NATIONAL RESEARCH SYMPOSIUM
23 - 25 SEPTEMBER 2015 AT HILTON HOTEL, WINDHOEK
BOOK OF ABSTRACTS
The National Research Symposium 2015 represents an important milestone in our country’s science, technology and innovation landscape and indeed in the history of our great Nation. This year the National Research Symposium is particularly significant as Namibia embarks on the implementation of the National Programme on Research, Science, Technology and Innovation for 2014/15 to 2016/17 that was approved by the Cabinet of the Republic of Namibia, and launched during the first quarter of 2015.

One of the 5 key strategic priorities in the National Programme on Research, Science, Technology and Innovation is “Disseminating Scientist and Technological Knowledge, looking towards a growing involvement of institutions researchers, enterprise and entire population”. Under this strategic priority a key initiative has been formulated that speaks to the promotion of dissemination and publication of research results. It is through this initiative that the National Research Conference is organized annually, where Namibian researchers are given an opportunity to present their research findings.

The theme for the Research Symposium 2015 “Research weaving the future and beyond” resonates very well with the mantra of the National Programme on Research, Science, Technology and Innovation for 2014/15 to 2016/17, which is the national research agenda contribution to the transformation of our economy into a knowledge based society. As a country, we have set ourselves ambitious targets which we must achieve for science, technology and innovation.

Several sectors and include health; agriculture and fisheries; water; energy; geology and mining; indigenous knowledge; social sciences and humanities, logistics; environment and tourism; as well as the areas addressing enabling technologies which are manufacturing technologies, information and communication technology; biotechnology and space science.

History, experience and evidence-based facts have shown that economic growth is always accompanied by research output and technological advancement. The National Research and Development Survey and the National Innovation Survey, which was recently launched by the Minister of Higher Education and Innovation, Honourable Itah Kandjii-Murangi, will certainly produce data that can help in understanding the size and shape of the Namibia R&D landscape and their use in system-level planning, monitoring and evaluation.

It is gratifying that the National Commission on Research, Science and Technology (NCRST), together with all stakeholders have pulled its weight towards the goal of socio-economic development by convening a National Conference of this magnitude. I am further pleased with the high quality and applicability of the current symposium research papers and I believe there is a lot of applications of research results out there. The papers cover all 15 research priority areas as identified in the National Programme on Research, Science, Technology and Innovation for 2014/15 to 2016/17.

I am confident that the National Research Symposium will grow from strength to strength and that a conversation will increase not only among the research academic community but also between academia and industry, which will provide opportunity for commercialisation of research results.
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i. Agriculture

Aiding Livestock farmers, reducing the Losses of Rural Subsistence livestock farmers caused by the death of Cattle, Goats, Sheep as a result of droughts and floods caused by climate change in Namibia.

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Introduction

Problem Statement

The number of loss of livestock experienced by a farmer during a drought or flood (caused by climate change) yearly in Namibia are staggering, a rural subsistence farmer or communal farmer can loose up to 40% of his livestock due to drought or floods, some loose up to 100% of their cattle, or their entire goat populations or sheep population if they are small livestock farmers.

After the animal has died from drought, the carcass is usually found rotten far away or it is not fit for human consumption as it is spoiled or too thin to consume.

Location

Together the Northern regions of Okavango East and West, Caprivi, Oshikoto, Omusati, Ohangwena Regions has a cattle population number of more than 3 million heads of cattle and 5 million small stock.

One can imagine the number of losses to be incurred if a drought is to strike in the northern six regions of Namibia.

To mitigate such a devastating impact, this proposal seeks funding to establish a Community Canning facility in between the 7 regions, serving all the farmers, and easily accessible.

Objectives

a) Community Canning facility will aim to reduce the Cattle numbers in each region, therefore giving the farmer a readily market throughout the year, for his livestock and income to re-stock after a drought or flood year is over or at least with a few number, the impact or losses will not be so sever, and he the farmer can control the outcome with a few livestock.

b) Most farmers in the north are Organic Farmers by default, the cattle qualify as Organic or free range, but the social part of dealing with cattle /livestock such as caring for the animals, water holes, disease control, treatment of animals, long distance movement will not qualify as Organic, the project will address this aspect and improve them to qualify as Organic.
Background

Livestock rearing constitute a large part of the Namibian population; about 70% of the population derives its income from this type of farming. Livestock farming contributes to food, security, income through self employment and contributes to the GDP of the country through the export of beef.

Northern Canning Facility aims to support communal farmers who are vulnerable to the affects of climate change in Namibia, the losses experienced by poorer livestock farmers who have no other means but rely heavily on their subsistence farming methods in the form of cattle rearing.

Droughts and floods as a result of Climate change have a devastating affect especially to communal farmers in this region.

Project beneficiaries

Provide a brief description of the direct beneficiaries (i.e. Target group) and indirect

The losses will be minimized from 70% causalities in some households down to 5%. This makes it difficult for the farmers to restock his livestock after a major drought as most of the animals have died. The training programs for these farmers will be a benefit in terms of skills.

The land on which the cattle grace will be relieved of the pressure; this will minimize conflict over grazing areas in these regions. Most of this livestock is free range this means that young man and young boys will be employed to drive the cattle over a distance of more than 10 kilometer’s to find grazing.

The cans produced will be consumed by Namibians contributing to Food security.

The cans are easy to open that means a household can buy a can open it and consume it with his pap/porridge which is the main staple of food in this area, this will reduce the time of cooking own soup to eat with the porridge. The project will be able to diversify the meat industry by involving the farmer to decide on the receipt that feeds his died that means recipes that can be stored for longer periods and are protein diet. Traditionally if a cow dies you need to consume it within 24 hours, the result of our R&D will make sure we have preservative innovative beef products.

The construction workers who will build the cannery and the local engineers involved in the construction phase will benefit, the idea is to use local builders who would normally come from the farmers house.
Explain how these beneficiaries will benefit from the project. Clarify the social, economic and environmental benefits for the direct beneficiaries

1. There are more than 20,000 farmers to be registered with our initiative this means they will be beneficiaries, members of our Participatory Guarantee System, which means becoming Organic conformant.

2. Basic internal control systems skills for themselves in their region to see if the livestock is fine and free of disease according to International Federation for Organic Agriculture Movement’s of standards as a benchmark etc

3. Learning about Organic Principles

4. The farmers will benefit from their sale of cattle directly to us: they get a good price; they also become direct shareholders in the canning facility through the distribution of dividends annually.

5. The main beneficiaries are the nomadic people of the Kunene region, the Ovahimba, this group has had a strategy to overcome climate change, droughts and floods by moving their herds of livestock to other grazing areas, but this is no longer possible as new groups of cattle herders move into the Kunene region, and conflict is arising. Our strategy is work with the Himba to reduce their herd of cattle and to find ways to reduce conflict with other tribes moving into the area, by offering them a good price for their cattle and helping them to do basic accounting for re-stocking their cattle in the following year. The same we will do with the people in the South of Namibia. In this way the program can be replicated to other areas.

Namibians consuming their own cattle benefit the farmer who in turn is a shareholder of the cannery. There are a number of this type of initiatives that are run in a similar way which are successful in making good profits for their members such as in the Social entrepreneurship movement and CSA, and other similar indicative’s in the Banana or Cocoa export led innovative. Ours is similar but only focused on internal consumption in Namibia. That means value addition to the cattle, farmers and consumers in Namibia. The reality is that also the raw material is readily available in large quantities, it’s developing the market that’s challenging but convincing people to eat canned food which is rom their own local breed the Sanga Nguni cattle it’s not a challenge at all.

Operations, Quality Management, Income

Implementation arrangements – (maximum 2 paragraphs)

Describe how the project will be executed and managed;

The Canning facility will operate as follows. The farmer will supply X number of cattle to the Facility. For example in the year 2015 we are expecting to receive 6,050 Cattle from the Farmers.

Management Committee comprising NGOs, Farmer Organizations, farmers themselves will oversee the process.

For one cattle slaughtered we will obtain 600 Tins, 400 g of beef (Goulash, consisting of Potatoes, paprika, beef, tomatoes, onions) all ingredients that are grown locally, no imports.

The Cans 400 g are than sold to the Namibian Defense Force, The Drought Aid Program, School feeding schemes, shops, supermarkets etc at a fixed non tax deductible price of N$ 16,00.
A management committee consisting of Farmer Organizations will manage the day to day operations of the Canning and slaughtering houses including the buying of the cattle and the Training of farmers, the management committee will be comprising of all the regions in the country.

Elaborate partners in the project and explain their roles;

The infrastructure will be put up according to international standard by benchmarking www.BESH.de

There will be a Slaughterhouse established plus a Mobile Unit Truck which can access in accessible places for slaughtering.

The people will be trained in the international HACCP and other standards in partnerships with Namibia Standard Institute. Employees will be given necessary skills, as well as the farmer in partnership with Training Institutions such as Krumhoek Agricultural Training School.

Total employment to generate is 300 fulltime employees, as most of the potato peeling and cooking will be done by our locally trained staff.

Infrastructure wills consist off:

a) Mobile Slaughtering Unit
b) Canning Building
c) Vegetable Processing Warehouse

Sustainability and replicability

Self-sustainability is the aim, the annual production for 2015 will be 3,630,000 (three million, six hundred and thirty thousand tins / food cans) produced. Annual targeted income of N$ 58,080,000 (fifty eight million, eighty thousand Namibian Dollars.

Half of this money goes back to the farmer to re-stock his livestock. This Project is a social project addressing a social concern and at the same making profits to sustain itself in the process, we are not merely a donor funded project we are an enterprise making profit for the farmers and caring and addressing the farmers needs.

Building on previous experience.

NUTPROX cc (Natural Organic Products Manufacturing and Marketing cc) has over 15 years of experience in the field of value addition to natural organic resources found in the northern part of Namibia. Organizing the first ever large group of farmers over 10,000 household to collect, harvest, decorticate, clean and package, and market Ximinia cafra and Ximinia American at village level, the project started with no knowledge of the amount of Indigenous fruit in the forest of Ohangwena, or its uses and, no data.

The Company was called the Ohangwena Forest Trust. It became very clear that our aim was not to become just another Community Based Organization, but we wanted to become self reliant and to make a profit from our natural resources so the organization was re-named Natural Organic Product manufacturing and Marketing cc and registered with the Ministry of Trade and Industry as a close cooperative to make better economic sense and to benefit from the Government Republic of Namibia.
initiative’s in terms of value addition to local indingineous fruits and also to pay the bills from our own profits trading in local natural resources.

Previous experience

The project worked mostly with rural farmers in the Ohangwena Region, towards Eenhana and Okongo, the project involved over 10,000 households collecting and value adding Ximimia Caffra and Ximimia Americana.

The lessons learnt are that value addition starts with the farmer harvesting his fruit or resource and that value adding through his own means. Then eventually when he passes it on to the middle processor, the product is of good quality. We also learnt that the middle man and the processor earned more than the rural farmer.

Lessons Learnt

The lesson learned is that we want to move away from this type of way of doing things, yes the farmer can add value to the extent that the middle man does not have a big job to do and the processor’s job is made easier, but the fact that almost all of the at least 70% of the income goes to the processor and the middle man is not good enough. During this project we want the farmer to own 70% of the profit and only 30% goes to the middle man and the processor. That why 70% of our project profit goes directly to the farmer and the rest of the 30% goes back into the operations.
Mitigating the impacts of climate change using ICTs

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Purpose

Looking at the latest trends of floods, unpredictable rainfall, droughts, melting glaciers and increased temperatures, it is safe to conclude that the climate has changed and communities around the globe are already being affected. In response, several adaptation strategies in the sectors of water, agriculture, human health, energy, transport and tourism have been employed to the alarming situation. The purpose of this research is to gain familiarity with the issue of climate change in Namibia, explore how ICTs are contributing to the fight against climate change in the global sphere, and determine the role of ICTs in mitigating the impacts of climate change in Namibia.

Method

The research will make use of qualitative and quantitative methods in order to gather data on the topic. To begin with, an understanding of how climate change is affecting the environment, society and economy of Namibia as well as the current extent of ICT application and its success in combating the effects of the phenomenon is fundamental. Readily available material relating to the topic from previous research ranging from publications to online databases will be reviewed. This literature search will also serve as an exploration of the ICT tools, methods and approaches available for the assessment of climate change impacts and assist in the determination of the most appropriate tools, methods and/or approach for Namibia. The research then endeavors to apply the selected tools, methods, and/or approaches during a period of time over which the impact of climate change on the environment, society and economy will be monitored.

The results in comparison with the status quo data gathered at the start of the research will assist determine how far the application of the said ICT tools, methods, and/or approaches have gone in mitigating the impacts of client change.

Results

To mitigate the impacts of climate change using ICT, a framework was proposed as shown in figure 1. The framework works in such a way that the population in general, through the use of mobile application, would access a remote weather service. Information obtained from the weather service is used to create community awareness and information sharing on surrounding threats that include floods, drought, soil erosion and uncertainty among others. The framework employs a service oriented model that uses location-base technology, the GPS.
Communities may be exposed to various impacts of climate change due to lack of awareness and sharing of information amongst themselves. This has resulted in serious repercussions and a lot of resources being channeled to arrest the situation. This paper has proposed a framework based on service oriented architecture that can be used to mitigate the impacts of climate change. Further work needs to be done in developing and implementing the full framework. A pilot study needs to be carried out in a specific area in Namibia before the whole system is rolled out.

References


Growth rate and biomass yield of selected indigenous forage legumes in Central Namibia

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Purpose
Forage legumes are important in improving nutrition of ruminants particularly during the dry season when there is a reduction in quality and quantity of feed available. The growth rate and biomass yield of 4 indigenous legumes (Otoptera burchellii [OB], Vigna lobatifolia [VL], Clotalaria argyraea [CA], Cullen tomentosum [CT]) and 4 improved legumes (Lablab purpureus [LP], Medicago sativa [MS], Canavalia ensiformis [CE], Vigna unguiculata [VU]) under different phosphorous fertilizer level applications was evaluated.

Method
The study was done at Neudamm campus farm of the University of Namibia to compare growth rates of legumes under different phosphorus (P) fertilizer regimes in a split-plot design. Single super phosphate was applied by broadcasting at four (4) levels (0, 60, 80 and 100 kg P/ha) to the eight (8) legumes, each with three (3) replications. Heights for erect species or length for prostrate species, was measured fortnightly, over period of two months. Vegetative material (leaves, twigs and stems) were collected at monthly intervals during the growing season and were air-dried in a laboratory and the biomass yield (tons dry weight/ha) determined. The square root transformation was used to obtain normally distributed data for both length and biomass measurements, before analysis. The GLM procedure (SAS, 2003) was used to analyze the data. Effects were considered significant at P ≤ .05.

Results
Growth rates were affected (P ≤ .05) by species of legume and the legume x fertilizer interaction effect tended towards significance (P = .0706). The least square means of the growth rates of different legumes at different P fertilizer levels are presented in Table 1.
Table 1. Least square means of forage legume growth rates (cm/day) at different levels of P fertilizer

<table>
<thead>
<tr>
<th>Legume</th>
<th>0 kg P/ha</th>
<th>60 kg P/ha</th>
<th>80 kg P/ha</th>
<th>100 kg P/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crotalaria argyrea</td>
<td>0.67 ± .12c</td>
<td>.</td>
<td>0.53 ± .17c</td>
<td>0.92 ± .17c</td>
</tr>
<tr>
<td>C. ensiformis</td>
<td>0.29 ± .07a</td>
<td>0.38 ± .07ab</td>
<td>0.42 ± .10ab</td>
<td>0.63 ± .10b</td>
</tr>
<tr>
<td>Cullen tomentosum</td>
<td>1.02 ± .10c</td>
<td>0.56 ± .10bc</td>
<td>0.88 ± .10c</td>
<td>0.41 ± .10a Lablab</td>
</tr>
<tr>
<td>purpureus</td>
<td>2.38 ± .09c</td>
<td>1.63 ± .08c</td>
<td>1.06 ± .10c</td>
<td>1.95 ± .10de</td>
</tr>
<tr>
<td>Medicago sativa</td>
<td>0.58 ± .08bc</td>
<td>0.44 ± .08bc</td>
<td>0.59 ± .10bc</td>
<td>0.44 ± .10c</td>
</tr>
<tr>
<td>Otoptera burchellii</td>
<td>0.77 ± .10b</td>
<td>1.08 ± .10a</td>
<td>1.45 ± .10c</td>
<td>1.10 ± .10Vigna</td>
</tr>
<tr>
<td>lobatifolia</td>
<td>0.73 ± .12b</td>
<td>0.69 ± .17b</td>
<td>0.86 ± .17bc</td>
<td>0.96 ± .12b Vigna</td>
</tr>
<tr>
<td>unguiculata</td>
<td>0.52 ± .07b</td>
<td>0.42 ± .07b</td>
<td>0.64 ± .10bc</td>
<td>0.35 ± .17a</td>
</tr>
</tbody>
</table>

Means with different superscripts within a column and within a row differ significantly (P < 0.05) and vice versa.

The biomass yield was affected (P < .05) by fertilizer level and legume species (Figure 1). Lablab purpureus produced highest biomass (P < 0.001) with 8.86 ± 0.08 Least Square Mean (t/ha). Clem and Cook (2004) recorded (4.0 tons/ha).

Figure 1: The least square means (tons dry weight/ha) for the different legumes

To the best of our knowledge, this is the first study to report on growth and biomass yield of C. tomentosum, O. burchellii and V. lobatifolia which are all indigenous to Namibia.
Conclusion
The results indicate that L. purpureus has highest biomass yield potential, but also that indigenous legumes (Otoptera burchellii, Vigna lobatifolia and Cullen tomentosum) could contribute substantially to improving nutrition of ruminants if well managed in rangelands.

References


EVALUATION OF A MOLECULAR DIAGNOSTIC METHOD TO DETECT CAMPYLOBACTER FETUS IN FIELD ISOLATES FROM NAMIBIA

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Purpose

Conventional bacteriological methods are used for the diagnosis of Bovine Genital Campylobacteriosis (BGC). The causative organism Campylobacter fetus subspecies venerealis (Cfv) is cultured and identified from the genital tract (van Bergen et al, 2005). Regional veterinary laboratories in South Africa and Namibia have reported between 0 and 12 % prevalence based on bacterial isolations from bull sheath wash submissions. The bacteriological diagnostic method is relatively insensitive due to the fragility of the bacteria (Madoroba et al., 2011). With the rapid advances in the molecular field, assays have become robust and less time consuming making these assays the preferred tools (Tu et al., 2005). Therefore the aim of this study was to evaluate the use of molecular assay (PCR) in detecting Campylobacter fetus in field isolates from Namibia.

Method

Evaluation involved 50 field isolates (clinical samples). The field isolates comprised of vaginal fluids and preputial washings/ scrapings, semen and preputial smegma secretions in bulls and in cows vaginal mucus and cervico-vaginal mucus obtained via swabbing. Using the polymerase chain reaction (PCR), sensitivity and specificity of the C. fetus specific-primer was tested using C. fetus reference strain (positive control) and field isolates. Culture assays were also used for detection in order to make a comparison.

Results

All C. fetus isolates yielded a single PCR amplicon of 301bp with the primers C878g1F and C878g1R. The sub-species Campylobacter fetus venerealis (Cfv) yielded PCR amplicons of 233bp with the primers, nC1165g4F and nC1165g4R. From the 50 isolates, 16 % came out positive for C. fetus and out of these 16%, 10% tested positive for the sub-species Cfv.

Conclusion

The sensitivity of the PCR was 25% more than that achieved using the conventional methods since after sub-culturing no growth occurred. This was due to the amplification of the signal for detection (DNA) by PCR. PCR also showed high specificity as it distinguished between the two venerealis and fetus sub species unlike the conventional methods. The detection limit of PCR remained the same after storage of the samples up to a month unlike the conventional methods as PCR is not affected by the viability of cells (OIE, 2008). Therefore, molecular assays should be used to improve the detection of Campylobacter fetus in bovine.
References


5. Global detection and identification of Campylobacter fetus subsp. venerealis. Revue Scientifique et Technique (International Office of Epizootics, 24(3), 1017-1026
Purpose

This paper assessed the economic impacts of climate change and the benefits of adaptation in maize-based production systems in South Africa, Namibia and Botswana.

Method

The paper applied the Trade-Off Analysis–Multi-Dimensional (TOA-MD) model to evaluate the economic impacts of climate change and the benefits of adaptation strategies for maize-based agricultural production systems in Southern Africa. The paper focused on analysing three main objectives: (a) the sensitivity of current crop production systems to future climate change, (b) the sensitivity of future crop production systems to future climate change and (c) the benefits of adaptation in the future.

Results

Economic impact of climate change

Figure 1 presents the impact of climate change on the net impact of farmers return for those three different core questions for South Africa, Namibia and Botswana respectively. This shows that there is significant positive impact on poverty percentage with a reduction of up to 6%.
Conclusions

Highly variable climatic conditions and the risk of extreme events make it important that policy be developed to safeguard the limited productive assets by means of targeted, pro-poor disaster insurance schemes. Apart from protecting the productive resources of the rural population, policy should target the diversification of the rural economic environment and strengthen rural-urban linkages. These policy directions should receive adequate attention during the formulation of a development policy and strategy. A national and regional debate is important to clarify the expectations of the agricultural sector to regional development, also in lieu of climate change, should be initiated to streamline policies aimed at the sector. Outright conflicting goals prevail which further undermine the potential of this vulnerable sector as well as the sustainable use of the environment.
Challenges and opportunities for agro processing industry development in north central Namibia: A case of Omusati region tomato value chain.

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Purpose

The agro processing industry in Namibia is still in its infancy stage of development. There are several efforts by the government to establish agro processing industry and there are several studies that have been instituted through the Ministry of Industrialization, Trade and Small to Medium Enterprise Development as well as the Ministry of Agriculture, Water and Forestry (MAWF, 2008; MAWRD, 1995 and MTI, n.d.). These efforts have included ascertaining the agricultural production base that serves as a supply base to agro processing. The main challenges faced in production of fresh produce for example tomatoes are high input costs (water, seeds, fertiliser, pesticides), high heat, poor farm sanitation, lack of capacity to produce required volumes for processing and marketing, as well as improper harvesting stages and or periods, improper packaging materials (Arah, 2015). There are also other off-farm challenges such inappropriate transportation system, lack of processing factories, lack of effective storage facilities, lack of market information and reliable markets (Arah, 2015). However, for fresh produce such as tomato in Omusati region, opportunity for value addition exist due to favourable production conditions which enable production of tomatoes throughout the year. Therefore the purpose of this study was to identify the challenges faced in the tomato value chain in north central Namibia, Omusati region as well as to identify the opportunities for the development of agro processing industry using tomato crop.

Method

The study employed a non-probability small scale survey to solicit information from 78 small scale tomato producers in Omusati region on production, harvesting, and marketing. In addition, key stakeholders in the horticultural sector of Namibia were also interviewed using a checklist of questions. Secondary data were also reviewed from published and unpublished data sources. Data was analysed in SPSS to generate descriptive statistics for production levels, marketing including post-harvest losses for tomato producers.
Results

Figure 1 below shows tomatoes harvested, sold, consumed or spoiled in Omusati region in 2013 and 2014 production seasons.

![Figure 1: Estimated tomato production in Omusati region](image)

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<td>5947</td>
<td>4602</td>
<td>97</td>
<td>901</td>
<td>1151</td>
<td></td>
<td></td>
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<tr>
<td>sold</td>
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<td>spoiled</td>
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</table>

Source: Field data

The results indicated the main challenges to be production capacity to meet demand, unsynchronized production leading to glut in the market periodically, inadequate training in global Good Agricultural Practices (GAP), lack of capital, lack of local expertise in value addition, high temperatures, incidence of pests, and high input and fuel costs for pumping water and to transport produce to the market. The farmers also experience high post-harvest losses due to high perishability of tomatoes as a result of lack of alternatives to fresh produce markets like processing industry as a consequence of periodic gluts in the market. This thus presents an opportunity for development of value addition in the tomato value chain by processing the tomatoes into various tomato processed products with longer shelf life (Table 1). The market for tomato processed products is available locally in the canning industry (fishing), caterers, schools, hospitals, defence, and retailers.
Table 1: Scenario for an opportunity for a tomato processing plant

<table>
<thead>
<tr>
<th></th>
<th>Minimum Size (ha): for production required for processing plant</th>
<th>Minimum Period (months)</th>
<th>Average yield (tonnes/ha)</th>
<th>Total yield: minimum for processing plant (tonnes/year) Running for 176 days</th>
<th>Job creation per shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current scenario</td>
<td>112.6</td>
<td>8</td>
<td>15</td>
<td>1689.6</td>
<td>minimum of 9 people</td>
</tr>
<tr>
<td>Potential scenario</td>
<td>56.3</td>
<td>8</td>
<td>50</td>
<td>2816</td>
<td>minimum of 12</td>
</tr>
</tbody>
</table>

Conclusion

This study concluded that there is need for tomato processing infrastructure in Omusati region as producers have both regional and domestic comparative advantage in producing tomatoes annually despite the water challenges. The recommendations from this study were that there is need for subsidies on inputs to enable farmers to produce at optimal capacity as well as emphasizing a cropping programme to ensure continuous supply. At the same time, the study recommends establishment of infrastructure for agro processing for value addition in the tomato industry through private public partnership schemes.

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Water provision to rural communities through community based management approach in Namibia, Omaheke and Oshikoto regions.

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Purpose

The challenge of providing safe drinking water in Namibia is compounded by water scarcity and the concentration of human population in areas far from major water sources. Namibia is therefore classified as one of the driest countries in sub Saharan Africa (Schachtschneider, 2000), a fact that is attributed to the general scarcity of water due to low, sparse and variable rainfall together with high evaporation rates (Mendelsohn et al, 2002). Hence, the Namibian government implemented the community based water management (CBM) strategy in 1997, in order to improve efficiency in the delivery of safe drinking water to communities in rural areas. CBM is recognized for cost saving and community empowerment but is dependent on institutional arrangements, willingness and ability of rural people to accept responsibility for water management. This paper reviews community based management, analysing the institutional arrangements and impacts of rural water supply reform on the livelihoods of rural communities in Omaheke and Oshikoto regions in Namibia. The paper concludes with recommendations to improve the functioning of institutional arrangements to provide water to rural communities.

The main objective of the paper is to review the CBM approaches and methods of rural water supply and management in Oshikoto and Omaheke region. The specific objectives are to: assess the contribution of community based management (CBM) to improved access to water in Oshikoto and Omaheke regions rural areas: to identify challenges in institutional arrangements that hinders access to water in rural communities, and to understand how lack of effective institutional arrangements affects their livelihoods.

Method

The paper depends on secondary material and information collected through Rural Water Information Systems (RUWIS) between 1999 and 2015. Secondary data analysis, is the analysis of data or information that was either gathered by someone else (e.g., researchers, institutions, other NGOs, etc.) or for some other purpose than the one currently being considered, or often a combination of the two (Cnossen 1997).

The RUWIS information is collected annually by the Ministry of Agriculture, Water and Forestry (MAWF). This study, focus on Kalahari constituency (Tsjaka-Ben Hur area) and Aminuis constituency (Orevia, Aroams and Jakkalsdraai) in the Omaheke region. In Oshikoto region the study focus on two pipelines in Omuthiya constituency, the Onamulele-Onaludhiya and the Onankankuzi-Okakoko, these pipelines supply water to several rural communities residing in villages along the pipelines.
Results

The main source of water supply in Omaheke region is through a borehole setup, under the MAWF, however water supply is managed by water point committees (WPCs). Results show that institutional arrangements in the initial stages (1998-1999) of the implementation of CBM approach was slow and did not deliver the expected results in Omaheke region. This could be attributed to the fact that the CBM approach was new to communities and establishing institutions at local level demands more time for consultations. Over the years (2000-2014) the number of established water points associations, water point committees increased, these are recognized institutions responsible for managing water resources in rural areas in Omaheke region. Gradually, significant achievements were recorded in training water point committees and water point caretakers as well as collecting and inputting information in RUWIS. The provision of water improved the livelihood of communities in terms of water for livestock farming.

In Oshikoto region, Omuthiya constituency, the main source of water supply is a pipeline scheme provided by NamWater and managed by water point committees. The Onamulele-Onaludhiya and the Onankankuzi-Okakoko pipeline are connected to the Omuthiya-Ambende. The implementation of CBM helped rural communities to access safe drinking water. Institutions such as water point committees and water point associations were established and functional. However, over the year’s institutional arrangements in the region has weakened, and became less functional. In addition, more members of the community opted for individual water access through private off takes. Water access diversified community livelihoods through trade enterprise (e.g. brick making and small scale irrigation).

Although the two regions are different in terms of mode of accessing water, the implementation of CBM improved access to safe drinking water. However, it appears that water supply through pipeline schemes experience more complex challenges related to collection and payment for water, compared to borehole communities who collects funds for operational costs. In both regions, communities diversified their livelihoods due to reliable water supply.

Conclusion

CBM approach in Oshikoto and Omaheke regions address issues of rural water, demand and access. Even though CBM approach has helped some communities manage their water points, it comes with challenges as some are unable to contribute financially towards the daily operation and maintenance of their water point. Therefore while communities still rely on government for repair and maintenance of water points, the government should continue to support and strengthen institutional arrangements. We recommend review of water policies to address challenges related to collection and payment for water experienced by communities in Oshikoto region receiving water from pipeline schemes.

Reference

Fog and Life: Making the link

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Purpose

Fog is a key service provider to the diverse coastal Namib Desert biota (Seely ed. 2012) delivering five times more moisture than rain (Pietruszka and Seely 1985). Fog formation is linked to cold water upwelling of the Benguela system. Global climate models predict a decrease in the prevailing anticyclonic wind system (Engelbrecht et al. 2015), coupled with a decrease in marine upwelling and warming of eastern Atlantic waters. To better understand and monitor these climatic changes, support enhancing the existing meteorological observation capacity at Gobabeb Centre recently was received (Kaspar 2015; Maggs-Kölling & Mitchell 2013, Seely & Straus 2013). Parallel networks of meteorological stations have been set up on the central Namib plains and dunes from the coast to the inland extreme of fog occurrence. All stations are operated in conjunction with an array of internationally funded measures based at Gobabeb (http://www.gobabebtrc.org/index.php/research/ecological-long-term-monitoring/foglife; Seely et al. In prep.). The purpose of this paper is to elaborate on the meteorological programme, with emphasis on fog, operated in conjunction with long-term observations of the biota of the central Namib-Naukluft Park.

Methods: SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management) supports an array of 75 meteorological stations in Angola, Botswana, Namibia and Zambia (Kaspar et al. 2015) of which eleven are part of the FogNet array based at Gobabeb. Including the base station at Gobabeb, ten other stations are located in perpendicular transects, seven from near the coast to 100km inland at 1000m elevation and four from Gobabeb northward at 400-500m elevation. All eleven stations record meteorological variables which include rain, fog precipitation, leaf wetness, temperature, humidity, wind speed and direction, net and global radiation, soil moisture and, at Gobabeb, evaporation and a soil temperature profile down to 1.2 m depth. Data are transmitted daily to SASSCAL WeatherNet (http://www.gobabebtrc.org/index.php/research/ecological-long-term-monitoring/foglife).

In 2015, an additional six stations, including a black bulb thermometer, were erected on a parallel transect across the Namib Sand Sea (NCRST: Seely and Straus 2013).

In conjunction with meteorological measurements, various methods will be used to establish the relationship between fog and plant growth. For example, to study Arthraerua leubnitziae horizontal deposition collectors (e.g. Nyaga et al 2015) will be set up along the FogNet transect from which we can obtain samples of deposition for elemental and isotopic analysis. Plant attributes to be...
investigated include allocation to below-ground structures, canopy properties (leaf area per stem area), leaf foliar properties, ability to take up foliar applied deuterium-labeled water, ability to take up 15N-labelled glycine NO3– and NH4+, uptake of Li, tissue elemental concentrations and tissue water, C and N isotopes.

**Results:** Preliminary results of fog measurements confirm the variation from west to east and along the north-south transect at 400-500m amsl.

![Fog precipitation chart](image)

*Figure 1: Fog precipitation coast to inland: CW, CM, KB, SH, VF, GK and north to south: MK, VF, S8, AU, GB.*

Although Arthraerua leubnitziae is restricted to the coastal fog zone, the role of fog, as a source of water only or nutrients, is yet to be established.

**Conclusion:**

Fog is a key climatic element of the Namib Desert. With climate change continuing at its current direction and pace, biota dependent on fog moisture will be influenced. Meteorological stations measuring fog in the central Namib Desert will help understand this phenomenon. Congruent studies of biota across the fog gradient will provide an indication of the impact of climate change on this arid landscape.
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Introduction

Namibia is the driest country in sub-Saharan Africa, where about 60% percent of the population depend on groundwater for water supply. It’s therefore of importance that these groundwater resources are managed properly, and this can only be done if groundwater systems are understood. One method that is used to understand the groundwater system is the use of stable isotopes. The signature of stable isotopes of pore water (i.e. oxygen and hydrogen) serve as a powerful tracer of hydrological processes in both the unsaturated and saturated zone by providing an integral fingerprint of water origin, flow path, transport processes, and residence times (Volkmann & Weiler, 2013). Isotopes can estimate recharge at both local and regional scale with temporal scale between seasonal and hundreds of years. Their signature distinguishes different recharge sources, but it is difficult to quantify recharge rates (Scanlon, et al., 2002). In this study, isotopic compositions of groundwater, surface water and rain water have been used to investigate water origin and recharge processes in order to provide basic information that will influence effective management and utilisation of the groundwater resources.

Methods

Three example sites where used; the Cuvelai - Etosha Basin, Ebenhazer-Kuzikus area and the Namib Desert (Figure 1). Rain samples were obtained in a monthly sum collector and rain events, while groundwater and surface water samples were collected during field campaigns carried at different times in 2014 and 2015. Samples were subsequently measured for stable water isotopes (δH and 18O) in the UNAM laboratory with an off-axis integrated cavity output spectroscope (Los Gatos Research, DLT-100).
Figure 1: Overview of Precipitation in the three example sites, Map source: ACACIA, Project

Results and Discussion

The resulting isotope data were plotted together with the global meteoric water line (GMWL) (figure 2). For the Cuvelai - Etosha Basin the groundwater isotope ratios ranged from -9.4‰ to 13.6‰ and from -63.1‰ to 45‰ for δ18O and δ2H respectively. In the Namibia desert isotopic ratios for δ18O range from -9.14‰ to -2.16‰ for groundwater and from -8.89 to -0.27‰ for rain water; for δ2H from -62.9‰ to -23.6‰ for groundwater and from -55.3‰ to 8.3‰ for rain water. Lastly in the Ebenhazer-Kuzikus area isotopic ratios for δ18O range from -12.54 to 5.17 for rain and from -8.24 to -1.24 for groundwater; for δ2H from -82.51 to 47.72 for rain water and from -59.05 to -23.01 for groundwater. Most samples are plotting along an evaporation line which was interpreted as enrichment due to evaporation of meteoric water before or after groundwater recharge. Groundwater samples that plotted along the Global Meteoric Water Line (GMWL) indicate recharge directly from precipitation before evaporation occurred subsequently during the dry season. Samples from the Cuvelai-Etosha Basin are more evaporated and this is because they were collected from open wells while in other sites samples are collected from the boreholes.
### Conclusion

In summary, groundwater recharge occurs directly from precipitation and evaporation occurs subsequently during the dry season. There is high evaporation especially in the Cuvelai-Etosha Basin, Kuzikus – Ebeneher has relatively older water than the other areas.

### References


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**Figure 2: Isotopic composition of groundwater samples from the three example sites**
Implementation of biomarker assays to monitor contaminants of emerging concern in water sources

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Purpose

Both endocrine disrupting chemicals (EDCs) and algal toxins are considered as contaminants of emerging concern (CECs), because they were not measured or monitored before, but may have potential adverse ecological and/or health effects. This study focused on assessment of two types of CECs: endocrine disrupting compounds (EDCs) and algal toxins in surface water sources in central Namibia. Some of the most important EDCs include alkylphenols, polychlorinated biphenyls, chlorinated pesticides, herbicides, and natural steroids such as estrogens, progesterones, and androgens (Swart and Pool 2007). Previous studies demonstrated that EDCs in drinking water may have adverse effects, including reduced fertility, abnormal development of male and female secondary sex characteristics and feminization of males (Rodríguez et al. 2007).

Increase nutrient run-off into reservoirs causes Cyanobacteria blooms. Toxins produced by such blooms include cyclic peptides, such as microcystins as well as alkaloids, such as anatoxins. Potential chronic toxicity from microcystins led the World Health Organization to establish a guideline of 1 µg/l as a maximum concentration of microcystin in drinking water (Harding 2006). Increasing urbanization and industrialization increases the introduction of CECs in surface water sources and it is essential that routine monitoring systems are developed.

Method

Bioassays were used to evaluate concentrations of EDCs (17β-Estradiol (E2), Estrone (E1) and testosterone) in 9 dams (Avis, Friedenau, Goreangab, Hardap, Von Bach, Naute, Oanob, Swakoppoort and Omataku) during the period 2010-2011, while microcystins and anatoxins were measured only in 3 dams (Goreangab, Von Bach and Swakoppoort) during 2013.

