CHUKA UNIVERSITY

Knowledge is Wealth *(Sapientia divitia est)* Akili ni Mali

Proceedings of the 2nd Open Week

Theme: Creation of awareness on the University's roles in innovation and human resources development

Goal: Open the University to the public, show-case technology hallmarks, and select ideas for commercialization.

Venue: Chuka University Pavilion Square

Entry: Free

Held from 5th to 9th June, 2017

Chuka University is ISO 9001:2015 Certified

Inspiring Environmental Conservation for Better Life

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PREFACE

Chuka University was established as the 2nd Chartered and 9th full-fledged public university in Kenya in January, 2013. It is located in Chuka Town in Tharaka-Nithi County at about 186 km from Nairobi City along the Nairobi-Embu-Meru Highway. The University organized an Open Week whose theme was: **Awareness Creation on the University's Roles in Innovation and Human Resources Development.** Cutting edge entrepreneurship technology and career opportunities were exhibited and professionals provided career guidance and counselling talks. The Chief Guest: Dr. Kevit Desai, Chair, LIWA.

Objectives were:

1. To provide an opportunity for staff and students to showcase Chuka University innovations, inventions, technologies, and academic programmes on offer to solve societal problems and spur economic growth.
2. To instill a culture of creativity and innovation in primary, secondary, college and university students.
3. To provide an opportunity for staff to interact, network and explore research collaborations to nurture.
4. To select student and staff novel and creative presentations with a potential for commercialisation.
5. To provide a platform for end-users to uptake the innovations and inventions for commercialisation.

Schedule:

6th June 2017, 8.00 am: Official opening ceremony
11.00 am: Visit exhibition of Faculty innovations, inventions and academic programmes. Get sensitization on career opportunities and admission process and research.
7th June 2017, 8.00 am: Visit exhibition of Faculty innovations, inventions and academic programmes. Get sensitization on career opportunities and admission process and research
8th June 2017, 8:00 am: Visit exhibition of Faculty innovations, inventions and academic programmes. Get sensitization on career opportunities and admission process and research.
2.00 pm: Official closing ceremony and Awards presentations.

Entry: The University offered free entry to the public, including primary, secondary, college and university students. Tel.'s were: 0202310512/18 or 0202021721 for clarification or confirmation.

Following here are proceedings of what was presented and exhibited. It is hoped that readers will find these proceedings informative and adoptable for commercialization in the short/long-run.

Prof. D. K. Isutsa, Ph.D.
Deputy Vice-Chancellor (Academic, Research and Student Affairs)

DISCLAIMER

Views and opinions expressed herein are those of contributing authors and not necessarily those of Chuka University. Only presentations that were orally presented, exhibited and consented by authors were published herein. The Editor reserved the right to typeset the papers to meet the bulletins layout.

CITATION

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PROGRAMME CONTENTS

Day 1: 5th June 2017 (Monday): Tent Pitching and Boardroom Set-Up			
Day 2: 6th June 2017 (Tuesday): Plenary and Exhibition Sessions			
TIME/PAGE	**ACTIVITY**	**FACILITATOR**	
8.00-9.00 am	**Arrival & registration**		
VENUE	**PAVILION BOARDROOM**		
GROUP	**ALL FACULTIES, STAFF, STUDENTS AND GUESTS PRESENT**		
	Opening Ceremony		
1	Cover page		
2	Preface		
9	Context remarks	**Prof. D. K. Isutsa**, Deputy Vice-Chancellor (Academic, Research & Student Affairs): *Tips for University dons for commercialization of research findings and leveraging of intellectual property rights*	
16	Exchange remarks	**Prof. Jospeter Mbuba & Prof. Jeffrey Nowak,** Visiting Professors from Purdue University, Fort Wayne, Indiana, USA: *Opportunities for staff and student exchange: Case of Carnegie African Diaspora Forum Programme et al., USA*	
20	Opening keynote address	**Dr. Kevit Desai**, Chief Guest/Linking Industry With Academia (LIWA) Chairman: *The roles of LIWA in technology and innovation transfer*	
22	Opening speech	**Prof. Erastus N. Njoka**, Vice-Chancellor: *The new paradigm for resource mobilization and enhancement for development of Chuka University and its students and staff.*	
	Reactions	**Staff and Students:** *Comments and questions*	
12.00-12.15 pm	**Break/Group Photo**		
VENUE	**PAVILION BOARDROOM: PLENARY**		**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Agriculture & Environmental Studies**		**Career/Motivational Talks & Visits**
24	Animal feeds formulation from agricultural byproducts and wastes as a way of cutting cost to improve productivity by Dr. Onesmus M. Nderi & Dr. Geofrey K. Gathungu		Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
28	Use of agricultural by-products to make wholesum diet for a lactating sow by Dr. Munene Nderi and Dr. Roselyne Kahindi		
31	Animal Sciences Innovations: Urea molasses block (UMB); Artificial colostrum; Storing and handling frozen semen by Adira S. Patrick, Caroline Nkirote Muremera, Mutuma Kioko Nicholas, Samuel Muema, Virginia W. Muigai, Caren K. Nyabuto		
39	Animal welfare through photography by Dr. D. C. Kemboi and Certificate in Animal Health Y2S2 Students		
41	Preparation of milking salve using locally available materials (Chuka University Udder PAL) by Mr. A. Musungu and Mr. Martin Mutembei		
43	Preparation of antimicrobial premium (swipe) sanitizer using locally available materials by Mr. A. Musungu And Mr. M. Mutembei		
45	Value addition in local products for sustainable development in the hospitality industry by John Kihiu Magothe and Geoffrey Akoko		
51	Integration of solar powered and plasma enhanced gasification system on municipal solid waste processing and energy generation in Mt. Kenya Region by Dr. Lemmy, M. Muriuki, Dr. Moses Muraya, Dr. Joel M. Gichumbi, Ms. Lucy, K. Mureu, Mr. Jafford, N. Rithaa, Dr. Stephen Muchina, Prof. Adiel Magana, Prof. Veronica		

	Nyaga, Dr. James Mutegi, Dr. Paul Kamweru, Dr. Cyprian Njue	
56	Making a home-scale biogas digester by Patrick Mwangi Ng'ang'a, Justin Mugendi, Samson Chabari and Bernard Soi,	
61	Making a cost-effective charcoal cooler/fridge by Eunice Wanjiku Kamau, Justin Mugendi, Samson Chabari and Bernard Soi	
63	Household water treatment using *Moringa oleifera* by Virginia Kavuu, Brian Owino & Martha Emojong	
65	Book publication: Advances in tourism management: Forms and development perspectives by Dr. L. Muriuki	
67	Short course: Environmental Impact Assessment and Environmental Audit by DESRD	
69	Multiplication and commercialization of seeds and planting materials of locally adapted and preferred crops: Case of AIVs and small fruits by D.K. Isutsa, J. Kiramana, G.K. Gathungu, C.A. Omukoko, S. Mulambula, L. M'Itunga, G. Kosgei, and C.M. Marangu	
78	Enhancement of banana productivity and value addition in eastern Kenya region using modern propagation, agronomy and by-products processing technologies by Dr. Geofrey K. Gathungu, Prof. Dorcas K. Isutsa, Dr. Moses M. Muraya, Ms. Grace A. Opetu, Dr. Alfred M. Mariga, and Mr. Geoffrey K. Kosgei	
89	Value addition in banana products and wastes (by-products) by Stephine Valentine Obunga, Felix Odhiambo Guya, Martha Nyambura Kama, Grace Nyokabi Ruiru, Lucy Muthoni, Dominic Kipkoech Kiru, Ruth Cheserek	
91	Soil and water conservation for increased crop productivity and environment protection by Dr. Geoffrey K. Gathungu and Haggai O. Ndukhu	
94	Processing locally adapted and preferred crops for value addition and enhancement of consumption: Case of pumpkin fruits and sweet potatoes by Ms. J. W. Kiharason and Prof. D. K. Isutsa	
103	Value addition in the processing of horticultural products and food preservation methods by Joyanne Wambui Karuma	
105	Manual publication: Food Science laboratory practicals guide by Mr. Stephen Wachira Kariuki	

Day 3: 7th June 2017 (Wednesday): Plenary and Exhibition Sessions

8.00-9.00 am	**Arrival and Registration**	
VENUE	**PAVILION BOARDROOM: PLENARY**	**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Arts and Humanities**	**Career/Motivational Talks & Visits**
106	Short course: National cohesion values and principles of good governance by Dr. D. Nkonge	Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
115	Short course: Public administration and governance skills for county government staff and other stakeholders by Mr. Christopher Kiboro	
120	Short course: Hands-on disaster preparedness and management skills for learning institutions administrators and other stakeholders by Dr. Anne A. Sande	
127	Short course: Geographic information systems and remote	

	sensing applications for field researchers and extension officers by Mr. D. Kinoti Kibetu	
129	Short course: Hands-on project planning, monitoring and evaluation skills for community development by Ms. Catherine W. Thiong'o & Ken Mwiti Murungi	
135	Charcoal-based evaporative refrigeration system for storage and preservation of fruits and vegetables by David Mbaru, CB5/12960/13	
140	Designing and making of recycled plastic bag bracelets by Fredrick Odongo Barasa, CB5/ 13003/13	
144	Design and development of a rat catcher by Joseph Kimathi Naibae, AB1/12283/13	
147	Formulation of charcoal-based shoe polish by Edna Mumbi Kimani, CB5/12962/13	
149	Design and development of solar box cooker by Ruth Timina Imbaya, CB5/12992/13	
150	Knowledge management, dissemination and commercialization by Prof. John Kobia & Mr. Enock Seme Matundura Bitugi	
11.00-11.30 am	**Break**	
VENUE	**PAVILION BOARDROOM: PLENARY**	**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Business Studies**	**Career/Motivational Talks & Visits**
152	Short course: Value chains and agribusiness management skills for producers, sellers and other stakeholders by Mr. K. Nthuni and Erick Apind	Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
157	Short course: Tips on do's and don'ts for successful entrepreneurship by Dr. Gilbert Mugambi Miriti	
165	Short course: Advances in book keeping and business accounting for SMEs by Mr. J. Masinde	
179	Short course: Contemporary human resource management skills for county government staff and other leaders by Ms. Catherine Kaimenyi	
184	Di-Traco software by John Kingau Wambugu, Julius K. Murigi, Jefferson K. Mwangi and Dr. Gilbert Miriti	
185	Integrated financial management and procurement information systems for enhancement of visibility and transparency in the county government financial systems by Amos Karanja Ng'ang'a, Charles Ngigi Mwangi, George Ochuonyo, Keith Stephen Ambayo, Lenox Oganda Omondi, James Wang'ombe	
186	Green procurement for sustainable development by Spirian Ndichu Macharia, Maryann Wangari Mbugua, Peter Maritim Kibet, Wycliffe Muneeni Nzomo, Esther Nzambi Manzi, Rose Mumbe Mwangangi	
1.00-2.00 pm	**Break**	
VENUE	**PAVILION BOARDROOM: PLENARY**	**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Education and Resources Dev't**	**Career/Motivational Talks & Visits**
190	Short course: Contemporary guidance, counseling, mentoring and academic advising skills for managers of learning institutions by Prof. Veronica K. Nyaga	Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
194	Short course: Demystifying early childhood development education skills for kindergarten and day care managers by Ms. Bornace J. Kimeli	
202	Short course: Elucidation of gender and disability mainstreaming skills for managers of learning institutions	

	by Dr. Beatrice M. Mburugu	
211	Short Course: Contemporary FGM mainstreaming skills for social workers by Dr. Susan M. Kinyua	
222	Design and construction of a daylight solar water heater by Haron Magata Nyariki	
Day 4: 8th June 2017 (Thursday): Plenary and Exhibition Sessions		
8.00-8.30 am	**Arrival and registration**	
VENUE	**PAVILION BOARDROOM: PLENARY**	**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Science, Engineering & Technology**	**Career/Motivational Talks & Visits**
224	Deployment of Chuka University's high precision equipment in sample testing and advisory services by Dr. O. Ombaka	Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
232	Production of rhizobia species for seed and plant inoculation for seed/crop productivity and livelihoods enhancement by Mr. Christopher S. Mutuku, Julius Mburu, EB2/12072/13 and Chrispino Pius, EB2/12074/13	
237	Biological control of tomato bacterial wilt caused by *R. solanacearum* using *B. subtilis* in coated seeds by Samuel Odhiambo Juma	
242	PCR identification of aroma, blast resistance, kernel length and yield genes in pishori rice grown in Kenya by D. Aloo, L. Tanui, Dr. J. Njiru and Dr. S. Kiruki	
246	Automobile collision advisory simulation by Vincent Ososi Oisebe, Simon Makuno and Joram Murage	
250	3-D Design by Maxwell Munene	
252	Proposal for secure electronic voting system for Chuka University by Hillary Kinyua and Samson Mwanzia Muthiani	
253	Design of automated street lights by Morris Mukiri Gitari and Charles Kinyua Gitonga	
10.30-11.00 am	**Break**	
VENUE	**PAVILION BOARDROOM: PLENARY**	**DIAS & TENTS: EXHIBITIONS**
GROUP	**Faculty of Science, Engineering & Technology**	**Career/Motivational Talks & Visits**
254	Deployment of clays and other technologies in purification of river water for bottling by Dr. Ochieng Ombaka and Mr. S. Muraya	Students and the public to visit Faculty innovations, inventions and academic programmes on exhibition and get sensitized on careers and admission process
265	Formulation of soaps and detergents by Mr. Joram Bulemi and Dr. Eric Chomba Njagi	
271	Preparation and antibacterial activities of bar soap from *Moringa Oliefera* and Croton *megalocarpus* seeds by Dr. Gichumbi, J.M., Dr. Ombaka, O., Muraya, S., Ogolla, F.	
276	Conversion of biomass residues to levulinate esters using solid acid catalysts by Dr. Eric Chomba Njagi	
280	Synthesis, characterization, cytotoxic and antimicrobial activities of ruthenium(II)arene complexes with N,N-bidentate ligands by Dr. Joel M. Gichumbi	
286	Modeling the role of treatment and counseling in the management of HIV/AIDS and tuberculosis co-infections by Dr. Mark Okong'o	
288	Analytical approach to semi-open/semi-closed sets by Dr. Sammy W. Musundi, Kinyili Musyoka, Priscah M. Ohuru	
290	Alternative method for the geometric construction of angles by Dr. Musundi Sammy W., Wanjohi Elijah	
291	Groundwater aquifer characteristic investigation using vertical electrical soundings by A. Odek	

295	Short course: Contemporary life and first aid skills for managers of learning institutions by Mr. Willy R. Mutisya	
303	Short course: Contemporary oral and community health skills for social workers and other stakeholders by Mr. Joshua K. Mwangi and Mrs. Dorothy Mbaya	
1.00-2.00 pm	**Break**	
VENUE	**PAVILION DIAS**	
GROUP	**ALL FACULTIES, STAFF, STUDENTS AND GUESTS PRESENT**	
2.00-5.00 pm	**Closing Ceremony and Awards Presentation**	
309	Closing keynote address	Ms. **Anne Samba** and Ms**. Cynthia Kamau, C/O GIZ, Nairobi**: Developing creative and innovative potential of young people relevant to employment
	Reactions	**Ms. Joyce Mghoi Macharia**, Assistant Dean of Students
312	Closing remarks	**Prof. Dorcas K. Isutsa**, Deputy Vice-Chancellor (Academic, Research & Student Affairs)
	Closing prayer	**Dr. Grace Gatune Murithi**, Senior Students' Counsellor
	Departure	

PRESENTATIONS' AND EXHIBITIONS' EVALUATION CRITERIA

The criteria were used by the judges to evaluate the entries in the Chuka University 2nd open week presentations and write ups and exhibits. Faculty staff and students submitted/were identified to present the: idea, innovation, invention, or short course/seminar syllabus indicated on the programme (see: circulation and www.chuka.ac.ke). Each item was allocated 10-30 minutes and the responsibility of the first or designated author to orally present to the audience/judges in Power Point format. The final 5-20 pages write-up of each idea, innovation, invention, exhibition in boardroom or tent, or short course/seminar syllabus was prepared following the criteria given below and used for compilation. A short course/seminar syllabus was basically derived from existing academic programmes and then written as per the given criteria plus a list of topics to be covered in 1 to 5 days.

If an idea, innovation, invention, exhibition, or short course/seminar syllabus was ready as products, it was prepared both as Power Point for oral presentation in the boardroom and products/posters for exhibition in tents. Budgets for preparation of small-scale exhibition products/posters were submitted to allow Procurement of items.

Note: both new proposals and finished research were allowed for plenary presentations, while only completed, ready aspects were allowed for exhibition. Aspects requiring embarking on elaborate research before exhibition were not eligible for the Open Week. Such aspects were to be prepared as proposal(s) and submitted separately for IRF. There will be more chance to present exhibits and orally during the 4th Research Conference in October, 2017.

Title of Idea/Project/Innovation/Invention/Exhibition/Short Course:							
Name of Presenter(s):							
Type of Presenter (Tick One)	Plenary Student		Plenary Staff		Tent Exhibition		
	Scale Scores					**Wt**	**Total**
Evaluation Criteria	5	4	3	2	1	**(4)**	**/20**
1. Novelty/Creativity/Originality (Title, Introduction, Problem, Objectives)							
2. Application/functionality (Methodology)							
3. Marketability (Prospective Users-Adopters-Uptakers-Upscalers)							
4. Cost effectiveness (Budgetary Cash flow of Expenditure versus Income)							
5. Oral presentation (Clarity, Articulation)							
Total Score						**(20)**	**/100**
References							
Length (5-20 pages)							

Judge's Name: . Signature: . Date: .

CONTEXT REMARKS

by Prof. D. K. Isutsa, Deputy Vice-Chancellor (Academic, Research & Student Affairs), Chuka University, P. O. Box 109-60400, Chuka

PART I: PROGRAMME SETTING

Two parallel venues, boardroom and tents, were used during the 2nd Open Week. There were plenary presentations of commercializable ideas in this boardroom, while at the same time the public arrived and visited exhibitions in the tents. The boardroom presentations were arranged by Faculty, each with a moderator, rapporteur, judges and presenters. The time allocated was 10-30 minutes per speaker to summarize their idea to the audience and judges. The scores shall were compiled and the top ideas were selected for nurturing into products. At 2 pm on Thursday, the participants assembled at the Dias for the Closing Ceremony.

PART II: PARTICIPANTS/BENEFICIARIES

The Open Week was for all Chuka University members and disciplines so as to achieve the SDGs. It has been said that the UN SDGs (Global Goals) are about the future. The 17 UN SDGs rallying call is "No One Left Behind". All people should be involved in realisation of the UN SDGs. The STEM-Science, Technology, Engineering and Mathematics mantra has changed to STEAMED-Science, Technology, Engineering, Arts, Mathematics, Entrepreneurship and Design. It has also been said that women can hold half the sky and youths are critical thinkers.

Owing to all these great observations and much more, it was been reiterated that:

1. E-business should be promoted to empower citizens in their businesses.
2. Successful approaches in research should be shared through cooperation, collaboration and knowledge exchange.
3. Social entrepreneurship should be profitable, sustainable and have real impact. Social projects should include impact/cash flow assessment.
4. School curriculum should incorporate business awareness and empathy so as to encourage youths to seek solutions to problems.
5. Quadruple helix (Academia, Government, Industry and Community [AGIC]) collaboration is a new model in carrying out social innovation and entrepreneurship.
6. Public-private-partnership and start-ups funding needs to be accessible to all. Thus encourage policy change to grant tax rebate for philanthropic businesses/companies.
7. Gender stereotyping of children should be avoided from an early age so as to nurture a future generation that views all as equals and able to excel in innovative research.
8. New talents should be developed in schools to create jobs in future to address job displacement by technology and automation.
9. There should be a shift in focus towards technical and vocational education and training to enhance employability/employment opportunities.
10. There is need to engage and sensitize the youths to be aware and internalize the 17 UN SDGs so as to bring about change of behaviour, attitude and actions, and most importantly, to trust them to implement constructive changes in their own economies/lives.

