in Swaziland which are either supported by the Swaziland Government or privately owned. Specifically the study sought to ascertain the extent to which the institutions respond to modern biotechnology and biosafety; and to determine the capacity of the institutions to respond to challenges and concerns of application and use of modern biotechnology techniques and products. The study concentrated on academic programmes and courses, research and outreach initiatives. Other institutional structures such as institutes and centres were considered where they exist. For some reasons it was difficult to include individual subjects or departments within the institutions, the student body, non-teaching divisions and the administrative structures.

The study was conducted as fulfilment of the activities in the SEA-UNISWA MoA for integration of modern biotechnology and biosafety in programmes and practices in institutions of higher education and training in the country. This collaboration is part of the implementation of Component IV on *Establishment of an Effective Public Education, Awareness and Participation in Decision-making system)*; a part of a flagship UNEP – GEF project aimed at building national capacity to implement the National Biosafety Framework (NBF). The specific activity being implemented in the component is the *Review of educational framework and introduction of biotechnology and biosafety into curriculum*.

The theoretical framework of the study was informed by the systems theory and was based on holism approach derived from Togo (2011). Based on one of the fundamental principles of the systems theory, the study was conducted across all the institutions’ core functions which include teaching, research and community service. The study also considered all critical institutional divisions that deal with and relevant to teaching, research and community service. The study used a variety of data collection techniques with the unit-based sustainability assessment tool (USAT) being the central data collection instrument. The USAT used was an adaptation of the original Togo (2008) USAT. The USAT was complemented by the use of guided questionnaires for key institutional respondents as well as *ad hoc* unstructured interviews with key institutional personnel. There was also use of internet sources such as institutional websites alongside analysis of existing documents, reports and any written materials.

Findings of the study reveal a general low level of integration of modern biotechnology and biosafety issues in programmes and processes of institutions of higher education and training in the country. Generally, levels of integration are particularly low or non-existent in non-science programmes and practices of the institutions. Science based and medical oriented institutions and faculties exhibited relatively moderate to higher levels of integration of modern biotechnology issues. The Christian Medical University and faculties of Agriculture, Science & Engineering and Health Sciences at UNISWA and SANU boasted programmes and courses that integrated biotechnology at moderate to higher levels. They had staff with expertise in the field and already teaching courses involving modern biotechnology and biosafety issues. With respect to research and community service there was little evidence of such in most institutions with the exception of UNISWA. UNISWA has centres dedicated to promotion and coordination or research and community service. Moreover, UNISWA had a structured way of storage and dissemination of research and community service information. However, very little research and community service projects addressed modern biotechnology and biosafety issues and concerns. Moreover, policy statements in all the institutions did not include modern biotechnology and biosafety issues. Nevertheless, the integration status observed in some divisions of the institutions gives a glimmer of hope for the future as they provide a starting point for institutions as they make attempts to integrate modern biotechnology.

It is apparent therefore that teaching faculties, departments, disciplines with science or medicine orientation have integrated modern biotechnology and biosafety more than those with a social and/or economic orientation. However, the science and medical based institutions need to adopt an interdisciplinary approach (they integrate social, economic and ecological dimensions of sustainable development) to expand the understanding of modern biotechnology in whole institutions.

The study ended with presentation of several recommendations that may be implemented to facilitate up scaling of integration of modern biotechnology and biosafety in the local institutions of higher education and training. The main recommendations include creation awareness about modern biotechnology and biosafety among staff and students; Enhancement of level of understanding and knowledge on modern biotechnology among staff; Institutionalization of modern biotechnology and biosafety integration; Appointment and training institutional focal points; use of incentives; Inclusion of modern biotechnology and biosafety issues in institutional policy and strategic plan statements; Mainstream modern biotechnology and biosafety in programmes and practices; Avail resources to support integration of modern biotechnology initiatives; and use of community service.

**CHAPTER 1**

**INTRODUCTION**

**1.1 Background to the Assessment**

Economic growth in Swaziland has lagged behind that of its neighbours and real GDP growth since 2001 has averaged 2.8% or lower, nearly 2 percentage points lower than growth in other Southern African Customs Union (SACU) member countries (Forsyth-Thompson, 2011). Low agricultural productivity in the SNL areas, repeated droughts, the devastating effect of HIV/AIDS and an overly large and inefficient government sector are likely contributing factors. Hence The Kingdom of Swaziland holds a vision of developing its economy and society to the level of the top 10% of developed countries in the world, a feat that involves mainly sustainable utilization of environmental resources, improvement of standards of living as well as attainment of food security. Enhancement of the country’s biotechnology capacity and capabilities is viewed as an option towards attainment of the national development vision outlined above. Biotechnology is not an entirely new concept in Swaziland and in the rest of the world. The traditional category of biotechnology has been in use for centuries in food preparation, growing of crops and rearing of livestock. Locally, the brewing of *umcombotsi* (traditional beer) and fermentation of *emasi* (sour milk) as well as crossbreeding and/or inbreeding of livestock types are considered as application of biotechnology. Elsewhere use of tissue culture especially in producing hybrid varieties of seed is common application of traditional biotechnology. Traditional or conventional biotechnology is generally acceptable with very limited or no complaints or concerns.

However, the current focus is on modern biotechnology which has raised massive debate, complaints and concerns in some sectors of the Swazi society. Modern biotechnology involves manipulation of organisms at cellular level to acquire a product (CBD, 2000). These are techniques of biotechnology application which include cloning, stem cell and genetic engineering (DNA). With the latter application has yielded the so called Genetically Modified Organisms (GMOs) or transgenic products. The development, use and Trans boundary transmission of modern biotechnology products and process has triggered global concerns and complaints over potential risks these may pose to the environment, biodiversity as well as human and animal health. Hence world countries adopted the Cartagena Protocol on Biodiversity (CPB) in January 2006 which deals with issues of biosafety. Biosafety refers to the prevention of large-scale loss of biological integrity, focusing both on ecology and human health (UNEP, undated). This informs the Swaziland Biosafety Act of 2012 which defines biosafety as mechanisms for ensuring the safe handling, transfer and use of products of biotechnology. Since it’s coming into effect in 2008 the CPB has been adhered to in addressing safe (trans-boundary) transfer, handling and use of modern biotechnology particularly GMOs that may have adverse impacts on environment, biodiversity as well as human and animal life. Modern biotechnology and biosafety measures appear to be more inclined towards agriculture than other sectors in the African context. The reasons have to do with the importation of seed and animal feed as well as influx of donor food from foreign sources (Dlamini and Dlamini, 2010).

The use of biotechnology for various purposes is not new globally and in Swaziland. However, the use of modern biotechnology entered the mainstream global economy in the mid-1990s especially in the development and production genetically engineered (GE) products for commercial purposes (Dlamini and Dlamini, 2012). Global trends indicate accelerated adoption and use of modern biotechnology especially in agriculture where hectares of land on transgenic crops increased 87 fold since 1996 while countries producing transgenic crops increased from 6 in 1996 to 29 in 2010 (Dlamini and Dlamini, 2010). Only a few countries in Africa, Burkina Faso, Egypt and South Africa, produce GE products for commercial purposes (Makinde *et. al*., 2009). With reference to biosafety and implementation of the CPB, 47 African countries are at various stages of development of National Biosafety Frameworks (NFBs) with 11 countries with functioning NFBs (Makinde et. al., 2009). NBFs ensure safe development and application of modern biotechnology and they consist of biosafety policy, legislation, regulatory regimes, and systems for handling requests, monitoring, compliance and public participation. Only South Africa has a functioning NBF and produces GE products for commercial purpose in the SADC region. A majority of SADC countries are yet to prepare and implement systems for safe application of modern biotechnology and NBF to address risks associated with use of GE products and technics.

Swaziland acceded to the CBP in 2006 and therefore is obligated to domesticate the Protocol by developing and implementing national instruments in line with the Protocol. Swaziland is primarily practicing traditional biotechnology with little in-roads into modern biotechnology (second generation biotechnology). However, this does not prevent the country from being affected by potential risks associated with modern technology as the country relies on imports of seed and food from external sources with GE capabilities. Moreover, persistent low productivity in the agricultural sector due to effects of climate change, loss of soil fertility, exorbitant farm inputs and others create a scenario where modern biotechnology may be viewed as a panacea to increase agricultural productivity. The country developed a NBF in 2005 and resources for its implementation are provided by the 4-year GEF funded Project. The project focuses on promulgation of the biosafety act, mainstreaming of biosafety into national policies and strategies, built capacity on risk assessment, risk management and LMO detection as well as train designated institutions in handling and management of LMOs. Progress has been made in some key components of the NBF. The National Biosafety Policy titled “Creating an Enabling Environment for the safe Use of Biotechnology and its Products in Swaziland” was adopted by relevant authorities. Moreover, the Biosafety Bill received Royal accent in 2012 to be a national legislation referred to as the Biosafety Act, 2012. Implementation of other components of the NBF is still underway including integration of Modern biotechnology and biosafety in programmes and processes of institutions of higher education and training.

**1.2 Setting of the Assessment**

The assessment was conducted in institutions of higher education and most training in Swaziland. These are universities and training colleges that are resident in Swaziland which are either supported by the Swaziland Government or privately owned. The audit did not include institutions operating in Swaziland but acting as agents of institutions whose head offices or owners are in other countries. The Government-supported institutions considered include the University of Swaziland (UNISWA) and affiliated colleges namely William Pitcher Teacher Training College and Ngwane Teacher Training College (plans are at an advanced stage to incorporate these colleges into UNISWA by 2014), Swaziland College of Technology (SCOT), Christian Medical University (CMU), Southern African Nazarene University (SANU) and Gwamile – VOCTIM. Other institutions considered include Limkokwing University of Creative Technology and Swaziland Skills Centres.

**1.2.1 The University of Swaziland**

The University of Swaziland is the largest and influential institution of higher education in the country. It has been the only university in the kingdom of Swaziland for quite a long time until recently where private universities are being established. The university is government owned and it developed from what was formerly known as the University of Botswana, Lesotho and Swaziland (UBLS) with headquarters in Lesotho and campuses in the three countries (*www.uniswa.sz*). At present, the university has three campuses with the main campus at Kwaluseni hosting five of the seven faculties, including the administration and the main library. The second is Luyengo campus which houses the Faculty of Agriculture and is located in the Malkerns valley, a small-scale commercial farming area. The third campus, which houses the Faculty of Health Sciences, is located in Mbabane, the capital city of Swaziland, and closer to the Mbabane Government Hospital which is the largest referral hospital in the country.

Currently, the university has a total of seven faculties offering a variety of programmes meant to respond to the national developmental needs of Swaziland. Student enrolment is approximately 5,400 students (about 2,650 males and 2,750 females) and administrative and academic staff compliment of about 350 (about 260 locals and 93 expatriate). It also boasts of a number of centres and affiliated institutes responsible for executing some of its operational functions or facilitating the smooth running of the university, for example research, community service, academic development etc. Table 1.1 is an outline of departments which reside in each of the faculties; and the centres and affiliated institutes.

*Table 1.1 UNISWA Faculties and Departments, Centres and Institutes*

|  |  |
| --- | --- |
| **Faculties** | **Departments** |
| **Agriculture** | Agricultural Education and Extensionhttp://www.uniswa.sz/images/spix.gifAgricultural Economics and Managementhttp://www.uniswa.sz/images/spix.gifAnimal Production and HealthCrop ProductionConsumer SciencesAgriculture and Bio systems Engineering |
| **Commerce** | Accountinghttp://www.uniswa.sz/images/spix.gifBusiness Administration |
| **Education** | Adult Educationhttp://www.uniswa.sz/images/spix.gifCurriculum and Teachinghttp://www.uniswa.sz/images/spix.gifEducational Foundations and Managementhttp://www.uniswa.sz/images/spix.gifIn-Service Educationhttp://www.uniswa.sz/images/spix.gifPrimary Education |
| **Health Sciences** | Community Health Nursing Sciencehttp://www.uniswa.sz/images/spix.gifGeneral Nursinghttp://www.uniswa.sz/images/spix.gifMidwifery Sciencehttp://www.uniswa.sz/images/spix.gifEnvironmental Health Science |
| **Humanities** | Academic Communication Skillshttp://www.uniswa.sz/images/spix.gifAfrican Languages and Literaturehttp://www.uniswa.sz/images/spix.gifEnglish Language and Literaturehttp://www.uniswa.sz/images/spix.gifHistoryhttp://www.uniswa.sz/images/spix.gifJournalism and Mass Communicationhttp://www.uniswa.sz/images/spix.gifTheology and Religious Studies |
| **Science and Engineering** | Biological Scienceshttp://www.uniswa.sz/images/spix.gifChemistryhttp://www.uniswa.sz/images/spix.gifComputer Sciencehttp://www.uniswa.sz/images/spix.gifElectrical & Electronic Engineeringhttp://www.uniswa.sz/images/spix.gif[Geography, Environmental Science and Planning](http://www.uniswa.sz/academic/science/gep/) (GEP)http://www.uniswa.sz/images/spix.gifMathematicshttp://www.uniswa.sz/images/spix.gifPhysics |
| **Social Sciences** | Economicshttp://www.uniswa.sz/images/spix.gifLawhttp://www.uniswa.sz/images/spix.gifPolitical and Administrative Studieshttp://www.uniswa.sz/images/spix.gifSociologyhttp://www.uniswa.sz/images/spix.gifStatistics and Demography |
| **Centres** |
| Academic Development Centre (ADC)Centre for Community Service (CCS) Consultancy and Training Centre (CTC)UNISWA Health Information and Counselling Centre University Planning Centre (UPC)UNISWA Research Centre (URC) |
| **Institutes** |
| Institute of Distance Education (IDE)Institute of Post-Graduate Studies (IPGS)Swaziland Institute for Research in Traditional Medicine, Medicinal and Indigenous Food Plants (SIRTMMIFP) |

Several other operational divisions and sectors exist which have not been included in the Table 1.1 above which perform various university functions. These include the Human resources/Corporate affairs, Physical planning, Bursary and Transport. Through the faculties and the various operational units, the university is committed to responding to the needs of the country. It is “firmly committed to a programme of expansion and development to retain its relevance and the aim of providing the expert manpower which the Kingdom needs” ([*www.uniswa.sz*](http://www.uniswa.sz)). Since its founding, UNISWA continues to strengthen its educational programmes in line with the country’s development needs.