For EDC analyses, water samples were collected between March 2010 and April 2011 every two to three months to capture the rainy and dry seasons. Thereafter extraction of organic compounds was done with DSC-18 solid phase extraction (SPE) columns (Supelco, Sigma-Aldrich) according to the procedure described in Pool and Magcwebeba (2009). E2, E1 and testosterone concentrations were determined using Enzyme Linked Immunosorbent Assay (ELISA) kits (Sigma, Germany). For algal toxin analyses water samples were collected from Goreangab, Von Bach and Swakoppoort dams during March (rainy season) and June (dry season) 2013. At each dam five replicates for the toxicity samples were collected from just beneath the surface in the euphotic zone. Algal toxins were measured using ELISA kits (Envirologix Inc. and ABRAXIS), to test for Mycrocystins (hepatotoxin) and for Anatoxins (neurotoxin).

Data was tested for normality and the Kruskal-Wallis test was used to determine significant differences between data. Where significant differences existed, the Mann-Whitney test was used for post hoc analysis. OpenStat 2013 was used for statistical analysis.
Results

E2 concentrations in all dams exceeded the predicted no effect concentration (PNEC) for fish (1 pg ml\(^{-1}\)) (Young et al. 2004). Highest concentrations of E2 were measured during September 2010 in Oanob and Goreangab dams (5.5 and 7.2 pg ml\(^{-1}\), respectively). The highest oestrone (E1) concentrations were measured during April 2011 in Goreangab dam (7.6 pg ml\(^{-1}\)) and during November 2010 in Avis dam (6.1 pg ml\(^{-1}\)), which is above the PNEC for fish (3 pg ml\(^{-1}\)) (Burkhardt-Holm 2010). Highest testosterone concentrations were measured during November 2010 in Friedenau dam (19 pg ml\(^{-1}\)). The average testosterone concentration for all dams (10 pg ml\(^{-1}\)) was significantly higher during November 2010 (beginning of the rainy season), compared to April 2011 (end of rainy season) (p < 0.05).

Algal toxin analyses revealed significantly higher (p < 0.5) microcystin concentrations in Goreangab dam (1.5 µg L\(^{-1}\)) compared to Von Bach (0.5 µg L\(^{-1}\)) and Swakoppoort (0.7 µg L\(^{-1}\)) dams during autumn and winter. In all dams anatoxin-A concentrations exceeded the World Health Organization (WHO) limit of 1 µg/L and were significantly higher than microcystin concentrations.

Conclusion

Results from this study suggested that water from Goreangab and Swakoppoort dams have endocrine disrupting potential and contain high concentrations of algal toxins. The rest of the dams investigated showed good water quality. The current study provides baseline information for future research.

References

Namibian Atmospheric Conditions and their Implications on the Frequency and Intensity of Precipitation

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Purpose
Of all the precipitation received annually in Namibia, about 83% evaporates; 1% is used as recharge for groundwater, while 14% is used up by vegetation, and runoff only constitutes 2% [1]. Due to shortages in surface water, the country relies heavily on groundwater reserves, which are subject to low recharge rates from rainfall and periodic ephemeral floods [2]. The increasing occurrence and severity of floods as well as shortage of water resources, is one of the worst hazards to the global ecosystem linked to global warming [3].

In this study the impact of atmospheric conditions (saturation vapor pressure, mixing height, temperature, wind speed, relative humidity, solar radiation, and ventilation rates, roughness, boundary layer and aerosol pollution load) on the frequency and intensity of precipitation in the vicinity of the Kuiseb, Cuvelai-Etosha, and Okavango-Omatako Basin was investigated.

Methods
Inferential statistical analysis and simulations of the atmospheric conditions based on meteorological data (obtained from the official website of the SASSCAL project) was conducted to generate information on the occurrence (intensity and frequency) of precipitation in Namibia. The SASSCAL weather/research stations used for this study are Dieprivier (Namib Desert Lodge), Windhoek (NBRI), Omatako Ranch, Okashana, Sonop Research Station, and Alex Muranda Livestock Development Centre. These were selected based on their proximity to the Kuiseb, Cuvelai-Etosha and Okavango-Omatako Basin. Sampling and morphological analysis of aerosols/atmospheric particulates was conducted in Ondangwa and Windhoek to determine the effects of aerosol pollution on moisture supply and hence precipitation within the Kuiseb and Cuvelai-Etosha Basin. Ten aerosol pollution measurements and morphological analyses were made in 5 locations (3 in the Village and 2 in Town) in Ondangwa during December 2013 and January 2014. Samples for Windhoek were collected from seven (7) locations namely, Cimbebasia, Rocky Crest, Greenwell Matongo, Freedomland, Goreangab, Hakahana and Havana in February 2014.

3. Discussion of Results
3.1 Intensity and Frequency of Precipitation
Changes in the location, type, amount, frequency, intensity, and duration of precipitation depend on climatic variations [4]. Figure 1 and Table 1 shows the annual precipitation and correlation coefficients for precipitation and meteorological parameters in the six study sites.
Figure 1: Annual precipitation for the six study sites

Clues to changes in precipitation come from local correlations of monthly mean precipitation with temperatures [5]. Thus, the warm Namibian climate increases risks of both drought where it is not raining, and floods where it is, but at different times and/or places. Even as the potential for heavier precipitation occurs from increased water vapor amounts, the duration and frequency of events is curtailed, as it takes longer to recharge the atmosphere with water vapor.

Water-Holding Capacity of the Atmosphere

The water-holding capacity of the atmosphere was determined by computing the saturation vapor pressure following the Clausius-Clapeyron (C-C) equation (which also governs the amount and type of precipitation), which is simplified in terms of the August-Roche-Magnus equation. The relation implies that saturation water vapor pressure changes approximately exponentially with temperature (Figure 2(a) and (b)) under typical atmospheric conditions, and that the water-holding capacity of the atmosphere increases by about 7% for every 1 °C rise in temperature [6].

A consequence of the partitioning observed in Figure 2 is that summers in particular, generally tend to be both warm and dry or cool and wet [5]. It can be observed that the water-holding capacity of the atmosphere increases as temperature increases.

Figure 2: Saturation vapor pressure for typical (a) flood year - 2011, and (b) drought year - 2013

Aerosol Pollution and Precipitation

The shapes of atmospheric particles observed in this study can be classified into spherical, irregular, cubical, flake (geometrically irregular), fibrous, and flocks (chain-like). Brown colorizations, with diamond shaped particles accompanied by central discoloration were observed. In general, cloudy black particles (which absorb most of the sunlight that hits them) indicating the presence of soot were observed on the two sites, which confirm more contribution to warming and not cooling of the

Table 1: Pearson’s correlation coefficients of rainfall and other meteorological parameters

<table>
<thead>
<tr>
<th></th>
<th>AT</th>
<th>WS</th>
<th>RH</th>
<th>LW</th>
<th>SI</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Muranda</td>
<td>-0.541</td>
<td>-0.603</td>
<td>0.603</td>
<td>-0.815</td>
<td>-0.518</td>
<td>-0.633</td>
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<td>Sonop</td>
<td>0.366</td>
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<td>0.439</td>
<td>0.139</td>
<td>0.562</td>
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<td>Deroiber</td>
<td>0.855</td>
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<td>0.475</td>
<td>-0.105</td>
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<td>0.502</td>
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<td>0.006</td>
</tr>
</tbody>
</table>

AT - Air Temperature, WS - Wind Speed, RH - Relative Humidity, LW - Leaf Wetness, SI - Solar Irradiance, ST - Surface Temperature
lower atmosphere.

The atmospheric parameters contributing to build-up or dispersion of aerosol pollution include mixing height or mixing depth \((h)\), transport wind, and ventilation rate \((VR)\), which represents the ability of the boundary layer to get rid of the pollutants [7]. A roughness parameter of 1.0 m for both Windhoek and Ondangwa was also estimated following [8]. According to Linacre and Geerts [9], a lower roughness length implies less exchange between the surface and the atmosphere. Thus, the aerosol pollution in Windhoek and Ondangwa masks the ground from direct sunlight, thereby reducing the overall moisture supply, and the precipitation.

**Conclusion**

The water holding capacity of the Namibian atmosphere increases with increase in temperature; aerosol pollution close to the Cuvelai and Kuiseb mask the ground and reduces moisture supply; thus, the Namibian climate increases risks of both drought where it is not raining, and floods where it is, but at different times and/or places. These changes in average precipitation will impact groundwater recharge rates, thus potentially impacting water supply.

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Rural households’ Flood Disaster preparedness:  
A comparative study of cases from Zambia and Namibia

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Purpose

The purpose of this study was to examine the level of flood disaster preparedness and assess Sense of Community (SoC) and Self-efficacy (SE) of rural households in Mwandi district of Zambia and the Eastern Zambezi Region of Namibia. Specifically, this study investigated whether having a high SoC and SE was associated with high flood disaster preparedness or vice versa. The study further investigated whether there is statistical significance differences in preparedness, SoC and SE between the two countries.

Method

A questionnaire survey of 188 randomly sampled households was conducted in flood prone areas of Eastern Zambezi region of Namibia (n=104) and Mwandi district of Zambia (n=84). The study employed a SoC scale based on 24 items as revised by Chavis (2008). SE scale was based on nine items as developed by Schwarzer & Jerusalem (1995). Flood disaster preparedness was designed with 41 items as obtained from Rustam (2013), Doocy (2013), Amidun et al. (2012), Mishra et al. (2010), Rachmalia et al. (2010) and Miceli (2008). The mean of means score for each item of preparedness, SoC and SE was categorised into three. Preparedness was given the following scores; 1.00-1.49 = high preparedness, 1.50-1.99 = medium preparedness and 2.00-3.00 = no preparedness. Whilst, SoC and SE were given the following scores; 0-1.5 = low, 1.5- 2.5 = medium, and 2.6-3.1 = high, 3.1- 4 = very high.

Results

The sample survey result indicated that an average rural household in the study area consists of five people in Zambia and four people in Namibia. In Zambia, household heads were 59.5% males and 40.5% females. On the other hand, in Namibia, Households heads were 57.7% males and 42.3% females. In Zambia on one hand, within the households interviewed, 42.9% of the respondents attended primary education and 52.4% attended secondary level education and were literate, as understood by their ability to read and write. Only 2.4% of the respondents never attended school. With respect to marital status, 58.3% of respondents were married, 11.9% were single and 16.7% were widowed or separated. In Namibia on the other hand, within the households interviewed, 63.5% of the respondents attended primary education and 27.9% attended secondary level education and were literate, as understood by their ability to read and write. Only 5.8% of the respondents never attended school.
attended school. With respect to marital status, 39.4% of respondents were married, 53.8% were single and 7% were widowed.

In Zambia, the results indicate a flood preparedness mean score of 2.08, which means no flood preparedness. In contrast, in Namibia, the mean score is 1.69, indicating medium level of flood preparedness. The result of the SoC in Zambia indicate a mean of 2.56 (medium SoC) and 2.53 (medium SoC) in Namibia. Self-efficacy results indicate a mean of 2.66 in Namibia (high Self-efficacy) and 1.74 in Zambia (medium self-efficacy).

A paired T-test was run to test for any significance difference in the flood preparedness between the two countries using mean scores of SoC and SE. The results revealed that there is no significance difference in the SoC mean scores (p=0.609) between the two countries. However, there is a statistically significant difference in the SE mean scores (p=0.001) and level of flood preparedness mean scores (p=0.001) between the two countries.

**Conclusion**

The significance differences in flood preparedness in two countries may be attributed to the frequency and severity of floods experienced in the two countries. Similarly, self-efficacy may differ significantly based on the context and nature of the flood. It is concluded that high self-efficacy translate to high level of household preparedness as results have indicated in Namibia.

**References**

Isotope hydrological study in the Lower Swakop/Khan River, Namibia

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Introduction

Namibia is one of the driest countries in sub-Saharan Africa and water supply in the driest part of the country, the Namib deserts, is very limited and relies on groundwater only. For the management of such resource, it is of importance to characterise the recharge processes and estimate amounts of groundwater.

An important tool to understand environmental conditions during recharge, and/or if the recharge process is direct (infiltration directly from precipitation) or indirect (infiltration after surface runoff) is the isotopic ratio δ18O and δ2H in groundwater. Variations in isotopic composition are produced by chemical or physical processes in compounds or phases; these cause isotopic fractionation e.g. during condensation and evaporation (Mook, 2000). Conditions such as season, altitude, latitude, continentality and amount of precipitation have an effect on the fractionation of stable water isotope. Stable isotopes of groundwater are thus very useful tools to identify the recharge processes, while chloride mass balance method or groundwater residence time determination allows the estimation of rates.

This study focused on the lower catchments of the Swakop/Khan River in the Namib Desert where precipitation varies in the range of 0 – 250 mm/a, elevation from sea level to 800 m amsl and potential evaporation between 2400 and 3400 mm/a. Groundwater is mainly used for water supply to mines.

Method

In this study, groundwater samples from the lower Swakop/Khan River were collected from 15 monitoring boreholes during a field campaigns in 2014. Coordinates, temperature, pH and electrical conductivity were measured in the field using a standard GPS and portable electrodes from Hach. Water samples (50 ml) were collected in air tight sealed glass bottles and analysed for stable isotopes using a Los Gatos LGR DLT-100 at University of Namibia with accuracies of 0.2‰ and 0.8‰ for δ18O and δ2H, respectively. Measurements were normalized to VSMOW. Sample for hydrochemistry were collected following standard procedure and analysed by Analytic Laboratories in Windhoek. 14C analyses for dissolved inorganic carbon in groundwater were done by IAEA using the ASM method.

Results and Discussion

Isotopic ratios for δ18O for groundwater from Swakop/Khan River range from -7.39‰ to -3.97‰ and for δ2H from -44.7‰ to -28.5‰. All samples plot to the right of the global meteoric water line (GMWL) and indicate some evaporation (Figure 1). This is comparable to data published for the Kuiseb and the Namib plains (Ploethner, 1998; Wanke et al. 2015). However, the Swakop/Khan River groundwater samples are less depleted than the groundwater for the Kuiseb River. Overall this points to a lower indirect recharge component for the Swakop/Khan than for the Kuiseb and also that...
the precipitation events leading to groundwater recharge occurred at lower altitudes in the Swakop/Khan River than in the Kuiseb River.

All groundwater samples from the Swakop/Khan River fall in the water quality class D, high health risk and unfit for human consumption, due to high electrical conductivity (4430 – 14770 µS/cm) with only one exception; the groundwater at Swakop Uranium falls in class C, indicating a low health risk. Chloride contents range between 695 and 6945 mg/l and indicate very low groundwater recharge rates and much lower than in e.g. the Kuiseb River.

14C for the groundwater ranges from 98.2 to 107.4 pmC in the Swakop/Khan Rivier and indicates recent recharge, while Ploethner (1998) found 53.5 to 109.1 pmC for the Kuiseb groundwater indicating a residence times between 0 and 5000 years.

![Figure 1: Plot of δ2H versus δ18O for groundwater samples from the Namib Desert and Global Meteoric Water Line (GMWL).](image)

**Conclusion**

Overall, the findings point to a very challenging situation: the recharge rates in the Swakop/Khan Rivier are very low and the absence of a palaeo-water component can either mean that such has never existed or that some previously existing palaeo-water has already been used up by the current abstractions.

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Development of a GIS - Based Support Tool for Integrated Water Resources Management in Zambezi Catchment Area within Zambezi Region, Namibia

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Purpose
The paper presents empirical findings on the potential value of a GIS - based support tool for Integrated Water Resources Management (IWRM) in Zambezi catchment area within Zambezi region of Namibia. It reflects on how participatory approaches were used to incorporate the local communities, farmers and experts’ inputs into the development of a GIS - based support tool.

Methods
The research applied a combination of approaches that include scientific literature studies, consultation meetings, FGD and GIS mapping. Both positive and negative impacts of participatory approaches in IWRM were measured and local communities, farmers and experts’ knowledge and inputs were objectively tested on the basis of this investigation’s findings.

Results
The research established that although experts have interest in IWRM of the Zambezi region, there is lack of technical support and knowledge concerning participatory approaches and GIS - based support tools. The outcomes of the study suggest that local communities, farmers and experts are willing to learn about participatory approaches and willing to share their knowledge on water resources and climate change issues. The developed GIS - based support tool was accepted with its maps. Consultative meetings, FGDs and workshop approaches we accepted in capturing and documenting knowledge from the local communities, farmer and experts in the region.

Conclusion
Key recommendations include comprehensive study on IWRM issues and better knowledge gathering from local communities, farmers and experts. The paper presents results of the GIS - based support tool and lessons learned from exploring IWRM concepts in the Zambezi region.

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Mining Impacts Water Resources Sector
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Purpose
Mining depths impact the hydrological surface and drainage patterns of above land and underground water resources.

Method
Mining practices that exceed depths of between 20km to 60 km below the earth crust on land would, access the MOHO discontinuity situated between the earth crust and the mantle, and trigger seismic waves that can result in earth quakes. On ocean floor surfaces the MOHO phenomena are accessible at depths of ±10 km below the earth’s crust. Mining practices employ blasting equipment to open the earth’s crust in order to access greater depth. In general practices the surface impact of blasting are reflect on the environmental surface, as cracks and fissure in the land surface.

Further blasting exceeding depths triggering the Moho phenomena may ignite earth quakes, which will displace the land. Water a natural flowing resources that carves its way into land, rocks and crevices, will be impacted as result of fault line properties formed in the land, resulting in deeper river course paths, re-routed water channels and hydrological flow pattern

Results
Conclusion

According to mining depth records, licensed mines may not have exceeded the depth level expected to trigger the Moho Phenomena, however reports of earth quake activities in and around mining field areas, reflect fault lines created after seismic activities. Water have to adapt its flow pattern in order to reach it natural destination, which may result in stagnant water pools, salt lakes, or depending on the strength of the water current eventual carving its way into or around the fault line obstructing its way. Satellite Aerial Orthophoto of the Okavango Delta appended, a typical adaptive tactic seen by a high volume of water when encountering a fault line.

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iii. Energy

Percolation threshold found for electrical resistivity of silver-nanoparticles/zirconia composite thin films fabricated by molecular precursor method (MPM).

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Purpose

Many researchers have been tried to incorporate metal nanoparticles into the semiconductor materials in order to improve the conductivity of the metal oxide [1]. This based on the fact that the electrical conducting particles (fillers/conductors) can be randomly distributed within a metal oxide matrix to form a composite [2]. This composite sample is non-conducting, until the volume fraction of the conducting phase reaches the so-called percolation threshold [3]. It has been experimentally and analytically investigated that in the conductor/semiconductor composite with conductor at or above a given volume fraction ($\phi_i$), a network of conducting particles is established and thus the composite resistivity suddenly decrease [1-3]. One of key requirements for the multiplication of semiconductor chip integration predicted by Moore’s law is to find high dielectric constant materials suitable for the advanced dynamic random access memory (DRAM) and complementary metal-oxide semiconductor devices such as SiO$_2$ [4]. Zirconia (Zirconium dioxide or ZrO$_2$) is considered as a potential replacement of SiO$_2$ due to its high dielectric constant (~25), wide band gap (4.6-7.8 eV), low leakage current level, and superior thermal stability [5]. We therefore, fabricated Ag-nanoparticles zirconia (Ag/ZrO$_2$) composite thin films at various volumetric fraction ($\phi_{Ag}$) values. Herein, we report for the first time, the incorporating of silver nanoparticles in zirconia matrix using the molecular precursor method [6]. Furthermore, we present the percolation threshold found for the electrical resistivity of Ag-nanoparticles zirconia composite thin film.

Method

Preparation of silver ($S_{Ag}$) and zirconia ($SZirconia$) precursor solutions by molecular precursor method (MPM)

The preparation of Ag precursor solution ($S_{Ag}$) is reported in our previous papers [7]. The precursor solution ($SZirconia$) containing the Zr$_{4+}$ complex of NTA obtained by a MPM is reported here for the first time: Dibutylamine (73.14 g, 20 mmol) and NTA (1.91 g, 10 mmol) were added to a mixture of 5 g of ethanol and 5 g of 2-propanol. The solution was refluxed for 2 h with stirring and then cooled to room temperature. After adding 4.514 g (10 mmol) of Zr(o-Bu)$_4$, the solution was refluxed for 2 h. The reaction mixture was cooled to room temperature, and 1.247 g (11 mmol) of 30% H$_2$O$_2$ was carefully added. The solution was then refluxed for 1 h. The precursor solution ($S_{composite}$) for fabricating Ag-NP/ZrO$_2$ composite thin films was prepared by mixing the solutions $S_{Ag}$ and $SZirconia$ of various concentrations to adjust the silver concentration in the range 10-80 mol%.

Film fabrication by coating and heat treatment
Precursor films were deposited on the quartz glass substrate at ambient temperature of 600°C using the spin-coating method, in a double-step mode: the first step was carried out at 500 rpm for 5s and the second, at 2000 rpm for 30 s, for all preparations.

Results and Discussions

Figure 1 (a) shows XRD patterns of pure ZrO$_2$ and COMP-Ag50ZrO$_2$ deposited on quartz glass substrates and heat treated at 600°C for 30 min. The XRD analysis indicates that no phases other than tetragonal zirconia (t-ZrO$_2$) and metallic silver were present in the composite thin films. This indicates that no reaction took place between zirconia and silver during heat treatment. It is well known that the crystalline phase adopted by zirconia is mainly dependent on the heat treatment temperature [8], hence, under the current conditions, single phase of t-ZrO$_2$ are obtained at 600°C, corresponding to the same phase reported in literature at an identical heat treatment temperature [8]. The presence of Ag NP in the composite does not have any influence on the crystal phase of zirconia.

![Fig. 1 XRD patterns of the ZrO2 thin film and Ag-NP/ZrO2 composite thin films. The peaks are denoted as follows: ▼: metallic silver, ■: tetragonal zirconia (t-ZrO2).](image)

Table 1 lists the film thickness and electrical resistance of Ag-NP/ZrO$_2$ composite thin films with $\phi_{Ag}$ ranging from 0.26 to 0.68. The ZrO$_2$ thin film was 90 nm thick; however, the thickness of the silver film could not be determined because the particles were discontinuously deposited, as revealed by the FE-SEM observation in our previous paper [7]. The electrical resistance of both the silver and ZrO$_2$ thin film exceeded 10$^8$ Ω and the values were too high to be determined using the conventional apparatus employed in the present study. Ag/ZrO$_2$ composite thin films with $\phi_{Ag}$ values of 0.43 and 0.54 exhibit the lowest electrical resistance of 96.7Ω and 68.0Ω corresponding to electrical resistivity of 4.4×10^{-3} and 3.0×10^{-3} Ω·cm, respectively.
Table 1 The calculated Ag volumetric fraction values, $\varphi_{\text{Ag}}$, film thickness, and electrical resistance of the ZrO$_2$, TiO$_2$, Ag-NP/ZrO$_2$ and Ag-NP/TiO$_2$ composite thin films fabricated on a quartz glass.

<table>
<thead>
<tr>
<th>Notation</th>
<th>Volumetric fraction of Ag in ZrO$_2$</th>
<th>Film thickness (Ag-NP/ZrO$_2$)</th>
<th>Electrical Resistance$^{1)}$ (Ag-NP/ZrO$_2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZrO$_2$</td>
<td>0.00</td>
<td>90 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>.00</td>
<td>130 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag40</td>
<td>0.250</td>
<td>110 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag42</td>
<td>0.27</td>
<td>120 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag45</td>
<td>0.290</td>
<td>120 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag46</td>
<td>0.30</td>
<td>110 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag50</td>
<td>0.34</td>
<td>120 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag55</td>
<td>0.38</td>
<td>140 nm</td>
<td>$&gt;10^8$</td>
</tr>
<tr>
<td>COMP-Ag60</td>
<td>0.43</td>
<td>130 nm</td>
<td>96.7(5)</td>
</tr>
<tr>
<td>COMP-Ag65</td>
<td>0.51</td>
<td>120 nm</td>
<td>74.0(2)</td>
</tr>
<tr>
<td>COMP-Ag70</td>
<td>0.54</td>
<td>170 nm</td>
<td>68.0(7)</td>
</tr>
<tr>
<td>COMP-Ag80</td>
<td>0.67</td>
<td>270 nm</td>
<td>$&gt;10^8$</td>
</tr>
</tbody>
</table>

Summary

Ag-nanoparticle/zirconia thin films, with various volumetric fractions of silver ($\varphi_{\text{Ag}}$) in a zirconia matrix, were successfully fabricated using the molecular precursor method, and their structural and electrical properties were clarified. This study shows that the molecular precursor method, does not only allow fabrication of metallic Ag NPs in titania as discussed in our previous papers but also offers excellent miscibility of the silver and zirconia precursor solutions is effective for overcoming the limitations in miscibility of the conventional sol-gel method and is necessary for fabricating composite thin films having a large $\varphi_{\text{Ag}}$ value. With this observation, one can assume that the incorporation of Ag NP in any medium using MPM is applicable but electrical conductivity will depend on the property and nature of the matrix and these observations pose no problem for clinical applications.

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Geomagnetic Disturbance Monitoring and Modelling in Namibia

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Purpose

Geomagnetically Induced Currents (GICs) are results of the interaction between eruptive plasma from the sun and the earth’s conductive structures. GICs essentially fall into the genre of space weather which is characterised by 11 year solar cycles of eruptive activity of the sun. GICs have negative effects on transmission grids as they cause half cycle saturation of transformer cores leading to transformer blow-ups and failure. These can cause blackouts of transmission grids, the most eminent as yet being the Hydro Quebec (USA) March 1989 disaster. Research studies carried out in Namibia and South Africa have confirmed the presence of GICs in the transmission grids of low and mid latitude regions. This research is therefore commissioned to target the following objectives:

- to measure the earth geomagnetic field perturbations in Namibia,
- to measure Geomagnetically Induced Currents (GICs) in Namibia,
- to monitor harmonic current flows
- to model the effects of geomagnetic fields, flow of GICs and harmonic currents in the High Voltage (H.V) power transmission network in Namibia
- To formulate mitigation and control strategies aimed at making the Namibian H.V Network more resilient to GICs.

Method

Modelling is done to estimate the possible GICs flows in the transmission network. Various modelling techniques have been developed and incorporated in various GIC studies. All modelling techniques are however based on fundamental physics of nature and follows the following formula to compute the DC voltage that acts as a driving force for GIC.

\[ V_{DC} = \oint_R \vec{E} \cdot d\vec{l} \]

\[ = \vec{E} \cdot \vec{L} \]

\[ = E_X L_X + E_Y L_Y \]
the network from input files containing network component specifications. The simulator then inputs for time-varying magnetic field values from which it computes the time-varying electric field values. The electric field with a combination of an earth model are then applied over the network in order to compute the time-varying GICs.

Various GIC measurement instruments have been placed at the Obib as well as the Ruacana substations of the national grid. The instruments include a set of Hall effect transducers that are placed at the transformer neutrals as well as NI dataloggers that are configured in Labview to keep a detailed record of the measurements being undertaken by the transducers at each point in time. The dataloggers were initialised with a sampling interval of 0.62 milliseconds.

Results

The OpenDSS simulation was carried out using the electric field data for the 1989 geomagnetic storm. The peak electric field values were calculated using the South African surface impedance and also in the uniform plane wave method. The simulation results presented large magnitudes of up to 30.14A in the transmission line between the Auas and Van-Eck substation. The simulation results further proved that there are no GIC flows in the HVDC line due to the delta connection on the high voltage side of the transformer.

The NRcan study aimed to improve and validate the OpenDSS study. The simulation was done for the k<4 storm that occurred in 2013 as well as the k=7 solar storm that happened in March 2015 storm. The simulation resulted in GIC magnitudes reaching above 7A at the Auas substation for the 2015 storm. A comparison study between the GIC measurements and the simulation for the 2013 storm was further carried out resulting in combined correlation coefficients above 60% when polarised data was utilised.

Conclusions

The results of the GIC monitoring activities in Namibia have shown the importance of continuity in with these monitory activities. The Auas substation was identified in both studies as a GIC hotspot in the Namibian transmission network. The current GIC monitoring scheme further aims at placing the GIC measuring equipments at these identified substations so that further validation studies can be executed in parallel with various modelling activities in the network.

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Gas Exploration self sustainability

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Purpose
In my Satellite Aerial Map Mineral Prospecting observations, I identified the remarkable tendency: that Gas fields have a natural regenerative propensity to recharge from natural earth forces.

Method
Mineral prospecting with Satellite Maps and data capturing with Satellite Aerial Orthophotos, I witnessed Gas field reserves have a regenerative deposit formation near areas of water, and have indentified and been able to study this tendency of Gas reserves along certain coast lines and in desert areas. The economically viable potential of mining these gas fields, should only involve extraction equipment that would enable suction in order for this gas to be extracted.

Results
During my Satellite Aerial observations, economically viable gas reserve deposits can be identified as a misty grey to white coiled deposit layers underneath the earth’s crust. Exploited or near depleted gas field deposits are reflected as an open flat dispersion in the gas field reserve deposit areas seen on the Satellite Maps, and can be distinctively noticed in desert environments. It was in these exploited gas field areas that I noticed, and was able to distinguish the natural regenerative ability of these fields, which can be indentified and recharged.
Conclusion

Field observations were conducted along coastal beach and country landscape environments to establish patterns in sedimentary and soil deposits. Certain mountain and soil surfaces reflect indications to similar conclusion. Surface land observations, results inconclusive for geological land formations. Sample areas were photographed, not as theory testability but to support dissimilar field theory data accumulation spread.

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iv. Space science

Status of Astronomy in Namibia

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Southern Africa is becoming a beacon for astronomy throughout the electromagnetic spectrum: In all wavebands accessible from ground, the largest astronomical facilities are either operational or in the process of being set up in the region, see e.g. [1].

The Southern African Large Telescope (SALT) in Sutherland (South Africa), measuring 11m in diameter, is the largest optical telescope in the Southern hemisphere [2].

The deployment of the telescopes of the MeerKAT radio telescope, being the largest and most powerful radio telescope in the Southern hemisphere, is on-going [3]. To date, 4 of the 64 planned MeerKAT telescopes will later develop into the Square Kilometre Array (SKA), the most sensitive radio telescope on Earth, utilizing outlier station all over Southern Africa [4]. The High Energy Stereoscopic System (H.E.S.S.) telescopes [5] in the Khomas highlands in Namibia are the largest and most powerful system of Cherenkov telescopes to study very high energy (E>100 GeV) gamma-rays. For its successor, the Cherenkov Telescope Array (CTA) [6,7], Namibia has been voted second of possible countries to host it [8].

Against this background, the current situation of astronomical research and education in Namibia will be reviewed, specifically focusing on recent developments.
References

Comparing cheetah density estimates derived using non-spatial and spatial methods

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Purpose

Abundance and density estimates are vital for effective wildlife management. However, determining these parameters for cryptic species and endangered species such as the cheetah (Acinonyx jubatus) is challenging. To circumvent this challenge the use of non-invasive techniques such as scat/hair DNA and remote camera traps (RCT) combined with the use of spatial maximum likelihood (Efford, 2004) or Bayesian capture recapture (SCR) models (Royle and Young 2008), are becoming increasingly popular as effective means of estimating abundance for secretive species. Another means of estimating density is the traditional or non-spatial capture recapture (CR). The latter differ from the SCR methods, in that it requires the buffering of the sampling area using ad-hoc methods such as the full maximum distance moved by individuals captured at multiple camera stations (FMMDM) or home range radius (HR) in order to derive an effective sampling area. In contrast, SCR models utilises spatial capture recapture histories that includes the spatial location of where individuals detected on camera during abundance and density estimation. In Namibia, the outdated extrapolated estimate from a small telemetry study conducted in 1980’s of 2,500 or 3,000 adult individuals continuous to be widely reported. Additionally, these methods remains largely untested on cheetah. Here we investigated the use of RCT with ad hoc non-spatial Classical and Bayesian SCR models for determining the abundance and density of a cheetah population in north-central Namibia.

Method

Between 2005 and 2011, 64 cameras (DeerCamTM DC200 and infra-red Bushnell Trophy) were deployed at 32 sites (2 per site), of which 21, 5 and 6 were at scent marking sites (e.g. playtrees),
next to roads or fencelines and in proximity to captive facility, respectively. Surveys lasted three months and were conducted annually between 2005 and 2009 and continuously between 2010 and 2011. The latter was stratified into three months periods. Therefore, there were 10 surveys in total, 4 and 6 in summer and winter respectively, each encompassing an average area of 377 km$^2$ (SD + 41.15 km$^2$). Individual cheetahs were identified manually, based on the unique spot patterns. In addition, 4 male cheetahs were monitored with telemetry to assess aspects related to edge effect and buffer width estimation for density estimation under classical methods. Gender was determined using cues such as the presence of visible genitals or the presence of accompanying cubs. For individual capture histories, we set an occasion as equal to 6 sampling days. The non-spatial programs CloseTest and CAPTURE were used to test the closure assumption, with the latter also being employed to estimate overall capture probabilities (p) and abundance (N). For density we buffer the camera trapping polygon using four estimators including full mean maximum distance moved of individuals (FMMDM) captured at multiple different camera stations, the mean radius of the 95% MCP of 4 collared male cheetahs which were detected on cameras (GSM-ESA); mean radius of the 95% MCP and Kernel of 41 previously monitored cheetahs (VHF-ESA) (Marker et al. 2008); and, the area of 100% of the MCP encompassing all fixes of the 4 GSM monitored cheetahs (GSM-polygon). For conducting SCR analysis, we used SPACECAP 1.0.5 (Gopalaswamy et al. 2012) implemented in R Version 2.15.2 (R Development Core Team 2012) for estimating density. We set the state-space $S$ to 6,158 km$^2$.

Results and Conclusion

Fig. 1 Cheetah density estimates derived through traditional (FMMDM, GSM, GSM-polygon and VHF) and spatial SCR.
Overall, 54 unique cheetahs were identified (8 ± SD 4 individuals per survey, 32 males, 7 females and 15 cubs). Individual capture probability as reported by CAPTURE ranged from 0.12 to 0.78 (0.32 ± 0.21 per survey), that resulted negligible probability of not detecting an individual if was in the study area during any of the surveys. Hence, we are confident that the abundance estimates approximate a “true” census at least for males (Gerber et al. 2014). Adult density estimates derived using non-spatial and SCR approaches were similar across the 10 surveys except for estimates based on VHF-ESA (Kruskal-Wallis $\chi^2_{24} = 21.73, P < 0.01$). By considering all ESA density estimates except for VHF estimates, we determined an overall average density across the 10 surveys of 6 ± 4 inds./ 1000 km$^2$ (range of 1 to 15 inds./ 1000 km$^2$). In turn, SCR density estimates across the 10 surveys was of 11 ± 4 inds./ 1000 km$^2$ (ranged from 6 to 19 inds./ 1000 km$^2$).

SCR’s low precision is possibly linked to the process of estimating the sampling variance for density that may not have affected the point estimates themselves (Efford and Fewster 2012). In terms of trends, all estimators including SCR-based estimates indicated an increase in density between survey 1 and 2, followed by a continuous decrease (surveys 3 - 5), a sharp increase (survey 6), slight decline (surveys 7-9) and an increase (survey 10).

The findings show that both traditional and SCR approaches may at times yield similar density estimates. However, this may by chance (Foster and Harmsen, 2011), no theoretical basis for this inference. As such, SCR approaches are encouraged to be used whenever possible for them being spatially explicit (linking individual captures to spatial use) and their superiority on accounting for various sources of heterogeneity. Additionally, we foresee the application of advances in SCR models to be limited by the low density of cheetah.

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Purpose

Lizards are important components of desert ecosystems serving a critical role in food webs as predators and prey. Lizard species communities are valuable models to study broader ecological processes such as species niche partitioning and response to climate change. Namib Desert lizard species diversity and endemism are high and many species are not well studied (Murray et al, 2014). Climate change is likely to alter habitat thermal properties and water inputs, particularly water from fog events that may change in frequency and magnitude. Studies on lizard physiology and ecology can provide important baseline data for understanding potential responses to climate change.

Methods

Several taxonomically diverse species of endemic Namib Desert lizards were selected for study, including species of conservation interest such as the Husab sand lizard (*Pedioplanis husabensis*), to investigate aspects of ecology (different habitats, diets thermal biology) and physiology.

Doubly labeled water was used to estimate energy use and water balance in free-living lizards (indirect estimate use of fog) (Nagy et al, 1993). Gut content and fecal pellet analyses under a dissecting microscope were used to estimate prey types eaten. Measurements on field-active lizard body temperatures, substrate and air temperatures were made where lizards are captured using a noose. Laboratory-based estimates of critical thermal minimum and maximum temperatures were then used to inform models of lizard thermoregulation. These models provided information as to when and where lizards can be active; substrate types; and daily timing of thermal constraints – e.g., when do temperatures go above critical thermal maximum temperatures?

Figure 1. *Meroles cuneirostris* with an “X” marking during field sampling.
Results

Based on behavioral data, *P. husabensis* are active foragers and spend about 50% of their time moving. *P. husabensis* is conservative in water usage with a low field metabolic rate giving it a water economy index (WEI) of 0.18 mL H₂O kJ⁻¹ (Murray et al, 2014). This suggests it could be independent of condensing fog on which some Namib animals depend (Henschel and Seely 2008). *Rhoptropus bradfieldi* had a WEI of 0.50 ml H₂O kJ⁻¹ (0.07 ml H₂O per 0.140 kJ) considered high. Either the geckos were drinking free water or consuming prey with water content higher than prey of a typical insectivorous reptile. Since geckos did not have access to standing water or rainfall during the study, we surmise that a significant proportion (70%) of observed water influx in *R. bradfieldi* during the study period arose from drinking fog-derived moisture (Murray et al, 2015). *Meroles cuneirostris* may source up to 48% of their water needs from fog (Murray et al. 2015; Murray et al. unpublished data).