Thus, all staff and students were encouraged to keep up the good work.

The United Nations Resolution A/RES/70/1 of 25th September, 2015. They include to:

(1) End poverty in all its forms everywhere
(2) End hunger, achieve food security and adequate nutrition for all, and promote sustainable agriculture
(3) Attain healthy life for all at all ages
(4) Provide equitable and inclusive quality education and life-long learning opportunities for all
(5) Attain gender equality, empower women and girls everywhere
(6) Secure water and sanitation for all for a sustainable world
(7) Ensure access to affordable, sustainable, and reliable modern energy services for all
(8) Promote strong, inclusive and sustainable economic growth and decent work for all
(9) Promote sustainable industrialization
(10) Reduce inequality within and among countries
(11) Build inclusive, safe and sustainable cities and human settlements
(12) Promote sustainable consumption and production patterns
(13) Promote actions at all levels to address climate change
(14) Attain conservation and sustainable use of marine resources, oceans and seas
(15) Protect and restore terrestrial ecosystems and halt all biodiversity loss
(16) Achieve peaceful and inclusive societies, rule of law, effective and capable institutions
(17) Strengthen and enhance the means of implementation and global partnership for sustainable development

PART III: TIPS FOR UNIVERSITY DONS FOR COMMERCIALIZATION OF RESEARCH FINDINGS AND LEVERAGING INTELLECTUAL PROPERTY RIGHTS

INTRODUCTION

Research commercialization is the process of transforming an idea or scientific discovery into new or improved product, process or service. The process is complex, non-linear, with false starts, dead ends, changes in direction and feedback loops. It requires different skill sets – scientific, technical, business, marketing. There are various options for realizing value – licensing, start-up, alliance. This paper will cover: What is technology commercialisation; Importance of technology commercialization; Technology commercialization process; Options for technology commercialization; Agents in technology commercialization; and Determinants of commercialization success.

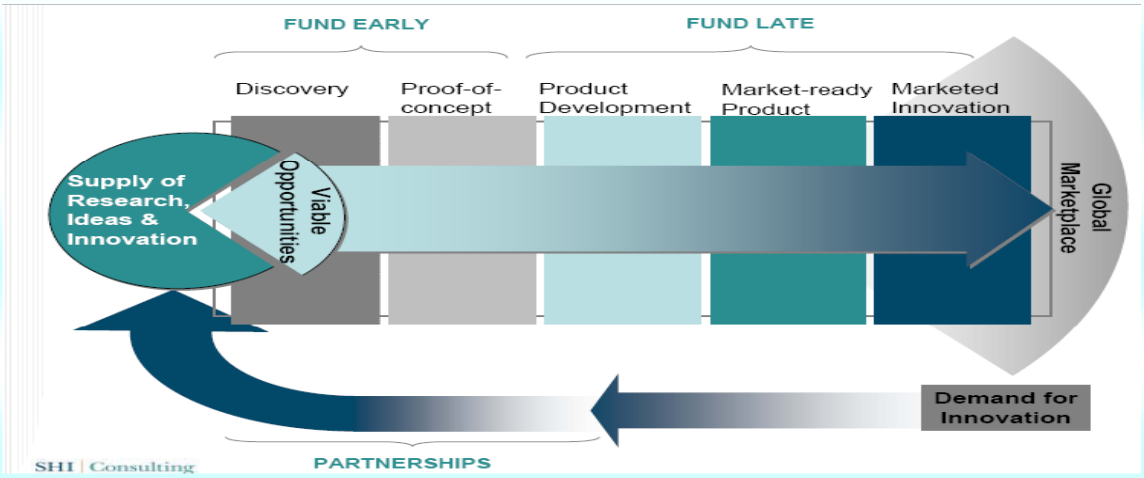
IMPORTANCE OF RESEARCH COMMERCIALIZATION

An idea or discovery, by itself, has no direct economic value. Economic value is created when an idea or discovery finds an application and gets translated into a product, process or service. Commercialization provides return to public investment in research. It ensures that new and promising ideas become seeds to innovative products and services. Commercialization leads to creation of new ventures which are needed for competitiveness and economic growth.

RESEARCH COMMERCIALIZATION PATHWAYS

University practitioners should not operate in isolation, but should interlink as shown below:

RESEARCH COMMERCIALIZATION PROCESS

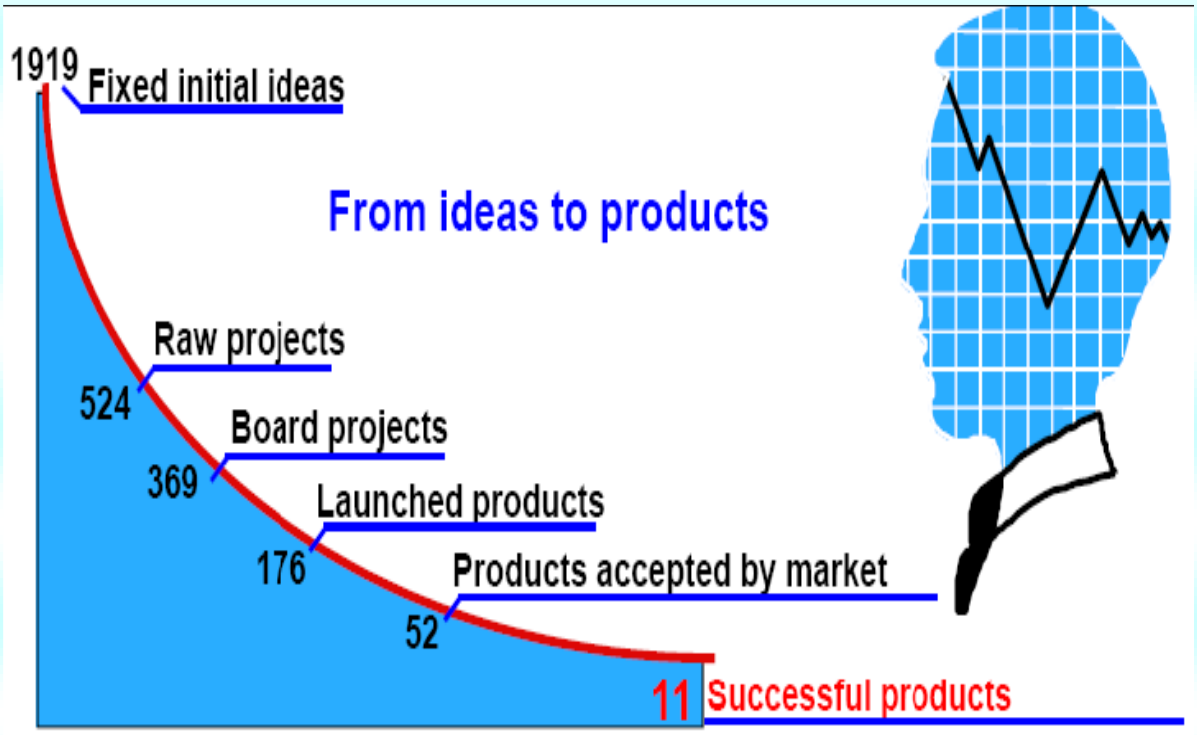


Pathways from discovery to the marketplace: Commercialization is non-linear with feed-back loops

1. Discovery/Conceptualisation Phase

•Research commercialization commences with the techno-market insight
•Ideas evolve through constant iteration between a new technological capability and market need
•Researchers generate new technological possibilities embodied in new discoveries and methods
•Research could be triggered by real or perceived market needs or by researcher's own convictions or interests

You need to start with many ideas to get one successful product



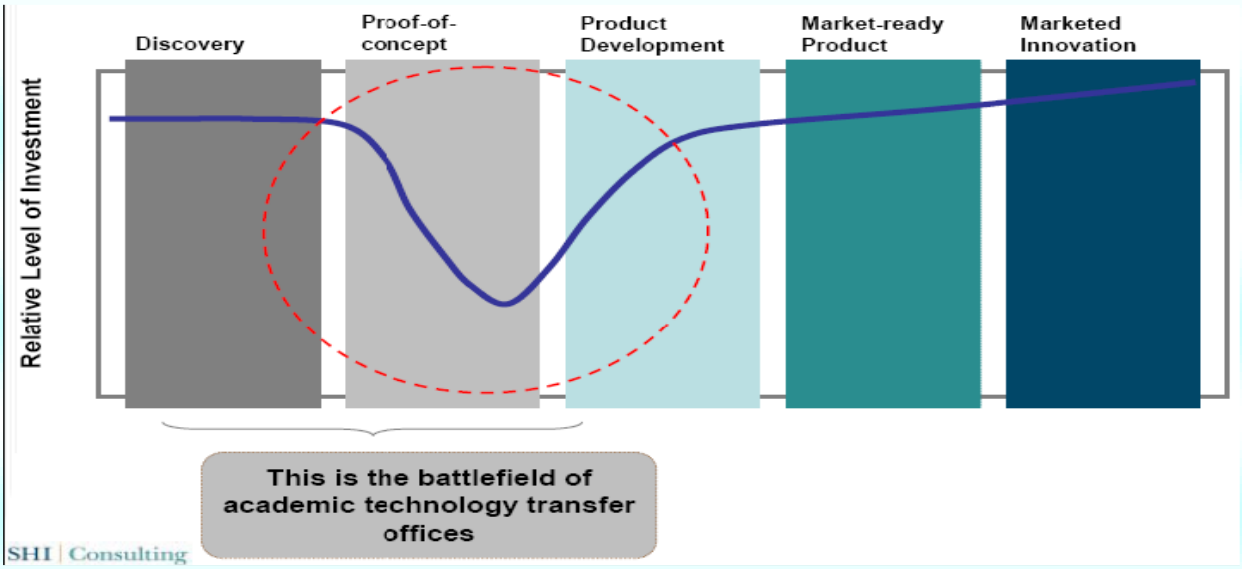
2. Proof of Concept Phase

Proof of concept entails evaluation of idea feasibility and commercial viability of an idea

•How is it done?

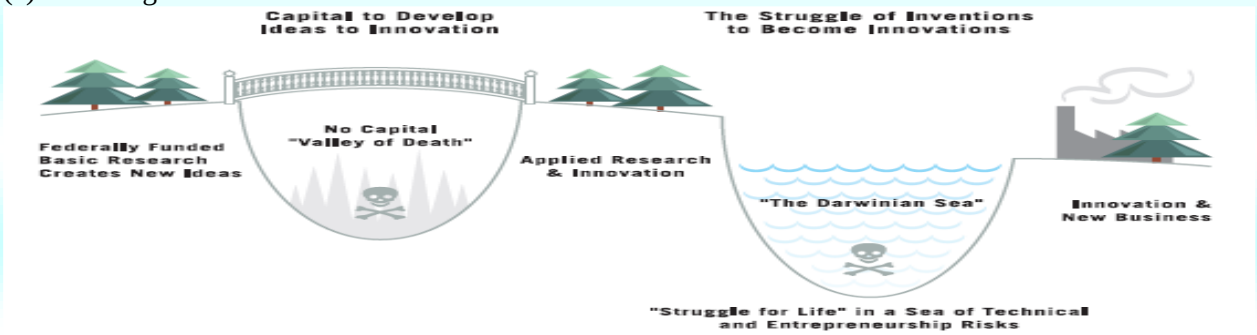
- prototype for product/service
- scaling-up and/or pilot plant for process

•This phase involves high risks, requires large resources and is frequently the end of the commercialization initiative – the phase commonly termed as "Valley of Death"

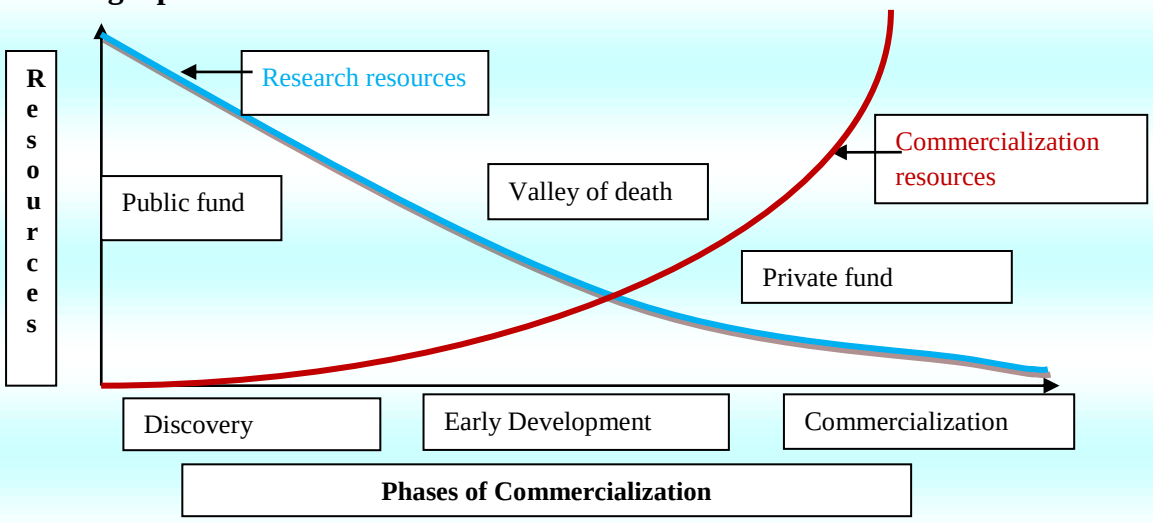


Resources for Research Commercialization

(a) Challenges



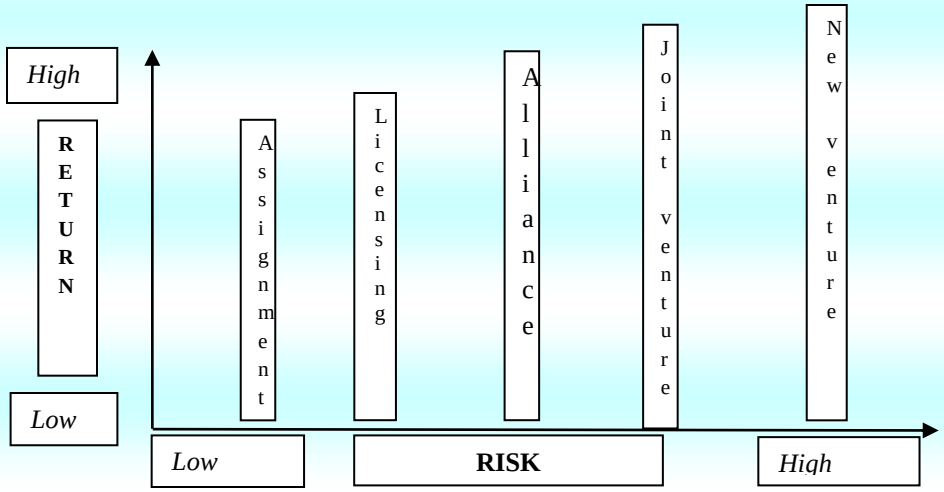
(b) Funding Options



3. Product Development Phase

Product development refers to the entire process of:
- identifying a market opportunity
- creating a product to appeal to the identified market;
- testing/trials; and
- modifying and refining the product

4. Research Commercialization Options



(a) Sale or Assignment of IP Rights

•Sale by owner of all his exclusive right to an invention to another person or legal entity
•Outright sale is suitable for common technologies
•The permission by the owner to a patented invention to another person or legal entity to perform one or more of the 'acts' which are covered by the exclusive right to the patented invention

Examples of Patents: Very straight forward stuff

- An asparagus production technique for the subtropical region.
- A micropropagation technique for virus-free garlic.
- A micropropagation technique for giant taro.
- 'Improved Chancellor' grape.
- Piperine, Piperidine alkaloid from *Piper nigrum* L. as a synergist to pyrethrins for the control of insect pests and vectors.
- Improved process and associated technology for pre-drying green leaf tea.
- Headwear.
- Remote Global System for mobile communication internal lock.
- Patenting is happening monthly. For more info, logo onto: http://www.kipi.go.ke/index.php/patents

(b) Licensing

•Licensing is one of the most common modes of technology commercialization
•Financial compensation typically include:

–Up-front fees or lump-sum payments
–Running royalties (e.g. based on sales volume)
–Milestone payments

Types of Licenses

Exclusive
- Only one licensee has the rights to exploit the invention
- Desirable for high risk investment
- Necessary to "induce" investment

Non-exclusive
- Similar licenses may be granted to more than one company
- Invention is a broadly applicable process
- Invention is useful to many companies thus not necessary to "induce" investment

Partially Exclusive
- Same technology licensed again for a different geographical region or for a different application
- Agreement must specify field of use or application
- Licensee has the rights to exploit only for the specified application

(c) Alliance

•Collaborating with another person or legal entity to acquire assets or expertise to complement the capabilities of the owner of the invention and that are essential to bring the invention to the market

• Examples of complementary assets are:

- Distribution channels
- Specialized manufacturing capabilities
- Sales force
- Other expertise

(d) Joint Venture

•A contractual agreement between two or more parties for the purpose of executing a business undertaking with mutual sharing of profits and losses

•There are 2 basic forms of joint venture (JV) namely equity JV and contractual JV
- The equity JV is an arrangement whereby a separate legal entity is created
- A contractual JV might be used where the establishment of a separate legal entity is not needed or where it is not possible to create such an entity

(e) New Venture

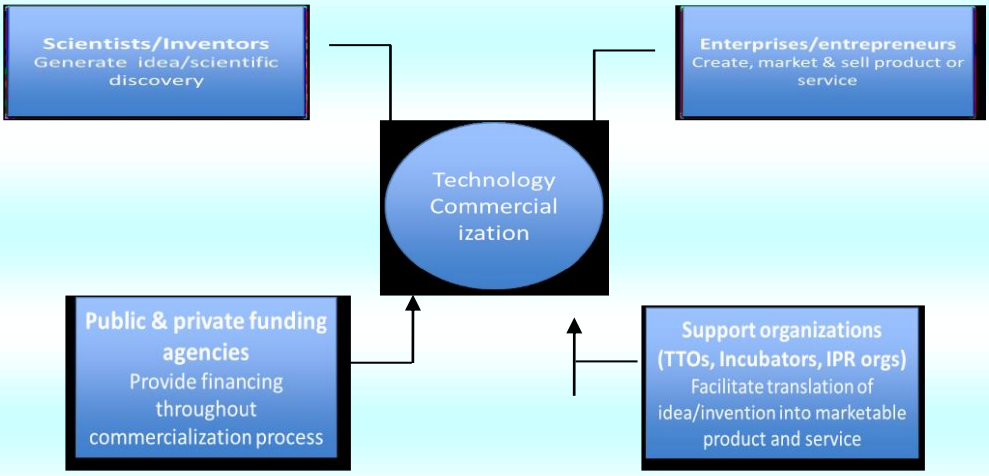
•Creation of new business or "start-up" by licensing technology
•Sometimes called "entrepreneurial technology transfer"
•In the USA 1-2 spin-offs per US$100 million research expenditure; best practice 5-20 spin-offs per US$100 million research expenditure)

DETERMINANTS OF COMMERCIALIZATION SUCCESS

•A compelling commercial concept
•Continuing validation through the acquisition of new, 'smart' and meaningful investment
•A 'champion' well matched to the needs of the project, especially during the more uncertain early phases
•Conducive environment (e.g. supportive organization culture, compatible incentives, enabling laws)
•Efficient access to external networks of resource providers
•Efficient mechanism to share information within organization and with potential resource providers

AGENTS IN RESEARCH COMMERCIALIZATION

Research commercialization involves multi-sectoral collaboration



ACKNOWLEDGEMENT

The Malaysian and Kenyan Governments for offering the "MTCP-MTDC Technology Commercialisation Workshop for Practitioners from African Countries" from 23rd to 27th June, 2014 in Malaysia, and source Amin, F. of MTCP-MTDC.