The vision and mission statements of the university as they appear on the university website (*www.uniswa.sz*) are:

* ***Vision*:** Leadership through excellence in education.
* ***Mission:*** to achieve excellence in teaching and learning, research and research training, community service, provision of opportunities for consultancy, professional leadership and enterprise development in the contemporary context.

A list of objectives through which the university intends to achieve its mission are also outlined. Though not apparently visible, underlying some of the objectives are sustainable development principles. These objectives have been identified as:

* establishing new academic programmes designed to meet the emerging needs of society;
* creating continuing education opportunities for the inculcation of life-long learning;
* teaching that encourages participation of students in entrepreneurship endeavours.

**1.2.2 UNISWA’s Affiliated Institutions**

***1.2.2.1 Ngwane Teacher Training College***

Ngwane Teachers College was established in 1982 to train teachers for primary schools. It is situated in Nhlangano in the southern part of Swaziland. It was built with assistance from the then European Economic Community (EEC). Between 1982 and 1986 the college offered a two year Primary Teachers Certificate (PTC) programme. From 1987 onwards the college offers the three years Primary Teachers Diploma (PTD). From April 1 2014 Ngwane College will be absorbed into the Faculty of Education of the University of Swaziland.

***Vision***
To provide a diversified curriculum for the development of highly skilled competent and resourceful teachers who will contribute effectively and efficiently to the development of the nation and the SADC region.

***Mission***
To be an excellent teacher education institution renowned for producing competent teachers and providing quality service by engaging experienced professionals using modern systems that prospective teachers and other significant stakeholders aspire to associate with in the deliverance of quality education in Swaziland and beyond.

Table 1.2 Ngwane College’s faculties and departments

|  |  |
| --- | --- |
| **Faculties** | **Departments** |
| **Applied Science** | Home EconomicsAgriculture |
| **Pure Science** | MathematicsScienceICT |
| **Social Science**  | HistoryGeographyReligious Studies |
| **Practical Arts**  | MusicPhysical EducationArts & Crafts |
| **Faculty of Languages**  | EnglishSiSwatiFrench |
| **Faculty of education**  | FoundationsSpecial EducationCurriculum and Methodology |

**Teaching staff**

Currently there are fifty (50) teaching staff members distributed amongst the six (6) college faculties and 70 non-academic staff members.

***1.2.2.2 Swaziland College of Technology***

The Swaziland College of Technology (SCOT) is a government training institution under the Ministry of Education and Training. SCOT was established in the 1940s as Trade School training local people on skills and technical qualifications mainly to join the government employment. Since then SCOT has grown to become the biggest institution in area of Technical and Vocational Education and Training (TVET) in Swaziland. Specifically, SCOT provides technician programmes in Automotive Engineering, Mechanical Engineering, Electrical and Electronics Engineering, Building Studies and introduced Secondary Teachers’ Training in Accounting, Metal and Wood Work. The aim is to enhance the development and expansion of the economy for the prosperity of the Swazi Nation within the SADC region. In the 2011/2012 academic year SCOT introduced B.Tech degree programmes in ICT and Business Administration faculties as an affiliation of the Vaal University of Technology (VUT) in South Africa. However, college faculties include Business Administration, Building and Civil Engineering, Education, Engineering and Science, and Information and Communication Technology (ICT). Affiliation of the College to UNISWA is questionable since other programmes are not monitored by UNISWA for quality assurance. In the data presentation chapter below SCOT will not be presented under UNISWA.

The ministry of Education and Training intends to transfer most of the diploma programmes to the vocational training centres such as VOCTIM to allow the colleges to offer higher level programmes such as National Diplomas and Degree Programmes.

**Mission**

To maintain the college’s position as the principal institution of higher level in Technical and Vocational Education and training in Swaziland.

**Objectives**

* To provide a wide range of full-time programmes which meet individual career aspirations in the light of the current and future requirements of business and industry in the public and private sectors.
* To be at the forefront of technological change through research and collaboration with employers in the public and private sectors.
* To assist in the development of entrepreneurship and creation of opportunities for self-employment.
* To link and liaise with other educational and training establishments including those in industry and abroad in order to utilize the country’s training facilities efficiently and cost effectively.

**Teaching Staff**

Teaching staff numbers over 83 members teaching short-term upgrading courses and middle technology level.

***1.2.2.3 William Pitcher Teacher Training College***

William Pitcher College was established in 1962 to train lower and upper primary school teachers. The two programmes were T4 for lower primary school and T3 for upper primary school. Both programmes were offered over a two year period. After independence there was an increase in the number of secondary schools, necessitating the training of more secondary school teachers. A two year secondary teachers’ certificate (STC) was introduced. At the same time the T3 and T4 programmes were phased out and replaced with a two year primary teachers certificate (PTC). A one year in-service primary teachers’ certificate in Home Economics was introduced in 1975 and continued until 2004 when it was phased out.

The PTC and STC programmes were upgraded to a three Primary Teachers Diploma (PTD) and Secondary Teachers’ Diploma (STD) in 1986. By then the college was affiliated to the University of Swaziland which accredited the certificates. With the continued increase in secondary schools and the departure of teachers to South Africa, the PTD programme was discontinued in 1993 leaving WPC to concentrate on the training of secondary school teachers. However, due to the introduction of Free Primary Education (FPE) the PTD programme was reintroduced in 2009. Like Ngwane College, William Pitcher College will be absorbed into the Faculty of Education of the University of Swaziland in 2014.

***Vision***
To provide teachers who are well equipped with competent teaching skills to facilitate academic excellence among learners in the schools.

***Mission***William Pitcher equips teacher trainees with skills to effectively teach learners in the schools under diverse social and academic challenges of the dynamic society, and inculcate the spirit of professional development.

**Objectives**

*William Pitcher College subscribes to the following objectives***:**

* To train primary and secondary pre-service teachers
* To engage in educational research.
* To equip teacher trainees with skills to interpret and implement the various subject syllabi.

**Subjects offered**

The following subjects are offered for the Secondary Teachers’ Diploma: English, SiSwati, Religious Education, Mathematics, Science, History, Geography, Education/professional Studies; with the support subjects of Music and Physical Education

**Key Functions:**

* Training primary and secondary school teachers
* Conducting Research
* Periodically review subject curriculum to address prevailing teacher training and school curriculum needs
* Plan, coordinate, supervise and assess teacher trainees’ work/activities at the college and while in schools during teaching practice.

**Services Provided**

* Staff development workshops for teachers in the schools
* Counselling for teacher trainees

**1.2.3 Limkokwing University of Creative Technology**

Limkokwing University of Creative Technology is an international privately owned university tracing its origins to Malaysia. It was established in Swaziland in 2010 and has its campus at the former Swaziland Institute of Management and Public Administration (SIMPA) premises in Mbabane. Some of the faculties include Architectural technology, Business management, Graphic design, Advertising and Hotel management.

**Vision**

To nurture graduates who would become responsible adults who will contribute to the well-being of an industry by using creative thinking to solve problems and provide fresh new perspectives to build business.

**Mission**

Transform Swazis into confident, skilled, techno-savvy individuals who can contribute to build Swaziland’s industries. These will be industries that are increasingly being managed by young people with the digital skills to operate a global business from their laptops. Limkokwing has the flexibility to build entrepreneurial skills through an exciting, stimulating campus environment purposefully built to stimulate creativity.

**Mandate/objectives**

* To prepare students with knowledge of continuing changes in which problems to be solved will be large and small, for every sort of function, in every type of climate, and for every budget.
* To provide students with an effective business education which will equip them with the analytical, conceptual and practical skills deemed necessary by the business community
* To train students who will be able to develop effective strategies for goal setting, time management and to execute design concepts to a professional standard.
* To produce graduates who will be able to develop effective strategies for goal-setting, time management and to execute design concepts to a professional standard.
* To help students develop quick and effective decision-making skills and enhance their human relations ability.

**1.2.4 Southern African Nazarene University**

The Southern African Nazarene University (SANU) was established in 2010, evolving from the merger of the Nazarene College of Nursing, Nazarene Teacher Training College and Nazarene College of Theology. The University is the result of the dream of the Swaziland Church of the Nazarene as it seeks as it seeks to extend its long history of service in the Kingdom of Swaziland. Stakeholders in the formation of SANU include the National Board of the Nazarene in Swaziland, the Africa Region and the International Board of Education in the Church of the Nazarene.

Before the establishment of SANU the three colleges collectively formed the Nazarene Higher Education Consortium (NAHEC). Campuses are in Siteki (Theology) and Manzini (Health Sciences and Education).The establishment of the University is a continuation of a long history of service of the Church of the Nazarene in Swaziland spanning over 100 years.

**Faculties and their programmes**

Faculty of Health Sciences - Post Diploma Certificate in Midwifery Nursing Science

 B.Sc in Medical Laboratory Science

 B.Sc in Nursing and Midwifery

 Diploma in Nursing and Midwifery

Faculty of Theology - Diploma in Theology

 Bachelor of Theology

Faculty of Education - Primary Teachers’ Diploma

* Bachelor of Special and Inclusive Education

**Vision and Mission Statement**

The vision and mission statement of SANU as it appears in the SANU website are as follows:

*Vision*

 SANU aspires for academic excellence through a balanced combination of faith, teaching and learning within the context of Christian holiness.

*Mission*

Commitment to the Great Commission and strives to provide excellence in higher education within the context of Christian Wesleyan holiness where minds are engaged in innovative teaching, learning, leadership, research and community service.

Aspiring to be a learning community where character is modelled and shaped and faith becomes an expression of faith and where individuals of high character and integrity are prepared to meet the challenges of their world.

Mandate/objectives

* Training and functional preparation of people to serve Christ in a multi-ethnic context through the outreach and nurture of the Church.
* To train individuals who would perform self-care to maintain life, health and well-being as well as creating a quality working environment to enable the delivery of a required standard of care which will meet the professional values of nursing, midwifery, and community health services.
* To prepare teachers for primary schools in the different subject combinations.

**1.2.5 Christian Medical University**

The Christian Medical University in Swaziland was established as collaboration between the Republic of Korea and the Government of Swaziland against the backdrop of massive shortages of medical personnel and escalation in national health challenges posed by the prevalence of HIV/AIDS and other diseases such as Tuberculosis, Malaria and other diseases. The commencement of operation of the Christian Medical University is viewed by the nation as a great step forward for a struggling national health system. Currently Swaziland has relatively few doctors, and Swazis at present receive their medical training outside of her borders. The successful establishment of Swaziland Christian University Medical School will serve to increase retention of healthcare professionals as well as facilitating further advances within the health system as a whole. The CMU offers a diversified curriculum with special focus on Medicine. It is dedicated to the advancement of the Health and ICT sectors in Swaziland, Africa and beyond by promoting Christian faith, excellence through education, healthcare, innovation, community engagement and research. The University has three colleges namely, Medical School, College of Nursing and College of Information and Communication Technology (ICT). The CMU aims at the following:

* Training of medical doctors
* Paving the way for a university hospital
* Encouraging the retention of Swazi doctors
* Facilitating further advances within the health system

**1.2.6 Gwamile - VOCTIM**

Gwamile Vocational and Commercial Training Institute is one of the principal institutes of higher learning in Swaziland. It was founded in 1987 under the auspices of the German Technical Cooperation Agency (GTZ) and the Swaziland Government. The campus is located in Kwaluseni, in the centre of the country, about one kilometre from the University of Swaziland. The institution is commonly known as Gwamile-Voctim and it caters mainly for school leavers who failed to make it to O’ levels for one reason or another as it accepts the Junior Certificate for entry into the programmes offered.

**Mission**

To produce qualified and skilled individuals who will be able to:

* Cope with changes in technology
* Cope effectively with the demands of work
* Understand the impact of industry on the environment
* Develop skills of self-employment

**Goals/objectives**

VOCTIM has the following goals:

* Enable Swaziland public and private sector establishments to recruit skilled craftsmen and clerical workers for the labour market.
* To provide school leavers and other young unemployed people with systematic training at craft level with a view towards self-employment.

**Programmes**

Programmes offered at VOCTIM include Automotive Engineering, Commercial Studies, Electrical Engineering, Mechanical Engineering, Trowel Trades, Wood Trades and Plumbing.

**Enrolment**

The total enrolment for all programmes is about 150.

**1.2.7 Swaziland Skills Centres**

Swaziland Skills Centres constitute the following three institutions:

* Manzini Industrial Training Centre (MITC-Emakhonweni)
* Nhlangano Agricultural Skills Training Centre (NASTC –Ndvungunye)
* Siteki Industrial Training Centre (SITC)

MITC is one of the centres belonging to the Swaziland Skills Centres. The other centres are Nhlangano Agricultural Skills Training Centre (NASTC – Ndvugunye) and Siteki Industrial Training Centre (SITC) located at Nhlangano, Southern Swaziland and Siteki, eastern Swaziland respectively. The centres are the only places in Swaziland where young people who are academically disadvantaged for any reason and at any stage can be trained in a skill which will enable them to earn a living by getting employment of being self-employed.

The centres were set up to provide training for young people for self-sustainability and gainful employment. They operate on the principle of training by production. The clientele is composed of trainees who will be training in workplace conditions. Those who can read and write and are between the ages of 18 and 25 may apply. Both males and females are encouraged to enrol.