Dietary analysis showed that *P. husabensis* consumes many termites, as does *M. cuneirostris*. *R. bradfieldi* in our population fed largely on ants, particularly ants in the genus *Lepisiota* sp. while also feeding on other ants, beetles, larvae and moths (Murray et al. unpublished data). The body temperatures of all three range between 30°C and 39°C, with the substrate between 26°C and 39°C and air temperature between 21°C and 36°C.

Conclusions

Lizards in the Namib are likely to depend on fog water to varying degrees, and we do not know this information for many of the Namib’s diverse array of lizard species. As lizard prey also depend on fog, the preys are likely to be affected by climate change parallel to the lizard. Understanding how organisms budget their energy, water, and thermal requirements is key to successful modelling of responses to future climate change scenarios. Further study needs to cover a wide range of species to ensure that all aspects of climate change with lizards are covered for better conservation of our lizards.

References

Sexual segregation in foraging of greater kudu (*Tragelaphus strepsiceros*) in a heterogeneous savanna, in Chobe National Park, Botswana

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**Purposes**

To studied the reasons for sexual segregation in foraging greater kudu (*Tragelaphus strepsiceros*) by assessing the differences in habitat use and food between sexes during wet season in Chobe National Park, Botswana.

**Method**

Kudus were located and observed from a vehicle. Fire breaks and tourist roads were used as daily fixed driving routes. Observations were done during the day between 06h00 and 18h00 when animals were visible. Habitat type was identified where feeding kudu found foraging. A driving schedule was followed to distribute data collection evenly across habitats (alluvial or sandy soil). Care was taken to include a balanced number of observations of males and females on both habitat types. Males were observed only as single males or in pure male associations and females alone or in family groups with or without attending males.

With each observation of kudu, two plots were established immediately after the kudu observation to describe vegetation. These sampling plots I called kudu plots and control plots. Kudu plot was established from a point where individuals were observed browsing. A control plot was established with the center 50 meters from the center of the kudu plot, perpendicular to the direction in which the kudu left the plot and to the right in relation to the direction of the kudu movement.

**Results**

Total sample size were 300 plots, 248 animals were observed, 153 females and 95 males.

Total number of trees recorded in the study area was 2006

Total number of tree species recorded was 24

The raw data were analyzed using multivariate statistical analysis in CANOCO to determine the habitat types and the results revealed that there was a clear separation of kudu females and males in nutrient rich habitats on alluvial and mixed soil while there was no clear pattern of segregation in the poor habitats on sandy soil.

Forage quality between kudu and control plots was tested by using selectivity index and results revealed that feeding patches for both females and males differed from control plots in food quality.

A T-test in two-way ANOVA of feeding site attractiveness values (FSAV) was used to test food quality...
of vegetation in plots; the results showed female kudu feeding plots did not differ from the control plots, whereas male kudu plots and male control plots showed a tendency to differ in food quality. There were significant differences in food quality between female and male kudu feeding plots.

Food quantity and browsing selectivity ANOVA test revealed that males were not statistical significance difference between trees available and trees browsed. In females there were significant differences in preference index between trees available and trees browsed.

**Conclusion**

There is evidence of sexual segregation in kudu foraging in a heterogeneous savanna, in Chobe National Park, Botswana

The results were to some extent consistent with the Jarman-Bell hypothesis (females’ select higher quality and also higher quality than males

Addition females seem to avoid predator- prone habitats.

**References**


The Impact of Climate Change on Namibia’s Climate Resource for Outdoor Tourism Activities

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Purpose

Tourism is a very important sector of the Namibian economy, attracting a significant number of tourists every year and providing economic growth and employment for the country (Namibia Tourism Board, 2012). Climate is regarded as a principal resource that has a strong influence on the tourism and recreation sector (Besancenot 1990; de Freitas et al., 2008). Current projections show that climate change will have a negative impact on Namibia’s tourism industry (MET, 2011). The aim of this study is to investigate the impacts, negative or positive, of projected climate change on Namibia’s climate resource for tourism. To do so, the “Tourism Climatic Index” (TCI), developed by Mieczkowski (1985), was examined.

The projections of climate change impacts on tourism presented are for the future period 2045-2065 and based on the low A2 scenario of the Special Report on Emissions Scenarios (SRES) of the Intergovernmental Panel on Climate Change (IPPC, 2007). The control run represents the base period 1900-2009, and is used as a reference for comparison with future projections. The TCI is estimated using climate data outputs from a weighted ensemble of 9 Global Circulation Models (GCMs), with a horizontal resolution of 55 km × 55 km.

Method

The TCI consists of five sub-indices: daytime thermal comfort; daily thermal comfort; precipitation; hours of sunshine, and wind speed. The five sub-indices and their relative contribution to the TCI are outlined in Table 1 below.

1 The data used in the analysis were weighted average outputs from an ensemble of nine Global Circulation Models (GCMs) - i.e., CGCM3.1 (T47), CNRM-CM 3, GFDL-CM 2.0, GFDL-CM 2.1, IPSI_CM4, MICRO C3.2 (medres), ECHO-G, ECHAM5 / MPI-OM and MRI-CGCM 2.3.2. The horizontal resolution is 0.5 minutes or 55 kilometres.

Table 1: Components of the Tourism Climatic Index (Mieczkowski, 1985)

<table>
<thead>
<tr>
<th>Sub-index</th>
<th>Climate Variable(s)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime comfort index (CID)</td>
<td>Maximum daily temperature (°C)</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Minimum daily relative humidity (%)</td>
<td></td>
</tr>
<tr>
<td>Daily comfort index (CIA)</td>
<td>Mean daily temperature(°C)</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Mean daily relative humidity (%)</td>
<td></td>
</tr>
<tr>
<td>Precipitation (R)</td>
<td>Precipitation (mm)</td>
<td>20%</td>
</tr>
<tr>
<td>Sunshine (S)</td>
<td>Daily duration of sunshine (hours)</td>
<td>20%</td>
</tr>
<tr>
<td>Wind speed (W)</td>
<td>Wind speed (km/h)</td>
<td>10%</td>
</tr>
</tbody>
</table>
A standardized rating system, ranging from 5 (optimal) to 0 (extremely unfavourable), is used to provide a common basis of measurement for each of the sub-indices. The following equation is used to calculate the TCI for outdoor recreational activities:

\[
TCI = 8CID + 2CIA + 4R + 4S + 2W
\]

Where \( CID \) = daytime comfort index, \( CIA \) = daily comfort index, \( R \) = precipitation index, \( S \) = sunshine index, and \( W \) = wind speed index. The maximum score for the TCI is 100 - Table 2 shows the standard classification of the TCI scores.

Table 2: Classification of the TCI (Mieczkowski, 1985)

<table>
<thead>
<tr>
<th>TCI score</th>
<th>Classification category</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>Ideal</td>
</tr>
<tr>
<td>80-89</td>
<td>Excellent</td>
</tr>
<tr>
<td>70-79</td>
<td>Very good</td>
</tr>
<tr>
<td>60-69</td>
<td>Good</td>
</tr>
<tr>
<td>50-59</td>
<td>Acceptable</td>
</tr>
<tr>
<td>40-49</td>
<td>Marginal</td>
</tr>
<tr>
<td>30-39</td>
<td>Unfavourable</td>
</tr>
<tr>
<td>20-29</td>
<td>Very unfavourable</td>
</tr>
<tr>
<td>10-19</td>
<td>Extremely unfavourable</td>
</tr>
<tr>
<td>Below 9</td>
<td>Below 9 Impossible</td>
</tr>
</tbody>
</table>

The climate data that was used in the estimation of the TCI were downloaded from the Climate Data Distribution Centre (DDC) of the IPCC and from the Climate Wizard platform of the World Bank. To show climate change impacts on Namibia's climate resource, average TCI for the months of June-July-August (JJA) and September-October-November (SON) were examined. These months correspond to the peak tourism season in Namibia.

Results

Figures 1a and 1b, in appendix I, shows the average TCI results for the baseline or present period (1901-2009) for the JJA and SON months, respectively. Based on the classification given in Table 2, the majority of Namibia's climate resource, in the months of JJA, presently rank between 60 and 89 on the 'TCI' scale in other words between "good" and excellent conditions for outdoor tourism activities. The only exceptions are small areas in the north-east and north-west of the country, which were ranked as acceptable (average TCI score: 50-59) for outdoor tourism activities. Results for the SON, baseline period, shows average TCI score of between excellent and acceptable (i.e., 50-89).

However, there is a distinctive pattern that emerges, the suitability of Namibia's climate resource for outdoor tourism activities gradually declines as you move, in a north-east direction from the coastal areas (i.e., where the climate resource is ranked excellent for outdoor activities) towards the inland northern areas of the country (i.e., where the climate resource is ranked acceptable for outdoor tourism activities).

The projection results for the mid-century period, 2045-2065, are presented in Figures 2a and 2b, for the JJA and SON periods, respectively. Comparison of the average TCI scores, in the JJA period, for baseline and future periods, shows a definite change. Climate change is predicted to have a negative impact on the climate resource of the northern areas of the country. On the other hand, the climate resource of the southern areas of the country are predicted to be more resilient to climate change. The average TCI score in the southern areas ranges between "very good" and "excellent" in the mid-century.
Results presented in Figure 2b clearly show that the SON season will be the most adversely impacted by climate change. Only the coastal areas of the country are predicted to have a “very good” to “excellent” climate resource for outdoor tourism activities in the mid-century period. The majority of the country is predicted to have a climate resource that is marginal to acceptable during the SON period.

**Conclusion**

From the aforementioned TCI results, it can be concluded that in the mid-century period (2045-2065), climate change will have a negative impact on Namibia’s climate resource for tourism activities, in both the JJA and SON periods. The results show that the climate resources of inland areas in the northern parts of the country will be the worst affected. The climate resource of coastal areas of the country is predicted to be more resilient to the impact of climate change. Although these results do not in any way predict a reduction in tourist flows to the northern parts of the country, in the mid-century, it would be imperative for decision makers to climate proof future tourism development initiatives in the northern parts of the country.

**References**


Appendix I

Figure 1(a): Average TCI for the JJA period - Baseline period (1901-2009)

Figure 1(b): Average TCI for the SON period - Baseline period (1901-2009)

Figure 2(a): Average TCI for the JJA period - Mid-century period (2045-2065)

Figure 2(b): Average TCI for the SON period - Mid-century period (2045-2065)
Environmental and anthropogenic spatial and temporal patterns of plant health of Welwitschia mirabilis in the central Namib Desert

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Purpose

Wilwitschia mirabilis is a long-lived gymnosperm endemic to the Namib Desert. It occurs from the Kuiseb River in Namibia to the Nicolau River north of Namibe in Angola, in a region where the rainfall varies from <50mm to about 200mm p.a. It is protected by law in Namibia and is also listed as a CITES Appendix II plant. Welwitschia is a unique plant, both in appearance and biology. It has been one of the main tourist attractions of the central Namib and a subject of several scientific studies. In the central Namib, there is a reference population of about 52 000 individuals occurring south of but adjacent to the developing Husab mine, slated to become the second largest uranium mine in the world. The cumulative impacts from the developing mine (potential impacts include interference with water supply and deposition of dust) are likely to be additional to the factors that normally affect plant health, yet it is not known how Welwitschia will respond to these potentially deleterious conditions. These impacts and the changing baseline conditions might affect their physiological processes, thus their growth and reproduction.

In this study we investigate plant health as a function of topography, geology and how patterns in health change over time. We aim to improve our understanding of the relationship of various natural driving factors to the plant’s health, to better gauge the potential additional impact caused by mining and to provide possible monitoring tool and management strategies. The findings from this study may in the future also aid restoration measures such as translocation and re-introduction of this unique plant.

Method

The study was conducted in the central Namib, within the Namib Naukluft Park (NNP), at two distinct Welwitschia populations, Welwitschia Plains and Gobabeb. Five catchments were digitized from satellite images and 20 plants were randomly selected from each catchment. Chlorophyll a fluorescence (as a good indicator of photosynthetic efficiency) was measured three times: December 2014 (after a pro-longed dry spell), January 2015 (after about 10mm of rain had fallen on all study sites) and April 2015 (after another rainy spell, but only in part of the study area). An increase in the chlorophyll fluorescence implies an increase in the photosynthetic efficiency. A one-way ANOVA was used to analyse the differences among catchments (p < 0.05) by using SigmaPlot 12.0 software.
We found significant differences in photosynthetic efficiency patterns across catchments over time (Fig. 1). All catchments had a low photosynthetic efficiency in December. Intensive browsing by horses at Welwitschia Wash possibly caused a reduction in photosynthetic efficiency relative to all other catchments at this time (Fig. 1). Photosynthetic efficiency increased markedly in all plants in three catchments (one at Welwitschia Plains and two at Gobabeb) during January, which was just after a rainfall event of about 10 mm across all catchments (Fig. 1). The browsed plants showed the most remarkable increase (Fig. 1). After another brief rain event, further increases occurred across all catchments (Fig. 1).

**Conclusion**

Our results provide the first look at how stress affects this unique plant species at a physiological level and suggests a number of questions about the levels of stress it can endure. Given that the plant probably relies on groundwater of some sort, we expected to find consistent differences among catchments as this would reflect different hydrological schemes. This was evident especially in the low photosynthesis response of the plants at Welwitschia campsite and at Welwitschia Wash near Gobabeb.

Episodic rainfall does increase the rate of photosynthesis, implying that chlorophyll fluorescence is a sensitive indicator of the plant’s level of water stress. However, the swift increase in photosynthesis after rain also implies that a weak photosynthesis signal is probably a natural but rapidly-reversible response to episodic and ephemeral stressors. A similar and somewhat more dramatic increase in photosynthesis in browsed plants after rain showed that the plants can also integrate an anthropogenic stressor without becoming fatally compromised, at least not in the short period we observed them.

As a tool to be used in long-term monitoring, the method has high potential. However, a fuller understanding of how Welwitschia reacts to different stressors will require integration across seasons and across a number of other potential drivers. Our study was a once-off study conducted in only a short part of the year. Considering the longevity of Welwitschia, longer-term studies should now be conducted to understand the spatial and temporal patterns of plant health.
References


Isolation and Genus identification of bacteria from urine contaminated soils of Windhoek

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Purpose

Pathogenic microorganisms ascend through the urethra or the insertion sites of catheters to cause urinary tract infections (UTI) (Muratani & Matsumoto, 2006). Although urine is generally sterile, it may harbor infectious microbes, in instances where it has come into contact with bacteria associated with the urethra, genitals, (Karak & Bhattacharyya, 2011) fecal material and the environment (Muratani & Matsumoto, 2006). Post-infection human pathogenic organisms may be excreted in large numbers in biological specimens such as urine. Hence, these organisms maybe transmitted directly (surface-to-mouth contamination) or indirectly (hand-to-mouth) and via other routes, such as the eyes, nose, and abraded skin (Reynolds, Watt, Boone, & Gerba, 2005). It is therefore imperative that studies that determine the biogeography of pathogenic organisms are contacted, due to their potential to identify organisms that may survive for extended periods and thus prevent the spread of human diseases (Flores et al., 2011). Therefore, this study aimed at determining if there was a shift in the balance of the microflora in urine contaminated soils by isolating, identifying and quantifying microorganisms in both urine-contaminated and non-contaminated soils.

Method

Soil samples were collected from 4 contaminated locations in Hakahana, Wanahenda, Greenwell Matongo and Dorado Park (Ara). Contaminated and non-contaminated (control) areas were identified visually by the presence or absence of urine respectively. Control sites were selected in the same localities as the contaminated sites. Qualitative test for the presence/absence of urease activity was done by using the urea base agar slant test. Microorganisms were isolated and enumerated using various selective media after a 24 hour incubation. These media were: Triple Sugar Iron (TSI), Cysteine Lactose Electrolyte Deficient (CLED), Soil Extract Agar (SEA) and Zhang Starch Soil Extract Agar (ZSSE). The former two were selective for enterobacteria and the latter for actinobacteria. Sub-culturing was done to obtain pure isolates. These isolates were characterized morphologically and biochemically. The genus of the colony was identified after being subjected to a series of reactions, these reactions included the gram stain, acid fast stain, simple and spore formation stain; catalase test, thioglycolate media and motility test.

Results

The degree of urease activity was measured by using triple, double, single positive or a negative sign, depending on the degree of the colour change from orange to beige pink in the test tube after inoculation and incubation. Dorado was triple (+++) positive, Eveline and Hakahana were double (++) positive, and Greenwell Matongo was single (+) positive. All control samples were negative or negligible. Pathogenic microorganisms from 11 genera were identified: Neisseria, Bacillus, Shigella, Klebsiella, Staphylococcus, Streptococcus, Sporosarcina, Escherichia, Enterobacter, Proteus, and Salmonella.
At Wanahenda, Hakahana and Greenwell matongo suburbs of Katutura it has been found that, a contaminated site harbours more pathogenic bacteria and less beneficial actinobacteria. However, at a control site, there were more beneficial actinobacteria and less of the pathogenic UTI causing microorganisms. However, an anomaly has been found at the contaminated site in Dorado, where the number of actinobacteria was more than that of pathogenic bacteria. At this site in Dorado, there number of beneficial actinobacteria is more than that of the pathogenic causing microorganisms.

**Conclusion**

There results show a clear shift in the balance, i.e. a reduction in the number of actinobacteria and an increase in the number of pathogenic bacteria at a urine contaminated site. There is a significant difference between the colony counts at a contaminated and non-contaminated (control) site, \( P=0.019 \) (\( \alpha=0.05 \)). The results indicated that public urination introduces pathogenic bacteria, causing a shift in the balance of the normal flora. It is not yet clear why these was not the case at Dorado.

**References**

vi. Fisheries

The selection of spawning locations of three pelagic fish species in the Northern Benguela upwelling system

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Purpose

Spawning locations of the pelagic fish species sardine (Sardinops sagax), horse mackerel (Trachurus capensis) and anchovy (Engraulis encrasicolus) have been studied intensively during the 1980s in the Northern Benguela upwelling system. Since then, changes in the biomass and/or stock structure have been observed for all three species and it has been suggested that these changes have led to changes in spawning behaviour. Furthermore, changes in environmental regimes have been observed in the Northern Benguela system with a high upwelling regime observed during the 1980s followed by a decrease in upwelling favourable winds (Peard 2007) accompanied by an increasing trend in sea surface temperature (SST) since the early 1980s (Monteiro et al., 2008). In this contribution, ichthyoplankton data collected in the early 1980s and early 2000s was analysed to investigate if changes in spawning locations between the two time periods have taken place.

Method

Sardine and anchovy eggs/larvae were collected along the Namibian coast during SWAPELS (South West Africa Pelagic Surveys) cruises from 1982 to 1985. From 1999 to 2005 annual ichthyoplankton surveys collecting eggs and larvae of sardine, anchovy and horse mackerel were conducted on board the Norwegian research vessel Dr. Fridtjof Nansen.

The preference of sardine and anchovy spawning along the coast during the two time periods was assessed by using Single Parameter Quotient (SPQ) analysis.

The spawning habitat preference of horse mackerel was modeled based on the egg and larvae data. Spawning habitat preference was studied using two methods: 1) modeling the distribution of eggs and larvae as a function of geographical and environmental variables using a Generalized Additive Model (GAM); 2) assessing association between the distribution of the eggs and larvae and that of the environmental variables at depth of distribution using Empirical Cumulative Distribution Function (ECDF).
Results

SPQ analyses of both survey time series (early 1980s and 2000s) have shown that there was a shift in the preferred latitude of spawning of sardine towards more southerly regions in the recent period. In the 1980s sardine preferred to spawn in the part of the coast around 19.5°S whereas in the 2000s the preferred location is farther south around 22.5°S.

Some differences in spawning habitat selection for anchovy have been observed between the two time periods. Although anchovy eggs were found in similar latitudes, they were found at lower temperatures (12°C to 14°C) in the 1980s compared to the 2000s (16°C to 18°C).

For horse mackerel the GAM model show that horse mackerel eggs are mostly found in the northern Namibia and are associated with areas characterized by temperatures between 16°C and 19°C and salinities between 35 and 35.6. Larvae on the other hand are found throughout the study area but mostly concentrated in the northern area, with patches around 20°S and 22°S. The larvae were associated with slightly warmer (18°C to 22°C) and more saline water (>35.5).

EDCF analysis showed that eggs and larvae were found mainly between 20 m and 150 m depth. Eggs were associated with a narrower temperature range (11°C to 17°C) than larvae (10°C to 20°C). Egg and larvae densities peaked at similar salinities ranging from 34.8 to 35.8. In terms of oxygen concentrations the distribution of eggs did not show preference to any oxygen concentration, while larvae densities peaked at oxygen concentrations between 2 and 4 ml/l, but showed a preference to a wide range of oxygen concentrations (0.18 ml/l to 5.8 ml/l. Although eggs and larvae showed a similar range of preference with regard to latitude (23°S to 18°S), alongshore distribution of eggs is more restricted to latitudes north of 21°S, while larval distribution is more widespread along the coast.

Conclusion

Our results confirm that central Namibian coast is still an important spawning area for sardine during at least some periods of the spawning season (January to March), despite the very low abundance and altered stock structure of the sardine spawning stock in Namibian waters. Selection of spawning location for the northern Benguela sardine seems to be driven by environmental conditions rather than biomass or stock structure. The hypothesis put forward by Crawford et al. (1987) that the Walvis Bay area has diminished in importance as spawning area after the stock collapse in the 1970s, preventing the stock from recovering, could not be confirmed.

Despite the very low biomass of anchovy, eggs and larvae are still found at very much the same latitudes in the 2000s as in the early 1980s. Eggs were, however, found at higher temperatures in the 2000s, in line with the general warming of the system. Higher temperatures possibly are less conducive to successful recruitment of anchovy, keeping the biomass at low levels.

Distribution of horse mackerel eggs during the early 2000s generally concurs with findings from earlier time periods, with the major spawning areas found to be north of 20°S. Horse mackerel eggs and larvae were found over a wide range of environmental variables, suggesting that they are robust to changes in the environment.
References

Spatial distribution of commercial bottom-trawl effort for hake-directed fishery in Namibian waters between 2000 and 2006.

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Purpose
Bottom-trawling is one of the most widespread sources of physical disturbance to the continental shelf substrates throughout the world. Previous studies[1,2,3] have shown that degradation and ecosystem changes have occurred in intensively fished areas. To date it has been difficult to attribute ecosystem changes to bottom-trawling intensities at a spatial scale that is representative of commercial fishing effort. Benguela Current System, this study quantifies and characterizes bottom-trawl intensity using commercial data (2000 - 2006) from the Namibian hake-directed bottom-trawl fishery for the first time[4].

Method
Bottom-trawl intensity is assessed by mapping the average number of hours trawled in a 1' latitude x 1' longitude grid square and as the average number of trawls per grid square[5] over a seven-year period, using ArcGIS software. Effort and catch per unit effort are estimated and modelled using general linear models first, and then generalized additive models or big additive models, with longitude, latitude, depth, year, seasons, vessel type, and regions as explanatory factors.

Results
Bottom-trawling intensity varied spatially off Namibia, with the average number of trawls per grid square patchily distributed. Southern Namibia was the most heavily trawled with high fishing effort (54.18 %), followed by central Namibia (25.06 %), with northern region the least trawled (20.77 %). Most of the effort was concentrated in water depths ranging 200 to 399 meters, and freezer vessels expended more effort (71.56 %) than the wetfish vessels (28.44 %) (Fig.1). Effort varied
Figure 1. Annual average trawl frequency per grid square (1’ x 1’) for the Namibian hake bottom-trawl fishery over the seven-year period (2000 – 2006).

significantly (p < 0.001) both annually and seasonally with the highest effort recorded in autumn and lowest in summer. Temporal and seasonal variations affected the catch per unit effort, and wetfish vessels accounted for higher catch per unit effort (64.11 %) than the freezer vessels (35.89 %).

Conclusions
This study has illustrated and characterized the temporal and spatial distribution of commercial bottom-trawl intensity off Namibia for the first time.

- Bottom-trawl intensity measured as average tow duration was uniform, and it displayed a patchy distribution when expressed as average number of trawls per grid.
- On average, the highest bottom-trawling took place in southern Namibia, with some large areas heavily trawled, followed by central Namibia with pockets of heavy trawling; and least bottom-trawling activity occurred in the north, but there were also areas of heavy trawling.
• Skippers preferred trawling in both soft sediments (mud-sand) and flat hard substratum (sand-gravel) in order to avoid trawl net damages on rough rocky grounds.

• Total duration and number of trawls per grid declined with increasing depth and this is associated with the difficulties to trawl in deeper waters.

• Season plays an important role in both the mean fishing effort and CPUE, with autumn and winter yielding the highest fishing effort; while autumn had the highest CPUE over the seven-year period.

• The GAMs analysis could only account for less than 20% of the variance, thus making them weaker predictive models in this case, due to the unavailable additional covariates from the data.

References


Heavy metal pollution: A concern along the Namibian Coastal Waters

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Purpose

In recent years, metal levels have been escalating in the marine environment as a result of human activities (Cardellicchio et al., 2008 and Vellemu & Omoregie, 2014). Furthermore, the rapid growth of urbanization, coupled with increased industrial activities has resulted in increased production and use of harmful elements such as heavy metals eventually entering the aquatic environment. There is likelihood for an eminent trace metal being transferred to higher trophic levels in the food web including human beings (Giarratano & Amin, 2010). Unlike many organic contaminants, metals cannot be eliminated from the environment by chemical or biological transformation (Andres et al., 2000). Thus, these pose major environmental and human health problems globally (Ensley, 2000).

This study aimed at providing baseline data on the levels of Pb, Cu, Zn and Fe in *Choromytilus meridionalis*, water column and sediments for the Central Namibian marine coastline. This is quite substantial for further investigations in the field of ecotoxicology in as far as bio-monitoring programs of the marine environment are concerned.

Method

Samples (water, sediments and mussels) were randomly collected from each of the following sampling sites: Walvis Bay Harbour (latitude 22° 56’ 50.3"S, longitude 14° 30’ 04.3”E), Swakopmund (latitude 22° 42’ 02.7”S, longitude 014° 31’ 14.9”E), Henties Bay (latitude 22° 24’ 34.8”S, longitude 014° 26’ 38.7”E) and Cape Cross (latitude 21° 45’ 22.5”S, longitude 013° 58’ 08.2”E) during the period; April to December 2012. Metal levels in samples were determined by inductive coupled plasma optical emission spectrometry (ICP-OES), Perkin Elmer Optima 7, 000 DV model. Mussel metal Bioaccumulation Factors from water (BAFwater) for Pb, Fe, Cu and Zn were determined using methods described by Morrison (2000).

Data were first tested for normality using the Kolmogorov-Smirnov test and analysed using a 4x2x3 factorial model of a completely randomised Analysis of variance (ANOVA) design. Comparisons of means for metal levels between and within mussels, sediments and water column were performed using the least significant difference (LSD) technique at 0.05 level of significance.
Results

Results obtained from this investigation indicated significant levels of Pb, Fe, Cu and Zn in sediments (P < 0.05), with undetectable levels within the water columns at all sampling sites (with except of water samples collected from Walvis Bay Harbour). Pb, Cu and Zn were significantly higher in sediments from the Walvis Bay Harbour. Fe levels in the sediments were significantly higher (p < 0.05) in Henties Bay stations, with undetectable levels recorded for Cape Cross stations. Within Walvis Bay Harbour, significant levels of Pb were detected in mussel samples, indicating a correlation of bioaccumulation from the environment. Significant seasonal variations in metal accumulation were observed across the various stations. Low BAFwater values were recorded from all stations.

Conclusion

Metal levels recorded in mussel samples from this investigation were within EU regulatory limits, thereby regarded safe for human consumption. However, levels of metals observed in sediments from Walvis Bay Harbour are of environmental concerns due to metal re-suspension and re-cycling from the sediments into the water column as a result of sediment disturbance (García, 2013). Despite the fact that low BAFwater values for collected mussels were recorded from all stations, however there is concern for Pb, Cu and Zn BAFwater values in mussels collected from Walvis Bay Harbour. This study has revealed that there is a significant level of metal in the sediments from the Walvis Bay Harbour. Thus, there is a need to initiate monitoring programme of the coastline for metal pollution.

References

MARKET DIVERSIFICATION OPPORTUNITIES FOR NAMIBIAN FISH AND FISH PRODUCTS

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Purpose

The purpose of this paper to analyse alternative markets will comprise of in-depth market analysis and supply strategies for the most lucrative export opportunities.

Method

In this study two methodological approaches were used that includes (i) The Decision Support Model (DSM), modelling realistic export opportunities and (ii) Bubble graph produced from trade statistics for international business development

Results

The following countries listed below come top:

1. The United States of America: it is a top market for frozen shrimps and prawns, whether or not in shell (HS30613); and also for frozen fish fillets (HS30420). It is also a potential market for fish fillets and other fish meat, whether or not minced (excluding 30302 and HS30420). It is characterised by a large product market with long-term growth, and thus general market potential.

2. Japan: top market for frozen shrimps and prawns, whether or not in shell (HS30613); and also for frozen fish fillets (HS30420). It falls under large product market with short- and long-term growth, thus it offers general market potential.

3. China: constitutes a market for frozen fish not elsewhere specified (excluding fillets and other fish meat of 03.04/livers & roes: HS30379). It passes for general market potential and a large product market with long-term growth.

4. Germany: is a potential market for frozen fish fillets (HS30420). It is filtered as a growing market (short- and long-term), and therefore a product market to be considered.

5. Spain: has a market for frozen shrimps and prawns, whether or not in shell (HS30613); it passed for a larger market with general market potential.

6. Thailand: is a potential market for frozen skipjack/striped-bellied bonito (Euthynnus Katsuwonus pelamis) (HS30343).

7. France: is a potential market for Pacific salmon/Atlantic salmon/Danube salmon (HS30212) and frozen fish fillets (HS30420).
Conclusions

This approach identified the top seven export opportunities; these include in descending order: The United States of America, Japan, China, Germany, Spain, Thailand & France:

When bubble graph applied with bigger bubbles for Japan and USA. Spain shows the largest portion share of Namibian exports (nearly 30%), followed by the DRC and South Africa respectively.

In line with the above key finding, there is need to build local capacity through acquisition of vessels. Funding strategies have to be developed, without putting the burden on tax-payers (the state). Despite infrastructural problems, the African market has great potential for Namibian fish. The popularity of Namibian mackerel within SADC is an example, and remains to be fully exploited.

This study provide general export opportunities is provided with regards to specific product opportunities, market performance, competition, market accessibility & market structure, but not import requirements and regulations included. Therefore, as the product classification used in this study only allows for the identification of broad opportunities further in-depth research is needed on local consumer preferences for specific meat cuts and characteristics.
Ore Characteristics Investigation for predicting Bit Penetration Rate at Okorusu Fluorspar Mine

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Purpose

The paper is expected evaluate rock characteristics; behaviour of rock under selected strength parameter and estimate drilling time for prediction of penetration rate. Furthermore, the selected rock or ore characteristics will reveal the response of ore and host rocks to applied strength parameter and penetration rate of rock drilling bit at the different section of the mine. Hence, this will provide needed information for determination of number of blast- holes to be drilled; the duration involved coupled with drilling cost which could be estimated with confidence.

Method

Point load strength index was determined using core samples of carbonatite, phonolite and fluorites. It was measured in accordance with the procedures recommended in (ASTM, 2006) D 5731-02. The mineral composition of the rock was determined using an X-ray diffraction machine. The fine rock material was grinded to a specified size; the X-ray diffract-meter then recorded the intensity of the diffracted beam electronically at precise angles as the specimen was scanned over an angular range (White and Willie, 2007). Porosity was determined using saturation and caliper method (Adebayo and Akande, 2011). Penetration rates were measured drilling at D-bottom pit with rigs 1, 3 and 4 at regular interval using vernier caliper. The regression model penetration rate prediction was developed using Statistical Package for Social Science (SPSS).

Results

The point load strength index varied from 3.73 - 13.69 MPa for carbonatite, 6.98 - 13.04 for phonolite and 4.68 - 5.39 MPa for fluorite. The ore and associated rock have high point load strength index based on (Rodney and Williamson, 1995) classification. The value of the porosity varied from 0.15% - 2.99%. The value of porosity has direct relationship with the strength of the rock. The penetration rates measured varied from 0.451 and 0.579 m/min. The average penetration rate was found to be 0.503 m/min. The regression model equation to predict penetration rate is expressed in Equation 1.

AVPR = 0.325 + 0.035Is50 + 0.001n …………………………………(1)

Where, AVPR is the average penetration rate, n is porosity and Is50 is point load strength index.
Figure 1 shows the plot of average penetration rate against regression standardized residual. The plot has multiple coefficient of determination of $R^2 = 0.883$ this confirm the validity of the model.

**Figure 1:** Average Penetration Rate against Regression Standardized Residual

**Conclusions**

The following conclusions drawn from this paper are: the selected rock investigated was found to contain carbonatites, phonolites and fluorites; the percentage of quartz is higher in host rock than ore, this means that lower penetration rate will be experienced in host rock than the ore. Finally, the average penetration rate was found to be 0.5026 m/min and formation was classified as high strength material. The regression model equation to predict penetration rate can be used for other formations having similar characteristics.

**References**

Advancement in Prospecting and Mining Technology

New advancement in visual geospatial distribution of mineral ore distribution

Method

Mineral Prospecting enabled with Satellite Maps and Satellite Aerial Orthophotos, using Google Earth and Flash Earth Satellite Maps enhance accurate location to mineral reserve deposits. Mineral Prospecting CC use Satellite Maps to prospect for Minerals, Energy and Fuel reserve deposit underneath the earth crust. This advance in prospecting as a result of a unique photo eye perception and satellite visuals depth perception enable location determination of mineral reserve below surface earth crust deposits. Spatial digital imagery collected from Satellite Map Mineral Prospecting that indentifies diamond, gold, copper, gas field deposits, crude oil (including black gold), uranium and coal. Satellite Maps studies enhance effective determination to GPS coordinate location determent on a global scale, with many global countries located on the Earth Satellite Maps prospecting capability from Aerial Location Windhoek, desk top level. Technological output deliverables in deliverable stages, Mineral Prospecting with Satellite Maps - reserve deposit Orthophotos, LandSat Map Prints and GPS coordinates, Satellite Aerial Orthophotos - including below earth crust visuals, and surface land aerial visuals of between 150m to 200m to ground level - enabling Satellite Aerial continental mapping, water resources hydrological flow pattern visibility of surface and underground water resources, and surface land formation, deformation and fault lines detectable.
Results
Satellite Aerial OrthoPhotographs
Conclusion
This means of prospecting with Satellite Aerial Orthophotos/ Digital Photography reducing impact of exploration and mining cost tremendously, with only GSP Coordinate to precious stone and industrial fuels location and depth drilling in order to open mining field. This tool has been tested and marketed to different international communities globally in order to ascertain competitive advantage, against more traditional prospecting equipment, results outstanding.

References
1. rЄzЄrVЄ Mineral Prospecting CC, (Reg nr: CC /2014 /13438), Mineral prospecting with Satellite Maps, Satellite Aerial Orthophotos
2. L. Nel, Satellite Aerial Orthophotographer, Google Satellite Map Print © October 2013
Purpose

With a contribution of approximately 25% to Gross Revenue inflows and contributing 10% to Gross Domestic Product (GDP), the Namibian mining industry is critical to the Namibian economy. The sector employs approximately 20000 employees, and in addition to supporting social programs, makes significant contributions to the survival of State Owned Enterprises (SOEs). The sector’s contribution continues to grow immensely and indications are that the industry will play an amplified role in the economic and social growth of Namibia. With a growing uranium industry, buttressed with competitive legislative instruments that promote investor interest, Namibia is set to be a leading minerals investment destination. Other sectors within the industry with prospects for immense growth include precious minerals, rare earth metals and gold. The purpose is therefore to create a model for human expertise to support an industry that is fast growing and central to economic growth as motivated by the aforementioned facts.

Method

Investigating and establishing on current policy initiatives and subsequently benchmark them with those of other developed countries to produce a model that suits the Namibian context.

Results

A comprehensive model for human capital model for the Namibian minerals industry as will be outlined in the full paper.

Conclusion

It is crucial that the solution developed be amenable to the local context and yet simultaneously addresses the acute skills shortage that so severely continues to plague the mining industry, hence threatening its sustainability.
Effect of physicochemical parameters on microbiological quality of Oshikundu

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**Purpose**

Oshikundu is a cereal based fermented beverage brewed from brans pearl millet (*Pennisetum glaucum*), locally known as “omahangu” and sorghum (*Sorghum bicolor*) flour. The objectives of the study were to measure the main physicochemical parameters such as titratable acidity, pH, viscosity, alcohol level and kinetics of acid evolution of oshikundu, and to link their variability’s to the total lactic acid bacteria (LAB) and yeast populations responsible for oshikundu fermentation.