Opportunities for Staff and Student Exchange: Case of Carnegie African Diaspora Forum Programme and Others in the USA

By Prof. Jospeter Mbuba and Prof. Jeffrey Nowak, Visiting Professors, Department of Public Policy, Department of Education, Purdue University, Fort Wayne, Indiana, USA

Prof. Jospeter Mbuba

Prof. Jospeter Mbuba is an Associate Professor of Criminal Justice at Purdue University, Fort Wayne, Indiana, USA. He earned his Ph.D. in Sociology with a concentration in Criminology from Louisiana State University in 2004 and his M.A. in Sociology from the University of Nairobi in 1997. Prior to his doctoral studies, he taught Sociology at Egerton University, where he had earlier graduated with a B.A. in Sociology and Economics in 1992. Prof. Mbuba conducts research on policing and law enforcement. He has published widely and has delivered numerous presentations at the annual Conferences of the Academy of Criminal Justice Sciences, Midwestern Criminal Justice Association, and Southern Criminal Justice Association, among others. He is a two-time recipient of Carnegie African Diaspora Fellowship for curriculum development for the University of Embu and Chuka University. He also delivers invited presentations about discovering the "hidden rules" of teaching today's university students. He was in Chuka University from early May to early August 2017. During the open week conference, he together with **Prof. Jeffrey Nowak** talked about: ***"Opportunities for staff and student exchange: Case of Carnegie African Diaspora Forum Programme (CADFP) and others programmes in the USA"***.

Prof. Jeffrey Nowak

In 2015, Prof Mbuba started an exchange program between his University and the University of Embu in Kenya. Through that collaboration, one of his colleagues, Prof. Jeffrey Nowak, visited the University of Embu in Kenya. Prof. Jeffrey Nowak is a Professor of Educational Studies in the College of Education and Public Policy at Purdue University, Fort Wayne Indiana, USA. Prof. Nowak visited Chuka University through invitation by Prof. Mbuba.

Definition

A discipline that prepares interested and qualified students to passively understand the types and causes of crime but also to actively pursue careers in the fast growing field of crime management

The Field of Criminal Justice

• Law enforcement	• Juvenile justice
• National security	• Narcotics control
• Community policing	• Private sector loss prevention
• Forensic science	• Crime scene investigation
• Judicial administration	• Traffic analysis
• Emergency management	• Intelligence gathering
• Probation services	• Law enforcement training
• Prisons supervision	• Warders/corrections officers
• Court clerk	• Correctional counselors
• Industrial security	• Prisoner advocates
• Witness management	• University lecturer/professor

Common Courses • Criminology • Criminal law • Prison issues • Policing • Criminal investigation • Community policing • Correctional counseling • Criminal procedure • Organized crime • Forensic science	• White collar crime • Victimology • Terrorism • Juvenile justice • Law in society • Corrections/prisons • Drug abuse • Ethics in criminal justice • Community corrections • Global security

CARNEGIE AFRICAN DIASPORA FELLOWSHIP

Brief History

- ☐ Paul Tiyambe Zeleza

Presidential Professor of African American Studies and History, Loyola Marymount University Los Angeles, California

- ☐ Report for the Carnegie Corporation of New York

"Engagements between African Diaspora Academics in the U.S. and Canada and African Institutions of Higher Education: Perspectives from North America and Africa"

Carnegie African Diaspora Fellowship

The Carnegie African Diaspora Fellowship Program is a scholar fellowship program for educational projects at African higher education institutions.

Funded by a grant from Carnegie Corporation of New York, which has an enduring commitment to higher education in Africa

- CADF is administered by Institute of International Education (IIE)
- The IIE conducts international exchange programs for scholars and university administrators
- Works through the Council for International Exchange of Scholars (www.cies.org)

Application Process

Institutions in Kenya, Uganda, TZ, Nigeria, Ghana, and South Africa

Eligible projects:

- ☐ Curriculum co-development
- ☐ Research collaboration and
- ☐ Graduate student mentoring and training
- ☐ A Project may run for 14 to 90 days
- ☐ Must have a visit by an African-born scholar who:
  - ◘ Lives in the United States or Canada
  - ◘ Works in an accredited college or university in either of those two countries
- ☐ Projects may be in any academic discipline or can be interdisciplinary
- ☐ Applicant must articulate how the fellow is to contribute during the project visit
- ☐ You may either identify a prospective fellow if you have one in mind

- ☐ You may also leave it open ended for IIE to find an appropriate Fellow for you
- ☐ Fellows apply separately and they either identify a host institution or leave it to IIE to identify a suitable host for them
- ☐ IIE maintains a roster of fellows and hosts
- ☐ IIE searches the roster to find possible matches according to the discipline specializations, expertise, activities and objectives described in project requests

Cost-Share

- ☐ Cost-sharing is expected
- ☐ Institutions may propose to provide cost-share funds directly to the fellow or to provide in-kind support
    - ◘ Accommodation… on-campus housing
    - ◘ Meals
    - ◘ Transport
- ☐ If an institution cannot cost-share, CADFP can off-set that cost but only if a strong justification is provided in the project proposal
- ☐ No receipts need to be submitted by the institution to the CADFP

Supporting Documents

- ☐ A letter to demonstrate this support, from an administrator holding the position of Dean or higher, on University letterhead, must be uploaded in the online project request system
- ☐ The letter should make it clear that administrator is aware of the project being requested and commits to having the institution provide the cost-share proposed
- ☐ The letter of support must be from someone other than the host institution contact person who submits the project request

Who Can Apply

- ☐ Faculty members in chartered public or private universities in Kenya, Uganda, Tanzania, Ghana, Nigeria, and South Africa
- ☐ Application is online to the Carnegie African Diaspora Fellowship Program
- ☐ For online application, visit: www.iie.org
- ☐ Email enquiries: africandiaspora@iie.org

FULBRIGHT

With nearly 8,000 grants offered each year in almost all academic disciplines and professional fields, there is a Fulbright opportunity for almost everyone.

Fulbright Programs

Fulbright runs various programs

- US Scholar Programs
- Non-US Scholar Programs
    - Core Fulbright Visiting Scholar Program
    - Fulbright Foreign Student Program

Core Fulbright Visiting Scholar Program

Each year some 800 faculty and professionals from around the world receive Fulbright Scholar grants for advanced research and university lecturing in the United States.

Individual grants are available to scholars from over 155 countries. Kenya is one of them.

- In countries where Fulbright has Commissions, scholars have to identify a host affiliation in the United States as part of the application process
- Scholars usually include a letter of invitation from the host institution in their application materials.
- In countries where Fulbright is administered by the Public Affairs section of the U.S. Embassy, (such as Kenya) scholars apply for awards and identify their specializations
- The applicant must be a citizen and be qualified to hold a valid passport
- For details, visit: ke.usembassy.gov

Fulbright Foreign Student Program

The Fulbright Foreign Student Program enables graduate students, young professionals, and artists to research and study in the U.S. for one year or longer at U.S. universities or other appropriate institutions

Foreign Student Application

Fulbright operates on yearly application cycles, which generally open approx. 15 months before the start of the grant with a deadline approx. 12 months before the grant start date.

- Fulbright application process is lengthy and rigorous
- The competition for Fulbright grants is merit-based
- For details, visit: cies.org

U.S. Embassy Nairobi

United Nations Avenue Nairobi
P. O. Box 606 Village Market00621 Nairobi, Kenya
Phone: 020 363-6000 option '1'
Email: NairobiEdUSA@state.gov

US Embassy Website Use Tips

- Go to: ke.usembassy.gov (don't start with www)
- Click "Education & Culture" tab
- Scroll down to find the following
  - **Study in the U.S.A.**
  - Study in the U.S.A.
  - Scholarships & Exchanges
  - **Local Programs**
  - Exchange Programs
  - EducationUSA

Thanks!

Prof. J M Mbuba. E-mail: mbubaj@ipfw.edu

The Roles of LIWA in Technology and Innovation Transfer

By Chief Guest/Linking Industry With Academia (LIWA) Chairman, New Rehema House, 2nd floor, Westlands,, P. O Box 66031-00800, Nairobi-Kenya, Tel.: +254 (0)20 2323 389, Email: kevitdesai@gmail.com

Dr. Kevit Desai, Chief Guest, Linking Industry With Academia (LIWA) Chairman
LIWA has seen Dr. Desai participate in multiple interventions initiated both by the government and private sector with regards to systemic and grass-root focus areas. Through this key involvement he have been instrumental in drafting and advocating for legislating, policy and strategy which have since been passed into acts of parliament in Kenya, specifically aimed at strengthening the country's education, research and innovation capabilities.

These includes: the University Act of Parliament, TVET Act of parliament and STI Act of parliament. In addition, for the past 15 years, he has been a key member within developmental commissions established by the Ministry of Higher Education, Science and Technology, Ministry of Information and Communication, and various Private Sector initiated Commissions, Committees and Alliances. At the grass-root level of intervention, he played a significant role in nurturing innovation oriented students and graduates through the annual students engineering exhibitions for the past 15 years.

With undying passion for education and the drive of facilitating the realization of its contribution to the country's national development agenda, he has been instrumental in championing initiatives of linking academia and private sector with the sole objective of enhancing quality of education, research and innovation to be at par with the requirements of the country's social and economic development agendas. This key capability will further ensure that the country's education sector sustainably remains relevant to the needs of the private sector, thus hugely contributing to the sector's development in line with human capital development as well as create a platform to provide solutions to the private sector challenges through continuous research and innovation. His inspiration to continuously play a key role in these significant initiatives is the drive to make a difference in and contribute to the development of Africa.

This year, he was appointed to serve as the Chairman of the Technical University of Mombasa.

During the 2nd Open Week Conference, he delivered to participants a keynote address titled: ***The roles of LIWA in technology and innovation transfer***. Below is the summary of the LIWA ecosystem that scholars and institutions should strive to operate in and subscribe

LIWA ECOSYSTEM

The Chief Guest acknowledged that research and innovation is vibrant in Chuka University based on a scan of the Open Week Programme. He introduced the context of engaging in research with two observations: The University's role of promoting skills through vocational training; and the need to meet industrial and national competencies.

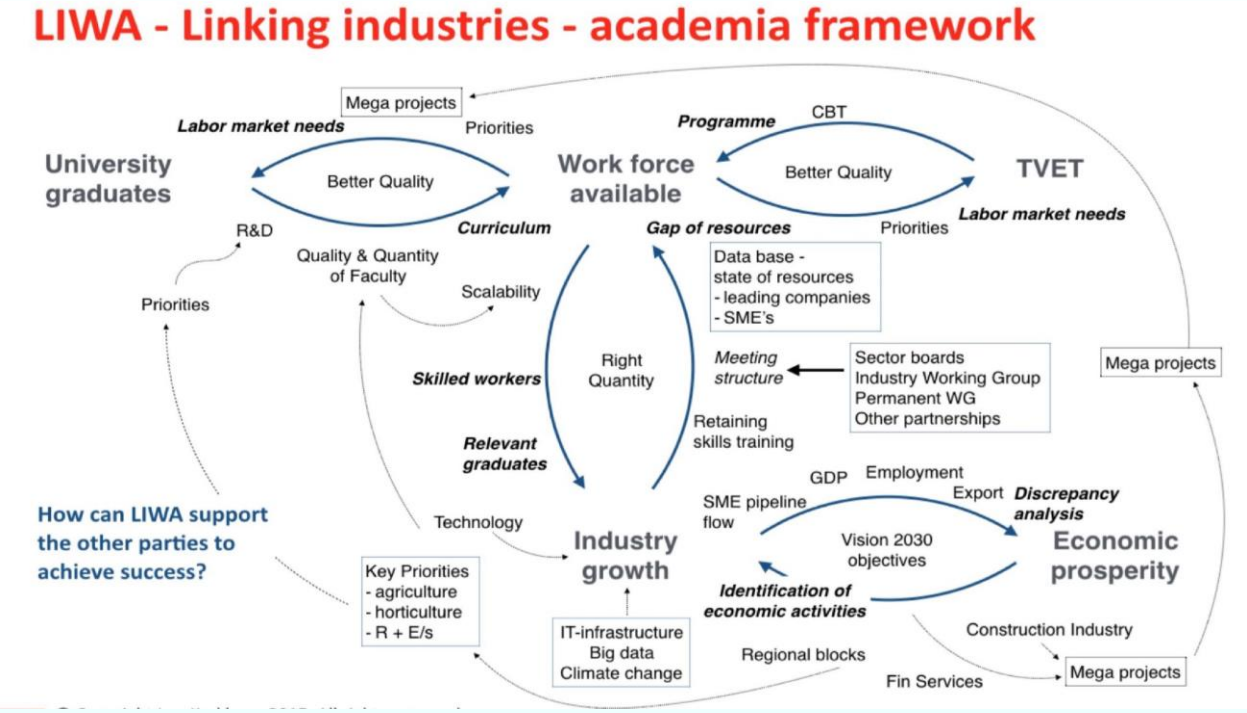


Figure 1: LIWA Ecosystem

Research does not only attract funds, but also re-conditions academic capacity. The private sector is active in experiental research, while the University is recognized in organized research. He emphasized the need of translating the research into innovations to improve livelihoods in the county. He stated that the demand for innovation is not just in the private sector, but also in the public sector. He also mentioned that he participated in the development of the national sessional strategy together with Professors Gichage, Shem Wandiga, Kabiru Kinyanjui, and other distinguished professionals. The strategic sessional papers were transformed into Acts, and therefore the entire STI Act is about socio-economic transformation.

Regarding the LIWA ecosystem/network framework, the University and TIVET institutions provide the workforce produced/needed for industrial growth, leading to economic prosperity. He noted that the innovations need to contribute to Small and Medium Enterprise development. He reiterated the need for collaborative synergies and also explained that the future of resource mobilization is research. The private sectors usually work when invited to engage. The SMEs and infrastructural support are important for everyone in the country. He mentioned the need for creating regional blocks to enhance development. Universities can then become coordinating centres for all these engagements. Collaboration was thus influential in building robust national research and extension systems.

The New Paradigm for Resource Mobilization and Enhancement for Development of Chuka University and its Students and Staff

By Prof. Erastus Nyaga Njoka, Vice-Chancellor, Chuka University P. O. Box 109-60400, Chuka

Prof. Njoka was born and pursued Primary and Secondary Education in Tharaka-Nithi and Embu Counties. Thereafter, he proceeded for further studies in Friendship University, Moscow. Upon successful completion, he returned to Kenya and was employed by Egerton University as a Lecturer. He served and rose through the ranks to become a Full Professor, Faculty Dean, Campus Director, College Principal, and currently Vice-Chancellor of Chuka University. He is an Alumnus of Friendship University in Russia, University of Jerusalem, Galilee International Management Institute in Israel.

Summary

The Vice-Chancellor welcomed all participants to Chuka University to view exhibited academic, research and innovative milestones achieved and are continuing to realise. The Vice-Chancellor thanked the Division of ARSA for coordinating the organisation of the Open Week, and all staff who participated in it. He noted that without research forums, the University will not have any reason to exist. He added that Africans have really let the Continent down by not engaging in innovative research, including winning Nobel awards. Thus there is need to engage in active research and become more independent in future. He emphasized the need to engage in open week activities annually and reminded staff to adopt a paradigm shift of behaving in public, but acting privately to remain competitive.

The Vice-Chancellor acknowledged that the Open Week forum was geared towards Strategic Goal 10 of enhancing linkage with the community. He then gave an illustration of a Nairobi-based barber who had challenged the University to collaborate with him. In the past, Chuka University helped communities to acquire piped water and feed the elderly people in Tharaka-Nithi County. He expressed satisfaction that the community was benefiting from the University. The equipment in laboratories should assist farmers in various aspects such as seed testing to overcome the predicament posed by the terminator gene. While noting the fact that the University was excelling in the Sciences, he acknowledged the fact that it had prolific Kiswahili writers who had authored many books. He concurred with the need to go beyond the applied research stage which prompted the University to initiate setting up of a Science Park.

The Speech

Our Chief Guest, Dr. Kevit Desai, other invited guests, staff and students, Good Morning. Allow me to state that right from its inception, this University embarked on serious development when the community donated the land on which it stands. Besides, the cooperation with the community has been strengthened in our strategic plan, specifically in Strategic Goal number 10 which lays emphasis on community outreach and linkages. To achieve the development agenda of the Strategic Plan, Chuka University has pledged to partner with local, national, and international education stakeholders. We are acutely aware that linkage and support mechanisms ensure that an institution is continuously in touch with its stakeholders so as to draw strength and build on national and international best practices.

As a centre of higher education, the University is a factory of ideas and innovations that should contribute to the generation of knowledge that can be utilized in development of other sectors of the economy including industries. To achieve its mandate, the University must keep abreast of the latest trends and developments in industry and generate more for it. It is for this reason that we at Chuka University are actively entering into public-private partnerships to improve our capabilities in academic, research innovation and in other areas of management. Besides participating in partnerships directly with other public and private sector organizations, partnerships have enabled us to share successful models and best practices. Partnerships can also provide a paradigm shift in the way we have always funded our activities. Through partnerships we can conduct training, research and consultancies together to identify new, appropriate and functional funding streams. We thus wish to establish more partnerships across the country and across nations. The University has to be locally relevant and internationally competitive by producing graduates who are socially responsible and globally competent. In this respect, we have engaged in exchange programmes which are aimed at bolstering the knowledge of the partnering institutions for mutual benefit. This involves the development of academic programmes, strengthening collaborations with national and international stakeholders, and providing appropriate services to both local and international students. In addition, Chuka University continues to contribute to development of the local environment, and to engage the community to identify their needs and to address them.

As envisaged in the in the Universities Act of 2012, Chuka University will continue to advance knowledge through quality teaching, scholarly research and publications. Through fórums like this one, the University promotes learning to the the students and the society in general. This is what taking the University to the people is all about. By demystifying the University, the community is able to interact with and find out how the University can benefit them. This could be by improving crop production through improved seeds, disease-resistant varieties, or high yields. Universities should help the community to overcome perennial food shortages by providing innovative fodder storage and fresh produce value addition methods. The University continues to contribute high calibre human resources by producing quality graduates every year. By so doing, the University supports and contributes to the realization of national economic and social development through provision of trained and skilled workforce. The research and innovations conducted in universities should be disseminated to the general public and community. This way the public and community will feel the impact of the research. Indeed the quality and quantity of research done by our researchers in this University is quite impressive. This is evidenced by the many quality proposals and theses being written each year. Some of the most prolific Kiswahili authors are Chuka University faculty members. We are proud of them.

Finally, universities should be emulated by other organisations for best practices. The services they provide should be excellent and beyond reproach. They should, for example, show the way by providing opportunities to all without discrimination. The minorities and other marginalized groups should be integrated with the rest of the society by being provided equal opportunities.

I now take this opportunity to declare the second Chuka University Open Week officially open.

Prof. Erastus Njoka, Ph.D.
VICE-CHANCELLOR

Faculty of Agriculture and Environmental Studies
Moderator: Dr. Moses Muraya
Rapporteur: Dr. Alfred Mariga
Judges: Prof. Levi Musalia; Dr. S. Munyiri; Dr. R. K. Kahindi

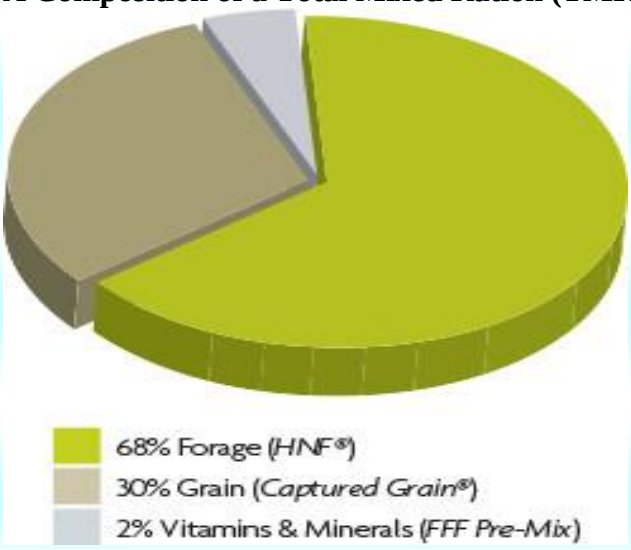
Animal Feeds Formulation from Agricultural Byproducts and Wastes as a Way of Cutting Costs to Improve Productivity

by Dr. Munene Nderi, Dr. Roselyne Kahindi & Dr. Geofrey K. Gathungu, Faculty of Agriculture and Environmental Studies, P. O. Box 109-60400, Chuka

Introduction

Providing proper utrition to dairy cows is important for health and optimal milk production. Dairy cow ration must contain good quality forage, a balance of grains and protein sources plu sminerals and vitamins. These food sources provide the nutrients needed by dairy cow for milk production, growth and reproduction. Feeds must be feed in the right amount and combination to proved a balance of nutrients to avoid exesses or deficiences. When rations are formulated corectely to meet the nutrients requrements of the cow, optimum feed digestion and utilization results. Feeding a TMR that contains all feed nutrients is effective, efficient and profitable.