**Courses offered at each of the centres**

|  |  |  |
| --- | --- | --- |
| **MITC** | **NASTC** | **SITC** |
| AgricultureBuildingCarpentryElectricalMetalworkMotor MechanicPanel Beating and Spray PaintingPlumbingUpholsteryICDL (Computer course) | AgricultureCarpentryElectricalMetalworkMotor mechanic | AgricultureBuildingCarpentryArts and CraftSewingMetalworkMotor mechanic |

**1.3 The modern biotechnology and biosafety context in Higher education**

The people and Government of Swaziland expect Institutions of higher education and training to address the developmental needs of local communities as well as respond to national and global socio-economic and environmental issues. In recent times the concept of development is no longer based on economic growth alone but has assumed new connotations resulting from a need to balance development and impacts of that development on the society, economy and environment. Hence, countries are increasingly pursuing sustainable development as a relevant development paradigm informing national and global economic and social advancement strategies (Banerjee, 2003). Institutions of higher education especially universities were identified to play a leading role in the pursuit of sustainable development (UNEP, 2006). One of the country’s main sustainable development challenges is the loss of biodiversity and increasing threats to existing ecosystems while there is an increasing potential for use of modern biotechnological technics which are a threat to integrity of biodiversity. It was of great significance for the country to accede to CPB to avoid the potential risks to loss of biodiversity associated with use modern technology as the country relies on imports of seed and food from external sources with GE capabilities.

Several key constraints and bottlenecks to the implementation of the CPB and NBF were identified by Dlamini & Dlamini-Mabuza, 2003. The most immediate one is the limited availability of specialised capacity and trained personnel on modern biotechnology and biosafety as well as lack of institutional knowledge and public awareness of the CPB, NBF and the 2012 National Biosafety Act. Dlamini & Mabuza-Dlamini (2003) noted the lack of training courses in modern biotechnology and biosafety is responsible for the lack of capacity to implement relevant local biosafety frameworks and policies. Hence action was recommended to create courses integrating national and international modern biotechnology and biosafety scenarios in local institutions of higher education and training. Moreover, the country has recently promulgated the Biosafety Act 2012 which seeks, among other things, to mainstream the advantages of modern biotechnology in national sectors such as agriculture, environment and health. The Act also deals with modern biotechnology and biosafety issues especially handling, transport and use of biotechnology products and processes.

The technicality and potential risks associated with modern biotechnology makes the Biosafety Act 2012 a legislation of significant proportions to the citizens of the country. It is therefore imperative that the legislation be exposed and disseminated to the nation through various means available including awareness creation, education and training. The 4th component of the UNEP-GEF funded project on capacity building sought to accomplish that through its public awareness and education systems. The current initiative, therefore, intends to implement some activities in Component IV of the GEF project especially as local institutions of higher education and training are expected to integrate modern biotechnology and biosafety in their curricula and other institutional practices through the mainstreaming approach. The assessment being undertaken is a precursor to that by establishing the current levels of integration of modern biotechnology and biosafety issues in programmes and processes in the institutions of higher education and training.

**1.4 Aims of the assessment**

The assessment is intended to ascertain the extent or level of integration of modern biotechnology and biosafety issues in programmes and processes in institutions of higher education and training in the country. The specific objectives of the assessment include the following:

* To establish the extent to which institutions’ academic and non-academic programmes and processes respond to and address modern biotechnology and biosafety issues.
* To assess the content of various programmes in faculties and institutions to estimate the level of integration of modern biotechnology and biosafety issues.
* To gauge institutions administrative and operation systems with the intention of determining capacity to respond to modern biotechnology and biosafety issues.
* To review UNISWA’s major activities in the context of the environment and sustainable development.

**1.5 Structure of the report**

The assessment report is presented in five chapters as well as the executive summary references and appendices. *Chapter 1* is an introduction to the report and it presents mainly background information to modern biotechnology and biosafety issues as well as to the various institutions that were considered in the assessment. *Chapter 2* highlights the research design and the methodological approach to the assessment which include description of types of data collected, data collection techniques as well as data presentation and analysis. *Chapter 3* is the presentation of the collected data according to the various institutions. Within the institutions data presentation was divided into faculties as well as other units (where available). *Chapter 4* presents an analysis and discussion of the findings along major thematic areas derived from or aligned with functional operations of institutions of higher education and training which include teaching, research, community engagement, policy and management, physical operations and maintenance as well as students’ activities. *Chapter 5* is conclusion of the report which highlights key findings of the assessment and makes recommendations particularly in the key areas requiring capacity building to improve integration of modern biotechnology and biosafety.

**Chapter 2**

**METHODOLOGY**

**2.1 Research design**

The is one of the activities covered in the SEA-UNISWA memorandum of agreement to integrate modern biotechnology and biosafety issues in programmes and processes of institutions of higher education and training in the country. It is an empirical study that relied mainly on qualitative data based on interpretation of events taking place among institutions according to meanings that people attach to them as well as their personal experiences (Cresswell, 1994). The numerical data collected reflected on perceived quality of phenomena *i.e.* the data was used to represent ordered qualitative responses expressing the extent of integration of modern biotechnology and biosafety issues in institutional programmes and processes.

**2.2 Theoretical framework**

The theoretical framework of the assessment was based on systems approach. This was due to its treatment of an institution of higher education and training as a whole. The data collection and analysis processes focused on the various components and sectors that constitute the institutions. The systems approach envisages a reorganisation of ways of thinking and knowing of the perceived reality as being based on *holism* (Banathy, 1997). Inherent in the systems approach is the emphasis on interactions and interrelations among sectors or components of entities therefore recognising the importance of relational aspects in developing explanations. The approach provides methods and instruments to construct a holistic view of phenomena under study allowing them to be perceived in interrelationship with each other and with the environment in which they are embedded (Banathy, 1992).

According to Togo (2011a) employing systems approaches in mainstreaming emerging concepts and issues such as modern biotechnology, biosafety, sustainability, climate change to name but a few, strengthens institutional responses to sustainable development challenges. Guided by the concept of holism, institutions of higher education and training are regarded as systems situated within the local Swazi society which in this case represents the system’s environment. In the systemic environment of institutions of higher education are concerned with political, social, ecological and economic issues that potentially influence education in terms of policy, resources and other educational requirements (Banathy, 1992). Through education, universities are expected to develop literacy among the students for them to actively participate in addressing the emerging issues mentioned above. Universities can also directly interact with their societies in addressing sustainable development challenges where use and application of modern biotechnology techniques is one of the challenges. These interactions are enabled by a two-way information exchange that is explained by the concept of feedback.

Institutions of higher education and training constitute of faculties, departments and other units (sub-systems of the education system) which are responsible for various operational functions of the university and include teaching, outreach and research as well as sectors responsible for management or administration and operations. Based on the concept of holism, all these subsystems or component parts of the institutions, as systems, were part of the study. In situations where identified operational divisions had many departments such as faculties, a few of those departments were selected for inclusion in the study. The study went further than university operational functions to include the student body which represents recipients of lessons in modern biotechnology and biosafety.

The kingdom of Swaziland is the smallest country in Southern Africa excluding the islands; it is landlocked and shares boarders with South Africa in the north, west and south and Mozambique in the east. Swaziland covers about 17,000 km2 in size and has a population of about 1.2 million people. About 70% of the population reside in the country side and depend on small-scale subsistence farming (FAO, 2013). Agriculture contributes about 12% to the country’s GDP and manufacturing is by far the biggest contributor to the country’s GDP. Swaziland experiences several development challenges such as annual fiscal deficits, unemployment, HIV/AIDS, high poverty rates, persistent food shortages. The subsistence farming sector is failing to produce adequate food crops to feed the growing Swazi population. Maize production has been declining since the late 1990s resulting in growing annual importation of maize mainly from South Africa. This state of affairs compelled the country to search for alternative development strategies and farming techniques which may include consideration for use of GMOs especially in agriculture to counter the effects of drought and escalation of farming costs. However, in the short term the country is vulnerable to importation of GMO maize and other food products; hence the importance and significance of the initiatives the country undertook to ensure safety in the trans-boundary movement and use of modern biotechnology techniques and products. The promulgation of the 2012 Biosafety Act. Therefore, it is imperative that the local population is made aware of the benefits and disadvantages of application and use of modern biotechnology techniques as well as the significance of the national Biosafety Act. It is a concern that a national consultative forum to identify the country’s development challenges for presentation in the Rio+20 summit on sustainable development omitted the potential dangers of uninformed application and use of modern biotechnology techniques and products yet such is an immediate threat to the country’s biodiversity, human and wildlife.

**2.4 Data collection techniques**

Primary and secondary data were collected during the assessment. Primary data was collected using mainly the Unit-based Sustainability Assessment Tool (USAT). Though the USAT was originally intended for the assessment of sustainability among units of universities (Togo & Lotz-Sisitka, 2009) but based on its versatility it is applied in the assessment of level of integration of modern biotechnology and biosafety in tertiary institutions in Swaziland. Specially designed self-administered data collection matrixes with accompanying score sheet were distributed among Deans and administrators in the case of the universities and principals in the case of colleges. The matrixes were accompanied by brief questionnaires soliciting data on various issues such as status teaching of modern biotechnology and biosafety, relevant policy documents or statements as well as relevant institutional practices. *Ad hoc* interviews were also conducted with key institutional personnel from both teaching departments and in management to solicit information on institutional mandate, vision and mission statements as well as handling of modern biotechnology and biosafety in academic programmes and courses offered. Secondary data was acquired mainly from official websites as well as documents such as calendars and promotion or information leaflets and pamphlets.

The USAT facilitates a rapid assessment of practices enabling identification of specific areas of strength and areas that may require future development in relation to sustainability concepts Togo, 2011b). USAT score sheets for various divisions had a list of indicators which are basically initiatives that universities, colleges and training centres are expected to be practising in the mainstreaming of modern biotechnology and biosafety. The indicators were coded for easy input and graphical representation. Each of the score sheets also contained assessment criteria detailing how to rate the indicators. The rating was based on evidence showing the existence of practices identified by the indicators. Respondents had to choose their response from 6 choices as follows:

**X = Don’t know** respondent has no information concerning the practice

**0 = None** there is total lack of evidence on the indicator

**1 = A little** evidence shows poor performance

**2 = Adequate** evidence shows regular performance

**3 = Substantial** evidence shows good performance

**4 = A great deal** excellent performance

For teaching departments, just the rating was adequate in meeting the assessment requirements.

**2.5 Validity and trustworthiness**

Addressing the issues of validity and trustworthiness was important for the study to be able to present a realistic picture of the status of integration of modern biotechnology and biosafety in programmes and processes of the institutions studied. Issues of validity and trustworthiness were addressed in a number of ways as stated below:

* Application of multiple data collection techniques that complement each other for triangulation purposes,

Putting effort to develop an accurate account from the data so as to ensure descriptive validity,

Solicit credible explanations from the study by use of systems theory and by making continuous reference to the data in developing explanations to ensure theoretical validity, and

* Engaging in self-reflexivity throughout all the stages of the study to avert researcher bias (Togo, 2011*b*).

**2.6 Data presentation and analysis**

**2.6.1 Data presentation**

Data was coded for input into MS Excel spread sheet to facilitate presentation, analysis and storage. For storage purposes the data organized and stored electronically in folders representing each institution in preparation for data analysis. Results of the USAT were captured using Ms Excel and radar diagrams were constructed for each of the institutions and faculties or divisions (where applicable). Qualitative data from interview scripts and documents were captured in MS Word. Institutional modern biotechnology and biosafety practices emerging from the data were identified by reading through the different data sources. For each institution of faculty/division (where applicable), these were then grouped under categories representing university functions of teaching, research and community engagement and then collated for presentation in chapter 3 below.

**2.6.2 Data analysis**

The analysis of collected data relied on the use of the inductive approach which entails developing conclusions (theory) from analysing phenomena (Togo, 2011*b*). This enabled the generation of themes/conclusions regarding the major operations and levels of integration of modern biotechnology and biosafety in programmes and processes of the local tertiary institutions. The approach was also employed to develop emerging themes from the opinions of the respondents regarding possibility for improving integration of modern biotechnology and biosafety practices within tertiary institutions. Development of the themes was significant as they somehow influenced the development of recommendations at the end of the report. For assessment of level of integration of modern biotechnology and biosafety, the indicator scores (rating) helped to determine practices with high and those with low integration levels.

To review institutional major activities in the context of modern biotechnology and biosafety, the abduction was employed. Abduction entails a process of observation and interpretation or re-contextualization of phenomena within a new context so as to understand them in a new way (Danermark *et. al*., 2002). Abduction facilitates seeing connections and patterns not observable in empirical data (Sterling, 2003). According to Danermark *et al*. (2002), abduction enables interpretation of phenomena in relation to a wider context. Modern technology and biosafety practices were re-contextualized within the current challenges the practices pose to the environment within a whole systems thinking as a conceptual framework.

**2.7 Challenges faced in doing the research**

Various challenges were experienced during the study which to a large extent delayed the run-time of the process. However, the challenges were not detrimental to the study as some of them were immediately addressed for the smooth progression of the process. Below are some of the challenges experienced:

* Inadequate background data especially in the newly established institutions as well as colleges. This is with the exception of UNISWA.
* Limited time and financial resources to visit all the institutions for in-depth study involving the various divisions in the institutions. There were problems with identification of the relevant personnel or respondents in some institutions. With the case of SCOT it is only the department of tourism that took the initiative to participate in the study.
* Diversity in institutional structures was also a challenge as some structures were elaborate while others not. Hence the analysis in some institutions is elaborate like in the case of UNISWA and less elaborate like in the cases of SCOT and other institutions.
* Respondents took time to return data collection tools resulting in delays in meeting the set timeline of the study.
* Besides rating the indicators, USAT Part B required respondents to identify key practices among the indicators and to provide information on how the identified practice (indicators) could be improved or to list initiatives they were involved in (students only). Information on identification of key areas was, however, not used in the data analysis as it was found that responses were not uniform probably due to variations in the interpretation of the term ‘Key’. Other respondents did not respond to this part of the tool.
* The lack of knowledge or unfamiliarity of modern biotechnology and biosafety affected the understanding of the items in the questionnaire hence there were responses that were irrelevant or not informative.