**Methods**

A total of 22 oshikundu samples were randomly collected from Ohangwena, Oshikoto, Omusati and Oshana regions in Namibia. Samples were kept in the fridge below 4 °C and were transported to the food biotechnology laboratory in the Department of Chemistry and Biochemistry at the University of Namibia. Analysis for titratable acidity, alcohol, kinetics of acid evolution and identification of LAB was done only on freshly laboratory brewed oshikundu. Meanwhile pH and viscosity was done on point of sampling as well as on the freshly brewed oshikundu. Each collected sample was used in back slopping process to brew fresh oshikundu which was used in the analysis. Ingredients used in brewing fresh oshikundu pearl millet flour, sorghum malt and bran were purchased from Oshakati open market. Biochemical identification test on the LAB and yeast isolates was performed using API 50 CHL and API 20C AUX kits respectively.

**Results**

The pH of Oshikundu ranged from 3.33 ± 0.127 in Oshana region to 3.60 ± 0.014 in Oshikoto region. Titratable acidity as lactic acid was found to be ranged between 1.20 % in Oshikoto and 1.68 % in Ohangwena region. This was found to be high in comparison to other studies that looked at lactic acid of oshikundu which was found to be 0.6 % (Taylor, 2004). Meanwhile acetic acid ranged between 0.10 % in Omusati and 0.30 % in Ohangwena region. Oshikundu is very low in alcohol where-by ethanol increased from 0 to 2 % (v/v) by the end of fermentation process. Viscosity of oshikundu was found to be low and ranged between 23.3 ± 1.154 mPas from Oshana and 41.0 ± 6.082 mPas from Ohangwena region. This is in correlation with the low viscosity and low amount of torque in the samples from each respective region, which ranged from 14.4 ± 0.838 % Oshana and 24.9 ± 3.464 % Ohangwena region. This would also correlate with the large amount of water used in brewing, hence low viscosity. The oshikundu predominant LAB belonged to *Lactobacillus* and *Lactococcus*
genera as identified through their abilities to ferment 49 carbohydrates using API 50 CHL kits. These bacteria are responsible for the production of lactic acid which is the main organic acid in *oshikundu* produced during fermentation. The low pH in *oshikundu* favors the survival of LAB since they are able to thrive under low pH and pathogens cannot. This could be the reason why there is a very low known reported cases, if any of *oshikundu* related food poisoning in Namibia. Yeast was also detected in *oshikundu* samples and identified as *Candida* sp., by using API 20C AUX kit. It is likely to be responsible for alcohol production during *oshikundu* fermentation.

**Conclusion**

The physicochemical parameters have a profound effect on the final product organoleptic properties such as flavour and taste.

**References**


Antimicrobial activity of pigment producing Streptomyces from Windhoek soil

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Purpose

The need for novel, safe and more effective antibiotics is a key challenge to the pharmaceutical industry today. Antibiotic resistance has become a worldwide problem, hence Streptomyces (filamentous gram positive aerobic actinobacteria) are considered to be a potential source of next generation antibiotics. The study aimed at investigating antimicrobial activity of pigment producing Streptomyces from Windhoek soil.

Methods

The soil samples were randomly collected from 3 different sites in Windhoek. Casein agar was used as a media for the isolation of Streptomyces. After incubation isolated bacteria were identified by means of biochemical tests (Starch degradation, gelatin degradation, casein hydrolysis, 7 % NaCl tolerance and acid tolerance), macroscopic technique (color, texture and smell), and microscopic technique (filamentous shape). Starch casein slant agar method was used for primary antimicrobial test (Celmer, 1956).

Antimicrobial compound was recovered from the filtrate by solvent extraction with Chloroform, n-Hexane and Methanol (Rana & Salam, 2014). The primary and secondary antimicrobial tests were performed against M. avium, E. faecalis and E. coli on Starch casei agar. Antimicrobial activity was determined for the 7 identified Streptomyces isolates by using casein slant agar method. The Streptomyces strains with primary antimicrobial activity were further grown in 1000ml nutrient broth to allow antibiotic production. Chloroform and n-Hexane were used to extract pigments from the 1000ml cultured broth. The solvents were concentrated by evaporating off the solvent in a fume hood and thin layer chromatography plates (TLC) were used to separate the pigments present in the concentrated solvent. Gentamycin was used as a positive control for primary and secondary antimicrobial detection.

Results

Seven different Streptomyces isolates were identified. Strong activity was determined against Escherichia coli, M. avium and E. faecalis. The largest zones of inhibition were observed Streptomyces isolate D against M. avium (19.5 mm) and Streptomyces isolate A against Escherichia coli (18.5 mm). 6/7 Streptomyces isolates produced pigments with antimicrobial activity as depicted in Table 1 below.
Table 1. Primary antimicrobial activity of Streptomyces isolates and colors of pigment formed.

<table>
<thead>
<tr>
<th>Streptomyces Isolates</th>
<th>Average Inhibition against E. coli (mm)</th>
<th>Average Inhibition against M. avium (mm)</th>
<th>Average Inhibition against E. faecalis (mm)</th>
<th>Pigment color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolate 1</td>
<td>18.5</td>
<td>0</td>
<td>0</td>
<td>Pink</td>
</tr>
<tr>
<td>Isolate 2</td>
<td>10</td>
<td>11.5</td>
<td>0</td>
<td>Green</td>
</tr>
<tr>
<td>Isolate 3</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>Green</td>
</tr>
<tr>
<td>Isolate 4</td>
<td>16.5</td>
<td>19.5</td>
<td>0</td>
<td>Yellow</td>
</tr>
<tr>
<td>Isolate 5</td>
<td>7.5</td>
<td>0</td>
<td>5</td>
<td>dark green</td>
</tr>
<tr>
<td>Isolate 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Brown</td>
</tr>
<tr>
<td>Isolate 7</td>
<td>0</td>
<td>0</td>
<td>6.5</td>
<td>Brown</td>
</tr>
</tbody>
</table>

Conclusion
Based on the results, there is high possibility of finding different antibiotics in Windhoek soil due to its wide Streptomyces biodiversity. Hence, further studies must be done to determine the properties of the pigments and to better identification technique must be used to fully characterize Streptomyces isolates.

References


Domestication of Marama bean in Namibia: Development of new crop alternatives in a Climate Changing agro-ecology

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Purpose

Marama bean (Tylosema esculentum) is indigenous and adapted to the dry parts of Southern Africa. It is a staple food for the Khoisan and Bantu people from those areas. In Namibia it grows wild mainly in Omaheke and Otjozondjupa regions. Marama bean has pods containing 1-2 oil and protein-rich seeds with a high nutritional value similar to soybean. Protein content is 30-39% and oil content is 30-43%. Its edible tuberous root is rich in starch [1]. The goal of this current domestication programme is to develop marama bean as a new crop alternative for Namibia and Southern Africa in the face of climate change climatic conditions.

Method

This programme was started in 2008 with an open-minded approach requirement and even implementation using brutal non conventional mindframe. The programme prioritised farmer-participatory approaches in order to develop empowerment tools for resource-poor farmers. In this method it was necessary to mix past practices and new styles in domestication thus ensuring that there was learning from the current and past experiences and invoking new ways. In this programme, crop selection was guided by serious consideration of climate change effects. The mindset was to develop indigenous crops since a simple just look at what Africans eat today, and ask how much of that is native to Africa, one can only mention 3-4 crops only and there rest of them were introductions. Climate change has therefore necessitated the serious need to develop local crops that are resilient and adapted to local environments for millennia, may be used to combat climate change effects. Indeed, in many fora where health issues of Africa are discussed one always hear that people should start eating traditional foods to avoid exposure to modern foods to which their physiology is not genetically adapted to. Whether true or false, real or perception, these voices need to be listened and something must be done, lest the future generations will not have kind words to current generation.

Results

This paper reports on the progress that has been made in the domestication of marama bean in Namibia while preparing it as a new crop alternative for arid and drought-prone agricultural zones as a long-term aridity mitigation strategy. The process started with germplasm collection, documentation and selecting marama genotypes with superior traits [2]. These traits included early germination and high numbers of seeds per pod [3, 4]. The University of Namibia has been developed candidate marama bean varieties and is testing marama seeds for its introduction as a possible response to climate change effects where crops such as maize and millets have been failing due to persistent droughts.
Conclusion

Marama has a huge potential to address the problem of malnutrition and hunger in the arid areas of Southern Africa. The results reported here are part of ongoing field screening work and multilocation trials for high yielding marama bean varieties.

References


The Regulation of Biosafety in Namibia, South Africa And Mauritius: A Comparative Analysis

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Introduction

The Convention on Biological Diversity entered into force in 1993. Today, the Convention is the main international instrument for addressing biodiversity issues. It provides a comprehensive approach to the conservation of biological diversity, the sustainable use of natural resources and the fair and equitable sharing of benefits deriving from the use of genetic resources. Namibia, South Africa and Mauritius are all parties to this Convention.

Biosafety is one of the issues addressed by the Convention. The concept of biosafety denotes the need to protect human health and the environment from the possible adverse effects of the products of modern biotechnology. Modern biotechnology is recognized as having a great potential to benefit human well-being, particularly in meeting needs for food, agriculture and health care. The Convention clearly recognizes these seemingly opposing aspects of modern biotechnology. Article 19, paragraph 3, of the Convention provided for the development of an international legally binding instrument to address the issue of biosafety. This was achieved in the form of the Cartagena Protocol on Biosafety to the Convention on Biological Diversity. The Cartagena Protocol is considered to be a significant step forward in that it provides an international regulatory framework to reconcile the respective needs of trade and environmental protection with respect to the biotechnology industry. The Protocol created an enabling environment for the environmentally sound application of biotechnology, making it possible to derive maximum benefits from the potential from biotechnology, while minimizing the possible risks to the environment and to human health. The Protocol provides for relevant legislative and regulatory instruments within the internal legal regimes of the states parties, which instruments would implement and comply with, the provisions of the Protocol.

Purpose

The paper will make an analysis of the domestic legal frameworks of Namibia, South Africa and Mauritius, on biosafety and make a comparison of how these three countries implement the provisions of the Cartagena Protocol. The comparison will look at, among others, the domestic institutional structures, administrative structures and processes (at a high level), as well as the scope of regulation of biosafety-related aspects and legal mechanisms therefor.

Method

The research method employed consisted of legal research and desktop analysis of the principal legislative and regulatory instruments (where applicable) in the three countries concerned. Relevant literature was also consulted.
Results
The results of the research would indicate the similarities and differences in the legislative approach to implementation of the Cartagena Protocol in the domestic legal systems of the three countries concerned.

Conclusions
In conclusion, the paper will try to identify what could be considered as best practices in the areas of comparison of these domestic legal frameworks.

References
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2. Cartagena Protocol to the Convention on Biological Diversity on Biosafety
5. Genetically Modified Organisms Act, 1997 (Act No. 15 of 1997) (South Africa)
The isolation, structural determination and bioactivity of 1E,3R,4S,5E,7Z-1-bromo 3,4,8-trichloro-7-(dichloromethyl)-3-methyl-octa-1,5,7-triene from a Namibian Plocamium species

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Key words: halogenated monoterpene, Plocamium, cytotoxic

Abstract
A rare but known compound namely 1E,3R,4S,5E,7Z-1-bromo-3,4,8-trichloro-7-(dichloromethyl)-3-methyl-octa-1,5,7-triene was isolated from a Namibian Plocamium species for the first time and characterized by means of one and two dimensional Nuclear Magnetic Resonance (NMR) spectroscopic data and Mass Spectrometry (MS) analysis. The compound exhibited minimal inhibition against HIV-1 reverse transcriptase, with 18 and 17 % inhibition at 65 and 129 µM, respectively. However, literature reviews indicate that this compound has good cytotoxic in vitro effects.

Introduction
Marine algae (or seaweed) can be roughly divided as being either red, green or brown. Red algae (Rhodophyta) of the family Plocamiaceae and Rhizophyllidaceae produce a number of different biologically active linear and cyclic polyhalogenated monoterpenes (Kladi et al., 2004). Of the 47 different species of Plocamium that occur around the world, at least 7 species occur on Namibia’s coastline (Bolton, 2014). These metabolites exhibit a wide range of biological activities including antifeedant effects on reef herbivores, antimicrobial, insecticidal, antitubercular and anticancer (Knott et al., 2005) activities.

In the continuing investigation of biologically active metabolites from southern African Plocamium species (Afolayan et al., 2009; Knott et al., 2005; Mann et al., 2007) the natural product chemistry of a Namibian Plocamium species was investigated. In this work, a description of the isolation, structural elucidation and biological activity of the major metabolite obtained from a Namibian Plocamium species of marine alga is reported.

It appears that the major metabolites isolated from selected South African Plocamium, Portieria and Laurencia species are unique to each species (Knott, 2012) within the South African context. However, some degree of overlap occurs with regards to some of the minor secondary metabolites isolated in each species of a specific genus, within the South African context. This is most likely due to common biogenic pathways of origin. For example, metabolites from the genus Plocamium follow the ocimene biogenesis pathway (Naylor et al., 1983). However, this does not necessarily mean that the chemistry of various Plocamium species from Namibia will be the same as that of various
Plocamium species from South Africa. Variations in geographical location, climate and seasonal changes are able to change the chemical profiles of certain marine algae.

Results and discussion

Plocamium samples were collected from the intertidal zone at Swakopmund, Namibia and immediately frozen. A partially thawed sample was extracted with MeOH. This was partitioned with hexane using solvent-solvent separation to yield a surprisingly ‘clean’ compound 1.

Identification of the major metabolite using NMR

The major metabolite present in this Plocamium species was confirmed by NMR and MS and identified based on a comparison of both experimental and literature values. This compound had previously been isolated from Plocamium cartilagineum (Mynderse and Faulkner, 1975), Plocamium surhii (Antunes, 2011) and Plocamium rigidum (Fakee, 2013). The $^{13}$C NMR data and $^1$H NMR data below for compound 1 are consistent with that reported by Fakee (2013) (Table 1). These correlations were also confirmed by means of a $^1$H-$^1$H Homonuclear Correlation Spectroscopy (COSY) experiment.

Table 1. 13C NMR (CDCl3, 100 MHz) data and 1H NMR (CDCl3, 400 MHz) data for compound 1. **Fakee (2013) NMR results included below.

<table>
<thead>
<tr>
<th>Carbon no.</th>
<th>$\delta^c$</th>
<th>$\delta^{c**}$</th>
<th>$\delta^h$</th>
<th>$\delta^{h**}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>110.2</td>
<td>110.2</td>
<td>6.58, d, 16.0</td>
<td>6.57, d, 13.6</td>
</tr>
<tr>
<td>2</td>
<td>137.5</td>
<td>137.5</td>
<td>6.44, d, 16.0</td>
<td>6.45, d, 13.6</td>
</tr>
<tr>
<td>3</td>
<td>71.5</td>
<td>71.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>68.2</td>
<td>68.2</td>
<td>4.53, d, 12.0</td>
<td>4.54, d, 6.8</td>
</tr>
<tr>
<td>5</td>
<td>127.4</td>
<td>127.4</td>
<td>6.33, m</td>
<td>6.33, dd, 15.5, 5.3</td>
</tr>
<tr>
<td>6</td>
<td>129.6</td>
<td>129.6</td>
<td>6.35, m</td>
<td>6.34, d, 15.6</td>
</tr>
<tr>
<td>7</td>
<td>138.5</td>
<td>138.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>119.6</td>
<td>119.7</td>
<td>6.32, s</td>
<td>6.32, s</td>
</tr>
<tr>
<td>9</td>
<td>65.5</td>
<td>65.5</td>
<td>6.97, s</td>
<td>6.96, s</td>
</tr>
<tr>
<td>10</td>
<td>25.3</td>
<td>25.3</td>
<td>1.77, s</td>
<td>1.77, s</td>
</tr>
</tbody>
</table>

Of concern was the stereochemistry at position 4. However, the upfield shift of the methyl signal at position 10 from $\delta$ 1.82 to $\delta$ 1.77 suggests S stereochemistry at position 4 (Mynderse and Faulkner, 1975).

Another point of contention was the nature of E/Z geometry at the $\Delta^{7,8}$ double bond. Literature values supported an E geometry, for example a proton shift of $\delta$ 6.33 at position 8 is characteristic of E geometry at the $\Delta^{7,8}$ double bond, while Z geometry at the $\Delta^{7,8}$ double bond has a proton shift of $\delta$ 6.28 (Mynderse and Faulkner, 1975). Fakee (2013) indicated that the carbon at position 8 has a shift of $\delta$ 119.7 for E geometry at the $\Delta^{7,8}$ double bond, and a shift at $\delta$ 119.3 for Z geometry at the...
\( \Delta^{7,8} \) double bond. Based on both these literature values, an \( E \) geometry might have been assigned to the \( \Delta^{7,8} \) double bond. However, a Nuclear Overhauser Enhancement Spectroscopy (NOESY) experiment showed strong correlations between H-8 and both H-4 and the methyl group at position 10 which strongly suggested \( Z \) geometry at the \( \Delta^{7,8} \) double bond (Figure 1).

\[
\text{Figure 1. } Z \text{ geometry at the } \Delta^{7,8} \text{ double bond based on NOESY correlations.}
\]

As a result, compound 1 was named, \( 1E,3R,4S,5E,7Z \)-1-bromo 3,4,8-trichloro-7-(dichloromethyl)-3-methylocta-1,5,7-triene.

The molecular ion for this compound could not be observed. The low resolution mass spectra of this compound exhibited an abundant ion at mass to charge ratio (\( m/z \)) 167, 169 (base peak), 171 (relative abundance: 3:4:1) which corresponds to an ion with a formula \( C_{20}H_{17}BrCl \), based on the isotope pattern and Mynderse and Faulkner (1975), this fragment ion is formed by the homolytic cleavage of the 3,4-bond of compound 1.

Bioactivity

IC\textsubscript{50} values of \( 1E,3R,4S,5E,7E \)-1-bromo 3,4,8-trichloro-7-(dichloromethyl)-3-methylocta-1,5,7-triene against the MCF-7 breast cancer cell line is an impressive 13.7 \( \mu \)M. Compounds bearing the gem-dichloro moiety are known to exhibit moderate to good cytotoxic activity against this breast cancer cell line (Fakee, 2013). In addition, compound 1 was also very bioactive towards oesophageal cancer cells with an IC\textsubscript{50} (\( \mu \)M) of 6.6 (Antunes et al., 2011). For the oesophageal cancer cell line test, the known anticancer drug cisplatin has an IC\textsubscript{50} value of 13 \( \mu \)M.

Interestingly, compound 1 showed minimal inhibitory activity towards HIV-1 reverse transcriptase (less than 20 % inhibition) at the highest concentration tested (129 \( \mu \)M). The anti-HIV results are indicative that compound 1 might demonstrate good inhibitory activity if tested at higher concentrations.

Conclusion

From a chemotaxonomic perspective, it is interesting to observe that South African Plocamium species can be classified on the basis of their major metabolites which are unique to each species. Compound 1 is the major metabolite found in the South African species of Plocamium suhrii. Although the chemistry of the major secondary metabolite isolated and characterised from this Namibian Plocamium sample is characteristic of Plocamium suhrii, further taxonomical investigations still need to confirm the full identity of this Namibian Plocamium sample. Bolton (2015) states, “The taxonomy of Plocamium in southern Africa is not properly sorted out.” Until the taxonomy of Plocamium in southern Africa is well established, tentative identification of Plocamium species in Namibia will remain an uncertain element of this research.

Compound 1 is easy to extract and is available in relatively large quantities off the Namibian coast.
where *Plocamium* species are commonly found. Literature reviews reveal that compound 1 exhibits good *in vitro* cytotoxic activity.

**Experimental section**

**General experimental procedures**

The $^1$H (400 MHz) and $^{13}$C (100 MHz) NMR spectra were all recorded on a Bruker 400 NMR spectrometer using standard pulse sequences. Spectra were referenced to residual protonated solvent resonances (CHCl$_3$ $\delta^H$ 7.25, $\delta^C$ 77.0). Chemical shifts were reported in parts per million (ppm), while coupling constants were reported in Hertz (Hz).

Gas Chromatography-Mass Spectrometry (GC-MS) analyses were performed on a Thermo Scientific Focus GC coupled to an ITQ 700 MS using Xcalibur Software, version 2.1, for data acquisition. A SGE BP5MS capillary GC column (30 m x 0.25 mm i.d., film thickness of 0.25 $\mu$m) was used with helium as carrier gas at a flow rate of 1.0 mL/min (constant flow) and a split ratio of 10. The GC injector was maintained at a temperature of 220 °C. Samples were injected in the split mode using a split ratio of 1:10. The oven temperature was programmed at 5 °C/min from 40 °C to 300 °C. EI-MS data were acquired at 70 eV and a mass range of $m/z$ 25 to 625 was scanned. Ion source and interface temperatures of 200 and 250 °C, respectively, were used for the analysis.

**Plant material**

*Plocamium* species were collected by hand at the intertidal zone at Swakopmund in May 2014 and kept frozen until extraction. The voucher specimen has been stowed away at the School of Pharmacy, University of Namibia. Identification of the algae was done by Mr. Lineekela Kandjengo from the Department of Fisheries and Aquatic Sciences, University of Namibia.

**Extraction**

*Plocamium* species (1.598 g wet mass) was steeped in 100 ml MeOH overnight. The partially concentrated methanolic extract was filtered through cotton wool and partitioned three times with hexane (3 x 30 ml). The hexane extracts were concentrated and weighted 0.271 g (dry weight 16.96 %).

**Compound 1:** (1E,3R,4S,5E,7Z)-1-bromo-3,4,8-trichloro-7-(dichloromethyl)-3-methylocta-1,5,7-triene (1): colourless oil; NMR data available in Table 1. As previously reported by (Mynderse and Faulkner, 1975).

**HIV-1 reverse transcriptase assay**

A non-radioactive reverse transcriptase colorimetric ELISA kit from Roche Diagnostics (Mannheim, Germany) was used to test compound inhibition to RT. The protocol outlined in the kit was followed using 4ng of enzyme per well (Fonteh *et al*., 2009; Kapewangolo *et al*., 2013). The compound was tested at 65 and 129 µM. Doxorubicin was used as a positive control.

**Acknowledgements**

A special thank you to Prof. Koch at the University of Stellenbosch for assisting us with NMR experimentation.
References


The Ocean as a Source of Antibiotics: Molecular and Morphological Screening for Fungi

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Purpose

Fungi display elaborate genetic and metabolic diversities which allow them to colonize a wide range of substrates in the most complex environments (Wisecover et al., 2014). In addition, Fungi compete with a host of other organisms for food. To survive they produce a specific set of metabolites capable of dealing with the set of microbes that coexist in their specific environment (Colak et al., 2009). These metabolites have been used to produce some of the best antibiotics. Penicillium, Cephalosporin and Griseofluvin are excellent examples (Perlman, 1974). Until recently, the majority of fungi exploited in biotechnology were from soils. However, the indiscriminate use of antibiotics has led to increase in multiple resistance to antibiotics. This creates a need to search for new sources of antimicrobial products, (Kothari et al., 2010) and the ocean is one such place. The purpose of the study is to isolate and characterize fungi from the Namibian ocean environment.

Methods

The study was conducted on the R/V Mirabilis research vessel during 8-12 May 2015. A Multicorer was used to collect sediment and water samples were collected with a CTD rosette from different stations. Water samples were collected and inoculated onto 5 different growth media in 60mm Petri plates and marked with „W“. Sediment samples were collected in 0-1, 4-5, and 9-10 cm profiles and inoculated on 5 different growth media and marked with „S“. Plates were monitored regularly and observations recorded.

DNA was extracted from 4 sediment samples using the MOBIO PowerLyzer DNA kit and protocol. The extracted DNA was visualized with gel electrophoresis using a 1% agarose gel stained with Gel Red. A PCR was performed on the extracted DNA with ITS1 and ITS4 primers with annealing temperature of 59°C. PCR products were viewed with gel electrophoresis using 1% agarose gel in TE buffer stained with Gel Red and run at 60V for 60 minutes.

Results

The water and sediment samples inoculated onto growth media yielded colonies of different sizes, shapes, colour and forms. The colonies showed molds with filamentous structures and bacterial types as well. Some colonies sporulated as they matured while a few produced pink, orange and yellow pigments. Some colonies produced a clear zone around it in the Starch medium.

Genomic DNA from sediment was amplified successfully with ITS1-ITS4 primers and produced bands between 500 - 1500 bp.
Conclusion
These results are indicative of fungi and bacteria isolated from the ocean environment. Genomic DNA from sediment was amplified successfully with ITS1-ITS4 primers. These primers are specific for the internally transcribed spacer region in the small ribosomal subunit of fungi (White et al., 1990). The PCR results therefore confirm the presence of fungi in the sediments isolated from Namibian ocean environments.

From the preliminary results above, the author concludes that there is fungal presence in the Namibian ocean environment. This is one step closer to answering the question; is the ocean a source of potential antibiotics? The answer is a resounding YES!

References
Improved growth of sorghum by co-inoculation with native PGPR strains Pseudomonas stutzeri ACM2-32, Kosakonia cloacae FCM2-50 and Bacillus amyloliquefaciens LSM1-61

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Purpose

The projected increase in the global population will result in an increased demand for agricultural products [3]. The use of agrochemicals (fertilizers, pesticides and commercial growth promoting substances) is known to increase crop production. However, excessive agrochemical use comes at a high financial cost and causes a negative impact on the environment. Thus alternative methods for increasing crop production have to be developed in response to the increased food demands of a growing population. Plant-growth promoting rhizobacteria (PGPR) are bacteria that colonize roots and improve growth and development of the plant. PGPR are able to influence plant growth because they are contributors of metabolic processes in the soil and they are producers of plant beneficial compounds [1],[5]. The poor harvest experienced by subsistence farmers can be overcome by using cheap and ecologically favourable biofertilizers (PGPR) [2],[4]. In this study, rhizosphere bacteria P. stutzeri ACM2-32, K. cloacae FCM2-50 and B. amyloliquefaciens LSM1-61 were screened for plant enhancing capabilities and applied as seed inoculants to assess the developmental growth effects on sorghum.

Method

Strains P. stutzeri ACM2-32, K. cloacae FCM2-50 and B. amyloliquefaciens LSM1-61 were obtained from the University of Namibia’s -80°C storage facility. The bacteria were screened for inorganic phosphate solubilisation, iron chelating siderophore production, plant hormone indole-3-acetic acid (IAA) production, antifungal activity and nitrogen-fixation potential through screening of the nifH gene. Sorghum bicolor seeds were treated with the bacteria and grown in pot experiments to assess the developmental growth effects by the bacterial strains. The bacterial strains were applied as single and in combination peat-based inoculants to evaluate their effects on the growth of Sorghum bicolor in a 25 day pot experiment.

Results

Strain P. stutzeri ACM2-32 had the capability to solubilize inorganic phosphate. The nifH gene was amplified from the genomic DNA of K. cloacae FCM2-50. Both K. cloacae FCM2-50 (8.98 ±0.46mg IAA/L) and B. amyloliquefaciens LSM1-61 (5.61 ±0.61mg IAA/L) produced IAA, additionally the latter exhibited antifungal activity. Single inoculants consisting of K. cloacae FCM2-50, B. amyloliquefaciens LSM1-61 and the co- inoculation treatment (P. stutzeri ACM2-32, E. cloacae FCM2-50 and B. amyloliquefaciens LSM1-61) enhanced sorghum root biomass as much as the commercial fertilizer (Table 1). The co-inoculation treatment enhanced the biomass of S. bicolor significantly (p = 0.032) compared to the water control.
Table 1  Comparison of treatment effects on sorghum plant mass, root mass, shoot mass, root length and shoot length

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant mass (g)</th>
<th>Root mass (g)</th>
<th>Shoot mass (g)</th>
<th>Root length (cm)</th>
<th>Shoot length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACM2-32</td>
<td>0.22 ±0.06(^{b})</td>
<td>0.05 ±0.01(^{b})</td>
<td>0.17 ±0.05</td>
<td>18.05 ±5.59</td>
<td>32.7 ±4.24</td>
</tr>
<tr>
<td>FCM2-50</td>
<td>0.29 ±0.02(^{b})</td>
<td>0.09 ±0.03</td>
<td>0.21 ±0.01</td>
<td>22.7 ±3.82</td>
<td>36.15 ±0.21</td>
</tr>
<tr>
<td>LSM1-61</td>
<td>0.39 ±0.18(^{b})</td>
<td>0.09 ±0.02</td>
<td>0.3 ±0.15</td>
<td>21.18 ±1.66</td>
<td>32.65 ±3.04</td>
</tr>
<tr>
<td>Co-inoculant</td>
<td>0.45 ±0.04(^{ab})</td>
<td>0.10 ±0.03</td>
<td>0.35 ±0.01</td>
<td>24.73 ±5.06(^{a})</td>
<td>34.93 ±1.31</td>
</tr>
<tr>
<td>Water</td>
<td>0.18 ±0.23(^{b})</td>
<td>0.07 ±0.09(^{b})</td>
<td>0.11 ±0.14</td>
<td>14.3 ±11.03</td>
<td>24.8 ±16.69</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0.83 ±0.16(^{a})</td>
<td>0.14 ±0.07(^{a})</td>
<td>0.69 ±0.09</td>
<td>22.95 ±2.47</td>
<td>49.95 ±2.05</td>
</tr>
</tbody>
</table>

Data is presented as mean ±SD

\(^{a}\) = mean difference between treatment and water is significant at the 0.05 level.

\(^{b}\) = mean difference between treatment and fertilizer is significant at the 0.05 level. Co-inoculant = treatment consisting of *P. stutzeri* ACM2-32, *E. cloacae* FCM2-50 and *B. amyloliquefaciens* LSM1-61

Conclusion

Results acknowledge the possibility of using biofertilizers that contain plant beneficial microorganisms to improve crop growth and to sustain environmental health.

References

Nutrient Content of Maxau and Âudaï, Fermented Beverages from //Karas Region, Namibia

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Purpose

The aim of this study was to evaluate the proximate composition and micronutrient content of two indigenous beverages; Maxau and Âudaï. Maxau is a maize-based fermented beverage meanwhile; Âudaï is a fermented goat’s milk. These two fermented products are traditionally produced by the Damara/Nama people in southern Namibia. There is an inadequate or lack of scientific data on its nutritional value and its usage especially in Namibian communities.

Method

The pH, titratable acidity of all samples was measured as lactic and acetic acid, using the methods described by James [1]. Moisture, ash and fat contents were determined according to Nielsen [2]. Protein was determined as crude protein using Bradford method [3]. Total carbohydrates were determined spectrophotometrically at 490 nm using the Phenol-Sulfuric Acid Method [4]. Calcium and iron contents in Maxau and Âudaï were determined using the permanganate titration and bipyridyl colorimetric methods respectively [1].

Results

The pH of Maxau and Âudaï ranged from 3.96 and 4.38, titratable acid 0.008 % and 0.26 % (as lactic acid) and 0.167 % and 0.525 % (as acetic acid) respectively. Total fat ranged from 0.450 % and 0.535 %, total ash 81 % and 72%, total protein 0.823 mg/ml and 1.859 mg/ml, total moisture from 89.17 % and 91.15 %, and total solids 10.83 % and 8.85 % for Maxau and Âudaï respectively. The calcium content in Âudaï is higher (0.053 %) than in Maxau (0.031 %). Âudaï also has higher iron content ($3.31 \times 10^{-5}$ %) than Maxau ($1.94 \times 10^{-5}$ %). HPLC analysis for amino acids showed that both Maxau and Âudaï contain tryptophan, methionine and cysteine. The total carbohydrate content is higher in Maxau (2.210 mg/ml) compared to Âudaï (2.083 mg/ml), whereas Âudaï has higher reducing sugars (3.5 mg/ml). The starch content of Maxau, 0.140 mg/ml, and the lactose in Âudaï was 2.561 mg/ml.
Conclusion

The nutrient content analysis revealed that *Maxau* and *Âudaï*, which form an essential diet for rural communities in Namibia, contain nutritive components that may contribute towards the daily nutrition requirements.

References

A COMPARATIVE ANALYSIS OF THE IN VITRO ANTIPLASMODIAL EFFECTS OF LOPHIOCARPUS SP. AND MORINGA OVALIFOLIA

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Purpose
Natural products have been used by many cultures to treat and cure various ailments and diseases for thousands of years. These traditional medicines cater to about 85% of the world population for their primary health care needs and their derivatives account for about 60% of the modern drugs that are available today. (Willcox et al. 2012). The presence of a number of compounds such as flavonoids, anthroquanones, alkaloids and steroids have been implicated in a number of medicinal properties including some antimalarial properties. Antimalarial drugs such as quinine, artemisinin and atovaquone have all been derived directly from plant sources (Melariri et al., 2012). Therefore, the aim of this study was to compare the analysis of antiplasmodial effects of two indigenous plants, namely, Lophiocarpus sp. and Moringa ovalifolia, investigated in vitro using Plasmodium falciparum 3D7A on the basis of their use by traditional healers to treat malarial symptoms.

Method
Preliminary phytochemical screening was carried out using thin layer chromatography (TLC) on organic and aqueous crude extracts respectively. In vitro antimalarial bio assay was performed in triplicate over a 24 and 48 hour basis at three concentrations. Antimalarial activity was assessed by parasitaemia determination. Each test well was analysed microscopically by making thin smears stained with 10% giemsa stain. Final percentage parasitaemia for all treatments were compared to the negative control.

Results
There was a significant difference in the reduction of parasitaemia between the extract effects at 24 and 48 hours (p value 0.0054). There was also no significant difference between the treatments as compared to the non treatment at 24 hours (p value 0.705). The concentration with the highest growth inhibition as compared to the negative control was the 50µg/mL organic extract of M. ovalifolia showing an inhibition of 83.3%. The organic extracts of both plants had the overall highest activity of inhibition as compared to the aqueous extracts. There was no significant difference is the antiplasmodial activity of the two plants as compared with each other (p value 0.522). The extracts were more effective after 48 hours and the organic extracts had an overall higher antiplasmodial activity. Overall the organic crude plant extracts exhibited higher antiplasmodial activity with the parasitaemia reducing to 0.2% while the aqueous extracts had a lower activity and reduced the parasitaemia to 0.27%
Conclusion

The results of this study support the use of these plants to treat malaria in the traditional setting and as complementary medicine for malaria treatment. The presence of compounds which have antimalaria properties together with their antiplasmodial activities strongly supports the use of these plants in the traditional setting to treat malaria. Although these plants were found to possess lead compounds for the development of antiplasmodial drugs but further analysis and studies are needed to confirm their potential as new antimalarial drug leads.

References


Antimicrobial and antiplasmodial activity displayed by actinomycetes isolated from Kavango and Rehoboth soils.

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Purpose
Microbial infections (communicable diseases) are a major cause of morbidity and mortality in developing countries[1]. These diseases include malaria, which is caused by Plasmodium falciparum. Malaria is one of the most devastating parasitic diseases in certain parts of the world, affecting over half of the world’s population [2]; others include diseases caused by consuming food and water contaminated by food -borne pathogens such as Mycobacterium avium, Staphylococcus aureus, and Escherichia coli.

Owing to emerging drug resistance to existing drugs [3], there is a need to discover new bioactive compounds for the treatment of malaria and bacterial borne-diseases. The purpose of this abstract is to present the potential use of secondary metabolites produced by soil actinomycetes as antiplasmodial and antimicrobial agents in view of their potential development into new drugs.

Methods
To achieve this, soil actinomycetes from the Kavango region and Rehoboth were sampled and cultured on various media. Secondary metabolites produced were extracted with three different solvent (Toluene, chloroform and methanol) to yield 14 distinct fractions. These were assayed for antimicrobial activity against M. avium, S. aureus and E. coli, with each fraction displaying a unique spectrum of activity.

Results
Secondary metabolites from isolates Y1 and Y3 displayed activity against M. avium, while 1A and Y2 showed activity against E. coli. None of the secondary metabolites displayed activity against S. aureus. Furthermore, 4 most bioactive fractions were assayed against a chloroquine resistant (D10) P. falciparum strain in vitro after 24 and 48 hrs of incubation, at various concentrations. A concentration dependent reduction in parasitaemia was observed across all four fractions both after 24 and 48 hrs. Fraction SO13 displayed the greatest reduction in parasitaemia, below 50% in comparison to both negative and positive control (Chloroquine).

Conclusion
The results of this study display a vast potential observed in the fractions analyzed can be
tapped into further to determine mode of action and hence improve chances of discovering novel antibacterial and anti-plasmodial treatments for emerging multidrug resistant pathogens.

References

1. http://www.who.int/whosis/whostat/EN_WHS09_Table2.pdf (Accessed August 2015)


Overview of Fungal antiplasmodial activities

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Introduction

Malaria is a protozoan disease caused by parasites of the genus *Plasmodium* and transmitted by female *Anopheles* mosquitoes (Cox, 2010). It is one of the leading causes of morbidity and mortality in the world, especially in children under the age of 5 years and pregnant women in developing countries (Alelu, Muluye, Mihret, Adugna and Gebeyaw, 2012). Mushrooms are a popular food in many cultures due to their unique flavor and texture profiles, nutritional properties and potential health benefits. Mushrooms like truffles have gained popularity as they have a unique aroma profile which is highly desirable in various foods (Wang and Marcone, 2011). Several fungi with antiplasmodial properties have been proved as sources for novel antiplasmodial compounds (Kadhila-Muandingi, Nametso, du Preez and Mumbengegwi, 2014).