A Composition of a Total Mixed Ration (TMR)



Statement of the Problem

Most of the ASAL areas such as North eastern lack effective and quality feeds to fed their animals due to insufficient fluctuating rainfall and drought spells which result to shortage of feeds for their animals and in extreme cases result to death of the animals. Most farmers are also complaining of poor quality feeds in the market which ‘has affected productivity especially in the dairy sector therefore by popularizing the TMR feeds we will be able to fill this gap by providing quality and nutritionally complete feed to the pastoralists in the ASAL areas and at the same time providing quality feed to the farmers this would improve our economy at large and results to eradication of poverty and lead to better living standards.

Objectives

1. To achieve a balance of microbial population within the rumen.
2. To provide the animal with a balanced ration in every mouthful she consumes.
3. To achieve maximum production per unit feeding.
4. To reduce the cost of production by formulating a ration that is cheap and whose ingredients are locally available.
5. To promote good health in dairy animals.

Justification

TMR contains a balanced diet for the dairy cow and it has so many advantages in that it increases productivity, increases palatability of low quality feeds e.g. straws, maize stovers, reduces labor and reduces the cost of feeds making it economical to the farmers. Therefore TMR would be very beneficial to the ASAL areas where due to fluctuating rainfall the quality of feeds is poor and sometimes results to shortages of feeds. Therefore this would eradicate poverty and improve our economy at large.

Total Mixed Ration for Feeding Dairy Cows

Good feeding management practices must be followed to achieve maximum performance from cows. Monitoring of forage and feed inventory on a regular basis and allocating appropriate animal group, testing forages and feeds several times throughout the year or when any noticeable change occurs and updating ration formulations based on milk production, milk fat and milk protein percent, current body weight and body condition scores, moisture changes in forages or high moisture feed ingredients, and prices of current feeds followed by checking forage moisture on a frequent basis is critical to implementing a successful TMR system. Separate TMR can be developed for different animal groups. These can be formulated for fresh cows, early lactation cows, and mid- and late-lactation animals, as well as for far off and close-up dry cows. Such multi-group strategies are particularly helpful for meeting the needs of dry cows.

Application

Feeding a total mixed ration (TMR) helps a dairy cow achieve maximum performance. Since its inception in the 1950s, it is now the most adopted method for feeding high producing, indoor-housed dairy cows in the world. This is accomplished by feeding a nutritionally balanced ration at all times, allowing cows to consume as close to their actual energy requirements as possible and maintaining the physical or roughage characteristics, which we now refer to as feed particle size, required for proper rumen function. Advantages and disadvantages of any feeding system, however, must be weighed before choosing a TMR.

Good feeding management practices must be followed to achieve maximum performance from cows. First, monitor forage and feed inventory on a regular basis and allocate to the appropriate animal group. Second, test forages and feeds several times throughout the year or when any noticeable change occurs. Lastly, update ration formulations based on milk production, milk fat and milk protein percent, current body weight and body condition scores, moisture changes in forages or high moisture feed ingredients, and prices of current feeds. Checking forage moisture on a frequent basis is critical to implementing a successful TMR system.

There are several strategies that can be used in TMR systems. Separate TMR can be developed for different animal groups. These can be formulated for fresh cows, early lactation cows, and mid- and late-lactation animals, as well as for far off and close-up dry cows. Such multi-group strategies are particularly helpful for meeting the needs of dry cows. One group TMR, on the other hand, can be used for lactating cows with or without top-dress feeding. Cows can be grouped based on actual or fat-corrected milk, days in milk, reproductive status, age, nutrient requirements, and health. Different farms have reasons for adopting different strategies for using TMR and these must be a decision of the farm manager based on many aspects of the operation as well as research and personal preference.

Cost Effectiveness

Improved feeding efficiency often occurs with herds using a TMR. Each mouthful of feed that the cow consumes contains the proper amount of ingredients for a balanced ration, resulting in a more stable and ideal environment for the rumen microbes and providing adequate carbohydrates and nitrogen sources that vary in their ability and rate of rumen breakdown. This in turn can lead to production of higher levels of microbial protein by the rumen microbes throughout the entire 24-hour day. A 4% increase in feed utilization can be expected when using a TMR compared to a conventional ration of forage and grain fed separately, twice daily. In addition, the ability to use feeds with various rates of breakdown is enhanced, often enabling even better nutrient utilization. Farmers can also utilize a greater variety of byproduct feeds with a TMR, thereby allowing for possible ration cost savings. The incidence of digestive and metabolic problems often decreases when a TMR is fed, and milk production has been shown to be as much as 5% higher with a TMR compared to conventional rations as a result of these benefits.

A TMR provides greater accuracy in formulation and feeding if managed properly. Using feed scales both on mixing equipment in a feed area allows the quantity of each ingredient fed to be closely controlled. When a TMR is mixed properly, a cow cannot consume significantly more or less of a forage or concentrate than planned in the ration formulation. Parlor and selective feeding can be discontinued or limited to token amounts to facilitate cow movement, unless specific milking systems such as robotic milking systems are being used. The TMR system is well adapted to mechanization with a mixer wagon or a stationary mixer with conveyors or mobile feeders. Mixing equipment must be properly maintained and load cells and scales must be kept in accurate working order. Mixers can be purchased that handle the addition of long hay, however these are seldom recommended. Many of the TMR mixers that chop long forage also break down other feed and silage particles while they are reducing the long hay particle size. The result is often that the entire TMR has reduced particle size as a result of attempting to add a few pounds of long dry hay to the mix. It is most always recommended to chop long forage as a separate commodity before adding it to the TMR mixer and mix for a limited amount of time as recommended by the manufacturer. This generally is no more than 4 to 5 minutes—just long enough to achieve a good mixture.

Commodity ingredients can be fed quite effectively in a TMR diet. Both unique and common types of commodities are often less expensive due to bulk handling and direct purchasing. However, quality control must be maintained when purchasing commodity feeds. This often entails additional feed analysis, but additional costs of transportation and handling required by a commercial feed manufacturer are avoided. The quantity of commodity feeds purchased depends

on rate of spoilage, level of use, and available storage space. Purchasing large quantities may not be economical due to increased inventory costs. Total feed losses for commodity feeds, including what occurs during storage and handling, can range from 3% for a dry grain product to 15% for a high-moisture product such as wet brewers grain. Purchasing should be based on quality and nutrients needed for the ration, not solely on price. Additionally, a greater variety of ingredients allow more flexibility in formulating the ration for various production groups. One of the major advantages of blending all the feeds together in a TMR is that it can mask the flavor of less palatable feeds. Feeds such as urea, limestone, fats, and some by-pass protein sources may be less palatable. However, through blending, they can be added to TMR in reasonable amounts with little to no reduction in feed consumption.

Challenges of a TMR Feeding System

Mixing or blending devices needed for the ration require small to moderate expenditures for equipment and maintenance. Further, it is important to follow the manufacturer's recommendations for mixing. Over mixing can cause serious problems due to grinding and pulverizing the feed. Under mixing can result in less effective feed utilization by the cows.

Accurate weighing with calibrated scales, which also may involve additional cost and maintenance, is essential. Care must be taken in formulating and mixing the ration. If the diet is not balanced correctly or mixed properly, the cow ultimately will suffer reduced performance. While this is true of any feeding system, it is under the control of the person feeding the herd. Remember with a true TMR, cows have no other option for a diet and depend solely on the ration for a balanced diet to achieve production and health.

In some cases, existing buildings, feed alleys, and mangers may make a TMR system nearly impossible to use. Some housing and feeding facilities may just not be well suited for a TMR system. Further, it may not be economical for all herds, particularly small herds or those using pasture feeding over an extended period of time, to implement a TMR system due to the increased cost of the feeding system per animal-day it is utilized.

Feeding Management on TMR Systems

Forages should be chopped properly before ensiling. Most forage particles in silage and haylage should range from 3/8 to 3/4 inch in length. Forage particles that are very fine, or grain that is too coarse or whole, should be avoided in the ration. Cows generally sort against long particles due to their less palatable nature and sort for finer particles in the ration. This behavior can lead to metabolic problems such as subacute ruminal acidosis (SARA). Cows consuming the finer particles of the ration are reducing their particle size consumption and, in effect, their NDF intake. These sorted diets contain more fermentable carbohydrates and less effective fiber than the formulated ration. Effectively a sorted TMR is not a balanced TMR, and much of the time, effort, and expense involved in making the TMR is lost when it is sorted by the cow.

It is imperative to develop rations based on current forage analysis reports. Current recommendations are to take the average of at least two separate and independent forage analyses from the same lab before building a TMR. Make ration adjustments when a change in forage is observed; again, this should be based on more than one sample and forage analysis. The dry matter of ensiled material should also be checked frequently. A change in dry matter can alter the TMR drastically, and these changes usually are more long term and progressive.

Accuracy of the scales and mixing system is critical to a TMR system, and a regular maintenance schedule should be planned and executed.

Determining the actual dry matter intake of cows often helps to indicate problems with forage quality and dry matter content. Cows should be within 5% of the expected dry matter intake. If actual dry matter intake exceeds 5% of the expected, that ration should be reformulated. Extremely low intakes may indicate that forage quality and/or dry matter contents have changed and may be a limiting factor to intake.

Marketability

Feeding of a TMR can be highly used in high Dairy producing farms since it increases productivity of the animals due to its vast benefits and hence be able to eradicate poverty and improve the economy at large. Since its inception in the 1950s, it is now the most adopted method for feeding high producing, indoor-housed dairy cows in the world. The formulation used is cost effective since it has included locally available materials to formulate a ration that can still be used by the small scale farmers in Kenya and the world at large.

Budget

Ingredient	**Cost**
Maize germ	80
Cotton seed cake	100
Sunflower meal	70
Wheat pollard	60
Wheat bran	50
Yeast	250
Dcp	150
Nappier	150
Desmodium	200
Calliandra	150
TOTAL	1260
Expected Income	

Use of Agricultural By-Products to Make Wholesum Diet for a Lactating Sow

by Dr. Munene Nderi and Dr. Roselyne Kahindi, Department of Animal Sciences, P. O. Box 109-60400, Chuka

Introduction

Genetic improvement of sows has been significant during the past two decades. Modern sows are not only leaner and heavier but also produce large litter. Conventional wisdom and some experimental data suggest that these sows have lesser appetite and at the same time have an improved capacity for milk production and the demand for milk by larger litter require that the

sow eats more or accelerate the extraction of nutrients from the body tissues. This problem is acute in the lactating first litter gilt.

Statement of the Problem

Lower than the desired voluntary feed intake of lactating sows is a constant problem nagging the commercial swine industry. Many factors such as genetics diet quality, diet composition and environment affect the feed intake of lactating sows. Inadequate feeding during lactating period affects return to estrus and the subsequent litter size.

Objectives

- To maximize milk production to ensure maximum litter growth rate
- To limit the sow weight loss to ensure optimum post weaning reproductive performance
- Keep feed wastage and diet cost low

Discussion

In the interactive effects of energy and proteins it's observed that thin body conditions experienced a delayed return to estrus. Sows fed on high energy and low protein diets during lactations loose similar total body weight but less back fat than sows fed low energy high protein diet. Therefore composition of weight loss may vary depending on which dietary essential, energy or protein is deficient. Energy is the most difficult dietary essential to supply in the diet of lactating sows in adequate amounts. In most cases lactating sows do not consume enough feed to supply their daily energy needs. Lactating sows possess a tremendous drive to produce milk and will cannibalize maternal body tissues to satisfy the energy demand of lactation. As the daily energy increases, loss of body weight declines during lactation and this shortens the interval to first post weaning estrus. The challenge of swine producers is to maximize energy intake during lactation and this can be achieved by increasing the energy density of the diet and or increasing the total quantity consumed. Dietary amino acids supplied in the form of natural protein are necessary to maintain the sow's body, produce milk and support the growth of maternal body tissues. The first two need are essential in the lactating sow. Fulfillment of the third need is differed until gestation when the nutritional need are not so demanding, milk productions consumes the lion's share of the total amino acids needed by the lactating sow. The amino acids needs are proportion to the level of milk production so increasing the amino acids concentration of the lactation diet increases the subsequent size of the litter. The lactating sow meal which is an aggregate of these components and others forms the ultimate feed for the lactating sow.

The aggregates include:

- Maize germ a good source of energy, and if wet grilled they form a supplementary source of protein together with the residue oils
- Wheat pollard is a supplementary source of energy
- Soya bean meal forms the natural source of plant proteins which is more preferred
- DCP(dicalcium phosphate) it's a good source of minerals e.g. phosphorus and calcium
- Canola meal it's a source of protein
- Iodized salt helps to supply iodine essential for proper functioning of the thyroid gland and also helps in the absorption of nutrients form the small intestines to the blood stream
- Premixes is a good source of minerals and vitamins
- Toxin binder binds out the mycotoxins and toxins hence cant harm the animal

Marketability

Commercialized feeds purchasing by farmers is very expensive however, there are still able to meet the nutritional requirement of the sows. Farmers are encouraged to use available agricultural products like the maize, soya bean and rapeseeds for their lactating pigs which are still capable of meeting this nutritional requirement and are readily available, hence lowering the production cost thus maximizing on profit. Our main targets are those farmers who [practice pig production as a business because small scale farmers who mainly use household wastes which do not meet the nutritional requirement and sometimes contains anti-nutritive factors which interfere with the normal digestibility and assimilation of the nutrients.

BUDGET: Costs incurred in making lactating Sow meal

Ingredients	**Input cost**	**Minimum cost**
Maize germ	70	
Wheat pollard	70	
Soya bean meal	80	
Dicalcium phosphate	60	
Lime	100	
Canola meal	150	
Iodized salt	30	
Vegetable oil	130	
Premixes	95	
Toxin binder	70	
Total		**875**

Feeds for lactating pigs

Ingredients	Trial 2	Trial 1	M Energy	Crude protein	Crude fat	Crude fibre	calcium	Phosphorous	Lysine	Methionine	cost
Maize germ	2	1.5	1700	10.6	12.3	15.2	0.1	0.2	0.4	0.3	
Wheat pollard	1.5	1.5	2700	16	4.5	7.5	0.13	0.9	0.48	0.16	
Soyabean meal	2	0.5	2690	35	7.4	2.5	0.26	0.48	0.16	0.14	
DCP	0.5	0.5	0	0	0	0	33	0	0	0	
Canola meal	2.5	2.5	3200	35	3.5	12	4.8	0	0.32	0.5	
Lime	0.5	0.2	0	0	0	0	23.2	0.1	0	0	
vegetable oil	0.2	0.2	0	0	0	0	0	0	0	0	
Iodized salt	0.2	0.15	0	0	0	0	0	0	0	0	
Premix	0.8	0.5	0	0	0	0	0	0	0	0	
Trial 1			3189	28.98	7.53	13.06	6.723	0.382	0.44	0.402	
Trial 2			2083	20.27	5.49	7.665	4.1015	0.276	0.264	0.237	minimum
Specifications			**3200**	**18**	**6**	**12**	**0.7**	**0.5**	**0.6**	**0.3**	

NATURAL MINERAL LICKS *(Mwonyo)* FOR IMPROVED LIVESTOCK PRODUCTIVITY

by Dr. Munene Nderi, Department of Animal Science, Chuka University, P. O. Box 109-60400, Chuka, Email: mnderi@chuka.ac.ke, Phone: +254 722 48 78 87

What are natural "mineral'' licks (Mwonyo)?

Natural mineral licks '*Mwonyo*' are particular sites in the environment which are visited by both ***domestic*** and ***wild animals*** to lick or consume soil. Animals consuming natural licks are argued to obtain *health, reproduction and productivity benefits*

Cattle and goats consuming soils at a natural lick site in Igambang'ombe, Tharaka-Nithi County

Mountain goats (Oreamnos americanus) going towards a natural lick site in Tuchodi forest, Britain

Farmers' perceptions on the natural licks

Livestock owners believe that licks play essential roles in health, reproduction and productivity of animals.

Homemade natural lick block

Goats consuming natural lick block

Research findings on the natural licks in Tharaka-Nithi County

- **There are:**

1. **Highly used licks;** Kibuuri, Kang'au, Kandondo, Gikurwe, Mikame, Maara, Nagundu, Kabariange, Kabuai and Kigwanga
2. **Moderately used licks;** Riankui, Kanduga, Kimenyi, Kieroo and Ikindu
3. **Abandoned licks;** *Thuci*

- **Natural licks contain essential minerals for livestock**

Mean concentrations (mg/kg) of minerals in natural licks consumed by livestock in Igambang'ombe

Lick sites	Ca	Na	K	Mg	P	V	Pb
Kimenyi	**44,445**	7,961	392	**26,640**	13	66	1
Kigwanga	1,614	**11,279**	795	3,392	ND	ND	14
Kibuuri	8,012	2,119	**1,800**	6,941	ND	90	4
Kieroo	19,812	4,756	679	24,427	**67**	56	3
Riankui	12,345	2,777	854	8,968	12	**700**	9
Control	1,125	104	107	3,462	ND	48	7

Key: Ca: calcium, Na: Sodium, K: Potassium, Mg: Magnesium, P: Phosphorus, V: Vanadium and Pb: Lead, ND: Not Detected

There is no difference between goats consuming natural licks and those consuming commercial mineral licks

Effects of Source of Natural Lick on Milk Yield (ml) and Quality in Lactating Goats

		Milk quality (%)					
Lick source	Milk (ml)	Butter fat	Protein	Density	Solids	Lactose	Solid-not-fat
Kang'au	474	3.67	4.39	30.45	0.78	3.69	8.95
Nagundu	373	3.32	4.35	29.46	0.76	3.50	8.67
Kabariange	383	3.67	4.53	29.43	0.77	3.43	8.75
Commercial lick	377	3.63	4.44	29.88	0.77	3.64	8.79

P>0.05, Kang'au, Nagundu, Kabariange

There is need to **demarcate** and **preserve** the natural lick sites as public utility and do more **research** on the potential benefits and environmental impacts

Types of licks in Igambang'ombe

Wall lick

Earth exposure lick

ANIMAL SCIENCES INNOVATIONS

by Patrick S. Adira, Caroline Nkirote Muremera, Nicholas Kioko Mutuma, Samuel Muema, Virginia W. Muigai, Caren K. Nyabuto, Department of Animal Sciences, Faculty of Agriculture and Environmental Studies, Chuka University, P. O. Box 109-60400, Chuka

Acknowledgement
We wholeheartedly acknowledge the Almighty GOD for giving us good health and breathe to have accomplished such an obligation. Secondly, we acknowledge the Department of Animal Sciences courtesy of Dr. Munene and Dr. Kahindi et al for allowing us to present their ideas at the tent exhibitions. Thirdly is to acknowledge the student participants for coming up with other new ideas and making the open week a success.