**Chapter 3**

**DATA PRESENTATION**

**3.1 INTRODUCTION**

Tertiary institutions conducted a self-sustainability appraisal using mainly Part A of the USAT which solicited various indicators grouped around core functions of tertiary institutions which are teaching, research and scholarship and community engagement. The USAT indicators in Table 3.1 below data were pre-coded for ease of representation using the MS Excel generated graphs. Besides the core functions noted in Part A above also included indicators that influence mainstreaming of modern biotechnology and biosafety such as curriculum, examinations and staff expertise and willingness to mainstream modern biotechnology and biosafety in institutional programmes and processes. The graphs portray the rating of the various specific indicators based on a scale of 0 to 4 showing increasing intensity in the existence of practices (represented by indicators), with X being used where the respondent had no information on the practice. Table 3.1 outlines USAT Part 1 indicators (for full explanation of the rating process and the structure of the USAT, see Appendix 2). The indicators in Table 3.1 below would be used in the presentation of findings for institutions involved mainly in teaching which is virtually all the tertiary institutions considered in the study. In the case of UNISWA the presentation of findings is elaborate as mentioned above and is faculty and division based. In other institutions the presentation of results is inevitably based on the whole institutions and biased towards teaching, research and community engagement. For institutional divisions, as it is the case with UNISWA, separate indicators are presented preceding presentation of findings.

*Table 3.1 USAT codes and indicators faculties (UNISWA) and other tertiary institutions*

|  |  |
| --- | --- |
| **Code** | **Indicator** |
| **Curriculum** |
| **CU1** | The extent to which the department offers courses that engage modern biotechnology and biosafety concerns |
| **CU2** | The level of integration of modern biotechnology and biosafety topics in courses referred to above |
| **CU3** | The degree to which local modern biotechnology and biosafety issues and challenges form part of the department’s teaching programme |
| **CU4** | The degree to which global modern biotechnology and biosafety issues and challenges form part of the department’s teaching programme |
| **CU5** | The extent to which the department enrols students in courses that engage modern biotechnology and biosafety concerns |
| **CU6** | The level of cross faculty collaboration in teaching modern biotechnology and biosafety programmes |
|  | **Teaching approach** |
| **TE7** | The capacity to make informed decisions  |
| **TE8** | Critical thinking skills  |
| **TE9** | A sense of responsibility |
| **TE10** | Respect for the opinions of others  |
| **TE11** | Integrated problem solving skills  |
|  | **Research and scholarship activities** |
| **RS12** | The extent to which the department (staff and students) is involved in research and scholarship in the area of modern biotechnology and biosafety |
| **RS13** | The degree to which global modern biotechnology and biosafety issues and challenges form part of the department’s research |
| **RS14** | The degree to which local modern biotechnology and biosafety issues and challenges form part of the department’s research  |
| **RS15** | The extent to which the department is collaborating with other faculties, institutions and stakeholders in pursuit of solutions to modern biotechnology and biosafety problems |
| **RS16** | The extent to which aspects of modern biotechnology and biosafety are used in selection/execution of research |
| **RS17** | The level to which aspects of modern biotechnology and biosafety are reflected in the department’s research outputs |
|  | **Community Engagement** |
| **CE18** | The extent to which the department (staff and students) is involved in community engagement in the area of modern biotechnology and biosafety |
| **CE19** | The level of commitment of the department’s resources in modern biotechnology and biosafety projects in the community |
| **CE20** | The degree to which local modern biotechnology and biosafety issues and challenges form part of the department’s community engagement |
| **CE21** | The extent to which the department collaborates with other stakeholders in addressing community modern biotechnology and biosafety challenges |
| **CE22** | The extent to which aspects of modern biotechnology and biosafety are used in selection/execution of community engagement projects |
|  | **Examination (assessment) of modern biotechnology and biosafety topics** |
| **EX23** | The extent to which modern biotechnology and biosafety aspects are assessed/examined during course |
| **EX24** | The extent to which modern biotechnology and biosafety aspects are considered in evaluating/assessing projects |
| **EX25** | The degree to which modern biotechnology and biosafety aspects are assessed in evaluating service learning programmes |
|  | **Staff expertise and willingness to participate** |
| **ST26** | The level of expertise of staff members in the area of modern biotechnology and biosafety |
| **ST27** | The extent to which staff members are willing to carry out research and community service activities on modern biotechnology and biosafety aspects/topics |
| **ST28** | The extent to which staff members are willing to teach modern biotechnology and biosafety topics |

**3.2 THE UNIVERSITY OF SWAZILAND**

The Findings for UNISWA are presented according to the various faculties and centres that were considered for the study. The overall picture of the status of integration of modern biotechnology and biosafety in programmes and processes at UNISWA could be ascertained having considered the status in the various faculties and centres as presented below. However, the data presented below indicate a general low level of integration of modern biotechnology and biosafety though levels vary from one faculty to another. For instance, faculties of Agriculture, Health Sciences and Science and Engineering indicate a relatively better integration status of integration of modern biotechnology and biosafety compared to the other faculties where the levels are extremely low.

**3.2.1 Faculty of Agriculture**

The faculty of agriculture has integrated modern biotechnology and biosafety to a larger extent compared to all other faculties at UNISWA. Figure 3.1 below indicates that the faculty’s strength lies in its staff expertise and willingness to teach as well as conduct research and community activities in modern biotechnology and biosafety. There is also a moderate integration of modern biotechnology and biosafety in the faculty’s curriculum, exams as well as in collaborative activities with other relevant entities. The faculty exhibits strength in teaching approaches especially ability to make informed decisions and critical thinking. However, these abilities are generally applicable in all fields and disciplines not particularly modern biotechnology and biosafety. Therefore, it is difficult to read much about integration of modern biotechnology and biosafety from these aspects. What emerged during interviews were differences observed among departments pertaining to levels of integration of modern biotechnology and biosafety; with some departments having integrated the technology more than others. For instance, the departments of Animal Science and Crop Production exhibited higher levels of integration compared to departments such Textile and Apparel Design Management and Consumer Sciences.

Figure 3.1 Level of integration of modern biotechnology and biosafety in the faculty of Agriculture

**3.2.2 Faculty of Commerce**

The integration of modern biotechnology and biosafety issues in the Faculty of Commerce is very low or non-existent. The faculty does not have courses or topics that address modern biotechnology and biosafety issues, neither does it have staff members who are conversant in this area. There is also no evidence of staff members engaging in research or community activities that involve modern biotechnology and biosafety. There are also no development partnerships between the faculty and other stakeholders to address modern biotechnology and biosafety challenges. The only positive rating noted in Figure 3.2 below is on aspects that have general application such as ability to make informed decisions, critical thinking and others as portrayed in Table 3.1 above.

*Figure 3.2 Level of integration of modern biotechnology and biosafety in the faculty of Commerce*

**3.2.3 Faculty Education**

In the Faculty of Education the integration of modern biotechnology and biosafety is also very low. Unlike in the faculty of Commerce, there is one course in the department of Curriculum and Teaching studies (Science Education) that addresses concepts of modern biotechnology and biosafety. There are no staff members competent in this area. There is also no evidence of staff members in the faculty participating in research or community activities that involves modern biotechnology and biosafety. The positive rating noted in Figure 3.3 below is on aspects that have general application such as ability to make informed decisions, critical thinking and others as portrayed in Table 3.1 above.

*Figure 3.3 Level of integration of modern biotechnology and biosafety in the faculty of Education*

**3.2.4 Faculty of Health Sciences**

Figure 3.4 indicates that there is relatively recognisable level of integration of modern biotechnology and biosafety in the faculty of Health Sciences though lower compared to the faculty of Agriculture. The faculty has several courses that include topics dealing or related to modern biotechnology and biosafety issues and concerns. There are also several staff members who are competent in this area and willing to teach as well as conduct research and community activities on modern biotechnology and biosafety. There is also evidence that staff members in the faculty engage in research and community activities which address modern biotechnology and biosafety issues although at a low scale. The faculty also collaborates with other stakeholders to address modern biotechnology and biosafety challenges.

*Figure 3.4 Level of integration of biotechnology and biosafety in the faculty of Health Sciences*

**3.2.5 Faculty of Humanities**

Figure 3.5 indicates absolute lack of any form of integration of modern biotechnology and biosafety in the faculty of Humanities. There is absolutely no evidence of integration of modern biotechnology and biosafety concerns in curriculum or courses offered in the faculty. There are also no staff members competent in this area to engage either in teaching, research or community engagement. Modern biotechnology and biosafety and associated issues are unknown in the faculty and were deemed irrelevant for needs and purposes of the faculty. Interviews however revealed interest in knowing more about modern biotechnology and biosafety.

*Figure 3.5 Level of integration of modern biotechnology and biosafety in the faculty of Humanities*

**3.2.6 Faculty of Science and Engineering**

Integration of modern biotechnology and biosafety issues is lower than anticipated in the faculty of Science and Engineering. There is a low to moderate integration of modern biotechnology and biosafety issues and concerns in courses offered and on willingness among staff to teach as well as conduct research and community engagement in the field of biotechnology (Figure 3.6).

*Figure 3.6 Level of integration of modern biotechnology and biosafety in the faculty of Science and Engineering*

The data in Figure 3.6 above reflects the status in some departments that have integrated biotechnology issues more than others. For instance, the department of Biological Sciences exhibits a higher level of integration of modern biotechnology and biosafety issues in various levels of its operations (Figure 3.7). The curriculum of the department has several courses examination papers that are informed by both local and international modern biotechnology and biosafety issues and concerns while it also has students admitted into courses dealing with biotechnological issues and concerns. The members of staff also boast expertise in the field and show keen interest to teach as well as conduct research and community engagement on modern biotechnology and biosafety issues and concerns. There are also staff members with biotechnological expertise in the department of Chemistry with minor integration of modern biotechnology and biosafety issues in some courses and research.

*Figure 3.7 level of integration of modern biotechnology and biosafety in the department of Biological Sciences*

**3.2.7 Faculty of Social Sciences**

The level of integration of modern biotechnology and biosafety issues and concerns is very low in the faculty of Social Science (Figure 3.8). However, the curriculum of the faculty includes a few courses that touch upon aspects of biotechnology however students are not examined on biotechnological issues. Currently the faculty does not have staff with biotechnology expertise nor research and community engagement activities on biotechnology and biosafety issues and concerns.

*Figure 3.8 Level of integration of modern biotechnology and biosafety in the faculty of Social Sciences*

**3.2.8 UNISWA Institutes and Centres**

UNISWA has several institutes and centres. However, the study considered only three centres namely the University Research Centre (URC), Centre for Community Service (CCS) and University Planning Centre (UPC). These centres have direct relevance to UNISWA’s core business of teaching, research and community engagement.

*3.2.8.1 UNISWA Research Centre*

The URC encourages, facilitates and coordinates research at UNISWA. The Centre supports research in a number of ways including but not limited to funding, expertise as well as dissemination of research output through hosting open seminars and publications. The centre also acts as link between research activities at UNISWA with research partners outside of UNISWA. The indicators in Table 3.2 below were used to ascertain the level of integration of modern biotechnology and biotechnology in the programmes activities of the URC.

*Table 3.2 USAT codes and indicators for the UNISWA Research Centre*

|  |  |
| --- | --- |
| **Code** | **Indicator** |
| ***Research agenda and practice*** |
| **RA1** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research agenda |
| **RA2** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research policy |
| **RA3** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research practice |
| **RA4** | Are there financial resources dedicated to encouraging and supporting research in Biotechnology and Biosafety |
| **RA5** | To what extent has the focus/orientation of research at UNISWA been in way influenced by the national and global Biotechnology and Biosafety agenda? |
| **RA6** | To what extent is research at UNISWA paying attention to specifically the Cartagena Protocol on Biosafety. |
| **RA7** | To what extent is research at UNISWA paying attention to specifically the recently promulgated National Biosafety Act. 2012 and other national initiatives on Biotechnology and Biosafety. |
| **RA8** | Level of integration of Biotechnology and Biosafety in research topics and proposals submitted at the Centre for support |
|  | ***Criteria for allocation of research funding*** |
| **CA9** | Are Biotechnology and Biosafety issues and concerns part of UNISWA’s criteria for allocating internal research funds |
| **CA10** | To what extent do external funders emphasise research on Biotechnology and Biosafety issues in their guidelines? |
| **CA11** | Are there funds specifically set aside to encourage and support research on Biotechnology and Biosafety issues |
|  | ***Research collaborations***  |
| **RC12** | Level of collaborative between/among departments and faculties on Biotechnology and Biosafety issues. |
| **RC13** | Level of collaborative between/among departments and faculties at UNISWA with external partner institutions nationally and globally. |
| **RC14** | General cross department/faculty collaborative research proposals submitted to the Centre in the past five years |
|  | ***Staff expertise and willingness*** |
| **EW15** | Estimation of the level of expertise among UNISWA staff members in the area of Biotechnology and Biosafety |
| **EW16** | The extent to which staff members are willing to carry out research on Biotechnology and Biosafety aspects/topics |

|  |
| --- |
| **Box 1 URC statement guiding research**Researchers are expected to follow international, regional, and national trends and agreements, which normally come with associated agenda, through being up-to-date with literature and interacting with their colleagues. Environmental and sustainable development is a key trend and Swaziland has entered into agreements with other bodies to sustain the environment and development of the country. |

The level of integration of modern biotechnology and biosafety is still low with an indication that it would increase in the near future. This is demonstrated by the URC’s statement guiding research (Box 1) which alludes to importance of consideration of international trends and agreement where among is the Cartagena Protocol on Biodiversity (CPB)which seeks to mitigate adverse impacts of GE products and techniques to the environment as well as human and animal life. Moreover, the reported high level of willingness among staff to conduct research on biotechnology and biosafety issues (Figure 3.9) points towards improvement in the level of integration of biotechnology and biosafety in research. Further, it was reported that there are staff members in the URC data base with expertise to lead and conduct research activities in modern biotechnology and biosafety. The URC has research links with external partners nationally and internationally while it also coordinates collaborative research among departments and faculties at UNISWA. Figure 3.9 below shows that in recent times research focus and orientation has been in a way influenced by national and global modern biotechnology and biosafety issues and concerns.