Lentinan, a (1-3)-beta glucan from *Lentinus edodes*, is an effective immunostimulatory drug is reported to induce protective Th1 immune responses to control the proliferation of malaria parasites during the blood- stage of P.y17XL infection by stimulating maturation of DCs to inhibit negative regulation of the Th1 immune response by Tregs, so it can be established that lentinan has prophylactic potential for the treatment of malaria (Zhou, Zhang, Zhang, Liu and Cao, 2009). According to Oluba Olusola, Eidangbe, Babatola, and Onyeneke (2012), *G. lucidum* mushrooms are said to prevent the proliferation of malarial parasites in mice. Their study found that extracts of *G. lucidum* possess significant antiplasmodial activity. In a different study Katsayal, Abdurahman, Abubakar, Musa, Ambali and Jahun, (2009), reported the antiplasmodial properties of the fungus *Chlorophyllum molybdites*. In Nigeria, *G. lucidum* aqueous extract is reported to have been used to establish changes in serum and liver lipoprotein cholesterol contents accompanying *Plasmodium berghei* malarial infection in mice (Oluba et al., 2012).

(Kadhila-Muandingi et al., 2014) reported the antiplasmodial activity of indigenous *Ganoderma lucidum* and *Terfezia pfeilii* Namibian mushrooms. Growth inhibition studies using cellular infection models of *Plasmodium falciparum* 3D7A were carried out to determine anti-plasmodial effects for the extracts from *G. lucidum* and *T. pfeilii*. Mycochemical screening revealed the presence of anthraquinones, flavonoids and steroids, in the mushroom extracts with each mushroom possessing all 3 classes of the antimalarial compounds at different intensities. It is further stated that the aqueous extracts for the two mushrooms showed antiplasmodial activity at concentrations ranging from 5-50µg/ml, with *T. pfeilii* extracts showing the highest activity with an IC50 of 0.022µg/ml compared to *G. lucidum* at 3.66 µg/ml.
Conclusion

Overall, research evidence shows that mushrooms are of biomedical importance, owing to a number of bioactive components found in them. They could therefore be considered as a potential agent for both malaria treatment and control. However, intense research is needed to explicate the different roles of multiple active compounds and the pathways involved.

References

THE MENTAL HEALTH OF ADOLESCENTS LIVING WITH HIV IN NAMIBIA: A CASE-CONTROL DESIGN

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Purpose
Little research has examined the impact of HIV-status and its associated challenges on the mental wellbeing of adolescents, particularly in sub-Saharan Africa, where 90% of the world’s HIV positive children live. Studies with adults living with HIV suggest that mental health problems delay the initiation of antiretroviral therapy and cause decreased levels of adherence once treatment starts. This study explored whether adolescents living with HIV in Namibia showed increased mental health problems compared to a control group. It also examined the role of context specific risk and protective factors on their mental health.

Method
Ninety-nine fully disclosed adolescents with vertically acquired HIV were interviewed at a State Hospital in Windhoek between July 2013 and March 2014, using a standardised questionnaire and compared to a randomly selected matched community comparison group (n=159). Interviews assessed emotional and behavioural symptoms of distress and risk factors including poverty, social support, orphan status and stigma. Data were analysed with t-tests, chi-sq, ANOVAs and regression.

Results
The groups were matched for age, gender and socio-economic background. The HIV group had a mean age of 14.5 with 51.2% females. There were significantly more orphans in the HIV group (p<.001), with only 36% still having both parents living. Adolescents in the HIV group reported significantly higher mean scores for total difficulties (p = .027) and conduct problems (p = .025). Orphan status was associated with the level of mental distress, with orphans reporting significantly higher levels of emotional and behavioural distress than non-orphans, irrespective of HIV status (p<0.05). In the HIV group, the level of stigma experienced as well as the level of deprivation (food security) was significantly associated with symptoms of distress, and adolescents with increased perceived social support reported fewer symptoms.

Conclusion
These findings provide support for interventions focused on lessening the negative effects associated with orphanhood, and further suggest that stigma reduction efforts within adolescent social contexts could have a positive effect on mental wellbeing.
Diagnosis and Characterisation of Cancers from Ultrasound Medical Images

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Purpose
The diagnosis and characterisation of various cancers and renal cysts has been an area of active research in medical imaging over the past years. Ultrasound imaging has become a very important technology in the diagnosis and characterisation of cancers and cysts. Ultrasound medical images are non-invasive, portable, transferable, adaptable, have excellent temporal resolution and they are relatively inexpensive. However one of its major weaknesses is the relatively poor quality of images due to artifacts, especially speckle noise. Speckle noise is granular noise which abruptly changes the pixel values and degrades the quality of the image [1]. Segmentation of ultrasound images can help to clearly see the outlines of various disorders present in a body part. The automatic diagnosis and characterisation of these disorders can enhance the reliability of the diagnosis by additional assistance and it reduces the human variation associated with manual reading of medical images which can be at times costly in terms of accurate diagnosis of the cancers.

There are many approaches presented for the detection of cancer using Neural Networks, e.g. [2, 3, 4]. Still no system is available that detects cancers reliably.

Methodology
A system for automatic diagnosis and characterisation of cancers and cysts from ultrasound images was developed. The system has got four sub-modules which are:

1. Pre-processing-This module is responsible removing speckle noise which is inherent in ultrasound images. Various imaging filters and/or algorithms are used to deal with this noise with the objective of improving the quality of the image e.g. the Gaussian.

2. Segmentation- The main objective of this module is to isolate the cancer region from the rest of the image. Segmentation would subdivide the image into constituent parts. This is done up to a level that we can clearly detect the cancer region. Various image processing techniques are used to separate the cyst region, like the region growing algorithm.

3. Features Extraction- After segmentation we should be able to extract features that would help us identify the cancers and cysts. The extracted features give the property of the texture or shape and are stored in a knowledge base. These are later compared with features of unknown sample image for classification later. The number of extracted features is reduced by principal component analysis (PCA) to select the important ones.

4. Classification- This module uses the neural network to classify the cancers bases on the reduced feature set obtained by the previous module. The network is simulated using the neural network toolbox function available in MATLAB.
Results

Our medical partners provided us with 23 ultrasound images of kidneys and labelled 10 of them as “cancer” and 13 with “no cancer”. We performed a cross validation by taking 22 pictures as a training set for the neural network and applied the detection algorithm on the remaining picture. Results obtained showed that the accuracy of the classifier was 83% for the 23 Ultrasound kidney images in our database.

Conclusion

The results obtained are promising and the system can be used for automatic diagnosis and characterisation of various cancers and cysts. (Funding-This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.)

References


A comparison of malaria risk factors between case and control households in the low transmission, pre-elimination Omusati Region of Northern Namibia.

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Purpose

Namibia has achieved great success in the reduction of malaria case numbers from over 500 per 1000 population in 2000 to between 1 -2 per 1000 population in 2013(MoHSS- NVDCP, 2009). The country has transitioned from the control phase of malaria epidemiology to the pre-elimination phase. However, since 2008, the reduction in number of cases has levelled off with small increases in reduction of malaria cases, between 1400 and 1800 cases per annum are being reported(Smith Gueye et al., 2014). This highlights the need for evidence-based targeting of interventions, for the final drive to eliminate malaria. For interventions to be appropriately targeted, the underlying malaria risk factors need to be identified and quantified. This would further reduce unnecessary, uneconomical and uninformed scaling up of intervention efforts paralleled with the gains of reducing further malaria transmission. Reactive Case Detection (RACD) was therefore used to determine risk factors for malaria transmission in Outapi and Oshikuku health districts in North Central Namibia. Henceforth, establishing the risk factors will help to inform the malaria control program of the National Vector Disease Control Programme (NVDCP) of the Ministry of Health and Social Services (MoHSS) on which interventions to strengthen. Informed interventions will help Namibia to recognize the set ambitious strategic goal of achieving elimination by 2020 (MoHSS-NVDCP, 2010; Pindolia et al., 2012)

Method

A household level cluster case-control study was carried out between January - May 2014 in the Oshikuku and Outapi health district of the Omusati Region. Reactive Case Detection (RACD) was used to trace back reported cases to their households. The geo - locations of control households were randomly selected from National Census Enumeration Point Data. A semi- structured questionnaire was administered to all members living in the same house as a reported case or a chosen control. Questions pertaining to the demographics (age and gender), net ownership and usage, presence of absence of a breeding site, travel in the past 6 weeks, outdoor nocturnal behavior, household spraying, and treatment seeking behavior following the self-reported history of fever were elicited from all eligible study participants.

Results

RACD identified 59 index case households for investigation, from patients presenting with malaria at clinics in the health districts and an additional randomly selected 77 households were investigated as controls. The distribution of males in case and control households was 47.3% and 43.5% respectively, and 51.8% and 56.3% for females. The mean age was 21 and 25 in case and control households respectively (Table 1)
Case households were found to own more nets than control households (71.2% vs 69.3 %). Net distribution per/person was 1.3 times higher in Control households. Controls have reported 6.8 % more net usage the previous night when compared to cases. Fever in the past 48 hours, was higher in case households, coupled with the highest numbers of people not seeking treatment for fever as well (n=38, 6.89 %). Spraying was also higher by 1.29 in case households. There were 6.9 % more breeding sites found in case households. 1.12 (or 3.8%) more individuals in control households have reported an overnight stay away from their place of residence in the 6 weeks prior to visitation, i.e. travel does not appear to be a risk factor.

## Conclusion

The findings from this case-control study using reactive case detection showed that fever screening, test and treat interventions need to be strengthened. Although IRS spraying and net ownership is higher in case households, the low net usage puts individuals in case households at an increased risk. The low distribution of nets p/person, calls for mass net distribution in combination with encouraged regular net usage. The high presence of breeding sites within case households suggests that larvaciding also needs strengthening, in order to impede larval development and mosquito breeding.

## References


### Table

<table>
<thead>
<tr>
<th></th>
<th>Case n(%)</th>
<th>Control n (%)</th>
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<tbody>
<tr>
<td>Mean age</td>
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<td>25</td>
</tr>
<tr>
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<td>268 (47.3)</td>
<td>153 (43.5)</td>
</tr>
<tr>
<td>Female</td>
<td>293 (51.8)</td>
<td>198 (56.3)</td>
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<td>5 (0.883)</td>
<td>1 (0.284)</td>
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<tr>
<td>Totals</td>
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<td>352 (100)</td>
</tr>
</tbody>
</table>

<sup>1</sup>NA represent missing values
Exploring the potential applications of Internet of Things (IoT) in the Health Sector: A focus on Namibia.

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Purpose

Technology has evolved as an enabler in many ways and application domains. The dynamic nature of the technology landscape has witnessed the birth of cutting edge solutions that has positioned nations in tandem with an elastic demand for quality services. The health sector has a critical need for real time and reliable technological solutions as supported by (Miorandi, Daniele, et.al 2012.) where mention is given of health care providers now delivering a range of internet based services to patients.

Internet-of-Things as espoused by (Miorandi, Daniele, et.al 2012.) envisions a future in which digital and physical entities can be linked, to enable a whole new class of applications and services. The networked nature of communication devices has enabled handling and monitoring of critical health situations using the evolving computing paradigm of Internet of Things (IoT). The capabilities offered by internet of things makes handling of some critical health conditions outside the general health premises as explained by (Wilson, E. Vance, and Nancy K. 2004) much manageable, like for health conditions such as chronic diseases, which may include but not limited to diabetes, severe injuries, and lengthy recuperation or rehabilitation periods. Remotely monitoring some of these patients under such conditions will greatly reduce their need to frequently travel for check-ups.

The proliferation of mobile devices in society and affordable sensor technology and actuators as presented by (Gubbi, et.al ,2013) makes Internet of Things (IoT) alive, hence sharing of information is easy across platforms and improved reaction times for needy situations in the healthy domain feasible.

Method

A qualitative research will be used to populate this research work, coupled with intense desktop research on related work successfully implemented and in operation elsewhere. A few case study sites will be selected to contextualise the health landscape in light of the technological equipment and their extent of use.

Physical site visits will be done through random sampling to avail concreate data on the actual technological layout and usage patterns in different health care centres. The sampling to cover both private and public health centres to eliminate generalisations.
Results
The focus of this work is to assess the health technological landscape needs of Namibia at a preliminary level and recommend viable solutions as informed by application capabilities on the ground. It is envisaged that, the potential capabilities of Internet of Things could be harnessed to present practical solutions and augment existing applications in the health sector, if proper need assessment is conducted, which is one of the key deliverables of this work.

We envisage a great impact in the health sector, stretching from the administration to the service delivery especially towards managing critical conditions in the case of patients who are not constantly in the proximity of health care facilities yet they may be in need of such.

Conclusion
Informed by successful implementations from elsewhere, this research will analyse the capacity of the current health sector’s technological fibre, and propose implementable solutions. The need to have the actual technological map of the entire health system in the country will of paramount importance to ensure the successful completion of this research focus and present practical solutions ultimately.

References
Mathematical model on the in-host human malaria dynamics with treatment

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Purpose
To explore the in-host dynamics of the plasmodium falciparum malaria parasite

Method
System of non-linear ordinary differential equations and numerical simulations

Results
Local and or global stability of equilibrium points, threshold drug efficacy level sufficient to eradicate malaria parasites from the human body.

Conclusions
The ODE model is positively invariant and has equilibrium points where parasite free state is locally and globally stable for a biological threshold and unstable for . Parasite present equilibrium is stable for . A threshold drug efficacy of will help clear all parasites in the body.

References
Preserving Moringa species for climate change and variability mitigation, improving community health and creating jobs

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Purpose

Millions of people are under the threat of famine connected to the change of the climate. The effects of climate change are making droughts more of a norm than an exception. This is a pattern that places some of the most vulnerable communities in an increasingly precarious position when it comes to meeting basic food needs. For smallholder farmers in dry lands, like Namibia, a failed harvest can mean months of malnutrition and hardship. “Conventional” crops such as cereals are often not native and require expensive inputs, significant irrigation and land preparation in order to produce a successful harvest. This means that they are more vulnerable to droughts. Trees, on the other hand, often survive when other crops fail. To know which aid is really durable to combat food shortages and efficient for climate change mitigation, it is good to look at the potential that is already available in developing and third world countries. Moringa is a very simple and readily available solution.

The presentation is a review of what is known about this important resource and will also discuss results of some of the studies we have done and the new insights about this peculiar tree. Our studies are aimed at empowering people and communities in rural areas towards sustainable and environmentally-sound development by facilitating access to improved nutrition, disease prevention and treatment, safe-drinking water, income generation and mitigating effects of climate change and variability through growth, use and advocacy of the Moringa, thereby eradicating poverty, hunger and malnutrition.

Method

The cultivation of both 3 Moringa species has also been tested in Namibia to in Windhoek and at the University of Namibia Neudam campus. To understand the mechanism of how the seeds of Moringa purify, a number of techniques have been used and these include surface tension, neutron reflection (NR) and scattering, zeta potential, circular dichroism, fluorescence, to mention but a few. The leaves, seeds and flowers have been analysed for metal and nutritional and micro-nutrient composition.

Results

The planting of the Moringa tree can play one important role in mitigating the effects of climate change and variability. A big problem that is partly caused by climate change is desertification. The Moringa tree can play a role in the fight against desertification. Because Moringa trees grow fast and...
well in dry areas, it can play a role in the battle against desertification. Fig. 1 shows 2 Moringa species cultivated in Windhoek and these were able to start producing pods within 9 months. Moringa can also grow in areas where strong winds and long dry spells occur simultaneously.

Figure1: Moringa species growing in Cimbebasia, Windhoek.

The different techniques used have elucidated the nature and mechanism for water treatment and observed several peculiar physicochemical properties which include amino acids composition, surface activity, protein-surfactant interaction and charge neutralisation, effects of pH and ionic strength, heavy metals removal (although the proteins are cationic), adsorption of proteins on solid surfaces and floc formation and structure.

Conclusion

The Moringa is multipurpose tree since nearly every part of it has some socio-economic and/or health benefits (e.g. medicinal, nutritional and commercial). Because it is adaptable to dry climates, it can be used to fight desertification and climate change and variability. Moringa can easily be grown in Namibia because of the favourable climatic conditions. The protein extracted from Moringa proteins can be used to develop cost-effective and more environmentally friendly materials such as natural organic coagulants.

References


A Novel Approach to Pre-Service Pharmacy Education: Students Experiential Training at key Pharmacy Practice Settings

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Purpose
Southern Africa has the greatest shortage of Pharmacists in the world\(^1\) and Namibia is no exception. The Pharmacist’s workforce in Namibia, and especially the public sector, consists of a large number of foreign pharmacists on short term contracts - a potential threat to sustainable healthcare\(^2\). In order to address this shortage the University of Namibia (UNAM) launched its first ever Pharmacy degree program in 2011. The curriculum was developed using a competency-based education and training (CBET) approach\(^3\) and focus was put on addressing the specific pharmacy human resource skill gaps of Namibia\(^2\).

A competent pharmacist must be built by developing the necessary skills, knowledge and attitude during pre-service training. Furthermore, most pharmacy curricula lack responsiveness to the changing skills and needs in pharmacy. In order to address both of these priorities UNAMs pharmacy degree curriculum includes four practical modules that ensure that students are exposed to current practices in pharmacy in Namibia’s four priority areas of pharmacy. As such the graduates from this course have skills, professionalism and knowledge that is relevant to the current market requirements.

Method
The four-year Bachelor of Pharmacy (Honours) degree was designed in an innovative way that introduces students to hands-on, current pharmacy practice in tandem with their theoretical and laboratory learning, through practical placements. The placements additionally provide the students with the opportunity to acquire knowledge and skills from pharmacy professionals that are practicing in a diverse range of settings.

The placements are designed in such a way that the areas of pharmacy practice students are exposed to progress in partnership with the campus-based modules throughout the course. The first placement is the Rural Placement at Ministry of Health and Social Services (MoHSS) facility outside the capital city Windhoek. This placement introduces the students to pharmacy in a rural setting and has a strong focus on public health, Primary Health Care, HIV and TB, and inventory management. They also perform a small medicine use survey, thus being introduced to the practicalities of operational research. The second placement is a Community Pharmacy placement where the students work in the private sector. In this placement the focus on learning moves to effective communication with patients, counselling them on their medicines, recommending the correct over the counter medicines and providing health education.

In the third placement, the Industrial Placement students are exposed to the Pharmaceutical Manufacturing industry as well as spending time at the Namibian Medicines Regulatory Council.
there is only one active Pharmaceutical Manufacturer licensed in Namibia, and so development of Pharmaceutical Manufacturing is a national priority. The fourth and final placement is the Tertiary Hospital Placement, where the students work in two of the MoHSS referral hospitals in Windhoek and are introduced to Clinical Pharmacy as a stepping stone for starting their clinical rotations in the final year of the degree.

**Figure 1: How the placements have spread across Namibia and Africa**

![Map of placements sites in 2012](image)

**Assessments**

The students’ performance in each of the placement modules are assessed by *viva voce*, completed workbooks, written reports and site supervisor’s assessments. The effectiveness of these placements is also assessed through questionnaires that are completed by students and site supervisors after each of the placements.

**Results**

The results of the placements have exceeded our expectations and have been worth the huge organisational effort they entail. A novel set of tools has been developed to optimise development of the students while on these placements, in addition to comprehensive assessment of both the students and the placements themselves.
The post placement evaluations highlight that all students find the placements extremely useful and help them to connect the theoretical learning to practice situations. The majority of students also feel that the diverse learning outcomes of these placements are met during their placements. A further benefit of these practical placements is the strong links built between School of Pharmacy and the Public and Private Pharmacy sectors within Namibia and Pharmaceutical Manufacturing sector across Africa. As such we ensure that our students are exposed to current pharmacy practices during their training and hence can hit the floor running when they qualify.

With the School of Pharmacy’s first graduates currently doing their internship, evaluation of how our graduates compare to their colleagues is an integral part of the School’s quality assurance process.

Conclusion

The implementation of the ambitious UNAM BPharm (Hons) curriculum including practical placements in the four key pharmacy sectors has been highly successful in developing pharmacists who have the knowledge, skills and attitudes essential for strengthening pharmacy in Namibia.

References

The value of herbal supplements for treatment of chronic diseases in Namibia

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Purpose

More than half of the world’s population relies on plant products which are in the form of herbal or dietary supplements, and or drugs [1]. In recent years, plants have generated a lot of interest as therapeutic agents due to their long-term use and because of their resulting perceptions as being safe and effective [2]. Western as well as urban populations use herbal supplements, usually processed; as a last resort for treatment or for general wellness whilst rural communities rely on them for primary health care and for chronic illness. Unfortunately, in both cases, insufficient data exist for these treatments to guarantee their quality, efficacy and safety, and are not always safe and free from side effects. The World Health Organization (WHO) put emphasis on the need for evidence-based herbal medicines that are sold on the market as supplements [3]. A comparative study was therefore conducted on the phytochemical composition and biological activities of a commercially available herbal supplement (SFL) and leaves of *Terminalia sericea* (TSL); both said to treat a variety of inflammation-induced ailments.

Method

Methanolic and aqueous extracts were prepared for both SFL and TSL by macerating 5 g of each sample in 80 % methanol and water, respectively for 24 hours. This was done twice. The extracts were filtered and dried in vacuo using a rotary evaporator and freeze-dryer. The dry aqueous and organic extracts were resuspended in water and DMSO, respectively to obtain concentrations of 5, 10, 30, 60 and 120 µg/mL. The varying concentrations of the extracts were then tested for their antioxidant activities using ABTS and DPPH methods, and were also tested for the presence of flavonoids, a class of secondary metabolites which is well-known for their antioxidant properties. Furthermore, the toxicity profile of the extracts was also determined using yeast cells.

Results

Preliminary phytochemical analysis revealed the presence of flavonoids in both plant products. The TSL extracts (both aqueous and organic) exhibited high antioxidant activity using the ABTS method with concentrations as low as 30 µg/mL; whereas SFL (both aqueous and organic) showed low activity at the same dose. For the DPPH assay at 5 µg/ml, antioxidant activity was higher for the TSL aqueous extracts decreasing the initial amount of DPPH by 82.5 % as compared to 59.2 % by SFL aqueous extracts; TSL organic extract showed a reduction of 52.9 %, whilst for SFL organic extract there was no reduction (-4.1 %). Cytotoxicity results indicated that the aqueous extracts of SFL had cytotoxic effects on the yeast cells, however, no harmful effects where exhibited by the organic extracts. TSL, on the other hand, showed no toxicity against the yeast cells for both the aqueous and organic extracts. Overall, the unprocessed leaves of *T. sericea* showed greater activity and had a better safety profile.
Conclusion

This study shows the importance of evaluating herbal treatments so they can become a viable healthcare option for chronic diseases in rural communities and in low resource settings.

References


Detection of non O157:H7 Shiga toxin-producing Escherichia coli (STEC) serogroups O26, O45, 103, O111, O121 and O145 from beef trim in Namibia.

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Purpose

Many different serotypes of Shiga toxin-producing *Escherichia coli* (STEC) that cause disease in humans have been described. Illnesses range from mild diarrhea to bloody diarrhea to hemorrhagic colitis (HC) and hemolytic uremic syndrome (HUS). *E. coli* O157:H7 is the STEC strain most often associated with the most severe forms of disease. However, numerous non-O157 STEC isolates have also been linked to illnesses and outbreaks of disease. Several studies showed that majority of non O157:H7 STEC infections are caused by strains from one of six major serogroups, including O26, O45, O103, O111, O121 and O145. Non O157:H7 Shiga toxin-producing *E. coli* (STEC) are food borne pathogens commonly associated with beef. In fact, there are ample data on the prevalence of non-O157 STEC in cattle from fed beef through processing and boneless beef trim destined for grinding. This study reports on the detection by STEC Suite Real-time BAX® System (DuPontTM) of non O157 STEC in beef trim samples (n 771) collected from a Namibian abattoir over a period of 8 months.

Method

325 ± 32.5g of Beef trims, collected from a local abattoir in Windhoek Namibia during the period of April to August 2014, were homogenized with 975 ± 19.5 ml of pre-warmed (42°C) BAX® System MP enrichment broth (DuPont Nutrition and Health, Wilmington, DE) in Whirlpack filter bags (Nasco, Fort Atkinson, WI), mixed in a Stomacher (Seward Laboratory Systems, Inc., Bohemia, NY) for 2 min, and then incubated at 42°C for 18 h before testing with the BAX® System assays. The BAX® System PCR assays used in this study were the BAX® System real-time PCR assay suite for STEC-Screening (*stx* and *eae*) virulence genes, which were both present in 136 (17.64%) out of 771 samples. Of the 136 positive samples for both *stx* and *eae* virulence genes, nine were positive for O26, one for O45, thirty-three for O103, one for O111, five for O121 and three for O145. There were also thirty-five samples positive for more than one STEC serogroup.
Conclusion

The presence of virulent STEC in beef trim is a public health concern. The use of polymerase chain reaction assay should aid quick detection of this virulent serotypes and help to prevent severe epidemic of human diseases associated with STEC infections.

References


Scientific validation of Namibian ethnomedicines used in the management of HIV/AIDS

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Purpose

HIV remains one of the serious challenges over development in Namibia. Over 23% of deaths in the country are being caused by HIV related diseases. The reduction of HIV incidence rates is hampered by the continuous development of viral resistance towards existing antiretroviral drugs. There is a continuous use of traditional medicines in managing HIV/AIDS and associated infections, especially in African communities. The use of medicinal plants provides an alternative means to existing antiretroviral therapy and this can be attributed to the adverse side effects of the drugs. There are two plants that are widely used in Southern Africa by HIV patients; African potato (Hypoxis hemerocallidea) and Sutherlandia frutescens; both plants are immune system boosters [1,2]. African potato has a long history of use by traditional healers; used in moderate to advanced stages in AIDS treatment and is popularly used in South Africa by HIV/AIDS patients to strengthen their immune system. The use of the African potato and Sutherlandia plants in managing HIV/AIDS is being supported by most Ministries of Health and NGOs in SADC countries. According to WHO, about 80% of the world population uses traditional medicine for primary health care. “The WHO Traditional Medicine Strategy 2014-2023 was developed and launched in response to the World Health Assembly resolution on traditional medicine [3]. The strategy aims to support Member States in developing proactive policies and implementing action plans that will strengthen the role traditional medicine plays in keeping populations healthy”. Therefore, it is of utmost importance for Namibia to support the use of its ethnomedicines through scientifically validating the traditional claims of the medicinal products in use. The present study provides some scientific validation for the anecdotal success of some Namibian plants used traditionally to manage HIV/AIDS.

Method

Organic extracts of traditional medicine were tested for inhibitory activity against HIV-1 enzymes; protease, reverse transcriptase and integrase. Antioxidant activity was also investigated.

Results

Selected herbal extracts demonstrated inhibitory activity against HIV-1 Reverse Transcriptase and Protease.

Conclusion

The overall data provide evidence that herbal medicines provided by two traditional healers for in vitro anti-HIV analysis might be a potential source of anti-HIV compounds.
References


Development of a web based patient record management system for private and public hospitals in Namibia.

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Purpose

This research focuses on the design of a web based patient record management system. This could provide information distribution and simultaneous access, fast information retrieval, better quality, high availability, higher confidence. We argue that ICTs can be utilized to overcome geographic isolation for the population in all areas, and it can facilitate access, dissemination, utilization and exchange of health information (Yamuah, 2005). The advantage of having web-based patients records on internet can bring about awareness of patients knowing their own medical problems and help them seek medical help. This can enable Namibia hospitals to adapt current technologies that are been used in other countries to ensure health services delivery (Archer et al., 2011).

Furthermore this study aims to benefit the society of Namibia at large especially the health sector.

Method

A qualitative research approach through interviews with medical personnel’s and a few patients is used. This was supported by questionnaires that were distributed to investigate the current state of health information sharing in Namibia. The technologies used for the health systems application include WAMP which includes windows, Apache MySQL and PHP. This was chosen since it is open source

Results

Most hospital still use paper based methods in storing or keeping patients records, public hospitals were found using a yellow for children and green booklet for adults. Here is where nurses or doctors will record medical history and prescriptions, and the book is given to the patient for storing.
Private hospitals and private doctors use hard copy files and store these in files with them; patients are sent to the pharmacies with a prescription on paper. Hospitals in Windhoek have access to computers and some with internet some without internet, but these computers are mostly used for billing systems claiming from medical aid and scheduling appointments in case of private hospitals. One hospital in Windhoek has implemented a health information system (HIS) that is run parallel with a manual system in carrying out hospital processes and activities.

Results on
Stakeholders engaged in the study ie doctor, nurses, patients and ICT administrators, all support the need of a web based patient record management system.

<table>
<thead>
<tr>
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<th>ICT in use</th>
<th>Sharing of patient medical records</th>
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<tr>
<td>Clinic-public</td>
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</table>

**Conclusion**
The overall data provide evidence that herbal medicines provided by two traditional healers for *in vitro* anti-HIV analysis might be a potential source of anti-HIV compounds.
References


Purpose

This paper documents the simulation models based on cellular automata for modeling and simulating the evolution of diseases, summarizes important results, and provides in-depth discussion of several cases. The paper presents the methodological aspects and concepts associated with cellular automata, as well as experiences which illustrate the application trends and potential of this technique. The paper concludes by noting the need to incorporate elements such as the treatment of uncertainty to increase analysis capacity.

Method

In this paper, the bibliographical analysis method is used in order to study, summarize and describe what a cellular automaton is and how it can be used in the study of evolution of diseases. Some applications of cellular automata are also presented.

Results

Epidemiology is a scientific discipline that aims to study the dynamics of population health to prevent diseases from health promotion. Epidemiological events caused by viruses such as Ebola [1], pollution from stationary sources of pollutants or new varieties of bioterrorism can cause significant loss of life and resources. For this reason, it is important to study and simulate the dispersion of pathogens in the population.

Cellular Automata (CA) are being widely used for its easiness to represent systems governed by natural rules in discrete steps and their ability to represent the interaction between individuals with the surrounding neighborhood. CA provides a formal framework for exploring the behavior of complex, extended systems and were originally conceived by Ulam [2] and von Neumann [3].

Some applications. Literature has a number of papers reporting simulations based on CA for modeling and simulating the evolution of diseases [4–6].

Fu and Milne [7] show the applicability of the models based on CA for epidemiologists and demonstrate the need for the epidemiology to not just focus on statistics, but also on the spatial behavior of epidemics. Another application that demonstrates the applicability of CA is the development of model presented in [8]. This model evaluates the influence of spatial heterogeneity on viral propagation.

Ferreri and Venturino [9] also used a CA to mimic prey-predator interactions of a pathogen affecting a population. Using a pushdown CA proposed in [10], propagation model takes into account the infected population and infested generations above to determine the next generation of the infested.

A proposal based on two-dimensional CA is shown in [11], where the environment is divided into
square cells and it is assumed that each cell in the population is homogeneous. This feature brings certain limitations because it is only possible to have a constant population under ideal laboratory conditions or practices.

The use of CA was also reported in the study of the dynamics of HIV infection [12]. In [13], details of a model based on 3-dimensional CA are presented.

Similarly proposals are presented with extended neighborhood [14] to facilitate the study of the dynamics of different diseases.

**Conclusions**

The use of simulation models is increasing used in the health sector to better understand and capture the bidirectional relationships between people and places over time.

Although the Moore neighborhood and Neumann neighborhood are presented as the most widely used, there are other proposals that extended the neighborhood to facilitate the study of the dynamics of different diseases are also available in literature.

Determining the most appropriate transition rules to the problem being studied plays a fundamental role in modeling using CA.

The CA is presented as a very useful tool for prediction and simulation, especially in diseases evolution. However, the paper also stresses the necessity of working on the treatment of uncertainty in this kind of models.

**References**


ISOLATION AND CHARACTERIZATION OF ACTINOMYCETES FROM MARINE SAMPLE.

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**Purpose**
To isolate actinomycetes from marine sediment. Characterization and screening the isolated actinomycetes for antimicrobial activities.

**Method**
Sediment samples were collected from the Atlantic Ocean, at the intertidal zone (SANUMARRC) between Swakopmund and Henties Bay in Namibia. About 10m from the beach front.

Actinomycetes were grown by serial dilution using spread plate method on Starch casein nitrate, M5, Starch casein, Raffinose histidine agar medium and all media were supplemented with 50mg/L nalidixic acid and 100mg/L nystatin to prevent fungal growth and incubated at 30°C for 15-30 days. Since no growth was observed, improved and enriched ZSSE and Gause’s no.1 media were used.

The isolated actinomycetes are to be characterized and screened for antimicrobial activity

**Results**
Epidemiology is a scientific discipline that aims to study the dynamics of population health to prevent No isolates were observed to have grown and in search to find the reasons for not growing, improved and enriched medium were used, using both the marine sediment and terrestrial sediment collected from the following Windhoek suburbs’ Katutura, Unam and Klein Windhoek.

Isolates were observed for the terrestrial sediment but not for the marine sediment. Isolates are still being tested for antimicrobial against Staphylococcus aureus, Escherichia coli and Micobacteria avium.

**Conclusion**
Actinomycetes account for the highest synthesis of bioactive metabolites (over 10000) which make them the highest source in comparison to other bacteria and fungi. However it is estimated that approximately 90% of all secondary metabolites which can be derived from actinomycetes are yet to be discovered (Davies, Adeleye and Wang, 2015). This suggests that more research need to be undertaken on actinomycetes inhabiting extreme environments such as the ocean. And this will only be achieved by coming up with more diverse and improved culture medium to facilitate the growth of these organisms as they are subjected to a variety of environmental changes, which in turn means that these organisms may be able to produce new metabolites to in order to adapt to their
environments. For successful isolation of actinomycetes from the rarely tapped environment such as the Namibian Atlantic Ocean, which experiences dramatic changes due to the Benguela front, thus it is of utmost importance that the Namibian government and institutions invest into researching for new improved pre-treatment methods, selective medium and culture conditions


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Trademarks infringement in cyberspace/Internet: A Namibian perspective

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Introduction

As a starting point, the unprecedented introduction of computers and the internet, and growing popularity of e-commerce, the use of trademarks for commercial purpose has gained tremendous significance. However, there is a downside to this trend of increased dependence upon the internet and Information and Communication Technologies (ICT), namely the difficulty posed in the detection & protection of trademarks infringements in the cyberspace or internet. The inference drawn is that the cyberspace is the new area where there is unauthorized use of trademarks in websites which has resulted in their infringement. Therefore, there is a need to address these infringements taking into consideration the trademark laws that are put in place and proposal of policies aimed at protecting trademarks. The difficulty is how does one protect trademarks and prevent its unauthorised use in the cyberspace. The trademarks infringements to a greater extent occur in the online medium rather than offline, this is due to the fact that data can be accessed, copied and transferred easily. Further, the cyberspace offers the platform for anonymity.

But, how does one infringe trademark in the cyberspace? Alternatively, when can a conduct amount to trademark infringement in cyberspace? In order, to understand trademark infringement in cyberspace, we have to understand the concept of trademark and be able to outline the various types of trademark infringements in the cyberspace. Because, many at times when browsing the internet, clicking on links and downloading logos or symbols, registering domain names etc we are unaware that we are having unauthorised use of a registered trademark.

Again the use of cyberspace or internet comes with so much freedom at the expense of abuse. Therefore, the role of law and regulation in this regard is very crucial.

Thus, in this paper the author examines the extent to which the Namibian trademark legislation or common law protects the infringement of trademarks or unauthorised or unlicensed use of trademarks, trade name, service marks in the internet or cyberspace. In order to address this issue, the paper will discussed Namibian cases involving trademarks infringements on cyberspace, where a Namibian case is not found the author will look at South African case law. Because cyberspace has no boundaries, the paper will conduct a comparative study of foreign jurisdiction in order to consider the effort made to curb trademarks infringement in cyberspace.

Purpose

The main objective of this research is to determine the extent to which trademark infringement in cyberspace or internet is protected in Namibia. Thus the research will address the role the Namibian trademark law and regulations plays in an attempt to curb trademarks infringement in cyberspace. This is done by studying the following;
a) The concept of trademark in general
b) The types or levels of trademarks infringement in cyberspace or internet
c) The trademarks law in Namibia
d) The comparative study of foreign jurisdiction
e) The challenges faced and the way forward

Thus, by studying the trademarks infringement in cyberspace, the research explores the weakness and strength of the national legal system.

Method

Much of the work done in this paper is library research. Thus the research involved the collection of existing information (data) and literature review on the trademarks infringement in cyberspace. Because immense research has been conducted by various authors on the subject, hence their work will be used in order to substantiate this research and their effort will be acknowledged in the references that will be provided. The researcher relied primarily on secondary data sources relevant to the subject. Thus the following research instruments were the main sources of information of this study: (a) Desktop research, which involved studying existing literature on the subject matter to give an understanding of Trademarks Infringement in Cyberspace/Internet. This encompasses sources such as books, journals, articles and statutes; (b) Internet, the researcher made use of the academic search engines to gain material on the topic;

Results

The information that was gathered during the research was analysed in order to present the results. The Data analysing process involved three steps. The Initial step included the collection of information; the second step entailed evaluation and integration of collected data. The last and most vital step was the interpretation in the form of deductions and conclusion which are relevant to the protection of trademarks infringement in cyberspace in Namibia.

Hence, the research found that despite the fact that there are legislations aimed at protecting trademarks infringement in Namibia, this legislations do not adequately address the infringement of trademarks in cyberspace. The legal enforcement of infringement of trademark rights in cyberspace is a very challenging area. Further, other jurisdictions such as the USA, India, and Germany etc have made efforts by way of legislation to address trademarks infringements in cyberspace.