Urea Molasses Block (UMB)

Introduction

Adequate balanced diet should be provided to ruminant animals like dairy cattle to get desired production such as milk, regular calf, etc. Ruminant animals depend so much on microbial digestion to release the nutrients that are found within the feeds. Poor quality feeds such as cereal straws, poor quality hay, or dry season forage that contains a lot of stem but less leaf can be deficient in crude protein (CP). Insufficient crude protein in the diet means that the microbes within the rumen can't be able to synthesize enough microbial proteins responsible for body maintenance, growth and production among other vital functions in the body.

Statement of the Problem

Livestock production in the recent past has become a challenge for most small scale and large scale farmers due to climatic change observed. Feed scarcity has become a major concern to all farmers who would like to earn a coin in their venture. In the ASAL areas, for example, the effects have been so adverse that several death cases of animals have been recorded. The idea of coming up with a ration that can help these animals from this areas to benefit from feeding on the existing poor quality pastures and for them to also synthesize their own microbial protein as a way of supplementation, is one among the immediate ways of mitigating the situation.

Objectives

1. To provide alternative protein supplementation for the animals.
2. To improve digestion efficiency of animals.
3. To maximize utilization of available feeds optimally.
4. To improve the animals performance in the ASALs and other areas.
5. To umbrella animals from adverse effects of drought.

Application (Methodology)

A urea molasses block qualifies the name because the active ingredients in the block are urea and molasses. The UMB is a protein supplement that contains necessary minerals and vitamins. It provides the Non Protein Nitrogen (NPN) to the rumen microbes with no risk. A 10kg block is prepared as outlined below:

(i) 3.9kg of molasses is weighed and put in a bowl.
(ii) 500g of Magadi/common salt + 1kg of urea is added to the mixture and mixed manually.
(iii) The mixture is left for at least 12hrs.
(iv) 300g of lime is mixed with 4.3kg of wheat bran separately then mixed with the solution mixed 12hrs earlier.
(v) The mixture is now put in a mold for compaction to give it a block appearance.

(vi) The block is then removed from the mold and allowed to solidify and harden for over 15 hrs before it is given to the animals.

(vii) Alternatively, a plate may be used to mold the blocks into a dish-shaped block.

Figure 1: Makiga machine

Figure 2: A mold and a finished UMB

Methods of feeding a UMB

The block is given to the animal to eat by licking. Care should be taken so that the animal cannot bite. By licking the block, the nitrogen level in the rumen remains longer period which increases digestibility of course roughages. Initially, if the animal neither does nor wants to lick the block, it should be habituated by spreading salt or bran on it. A 2.5kg block can be fed tor 4-6 days in case of cattle and 20-40 days for sheep and goats.

Usefulness of feeding UMB

- Increases palatability and thus increases feed intake.
- By feeding UMB, the body weight gain, drought power and milk yield of cattle, sheep and goats increases.
- Increases digestibility and absorbability of course roughages.
- Increases the nutritive value of feeds.
- Animals come on heat earlier.
- If supplied to pregnant animals, healthy and strong calves are born.
- Decreased calving interval in cows.

Precautions

- The block is given to cattle over one year and for goat and sheep of over 6 months of age.
- Cattle should not be given over 500g of the block and for sheep and goats, not more than 100g block daily.
- Blocks never supplied ground form or in drinking water.
- Do not provide to calves and non-ruminants.
- This is not a basal diet and so the animal should be supplied with normal feed and clean water together with the UMB.

Marketability

The innovation is targeting the small scale farmers and large scale farmers who are living in the ASAL areas. The idea is not common in the Kenyan market but with continuous sensitization on the importance of use of such a product, then the farmers will have several challenges associated with giving the animal poor quality feeds. Drought in the larger part of Kenya has affected animals' potential and use of such a product could salvage the situation.

Budget

Ingredient	Input cost/kg/litre(Ksh)	Minimum cost of sale.(Ksh)
Molasses	80	
Urea	70	
Common salt/Magadi	40	
Lime	50	
Wheat bran.	60	
	Total. 300	500

Artificial Colostrum

Introduction

What is colostrum? In the dairy industry, the first milking after calving is considered colostrum while milk produced on the second and third day is called transition milk. Colostrum differs from normal milk in many ways. It's markedly higher in solids fats, proteins, carbohydrates, vitamins but lower in lactose. If intestinal cells are not saturated by colostrum proteins, pathogenic bacteria may reach these sites allowing colonization and if the bacteria reach the absorptive sites before colostrum proteins the calf will be at a greater risk of blood infection, which is fatal.

Importance of Colostrum to the Calf

Newborn calves (as well as pigs, foals, sheep and goats) are born without antibodies in the blood which are critical to the proper functioning of the immune system. Colostrum contains large amount of antibodies and is the primary source of them for the calf. Colostrum is concentrated source of fat (a source of energy), protein (for energy and body growth) vitamins (especially fat soluble vitamins) and minerals. Colostrum also contains hormones and growth factors that may play an important role in the calf growth and health.

Artificial Colostrum

Sometimes when a dam calve it may come down with diseases that affects milk production e.g. Mastitis, the animal may die for examples in cases of chronic mastitis which result to sudden death of the animal or a disease that can be transmitted through milk to the calf and in such situations the farmer should intervene and make artificial colostrum to ensure the calf survives and grow healthy. The objective of making artificial colostrum is to supply the required nutrients to the calf thus ensuring better growth. The types of nutrients needed includes: protein, fats, milk protein and lactose.

Ingredients: Warm water, whole milk, an egg, cod liver oil, and castor oil. Whole milk provides required milk protein and lactose while an egg is a source of protein. The reason behind the use of an egg as source of protein is because egg is an ideal source of protein in terms of balanced essential and non-essential amino acids. Cod liver oil and castor oil serves as sources of energy.

Statement of the Problem

Dairy sector is one of the most embraced enterprises by many farmers in the country. But many farmers mostly the small scale farmers are experiencing many problems which are mainly caused by unreliable rainfall pattern resulting to poor nutrition and nutritional deficiencies resulting to many losses especially to dry cows and lactating cows.

Procedure of Making Artificial Colostrum

- Warm water is mixed with whole milk in the ratio of 1:1 in a clean container
- A teaspoon of cod liver oil is mixed with a teaspoon of castor oil
- An egg is added to the castor and cod liver oil mixture

- The two mixtures are mixed thoroughly

Bottle feeding method can be used to feed the calf the artificial colostrum or bucket feeding method but the calf should be fed according to its body size.

Application

Artificial colostrum can be of great help when the dam either dies, lack enough milk after calving or calves and come down with disease that can be transmitted to the calf through milk. Artificial colostrum can not only be used in bovines but also in other animal species e.g. caprines but the whole milk used should be of the same species.

Marketability

In most parts of the country mixed farming is the main practice where the farmer's rear livestock for milk and manure production and also practice crop production for subsistence food. In such case it's uncommon to find dams calving at the same time because no technology used e.g. synchronizing the animals and if the dam dies she or he will need a source of colostrum to save the calf. Our main target is the small scale farmers who happen to be the majority in the country especially in the central and eastern provinces of the country.

Cost Effectiveness

The ingredients used in making of artificial colostrum are readily available hence it's cheap. Feeding is done according to the body weight of the animal and in most cases you find a calf should take only 2 litres of colostrum per day for only five days.

Water which is one of our ingredient is always available and at no fee while and egg only goes for Ksh. 15, whole milk one litres is only 30 shillings from a farm. The only ingredients which are a little more expensive are the castor and cod liver oil and are only used in little amounts hence the farmer can use 250ml castor oil and cod liver oil for a given period of time.

Unlike milk replacers which are commercially manufactured they are expensive to buy and in some cases the content is adulterated resulting to digestive upsets, reduced performance of the calf or even deaths. Other mistakes may arise when diluting or when feeding resulting to loose dung or temporary non-infectious scours, and because of all these disadvantages artificial colostrum remains the best both in terms of cost friendly and doesn't require technical skills during making.

Recommendation

Because of the limited time I did not manage to get an ingredient to act as source of antibodies to the calf hence I recommend the university to for further research on other ingredients to substitute the one I used and also help find an antibody source.

Budget

Ingredients	**Input Cost**	**Minimum Cost Of Sale.**
Castor oil	110	
Cod liver oil	360	
Whole milk	30	
Eggs	15	
water	0	
TOTAL	515	600

Storing and Handling Frozen Semen

Introduction

Considerable change has occurred within the artificial insemination (AI) industry. The most obvious change was the transition to the straw as the predominant semen package. This package system has several advantages over the ampule. More units can be stored in bulk at the AI organization and in farm semen tanks. The straw system allows more complete delivery of semen during insemination. Probably most important, the straw permits more uniform control of the freezing and thawing process which has led to improved sperm cell recovery. The major disadvantage of the straw system is vulnerability to mishandling.

Semen Tank Management

1. Avoid excessive movement or abuse of the tank.
2. Routinely monitor nitrogen levels and keep a record of nitrogen loss. Remember, even new tanks can have defects and fail.
3. Store the semen in an area with good light but out of direct sunlight. Observe the tank daily. Once a tank fails, nitrogen is lost very rapidly. Plan to have an alternative semen tank available in case of a failure.
4. Keep the tank elevated above the concrete floor or other wet and poorly ventilated surfaces. Corrosion of the outer shell will shorten the functional life of the tank and possibly cause failure.
5. Store only the amount of semen needed for six months

Statement of the Problem

Insemination failures are the major factor affecting dairy cattle farmers in our country. This is due to mishandling of frozen semen stored in liquid nitrogen container and also poor heat detection by farmers. Another major criticism and concern for the warm water thaw is the danger of cold shock caused by mishandling the straw following thawing. Cold shock is the permanent injury to sperm caused by a sudden decrease in semen temperature after thawing.

Objectives

To offer extension services to farmers on causes of insemination failures to farmers.

Functionality

The maintenance of very low liquid nitrogen temperatures in the inner chamber is due to high quality solid insulation material and vacuum in the outer chamber. The inner chamber containing liquid nitrogen is actually suspended from the outer shell by the neck tube. Abnormal stress on the neck tube caused by sudden jarring or excessive swinging motion could crack the tube and result in vacuum loss. Since vacuum is the major insulation component of the tank, a loss of it causes an increase in temperature within the inner chamber and a rapid evaporation of nitrogen. Accumulation of frost at the top of the tank indicates a rapid evaporation of liquid nitrogen.

Adopters

Prospective users of this information are both farmers and artificial inseminator. This will help them gain skills on proper techniques of handling semen.

Animal Welfare through Photography

by Dr. D. C. Kemboi and Certificate in Animal Health Y2S2 Students, Department of Animal Science, Chuka University, P. O. Box 109-60400, Chuka, Kenya.

Introduction

Animal welfare is the well-being of animals. The standards of "good" animal welfare vary considerably between different contexts. These standards are under constant review and are debated, created and revised by animal welfare groups, legislators and academics worldwide. The welfare of any sentient animal is determined by its individual perception of its own physical and emotional state. This applies equally to the huge population of food animals as to the pets on whom we may lavish individual attention. Increasing public concern for action to improve animal welfare has generated the demand for animal welfare science that seeks to improve our understanding of the nature of animal emotions and motivation, and from this, improve the quality of our care. The animal welfare scientist has a responsibility to communicate new knowledge and understanding in a manner that is most appropriate to the full spectrum of individuals in society; those directly involved in the care of animals on farms, in laboratories, zoos and in the home, and finally those who may have little direct contact with animals but derive from them some utility or pleasure.

Five Freedoms of Animal

1. Freedom from Hunger and Thirst

By ready access to fresh water and diet to maintain health and vigor.

2. Freedom from Discomfort

By providing an appropriate environment including shelter and a comfortable resting area.

3. Freedom from Pain, Injury or Disease

By prevention or rapid diagnosis and treatment.

4. Freedom to Express Normal Behavior

By providing sufficient space, proper facilities and company of the animal's own kind.

5. Freedom from Fear and Distress

By ensuring conditions and treatment which avoid mental suffering. The welfare of an animal includes its physical and mental state and we consider that good animal welfare implies both fitness and a sense of well-being. Any animal kept by man, must at least, be protected from unnecessary suffering.

Statement of the Problem

Of huge concern is how farm animals are mistreated both animals used for production such as cattle, donkey and also other research animals used in laboratory. Animals are sentient being and need to be treated well with no suffering or pain.

Objective

Educating both farmers and researchers that animals are sentient being and they should be respected.

Adopters

Teachings on animal welfare including the 5 freedoms of animal are to be adopted by farmers and researchers. Researchers need to ensure they use the minimum number of animal required for experiment without over using lab animals thus causing more suffering.

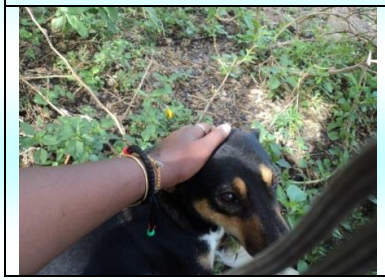
Animal Welfare Freedoms, "A Life Worthy Living for Animals"

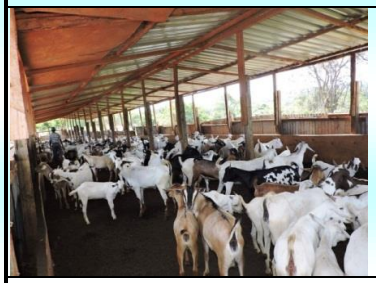
PICTORIAL

Animal Welfare

Means how an animal is coping up with the condition in which it lives. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter

FIVE ANIMAL FREEDOMS (Source: wthn.com)

Freedom from hunger and thirst	
RIGHT	**WRONG**
	
Freedom from pain, injury and disease	
	
Freedom from fear and distress	
	

Freedom from discomfort	
RIGHT	**WRONG**
	
Freedom to express normal behaviour	
	
ANIMALS HAVE FEELINGS TOO	
"You can judge a man's true character by the way he treats his fellow animals" Sir Paul McCartney	

Preparation of Milking Salve Using Locally Available Materials

By Amiani Musungu Email: amianimusungu@gmail.com and Martin Mutembei Email: mutembeimartin@yahoo.com Department of Animal Science, Chuka University, P. O. Box 109-60400, Chuka

Introduction

Mastitis is a common problem in both small scale and large scale dairy farms with the commonest cause being microorganisms which spread from one quarter to the other due to poor milking techniques, lack of adequate hygiene among milking persons and the environment.

Problem statement

The common risk factors that does predispose the udder to infection being poor milking techniques that leave the teats with cracks exposing them to microbial infections To avoid this, use of milking salves is usually recommended to avoid mechanical damages on the teats besides other factors. the milking salve required must be able to meet various basic properties which includes –high melting point beyond the room temperature, prevent entry of microbes both internally and external besides assisting to heal wounds and cracks on the teats.

Objective

To prepare a cost effective milking salve using locally available ingredients materials antiseptic non corrosive with high melting point incorporating herbal extract which are known to be antimicrobial, anti-inflammatory and skin smoothening effect.

Requirements/Ingredients

Lanolin: Skin softener
Petroleum jelly: skin soother, coating of cracks/wounds
Pine perfume: Fragrance
Dichlorophen: Antimicrobial
Packaging containers.
Rosemary oil extracts: Anti-inflammatory/fragrance

Advantages

1. Cost effective: Reduces cost of purchase of milking salve incurred by the university
2. Reduces cases of mastitis in dairy farms
3. Easy to use with a higher melting point over 30^{o}C
4. Protects the user hands.

Disadvantages

1. Expertise of producing.

How To Use

Hand milking:

1. Thoroughly clean udder, teats and hands with clean warm water.
2. Wipe off excess water
3. Apply milking salve generously on the hands before applying on the teats.

Marketability

This product is cheap and superior compared with ones in market, can be locally prepared. It can be used by the following potential consumers: University farms, Dairy Farmers, University Staff

Cost effectiveness

Expenditure items	Total	Quantity	Expected income	Difference
Lanolin (400 g)	1500	Total product = 5 kg	Total product =5 kg Price/ kg = 8300/5 Ksh. 1660 Market price per kg=Ksh. 785 Comparison with market price = Ksh. 875	Difference per kg = Ksh. 785
Petroleum jelly (5 kg)	2000			
Pine perfume (100 ml)	800			
Dichlorophen (50 g)	2000			
Packing containers - 250 ml (10) and 500 ml (5)	1500			
Total	**8,300**			

NB: Our production cost was higher since most of these ingredients are sold in bulk. And hence getting in small quantities is expensive.

References

Mastitis in dairy cows. www.ahdb.org.uk

COMMENTS:

Need to check with KEBS for quality.

Preparation materials not quite locally available but products are great. keep up

Preparation of Antimicrobial Premium (Swipe) Sanitizer Using Locally Available Materials

By Amiani Musungu, Email: amianimusungu@gmail.com and Martin Mutembei, Email: mutembeimartin@yahoo.com, Department of Animal Science, Chuka University, P. O. Box 109-60400, Chuka

Introduction

Microbes are the commonest causes of food borne infections in Kenya WHO estimates 2.2 million deaths occur worldwide due to food borne diseases (WHO). Washing hand with soap and running water is the best way recommended to reduce the number of germs. However with the recurrent cases of water shortages, an easy safe and convenient method of getting rid of the microbes is required. Alcohol based hand sanitizer with alcohol content over 60% can quickly reduce the number of germs (CDC).

Problem statement

Biological laboratories, wash rooms, hand shaking agricultural practical practices and hospital care practices are a common source of acquiring microbes by students and public at large. Staffs in universities setting usually have very little time available between practicals and meals and hence increase in chances of carrying microbes. In the small scale farm setting, microbes can be transferred by milking person's hand between animals in case one or quarter animal infected with mastitis.

Objective

To prepare an affordable effective hand sanitizer using locally available ingredients

Requirements/Ingredients

Ethyl alcohol: Antimicrobial; Hydrogen peroxide: Antiseptic; Glycerin: Skin soother; Tris: Thickener; Tylose: Stabilizer; Erytinozine: Colouring; Fragrance; Rosemary oil extract: Anti-inflammatory/fragrance.

Application

1. This product will come in handy for both students and laboratory staff after laboratory practical's
2. It can be used in wash rooms offices, workshops and hospital setting to avoid nosocomial infections.
3. It can be used by dairy farmers before milking and between milking different cows to reduce spread of microbes causing mastitis

Advantages

1. Effective hand sanitizer with certainty of effectiveness
2. Cost effective: Reduces cost of purchase of hand sanitizers incurred by the university
3. Reduces cases of food borne diseases in students and staff
4. Reduces cases of mastitis in dairy farms
5. Easy to use and portable

Disadvantages

1. Expertise of producing

How to Use

1. Read the instructions carefully.
2. Apply the product to the palm of one hand.

3. Rub the hands together.
4. Rub the product over all surfaces of your hands and fingers until your hands are dry.

Marketability

The product has a wide area of application areas which involve antimicrobial aseptic technique and comes in handy in the following area:

1. University laboratories
2. Staff and students for personal use
3. Hospitals
4. Hotels
5. Schools
6. Community

Cost effectiveness

Expenditure items	**Total**	**Quantity**	**Expected income**	**Difference**
Ethyl alcohol -4.5liters	2000	Total product = 6 liters	Cost per liter=10,700/6=1783 (Ksh. 89.15 per 50 ml) Comparison with market price=4000 per liter(200 ksh. per 50 ml)	Difference per liter = Ksh. 2,217
Hydrogen peroxide-500mls	500			
Glycerin-500 g	500			
Tris-200 g	1500			
Tylose-500 g	2000			
Erytinozine-20 g	500			
Fragrance (lavender)	200			
Dispensers-250 ml (10) and 500 ml (5)	1500			
Total	**10,700**			

References

Hand washing: Clean hands save lives. www.cdc.gov

COMMENTS:

What is the shelf life; has it been tested in the labs to confirm the safety of the new product? Preparation materials not quite locally available but products are great. Keep up

Value Addition in Local Products for Sustainable Development in the Hospitality Industry

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Acknowledgement
We thank God for granting us good health and favor throughout the project. We also pass our sincere regards and to Chuka University, Academic and Research Affairs Division for facilitating us with the resources for carrying out this project and giving us the open week forum for exhibition. Finally we thank a number of staff including Dr Lemmy Muriuki, Mr. Kenneth Munene, Miss Christine Kinyua and Miss Judy Mwikali for their professional guidance and technical support in carrying out the entire project.