*Figure 3.9 Level of integration of modern biotechnology and biosafety in the University Research Centre*

The URC endeavours to facilitate the coordination, accumulation and dissemination of knowledge and information through research and enhance economic growth and development and promote socio-cultural values. *Ad hoc* interview with the Director of the URC revealed that research priorities at UNISWA are in the development aspects of the country, including socio-economic, political and, human and natural resource management. Issues with potential to affect environment and sustainable development, such as application and use of modern biotechnology techniques and products are considered by the Technical Advisory Committee of the UNISWA Research Board when recommending research proposals for funding. In addition, the university now has an Ethical Conduct of Research Policy which caters for issues related to human, animal and, natural resources issues. However, the committee responsible for operationalizing the policy is not yet in place.

*3.2.8.2 Centre for Community Services*

The Centre for Community Services (CCS) was established following the university’s strategic plan which identified excellence in the provision of community service as an important element of the University’s core business alongside teaching and research (http://www.uniswa.sz/centres/ccs/index.htm). The CCS’s own vision and mission statements, articulated in its strategic plan emphasize issues of national development and quality and relevance of community services both of which are integral to sustainable development. This makes modern biotechnology and biosafety issues essential for consideration in the selection and implementation of community service activities. The indicators in Table 3.3 below were used to estimate the level of integration of modern biotechnology and biosafety issues in the Centre for Community Service (CCS).

*Table 3.3 USAT codes and indicators for the CCS*

|  |  |
| --- | --- |
| **Code** | **Indicator** |
| ***Community projects and practices*** |
| **CS1** | To what extent does the Centre engage in community projects that address biotechnology and biosafety concerns? |
| **CS2** | To what extent are biotechnology and biosafety issues influential in selecting community projects? |
| **CS3** | To what degree does the Centre emphasize or encourage departments or individuals involved in community engagement work to undertake projects that address biotechnology and biosafety issues in communities? |
| **CS4** | What is the level of commitment of departments or individuals involved in community engagement work to undertake projects that address biotechnology and biosafety issues in communities? |
| **CS5** | To what extent does the Centre collaborate with other stakeholders in addressing community challenges in the areas of biotechnology and biosafety? |
| **CS6** | The degree to which **local** biotechnology and biosafety issues and challenges inform the Centre’s strategy and policy  |
| **CS7** | The degree to which **globa**l biotechnology and biosafety issues and challenges inform the Centre’s strategy and policy  |
|  | ***Staff expertise and willingness*** |
| **CS8** | What is the level of expertise of staff of the Centre in the area of Biotechnology and Biosafety? |
| **CS9** | Estimation of the level of willingness among staff to undertake community outreach projects on biotechnology and biosafety issues. |

The level of integration of biotechnology and biosafety issues is very low or non-existent in the CCS. The Centre does not address modern biotechnology and biosafety issues nor emphasize their inclusion in community service activities in the institutions (Figure 3.10). Moreover, there is very little and remote influence exerted by biotechnology and biosafety issues in community service activities undertaken. Members of staff collaborating with the CCS have very limited expertise in modern biotechnology and biosafety. However, the willingness among staff to undertake community outreach projects on biotechnology and biosafety issues and concerns is very high.

*Figure 3.10 Level of integration of modern biotechnology and biosafety in the Centre for Community Services*

The centre encourages departments and individuals within UNISWA to undertake projects that address emerging and critical issues and concerns brought about by new technology and innovation among the local communities. This is part of CCS attempt to encourage staff and students’ organizations to engage in community activities and projects that would have positive impacts on people, economy and the environment. At present the CCS experiences a number of challenges which include lack of adequate institutional budget for community service, lack of specific time dedicated to community service, absence of incentives for staff and student participation in community service and others. The status of existence of an institutional community service policy is yet to be ascertained but the onus is on CCS to initiate the process leading to the formulation of the policy.

*3.2.8.3 University Planning Centre*

UNISWA has a University Planning Centre (UPC) which is responsible for all planning activities at the university. It was established in 2001 after the adoption of the university strategic plan which commits the university to self-renewal. Among other things, it is responsible for implementation of action plans of all new programmes and projects of the University. It networks with other units at the university through Faculty Planning Committees (FPCs) which are chaired by Deans or heads of units. *Ad hoc* interview reveals that the Centre was established to take a lead and give support to academic planning activities within the university; it therefore supports the academic departments’ efforts to mainstream emerging development issues such as application and use of modern biotechnology techniques and products in their curricula. It also liaises with the Physical Planning Department, which is responsible for estates, on new projects at the proposal stage making sure that the department protects and guarantees safety to the environment when it undertakes those new projects. The indicators in Table 3.4 below were used to estimate the level of integration of modern biotechnology and biosafety at the UPC.

*Table 3.4 USAT codes and indicators for the University Planning Centre*

|  |  |
| --- | --- |
| **Code** | **Indicator** |
| **Insti*tutional Policy*** |
| **IP1** | The extent to which the institution’s policy reflects an engagement with Biotechnology and Biosafety concerns |
| **IP2** | The degree to which national and global Biotechnology and Biosafety issues inform decision making processes in the institution |
| **IP3** | The level of support the institution gives to Biotechnology and Biosafety in its programmes and practices |
| **IP4** | Existence of Biotechnology and Biosafety related policies at the institution  |
| **IP5** | Integration of Biotechnology and Biosafety issues in institutional policies |
| **IP6** | Integration of aspects of Biotechnology and Biosafety in the institution’s vision and mission statement |
| **IP7** | Integration of aspects of Biotechnology and Biosafety in the institution’s strategic issues and objectives |
| **IP8** | Reflection of local Biotechnology and Biosafety challenges in policies and written statements |
| **IP9** | The degree to which policies and written statements reflect national and global Biotechnology and Biosafety issues |
| **IP10** | Implementation of policies of Biotechnology and Biosafety/Biotechnology and Biosafety related policies |
| **IP11** | Plans to improve Biotechnology and Biosafety focus in the next policy review cycle |
| **IP12** | The presence of a body responsible for biotechnology and biosafety at the institution |
|  | ***Institutional policy on staff*** |
| **PS13** | Consideration of aspects of Biotechnology and Biosafety in staff hiring decisions |
| **PS14** | Consideration of aspects of Biotechnology and Biosafety in orientation programmes for new staff members |
| **PS15** | Staff development in Biotechnology and Biosafety  |
| **PS16** | Staff rewards in Biotechnology and Biosafety activities  |
| **PS17** | Awareness raising in Biotechnology and Biosafety  |
| **PS18** | Institution driven celebrations or commemorations ensuring visibility of Biotechnology and Biosafety issues |

Figure 3.10 shows a moderate and encouraging level of integration of modern biotechnology and biosafety issues in the university’s policies. The level of integration is particularly higher in the reported existence of a body within the institution responsible for modern biotechnology and biosafety issues. Moreover, global and national biotechnology and biosafety issues and concerns informed decision making processes in the institution and local biotechnology and biosafety challenges are reflected in the institution’s policy statements. There is moderate integration of modern biotechnology and biosafety issues in the implementation of the institutions policies. In addition, the institution makes modern biotechnology and biosafety issues and concerns visible in the commemoration of relevant national and global events. However, UNISWA has not considered the inclusion of biotechnology and biosafety issues in the staff recruitment, development and induction programmes to raise awareness and importance of such issues among all staff members.

*Figure 3.10 Level of integration of modern biotechnology and biosafety in the University Planning Centre*

**3.2.9 Institutions affiliated to UNISWA**

Institutions affiliated to UNISWA include William Pitcher Teacher Training College, Ngwane Teacher Training College and Swaziland College of Technology. For data collection, a similar instrument to UNISWA’s faculties (Appendix 1) was used. In data presentation the indicators for assessment in Table 3.1 above were used. For purposes of this study, the affiliated institutions were treated similar to the University of Swaziland faculties. This worked relatively well for the teacher training colleges but not so well for SCOT.

*3.2.9.1 William Pitcher Teacher Training College*

At the William Pitcher College the integration of modern biotechnology and biosafety is very low (Figure 11). There are few courses that touch on aspects of modern biotechnology and biosafety and these are mainly in the science subjects such as Biology and Chemistry. Students seem not to be assessed or examined in this area even those in the Science stream. There are no research and scholarship activities in modern biotechnology and biosafety. The College also does not appear to be involved in community engagement activities that address modern biotechnology and biosafety issues and concerns. There is a moderate level of number of staff with modern biotechnology and biosafety expertise especially in the Science stream. Moreover, there is high level of willingness among the College staff to conduct research and community service on biotechnology and biosafety issues and concerns. The staff members are also willing to teach topics and courses integrating modern biotechnology and biosafety issues.

*Figure 3.11 Level of integration of modern biotechnology and biosafety at William Pitcher College*

*3.2.8.2Ngwane Teacher Training College*

Like William Pitcher College, Ngwane College has both Science and Arts streams alongside specialization in extra-curricular activities such as music and physical education. There is very low level of integration of modern biotechnology and biosafety issues in the entire College save for a few courses in the departments of Pure and Applied Sciences that touch upon aspects of modern biotechnology and biosafety albeit very weak (Figure 12). There are also very few staff members with expertise in modern biotechnology and biosafety especially in the Science stream. The only positive status is that aspects of the assessment that are of general application with little direct relevance to the subject such as ability to make informed decisions, critical thinking and others. The staff did not demonstrate any interest and willingness to teach as well as conduct research and community service on modern biotechnology and biosafety issues and concerns.

*Figure 3.12 Level of integration of modern biotechnology and biosafety at Ngwane College*

**3.3 SOUTHERN AFRICAN NAZARENE UNIVERSITY**

The Southern African Nazarene University (SANU) has three main faculties offering training in health sciences, education and theology from diploma qualifications to Bachelor’s degree. Overall, SANU has a lower level of integration of modern biotechnology and biosafety than anticipated. Figure 3.11 below shows moderate integration levels in the curriculum and staff. There are a number of courses that include modern biotechnology and biosafety issues. These are in the faculty of Health Sciences which also boasts of a moderate existence of staff with modern biotechnology and biosafety expertise and willing to teach as well as undertake research and community service on such issues. It was reported that the institutions undertakes community service activities informed by modern biotechnology and biosafety issues and collaborates with other stakeholders to address modern biotechnology and biosafety issues and concerns. The courses acquired from the faculties of Education and Theology indicate that these faculties have very little or nothing to do with modern biotechnology and biosafety. These faculties are responsible for the institution’s lower than anticipated level of integration of modern biotechnology and biosafety in its programmes and processes.

*Figure 3.11 Level of integration of modern biotechnology and biosafety at SANU*

**3.4 LIMKOKWING UNIVERSITY OF CREATIVE TECHNOLOGY**

Limkokwing University of Creative Technology’s programmes and courses indicate a highly ICT-based institution demonstrating with little or no emphasis on modern biotechnology and biosafety issues. Figure 3.12 below shows one of the lowest levels of integration of modern biotechnology and biosafety issues in teaching, research and community service. The only positive status observed is the willingness among staff to introduce aspects of modern biotechnology and biosafety in existing programmes and courses. Moreover, the shading noted in Figure 3.12 below pertains to general indicators with little direct relevance to integration of modern biotechnology and biosafety.

*Figure 3.12 Level of integration of modern biotechnology and biosafety at Limkokwing University of Creative Technology*

Limkokwing University of Creative Technology is a relatively new institution in Swaziland which conducted its first graduation ceremony in 2014 hence there is nothing much reported on research and community engagement. Other fundamental details about the institution were not readily available during the study.

**3.5 SWAZILAND COLLEGE OF TECHNOLOGY - SCOT**

The indicators in Table 3.1 above were used in the assessment of level of integration of modern biotechnology and biosafety at SCOT. Figure 3.13 below portrays a relatively low integration of modern biotechnology and biosafety in the College. However, there are impressive integration levels in the College curriculum as several courses offered include topics and aspect of modern biotechnology and biosafety. Some staff members also have expertise in the field while also demonstrating willingness to teach as well as conduct research and community service on biotechnology and biosafety issues and concerns. Moreover, some examination papers assess students on aspects of modern biotechnology and biosafety. There were very limited number of community service activities that addressed modern biotechnology concerns and biosafety issues.

*Figure 3.13 Level of integration of modern biotechnology and biosafety at SCOT*

**3.6 GWAMILE - VOCTIM**

Gwamile Vocational and Commercial Training Institute is one of the principal institutes of higher learning in Swaziland. It was founded in 1987 under the auspices of the German Technical Cooperation Agency (GTZ) and the Swaziland Government. The campus is located in Kwaluseni, in the centre of the country, about one kilometre from the University of Swaziland. The institution is commonly known as Gwamile-Voctim and it caters mainly for school leavers who failed to make it to O’ levels for one reason or another as it accepts the Junior Certificate for entry into the programmes offered.

The indicators in Table 3.1 above were used to estimate the level of integration of modern biotechnology and biosafety in the institution. Based on the indicators Gwamile-VOCTIM demonstrated a very low level of integration of modern biotechnology and biosafety concerns and issues in its teaching, research and community engagement activities (Figure 3.14). Moreover, there are no staff members competent in this area. Staff members in the Institute do not seem to engage in research or community activities that address modern biotechnology and biosafety challenges. However, they demonstrated willingness to undertake teaching as well as research and community service addressing modern biotechnology and biosafety issues and concerns.

*Figure 3.14 level of integration of modern biotechnology and biosafety at Gwamile-VOCTIM*

**3.7SWAZILAND SKILLS CENTRES**

The Swaziland Skills Centres are situated in Manzini, Nhlangano and Siteki under different names and areas of specialization as indicated in 1.2.7 above. Like Gwamile-Voctim, Swaziland Skills Centres offers vocational education in a variety of fields to Swazi students who did not perform well in school or make to higher educational levels. The training is more along the on-the-job training model and practical based with very minimum time spent attending class lessons. The indicators in Table 3.1 above were used in the estimation of level of integration of modern biotechnology and biosafety among the Swaziland Skills Centres.