Conclusion

The traditional laws for protecting trademarks have been applied also in cyberspace. However, due to inherent nature of the internet, several pertinent issues have emerged such as the principles to determine jurisdiction, recognizing the hybrid varieties of online infringements, resolving conflict of laws issues which apply equally in cyberspace. The legal enforcement of infringement of trademark rights in cyberspace is a very challenging area. Nevertheless, this can be overcome by creating awareness and training to the law enforcement agents.
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Open Data Portal, a Technical Enabler to Drive Innovation in Namibia Lameck
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Purpose

Over the past years there has been a paradigm shift in the publishing of data and, or information, for example public information, research papers, leaflets and alike were predominantly in hard copies, these are currently more digital and open on the internet enabling data and information to be easily analysed and consumed; thus easing access to information. The trend of opening up public data is growing, attracting interest from major governments, public institutions and agencies who are the biggest collectors and consumers of public data.

The growing interests and adoption of open data initiatives is primarily due to the numerous opportunities open data provides for both government and citizens [1]. This work is focused on reviewing open data portal success story, best practices and the impact that an open data portal can have in driving innovation in Namibia and how such portal should be designed.

Method

This paper attempts to explore the impact an open data portal will have in fostering and driving innovation in Namibia. The following open data initiatives: http://data.gov, http://opendata.go.ke, http://data.gov.uk were studied and their impact evaluated. This open data portals were carefully selected for being leaders in open data initiative and also because of the impact they have in their respective countries. Secondly, best practice lessons from each initiative were then used as comprehensive base to design an open data portal for Namibia, which follows an open innovation approach to create solutions that delivers better services, keep citizens informed and hold government to account for their promises.

A combination of exploratory and action research techniques was be adopted in this study. Given that exploratory action research is suitable for gaining insights, assess phenomena in a new light and then use the gain knowledge to develop solution aimed at overcoming the problem [2, pp. 139 – 145].
To avoid subjective and biased views from our results two tools, namely Total validator and UITest.com were used to evaluate the above mentioned portals considering the criteria mentioned below:

- Datasets conformance to open data principles
- Level of activities happening on the portal
- Tangible benefits from data portal
- Level of innovation of each initiative

Results

Table 1 below illustrates the number of visitants each portal receives on a daily, monthly and yearly basis. The portal in the US and UK receives the most visitors compared to Kenya. This findings confirms the Open Data barometer findings which states that open data is more successful and impactful in countries with strong political freedoms, and thus tend to rapidly reach maturity [3].

<table>
<thead>
<tr>
<th>Country</th>
<th>Visitors (daily)</th>
<th>Visitors (Monthly)</th>
<th>Visitors (Yearly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>40,933</td>
<td>127,976</td>
<td>14,735,712</td>
</tr>
<tr>
<td>UK</td>
<td>29,739</td>
<td>892,155</td>
<td>10,705,860</td>
</tr>
<tr>
<td>Kenya</td>
<td>2,736</td>
<td>82,066</td>
<td>984,792</td>
</tr>
</tbody>
</table>

Table 1: Number of portal visitants

Innovation is the last category analysed, Kenya has done enormously well with a lot of innovative features available on the portal. However, greater commitments, more action still needs to be taken to increase advocacy, awareness and unleash maximum potential of open data. After a thorough analysis of the above mentioned portals, best practices lessons were then adopted and used to design architecture of the open data portal for Namibia illustrated below.

After a thorough analysis of the above mentioned portals, best practices lessons were then adopted and used to design architecture of the open data portal for Namibia illustrated below.
The portal architecture follows an open innovation approach with the intention of nurturing an innovation eco-system around public data in Namibia, by enabling developers through APIs to easily interact with the data, consume it by creating fascinating mash-up and innovative solutions that enhance service delivery and quality of life.

Conclusion

It has long been established that free markets and Society thrive on the open-free exchange of information, and so is innovation. Open data portal are essential drivers of innovation because they bridge the gap between data and citizens. Hence implementing an open data portal that follows the open innovation approach in Namibia will level the innovation playing field and drive the commercialisation of data. In conclusion, open data is on the agenda of many governments; data portals are crucial enablers to unleash opportunities presented by open data. However as we have learned from examples analysed in this paper, data portals are still not perfect but with the advancement in technology, significant improvements is inevitable. The data revolution is here, let’s embrace and exploit it through innovation.

References

Use of Artificial Immune Systems (AIS) in Industrial Control System (ICS) Security

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Background

Industrial Control Systems (ICS) control critical industrial processes for example they control electricity and water distribution, food and beverage production. It was previously thought that ICS networks were safe from network attacks because they were not interconnected to business IT networks and the Internet [1]. ICS were eventually connected to business networks which meant that ICS became susceptible to network attacks that already existed and to ICS specific attacks.

Advanced Persistent Threats (APT) which attack ICS, bypass access and identification security controls, data integrity security controls, monitoring and accountability security controls. APTS can bypass normal security devices like firewalls and they are not detectable with normal intrusion detection systems and antiviruses.

This research proposes emulating the immune system which; is responsible for detecting and protecting the body from harmful microorganism to ICS security mechanisms to a bio-immunology inspired ICS security model.

Purpose

The purpose of this research is to develop a bio-immunology inspired networking security model for improving existing ICS defence from APT.

To achieve the purpose of the research the following questions will be answered

1. Where and how do APTs Attack ICS?
2. Why do APT attacks happen: Are ICS vulnerabilities from ICS inner workings/ operations, security strategy site or else?
3. What approach can be considered in either case to avoid APTs attacks?

Methodology

This investigation falls under Constructive Research Methodology. Muyingi et al. (n.d.) state that in such investigation something novel is researched, designed, implemented, evaluated then theorised about, which may be a new sorting algorithm, or new process.

Data collection and Analysis

Qualitative data analysis

Information about APTs and the current bio-immunology inspired security best practices will be obtained from existing literature. Analysis of such literature will assist in modelling APT behaviour and the discovery of weaknesses in current security best practices. Results will be used to design a bio-immunology inspired security model.
Simulations & Experiment

A simulation experiment will be used to test bio-immunology inspired security model.

Results

First it was discovered that APT get initial access into ICS by using social engineering techniques like spear phishing and web based click jacking. Secondly APTs attack ICS to sabotage operations and to steal data about the targeted attacks. Thirdly ICS vulnerabilities can be attributed to human weaknesses as they are social engineered by APT attackers. Forth technical implementations in ICS as a result of best practices or standard recommendation do not deter ICS. This means that ICS have some software and system configurations that are exploited by APT.

It is possible to design a bio-immunology inspired networking security model to protect ICS from APT by:

• Fully understanding ICS operations
• Fully understanding ICS security needs in order to map to the correct immune system functionalities
• Fully understanding immune system functionalities that will be emulated in ICS security
• Mapping ICS security needs to relevant immune system functionalities to required ICS security needs
• Translate the immune system functionalities into mathematical models
• Translate the mathematical models into computational models.

Conclusion

It is evident from the way APT intrude systems that humans are a very weak link in securing ICS. Organisations need to engage their employees in more security training. It is also apparent that even though initial infection of APT is by exploiting humans ICS do not have sufficient technical configurations to deter APT as such a new way of securing ICS is required. Bio-immunology inspired security model is envisioned as the future in securing ICS from APTs.

References

Multimodal biometrics for better security: A case of Namibian government departments.

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Body

The developments in Information and Technologies (IT) has seen IT playing critical roles among them enhancing the implementation of national security involving the upkeep of sensitive information making sure its accessible to the right people from any location. As technology advances both in architecture and playing more and more critical roles in governmental departments, once reliable traditional authentication and verification systems are now open to a number of security breaches some of which may not be combated by these old or traditional security measures. For instance, Personal Identification Numbers (PIN numbers) and password that are normally used to authenticate system users are vulnerable to shoulder surfing and systematic trial-and-error attacks. Cases have since been reported in Namibia in which people have lost personal belongings worthy thousands of dollars as a result of information security breaches. To address all these issues, propositions have been made among them the use of multimodal biometrics and keystroke dynamics for security purposes. Biometrics offer reliable identification mechanisms for better security because of their different characteristics namely universality, uniqueness, permanence, collectability, performance, acceptance and circumvention.

Purpose

This research investigates current challenges and factors affecting the successful deployment of multimodal biometric systems by the Namibian government. Among the aims, the research seeks to establish the required IT infrastructures, identify challenges and different biometric technology architectures for multimodal biometric securities for the Namibian government. Based on these findings, the research proposes a framework of multimodal biometric deployment in Namibian government.

Method

The research uses a qualitative case study approach for its data collection. A questionnaire, interviews, observations and document analysis were used for data collection. Multiple case study strategy was used which saw data being collected from three different Namibian Ministries. Within and cross-case data analysis was done, using coding to identify emerging themes from data collection.
Results

Results show that a number of biometrics are used in government departments in Namibia among them include fingerprints, face, iris, voice and hand geometry. In addition, IT infrastructures and architecture necessary to support these biometrics securities comprises of an image acquisition module, feature extraction module that processes the acquired image thereby extracting the salient or discriminatory features and the matching module that matches the acquired image with the template in the database. It was also found that the Namibian government is faced with challenges ranging from economic, technical, social and political challenges. Based on these findings, the research proposed a framework of multimodal biometric implementation indicating core components that need to be looked into in order to successfully deploy biometric securities within the Namibian government.
Open Online Community Of Practice For Computer Studies Teaching Practitioners in Namibia

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Purpose
This research focuses on the Computer Studies teachers in Namibia and employs participatory design as it aims to design, follow and influence the implementation of a social networking platform that can be used for information sharing among members of an Open Online Community of Practice (OOCoP) for selected teachers. Furthermore, this research aims at evaluating the factors affecting the adoption process of the implemented OOCoP using the Unified Theory of Acceptance and Use of Technology model (UTAUT).

Method
An analysis of the first prototype, using participatory design led to changes being applied in the second prototype to emphasize the social dimension in the learning, participation and active collaboration processes.

Technologies for development
a) Microsoft ASP.Net (C#) for server side processing; HTML, Java Script and CSS for client side processing and presentation and IIS for the web server
b) Microsoft ASP.Net (C#) for the processing logic and IIS for the web server
c) Microsoft SQL Server and SQL for the relational database

Using the Case study approach, data were collected through participant focus group interviews and online survey questionnaires. Online survey questionnaires were hinged on the UTAUT model in efforts to better understand the factors influencing the prototype adoption process.
Results

The subsequent analysis suggests that the applied changes improved collaboration, enhanced the learning process and active participation of experts in the OOCoP. Additionally, the availability of peer support created a sense of belonging to members particularly the newcomers. Other factors such as Policy and technological infrastructure could not be reliably evaluated using the chosen models. These factors were identified to influence future work on OOCoP for information sharing and knowledge creation.

Login Page of the developed OOCoP tool

Conclusion

The research provides empirical evidence of the value of peer support in OOCoP setups in education. Through participatory design, the features of the Google Group were improved and the weaknesses addressed. The UTAUT model and focus group findings point towards the identification of some of the factors that influence the adoption and usage of the OOCoP.

References.


Determining the Feasibility of Free Space Optical Communication in Namibia

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Purpose
Free Space Optical Communication (FSOC) is a line-of-sight (LOS) technology that transmits a modulated beam of light through the atmosphere to provide high bandwidth optical connections [1], [2]. FSOC is conducive for distances where LOS is possible. FSOC is characterized by low installation costs. Compared with Radio Frequency (RF) communication, FSOC offers higher bandwidth, lower interference, license-free operation, and lower initial capital expenditure (CAPEX). Despite all the attractive features, FSOC is known to be sensitive to weather conditions, which can result in loss of optical signal power. Atmospheric obscurants such as fog, haze, smoke, dust and clouds may turn the propagation environment into a multiple scattering medium thereby creating scattering losses [1], [3]. FSOC also suffers from atmospheric turbulence, which causes fluctuations in the received light signal’s intensity and phase, thereby impairing link performance [2]. Scattering and turbulence are the major contributors to atmospheric loss in FSOC [4].

Namibia is generally an arid country [5], [6] with clear skies and low annual rainfall, hence Namibia’s atmospheric conditions present a great potential for FSOC. To the best of our knowledge, a study on the feasibility of FSOC in Namibia has, however, not been carried out. This study is, therefore, aimed at determining the feasibility of FSOC in Namibia based on optical link margin and atmospheric loss models from literature.

Method
Six locations (Windhoek, Ondangwa, Katima Mulilo, Grootfontein, Keetmanshoop, and Walvis Bay) are chosen across the country and visibility and wind speed data is collected from the Meteorological Department for all the locations for periods of more than 5 years. Altitudes of the locations are also collected. Visibility profiles for the locations are determined and classified by using statistical techniques. Average scattering and turbulence losses are computed for each location. The optical link margins are also computed for all areas and optimal link distances and minimum visibilities for the availability of FSOC are computed for all locations under average atmospheric conditions. The worst case conditions for visibility and wind speed are also used to calculate the worst atmospheric conditions for FSOC in Namibia.
Results

Katima Mulilo, Grootfontein, Ondangwa, and Keetmanshoop have average visibilities above 74 km, which are higher than Windhoek, which has a visibility of 70 km. This can be attributed to the fact that there are fewer industrial activities in these four locations when compared to Windhoek. Walvis Bay, which is a coastal location within the Namib desert, has the lowest visibility of 60.78 km. This is attributed to the coastal fog conditions due to the presence of the cold Benguela Current off the coast which is responsible for a zone of high frequency fog (>50 days a year) hugs the coast over almost the entire length of the Namib[7]. Walvis Bay is, therefore, found to have the highest scattering losses when compared to all the other locations.

Walvis Bay lies in the medium turbulence zone based on its refractive index structure parameter of 2.54616E-15 m-2/3, whereas all other locations lie in the low turbulence zone with Windhoek having the lowest refractive index structure parameter of 8.54919E-17 m-2/3. Under average atmospheric conditions the highest optimal link distance found is 9 km for Windhoek and the lowest is 4 km for Walvis Bay. Under the worst case atmospheric conditions, the highest optimal link distance was 7 km for Grootfontein and Katima Mulilo and the lowest was 4 km for Walvis Bay.

Conclusion

The optimal link distances determined in this work show that FSOC is a feasible technology for Namibia for last mile access networks. It has also been observed that the high visibility recorded in Namibia results in very low scattering losses but the overall atmospheric loss depends more on turbulence losses and hence the link availability is mainly influenced by turbulence. As part of future work, practical field tests, using FSOC equipment must be carried to see if there is a correlation between practical results and the ones based on theoretical models in this work.

References

Mobile Based Information Sharing for People with Disabilities in Namibia

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Purpose

This study focuses on mobile based information sharing that has been introduced into the lives of disabled people in Namibia. It will also looking at the adoption of mobile usage by people with visual and motor disabilities. The adoption of mobile usage relies on the adaptation which based on user and device models, managed by means of ontologies.

The main purpose of this study is to design a mobile based information sharing platform that will allow people with disabilities to access national information and other related services anywhere, anytime without physically visiting disability centres. I will also identify the ICTs used by disabled people in Namibia, understand how disabled people will adopt on the usage of mobile phone in their daily lives and examine how disability related information can be distributed to the people living with disabilities.

Method

In this research, qualitative research method, case study and interpretive technique will be employed based on the objectives of the study. National Disability Council will be used as the case in this study.

Feedback from the collected data will be used to motivate the development of a mobile application. Hybrid Apps in Microsoft Visual Studio (HTML, JS and CSS) Technologies will be used to develop mobile app (“Mobile Web Apps,” 2015). Interpretative approach using Diffusion of Innovation (DoI) theory according to Roger (2003) will be used.

![Figure 1: Overview of the Method carried out](image-url)
Results

A mobile based application information sharing architecture for people with disabilities to access information is developed.

![Proposed System Architecture](image)

**Figure 2: Proposed System Architecture**

An analysis to understand how disabled people will adopt on the usage of mobile phone in their daily lives and how the innovative idea will diffuse among the community of people with disabilities was carried out.

Conclusion

Mobile devices provide numerous opportunities for everyone to access the Web, especially people with disabilities. Due to the high demand drawn from the research carried out in 2014, this study focuses on motor and visual impairments. A functional mobile based application information sharing for people with disabilities is expected to be up and running by the end of the research and few written publications will be released.

References

An adoption of Information and Communication Technology (ICT) as a tool in teaching and learning in high schools: a Namibian case study.

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Purpose

The research proposes an ICT adoption strategy that could be used for high schools in Namibia. The main aim of the research is to come up with an ICT adoption strategy for high schools. Furthermore, it is important to understand how the overall performance of learners can be improved through the adoption of ICTs in subjects being taught in high schools within the Khomas region. This can be achieved by conducting research in high schools and determining what teaching methods teachers are currently making use of. Furthermore, how these methods can be improved to benefit the learning process of learners and increase the effectiveness of teaching in high schools.

Method

This research is based on an analysis of an adoption strategy for the usage of ICTs in high schools. The research will make use of both quantitative and qualitative methods. The research targets three high schools in the Khomas region that have ICTs but are not necessarily being fully utilised to enhance teaching and learning. It is a case study which will reflect the Namibian context. It is important for learners to learn how to use technology and not merely learn about technology (Soule, 2003). This is one of the reasons as to why my research is more focused on the teachers as they are the ones responsible for exposing learners to ICTs in schools. A literature review will be conducted. Furthermore, interviews will be carried out with the teachers in charge of teaching ICTs as a subject in the school. These interviews shall be recorded and later on transcribed for further analysis. On the other hand, self-administered questionnaires will be distributed to the teachers. The questionnaires will be handed out to the teachers with questions about their teaching experiences and what impact they think adopting ICTs for learning and teaching will have on school performance by learners just to mention a few. This research aims to have 30 teachers participate in the questionnaires. By using these methods, a clear understanding of ICTs usage in high schools can be made.

The face to face interviews will contribute towards a large amount of data that can be gathered because the interview is conducted the candidate may reveal information that did not make up part of the initial questions asked but may prove to be important and can be used in the research. For useful data to be gathered it is vital to get the right sample of teachers to take part in this research. The discovery of the best way to adopt ICTs in high schools may happen. The research will gather data from the school and analyze it. Once analyzed, an existing strategy for the adoption of ICTs will be adapted to the schools' specific structure and molded for its advantage. The reason behind the teachers being the only participants in my research and excluding the learners is because the teacher’s approach to teaching is able to influence the way a learner receives and processes the information and knowledge that is being transferred from the teacher. Therefore, it becomes evident that there is a need for these young people to be exposed to ICTs through the teaching and learning process so that they are able to experience enriched learning (Moore, 2005).
Results

Though the research is currently at its infant stage, available results show that:

- Those schools which have adopted to ICTs in teaching and learning perform better
- ICTs can enhance and make teaching and learning more interactive and engaging
- ICTS have the potential to benefit the Namibian Education Sector
- There is need to re-align the current curriculum to accommodate ICTs with the Education Sector
- Stakeholders bee to come up with an ICT adoption strategy

Conclusion

The Namibian government has acknowledged the need for ICTs to become a major part of the school curriculum through their vision 2030 policy. Currently the usage of ICTs in Namibian schools is limited. There is a need for the adoption of ICTs for teaching and learning to take place in high schools so that learners are exposed to an enriched learning experience. ICTs make teaching and learning more interactive and engaging. Although there are challenges that can be faced with the usage of ICTs in schools they are outweighed by the benefits that can be gained.

References

A Software Defined Network Solution for Communication in a Smart Grid

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Purpose

Electricity shortages are being experienced in many countries in the world with South Africa and India being recent examples. Poor visibility along the power grid, limited monitoring and control of what happens on it contributes to the erratic supplies of electricity. The power grid of today which is characterised by limited communication network can be represented as shown in Fig 1.

![Traditional power grid](image)

**Fig 1. Traditional power grid. [1]**

The limited communication that occurs on the traditional power grid employs Ethernet technology which exhibits high latency coupled with high workload. In this technology, there is no complete overview of the networked equipment. The Ethernet technology based solution also has the drawback that the way it operates consumes a lot of energy. In [2], it is stated that the communication networks consumes an estimated 8% of the total power used in the world. Because of the shortfalls of the traditional grid, the smart grid has emerged and it is anticipated that millions of equipment will be connected on it. The Federal Energy Regulatory Commission defines it as “a power system architecture that permits two-way communication between the grid and essentially all devices that connect to it, ultimately all the way down to consumer appliances” [3]. To convert the traditional grid to the SG, a solid communication infrastructure will be superimposed on top of the power infrastructure of fig 1, and this communication will be the cornerstone to the success of the SG [4]. The development of the smart grid will be based upon complex networking between a vast number of sensors, DERs, smart meters etc [5]. In this paper we propose a solution employing a software defined network (SDN). SDN separates the control plane and the data plane [6]. This results in the
control plane making all the decisions on how data should traverse the network. Using this kind of technology, the controller will have a clear overview of the whole network hence improving visibility. Also not every packet will be send to the controller for processing, this reduces latency and the work that the controller does and hence reduces the amount of energy consumed. Limited publications have been reported on the application of the SDN to the smart grid despite its potential.

Method
After obtaining the type of data, traffic profiles, applications and services, the data will be categorised based on bandwidth requirements, priority, QoS e.t.c. This will be followed by using the Mininet to model the SG topology which will consist of various equipment that run the applications and services in the SG environment. The control plane will be programmed with mathematical algorithms determining the way the traffic will be routed over the network. Monte Carlo technique will be used to model the traffic of certain applications in the SG at any given time. Distributed Internet traffic generator (D-ITG) will now be used to mimic the appropriate traffic and the appropriate quantity to route over the network. Use case scenarios will be implemented to generate the appropriate traffic which will be routed over the model of the SG developed as stated above. Several experiments will be run. Performance parameters such as delay, packet loss, load balancing, QoS, jitter, throughput etc. will be analysed. The results will be compared with other published results. Error bars will be plotted and used to determine how far the model fares with other models. Different topologies will be modelled, different algorithms will be developed and different operational scenarios together with typical faults will be introduced and the above tests repeated.

Results
The work aims at obtaining a semi IP less, intelligent and energy efficient model of the communication system of the SG with low latency as compared to the current networks in use. This is possible due to the operational characteristics of the SDN.

References
Web based Namibian Parent-Teacher Communication Platform

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Purpose

Parental involvement in schools as well-defined by Kohl, McMahon, and Lengua (2000) comprehends three areas: direct contact with teachers, parental actions at school, and parental actions at home. The relationship between home and school is a powerful influence on children learning and development, which digital technologies have the capacity to support and enhance (Lyndsay, 2010). New technologies have the power to better the parent-teacher relationship by providing easy, efficient, and effective methods of transferring information. Furthermore, children’s behavior and social adjustment improve when parents are proactive with schools and neighborhoods to cultivate an environment that promotes learning.

The study aims to ensure that parents and teachers could take full advantage of technologies to bridge the communication gap and build family-school partnerships thus leading to better communication between teachers and parents about learner’s performance at school. The traditional method of sending information via mail and with learners results to information either ends up not reaching the parents or arriving one or two weeks late. The worse scenario a learner can choose not to deliver the letter or give false information to the parents. The following are specific research purposes:

- Identify information that will be shared by parent and teachers
- Determine ICTs used by both teachers and parents
- Develop a web based application for parent-teacher interactions

Method

Qualitative data collection techniques will serve as the research methods during this study. This particular style of action research places a great deal of emphasis on the how. Open-ended interviews with teachers and parents will be conducted. Furthermore, surveys will be administered to students. The findings from the study are used to develop the web based parent-teacher application.

The setting of the research is specific to two locations, namely: Windhoek (Khomas region) and Oshakati (Oshana region). The settings of the two locations are different from each other in the context of community or region English language proficiency, availability of technology and computer or tech savvy.

The participants in this research include 30 learners from each region: Khomas and Oshikoto respectively. These learners will be randomly selected from grade 9-12. Additionally five interviews will be carried out to teachers who have over five (5) years of teaching experience in each region. Lastly five (5) parents from each region will be interviewed.
Results

The data gathered from the interviews from parents, teachers, and from surveys administered to learner will be transcribed and used in the development of a web based parent-teacher communication platform. Figure 1 shows how the communication between parents and teacher will be streamlined via a Parent-Teacher Communication Platform.

Figure 1: Web based Namibian Parent-Teacher Communication platform

Conclusion

As a result to ensure that a more reliable and effective form of communication, this research will focus on filling the gap on the existing research by emphasizing on developing a web based application that streamline the communication challenge between parents and teachers.

References


UNDERSTANDING THE ADOPTION OF E-GOVERNMENT SERVICES IN NAMIBIA

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Introduction

Electronic government (e-government) refers to the usage of information technology and communication to disseminate, share, interact and conduct various types of transactions with citizens, businesses, and other government agencies, and is one of the outcomes of rapidly growing technology development. However the success of such effort not only depends on the support of the government side but on the citizens” willingness to adopt these services also a dominant factor (Lanka, n.d.) (Venkatesh, 2003) suggested a more complete model for the understanding of the acceptance and adoption of Information Technology. Their model constructs upon and extends beyond the well-established Technology Acceptance Model (TAM). This study utilizes this new Unified Theory of Acceptance and Use of Technology (UTAUT) to enhance our understanding of the adoption of e government services in Namibia.

Research Purpose

The aim of this research is to apply UTAUT model constructs and other constructs to measure levels of end-users acceptance and use of e-government services.

Specific objectives of the research will be;

1. Investigate the appropriate e-Government implementation and adoption models.
2. Investigate factors that enhance access and use of e-Government information and services.
3. Investigate factors that might hinder the usage of e-Government information and services.

Research mode and hypothesis formation

Based on research work done by Venkatesh et al. (2003) the following hypothesis are formulated

1. H1: “Performance expectancy” has positive influence on “Behavioral intention.”
2. H2: “Effort expectancy” has positive influence on “Behavioral intention.”
3. H3: "Social influence” has positive influence on “Behavioral intention.”
4. H4: "Facilitating conditions” has positive influence on “Use behavior.”
5. H5: "Behavioural intention” has positive influence on “Use behavior.”
Research results

In this paper, we adopt UTAUT to investigate the use of e-government services by the citizens. Results will be collected and analyzed by the use of an online survey.

Conclusion

The purpose of this study is to understand the adoption of e-government services in Namibia and this is relatively not a new emerged technology but already existing phenomenon and thus a lot of work, research and literature do exist however recent studies done in Namibia on this topic concentrated on issues like interoperability, Government policies and etc. None of them focused on adoption of e-government. Thus the study intends to investigate and get a better understanding adoption of e-government services using UTAUT model as a suitable model to understand the adoption of e-government services at a high level. Thus this study will be an exploratory study.

Bibliography


Extended Abstract

This study will focus on the identifying the critical factors influencing innovation amongst rural youth in Namibia. Although innovation in rural Namibia have been forth coming at a relatively slow phase, a few brilliant ITC innovations have serviced from especially the youth in rural Namibia (Kapanda 2008). However despite the huge innovative potential of young people in rural Namibia, less young people are being innovative in everyday situations requiring innovative solutions (Rogers, 2002). For Namibia to achieve its millennium objectives in becoming an industrialized country the youth should become the drivers of innovation (Geingob 2015). It is against this backdrop that this study will employ a quantitative methodology approach to determine the drivers and killers of innovation amongst Namibian youth. The findings of this study will be used to advise both public and private sector organizations on how they can help eliminate the killers of ITC innovation and support more young people to become innovative thinkers and doers. This study will also help Namibian rural youth to become part of and more active in the information age.

References

IMPLEMENTATION OF A MOBILE INTERACTIVE TEACHING AND LEARNING APPLICATION FOR NAMIBIAN SCHOOLS

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Purpose

The growth of technology has enabled developments in various sectors of the economy. One of these sectors has been the education. Technology has been used to transform teaching and learning within the classroom. In this research, mobile learning is discussed. This has been motivated by the fact that Namibia secondary and primary schools in rural areas are geographically and socially isolated. Rural Namibia schools face a number communications technology (ICT) for supporting the educational processes has motivated problems including ways in getting learning materials, as well as inadequacy in qualified teachers. The impact of these problems is poor performance in National Examinations. This poor performance however is highly noted in science and mathematics subjects. The problem in getting learning materials can be reduced by employing ICT in both secondary and primary school education system.

A qualitative research approach using questionnaire, interview and prototype design was employed in the research. Urban and rural schools in Namibia were engaged.

Method

Several methods were used to achieve, the main objective of the study, which is to develop an interactive application system for Namibian public schools (primary and secondary), which is unique to Namibia and will assist teachers and learners through teaching and learning processes.

Questionnaires were used to obtain general information about the mobile usage at school, mobile network coverage, and challenges users experienced with mobile phones, application usage on mobile phones and mobile usage at schools premises. From the questionnaire findings, a mobile prototype was designed.

Focus group was used as well to gather general information on mobile usage on education and mostly the focus group was used to help in system design e.g. interface design and system features. The focus group consists of two Heads of department (HOD), four teacher, one principal and three learners.

For the m-learning application development agile development method was adopted. Agile methods are incremental development methods in which the increments are small and, typically, new releases of the system are created and made available to customers every two or three weeks [1]. They involve customers in the development process to get rapid feedback on changing requirements. They minimize documentation by using informal communications rather than formal meetings with written documents.
Results

In terms of mobile phone ownership, 14 students indicated that they do not own a mobile phone while the remaining 22 own at least one mobile phone, more students own mobile phones compared to those who do not own a mobile phone making the use of m-learning a possibility or feasible. In particular to teachers, all rural based teachers own a mobile phone while 16 of the 25 urban based teachers own a mobile phone.

All students indicated that it is not allowed to use a mobile phone at school. In addition, students indicated that mobile network coverage is good (73%) with only 6% of the students indicating that they stay where there is no network coverage. In addition, the majority of teachers concede that network coverage is good and excellent. These results promote the development and use of m-learning as most students and teachers have a greater chance of accessibility through mobile phones at any given location.

When it comes to learning, 94% of the surveyed students concede that they prefer learning using books. Only 6% prefer learning using laptops. None of the students prefer learning through a mobile phone. This could be attributed to a lack of knowledge and experience over such techniques. 70% of rural based teachers prefer to study using books while only 20% prefer to study using mobile phones. However, urban based teachers prefer to study using books 48% and laptops 40%. Only 12% prefer to study using mobile phones. This result implies that, books are the dominant preferred studying method across participants. As such, the m-learning system to be designed has to support the use of books. For instance, m-learning can be used to send practice questions or initiate discussions using material from text books. It can also be used to remind students to do read on certain chapters of the books.

Common problems associated with mobile phones were also evaluated. These problems relate to network coverage, battery life and use of particular mobile phone features. Results show that, the phone battery is the most (51%) common problems with mobile phones. This can be caused by the amount of time students spend at school without any power source to recharge their mobile phones.

Participants’ ways or methods of receiving news were evaluated. To some extent, this also evaluated teachers and students’ preferred method of communication. Evaluated ways of receiving news include newsletter, cellphone, email and other (word of mouth, televisions, notice boards, the internet). In particular to students, rural based students and teachers indicated that cellphones are the most common way by which they receive news-57% students and 52% teachers. Urban based teachers rely most (40%) on other means of communication followed by cellphones (32%). This result shows that, overly cellphones are the dominant method of communication for all groups combined. Nevertheless, for rural students and teachers, newsletters (29% and 32% respectively) have a fair usage and other means or sources with 20% for students and 21% for teachers.

Below are the screenshots on the interactive application that was developed. The system can be view from a mobile phone, tablet and computer.
Conclusion

An interactive web application is a web application that uses various software to create an interactive experience that allows the person viewing the web application to be actively engaged with the site [2]. This can be done for a number of reasons and by using various methods and software to accomplish this interactivity. An interactive website can be just about any website that allows users to go beyond simply reading text and viewing images. Interactive web applications can be used as educational tools. In terms of education, Interactive web application engages students by providing information and resources along with practice, simulations, and other learning activities. They can be highly interactive, content-rich simulations such as games, puzzles and quizzes. In general, an interactive website will use the standard graphical user interface (GUI) present on all websites to create interactivity with the viewer.

References


Development of a web based patient record management system for private and public hospitals in Namibia.

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Purpose

This research focuses on the design of a web based patient record management system. This could provide information distribution and simultaneous access, fast information retrieval, better quality, high availability, higher confidence. We argue that ICTs can be utilized to overcome geographic isolation for the population in all areas, and it can facilitate access, dissemination, utilization and exchange of health information (Yamuah, 2005). The advantage of having web-based patients records on internet can bring about awareness of patients knowing their own medical problems and help them seek medical help. This can enable Namibia hospitals to adapt current technologies that are been used in other countries to ensure health services delivery (Archer et al., 2011).

Furthermore this study aims to benefit the society of Namibia at large especially the health sector.

Method

A qualitative research approach through interviews with medical personnel's and a few patients is used. This was supported by questionnaires that were distributed to investigate the current state of health information sharing in Namibia. The technologies used for the health systems application include WAMP which includes windows, Apache MySQL and PHP. This was chosen since it is open source

Results

Most hospital still use paper based methods in storing or keeping patients records, public hospitals were found using a yellow for children and green booklet for adults. Here is where nurses or doctors will record medical history and prescriptions, and the book is given to the patient for storing.
Private hospitals and private doctors use hard copy files and store these in files with them; patients are sent to the pharmacies with a prescription on paper. Hospitals in Windhoek have access to computers and some with internet some without internet, but these computers are mostly used for billing systems claiming from medical aid and scheduling appointments in case of private hospitals. One hospital in Windhoek has implemented a health information system (HIS) that is run parallel with a manual system in carrying out hospital processes and activities.

Results on Stakeholders engaged in the study ie doctor, nurses, patients and ICT administrators, all support the need of a web based patient record management system.

<table>
<thead>
<tr>
<th></th>
<th>ICT in use</th>
<th>Sharing of patient medical records</th>
<th>Recommendation of web based patient record management system</th>
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<tbody>
<tr>
<td>Hospital A-public</td>
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<td>yes</td>
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<tr>
<td>Hospital B-public</td>
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<td>yes</td>
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<tr>
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<tr>
<td>Clinic-public</td>
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</tbody>
</table>

**Conclusion**

The research could provide information distributed and simultaneous access, fast information retrieval, better quality, high availability, higher confidence and lower costs. Patients will get access to their medical history when available on web and there will be no duplication of data also medical practitioners share information.
References


IMPLEMENTATION STRATEGY FOR E-READERS IN NAMIBIAN SCHOOLS

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Purpose
In this study, we proposed implementing e-readers (electronic reading devices) in Namibian schools. The benefits of e-readers include portability, low energy consumption, increased capacity for educational content storage, low price and Wi-Fi connectivity. E-Readers could be utilized in Namibia’s education sector to solve some current problems, especially the lack of teaching & learning materials. This study, therefore, aimed to assess the readiness of the Namibian academic community for the deployment of e-Readers in schools, as well as to outline appropriate implementation strategies for successful e-Reader integration. The implementation plan was based on feedback from different stakeholders who were engaged during the research.

Method
The study utilized mainly qualitative methods of data collection, and falls under the interpretative paradigm of Design-Based Research. This paradigm exists to establish pragmatic inquiry, evidence-based claims and validation by use [1]. Data collection in this research involved semi-structured interviews and questionnaires carried out among educators, students and traditional book publishers. Data analysis in this study was carried out using Grounded Theory, allowing the data to inform the discovery of theory. This method allows themes, issues and important topics to emerge from the data through iterative reading of the data; these topics then form the basis for subsequent analysis.

Results
Our findings indicate that there are still a lot of infrastructural challenges that need to be resolved before such a programme can truly take off. These include electricity and internet coverage in underserved areas and government backing for community-based reading programmes. Furthermore, kids are not sufficiently interested enough in reading physical books widely and on their own, a problem exacerbated by poor family involvement in their school work.

Our implementation strategy involves the coordinated efforts of several stakeholders. These are the government, teachers, publishers, developers, and students. Government would be responsible for building up and maintain adequate infrastructure such as electricity grid coverage and internet access, in addition to grassroots-level publicly funded libraries. They will also subsidize initial acquisition costs of the e-readers and provide teacher training. Teachers will then be required to
undergo professional development in order to maintain teaching efficacy, as well as to liaise with publishers to develop and design the syllabi to be put on the devices. Publishers will be responsible for designing the layout of the content, publishing, marketing and distribution of the content for the devices. Developers will contribute by creating interactive content for the devices to be used in the classroom, and in the process building local ICT capacity and creating jobs.

Figure 1: Implementation Framework for E-readers in Namibia

Conclusion

The implementation of e-readers in Namibian classrooms is an initiative that can be undertaken alongside more traditional solutions to solving the problem of a poor reading culture and limited supply of engaging textbooks, in the process transforming Namibia’s education sector into a truly forward-looking 21st century model of success.

References

Purpose
Similar to many other countries in Southern Africa, Namibia records a very high rate of youth unemployment, leading to a number of socio-economic challenges. We hypothesise that, the inclusion of unemployed youth into participatory design activities can release creativity and innovative ideas that could be used to resolve youth related issues.

Method
A variety of participatory workshops using an assortment of service design methods and tools were held with the different unemployed youth groups. Thus the openness of participatory service design applied to the vast field of youth unemployment services, allowed the youth participants to identify and self-determine services to be developed.