Objectives
To utilize locally available produce for domestic consumption and commercial purpose.
To determine the impact of local produce in the hospitality industry.
To determine cost effectiveness of local produce.

Introduction
There is value which can be added to the local produce by either using different methods of cooking other than the usual ways known by the members of the society. This can be in terms of healthy living, creation of employment and having a variety of meals for domestic consumption and commercialization. The produce includes: arrowroots, Green bananas, sorghum, millet and sweet potatoes. In addition, we can enhance meal experience of the local produce through flavor, appearance, taste, smell and texture. This can be done through inclusion of other courses like apple and pineapple flambe desserts, tropical fruit desserts, mocktails and cocktail beverages.

Products
Arrow root-based products nutritional value
Arrowroot is very low in calories. It is free from gluten and gluten free products are used for special food preparation. It contains moderate levels of some essential minerals like copper, iron, manganese, phosphorous, magnesium, and zinc.

1. **Natural arrow root cake**
Ingredients: Arrow root, honey to add flavor and to bind the arrow roots, lemon to add flavor and as a preservative.

Method
Boil arrow roots and slice them into different shapes
Mash a portion of the boiled arrow roots.
Make a paste of honey and lemon juice.
Apply the paste into the sliced arrow roots.
Arrange them in piles and paste using the mashed arrow roots.
Serve as an accompaniment of a hot beverage.

2. Arrow root chapatti
Ingredients: Arrowroot flour, Wheat Flour, Olive Oil, Seasonings.

Method
Mix arrow root flour and wheat flour in the same ration (1.1)
Add seasonings. Add olive oil.
Mix to form a dough.
Portion into different rolls and fry in a pan.

3. Arrow root Ugali
Ingredients: Arrowroot flour, Maize flour, Water

Method
Into boiled water add a mixture of arrow root and maize flour in the same ratio.
Stir the mixture and simmer for 10-20 minutes. Serve when hot.

4. Baked arrow root cake
Ingredients: Arrow root flour, wheat flour, honey, eggs, butter margarine.

Method
Mix flour in the ratio of 1.1.
Add honey and Margarine and mix with the flour.
Add eggs into the mixture and stir to form a paste.
Put the paste in a greased baking tray and bake for 1 hour.

5. Green banana based products
(a) Green banana chapatti
Ingredients: Green banana flour, wheat flour, olive oil, seasonings.

Method
Mix green banana flour and wheat flour in the same ration (1:1)
Add seasonings
Add olive oil.
Mix to form a dough.
Portion into different rolls and fry in a pan.

(b) Green banana ugali
Ingredients: Green banana flour, maize flour, water

Method
Into boiled water add a mixture of green banana and maize flour in the same ratio. Stir the mixture and simmer for 10-20 minutes. Serve when hot.

(c) Green banana cake
Ingredients: Green banana flour, wheat flour, honey, eggs, butter margarine.

Method
Mix flour in the ratio of 1:1.
Add honey and Margarine and mix with the flour.
Add eggs into the mixture and stir to form a paste.
Put the paste in a greased baking tray and bake for 1 hour.
Whisk eggs on a side

(d) Nutritional value

The fruit holds a good amount of soluble dietary fiber that helps in regular bowel movements; thereby reducing constipation problems. Fresh banana is a very rich source of potassium. Potassium is an important component of cell and body fluids that helps control heart rate and blood pressure, countering harmful effects of sodium. Magnesium is also present in banana and is essential for bone strengthening and has a cardiac-protective role as well.

6. Sorghum and Millet based Products

(a) Sorghum and millet chapatti

Ingredients: Sorghum and millet flour, wheat flour, olive oil, seasonings.

Method

Mix sorghum and millet flour and wheat flour in the same ration (1:1)
Add seasonings.
Add olive oil.
Mix to form a dough.
Portion into different rolls and fry in a pan.

(b) Sorghum and millet ugali

Ingredients: Sorghum and millet flour, maize flour, water

Method

Into boiled water add a mixture of sorghum, millet and maize flour in the same ratio.
Stir the mixture and simmer for 10-20 minutes. Serve when hot.

(c) Sorghum and millet cake

I**ngredients:** Sorghum and millet flour, wheat flour, honey, eggs, butter margarine.

Method

Mix flour in the ratio of 1.1.
Add honey and Margarine and mix with the flour.
Add eggs into the mixture and stir to form a paste.
Put the paste in a greased baking tray and bake for 1 hour.

7. Sweet potato-based products

(a) Sweet potato chapatti

Ingredients: Sweet potato flour, wheat flour, olive oil, seasonings.

Method

Mix sweet potato flour and wheat flour in the same ration (1.1)
Add seasonings and olive oil.
Mix to form a dough.
Portion into different rolls and fry in a pan.

(b) Sweet potato ugali

Ingredients: Sweet potato flour, maize flour, water

Method

Into boiled water add a mixture of sweet potato and maize flour in the same ratio.
Stir the mixture and simmer for 10-20 minutes. Serve when hot.

(c) Sweet potato cake
Ingredients: Sweet potato flour, wheat flour, honey, eggs, butter margarine.

Method
Mix flour in the ratio of 1.1.
Add honey and Margarine and mix with the flour.
Add eggs into the mixture and stir to form a paste.
Put the paste in a greased baking tray and bake for 1 hour.

8. Jerusha Kanyua honey bread
Ingredients: 250ml milk, 90 g butter plus extra virgin oil for greasing, 125 ml clear honey, 1 egg, 1 tbspn ground coriander, 1 tsp salt, ½ tsp ground cinnamon, 600 g wheat flour, 10 g instant dried yeast.

Method
Mix flour, ground coriander, salt, yeast, ground cinnamon.
Add butter, eggs, milk and honey and mix together to make dough.
Put in heat to prove
Bake in an oven for 1 hour.

9. Pineapple and apple flambe'
Ingredients: Round sliced apples/pineapples, butter, honey, brown sugar, alcohol as spirit

Method
Melt butter in a source pan
Add brown sugar into the melted butter
Add sliced apples / pineapples into the pan
Add a little alcohol inform of spirit and expose the pan into the fire to produce a flame
After the apples or pineapples have turned brown, remove from the fire
Curve the dessert to serve

10. Mocktails
A mock tail refers to a mixture of a non-alcoholic drink
(a) Chuka orange iced tea
Ingredients: Orange juice, grenadine syrup, iced tea, orange slices
Ingredients: Lime juice, sprite, lemon peels
Method: Mix the above in a cocktail shaker and shake to get the final mixture

(b) Chuka special (mixed fruits blended)
Ingredients: Mangoes, ripe bananas, water melon, pineapples, oranges, avocado
Method: Slice the above fruits in a blender and blend them together

(c) Banana smoothie
Ingredients: Ripe bananas, Warm milk, Honey
Method: Mix the ingredients in a cocktail shaker

11. Cocktails
A cocktail refers to a mixture of alcoholic drinks
(a) Screw driver
Ingredients: Vodka, orange juice

(b) Chapman
Ingredients: Sprite, lemon juice, grenadine syrup, kenya cane
Method: Mix the ingredient together in a cocktail shaker

Application of these products
The products making can lead job creation either as self-employment or being employed in a commercial establishment such as hotels. They are used for health value as they are of high rich in nutrients. The recipe for preparing these products can be used in hospitality industry which has shifted to western cuisines and neglected African cuisines. The products can be used for both commercial and domestic purposes. For baked arrowroot, green banana and sweet potato cake, we mixed wheat flour with the natural flour. These products are healthy for consumption since gluten effect found in wheat flour is neutralized by the natural flour.

BUDGET FOR THE PRODUCTS

ITEM	QUANTITY	UNIT PRICE	AMOUNT
Eggs	2 trays	360	720
Milk	10 pkts (500ml)	70	700
Wheat flour	6 kg	60	360
White pepper	1 tin	300	300
Sunflower oil	3 litres	180	540
Olive oil	2 litre	500	1,000
Dried thyme	1 tin	120	120
Butter	3 blocks (500g)	450	1,350
Honey	3 tins (500ml)	350	1,050
Ground coriander	1 tin	120	120
Salt	1 kg	30	30
Ground cinnamon	1 tin	120	120
Ground clove	1 tin	120	120
Brown sugar	2 pkts (500g)	120	240
Viceroy brandy	3 bottles (750 ml)	600	1,800
Icing sugar	3 pkts	110	330
Pure Glycerine	1 bottle	70	70
Gelatin	1 tin	120	120
Gin	1 bottle	700	700
Vodka	1 bottle	700	700
Rum	1 bottle	1200	1200
Whisky	1 bottle	700	700
White wine	1 bottle	700	700
Red wine	1 bottle	700	700
Angostura bitters	1 bottle	300	300
Grenadine syrup	1 bottle	200	200
Lime cordial	1 litre	180	180
Sprite	2 litre	150	150
Coca cola	2 litre	150	150
Vermouth	1 bottle	1300	1300
Cocktail cherries	2 tins (green and red)	250	500
Arrow roots	5 kg	100	500
Aubergine	½ kg	150	75
Butternuts	2 pieces	80	160
Courgettes	½ kg	150	75
Fresh coriander	3 bunches	30	30
Fresh ginger	½ kg	300	150
Garlic	½ kg	300	150
Green apples	30 pieces	30	900
Lemons	10 pieces	10	100
Limes	10 pieces	20	200

Onions	2 kg	85	170
Oranges	10 pieces	30	300
Pineapples	10 pieces	1500	1500
Red chile	¼ kg	100	25
Red pepper	½ kg	200	100
Sweet potatoes	10kg	100	1000
Water melon	5 pieces	150	750
Aluminium foil	2 rolls	500	1000
Bread knives	2 pieces	200	400
Charcoal	1 debe	300	300
Cling film	1 roll	800	800
Cocktail umbrellas	1 pkt	300	300
Cooking gas	6 kg refill	1000	1000
Ice bucket and tongs	2 pieces	500	1000
Pallete knife	1 piece	600	600
Pizza cutter	1 piece	500	500
Serviettes	4 pkts	80	320
Straws	1 pkt	90	90
Toothpicks	4 pkts	25	100
Water jug (glass)	5 pieces	400	2000
Facilitation fee		4,000	4000
			35,165

Conclusion

Through the utilization of this locally available produce, we found out that they can be used to get various products which are of great impact to the society and the economy. These products can enhance sustainability not only to the current generation but also to the future generation. with knowledge and understanding of their value, they also lead to startup of companies for manufacturing of the flours to ensure the produce are available in and out of season and in all parts of the country.

Recommendation

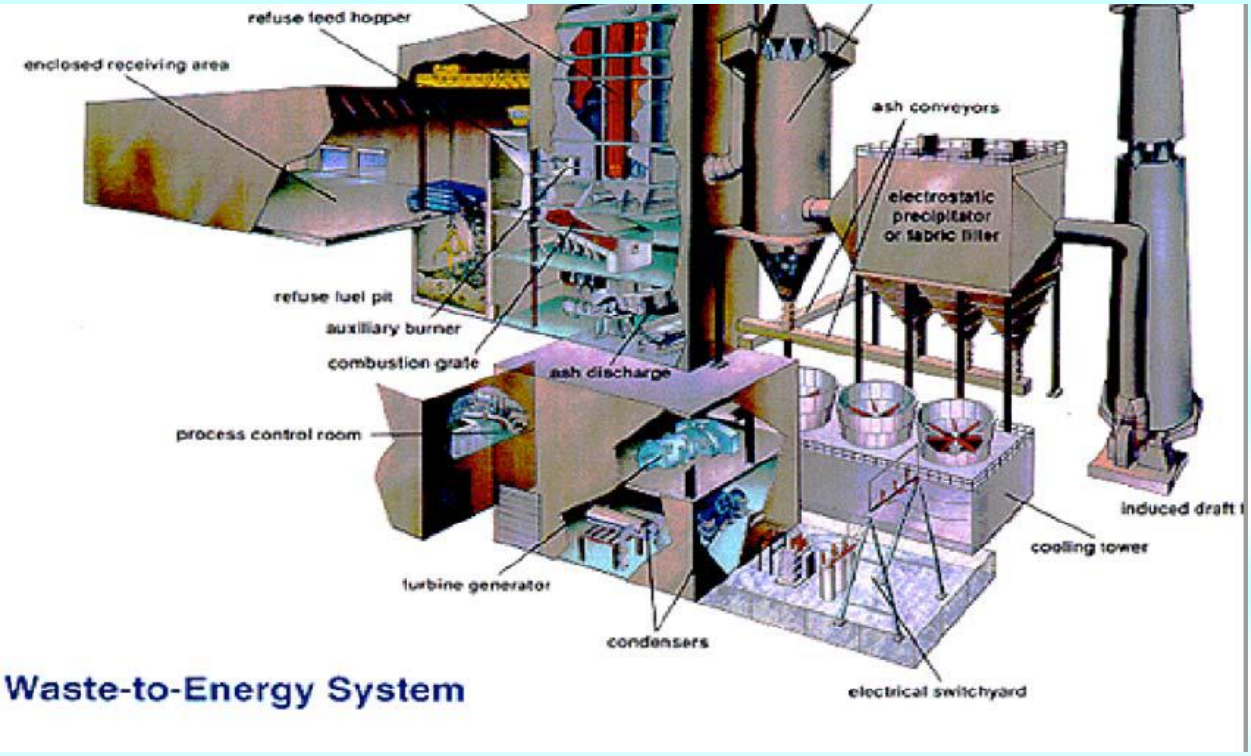
We recommend these products to the members of the public, to hotels and other commercial premise for healthy living. To our institution we recommend more open week forums with proper advertisement to ensure awareness is created.

COMMENTS:

They can include photos so that one will appreciate what was being talked about.
The flow of the presentation could change so that they start importance and nutritive value of key ingredients before explaining the products.
Good presentation but work on marketability.
Carry out cost effectiveness of acceptability.
In all cases, indicate quantities of the ingredients being mixed.

Integration of Solar Powered and Plasma Enhanced Gasification System on Municipal Solid Waste Processing & Energy Generation in Mt. Kenya Region

1. ***Dr. Lemmy, M. Muriuki, Chuka University- PI/Project Coordinator, Tourism Management)***
2. ***Dr. Moses Muraya, Chuka University- Plant Science aspects***
3. ***Dr. Joel M. Gichumbi, Chuka University- Chemistry aspects***
4. ***Ms. Lucy, K. Mureu, Chuka University- Conservation aspects***
5. ***Mr. Jafford, N. Rithaa, Chuka University- Conservation aspects***
6. ***Dr. Stephen Muchina, Karatina University- Finance aspects***
7. ***Prof. Adiel Magana, Chuka University- Biological aspects***
8. ***Prof. Veronica Nyaga, Chuka University- Psychology, social aspects***
9. ***Dr. James Mutegi, IPNI- Soil Science aspects***
10. ***Dr. Paul Kamweru, Chuka University- Physics aspects***
11. ***Dr. Cyprian Njue, University of Brighton, UK.- Geology aspects (A partner Institution)***



Introduction

This research provides more robust measurement and monitoring criteria for MSW effects on water, soil and air quality in the Mt Kenya Region (MKR). Previous studies document subsequent effects of waste management on the soil and aquatic ecosystem while suggesting more sustainable waste management criteria. Water treatment and soil treatment often neglected. Extensive research has been carried out on the economic utilization of MSW in developing countries hence demonstrating the opportunities for waste regeneration (Kelessidis, Alexandros, Stasinakis & Athanasios, 2012; Mills, et al, 2014). Many developing countries still face the environmental challenge of MSW due to inappropriate waste management systems and inefficient legislative support. This study examines waste types, quantities, collection approaches and utilization regimes. It finally evaluates the potential processing of MSW for energy recovery and power production. Plasma assisted gasification is suggested as a more sustainable approach of MSW energy generation.

Project Objectives

To establish the types of solid waste generated, quantities and existing collection options in selected urban centres in MKR

To determine the effects of MSW on water, soil and air quality

To determine the existing Municipal Solid Waste utilization methods in MKR

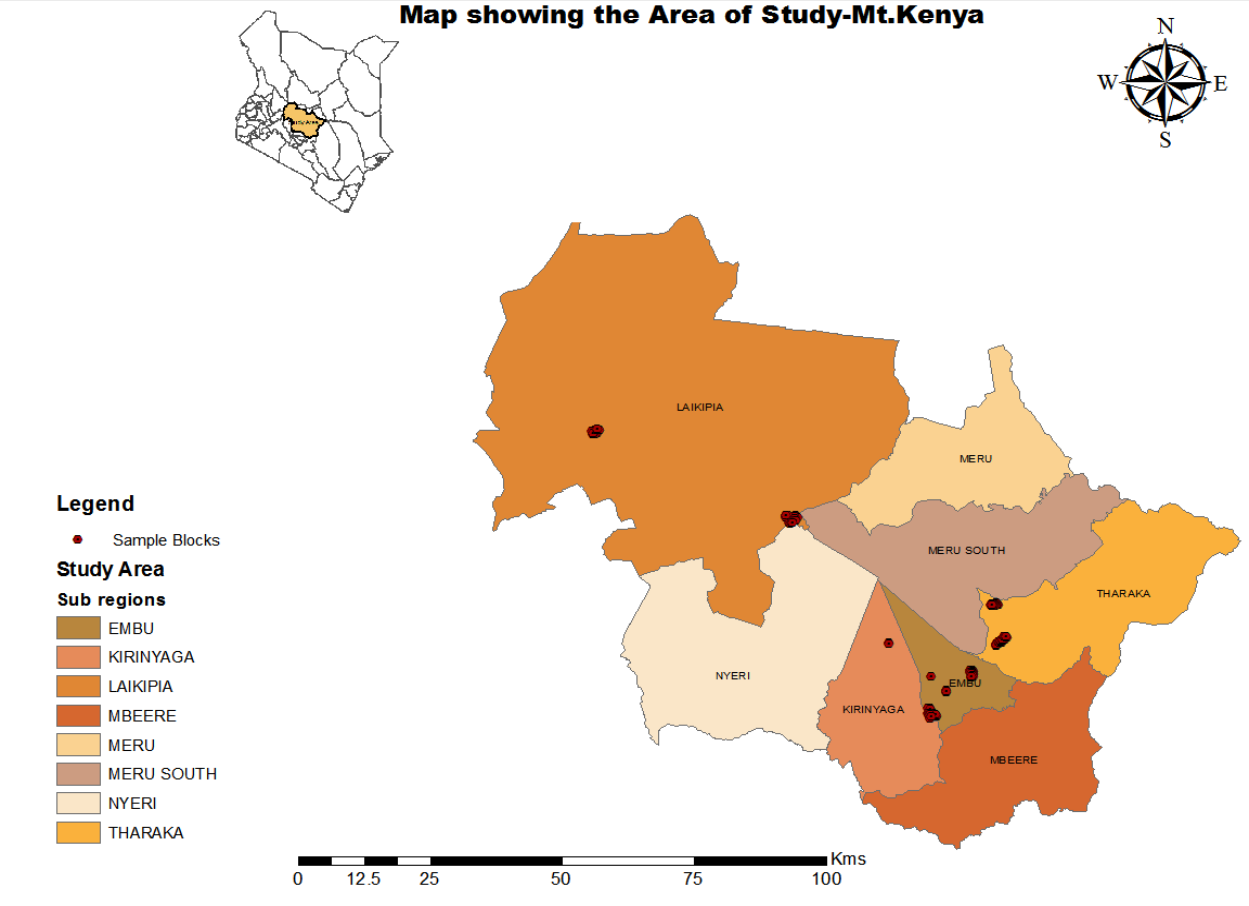
To assess the relationship between quantities of solid waste and energy generated in MKR

To develop a model solar powered and plasma enhanced gasification plant in Tharaka-Nithi County, Kenya.