The level of integration of modern biotechnology and biosafety was found to be low among the Swaziland Skills Centres. However, Figure 3.15 below shows a modest integration of biotechnology issues in the curriculum where some courses touch upon aspects of modern biotechnology and biosafety especially in the Agricultural training of the institutions. Moreover, there is willingness among staff to introduce aspects of modern biotechnology and biosafety in existing programmes and courses. Some examinations, oral or written, were found to assess students on modern biotechnology and biosafety issues albeit on very weak level. The Agricultural training wing has a huge potential of integrating biotechnology and biosafety issues particularly in crop production and poultry.

*Figure 3.15 Level of integration of modern biotechnology and biosafety in the Swaziland Skills Centres*

**3.8 CHRSITIAN MEDICAL UNIVERSITY**

Swaziland Christian University is a Christian international University that has its origins in Korea and offers a diversified curriculum with special focus on Medicine. The indicators in Table 3.1 above were used in the estimation of the level integration of modern biotechnology and biosafety in the institution. As anticipated, the CMU has a relatively higher level of integration of modern biotechnology compared to a majority of other institutions in the country. The curriculum has many courses that have aspects of modern biotechnology at varying levels. The examinations also assess students on varying aspects in the field of modern biotechnology and biosafety. The staff members have expertise in modern biotechnology and are currently teaching courses in this field including their high level of willingness to conduct research and community service addressing modern biotechnology and biosafety issues and concerns. Information on research outputs and community engagement projects was not available during the time of the study. Hence there was a low rating for the institutions on these aspects (Figure 3.16). However, this may be attributed to the fact that the institutions was opened less than year and had not yet started mounting and completed such activities.

*Figure 3.16 Level of integration of modern biotechnology and biosafety at the Christian Medical University*

**Chapter 4**

**ANALYSIS AND DISCUSSION**

**4.1 INTRODUCTION**

The main aim of the country’s education system is to produce an enlightened and participant citizenry that has skills and knowledge to contribute positively to economic and social development (Ministry of Education and Training 2011). This is the principle guiding the intentions to integrate modern biotechnology and biosafety in the country’s tertiary institutions. Chapter 3 above presented information that helped to ascertain the level of integration of modern biotechnology and biosafety in programmes and processes of local institutions of higher learning and training. This chapter synthesizes the information in Chapter 3 mainly to portray a national picture on the level of integration of modern biotechnology and biosafety. The discussion of the integration status focused on the three core operation areas of institutions of higher education and training in the country. These core areas are teaching, research and community engagement. It must be noted and taken into account that the study was able to acquire detailed information on the University of Swaziland. This is understandable because for a long time UNISWA has been the only university in the country and currently it is the largest institution accounting for 24% of 38% students that make it to tertiary education (Mahlahat, 2011).

**4.2 LEVEL OF INTEGRATION IN TEACHING**

In all the core areas of operation of institutions of higher education and training teaching is particularly significant in the integration of modern biotechnology and biosafety in the institutions. In that way teaching addresses directly the education sector policy’s intentions of creating an enlightened nation. The set up and operation of institutions in the country demonstrate a common denominator which is teaching. Research and community service are admittedly treated superficially in a majority of the institutions except the UNISWA. This therefore, places teaching at the heart of institutional responses to integration of new ideas, technologies and innovations as the country advances in its various aspects of development. The importance of application and use of modern biotechnology techniques and products is increasingly being recognized in the country and by the academia as the country grapples with challenges of health, food insecurity, economic development and others. The dangers associated with use of modern biotechnology are fully appreciated hence the promulgation of the National Biosafety Act of 2012 by the Government of Swaziland. At present many higher education institutions are involved in the investigation of salient attributes graduates should possess besides the common disciplinary qualification when they leave universities and colleges. Information from such research is still scanty especially in Africa but Nhamo (2011) is of the view that education must put emphasis on teaching issues and concerns with potential negative impact on sustainable development.

The extent of implementation of sustainable development in teaching varies from one institution to another and with faculties and disciplines. Among the institutions studied an appreciable level of integration of modern biotechnology and biosafety was noted in science and medical based institutions and faculties. While the general integration level is low at UNISWA, the faculties of Agriculture, Health Sciences and Science and Engineering showed a moderate to higher degree of integration of modern biotechnology and biosafety compared to the other four faculties. As noted above the departments of Animal Science, Crop Production, Biological Sciences and Chemistry to some extent interact with the modern biotechnology theory and practice. However, the CMU, which is primarily a medical institution, demonstrated an above average integration level of integration of modern biotechnology and biosafety. This is due to the fact that this field has made significant inroads into medicine especially in the area of vaccines. A majority of courses in the institutions have aspects of modern biotechnology and biosafety. SANU’s faculty of Health Sciences demonstrated a significant level of integration of biotechnology issues especially in the nursing courses. The teacher training colleges, SCOT and the vocational centres demonstrated very low levels of integration. However, the departments of science education, agricultural training had some courses touching on aspects of modern biotechnology and biosafety. These institutions do not have training programmes or short courses on modern biotechnology which is consistent with a situation that was established by Dlamini & Mabuza-Dlamini (2003) in a study they conducted early in the 2000 decade.

For purposes of creating an enlightened society on modern biotechnology and biosafety issues and concerns it is imperative that all institutions, faculties and departments integrate aspects of modern biotechnology and biosafety in their programmes and courses. The significance and dangers of application and use of modern biotechnology must be part of knowledge local graduates should have acquired on their exit from tertiary institutions. Moreover, graduates must also be aware of the various ways of management of biotechnology techniques and products within the basic understanding of the recently promulgated national Biosafety Act.

It was interesting to observe that while institutions and faculties appear to have integrated modern biotechnology and biosafety aspects in content of some courses, these courses are not necessarily compulsory. This may imply that chances students may go through an institution or faculty with courses integrating aspects of modern biotechnology without having exposure to it. However, this may not be the case at CMU and the faculties of Health Sciences at UNISWA and SANU as well as departments of Animal Science, Crop Production and Biological Sciences at UNISWA where modern biotechnology and biosafety are integrated in most of the courses that all students take. In that way students are directly exposed to modern biotechnology and biosafety issues and concerns. Some respondents interviewed in this study suggested making courses offering aspects of modern biotechnology and biosafety mandatory. Other opinions indicate that such a suggestion may not be a solution instead we need to consider contextualizing and mainstreaming of modern biotechnology and biosafety within programmes, disciplines and courses so that students can understand the relationship between their chosen programmes and courses with modern biotechnology in the curriculum and pursuit of sustainable development.

While integration of modern biotechnology and biosafety is generally low in higher education institutions in the country, the fact that at least some modern biotechnology content exists in some institutions is an advantage and reason for optimistic outlook pertaining to its integration in the near future since it gives institutions starting points. Though a comprehensive assessment of departments, disciplines and courses was not possible given time and other technical limitations, this study observed that a number of courses in each of the institutions and faculties studied could be potential vehicles for programmes and courses that have integrated modern biotechnology and biosafety issues and concerns fully. As observed above the potential to integrate modern biotechnology and biosafety differs among institutions and disciplines but at least it gives them “somewhere to start” or entry points in the integration of modern biotechnology and biosafety.

The integration of modern biotechnology and biosafety in teaching is not merely aimed at assisting students to pass examinations and get employed but also to promote and inculcate values that students should uphold in their life after tertiary education. The values should enable students to participate in finding solutions to concerns and challenges that may be due to application and use of modern biotechnology techniques and products. This observation was made by Togo and Nhamo (2011) with respect to teaching of environment and sustainability in universities. This also applies to the use of examinations where there some values and stewardship promoted in teaching that may be difficult to be assessed through examinations. Such values normally manifest themselves in voluntary community outreach programmes students undertake. Unfortunately, there are very few examples of projects mentioned during the study. Examination of values and stewardship may not be enough. Where possible, it could help students take modern biotechnology and biosafety seriously. Moreover, it is difficult to evaluate internalisation of sustainability values except maybe by observing whether students are applying it in their day to day lives. This is however difficult to do in a university context and, at the same time might turn out to be costly. It is therefore important that universities employ teaching approaches that “contribute to the development of critical thinking skills, capacity to make informed decisions, a sense of responsibility, respect for the opinions of others and integrated problem solving skills among students” (Togo and Lotz-Sisitka, 2009:10). To an extent, departments at UNISWA employ such teaching approaches (Togo, 2011).

**4.3 LEVEL OF INTEGRATION IN RESEARCH**

All institutions of higher education and training are expected to conduct research as one of their core functions through which they respond to national sustainable development issues and concerns. It is often mentioned that higher education institutions should be involved in research that contributes and promotes national development goals and sustainable utilization of national environmental resources. The level of research conducted by local institutions is very low not to mention research focusing on modern biotechnology and biosafety. It is only at UNISWA where research is prominent since there is actually a centre facilitating and coordinating research (URC). There is also evidence of on-going research, completed and published research reports in all faculties and departments (Vice Chancellor’s Report, 2013). Integration of modern biotechnology and biosafety issues is however very low and this is mainly due to limited specialised capacity and trained personnel as well as low level of awareness of modern biotechnology and biosafety among staff members especially from the non-Science faculties and departments. A similar situation was observed by Dlamini and Dlamini (2012) in a GEF-funded capacity building research project they undertook to identify bottlenecks and constraints of the implementation of the NBF and the Cartagena Protocol. It was mentioned that increase in research activities and output in this field would only be realised if most of the researchers (teaching staff) are made aware and equipped with basic knowledge and understanding of modern biotechnology and biosafety issues and concerns. This situation may also be the case in the other institutions of higher education and training except CMU.

Moreover, the research agenda at UNISWA is shaped, with the facilitation of the URC, by research priorities themes submitted by the various faculties. With adequate awareness and knowledge staff members in the faculties may include aspects of modern biotechnology and biosafety in their research priorities. The multi-stakeholder approach in which the URC is operated has a potential to increase the relevance of the research themes in various sectors at UNISWA and in the country’s society and economy. If the research priority areas are successfully implemented through the URC, this will definitely enhance the relevance of UNISWA’s research outputs to national development goals. Therefore, it is important that interdisciplinary research is encouraged when implementing the research priories. This will result in research projects that are located in the broad environment and sustainability context where modern biotechnology is situated, therefore helping researchers to understand interdependencies and interconnections of disciplines.

Research in the other universities, though recognised as one of the key areas of their responsibilities, is approached and conducted at superficial level due to a number of factors. Some of the key factors include absence of institutional policy and structures responsible for research as well as lack of basic resources to facilitate and support research. The integration of modern biotechnology and biosafety was found to be low in the institutions including UNISWA. However, there is an obvious potential for growth in research activities and outputs especially in local institutions especially those offering programmes and training in the field of medicine such as CMU and faculty of Health Sciences at SANU. There were no institutional policy statements from most of the local institutions but respondents were aware of their institutions' roles to undertake research.

It must be noted that Ethical Conduct of Research Policy considers protection of human and animal research subjects during research. This makes consideration of issues of biosafety significant in research. Some research results and recommendations may suggest application and use of modern biotechnology techniques and products unaware of their potential impacts on biodiversity and human life as well as majors for handling and transportation of modern biotechnology products and materials. This proves the importance of exposure of researchers to basic understanding and knowledge of modern biotechnology and biosafety issues and concerns.

**4.4 LEVEL OF INTEGRATION IN COMMUNITY ENGAGEMENT**

Community service has been contextualized in institutions of higher education and training within a systems framework. Figure 4.1 below is a nested systems model which shows how the community service initiatives are placed within society and education. Community service needs and problems may be acquired directly from the community and be addressed directly by an institutional structure responsible for community service. Alternatively, community needs and problems may be identified and derived directly from the community through educational activities (teaching and field research) to inform institutional community service structures. Addressing such needs and problems may be undertaken from the education sphere through fieldwork and community educational exercises conducted by staff and students. Alternatively, the community needs may be addressed at the institutional community service structure with the participation of students and staff through initiated fieldwork and other field activities.

*Figure 4.1 Contextualization of community service in higher education institutions based on the systems approach (****Adapted from Togo, 2011b****)*

Community service is the vehicle through which institutions of higher education and training communicate and interact with their communities (Togo, 2011). Through community service institutions are able to situate themselves within the context of the environment where they are located. In this way higher institutions will not be viewed as ‘ivory towers’ isolated from the socio-economic and political problems of the surrounding communities. Ideally higher education institutions are expected to reach out to society to develop healthy relations and assist communities understand some of the development issues which impact on the sustainability of their communities (Wright, 2002). It is important that higher education institutions undertake and attach significance to interventions made in local communities which are not necessarily educational but can directly avert some sustainable development challenges.

The study revealed that local institutions undertake community service activities at varying levels and approaches. In most institutions community service is undertaken on *ad hoc* basis by staff and in most cases by students’ clubs and societies. It is only at UNISWA where community service is approached in a structured manner through the established Centre for Community Service. However, in all institutions there were a negligible number of community service projects, if any, addressing community modern biotechnology and biosafety issues and concerns.

Another observation made from the research is the role of community service in supporting research and teaching in particular. Community service exposes staff to potential research issues especially observed or derived from community needs and concerns. Moreover, community service exposes students to practical and hands-on experience on issues through participation in activities applying theoretical knowledge acquired from classroom lessons. According Martin, *et. al. (*2006) community service offers experiential learning and can be employed to complement teaching. Experiential learning is employed at UNISWA and other institutions in the form of fieldwork and field excursions as part of the student’s learning experience. Fieldwork enables students to gain hands-on experience and to deal with real issues and people in the community.

**4.5 LEVEL OF INTEGRATION IN STUDENTS ACTIVITIES**

Due to unforeseen circumstances, the study did not involve student clubs and societies that exist in all the institutions that participated in the study. However, the level of integration of modern biotechnology and biosafety among students’ bodies may be estimated from the findings made in the various institutions. If that is anything to go by the level of integration of modern biotechnology and biosafety in students’ activities is expected to be generally low.