Results
Preliminary results from our participatory service design interventions with unemployed youth participants in Windhoek and Epukiro show great potential. Self-actualisation emerged as the main theme among the youth to counter current symptoms such as alcohol and drug abuse, violence, crime, and suicide. In close collaboration with the youth, we have developed first prototypes of mobile and web-based services supporting youth to youth communication, crowdsourcing of funds for grassroots projects, project planning, job matching, career counselling and mobilisation of other youth. The interventions have shown great success in terms of youth engagement and skill development. The youth demonstrated their deeper understanding of the socio-economic settings as well as the desire to contribute to a major change, by empowering themselves and fellow youth.

The youth also highlighted the need for a sustainable youth center that will serve as a platform for the youth to interact, communicate and share information.
Conclusion

The new technologies and services need to be deployed and integrated into current and future support structures through the involvement of all stakeholders thereby creating resilient systems. Many lessons were learned from the co-design activities with the youth, which are to be taken further for policy and infrastructural developments.

References

None for the Abstract.
Social Work’s Contribution in Promoting Social and Economic Equality: A Namibian Case Study

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Purpose
Since emerging from apartheid rule in 1990, Namibia has made steady economic progress and is classified as an upper middle income country. However, beneath Namibia’s grandiose economic ranking, lies a vast array of inequalities that compromise the social and economic well-being of the majority of its inhabitants. In view of this paradoxical status quo, the goal of the study was to determine social work’s contribution in promoting social and economic equality in Namibia.

Method
The study adopted a qualitative research approach and utilised a collective case study design. The sample was purposively selected and consisted of social work participants. Research data were collected through semi-structured one-on-one interviews and document analysis.

Results
As inequalities deter the realisation of the Millennium Development Goals, the study maintains that targeted efforts to tackle poverty and inequality are an urgent imperative, even in upper middle income countries, such as Namibia. The study postulates that social workers can play a significant role in promoting initiatives aimed at achieving social and economic equality through the use of a social development approach. As opposed to pursuing economic or social development in isolation, social development is centred on striking a balance between economic and social progress. In so doing, social development promotes social inclusion and the fulfilment of basic human needs. The findings show that the Government of the Republic of Namibia is attempting to shift social work services from a curative and remedial focus to an emphasis on social development (Ministry of Health & Social Services, 2010:1). However, the majority of Namibian social service organisations have not yet come on board in this regard. The study recognises social work as a key player in promoting social and economic equality and in uplifting the welfare of vulnerable and marginalised populations. The investigation reveals that in the absence of formally adopted social welfare policies, social workers in Namibia are making individual strides to enhance the well-being of the marginalised people they work with. Since social work is considered a scarce skill, the research findings allude to the role of legislation in enhancing social work practice and the inclusion of vulnerable people in Namibia’s social and economic development so as to ensure a better future for all.
Conclusion
The study concludes that skills shortages, a lack of continual professional development avenues for social workers in the social development paradigm and poor coordination of social welfare services seriously undermine the promotion of social and economic equality in Namibia. The study recommends effecting provision 22(1) of the Social Work and Psychology Act 6 of 2004 (Republic of Namibia, 2004:30) to register social auxiliary workers to complement the existing social work force. Finally, expediting the finalisation of the social development policy draft (Republic of Namibia, 2014) is recommended so as to bring about uniformity in how social workers in Namibia tackle developmental challenges.

References
CONTEXTUALISING THE DRIVERS AND IMPACT OF CORRUPTION ON DEVELOPMENT OF TWO DEVELOPING COUNTRIES AS OPPOSED TO A DEVELOPED COUNTRY

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Purpose

During the past two decades, the debates around corruption and ways to contain it have acquired a new intensity and concentrated focus. Corruption has risen to the top of the development agenda. An example of this new intensity and focus is a bulletin of the Carnegie Endowment for International Peace about Trade, Equity and Development published in 2002. In this document Peter Eigen (2002: 1), Chairman of Transparency International (TI), said that corruption is perceived not only as an ethical problem, but also as a governance issue that has a direct impact on development.

Within the sphere of socio-economic and management studies, the concept of ‘development’ is normally associated with any improvement which enhances the capacity (ability) of an entity to perform its functions. The systems view of development defines development of a social system as a learning and creative process “by which a social system increases its ability and desire to serve its members and its environment by the constant pursuit of truth, plenty, good, beauty and liberty” (Ackoff, as cited by Gharajedaghi, 1982: 54). The systemic definition of development moves beyond the enhancement of ability by pointing to the crucial role of human behaviour (‘desire to serve’) in a multidimensional development process. In contrast, self-serving behaviour is the hallmark of corruption. Corruption is thus the antithesis of a ‘desire to serve’, as specified in the systems definition of development. Corruption is also the antithesis of integrity (Spies, 2003: 9), because a breakdown of integrity means a systemic breakdown. The central theme of this article is that corruption is generally a systemic and complex problem. Impacts are co-produced that act as primary obstructions to development. Impacts cannot be separated from co-producers, because all impacts also act as co-producers and vice versa. The impacts and co-producers are so intertwined that it is not possible to categorise them without posing questions about their relationships and interactions.

Measuring the impact of corruption can be useful for developing and prioritising change-management strategies. However, developing reliable indicators to measure social harm is challenging. As evidence of corruption tends to disappear and because of privacy challenges, most impact studies of corruption are perception studies. To increase the validity and reliability of such studies, they should be followed up by empirical studies and/or actual examples and cases that reflect reality. Perception indices tend not to be supported by theory nor a rigorous methodological approach. Perception studies can be subjective and their validity can be questioned by development recipients as not necessarily accounting for the most appropriate development indicators.

Method

The description in this paper of corruption problem situations, which in fact consist of sets of problems without a root cause, is in itself a methodological element. The unit of analysis is systemic corruption. The research methodology applied in this paper is systems thinking and specifically the
soft systems approach. Checkland’s (1981) soft systems approach is an outstanding method for investigating corruption without having a clear indication of the problem. Ackoff’s (1999) idealised design approach is an appropriate framework to contextualise complex and systemic corruption. In order to contextualise the impact of corruption on development, a comparative analysis of outstanding development characteristics of developing as opposed to developed countries of 16 internationally indices has been conducted.

Results

The next section provides a comparison of the outstanding characteristics that co-produce corruption in developing countries such as Namibia and Kenya compared to a developed country such as Norway. Norway was selected because it is ranked number one on the Human Development Index (2011) and the Democracy Index (2011). These indicators reflect perceptions about some of the key drivers of development, and corruption is a developmental challenge. Kenya, which is ranked 154th (out of 183 countries) and given a score of 2.2 out of 10 (with 10 being a perfect score) on the Corruption Perception Index of Transparency International (2011), was selected because it can be perceived as one of the more corrupt developing countries compared to Namibia, with its ranking of 120th (with a score of 4.4), as one of the less corrupt developing countries.

Economic

In developed countries such as Norway, the economy is innovation driven compared to developing countries, where it is factor driven, such as Kenya, or efficiency driven, such as Namibia. Namibian income distribution is highly skewed and there are high levels of inequality. Corruption is listed in Kenya and Namibia as one of the ‘most problematic factors’ for doing business. Keeping all other variables constant, excessive regulations and corruption co-produce delays in the number of days it takes to start a business in Namibia and Kenya compared to Norway.

Scientific/Knowledge/Technology

Considerable differences exist between expected and mean years of schooling in developed compared to developing countries. This has an effect on productivity, quality of labour and staff training. Combined gross enrolment in education is between 25 and 30 percent lower in the two developing countries than in Norway. Because of major differences in technological readiness between developed and developing countries, and limited collaboration between research institutions and industry, Kenya and Namibia are weak in terms of technological application.

Political

Political systems differ between developing countries compared to developed countries. For example, Norway is classified as a full democracy, Namibia a flawed democracy and Kenya a hybrid between a democracy and an authoritarian regime. The electoral process and voting are rated substantially higher in Norway compared to the two developing countries. In Norway and Namibia, there is a high level of public trust in politicians. The implication is that there is no substantial demand from voters in Namibia for politicians to reform public sector systems.

Ethical/Moral/Spirituality

Civil society in developing countries, such as Kenya and Namibia, is less inclined to express their opinion to public officials; and government policy making is less transparent compared to developed
countries such as Norway. What is morally acceptable is determined by the political group in power, which often represents only one, or the biggest, ethnic group. The prevalence of activities of organised criminal groups and police services that are less reliable than those in developed countries increase the probability that developing countries, for example Kenya, are less able to maintain law and order.

Aesthetic/Inspirational

Fewer years of schooling and a lower quality of education and staff training in developing countries, such as Namibia and Kenya, partially explain the lower capacity for innovation and utility of patents granted compared to developed countries such as Norway. There is a big difference in life expectancy at birth, under-five mortality and maternal mortality rate between Norway compared to Kenya and Namibia. The proportion of urban populations that live in slum areas and the annual growth rate of slums are substantially higher in Kenya than in Namibia. Slums are not an issue in Norway. More than half of urban Kenyans live in slums.

Conclusion

From analysing the 16 indices, patterns emerge that demonstrate that developing countries such as Namibia and Kenya, with a relatively low score in terms of development indicators, present more obstructions to development that act as co-producers of corruption compared to a developed country such as Norway, which has fewer such obstructions. These co-producers and their interaction increase the level and complexity of corruption as well as magnify its impact on development.

References

Meaningful work and secondary school teachers’ intention to leave

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Purpose

Quality education is regarded as a powerful tool in ensuring the economic, democratic and social development of nations (Kubberud, Helland & Smith, 1999). Substantial evidence exists showing that a significant number of teachers worldwide struggle with high levels of distress and burnout (Jackson, Rothmann & Vande Vijver, 2006). According to NANTU, approximately 2,000 teachers in Namibia leave the profession annually owing to high job demands, negative job conditions and the few incentives on offer designed to retain qualified teachers, whilst local colleges and universities can produce only 1,200 replacements per year (Mseyamwa, 2007). Kandetu (1998) asserts that Namibian secondary school teachers are resigning at such an alarming rate that this threatens to paralyse secondary schools in the country. National budgetary constraints prohibit lucrative external resources for teachers. If incentives in the form of external resources are not generous and readily available to teachers, it is crucial to focus on intrinsic resources to motivate and retain them. Meaningfulness of work was identified as a protective psychological condition (Matuska & Christiansen, 2008), which might be associated with talent retention (Swart & Rothmann, 2012). Steger, Littman-Ovadia, Miller, Menger and Rothmann (2013) found that psychological meaningfulness promotes work engagement even when employees experience high levels of negative affect. Wolhuter, Van der Walt, Potgieter, Meyer and Mamiala (2012) have indicated that the student teachers they studied were inspired by meaningful experiences. Psychological meaningfulness is not simply an effect of some or other specific working condition of an individual, but a result of an individual’s spontaneous and continuous effort to find meaning irrespective of the conditions they endure (Isaksen, 2000). Organisations usually attempt to retain employees, as employee turnover can affect the organisation and employees negatively. Dess and Shaw (2001) point out that when an employee leaves an organisation, it could affect the performance of the organisation negatively due to the loss of organisational wisdom and expertise (Glebbeek & Bax, 2004). Retention of teachers in secondary schools requires knowledge of the factors contributing to experiences of meaningfulness at work. The following hypotheses were set for this study:

H1: Work-role fit, job enrichment, co-worker relationships and supervisor relationships are positively related to psychological meaningfulness of a teachers’ work.

H2: Work-role fit, job enrichment, co-worker relationships and, supervisor relationships are negatively related to teachers’ intention to leave.

H3: Meaningfulness of work is negatively related to teachers’ intention to leave.

H4: Work-role fit, job enrichment, co-worker relationships and supervisor relationships indirectly affect teachers’ intention to leave, by means of psychological meaningfulness.
Method

A quantitative and descriptive research approach was followed. A cross-sectional survey was used to gather data and analyse relations between variables (Creswell, 2009). Secondary school teachers of all the government and private schools of the Khomas, Otjozondjupa, Omaheke, Erongo, Hardap and Karas educational regions in Namibia were invited to participate in this research study on a voluntary basis, forming the target population. A total of 2,332 secondary school teachers are employed in these regions. At the commencement of the research, 969 teachers were employed at the schools that agreed to participate in the study. Of these teachers, 502 participated in a convenience sample, and participants were selected on the basis of availability and willingness to participate (Gravetter & Forzano, 2006). The sample included teachers as well as members of school management, such as heads of department and principals. The Work-role Fit Scale, the Job Diagnostic Survey (Hackman & Oldham, 1975), the Co-worker Relationships Scale, the Supervisor Relationships Scale, the Psychological Meaningfulness Scale (Spreitzer, 1995) and the Turnover Intention Scale have been utilised in this study to collect data on teacher phenomena. The data analysis was carried out by means of Mplus version 7.3 (Muthén & Muthén, 1998-2012).

Results

Table 1 shows that the reliabilities of the constructs were acceptable when compared to the guideline of 0.70 (Wang & Wang, 2012). Statistically significant ($p < 0.01$) relations exist between all the variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
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<th>4</th>
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<tbody>
<tr>
<td>1 Work-role fit</td>
<td>0.90</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2 Job enrichment</td>
<td>0.74</td>
<td>0.67***</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>3 Supervisor relationships</td>
<td>0.95</td>
<td>0.44***</td>
<td>0.62***</td>
<td>-</td>
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<tr>
<td>4 Co-worker relationships</td>
<td>0.95</td>
<td>0.42***</td>
<td>0.50***</td>
<td>0.65***</td>
<td>-</td>
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<tr>
<td>5 Psychological meaningfulness</td>
<td>0.94</td>
<td>0.68***</td>
<td>0.65***</td>
<td>0.42***</td>
<td>0.41***</td>
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<tr>
<td>6 Intention to leave</td>
<td>0.76</td>
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**p < 0.01

Table 1 Reliabilities and Correlations of the Scales

Work-role fit and job enrichment were positively associated with psychological meaningfulness. Psychological meaningfulness is significantly related, statistically, to work-role fit, job enrichment, supervisor relations, and co-worker relations. Hypothesis 1 is thereby supported. Furthermore, the path coefficients of work-role fit and psychological meaningfulness were statistically significant and had the expected signs. Work-role fit and psychological meaningfulness were negatively associated with intention to leave. Hypothesis 2 is partially supported. Psychological meaningfulness was strongly associated with intention to leave. Work-role fit, job enrichment, supervisor relations, and co-worker relations were statistically significantly and negatively related to intention to leave. Hypotheses 2 and 3 are supported.

Regarding the indirect effects of work-role fit and job enrichment on teachers’ intention to leave, the 95% CIs for psychological meaningfulness did not include zero. Hypothesis 4 is partially supported, namely that work-role fit and job enrichment impact intention to leave via psychological meaningfulness. None of the other indirect effects were significant.
Conclusion

It is firstly concluded from this study of secondary school teachers in Namibia that psychological meaningfulness of work can be associated with teachers’ intentions to leave their jobs and organisations. Secondly, although work-role fit, job enrichment, and supervisor and co-worker relations are strongly associated with psychological meaningfulness of teachers’ work, two factors, namely work-role fit and job enrichment, were statistically significant predictors. Lastly, work-role fit and job enrichment made significant contributions to teachers’ intention to leave their jobs, as well as to leave the organisation that employs them.

References

WHY MEN UNDERTAKE “PASSION KILLINGS” IN THE NAMIBIAN CONTEXT

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Purpose

“What kind of a society am I leading? We continue to lose innocent lives, especially those of women and girls as a result of gender-based violence, perpetrated mostly by men. We are destroying the good name of our country,” (His Excellency Hifikepunye Pohamba, 2014, p.1, cited in Kangootui, 2014). In Namibia, a total of at least 72 murders of women by their male intimate partners were reported between January 2012 and June 2014 (Shaanika, 2012; Sibolile, 2014). Therefore, it is this high incidence that prompted the exploration of the reasons why men kill their female intimate partners in Namibia. Furthermore, research findings reveal that females are six times more likely to be victims of this crime as compared to males (Stöckl et al, 2013). Hence, the peppering of incidence of women committing this crime against men do it in self-defence-to counter the abuse perpetrated by their male partners (Serran & Firestone, 2004).

Method

A semi-structured interview was conducted with ten offenders who have been convicted and sentenced for the murder of their female intimate partners.

Results

Findings concurred with previous research stating that the intertwined influence of patriarchal system in our cultural beliefs and attitudes, external influences such as substance abuse, as well as a lack of emotional control and problem-solving skills, affects Intimate Partner Homicide (IPH).

Conclusion

These findings place emphasis on how empowering young men and perpetrators with emotional control and problem-solving skills (Porporino, 2010) may subsequently reduce the rate of committing IPH or repeating them. Furthermore, because it appears that IPH is influenced by the interaction of biological, environmental and psychological factors, reducing and/or preventing cases of IPH, should be a holistic approach that must tackle these factors from three different levels; at the primary, secondary and tertiary level.
References


AN EVALUATION OF INFORMAL FOOD VENDING AND FOOD INSECURITY IN WINDHOEK, NAMIBIA

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Purpose
Informal food markets are on the increase in urban and peri-urban settings of Namibia. These vending activities can be considered as an income generating strategy to ensure food security under challenging economic conditions. Research on the viability and optimality of such innovations is still limited. This research focused on men, women involved in informal food vending Windhoek, Namibia in terms of their demographic characteristics (age, gender, marital status, level of education, head of household status), food market characteristics (customer base, competition, income, sources and types of food items, food gathering patterns, vending space), and the challenges they face on a day to day basis. The study findings will be used to guide policy on food markets, and food security for sustainable livelihoods in Namibia and Southern Africa in general.

Method
This study was based on a stratified random sample of 43 street vendors in various parts of the City of Windhoek namely Wernhill Park under the bridge, Single Quarters, Soweto Market, Herero Mall, and Okryangava. The demographic and vending profiles and characteristics of the street vendors were summarized by means of descriptive statistics in form of measures of centrality, dispersion, charts and cross-tabulations.

Results
Results indicated that the age of the street vendors ranged from 15 to 55 years of age with a mean of 32 years and a standard deviation of 10 years giving a 95% confidence interval of 28.66 to 35.53 years. The histogram for the age distribution is given in Figure 1.
Figure 1: Histogram of the age distribution of street vendors

Most of the street vendors were female (67.4%). The vendors either operated mobile (35.7%), stationary stalls (61.9%), or both (2.4%). The distribution of vendors by marital status was single (76.7%), married (14%), Living together (4.7%), divorced (2.3%) and widowed (2.3%). In terms of their highest educational level, those with primary or no formal education were 38.1% while those with secondary or higher education were 61.9% as indicated in Figure 2. The vendors mostly came from female headed households (52.4%).

Figure 2: Highest Educational Level of Street Vendors
The types of food sold by the vendors included apples, onions, potatoes and eggs, Ongudo, ongundu, and sorghum flour; Traditional foods (flour, beans, nuts, vegetables and berries, pears, bananas; Porridge, meat and juice, breads, doughnuts and fat-cakes, oshiwalmo fried chicken; Dry grapes and caterpillar; Tomatoes, green pepper, oranges and cabbage, fish, chillies, flour for oshikundu, oshikunde; Kapana; Macaroni, soup and sounges, salads, soft drinks, sweets. Sources of the food items sold included China town, buying cattle from farms for meat, from Ondingwa, from shops such as Namika, Stop and shop, cultivation in Kavango and Rundu, personally cooking the food, from Ovamboland and Rundu (beans) and caterpillars from Tanzania-Tanganyika and Zambia, from Oshikango,

Daily incomes of the street vendors ranged from N$5 to N$6000. With an average income of N$647.93 and a standard deviation of N$1247.25. The 95% confidence interval of N$254.25 to N$1041.61.

Challenges cited by the vendors included Cattle being very expensive to buy for meat, the need to work harder to get some money, lots of competition, Small space for operating, saloons around and fears that hair will get into food, Robberies, If it rains they are just forced to pack and go home there will be no shelter, few customers, Sometimes products are not finished up and they get stale, and Need to protect food from dust and the sun.

Conclusion

Informal food markets are providing a source of livelihood for those unemployed in Windhoek and has a lot of potential if managed properly. There are safety and health risks involved which policy makers could look into.

References.

NAMIBIA-THE LIBERATION STRUGGLE REVISITED-THE UN AND RELEVANT PARTIES INVOLVEMENT.

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Purpose
The purpose of this venture is to eventually inform the public and the wider audience as to all the stakeholders in Namibian Liberation Struggle from the world “go”.

Method
The message is to get across in small doses via platforms such as those provided by NCRST.

Results
This will result in a subsequent change of mindset for the better. This will lead to tolerance among people and Namibians in particular.

Conclusion
In conclusion, one can't think of no other way of doing justice to the heading other than the accomplishments of the two siblings, namely, Frans and Joseph and their comrades in employment and social activities. Interesting, though, Both Uncle France and his Brother Joseph, passed on, and lay down in unmarked graves! God knows till when! Does that have anything to do with the Maharero and Kahimemua legacies?

REFERENCES

1. U.N. Charter, Chapter vi, Article 33 On Pacific Settlement of Disputes
Body of Extended Abstract

Introduction

When having such topics at hand, its practically impossible to overlook such places such as Otjihajavara (Okapuka Lodge), Hofnung (Heja Lodge), Groot Aub, to mention, a few. Not to overlook the capital all other towns, such as Walvis and Swakop, Usakos, Omaruru, Karibib, Okahandja, Tsumeb, Gobabis, Karibib, Rehoboth, Luderitz etc.

Otjihajavara was the was possibly the most prominent of the lot, for the sake of our discussion simply due to the fact that it was the de facto head quarters, maned by the popular Uncle Frans. His brother, Joseph was the foreman at Hofnung. His wife, Victorines, Uncle Frederick, was headman at Okondjatu, of the then Omaheke, currently, Otjozondjupa region. The same goes for his brother’s wife, Orpa, who was related to the Chief of Otjimbingue. Subsequently, Joseph divorced his Otjiherero speaking voice and took a Nama speaking wife by the name of Theresia. Joseph jr, Uncle Frans’ son who was adopted by his brother, Joseph, was still with them.

U.N. Charter, Chapter vi, Article 33 On Pacific Settlement of Disputes. [1]

(1) The parties to any disputes, the continence of which is likely to endanger maintenance of international peace and security, shall' first of all, seek solution, seek solution by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or otherful means of their own choice.

(2) The Security Council shall when it deems necessary, call upon the parties to settle their by such means.

Regional arrangements, article 52 of the U.N Charter VIII

Nothing in the present Charter precludes the existence of regional arrangements or agencies for dealing with such matters relating to the maintenance of international peace and security as appropriate for regional action, provided that such arrangements or agencies and their activities are consistent with the purpose and purpose and principles of the UN.

The pioneers of the second phase of the liberation struggle.

The Namibian struggle for independence can be divided in two faces. The first being the 1904, War of Genocide, which depicted the Germans against the Ovaherero and Namas. The result was that 80% of Ovaherero and 60% Namas lost their lives. Those who were lucky to survive the German guns, scattered over and out of the country. Countries being, the than Bechuanaland, Angola and South Africa. King Maharero who fled to Bechuanaland, ended up in South Africa where he ended up running a farm at Waterberg. Uncle Frans, who was conscripted during WWII ended up being in South Africa hence what befall King Maharero in South Africa touched him greatly. Hence his decision to try and rectify if at all and to highlight what need to be highlighted. Hence his application for the position the position of the farm employee. He subsequently ended up not only being a farm foreman, but also a manager.

His stepfather, Martin who hailed from Omaruru, was a railway employee stationed at Otjihavara but at the railway station not the farm. He however, traveled via the width and breadth of Namibia. Hence, he was conversant in Nama, Oshiwambo and Tsetsuana. At Otjihavara he fell for Uncle Frans mother, Louis and married her. They subsequently ended up manning one of the Outposts. To realise his wish of rectifying the Maharero name, he (Uncle Frans) recruited August, who happened to have been a member of the Tjamuaha Royal House. This is also true of Mr Katuamba. All had
His stepfather, Martin who hailed from Omaruru, was a railway employee stationed at Otjihavara but at the railway station not the farm. He however, traveled via the width and breadth of Namibia. Hence, he was conversant in Nama, Oshiwambo and Tsetsuana. At Otjihavara he fell for Uncle Frans mother, Louis and married her. They subsequently ended up manning one of the Outposts. To realise his wish of rectifying the Maharero name, he (Uncle Frans) recruited August, who happened to have been a member of the Tjamuaha Royal House. This is also true of Mr Katuamba. All had their families with them. The same goes for the Kamangoti s, Amgabeb s, Rooinasie s, Kapitango s, Hondjera s, Tjivikua s, Nyondui, Katapero (Tlabanello?) etc, etc. The latter was not necessarily along family lines but along nation building. To mention but a few.

Uncle Frans and Chief Kutako crew

Uncle France’s influence did not only end in Otjihavera but extended beyond the Windhoek Valley. Having been a former student of Dobra, a former soldier, a member a the Red Flag, a member of Otjeue Peer Group, a member of the Roman Catholic Church and also having been a gifted charismatic person, backed by his position of being a farm manager all these assisted him in making friends easily along the way. These friends were like Johannes, Christoph, David, Mathias, to mention but a few. These extended to elders like Willy, Eugen, Stephanus, Fritz ect. ect. These are not just some bodies, but the cream of the crop! Some of these were among Chief Hosea’s right hand man. Not to mention business people who were traveling along The Windhoek Valley such as Oscar and Hanneman.

Uncle Frans goes underground

During the mid to late 1950 to early 1960 s, Uncle Frans went underground, This was the result of the passing of away of the than employer of Uncle Frans. The employer’s son, Bobby and Joseph’s assistant, at Hofnung, Johannes, took over the management of the farms. Uncle Frans, went for a brief farm management stint at Omitara area with some of his ex employees, some remain in the Hofnung area. Uncle Frans, subsequently returned to the Windhoek Valley and the City of Lights, Windhoek.

All this coincided with the formation of political parties, exodus into exile, and the Old Location Massacre!
Purpose

The purpose of this research is to begin to impact the quality and effectiveness of basic service delivery (e.g. energy, housing and water) in Namibia by starting a national conversation about customer service and the importance thereof. In Namibia it is widely accepted that delivery of basic services to the wider population is problematic, evidence by regular complaints in the media, the recent land protest activities by the Affirmative Repositioning movement and the millions of dollars returned to treasury each year that local authorities have failed to spend on service delivery. Yet it is very unlikely that effective service delivery can exist in a climate where customer service is so poorly valued, as the one is inextricably bound to the other. The underlying proposition of this research is, if we can raise the quality of customer service in the society we are likely to have a positive impact on service delivery and therefore be a catalyst for social change.

Method

The HP-GSB initiated some customer research to measure service quality across a number of critical service sectors that impact the majority of households in Namibia.

The aims of the research were to:

1. Accurately measure service quality - this involved identifying best practice in measurement (Parasuman et al., 1985; 1988; Zeithaml et al., 1990; Whyte et al., 1996; Whyte and Wambui 2014) and create a baseline as no objective evidence on customer service in Namibia existed.

2. Provide a common measure or benchmark against which the performance of different services could be compared.

3. Provide a diagnostic capability through which service suppliers could be advised how to improve their services

4. Provide data on which conversations could be started and awards for service excellence made.

Business Intelligence Africa (BIA) an independent research company visited 1500 homes nationally and collected 7286 perceptions of customer service for the following service sectors: Supermarkets, Banks, Health Services, Municipal Services, Energy Services, Telecommunications, Home Affairs, Insurance Services, Post Office Services, Educations Services, Security Services and Transport Services.

Results

Results broadly fall into two groups (i) the identification and triggering of ‘conversation levers’. These levers helped facilitate the conversation and awareness of customer service and (ii) Theory building, from the research a new model of service quality is postulated called the Service Exchange Model.
Conversation levers - the following levers were the ones to emerge as a result of this research to help facilitate national conversation and social change:

The results of the survey, in aggregate and for the 12 sectors were reported widely in the press with individual articles featuring each of the service sectors Service Excellence Awards, rewarded the best performing company or branch in each service sector and the overall winner (Roman Catholic Hospital), this event was widely reported in the media Companies who rated in the survey were encouraged to acquire reports so they could learn where and how their service could be improved (15 companies acquired the report) Media activity, numerous reports and articles were published in hard and social media Master classes and training in customer service emerged as a result of the initiative and research The Customer Service Association of Namibia (CSAN) was also formed as a direct outcome of this research, having two main aims to promote (i) a Professionals forum for exchanging ideas and best practice and, (ii) a Research forum where companies can specify and fund areas of research to specifically assist their organisations. Theory building, the research led to the re-conceptualisation of service quality literature and the postulation of the Service Exchange Model to explain how the exchange between the service organisation, the service deliverable (product or service) and the service experience all contribute to create a unique service journey.

Conclusion

Has social change been achieved? Clearly, not yet. The author and team were clear from the outset that this would be a long term project perhaps spanning at least five years. To this end, data from a second survey has already been collected and is being analysed. Social change beginning to happen? The evidence of media activity by NaMedia suggests there has been an increase in media discussion on customer service since our efforts began. Initial evidence also suggests that our work with conversation levers is bearing some fruit whether in the long-run we will be successful, only time will tell.

References

The Use of Social Media as a Public Participation Strategy in the Public Service of Namibia

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Purpose

The growing interest in social media is largely a result of increased discontent from the public with regard to service delivery and the new digital channels which have created new platforms for views to be shared widely. This growing interest may mean that the use of social media also implies that no one, from ordinary citizens to politicians, is immune to its mobilisation power and its power to expose.

The current use of social media as a strategy to empower citizens and to give them voice with regard to the delivery of government services, policies and programmes in Namibia has not yet been studied extensively. Most related studies about service delivery improvement and public participation focus on systemic challenges in the E-government and E-governance context (Van Staden & Mbale, 2012; Van Staden, 2011), confirm poor and ineffective public participation at community level (Nampila, 2005) and conclude that there are low democratic participation levels in the formulation of policies (Marthinussen, 2013).

Given the speed at which people have embraced the use of social media worldwide, the study provided a suitable opportunity to ask how social media may be used as a strategy to facilitate public participation in government service delivery and in particular in the public service of Namibia.

The objectives of the study were two-fold:

- To examine legislation and policies, which relate to social media in Namibia and the extent to which they address public participation.
- To examine the readiness of the Namibian government to use social media as a means of public participation.

Method

The population of the study was the Public Service of Namibia. In particular, staff working as public liaison officers or in the information communication and technology (ICT) directorates were interviewed. In order to arrive at describing the units of analysis, a purposive sampling approach was used to select participants.

While all 27 O/M/As made up the sampling frame and would have been included initially, only O/M/As found to accommodate and to illustrate a readiness to implement social media were purposefully selected for inclusion in the study.
These were the Office of the Prime Minister as taking the lead in implementing the e-governance strategy, and the Ministry of Information and Communication Technology, as the driver and custodian of the e-governance policy. Respondents were chosen from these government institutions because both institutions have been at the forefront of digital and information communication technology progress in government.

Data collection Instruments and Approach

With regard to the data collection approach employed in this study, namely the use of multiple methods or triangulation which guides the current study is highlighted by Babbie and Mouton (2001:282-283). The authors emphasise the need for triangulation or the use of multiple sources of evidence in order to achieve replication and convergence for the findings to be reliable. In using the emic or insider approach of studying a phenomenon, the use of multiple systems, perspectives and sources of evidence achieves replication as it increases the chances that a finding is reliable. The study comprised two data collection approaches: an analysis of documents (which included website reviews) and the use of interviews which is explained in the next section.

Results

An analysis of the research findings illustrate that overall the official Namibian government portal is still dominated by content and as an information source. In this regard, now in the early stages of e-government implementation, there are limited services available with no options of using social media to fully participate and collaborate with the government.

An equally important part of the findings is that in terms of e-government, there is a strong potential to use social media as a strategy for public participation in empowering the public to fully participate in policymaking. However, the study found that there were a number of associated challenges which include, firstly, that policymakers have not yet taken advantage of the opportunities this brings. Secondly, despite the sound policy and legal framework supporting broad public participation efforts, the bureaucratic manner in which government is structured and how general communication is managed in government do not allow for the responsiveness and the feedback that a social and digital media environment may bring.

Similarly, the study also revealed the absence of a social media policy which is aligned to the strategic and e-government framework. Given the rights to freedom of expression, this, nevertheless, has implications for how social media is used or in some cases misused by politicians, political parties and interest groups to advance their individual agendas.

Conclusion

Recommendations for Policymakers

To begin with, a policy for the use of social media which outlines its use and outlines the risks and aspects pertaining to security, updating, maintenance and interaction with the public is recommended. In particular, the manner in which feedback is managed through social media and digital channels should be addressed. With a multitude of issues on various levels, content, language, ease of use and translation issues should be addressed. Hence, in crafting the social media policy, a multi-stakeholder approach ensures that the only drivers of the policy formulation phases are not within the sole control of the technocrats and ICT experts.

Secondly, the Namibian government web portal and, particularly, the individual websites of Offices, Ministries and Agencies, as part of the e-government strategy, should consider incorporating social media applications and strategies which not only provide information, but also promote additional means of interacting and collaborating with the public they serve. In addition to the introduction of these applications, the government should consider intensifying its efforts at redirecting users to
government websites which should be updated regularly and should be less content driven and more service orientated.

Thirdly, the manner in which government builds and sustains relationships and networks to foster trust deserves attention. The introduction of other forms of engaging the public through the use of other digital and social media channels such as short messaging service (SMS), WhatsApp, Google Chat, Hangouts, Mxit, Microsoft Instant Messenger (IM), Facebook, Twitter and Skype were considered for these purpose.

Fourthly, in terms of the poor levels of public participation, the introduction of publicity and raising awareness through the use of social and digital media should feature prominently as a precursor to the provision of information so that the public are given a holistic picture and in the process develop and enhance the relationship between the various stakeholders and government. The integration of services to speak to individual user requirements as a benefit of an integrated “i-government” outcome speaks to the requirement of fostering relationships and building confidence in the government.

Finally, the existing mind-set towards the use of social media and the cultural as well as organisational barriers with regard to its use need to be addressed. Hence, there is a need for the Namibian Institute of Public Administration and Management (NIPAM) to introduce and present courses on the principles of public participation and strategies. Other training in this vein could also focus on the usefulness of social and digital media for improved service delivery and governance and building competencies. This is also useful in addressing issues pertaining to the digital divide; where in addition to having access to information, politicians, the public and interest groups need to be educated and made aware of the potential of social media to increase transparency and to nurture a culture of accountability.

Consequently, these five key recommendations for policymakers which may require extensive stakeholder consultation are based on both the theory and practical experiences of the respondents that were interviewed.

In conclusion, in adopting a futuristic outlook with regard to the use of social media and the ICT environment for public participation, political scientist Farrell (2012:47) predicts that the dynamics and interplay of the relationships between politics and the internet will be “both ubiquitous and invisible” in time, as it becomes normative to study political science, ICT, media and governance holistically.

References.


Why should commercial organisations incorporate indigenous knowledge into the commercialization of local products?

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Purpose
To highlight the importance of incorporating indigenous knowledge into the commercialisation of local products

Method
Fishbein’s theory formed the basis for the construction of the attitude scales used to measure the strengths of the beliefs held about Meme Mahangu flour and traditionally fermented mahangu flour respectively. The scales were also used to measure the evaluation of the beliefs held. Branching logic was deployed to ensure that respondents familiar with both Meme Mahangu and traditionally fermented mahangu were selected. Data were collected from mahangu consumers hailing from the primary mahangu growing and consuming regions in Namibia. The actual data recording happened through face-to-face interactive electronic interviews administered using an iPad. A 10-point scale was used to measure the strength of beliefs about Meme Mahangu and traditionally fermented mahangu and a five-point scale was used to evaluate the beliefs held about the two flours respectively. Data processing was performed by SPSS for Windows 22.0. Fishbein’s multi-attribute model was used to determine the overall attitude toward Meme Mahangu and traditionally fermented mahangu respectively.

Results
The negative evaluation of the attributes associated with Meme Mahangu show that respondents dislike attributes associated with non-fermented mahangu flour. The respondents also have a very strong believe that Meme Mahangu flour possess the attributes associated with non-fermented mahangu flour. The overall attitude towards Meme Mahangu is negative.
Conclusion

This research confirms the importance of incorporating indigenous knowledge into the commercialisation of traditional products. If commercial organisations omit indigenous knowledge from their commercialisation strategy the uptake of the traditional product by target market will be below par.

References


A critical assessment of the National Language Policy in promoting the use of indigenous Namibian languages in governance.

C. Harris

Ph.D. Candidate at the University of Namibia

Introduction

The main purpose of this paper is to investigate the viability of using indigenous Namibian languages in all aspects of governance in the country. Like elsewhere in Africa, African languages have been largely marginalised by respective continental governments in favour of former colonial languages. In the case of Namibia, the then liberation movement SWAPO, regarded it as necessary to choose one and only official language for a future independent Namibia. The choice of language thus became an important tool in the struggle for independence. In order to achieve unity and other associated goals in the country, English was thus chosen to this effect. English, French, Portuguese and to an extent Spanish are far and large the dominant languages of governance in the whole of Africa despite being used by small percentages of people in their day to day interactions.

1. Research Methodology

1.1 Research Design

In conducting this research, two research methods were employed, namely qualitative research and quantitative research. However, qualitative research method was utilised more than quantitative research methods in a study because it offers more advantages than the latter.