Methodology

Quasi factorial experimental research design laid out in a randomized complete block design was used to select the sites. It involved mapping 3 counties, with 2 sites in each county. 6 sites were selected: Nanyuki and Rumuruti in Laikipia; Chuka and Chogoria in Tharaka-Nithi, Embu and Runyenjes in Embu County.

Site characteristics



Sampling procedures

8 blocks measuring 500* 500 meters were made in each of the 6 sites totalling to 48 blocks. 4 soil samples were picked from each of the 48 blocks totalling to 192 soil samples. 9 river water samples and 9 stream river samples were picked from each of the 48 blocks. This totalled 3,888 water samples. Experiments were carried out for collecting water samples and soil samples in Rumuruti only. Data collection is pending in the other 5 research sites. The study determined the pH, electoral conductivity, BOD, COD, microbial composition, nitrates, sulphates, Phosphorus, Iron and heavy metal contaminants (Pb, Al, Zn, Ni, Mn).

Data collection
Transects of 2 km were established to in areas with rivers and streams. Grab sampling was used for the water samples, BOD bottles were used in the collection (in triplicates) at each transects. Soil samples were collected in each sub-plot (1-15 cm, 16-30 cm) depth

Preliminary results
Preliminary results indicate that plastic bottles and bags contributed to the highest quantities of MSW (64%) food waste (23%) dippers (11 %) and other waste types (2%). Disposal on compounds and dug out pits were the most common disposal strategies. Feeding animals and sale of scrap metal were the most common waste utilisation methods. Preliminary results revealed that waste reduction was the most appropriate MSW management strategy.

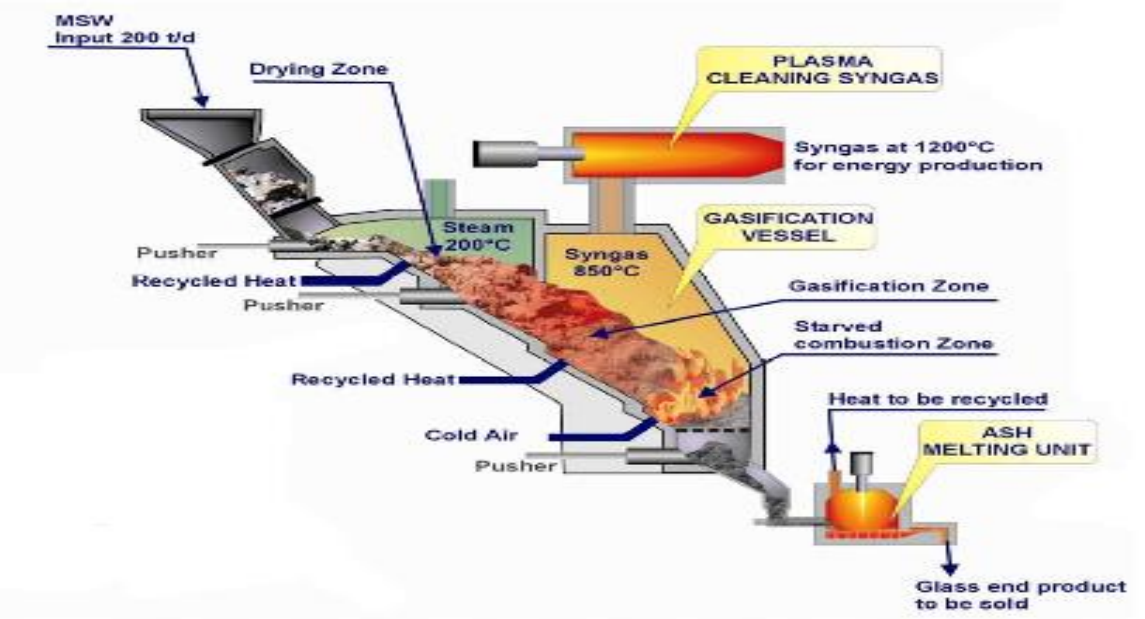
Results- water data
Water data from Rumuruti samples indicated differences in stream and river pH, dissolved oxygen and electrical conductivity. This is indicated in the table below.

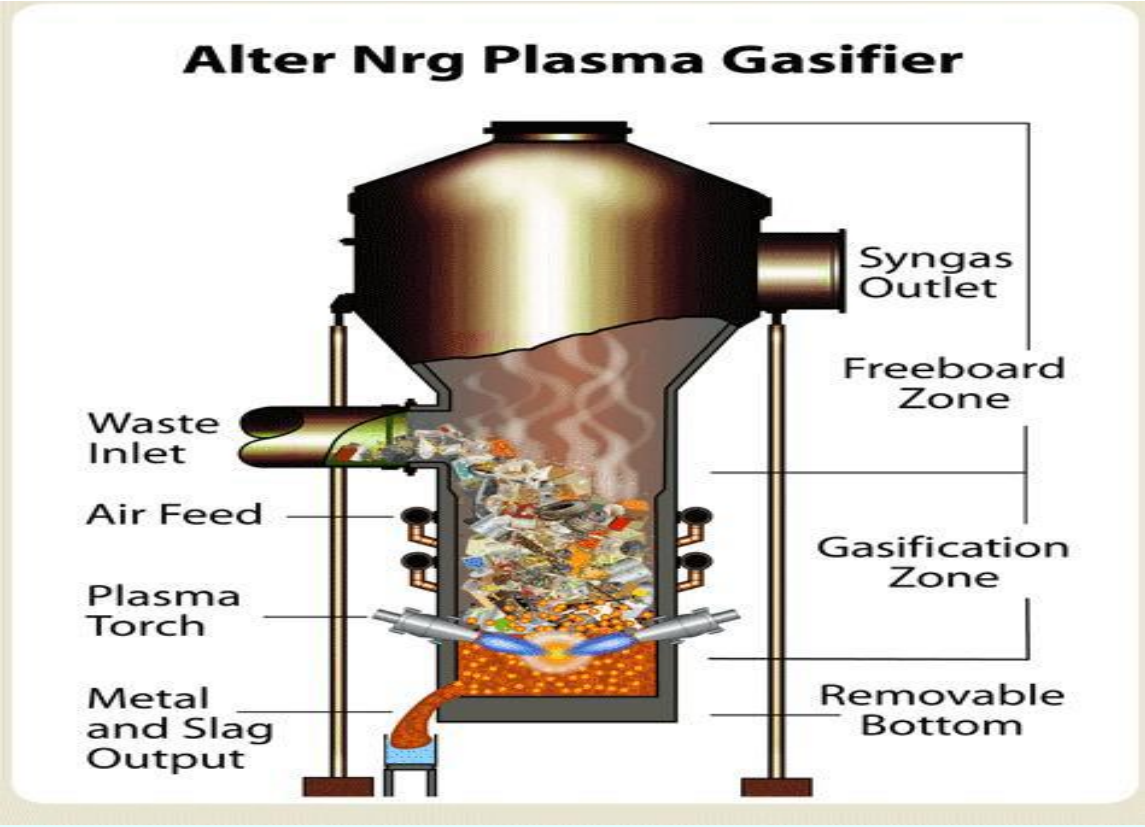
Stream Transect (TR) Grab (GR)	**pH**	**DO**	C μs	**River pH**	**DO**	C μs
TR1 GR 1	7.80	4.00	164	7.64	4.06	356
TR1 GR 2	7.80	4.16	164	7.73	4.09	356
TR1 GR 3	7.90	4.18	164	7.64	4.10	356
TR2 GR 1	7.96	4.00	170	7.72	4.18	366
TR2 GR 2	8.05	4.45	170	7.74	4.14	366
TR2 GR 3	8.11	4.43	170	7.66	4.09	366
TR3 GR 1	7.51	4.40	180	7.67	4.19	157
TR3 GR 2	7.51	4.36	180	7.61	4.20	157
TR3 GR 3	7.20	4.30	180	7.58	4.24	157

Results
Water and soil samples for the preliminary study are being analyzed in Chuka University (for biochemical parameters). More samples will be analyzed in Kenya Mines laboratory. As more analysis is being undertaken, the researchers have proposed an integrated waste management system (WTE)

GASIFICATION AS A CLEAN ENERGY METHOD
Gasification minimizes the emission of Carbon dioxide, hence prevents greenhouse effect
The chemical processes and outputs are indicated below;
Combustion
$C+ O_2 \rightarrow CO_2$
A flame is produced

Gasification
$C+1/2\ O_2 \rightarrow CO$
$C+CO_2 \rightarrow 2CO$
$C+H_2O \rightarrow CO+H_2$
Syngas is produced.





WTE approaches	Conventional Combustion	Grate Gasification	Plasma (WPC)	Plasma (In EnTec)	Plasma (Europlasma)
Feed stock	MSW	MSW	MSW/ASR + met Coke	MSW	MWS/Industrial waste
Oxidant	Air	Enriched Oxygen	Enriched Oxygen	Enriched Oxygen	Air. CO_2
Energy for kWh/tonne	plasma torch of MWS	NA	115.20	34	133
Composition	of syngas (%)				
CO	-	41	31.50	41.40	41

CO_2	-	13.80	8.33	16.60	4
N_2	-	NA	12.10	5.60	14
H_2	-	33.70	16.20	34.80	33
CH_4	-	4.10	1.00	0.10	NA
H_2S	-	0.13	0.02	NA	NA
HCL	-	0.13	0.03	0.00	NA
H_2O	-	6.30	29.20	1.50	8
Economics Per tonne of	(USD) MSW				
Net power Out (kWh)	500	533	617	450	500
Capital cost	60	76.8	81	76.8	86
Labor costs	10	10	10	10	10
Variable costs	28.8	43	32	43	53
Sale power	50	53.3	61.7	45	50
Sale of slag /metal	2.25	2.47	2.47	2.47	2.47
Net benefit	19.05	- 8.68	6.72	- 16.98	- 30.15

Solar enhanced gasification

This project modifies the plasma gasification approach by installing of solar powered reflectors system for the input power. This will reduce the electricity costs with more than 60% while cutting on the aggregate variable costs. It also proposed the reduction of plasma torches from 4 (in latest plasma gasification systems) to 2. This will minimize the capital costs to about 20%.

Market Overview

The immediate market will include local households in Tharaka- Nithi, Embu and Laikipia counties. Key competitors include; Kenya Power Company and KENGEN Company. Penetration pricing will be developed at the first year of operation, then average cost pricing will be used in the second and third years of operations. Value- added pricing will later be used in the fourth and 5^{th} years of operation.

Licenses and Taxation

Various licences shall be required to operate the gasification plant upon its due completion. These include; Public health inspection certificate, County administrative approvals, NEMA licence and National Construction Authority permits. Importation of gasification machines and equipment will require payment of VAT

Implementation Strategies

The project finance approach of privatization shall be applied in the construction. A private developer will be contacted to develop a gasification plant in each of the county. Partnership arrangements between the institutions will enhance efficiency in supervisory roles. After the construction, a 5 year management contract will be given to the private operator to use the facility (2019- 2024). Later operation of the plant will be by the respective county government.

Risk Analysis

Electricity input costs (variable costs) and Installation of plasma torches (capital costs) will contribute to high cost incurrence. Solar power will therefore be used to subsidize the electricity costs. The number of plasma torches will also be reduced from four to two. The sale of recyclables and slag before gasification will enhance the revenue from the plant. In the 3^{rd} year of operation, the private operators will be charged for the waste received for processing. Construction of the gasification plant will contribute to noise pollution and increased air

particulate. In mitigation, the site will be located at least 5 kilometres from the town and far from human settlements. Environmental Impact Assessment will be undertaken by NEMA in order to determine its environmental feasibility.

TIME/ ACTIVITY	Jan-Nov 2016	Dec 2016-Mar 2017	May-Nov 2017	Dec 2017 Dec 2018	Jan- Mar 2019	Apr 2019	May 2019-2024
Pilot study-prefeasibility							
Data Collection, analysis and reporting							
Plant feasibility tests/ EIA							
Plant development under project finance							
Environmental Control tests							
Plant operation under management contract							

COMMENTS:

Since this was not a scientific conference, the presentation should have been simple enough for consumers or market.

Please check on adoption-compare to KPLC & solar energy.

Making a Home-Scale Biogas Digester

by Patrick Mwangi Ng'ang'a, Justin Mugendi, Samson Chabari and Bernard Soi, Chuka University, Department of Environmental Studies and Resources Development, P. O. Box 109-60400, Chuka

Introduction

A biogas plant/digester is an anaerobic digester of organic material for the purposes of treating waste and concurrently generating biogas fuel. Biogas is a clean, efficient, and renewable source of energy, which can be used as a substitute for other fuels in order to save energy in rural areas. The treated waste is a nutrient-rich, nitrogen-rich fertilizer, while the biogas is mostly methane gas with inert gases including carbon dioxide and nitrogen.

Purpose of the Project

To showcase a project inventory to promote science and environmental oriented programmes such as animal science, plant science and environmental studies to solve social, economic and environmental problems facing the community.

Social Purpose

1) ***Conflict resolution*** – reduced conflict among the community members in firewood/fuel-wood harvesting/collection.
2) ***Unity*** – bring community members together to harmonize the resources used in biogas production assuming it is a community project.
3) ***Change in culture*** – shift from using fuel-wood/firewood to using biogas.

Economic Purpose

1) ***Employment*** – short-term employment in the initial stages of the project
2) Economical utilization of resources which will have otherwise been useless such as the domestic wastes
3) Valuable by-products that is, manure and the gas for cooking, lighting and heating

Environmental Purpose

1) ***Reduced pollution*** – biogas plant/digester and the use of its by- products emits low greenhouse gases
2) ***Reduced deforestation*** – it is an alternative to firewood/fuel-wood energy sources
3) ***Reduced damping*** – domestic wastes are use reducing accumulation

Statement of the Problem

In recent decades there has been a rapid human population growth in Kenya, both in the urban areas and within the rural areas. These has increased the use for fuel-wood, natural gas and charcoal production as well as increased damping of domestic wastes. The environment has become degraded as a result due to rampant pollutions and greenhouse gases emission hence climate change and high costs of living due to high cost of fuel which is essential for domestic purposes of cooking, lighting and heating. There is a need to overcome these challenges and therefore these idea of making a home-scale biogas digester will be ideal to reducing fuel wood, natural gas and charcoal burning as well as increased domestic wastes damping habits towards promotion of a healthy, sustainable and a cost effective energy source – biogas to the locals.

Objective of the Project

The project will be undertaken in line with the following objectives;

General objective

1) To make use of the domestic wastes

Specific objective

2) To generate new form of energy (biogas)

Application/Functionality

The biogas plant of five main structures or components:

a) Inlet Tank
b) Digester Vessel
c) Dome
d) Outlet Chamber
e) Compost Pits.

The required quantity of feedstock and water is mixed in the ***inlet tank*** and the slurry is discharged to the ***digester vessel*** for digestion. The gas produced through methanogenesis in the digester is collected in the ***dome.*** The digested slurry flows to the ***outlet tank*** through the manhole. The slurry then flows through the overflow opening in the outlet tank to the ***compost pit.*** The gas is supplied from the dome to the point of application through a pipeline (Karthik Rajendron et al, 2012) (Jyothilakshmi .R. et .al, 2013).

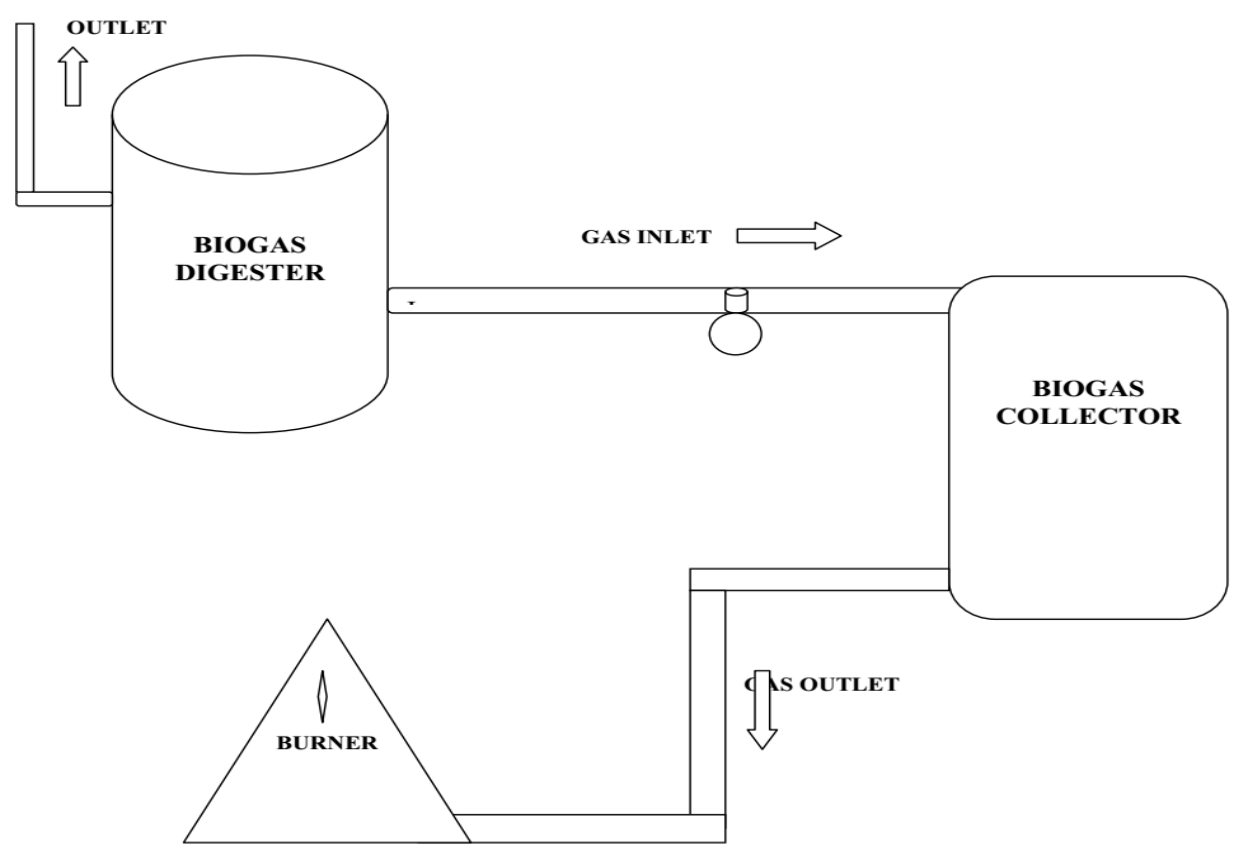


Figure 3: Biogas plant structure

Figure 4: Biogas plant picture (exhibition item)

The digestion process (anaerobic digestion) of the plant involves four different steps

a) hydrolysis,
b) acidogenesis
c) acetogenesis, and
d) methanogenesis.

In hydrolysis, complex carbohydrates, fats, and proteins are first hydrolyzed to their monomeric forms by exoenzymes and bacterial cellulosome.

In the second phase (acidogenesis), monomers are further degraded into short-chain acids such as: acetic acid, propionic acid, butyric acid, isobutyric acid, valeric acid, isovaleric acid, caprionic acid, alcohols, hydrogen, and carbon dioxide.

During acetogenesis, these short-chain acids are converted into acetate, hydrogen, and carbon dioxide.

In the last phase, methanogens convert the intermediates produced into methane and carbon dioxide. Almost one-third of methane formation is due to reduction of carbon dioxide by hydrogen. The digestion (anaerobic digestion) depends on several different parameters for an optimum performance. Some of these parameters are: pH, temperature, mixing, substrate, C/N ratio, and hydraulic retention time (HRT). Digestion is a slow process and it takes at a minimum of three weeks for the microorganisms to adapt to a new condition when there is a change in substrate or temperature. A symbiotic relationship is necessary between the hydrogen-producing acetogenic microorganisms and the hydrogen-consuming methanogens. Furthermore, a neutral pH is favorable for biogas production, since most of the methanogens grow at the pH range of 6.7–7.5. Temperature is also an important factor in the biogas production. Most of the acid forming microorganisms grows under mesophilic conditions; however, for methanogens, a higher temperature is favorable. (Karthik Rajendron et. al, 2012)(Jyothilakshmi et al., 2013). Mixing is also an essential parameter for biogas production. Too much mixing stresses the microorganisms and without mixing foaming occurs. Methane-forming microorganisms grow slowly, with a doubling time of around 5–16 days.