**Chapter 5**

**CONCLUSION AND RECOMMENDATIONS**

**5.1 INTRODUCTION**

The chapter draws conclusions from the discussion made in Chapter 4 above and further makes recommendations for improving the level of integration of modern biotechnology and biosafety in programmes and processes in institutions of higher education and training in Swaziland. The conclusion would be based on the three core areas of responsibility for institutions of higher education and training namely teaching, research and community service or engagement.

**5.2 CONCLUSION**

The study established that there was generally a low level of integration of modern biotechnology and biosafety issues in higher education institutions in the country. Though low levels of integration were observed, levels of integration tended to vary among institutions and faculties within institutions. Generally moderate levels of integration of modern biotechnology and biosafety were noted in science based and medical oriented institutions and faculties where there were programmes and courses either teaching or examining students on modern biotechnology. However, courses with modern biotechnology and biosafety content are offered in individual faculties and disciplines and not in a holistic interdisciplinary manner thus reducing their impacts in scaling up integration of modern biotechnology and biosafety within the institutions.

It was difficult to discuss research and community service in an elaborate manner in a majority of the institutions since very little data was availed for the study. The University of Swaziland is the only institutions with research and community service structures and programmes of action. UNISWA also had a register of research activities reported and disseminated in a number of ways including annual Vice Chancellor’s reports, seminar registers as well as research reports and two refereed journals (UNISWA Research Journal of Agriculture Science and Technology (UREJAST) and the UNISWA Research Journal (UREJ). There were very few research articles on modern biotechnology and biosafety while most of the community service projects undertaken did not address the community’s modern biotechnology issues and concerns.

There was no discussion of the UNISWA’s Planning Centre (UPC) since a structure like this one does not exist in almost all the institutions in the country. However, similar functions are performed by other institutional structures simultaneously with other functions. The UPC and similar structures have a crucial role in the planning of institutional programmes and operations. They ensure formulation and implementation of institutional policies and strategic plans. Successful integration of new and emerging issues into programmes and practices is facilitated by institutions’ planning centres and departments.

Capacity in modern biotechnology and biosafety is also lacking in many institutions and faculties. There was limited availability of teaching and research personnel in a majority of the institutions studied. The situation was better in the CMU and science and health oriented faculties in the universities and training colleges. However, a high level of willingness among staff was observed especially to teach as well as undertake research and community service that address modern biotechnology and biosafety issues and concerns. The staff requires relevant capacity building to be able to integrate modern biotechnology and biosafety in their teaching, research and community service activities.

A number of challenges negatively affecting the integration of modern biotechnology and biosafety were noted in the discussion above. The main challenges include lack of resources such as finance, well capacitated personnel as well as low level of awareness of biotechnology and biosafety among administrators and staff in the institutions. In addition, most written policy statements in the institutions do not reflect modern biotechnology and biosafety issues as there are neither policies nor strategic objectives on modern biotechnology and biosafety. Policy and strategic objectives clearly articulating inclusion of modern biotechnology and biosafety are needed for effective integration of modern biotechnology and biosafety in local institutions of higher education and training.

**5.3 RECOMMENDATIONS**

The recommendations made below are derived from the findings of the study as well as the challenges to integrate of modern biotechnology and biosafety presented above. The recommendations mainly address the problems of low level of awareness, lack of understanding and knowledge of modern biotechnology and biosafety issues, non-inclusion of modern biotechnology issues in institutional policy statements and of both human and financial resources to support integration of modern biotechnology and biosafety in programmes and processes in institutions of higher education and training in the country.

**5.3.1** **Creating awareness about modern biotechnology and biosafety**

There is need for creating awareness of modern biotechnology and biosafety as well as issues and concerns associated with application and use modern biotechnology techniques and products. The awareness creation must also include understanding what modern biotechnology entails in the context of the institutions. It is important that awareness creation campaigns are undertaken in the institutions targeting all staff members and students. Having a dedicated website which captures modern biotechnology and biosafety issues and practices being implemented can help in raising awareness among staff members in the institutions the university to participate. Some institutions were reported to be publishing newsletters periodical which can also be used to disseminate information on modern biotechnology and biosafety to staff members and students.

**5.3.2** **Enhance level of understanding and knowledge of modern biotechnology and biosafety**

It is important for staff, as implementers of the integration of modern biotechnology, to be capacitated with basic understanding of modern biotechnology especially what it means recognizing that there is currently lack of understanding of what it is. Moreover, there could be different meanings and interpretations that are attached to the modern biotechnology so that a common understanding of the concept is achieved in the context of the institutions. It is highly recommended that institution-based training workshops for all staff and leaders of students’ clubs and societies be undertaken. Such training workshops would expose participants to, among other things, basic understanding of the technology, its benefits and dangers as well as the intentions and functions of the national Biosafety Act of 2012.

It is crucial that the initiatives to enhance the understanding of modern biotechnology and biosafety be extended to senior management and individuals occupying influential positions in the various divisions of the institutions (faculties, centres, departments). This is helpful to acquire their buy-in and support for initiatives to integrate modern biotechnology and biosafety in institutional programmes and practices. At UNISWA divisions such as the University Planning Centres, Human Resources Office and Physical Planning influence the operations of other departments and units of the institution. For instance, some decisions made in these divisions may lead to development of a UNISWA environmental or sustainability policy with modern biotechnology and biosafety issues included which other units within the institutions would be obligated to implement thereby infusing modern biotechnology and biosafety in their operations as well.

**5.3.3 Institutionalization of modern biotechnology and biosafety**

Lessons from the mainstreaming of environment and sustainability has shown that institutionalization of issues to be mainstreamed in the institutions is important. In simple terms, institutionalization refers to placing or locating an activity within existing structures within institutions. What is suggested is that initiatives aimed at integrating modern biotechnology and biosafety be deliberately placed within existing relevant departments or divisions within institutions. This benefits the initiatives in a number of ways including being accepted and recognised as the institution’s activity alongside others (garnering a sense of belonging). Moreover, the initiative benefits from access to institutional resources accorded to the structure they placed it in. The institutional resources are both financial and material. For example, the mainstreaming of environment and sustainability was placed under the Academic Development Centre, a structure providing in-service training to all staff members, and it benefits from institutional support such as secretarial services, handling of logistics for workshops and seminars, office space, access to internet and others.

**5.3.4 Appointment and training of focal points for modern biotechnology and biosafety**

Every new techniques or innovation needs champions and advocates facilitating its uptake by users. Institutional focal points or champions would play a significant role in rallying staff to be acquainted with modern biotechnology and biosafety issues. Focal points are the interface between the source of the innovation and staff members who are expected to adopt and operationalize the technology. Modern biotechnology is a highly scientific and technical field that needs to be demystified and simplified to be comprehended by the entire staff and students in the institutions of higher education and training. Properly trained and capacitated institutional focal points would play this critical role in the various institutions where they are based.

**5.3.3 Use of incentives**

The incentives are commonly in the form of awards that varying in their nature. Awards may be used to encourage interest among staff members to participate in initiatives aimed at the integration of modern biotechnology and biosafety in programmes and processes in the institutions. Ideally, staff members need to be encouraged to undertake teaching, research and community service activities addressing modern biotechnology and biosafety issues and concerns. Awards may be dedicated to say community outreach, research and/or teaching and should be instituted for best practices in for example activities that address management modern biotechnology based project or campus based measures to prevent environmental damage by use of modern biotechnology products or techniques. Other awards may in the form of research grants or staff development opportunities in modern biotechnology and biosafety as well as financial awards to facilitate participation of staff in national and international conferences and research activities on modern biotechnology and biosafety. Incentives could also be in the form of competitions, for example writing of academic essays addressing community biotechnology and biosafety issues and concerns.

**5.3.5 Inclusion of modern biotechnology and biosafety issues in institutional policy and strategic plans**

Most policy statements in the institutions studied did not include modern biotechnology and biosafety issues. There is, therefore, an obvious need for re-orienting institutional written statements and policy that make modern biotechnology visible. The formulation of institutional policy on environment and sustainable development is recommended and must include modern biotechnology and biosafety issues as institutions’ direct adherence to the implementation of the national Biosafety Act of 2012. The policy will also help to operationalize the institutions’ written statements on modern biotechnology. A research and community engagement policy which mainstreams modern biotechnology and biosafety could also be developed.

**5.3.6 Mainstream modern biotechnology and biosafety in programmes and practices**

The findings indicated a low level of integration of modern biotechnology and biosafety in programmes and processes in the local institutions of higher education and training. There is, therefore, a need to improve mainstreaming of modern biotechnology and biosafety in programmes and courses offered by the institutions. Mainstreaming can be done in existing programmes and mandatory courses, like the HIV/AIDS, in institutions where they exist. This has to be done in such a way that modern biotechnology takes precedence and students are introduced to the fundamentals of the field or subject first and then how it relates or interfaces with other different disciplines such as Agriculture, health, commerce and others. HIV/AIDS, for instance, would then be taught as one of the main beneficiaries of modern biotechnology thus easing the socio-economic burden it has placed on the country’s people and economy. Mainstreaming modern biotechnology in courses at discipline level can be done in a way that shows how each of the disciplines inter-connects with what students have learnt in the mandatory course. This should also be done in a manner that does not dilute the subject content of the discipline and increase focus on biotechnology.

Mainstreaming can also be possible in non-teaching processes within the institutions. For instance, the Human Resources department may mainstream modern biotechnology in the staff development policy and recruitment criteria. For example, there will be a score range a potential employee being recruited should attain in the category of knowledge and understanding of modern biotechnology and biosafety issues. The Human Resource department may also develop a programme for orienting new staff which includes aspects of modern biotechnology and biosafety.

**5.3.7 Avail resources to support integration of modern biotechnology and biosafety**

There is need to allocate resources (especially finance) specifically to support institutional initiatives to integrate modern biotechnology and biosafety. Financial resources can be allocated for inter-departmental projects that seek to integrate biotechnology issues and promote its understanding in the local communities. Above we suggested institutionalization of integration of modern biotechnology initiatives as a way of accessing budgetary support to such initiatives.

**5.3.8 Integrate modern biotechnology and biosafety through community service**

Community service provides various forms of experiential learning of modern biotechnology and biosafety that can be infused in the curricula (e.g. fieldwork, work integrated learning and research). This kind of learning enhances the development of problem solving skills among students. Institutions and faculties may choose to implement forms of experiential learning which work better than with lessons in their disciplines. Modern biotechnology and biosafety community outreach projects can also be promoted among students studying disciplines which do not have much biotechnology content or are failing to mainstream it for any particular reason.

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**APPENDICES**

**Appendix 1 USAT AND INTERVIEW GUIDE FOR FACULTIES (IN THE CASE OF UNISWA) AND OTHER INSTITUTIONS**

**Unit-based Sustainability Assessment Tool (USAT)**

***PART A***

**Teaching, Research and Community Service**

**Biotechnology** is the use of microorganisms, such as bacteria or yeasts, or biological substances, such as enzymes, to perform chemical processing in applications including production of food substances such as cheese, wine and beer as well as non-food substances such as antibiotics, genetically engineered vaccines and hormones, bioconversion of organic waste for environmental clean-ups such as oil spills (this is accomplished through the use of a genetically engineered bacteria).

**Biosafety** is the maintenance of safe conditions in biological research or processes to prevent harmful impacts to the non-laboratory organisms and the environment as well human beings. For instance the precautions taken to control the cultivation and distribution of genetically modified crops and products.

The University of Swaziland, through the MESA Implementation Committee (MIC) is collaborating with the Swaziland Environment Authority (SEA) to implement a project aimed at integrating Biotechnology and Biosafety in programmes and practices of institutions of higher education and training in Swaziland. As one of the activities in the project the MIC is conducting an audit to establish the prevailing status of integration of Biotechnology and Biosafety issues at UNISWA. The MIC is using the Unit-based Sustainability Assessment Tool (USAT). USAT is an adaptable tool that was originally designed to assist in assessing the extent to which university departments engage in sustainable development concerns in core activities such as teaching, research and outreach activities. In the use of the USAT you are requested to give your impressionon the identified dimensions of your Centre using the assessment criteria below.