1.2 Population of this study

The target population for this study was mainly Namibians from all walks of life, as well as some several senior and low level government officials and politicians.

1.3 Sampling method

Purposive Sampling was employed in this study. The sample of the population mentioned are mostly Namibians from the main 8 linguistic groups of the country and several senior government officials and politicians.

1.4 Methods of data collection

(a) Interviews

Face to face interviews were conducted in this regard to selected interviewees from government officials, politicians and Namibians from all walks of life.
1.5 Procedures

Selected members from different language groups were interviewed on why they think it is important for the Government to utilize indigenous African languages in all aspects of governance and whether the current National Language Policy should be revised to ensure that more is done to promote and protect the nation’s languages. The researcher interviewed eight (8) Chiefs and/or senior traditional authority members of the said communities.

Results

• After this research was completed, it was discovered that a significant percentage of Namibians are not well versed in the official language English. Despite this state of affairs, the majority of citizens still prefer to have English remain as the official language of the state. English is still widely seen as a language of prestige and social mobility. Good command of the English language opens many economic opportunities for most people.

• There is a lack of political will on the part of the Namibian government to promote and protect all indigenous languages.

• There is growing interest in academia and the general public to promote and protect Namibia’s indigenous languages.

• There is still confusion with regard to the viability of the National Language Policy that the country adopted immediately after independence. There have been calls from some segments of society to promulgate a specific law for language protection and promotion.

Conclusion

Despite evidence that the “English only” language policy adopted by Namibia upon independence is far and large not viable in tackling some of Namibia’s pressing issues. The government seems to have no plans to rectify the challenges associated with the “English only” language policy in the country. The National Language Policy is largely dormant and rarely consulted upon whenever issues of language rights come to the fore in Namibia. The need for a constitutional amendment to recognize all of Namibia’s indigenous languages as co-official with English is encouraged and supported by academics and also some members of the public and such the government should heed this call and regard it as amongst its national priority.

References

Co-designing Indigenous Knowledge Management Systems with Namibian Rural Communities

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Purpose

The digitalization of indigenous knowledge has been considered to be a viable solution to preserve indigenous cultural heritages. However the epistemological differences between indigenous knowledge systems and the mainstream knowledge systems embedded in technologies need to be accounted for within the design of indigenous knowledge management systems. A promising approach has been community-based co-design with indigenous communities to promote local value propagation in the newly created technologies. We have been engaged with various rural communities in Namibia co-designing technologies for the purpose of indigenous knowledge collection, representation and transfer across generations. However software artefacts developed for one specific rural community with its traditional customs cannot be simply rolled out to other rural communities without certain adaptations. Every rural community with its own unique traditional customs setup requires a different digital representation in order to preserve its uniqueness. Having developed 3D graphical representation tools with one pilot community in the Omaheke region we are currently exploring crowdsourcing as a sustainable mechanism to replicate and adapt the technology to other indigenous rural contexts in Namibia. Crowdsourcing approach has been chosen as a way to overcome expensive technology adaptation from one rural community to the next. This novel and unique approach aims at supporting rural communities to crowdsource specific requests, in this case 3D models to the global crowd. Yet co-developing technologies that can bridge the communication gap between rural communities and the outside world present us with specific challenges, such as language and literacy, technology access, usability and skills. Having simulated a full crowdsourcing cycle with one OvaHimba community has pointed as at specific points for further investigation. Firstly we need to ensure that the task requests and feedbacks from the rural community are formulated in a way that is comprehensible to the crowd on the www. In this paper we present the methods and current findings of our community- based co-design endeavour of the crowdsourcing tool.

Method

The research approach that is undertaken for this study is action research (AR). The core objective of AR is to create new knowledge by searching solutions or improvements to “real-life” practical problem situations [2], [4]. The nature of this study is unpredictable and involves complex human social aspects that cannot be studied based on a predefined hypothesis testing as in natural science thus AR approach is applicable. Any AR research is composed of these elements: framework of ideas and concepts, a way of applying the ideas, and an area of interest to apply the ideas [3]. AR elements will be incorporated into this study as follows:

– Crowdsourcing, task formulation, and 3D model evaluation as a framework of ideas and concepts
– Community-Based Co-Design [1], [6] as a way of applying ideas
– Preserving IK in rural communities as the area of interest

In AR, research interests are defined into themes after the researcher have declared the ideas and ways on how to apply them. AR is an iterative cyclic continuous process. Themes are broader set of questions, puzzles, and topics that motivate the researcher [3]. The current themes for this study are therefore defined as follows:

• How can rural communities formulate their 3D model task requests so that it is clear enough to be understood by the outside crowd?
• How can rural communities effectively evaluate the delivered 3D models?

Three crowdsourcing concept actualisation co-design workshops were held with the identified rural communities. The three pilot study communities are the OvaHerero community from Erindi Roukambe village in Omaheke region, OvaHerero community from Okomakuara village situated in the eastern part of Namibia, and an OvaHimba community from Opuwo. The purpose of these workshops was to identify a distinct process of how members of the rural communities may carry out the crowdsourcing activities on their own.

Results
As an outcome from the crowdsourcing conceptualisation workshops carried out a suitable community crowdsourcing platform (CCSP) was proposed by Stanley et al [5]. Although CCSP platform will initially be experimented with rural communities’ crowdsourcing request for 3D models, the overall goal is for the platform to be generic for rural communities to crowdsource any software artefact of their needs. CCSP should have two front-ends, a web based and a mobile tablet front-end. The web based front-end will be used by the contributors for viewing, downloading and uploading requests. The mobile tablet front-end will be used by the rural communities for task formulation and downloading the delivered 3D models.

Conclusion
Crowdsourcing conceptualisation of taking images to be used as a thumbnail for the task request management process was carried out well as the elders from rural communities knew exactly what they wanted to be taken and could fairly well compare the delivered 3D models with the images taken earlier.
References


A path towards industrial milling of pearl millet (mahangu) grain into flour with “traditional-tasting” qualities

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Purpose

Fermented pearl millet flour porridge is a popular staple food for more than 50% of the population in Namibia [1]. Most of the consumers prefer an acquired unique taste, colour and smell. However, industrial millers in Namibia do not produce this type of flour [2]. This is a result of complex and diverse grain processing steps and techniques at household level, which poses a challenge to replicate the household processing techniques in commercial milling operations.

Traditionally, pearl millet grain is subjected to various fermentation regimes and then milled into flour which apparently confers the perceived typical “traditional taste”. At the same time, there is almost no consistency in the quality of flour produced between households using apparently the same traditionally processing on the same grain. Like at household levels, SMEs which incorporate a fermentation step in their manufacturing of pearl millet flour do not have standardized and/or controlled fermentation conditions. This results in the production of flours that have inconsistent sensory qualities. This study aims to isolate and investigate the effect of eendjeke fermenting microorganisms to improve and optimise the consistency of the “traditional taste”. Eendjeke is a by-product of fermented pearl millet consisting of remnants of shredded pearl millet grains and are used by traditional households as a starter culture to speed up the fermentation process and to improve the flavour of mahangu flour.

Methods

The fermenting microorganisms were isolated from eendjeke. Four of these were used to determine conditions temperature-moisture-time combinations for optimisation of the fermentation conditions. The four isolated microorganisms were used because they showed pH and total acidity values comparable to those found in pearl millet flour that is traditionally processed and is in the market. The fermented grains were milled using a hammer mill with an opening screen sieve of 0.8 mm. Proximate analysis and in vitro starch digestibility still pending, will be tested as described in Annor [3].

Results

This study, due to intellectual property issues will only present selected results on the fermentation conditions (fermentation microorganisms, moisture, temperature and fermentation period) of four isolated microorganism from which an optimally and consistent fermented pearl millet flour was obtained. The consumer preference scores between samples will also be presented.
Conclusions
This study is a step closer to the characterisation of an optimal starter culture that is safe and effective in giving the flour “the traditional taste” and to the potential economical use of this starter culture in a commercial process flow.

References
Literature indicates that literacy benefits people if it is linked to their indigenous knowledge systems and ways of knowing (Papen, 2005). Studies conducted internationally on literacy, health and indigenous knowledge reveal that active participation in the development of society by the indigenous communities occurs when there is the transition from oral literacy traditions to cultures that combine oral, visual and written literacy with regard to health (Papen, 2005). Studies conducted in Africa, have emphasised that indigenous knowledge systems offered the basis for problem solving strategies for local people especially for indigenous and poor communities, and particularly with regard to health (Ocholla & Onyancha, 2008).

The Ovahimba people of the Kunene region in North West Namibia are known to possess valuable and useful indigenous knowledge for health practices. However, with the increasing dependence on Western medicines and health practices, the use of these effective indigenous healing practices is decreasing, as is the transfer of knowledge and shared benefit to community and societal development. Furthermore, these health practices are not well documented and there has been little or no research done in Namibia as to how Ovahimba indigenous knowledge on health matters may be recaptured and used to develop literacy learning programmes. It is in this context that the researcher investigated whether incorporating the Ovahimba indigenous knowledge about health into literacy programmes will lead to both literacy acquisition.

Purpose

The study aimed to document oral, visual and written literacies on indigenous health issues practised by the Ovahimba people. The study further investigated how Ovahimba indigenous health knowledge may assist in the development of appropriate learning content and literacy programmes. In this way the study contributed to the design and content of literacy programmes with aim to advance the health of the Namibian people. The study employed a multiliteracies theoretical perspective to deepen the understanding about indigenous knowledge and literacy learning and the prospective for addressing health issues.

Method

The researcher made use of a qualitative approach with an ethnographic research design, in order to listen and learn the ways that participants represent and talk about their understanding of diseases, illnesses and health risks. The ethnographical design is particularly appropriate for exploring the complex and interrelated issues of indigenous literacies and health. A snowball sampling was used to select twelve participants, who were information-rich about indigenous knowledge on health issues. Two key informants were selected from each of the following categories: nurses, missionaries, healers, elders, chiefs and from the general population. During data collection the researcher lived for five (5) months among the Ovahimba communities in the Kunene region.

The structured and semi structured interview guides and observation methods were used to collect
data. After the data collection, the researcher made use of the ‘analytical induction’ method to analyse the and generated categories, themes and patterns and ideas from the data. The information obtained used to design guidelines which will support in the development of appropriate learning content for literacy programmes in Namibia.

Results

<table>
<thead>
<tr>
<th>Diseases/illnesses</th>
<th>Methods of treatments</th>
<th>method of preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach ache</td>
<td>Ondombe roots.</td>
<td>Roots should be crushed in hot or cold water and a person can drink the water three times daily</td>
</tr>
<tr>
<td></td>
<td>Omuhama’s root</td>
<td>The leaves can be chewed three times a day</td>
</tr>
<tr>
<td></td>
<td>Mopani s’ leaves’</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

The study’s findings revealed that the Ovahimba community used their health indigenous knowledge every day, as they relied on plants’ roots, leaves and branches as methods of treatments for different diseases and illnesses. However, what is very interesting about these findings is that, the Ovahimba community aspire their health indigenous knowledge to be documented for their future generation and for other communities. Hence, it’s really significant that as a nation we should support the Ovahimba community in making sure that their indigenous health knowledge are acknowledged.

References

Ethnobotanical study of medicinal plants in Omusati Region

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Purpose

The aim of this study is to document ethnobotanical knowledge for Omusati region, central northern Namibia, as a way to preserve cultural and biological diversity for future generations.

Method

Data Collection

Fieldwork was conducted in three of the ten constituencies of Omusati Region. Voucher specimens for plant specimens that could not be identified were prepared and lodged at the National Herbarium of Namibia. Informal interviews and questionnaires were used as data gathering instruments for the ethnobotanical surveys.

Data Analysis

Data were analyzed by applying the following quantitative ethnobotanical methods: Informant consensus factor (FIC) and Fidelity level (FL). The informant consensus factor (FIC) was calculated according to Heinrich et al. (1998). A low FIC value (close to 0) indicates that plants are chosen randomly, or that informants do not exchange information about their use. Conversely, high values (close to 1) are obtained when a well-defined selection criterion is applied by the community and/or if information is exchanged between informants. The FIC was calculated as follows:

FIC = Nur-Nt/Nur-1; Where: Nur is the number of use reports in each use category; Nt is the number of taxa used (Nt) to treat an ailment/condition.

The Fidelity Level (FL) of each plant species was calculated based on use reports which have been cited by ten or more informants for being used against a given ailment (to determine culturally important medicinal species) and obtained from the formula FL (%) = (Np/N) x 100; where Np = number of informants claiming a use of a plant to treat a particular ailment; N= number of informants that use the plant to treat any given disease (Alexiades, 1996).

All use reports were placed into one of 10 categories: cold and cough; eye infections, malaria fever, cuts and wounds, diarrhoea, ear infections, gastric pain, allergy, stomach worms and chicken pox.

Results

In this present study, 54 medicinal plant species that belong to 28 families were documented comprising 25 tree species and 29 herbaceous species. FIC and FL values are presented in Tables 1 and 2 respectively.
Table 1. Category of use and informant consensus factor (FIC) for each category

<table>
<thead>
<tr>
<th>Use category</th>
<th>Number of taxa (Nt)</th>
<th>Number of use reports (Nur)</th>
<th>Consensus Factor (FIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough &amp; cold</td>
<td>19</td>
<td>31</td>
<td>0.4</td>
</tr>
<tr>
<td>Eye infections</td>
<td>8</td>
<td>21</td>
<td>0.65</td>
</tr>
<tr>
<td>Malaria fever</td>
<td>2</td>
<td>6</td>
<td>0.8</td>
</tr>
<tr>
<td>Cuts &amp; wounds</td>
<td>7</td>
<td>9</td>
<td>0.25</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>4</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>Ear infections</td>
<td>5</td>
<td>8</td>
<td>0.43</td>
</tr>
<tr>
<td>Gastric pain</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Allergy</td>
<td>2</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>Stomach worms</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2. Most frequently used plants for different ailments based on highest FL (%) in each use category (Total informants = 31)

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Use category</th>
<th>Citation for particular disease (use report)</th>
<th>Fidelity Level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sclerocarya birrea (A.Rich.) Hochst. subsp. caffra (Sond.) Kokwaro</td>
<td>Cough and cold</td>
<td>13</td>
<td>77</td>
</tr>
<tr>
<td>Aloe littoralis Baker</td>
<td>Eye infections</td>
<td>18</td>
<td>56</td>
</tr>
<tr>
<td>Acrotome inflata Benth.</td>
<td>Mosquito repellent</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Pechuel-Loeschea leubnitziae (Kuntze) O.Hoffm.</td>
<td>Cough and Flu</td>
<td>17</td>
<td>41</td>
</tr>
<tr>
<td>Pennisetum glaucum (L.) R.Br.</td>
<td>Diarrhoea</td>
<td>10</td>
<td>60</td>
</tr>
</tbody>
</table>

Conclusion

Traditional knowledge in Omusati region is largely specialized, and not shared or common to all the inhabitants of the region. The highest Fidelity Level values were obtained for Acrotome inflata, Sclerocarya birrea, Pennisetum glaucum and Aloe littoralis. Further studies are needed to evaluate these medicinal plants for antimicrobial priorities and to characterize the bioactive compounds.

References

Perceptions and experiences of beneficiaries of indigenous healing practices in Kaliyangile District of the Zambezi Region, Namibia

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Purpose
This paper is based on the study that was conducted in early 2014 in Kaliyangile District of the Zambezi Region in Namibia. The aim of the study was to investigate the experiences and perceptions of beneficiaries of indigenous healing practices.

Method
The study employed a phenomenological research design. Phenomenology is a school of thought which enables the researcher to focus on peoples’ lived experiences and interpretations of activities and concepts embedded within their setting. This research design enabled the researcher to determine the beneficiaries’ experiences in using indigenous healing services; discover how indigenous healers communicate treatment procedures and health information to beneficiaries and determine health education services available to beneficiaries of indigenous healers in the Kaliyangile District. The researcher used the snowball sampling procedure in order to gather rich and comprehensive data on how local people experience and perceive indigenous healing treatment and services provided for various ailments.

Results
Data analysis revealed that indigenous healers have claimed success in the treatment of several diseases and disorders including mental disorders, infertility, malaria and opportunistic infections. All the beneficiaries interviewed further revealed that indigenous healers were their first point of contact before they can think of seeing the western doctor because indigenous healers are best understood by their patients and their environments. The study also revealed that indigenous healers are not only healers but they are also counselors, social workers, politicians, as well as detectives in their communities.

Conclusion
It is in this regard that the beneficiaries respect and regard indigenous healers as people of high social status regarding their contribution to primary healthcare services. Indigenous healers are therefore effective agents of change because they have authority in their communities.
References


Preservation and accessibility of Indigenous Knowledge (IK) in Namibia: “Preserve Namibia Indigenous Knowledge” project

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Purpose

Indigenous Knowledge is an important component in the livelihood of communities which ultimately contribute to National Development Goals.

Namibia Indigenous Knowledge is currently poorly documented or not accessible. The unavailability of indigenous information in libraries and information centres has been observed by the Directorate of Namibia Library and Archives Service (NLAS) in all libraries countrywide. In an attempt to address this critical shortfall, funds were sourced from National Commission on Research and Technology (NCRST) to assist with preservation of Namibia Indigenous knowledge.

“Preserve Namibia Indigenous Knowledge” project is aimed at contributing to the preservation of Indigenous Knowledge by capturing videos, introducing advanced systems to improve and enable easy access to indigenous information. This in a long run will benefit communities to understand their cultural heritage and assist in introducing innovative projects to enhance productivity. The documentations that will be produced through this project will be accessible by researchers, scholars, tourists and the general public. They will also be archived as reference materials for Namibia’s future generations.

Method

Action research method was used to collect data in consultation with community leaders, elders, experts and community project coordinators. In addition, a technical team to produce videos has been hired to ensure quality for TV broadcasting and DVDs distribution. Accompanying publications will also be prepared and easy reference systems like website, mobile applications will be designed.

Results

The result of the project is that the target group will have access to Namibia indigenous information which they can use to improve their livelihood.

The study found that there are still opportunities to capture and document valuable information as knowledgeable community members are willing to share their skills. Nevertheless, the project is labor intensive, costly and it requires skilled and experienced personnel and those are serious challenge to the entire process of preserving Indigenous Knowledge.

The findings also shows that there is an urgent need to continue documenting Indigenous
Knowledge and create innovative systems to enhance access to information as there is a threat of extinction.

Conclusion

The immediate recommendations from this project is for the institutions with interests in preservation of Indigenous Knowledge to further recognize the importance and value of safeguarding crucial knowledge from the communities.

References

Crude Oil Reserves Deposits Economical Viability Potential

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Purpose
In the earth’s crust formation, a mineral composite representing a white pearl layer can be seen on the Satellite Maps. These white pearl layer formations are currently in- economically exploited, and are generally crushed into pot-ash and used in stone building.

Method
Mineral prospecting with Satellite Maps and data captured with Satellite Aerial Orthophotos. In land locked countries, the earth’s crust formations where this mineral generally regarded as potassium are present, represent a much harder looking reserve deposit formation, as appose to areas where the country has a coast line or an island in which this pearly earth crust formation appears much softer and more translucent in color. These layers I observed in certain areas form the top layer for diamond field deposit formations and pearl deposit formations in coastal areas.

rЄzЄrVЄ Mineral Prospecting CC draws the conclusion that crude oil reserve deposits that are regarded not economically viable to mine, are present in reserve deposit layers where gold, copper and this white pearl layer are presents a mineral composite potential conversion into pearl or white gold mineral re-compositions.

Results
Where a lighter grade crude oil forms the top layers to coal deposits, I observed a natural regenerative propensity of crude oil from these reserve deposits. This type of grade of crude can still be mined economically but would require a much larger areas for mining and this grade of crude oil may still either be in a regenerative stage or early reserve deposit formations stage.
Satellite Aerial Orthophotos
Conclusion

Crude deposits near gold or coal deposits reflected as black colored rock type formations in certain areas, forms a darker grade of crude oil which will be visible in a darker brown or near black and can be indicative of the crude oil reserve formation periods.

References

1. rЄzЄrVЄ Mineral Prospecting CC, (Reg nr: CC /2014 /13438), Mineral prospecting with Satellite Maps, Satellite Aerial Orthophotos.
RARE EARTH ELEMENTS IN TOURMALINE FROM NEUSCHWABEN PEGMATITES

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Purpose
The purpose of this paper is to present the chemical compositions of tourmalines occurring in Neuschwaben pegmatites south of Karibib in the Erongo region in order to characterize the various tourmaline minerals and their petrogenesis with particular reference to rare earth elements (REEs) in tourmaline. The tourmaline bearing pegmatites occur in the high-temperature and low pressure Central Zone of the Damara Belt and are considered to have formed during the late stages of the magmatic-hydrothermal processes associated with the Damara granites of Neoproterozoic age.

Method
Field geological mapping established that the northeast to southwest trending pegmatites occur in pegmatitic granites in which black, dark blue and green tourmalines are associated with quartz, muscovite, microcline, albite, lepidolite and minor illite. Selected tourmaline samples were analysed by X-ray fluorescence (XRF) and by inductively coupled plasma mass-spectrometry (ICP-MS) for major and trace elements and rare earth elements (REEs), respectively. In addition, X-ray diffraction (XRD) analyses were performed on tourmaline separates in order to determine the unit cell dimensions of the respective tourmaline minerals.

Results
The generalized structural formula of the tourmaline supergroup may be expressed as XY3Z6(T6O18) (BO3)3V3W (Hawthorne and Henry, 1999). Based on the dominant occupancy of the X-site, which is occupied by Na+, Ca2+, K+ cations or by vacancies (□), the studied tourmalines belong to the primary alkali group (Fig. 1). Tourmaline compositions vary from elbaite to schorl largely as a result of the substitution Fe2+3 ⇨Al1.5 + Li1.5 in the Y-site. The tourmaline structural data also show that most of the tourmalines belong to the schorl-elbaite solid solution series with a minor dravite-schorl series. In addition, ratio plots of Fe/(Fe + Mg) versus Mg and of Na/(Na + Ca) versus Ca both show trends of increasing Fe and Na with decreasing Mg and Ca contents, respectively, suggesting increasing fractionation during crystallization from parent magmatic-hydrothermal fluids.
The total rare earth element (ΣREE) content in tourmaline varies from 3.97 to 42.84 ppm with the light rare earth elements (LREE) being more enriched (3.37 to 30.76 ppm) in comparison to the heavy rare earth elements (HREE) which range from 1 to 12.08 ppm. The low REE concentrations in tourmaline (<10 to ≥10 chondritic) show flat chondrite normalized patterns characterized by a distinct negative europium (Eu) anomaly (0.53 to 0.76 EuN/EuN*) and slight enrichment in the light rare earth elements (LREE) compared to the heavy rare earth elements (HREE) (Fig. 2). One exceptional tourmaline sample (Q5D-BB) of black to blue schorl has relatively higher concentrations of both LREE and HREE compared to the others (Fig. 2). This tourmaline sample also exhibits a pronounced positive cerium (Ce) anomaly (CeN/CeN* = 1.9) in contrast to the other tourmaline samples with negative Ce anomalies (CeN/CeN* from 0.7 to 0.9).
Figure 2. Chondrite normalized REE patterns of tourmalines from Neuschwaben with normalized values after McDonough & Sun (1995).

Conclusion

The Neuschwaben tourmalines mostly belong to the elbaite-schorl series and have a distinct negative Eu anomaly characteristic of late magmatic tourmaline. The slight enrichment in REEs and the positive Ce anomaly in sample Q5D B-B indicate a different magmatic hydrothermal phase of tourmaline crystallization under more oxidizing and higher temperature conditions during which tetravalent Ce was relatively concentrated in preference to the other trivalent REEs.

References


Suitability of sand from Oshanas in Ongwediva for use as mould material in sand casting foundries

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Purpose

Foundry sand is extracted from river beds, lakes, seas, and deserts. This work was undertaken to ascertain the suitability for foundry purposes of sand found in Oshanas in Ongwediva by determining the chemical, physical, and mechanical properties of test sand samples. Refractory sands used for moulding are silica, magnesite, zircon, silimanite, and olivine. Silica sand is widely used in foundries because it is a very good refractory material. It can be used repeatedly for moulds after addition of binders, is cheap and readily available, and is chemically inert to molten metals and alloys.

Method

Two bulk sand samples of 50 kg each were collected from two Oshanas in Ongwediva. One of the Oshanas is in Okatope village adjacent to the Jose Eduardo Dos Santos Campus and the other is in Old Ongwediva. The bulk sand samples were split into smaller test samples using a Jones Riffle Splitter, while care was taken to label all the sample bags accordingly. The test samples were subjected to various foundry sand tests to ascertain the chemical, mechanical and physical properties following standard test procedures in the Indian Standard IS 1918 (1966) \cite{1}. Physical properties tests included determination of grain size distribution using serial sieves of gauges 75, 106, 180, 425 and 2000 µm, determination of sintering point, determination of moisture content by heating 50 g sand samples in an oven at 110°C for 1 hour and noting the weight change, and clay content determination using 475 cm\textsuperscript{3} of distilled water and 25 cm\textsuperscript{3} of 3.0 % caustic soda solution on 50 g oven dried sand samples. Mechanical properties tests were done to determine the Shatter Index, green compressive strength and dry compressive strength of standard, cylindrical, rammed sand specimens of diameter 152 mm and height 132 mm. Sand ramming was done with a mechanical jack, while the strength was tested on a Uniaxial Compressive Machine. The mechanical properties were tested at different moisture contents varying from 4 -12 % of the total weight of the prepared sand. Moisture content was varied by adding water or oven drying the sand, emulating foundry practice. Chemical composition of the sand samples was determined using a portable X-Ray Fluorescence (XRF) analyzer.

Results

Chemical analysis showed sands from both Oshanas contain sufficient silica to be used as foundry sands, and qualifies to be called silica sand. Along with silica small amounts of iron oxide, alumina,
lime, magnesia, soda, potash, barium oxide, titanium oxide, manganese oxide, zirconia, and strontia, were present as impurities. Sand from the Old Ongwediva Oshana had a fusion point of 1,073°C, which is high enough for application in non-ferrous foundries. Sand from Okatope Oshana had a fusion point above 1,200°C.

A furnace that can reach 1,500°C is required to determine the exact fusion point of that sand. Nonetheless, apart from nonferrous foundry applications this sand could be ideal for cast iron foundries where melting points average 1,260°C. The lower fusion point of sand from the Old Ongwediva Oshana is attributable to the lower silica content (42.94% vs. 62.72%) and higher alkaline impurity levels. The sorting coefficient falls within the acceptable range of 1.40 - 2.50 for naturally bonded sands. The sand grains shape can be described as sub-angular and thus the sand is expected to be flowable enough for moulding. The Grain Fineness Numbers (43.03 for the Okatope Oshana sand and 53.63 for the Old Ongwediva Oshana) fall within the acceptable range of 40 - 220 [2]. These sands are coarse in nature as classified by Tipper [3]. The sorting coefficient was greater than 2 for both sands which is an acceptable value [4]. Average moisture and clay content in the sand from the two sources were 4.52% and 10.98% respectively. The sand therefore is naturally bonded and can be moulded without additional binders. Mechanical properties were observed to vary with water content, and summarized in.

Table 1 are the maximum values recorded including the percentage of water in the specimens at which the values were obtained.

Table 1. Mechanical Properties

<table>
<thead>
<tr>
<th>Oshana</th>
<th>% Water</th>
<th>Green Compressive Strength (kN/m²)</th>
<th>Dry Compressive Strength (kN/m²)</th>
<th>Shatter Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Okatope</td>
<td>4</td>
<td>13.54</td>
<td>16.88</td>
<td>75.4</td>
</tr>
<tr>
<td>Old Ongwediva</td>
<td>12</td>
<td>10.43</td>
<td>13.28</td>
<td>55.1</td>
</tr>
</tbody>
</table>

Conclusion

While the sand drawn from the two sources generally consists of the same chemical elements, the actual percentages vary so the chemical composition is non-uniform and this in turn results in variable physical and mechanical properties. The sand can be classified as silica sand, with coarse and well-sorted sub-angular grains, and naturally bonded making it suitable for foundry use. Further research should be carried out on sand from other Oshanas and ways of improving the green compressive strength of sand casting. As it is, the range of green compressive strengths obtained is relatively low compared to the ranges given by Dietert [5]. There is also need for permeability tests and workability tests on the sand when mixed with synthetic binders.
References

PERFORMANCE EVALUATION OF A HYDRAULIC MARULA OIL PRESS AND DETERMINATION OF MARULA KERNELS’ PROPERTIES

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Purpose

Sclerocarya birrea (the Marula tree) products have generated much interest due to the products’ qualities and their potential for industrial development [1]. The oil from Marula kernels has nutritional, cosmetic and medicinal properties [2]. Despite the potentials of Marula fruits and kernels, there has been little commercialisation in Namibia [3]. The Rural Development Centre (RDC) in Ongwediva manufactures hydraulic presses for the extraction of oil from Marula kernels. Despite the improved productivity and a strong interest in the oil, the sales of the presses have gone down. This study’s aim was to evaluate the performance (extraction rate, extraction efficiency and yield) of the Marula press in extracting oil from marula kernels and compare it to the manual (traditional) method at two temperatures (30°C and 45°C). Furthermore, the study aims at determining some mechanical and physical properties of the Marula kernels (such as kernels’ yield force, bulk density and length) that can be used to design an improved oil extractor from Marula kernels.

Method

Marula kernels were heated to 30oC and a batch of 4533.3g was placed in the marula press and squashed by the press’ jack until the jack was no longer movable. The time of jacking was recorded. Pressure was then maintained to allow the oil to flow out through the perforations for 30 minutes for complete oil collection (It was observed that the oil flow decreases drastically after 30 minutes). Once the oil was collected and weighed, the press cake was removed and weighted too. The mass of oil extracted is the difference in masses of the fresh kernels and the press cake. Extra oil was expelled from the press cake for another 30 minutes. The overall oil mass, extraction efficiency and percentage yield were then calculated. The procedure repeated for kernels at 45°C.

A Vernier calliper was used to measure the lengths of whole (intact) kernels. The bulk density was determined as the mass of solids divided by the bulk volume. The yield force (the force at which the kernels yield oil) was determined using a Universal material tester. The oil mass from each batch of fresh kernels was added to the oil mass from its press cake. The overall oil mass, extraction efficiency and percentage yield were then calculated.

Results

Though more oil is obtained when oil is extracted from fresh kernels heated to 45°C than when they are at 30°C, a two sample t-test between the mass of oil obtained from expelling oil from Marula kernels at 30°C and 45°C indicates that there is no significant difference ($p= 0.06>0.05$) between the mean oil mass obtained at the two temperatures. However, the amount of oil expelled by the press at 30°C is significantly higher ($p = 0.043<0.05$) than that obtained through the manual method.
The average force at which the kernels yielded was calculated to be 1.9kN. The pressure at which the oil starts flowing was calculated to be 598.0 kPa. The pressure developed at 12kN was 3.8 MPa. The bulk density of Marula kernels was determined to be 419.4kg/m³. The longest measured kernel was 17.8mm long.

**Conclusion**

A Marula hydraulic press performance was evaluated. The Marula oil press attained an extraction rate, percentage yield and an extraction efficiency of 1.25kg/hr, 27.6% and 47.1% respectively. The equipment is capable of handling a large mass of kernels and thus saves up time but a lot of oil is left in the press cake due to poor extraction efficiency. Expressing marula kernels at 45°C gave higher extraction efficiency, percentage yield and extraction rate compared to 30°C. So the data suggests that there is a positive correlation between temperature and performance. However, there is no significant difference (p= 0.06>0.05) between the mean mass oil obtained with the press at these two temperatures. There is, however, a significant difference between the amounts of oil extracted from the press compared to when the oil is extracted traditionally. The mass of oil extracted with the oil press was 795.5g more than that from the manual (traditional method) method for the same length of time.

**References.**

2. PhytoTradeAfrica “The Uses and Properties of Marula Oil,”
ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF COMPUTER INTEGRATED MANUFACTURING AMONG MANUFACTURING COMPANIES IN WINDHOEK, NAMIBIA

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Purpose

Computer Integrated Manufacturing (CIM) which is the integration of automated manufacturing plant and process is being adopted worldwide in manufacturing industry for various advantages and platform for profit making associated with it [1] [2].

The main objective of this research project is to assess the Knowledge, Attitude and Practices (KAP) of CIM among manufacturing companies in Windhoek [3]. The project will also find if there is a relationship between CIM practice and company characteristics like size, age or ownership of company [4].

Method

The research design was both qualitative and quantitative. It involved written questionnaire and oral interview surveys. The population of the study comprised of 46 companies that are members of the Namibia Manufacturers’ Association (NMA) based in Windhoek and were actively engaged in the manufacturing of products at the time the study.

Purposive and convenience sampling methods [5] were used to select companies that were interviewed. Using information about KAP of CIM from literature [1], questions were drawn up for the questionnaire and interview schedule. The level of practice of CIM in companies was determined by the presence of those components of the CIM structure [1].

A reliability test was carried out by giving preliminary questionnaire to researcher peers. Secondly, the questionnaire and interview schedule were given to 4 manufacturing companies. The questionnaire and interview schedule were improved by addressing issues identified from the reliability tests.

Companies were requested to participate in the study by means of emails, calls, and personal visits. A total of 39 questionnaires were handed out of which 19 were received back. Furthermore, three (3) interviews were also conducted. The respondents to the questionnaire and interview survey were production managers (or equivalent) of companies that took place in the study.

The questionnaires results were recorded onto an Excel sheet for analysis with SPSS, while the recordings of the interview were transcribed onto a word document for qualitative content analysis.
Results

From the definitions of CIM given by production managers, companies perceive CIM to be an automation of manufacturing process by means of machines controlled by computers. However, the concept of integration is lacking from their understanding of CIM.

Despite knowing that CIM causes loss of manual labour, companies have plans to expand and practice more CIM. Companies are trying not to use complete CIM systems by having semi-automated manufacturing systems in order to provide jobs. They felt that, as the competition stiffens and cost of labour goes up, all companies will consequently end up having complete CIM system because companies feel that complete CIM system is the ideal case for them.

No company was found to be practicing CIM in all process of business, although over 80% of the companies were found to be using some elements of CIM (Computer Network and Database Management systems, Computer Aided Quality Management Systems, Product design and evaluation, Manufacturing Automation Systems, Management Information System). Over 90% of the companies uses manually operated machines in some of their processes as shown in the table below.

Internationally owned companies were found to be use more robots in their processes than locally owned companies, this agrees with literature [6] that, internationally owned companies have new and advanced manufacturing technologies.

Conclusions

Local manufacturers perceive CIM as just an automation and control of the manufacturing processes but do not fully comprehend the fundamental concept of CIM which is integration of processes.

Manufacturing companies in Windhoek have a positive attitude toward CIM and are of the opinion that that partial CIM systems are ideal for Namibia in order to ensure profit for companies and employment for people.

No company in Windhoek is having a complete CIM system, but all companies have at least some part of CIM components in their manufacturing methods. There is a very low level of integration among manufacturing companies in Windhoek (<10%) which can be attributed to the lack of integration in the understanding of CIM among local manufacturers.

References

Can nutritious Omaungu (Gonimbrasia belina) caterpillars be made an invisible but present part in our diet?

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Purpose

Omaungu (mopane worms) are caterpillars harvested from primarily mopane trees. However, they can also exist on other trees during the spring to summer season of such trees. Omaungu are the larvae stage in the life and growth cycle of Gonimbrasia belina moth. They are nutritious, with a good profile of protein quality. They are a common delicacy among many elderly people who grew up in rural areas in the major populated parts of Namibia. Despite their nutritional value, it is believed that with rapid urbanization, younger people especially those who grew up and those growing up in urban areas tend to not prefer these worms. This could be due to the unavailability of different ways/forms in which to consume these mopane caterpillars to appeal to this type of consumers. Moreover, there is need to improve nutrition especially the protein content in foods consumed in many rural and informal urban areas, where protein and mineral deficiency is prevalent. This contribution presents results on the potential and experientially demonstrated flow process development of the mopane worms in a powdery form and composited with locally available vegetables such as Ombidi (Catflower, Cleome gynandra leaves).

Methods

Dried mopane worms and Ombidi were bought from two open markets, namely Oshakati and Okuryangava Stop-and-Shop (Windhoek) markets. Carrots, butternuts, tomatoes, red peppers were bought from Pick & Pay Supermarket in Windhoek. These fresh produces were cleaned and appropriately prepared into thin pieces/pulp to facilitate their easy drying in the sun. All these items were separately crushed to powder using a coffee grinder and different compositions and ratios were mixed. These resulted in at least 6 different powdery soups of enhanced nutritional content. The colour of the resulting soups/broths following 10 min cooking of soups (1:10, soup to water) was assessed. The protein, ash, Fe, Zn and vitamin A and E contents were determined as described by Teffo et al [2].

Results

Preliminary data suggests that the compositions that had higher amounts of carrots and butternut than any other components resulted in soups of relatively lighter colour. The higher the amount of ombidi and mopane worms relative to other components the darker was the colour of the soup. The protein content was proportional to the amount of mopane worms present in the soup.
Conclusions
The simple processes to produce the dried soups have been demonstrated. The enhanced protein content and possibly quality can be beneficial especially to people who have less access to meat products. The potential use of the developed soups depends on pending consumer sensory tests and technology transfer uptake by SMEs.

References