|  |
| --- |
| ***Assessment Criteria******X = Don’t know:*** *No information concerning the practice****0 = None:*** *There is total lack of evidence on the indicator****1 = A little:*** *Evidence show poor performance* ***2 = Adequate:*** *Evidence show regular performance* ***3 = Substantial:*** *Evidence show good performance****4 = A great deal****: Excellent performance* |
|  |

|  |
| --- |
| **Score** |
| **Code** | **Indicator** | **x Don’t know** | **0 None** | **1 A little** | **2 Adequate** | **3 Substantial** | **4 A great deal** |
|  | **Curriculum** |
| **CU1** | The extent to which the department offer courses that engage Biotechnology and Biosafety concerns |  |  |  |  |  |  |
| **CU2** | The level of integration of Biotechnology and Biosafety topics in courses referred to above |  |  |  |  |  |  |
| **CU3** | The degree to which local Biotechnology and Biosafety issues and challenges form part of the department’s teaching programme |  |  |  |  |  |  |
| **CU4** | The degree to which global Biotechnology and Biosafety issues and challenges form part of the department’s teaching programme |  |  |  |  |  |  |
| **CU5** | The extent to which the department enroll students in courses that engage Biotechnology and Biosafety concerns |  |  |  |  |  |  |
| **CU6** | The level of cross faculty collaboration in teaching Biotechnology and Biosafety programmes |  |  |  |  |  |  |
|  | **Teaching approach****How far the teaching approach contributes to development of the following characteristics among students:** |  |
| **TE7** | The capacity to make informed decisions  |  |  |  |  |  |  |
| **TE8** | Critical thinking skills  |  |  |  |  |  |  |
| **TE9** | A sense of responsibility |  |  |  |  |  |  |
| **TE10** | Respect for the opinions of others  |  |  |  |  |  |  |
| **TE11** | Integrated problem solving skills  |  |  |  |  |  |  |
|  | **Research and scholarship activities** |  |
| **RS12** | The extent to which the department (staff and students) is involved in research and scholarship in the area of Biotechnology and Biosafety |  |  |  |  |  |  |
| **RS13** | The degree to which global Biotechnology and Biosafety issues and challenges form part of the department’s research  |  |  |  |  |  |  |
| **RS14** | The degree to which local Biotechnology and Biosafety issues and challenges form part of the department’s research  |  |  |  |  |  |  |
| **RS15** | The extent to which the department is collaborating with other faculties, institutions and stakeholders in pursuit of solutions to Biotechnology and Biosafety problems |  |  |  |  |  |  |
| **RS16** | The extent to which aspects of sustainable development are used in selection/execution of research |  |  |  |  |  |  |
| **RS17** | The level to which aspects of sustainable development are reflected in the department’s research outputs |  |  |  |  |  |  |
|  | **Community Engagement** |  |
| **CE18** | The extent to which the department (staff and students) is involved in community engagement in the area of Biotechnology and Biosafety |  |  |  |  |  |  |
| **CE19** | The level of commitment of the department’s resources in Biotechnology and Biosafety projects in the community |  |  |  |  |  |  |
| **CE20** | The degree to which local Biotechnology and Biosafety issues and challenges form part of the department’s community engagement |  |  |  |  |  |  |
| **CE21** | The extent to which the department collaborates with other stakeholders in addressing community Biotechnology and Biosafety challenges |  |  |  |  |  |  |
| **CE22** | The extent to which aspects of sustainable development are used in selection/execution of community engagement projects |  |  |  |  |  |  |
|  | **Examination (assessment) of Biotechnology and Biosafety topics** |  |
| **EX23** | The extent to which Biotechnology and Biosafety aspects are assessed/examined during course |  |  |  |  |  |  |
| **EX24** | The extent to which Biotechnology and Biosafety aspects are considered in evaluating/assessing projects |  |  |  |  |  |  |
| **EX25** | The degree to which Biotechnology and Biosafety aspects are assessed in evaluating service learning programmes |  |  |  |  |  |  |
|  | **Staff expertise and willingness to participate** |  |
| **ST26** | The level of expertise of staff members in the area of Biotechnology and Biosafety |  |  |  |  |  |  |
| **ST27** | The extent to which staff members are willing to carry out research and service activities on Biotechnology and Biosafety aspects/topics |  |  |  |  |  |  |
| **ST28** | The extent to which staff members are willing to teach Biotechnology and Biosafety topics |  |  |  |  |  |  |
|  | Others (please specify): |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

***USAT Part B***

**Opinions and Documents**

**OD29**

Do you teach any Biotechnology and Biosafety topics (e.g. ecological, socio-economic, political, etc.) in courses in your department? Explain and give examples of topics and courses.

**OD30**

Is it mandatory for students to take a course on issues related to Biotechnology andBiosafety?

**OD31**

In your Faculty, do the students undertake research that in a way addresses Biotechnology and Biosafety issues? Please explain.

**OD32**

Describe how the knowledge existing in your Faculty being applied to Biotechnology and Biosafety concerns in the surrounding community.

**OD33**

Are there any partnerships between your Faculty and other Faculties, universities and /or other stakeholders (NGOs, Businesses, Municipalities, etc.) or any other partnerships in which Biotechnology and Biosafety issues are given visibility? Please explain.

**OD34**

What other Biotechnology and Biosafety practices (if any) do you emphasise on as a Faculty?

**OD35**

Regarding the taking up of Biotechnology and Biosafety topics/issues in teaching, research, community engagement and other operations, how do you think this can be encouraged so as to become at least a component of factors influencing the focus of such activities?

**OD36**

Do you think there is room for improving the Biotechnology and Biosafety focus of your Faculty? If so can you explain how that can be done?

**OD37**

Please provide a list of 2010/11 to 2012/13 Faculty and student research projects (publications and dissertations) with some coverage of Biotechnology and Biosafety issues and concerns.

**OD38**

Please provide a list of community engagement projects with some coverage of Biotechnology and Biosafety issues and concerns.

**Appendix 2 USAT AND INTERVIEW GUIDE FOR UNISWA RESEARCH CENTRE**

**Unit-based Sustainability Assessment Tool**

***USAT Part A***

**Biotechnology** is the use of microorganisms, such as bacteria or yeasts, or biological substances, such as enzymes, to perform chemical processing in applications including production of food substances such as cheese, wine and beer as well as non-food substances such as antibiotics, genetically engineered vaccines and hormones, bioconversion of organic waste for environmental clean-ups such as oil spills (this is accomplished through the use of a genetically engineered bacteria).

**Biosafety** is the maintenance of safe conditions in biological research or processes to prevent harmful impacts to the non-laboratory organisms and the environment as well human beings. For instance the precautions taken to control the cultivation and distribution of genetically modified crops and products.

The University of Swaziland, through the MESA Implementation Committee (MIC) is collaborating with the Swaziland Environment Authority (SEA) to implement a project aimed at integrating Biotechnology and Biosafety in programmes and practices of institutions of higher education and training in Swaziland. As one of the activities in the project the MIC is conducting an audit to establish the prevailing status of integration of Biotechnology and Biosafety issues at UNISWA. The MIC is using the Unit-based Sustainability Assessment Tool (USAT). USAT is an adaptable tool that was originally designed to assist in assessing the extent to which university departments engage in sustainable development concerns in core activities such as teaching, research and outreach activities. In the use of the USAT you are requested to give your impressionon the identified dimensions of your Centre using the assessment criteria below.

|  |
| --- |
| **Assessment Criteria****X = Don’t know:** No information concerning the practice**0 = None:** There is total lack of evidence on the indicator**1 = A little:** Evidence show poor performance **2 = Adequate:** Evidence show regular performance **3 = Substantial:** Evidence show good performance**4 = A great deal**: Excellent performance |
|  |

|  |
| --- |
| **Score** |
| **Code** | **Indicator** | **x Don’t know** | **0 None** | **1 A little** | **2 Adequate** | **3 A great deal** | **4 Sub-total** |
|  | **Research agenda and practice** |
| **RA1** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research agenda |  |  |  |  |  |  |
| **RA2** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research policy |  |  |  |  |  |  |
| **RA3** | To what extent are Biotechnology and Biosafety issues and concerns given visibility in UNISWA’s research practice |  |  |  |  |  |  |
| **RA4** | Are there financial resources dedicated to encouraging and supporting research in Biotechnology and Biosafety |  |  |  |  |  |  |
| **RA5** | To what extent has the focus/orientation of research at UNISWA been in way influenced by the national and global Biotechnology and Biosafety agenda? |  |  |  |  |  |  |
| **RA6** | To what extent is research at UNISWA paying attention to specifically the Cartagena Protocol on Biosafety. |  |  |  |  |  |  |
| **RA7** | To what extent is research at UNISWA paying attention to specifically the recently promulgated National Biosafety Act. 2012 and other national initiatives on Biotechnology and Biosafety. |  |  |  |  |  |  |
| **RA8** | Level of integration of Biotechnology and Biosafety in research topics and proposals submitted at the Centre for support |  |  |  |  |  |  |
|  | **Criteria for allocation of research funding** |
| **CA9** | Are Biotechnology and Biosafety issues and concerns part of UNISWA’s criteria for allocating internal research funds |  |  |  |  |  |  |
| **CA10** | To what extent do external funders emphasise research on Biotechnology and Biosafety issues in their guidelines? |  |  |  |  |  |  |
| **CA11** | Are there funds specifically set aside to encourage and support research on Biotechnology and Biosafety issues |  |  |  |  |  |  |
|  | **Research collaborations** |
| **RC12** | Level of collaborative between/among departments and faculties on Biotechnology and Biosafety issues. |  |  |  |  |  |  |
| **RC12** | Level of collaborative between/among departments and faculties at UNISWA with external partner institutions nationally and globally. |  |  |  |  |  |  |
| **RC13** | General cross department/faculty collaborative research proposals submitted to the Centre in the past five years |  |  |  |  |  |  |
|  | **Staff expertise and willingness** |  |  |  |  |  |  |
| **EW14** | Estimation of the level of expertise among UNISWA staff members in the area of Biotechnology and Biosafety |  |  |  |  |  |  |
| **EW15** | The extent to which staff members are willing to carry out research on Biotechnology and Biosafety aspects/topics |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

***USAT Part B***

**Opinions and Documents**

**OD 16**

Promoting integration or uptake of Biotechnology and Biosafety issues and concerns in university operations and functions (including research) has in most cases been at the level of a few enthusiastic individuals.

***How can this initiative be promoted to become a focus at institutional level (in research)***

***What role do you think your Research Centre can play in the process?***

**OD17**

May you provide any of the following documents (if available) for review purposes:

* ***University research policy***
* ***University annual research report/review***
* ***Any research titles supported in the last 5 years.***

**Appendix 3 USAT AND INTERVIEW GUIDE FOR UNIVERSITY PLANNING CENTRE**

**Unit-based Biotechnology and Biosafety Assessment Tool**

***USAT Part A***

**Biotechnology** is the use of microorganisms, such as bacteria or yeasts, or biological substances, such as enzymes, to perform chemical processing in applications including production of food substances such as cheese, wine and beer as well as non-food substances such as antibiotics, genetically engineered vaccines and hormones, bioconversion of organic waste for environmental clean-ups such as oil spills (this is accomplished through the use of a genetically engineered bacteria).

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|  |
| **Score** |
| **Code** | **Indicator** | **x Don’t know** | **0 None** | **1 A little** | **2 Adequate** | **3 Substantial** | **4 A great deal** |
|  | **Institutional Policy** |
| **IP1** | The extent to which the institution’s policy reflects an engagement with Biotechnology and Biosafety concerns |  |  |  |  |  |  |
| **IP2** | The degree to which national and global Biotechnology and Biosafety issues inform decision making processes in the institution |  |  |  |  |  |  |
| **IP3** | The level of support the institution gives to Biotechnology and Biosafety in its programmes and practices |  |  |  |  |  |  |
| **IP4** | Existence of Biotechnology and Biosafety related policies at the institution  |  |  |  |  |  |  |
| **IP5** | Integration of Biotechnology and Biosafety issues in institutional policies |  |  |  |  |  |  |
| **IP6** | Integration of aspects of Biotechnology and Biosafety in the institution’s vision and mission statement |  |  |  |  |  |  |
| **IP7** | Integration of aspects of Biotechnology and Biosafety in the institution’s strategic issues and objectives |  |  |  |  |  |  |
| **IP8** | Reflection of local Biotechnology and Biosafety challenges in policies and written statements |  |  |  |  |  |  |
| **IP9** | The degree to which policies and written statements reflect national and global Biotechnology and Biosafety issues |  |  |  |  |  |  |
| **IP10** | Implementation of policies of Biotechnology and Biosafety/Biotechnology and Biosafety related policies |  |  |  |  |  |  |
| **IP11** | Plans to improve Biotechnology and Biosafety focus in the next policy review cycle |  |  |  |  |  |  |
| **IP12** | The presence of a body responsible for Biotechnology and Biosafety at the institution |  |  |  |  |  |  |
|  | **Policy on staff** |
| **PS13** | Consideration of aspects of Biotechnology and Biosafety in staff hiring decisions |  |  |  |  |  |  |
| **PS14** | Consideration of aspects of Biotechnology and Biosafety in orientation programmes for new staff members |  |  |  |  |  |  |
| **PS15** | Staff development in Biotechnology and Biosafety  |  |  |  |  |  |  |
| **PS16** | Staff rewards in Biotechnology and Biosafety activities  |  |  |  |  |  |  |
| **PS17** | Awareness raising in Biotechnology and Biosafety  |  |  |  |  |  |  |
| **PS18** | Institution driven celebrations or commemorations ensuring visibility of Biotechnology and Biosafety issues |  |  |  |  |  |  |
|  | Others (please specify): |  |  |  |  |  |  |

***USAT Part B***

**Opinions and Documents**

**OD18**

How is a concern for and commitment to, Biotechnology and Biosafety issues given broad visibility at your university? What about through guest speakers, conferences, Earth Day celebrations, for example?

**OD19**

To what extent is Biotechnology and Biosafety in education, research and operations a regularly appearing subject in meetings and in internal and external publication (scientific or other)? Please explain.

**OD20**

What plans (if any) are there at the institution to strengthen commitment to Biotechnology and Biosafety (such as a reviewed or new strategic plan reflecting Biotechnology and Biosafety)?

**OD21**

The uptake of Biotechnology and Biosafety and associated issues and concerns institutions of higher education and training is, in most cases, promoted by a few enthusiastic individuals.

1. *Do you think it is possible in the institution to have the promotion of sustainable practices as an underlying agenda in all functions and operations of the university? If so how can it be achieved?*
2. *What other steps do you feel may need to be taken to promote the take up of Biotechnology and Biosafety concerns and why?*

**OD22**

May you cite any documentation that reflects the future orientation of the institution other than the strategic plan.

**Appendix 4 DATA COLLECTION TECHNIQUES USED IN THE INSTITUTIONS AND FACULTIES**

|  |  |
| --- | --- |
| **INSTITUTION** | **Data collection tools** |
|  | **USAT** | **Questionnaire** | **Interviews** | **Documents** | **Internet resources** |
| **UNISWA** | √ | √ | √ | CalendarStrategic plan | List of coursesList of programmes |
| **Limkokwing** | √ |  | √ |  | List of programmes and courses |
| **SANU** | √ | √ |  |  | List of courses |
| **CMU** | √ | √ | √ |  | Information pamphlets |
| **WPTTC** | √ | √ |  |  | List of courses |
| **NTTC** | √ | √ | √ |  | List of courses |
| **SCOT** | √ | √ |  | List of programmes |  |
| **VOCTIM** | √ |  |  |  | Overview of the functions of the institute  |
| **Swaziland Skills Centres** | √ | √ |  | Strategic plan | Overview of the functions of the centre |

**Appendix 5 THE MESA AUDIT TEAM**

1. **Mandla Mlipha - Team Leader and Lead Author**
2. **Nathie Maseko - Member**
3. **David Manyatsi - Member**