Marketability

Biogas digester is applicable to community members, in homes, farms and in the rural areas. It is sustainable, affordable and has no negative effects on people's health and on the environment. It also makes use of the Social, economic and environmental knowledge; Technology and research thus those in social, economic and environmental disciplines are also significant in these project undertakings and implementation. Biogas has a wide use some of which are well known in Kenya. These includes: Gas-powered refrigerators or a chicken incubator which are run on household biogas and use for cooking, lighting and heating.

Several key ministerial sectors are also important in use, support and implementation of this project as it is a crucial initiative to these sectors mandates. These ministerial sectors are; Agricultural sector where the project will act as an initiative towards sustainable agricultural practices and the environmental sector acting as an initiative towards clean energy and a clean environment. The plant/project shall also involve government (both local and national government) in their initiatives and efforts towards achieving the sustainable development goals that is:SDG 2: Eradicating extreme poverty and hunger; SDG 3: Good Health; SDG: 7 renewable energy; SDG:9 industry, innovation and infrastructure and SDG 13: Climate action.

Cost Effectiveness

The project plant (home scale biogas digester) is easily portable, requires low construction cost. It is easy to installation, Easy to handling and readily adaptive to existing environmental conditions. The plant is ideal and operating semi-continuously with a HRT between 20 and 30 days and requiring low solid contents which normally vary between 11 and 14%. The key budget for the plant is low and most economical in the long run. The budget will include:

Item	**Quantity**	**Unit price**	**Cost**
50 Liter Bucket	2	400	800
20 Liter Bucket	1	250	250
6 Meters Delivery Pipe	1	150	900
Valves	3	400	1200
3inch PVC pipe	1	700	700
Gas Burner	1	500	500
Conta-glue	1	250	250
Labour	1000		1000
Total			**5600**
One unit of the fully assembled biogas digester is expected to sell at			8,000
Thus generating an income of			**2,400**

References

Jyothilakshmi .R. et .al. (2013). Portable Biodigesters. *International Journal of Innovation Research in Science, Engineering and Technology, Vol. 2 Issue 8*.

Karthik Rajendron et. al. (2012). Household Biogas Digester- A review. *Energies ISSN:1996-1073*, 2911 -2942.

COMMENTS:

Balance slides on each slide; how adaptable and cost effective are these biogas digesters? Improve on statement of the problem (SMART).

Making a Cost-Effective Charcoal Cooler/Fridge

By Eunice Wanjiku Kamau, Reg. No. DB2/12421/13, Justin Mugendi, Samson Chabari and Bernard Soi, Chuka University, Department of Environmental Studies and Resources Development, P. O. Box 109-60400, Chuka

Introduction

A fridge is a household appliance consisting of thermally insulated compartments and heat pump that this makes the inside of the fridge to be cooled to a temperature below the ambient temperature of the room. Refrigeration is an essential food storage technique in developed countries. The low temperatures lower the reproduction rate of bacteria and thus reducing the rate of food spoilage. transfers heat from inside the fridge to the outside essential for food storage A charcoal cooler will uses the principle of evaporative cooling to maintain a cool interior temperature for refrigeration and food preservation in areas where electricity is unavailable. Food refrigeration is a developmental need in hot climate areas. Preservation of food through refrigeration can help with hunger and starvation in developing world by keeping foods fresh longer. In areas with no electricity, refrigeration is particularly more challenging and has led to the design of a charcoal refrigeration device.

Typical refrigerators are kept around 2-3 degrees Celsius while a charcoal fridge is not typically capable of maintaining temperatures of 2-3^{o}C but can be significantly cooler than ambient temperatures about 5-10^{o}C depending on prevailing climatic conditions. Charcoal doesn't cool; the evaporation of water provides the cooling because water requires energy to evaporate. The energy comes from sunshine; evaporation cools the water in the coal, and also the space surrounded by the coal. The reason why charcoal makes excellent material for a refrigerator is that charcoal absorbs water like a sponge, and its color absorbs heat from the surrounding. The coal doesn't get used up in the cooling process; hence there is no need to be concerned about environmental impact of making charcoal for this purpose

Statement of the Problem

Food refrigeration is a developmental need in hot climate areas. Preservation of food through refrigeration can help with increased hunger and starvation in developing world by keeping foods fresh longer. In areas with no electricity, refrigeration is particularly more challenging and need to use alternative methods that can prolong the shelf life of foods. the charcoal cooler provides a potential solution to this problem.

Objective

To curb the refrigeration challenge of food in areas with no electricity as in developing countries.

Functionality

The charcoal cooler/fridge is designed to lower air temperature when the charcoal wall is moistened, air moving across the charcoal wall picks up moisture and its temperature is lowered and hence the inside of the structure becomes cooler. Relative humidity affects the functioning of this charcoal cooler, as the relative humidity of the air increases the performance of the system, that is, its cooling capability declines limiting its application in moist places, as humidity increases the temperature differences between the outside and the inside of the chamber decreases. To test if evaporative cooling will be effective, the wet bulb temperatures can be measured by placing a moist cloth on the end of a thermometer and waving it through the air. The temperature read by the thermometer is the theoretical minimum temperature that can be achieved through evaporative cooling. Evaporative cooling is most effective in climates where relative humidity is less than 30%. The site onto which a charcoal cooler is to be built should be

considered carefully since this will influence its operation. This device rely on air movement in order to be effective, thus it should not be placed in locations which receive little or no wind.

Marketability

The charcoal fridge can be used by almost every home in the local community because of its simplicity, acceptable level of efficiency and low running cost. Most areas in Kenya have a relative humidity lower than 30% therefore geographically it can be used widely. The budget for one unit of the charcoal cooler is as follows:

Item	**Quantity**	**Unit price**	**Cost (KSh.)**
Long 6ft Timber-frames	12	132	1584
Galvanized metal sheet	7 meters	250	1750
Nails	2kgs	100	200
Chicken wire mesh	6 meters	100	600
Charcoal	1½ bags	1100	1650
Labour			2000
Total		**7784**	
One unit of the charcoal cooler is expected to sell at			9,000
Thus generating an income of			**1,216**

Cost Effectiveness

The cooler reduces the spoilage rate and allows for more time for sale of perishable goods by maintaining low temperatures. Very little maintenance is required however when first constructed the cooler should be monitored to ensure effective moistening of the charcoal. Inspection of charcoal will show if it is moist as wet charcoal has a shiny appearance.

References

Francis O.Wayua et. al. (2012). Design and Performance Assessment of Low Cost Evaporative Cooler for Storage of Camel Milk in Arid Pastrol Areas of Kenya. *International Journal of Food Engineering*.

Rakesh. B. K. et. al. (2013). Study and Fabrication of Charcoal Cooling System.

COMMENTS:

Good innovation for use especially outdoors for horticultural produce in the farms. It is already known. What is remaining is adoption. Work on tackling challenges impeding adoption.
Improve on statement of the problem and identify problem being solved in research.

Household Water Treatment with *Moringa oleifera*

by Virginia Kavuu, Brian Owino and Martha Emojong, Department of Environmental Studies and Resources Development, P. O. Box 109, Chuka

INTRODUCTION

Using natural materials to clarify water is a technique that has been practiced for centuries and of all the materials that have been used, seeds of the Moringa have been found to be one of the most effective. Studies have been conducted since the early 1970's to test the effectiveness of Moringa seeds for treating water. These studies have confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity.

Moringa oleifera seeds treat water on two levels, acting both as a coagulant and an antimicrobial agent. Moringa works as a coagulant due to positively charged, water-soluble proteins, which bind with negatively charged particles (silt, clay, bacteria, toxins, etc.) allowing the resulting "floes" to settle to the bottom or be removed by filtration. Moringa also acts directly as growth inhibitors of microorganisms. Water treatment with Moringa solutions will remove 90-99.9% of the impurities in water (Schwarz, 2000).

PURPOSE OF THE PROJECT

To showcase a project inventory to promote science and environmental orientated programmes such as environmental science in order to solve social, economic and environmental problems facing the community.

Social purpose

1. ***Conflict resolution based on water problems*** – reduced conflict among the community members in limited fresh potable water sources by treating wastewater rendering it safe for use
2. ***Environmental Unity*** – To embrace the planting of *Moringa oleifera* by community members to obtain associated benefits other than use in water treatment.
3. ***Change in culture*** – shift from using alum for water treatment to using *Moringa oleifera* seeds.

Economic purpose

1. ***Employment*** – through income generated from sale of moringa seeds
2. Economical utilization of tree products such as the seeds from moringa tree
3. Valuable by-products for instance oil for cooking and making soap
4. Reduced cost of water treatment by using locally available resources

Environmental purpose

1. ***Minimise impact of climate change*** – The tree acts as a carbon sequester thus reducing amount of carbon in the atmosphere
2. ***Increase afforestation*** – it aims at increasing total tree cover in an area
3. ***Aesthetic value*** – Moringa is an ornamental tree that adds beauty in home compounds

Statement of the Problem

In recent decades there has been a rapid human population growth in Kenya, both in the urban areas and within the rural areas. This has increased the demand for water which is a limited resource. In addition, the environment has become degraded and as a result, continued sedimentation of water bodies especially from soil erosion has polluted water bodies making the more turbid and unsafe for human consumption. There is a need to overcome these challenges and household water treatment with *Moringa oleifera* is a natural and a cost effective method of making sure there is safe water for drinking and other consumption patterns. This can be

achieved through sensitization and awareness creation on the importance of *Moringa oleifera* as a water treatment plant along with other benefits ranging from social, environmental, economic and health.

Objective

The project will be undertaken in line with the following objectives;

General objective

To make use of the moringa seeds

Specific objective

To generate new form of water treatment

Application/Functionality

The components/ materials required include:

A container
Moringa seeds
Pestle and a mortar / a grinder
Stirrer

Procedure for Household Water Treatment using *Moringa oleifera*

1. Collect mature *Moringa oleifera* seed pods and remove seeds from pods
2. Remove seed coat to obtain clean seed kernels; discard discolored seeds.
3. Determine quantity of kernels needed based on amount and turbidity of water.
4. Crush appropriate number of seed kernels to obtain a fine powder and sift the powder through a screen or small mesh.
5. Mix seed powder with a small amount of clean water to form a paste.
6. Mix the paste and 250 ml (1 cup) of clean water into a bottle and shake for 1 minute to activate the coagulant properties and form a solution.
7. Filter this solution through a muslin cloth or fine mesh screen (to remove insoluble materials) and into the water to be treated.
8. Stir treated water rapidly for at least 1 minute then slowly (15–20 rotations per minute) for 5–10 minutes.
9. Let the treated water sit without disturbing for at least 1–2 hours.
10. When the particles and contaminates have settled to the bottom, the clean water can be carefully poured off.
11. This clean water can then be filtered or sterilized to make it completely safe for drinking.

Marketability

Household water treatment using *Moringa oleifera* is applicable to community members, in homes, farms and in the rural areas. It is sustainable, affordable and has no documented negative effects on people's health and on the environment. It also makes use of locally available materials to solve economic and environmental problems. Moringa has a wide range of uses some of which are well known in Kenya. These include: Manufacture of cooking oil from the seeds, making of soap, the leaves are highly nutritious and therefore have been widely used as vegetables among other benefits. This project would be of great significance to government ministries. These ministerial sectors are; Agricultural sector where the project will act as an initiative towards sustainable agricultural practices since moringa tree is a multipurpose agroforestry tree; the environmental sector acting as an initiative towards carbon sequestration and water sector by replacing the use of chemicals for water treatment. The project shall also involve government (both local and national government) in their initiatives and efforts towards

achieving the sustainable development goals that is: SDG 2: Eradicating extreme poverty and hunger; SDG 3: Good Health; SDG 9: Industry, innovation, and SDG 13: Climate action.

Cost Effectiveness

Household water treatment using *Moringa oleifera* is cost effective since the materials are obtained locally. The budget is relatively low and most economical in the long run once every household plants moringa trees. The budget included:

Item	**Quantity**	**Unit price**	**Cost**
20 Liter container	2	400	800
1kg moringa seeds	1	1000	1000
Pestle and mortar	1	500	500
Stirrer	1	100	100
Total			**2400**
One unit of the fully assembled treatment for 20 litres of water is expected to			KSh. 5000
generating an income of			**Ksh. 2,600**

REFERENCES

Jyothilakshmi .R. et .al. (2013). *Moringa oleifera* for water purification . International Journal of Innovation Research In Science, Engineering and Technology, Vol. 2 Issue 8.

Karthik Rajendron et. al. (2012). Water treatment using Moringa- A review. water ISSN:1996-1073, 2911 -2942.

Schwarz, D. (2000). Water Clarification Using Moringa Oleifera. Gate information service. Eschborn, Germany

COMMENTS:

Good presentation

Determine quantities that do not affect water quality or know methods of preserving the seeds.

Good work but check on chemical composition.

Book publication: Advances in Tourism Management: Forms and Development Perspectives

by Dr. L. Muriuki, Department of Environmental Studies and Resources Development, Chuka University, P. O. Box 109-60400, Chuka

Tourists take photos in Masai Mara National Park

Introduction

Kenya is globally recognized as an exotic tourism destination; which mainly promotes wildlife based and beach tourism.

Tourism is a recent discipline in Kenya which was introduced after independence (1965). Utalii college was offering Cerfificate and Diploma training since 1969. Tourism training at the university began in1999 (Bsc. Tourism in Moi University). In 2001 it was developed as a specialization in business management (Bachelor of Tourism Management). Conventionally tourism management is regarded as an applied social science

The airline sector is perceived as the most lucrative business but not well developed in Kenya. Tourism is a recent industry, with few experts experienced in it.

The Need for University Level Tourism Training

The industry is visible when it contributes to the GDP, or when there is a travel ban.

Other times tourism has been ignored as a sector

Much effort has been geared towards tourism marketing; especially wildlife based and beach tourism.

Kenya lags behind in tourism product and facilities development.

Although Kenya is ranked as position 5 in Africa, tourism service delivery does not meet international standards. The industry performance can be enhanced through training at university level.

Moi, Kenyatta, Maseno, Kisii, Chuka, Karatina, Masai Mara, TUK, TUM, Eldoret, Nairobi, Kabianga, Muranga, Strathmore, Kemu universities offer tourism management programmes

Facilities development is not enough: Personnel training is imperative for efficient service

Tourism trainers rely on books with international cases while lecturers are trained in applied areas. No comprehensive book has been written on tourism management in Kenya

The Book

The book has been compiled for 7 years. It has 220 pages and 19 chapters. It focusses on both the demand and supply perspectives of tourism " within a kenyan context". It interrogates the development criteria for various tourism forms. It provides case studies selected from Kenya. It has sample examination questions after each chapter

Resource conversion into products is well covered

Tharaka Cultural Dance. *Alternative tourism development is an avenue for product diversity*

The Book Coverage

- Tourism development (aspects) (5 chapters)
- Forms of tourism (5 chapters)
- Travel operations (1 chapter)
- Hospitality Operations (1 chapter)
- Product development (1 chapter)
- Tourism marketing (1 chapter)
- Travel Distribution Management (1 chapter)
- Tourism planning (2 chapters)
- Sustainable development in tourism (1 chapter)
- Progress in tourism research (1 chapter)

Structure and Organization (S&O)

Part One: Tourism Industry, Development aspects and Management (chapters 1-13)

Part Two: Contemporary Issues in Kenya's Tourism (Chapters 14 - 20).

S & O- part one:	S& O: Part Two
• Chapter 1- Introduction • Chapter 2- Types and forms of Tourism • Chapter 3: Evolution and Historical Dev't of Tourism • Chapter 4: Components of Tourism • Chapter 5: Demand of Tourism • Chapter 6: Tour Operations Development in Kenya • Chapter 7: Travel Distribution and Management • Chapter 8: Tour Circuit Planning in Kenya • Chapter 9: Hospitality Operations Dev't in Kenya • Chapter 10: The Supply of Tourism • Chapter 11: Impacts of Tourism • Chapter 12: Tourism Planning • Chapter 13: Marketing Strategies for Tourism in Kenya	• Chapter 14: Marine and Coastal Tourism • Chapter 15: The growth of Ecotourism in Kenya • Chapter 16: Rural Tourism Development in Kenya: An empirical investigation • Chapter 17: Cultural Tourism Development • Chapter 18: Sports Tourism Dev't • Chapter 19: Sustainable Development in Tourism • Chapter 20: Progress in Tourism Research

Contribution: Forms and Development Perspectives	What are the New Ideas
It interrogates Kenyan products with development potential i. Marine and coastal tourism ii. Ecotourism in Kenya iii. Cultural tourism development iv. Sports tourism development v. Sustainable tourism	It discusses existing and potential routes in Kenya; • Coastal Circuit -South Western Circuit • Rift Valley Circuit -Western Circuit • Nairobi Circuit -Central Kenya Circuit • Eastern Kenya Circuit -Northern Kenya Circuit
 **Sun rise**	**Publishers** • The first edition is to be published by Chuka University Press • The second ed. Will be published by SAGE Publishers • Currently handling editors proof • The first copy will be available in September, 2017

COMMENTS:

Can consider future perspectives on the tourism industry.
Challenges, opportunities as we look forward towards 2030

Short Course: Environmental Impact Assessment and Environmental Audit by DESRD & National Environment Management Authority (NEMA)

1. INTRODUCTION

The National Environmental Management Authority (NEMA), under the Environmental Management and Coordination Act (EMCA) of 1999, is the principal government organ charged with the supervision and coordination of the implementation of al policies and legislation dealing with the environment in Kenya. consequently, NEMA's major task is to ensure that the country attains sustainable development through the incorporation of environmental concerns in all development policies, programmes and activities. EMCA 1999 requires that all new development projects must undergo environmental audits EA annually. EMCA (1999) clearly indicates the projects that must undergo EIA and EA.As stipulated under EMCA(1999), NEMA has formulated EIA and EA regulations, vide Legal Notice No.101 of June 2003,which all proponents must strictly adhere to. These regulations clearly spell out the methods to be followed in the carrying out of EIAs and EAs. The regulations also state clearly how NEMA identifies and registers the experts who will carry out EIAs and EAs. The successful implementation of EIA and EA regulations (2003) will very much depend on the availability of a pool of experts well versed with all aspects of EIA AND EA. In conjunction with representative stakeholders drawn from Egerton, Kenyatta and Moi Universities, KSoG, Kenya National Cleaner Production Centre (KNCPC) and Kenya Science Teachers (KSTC).NEMA has therefore developed a comprehensive and integrated curriculum on the theory and practice of EIA and EA.

2. OBJECTIVE OF THE CURRICULUM

The curriculum is intended for all candidates who are potential lead and associate experts on EIA and EA. The curriculum will stream line the major areas that all prospective EIA and EA must be versed with over and above their areas of specialisation. The curriculum also emphasizes on the areas candidates must have practical and field exposure during the EIA and EA training.

3. QUALIFICATION REQUIREMENTS

Candidates for the EIA and EA course shall have qualifications suitable for registration as Lead or Associate experts (as specified in the Fourth schedule of EIA and EA regulations, 2003) or any other person interested in becoming conversant with issues on EIA and EA.

4. MODE OF TEACHING

NEMA recommends that this curriculum should be offered through intensive lectures, case studies, practicals and site visits. This will ensure that the candidates gain comprehensive understanding of concepts, principles, and practical applications of EIA and EA.

5. DURATION

This curriculum should be offered in a minimum two weeks of intensive residential training. Each of the recommended topics and case studies shall be covered by not less than six (6) contact hours. The site visits shall take at least two (2) days (48hours).

6. ASSESSMENT METHOD

The EIA and EA course shall be examined by continuous assessment, including site visits and case study reports (40%) and a three-hour (3) end of course examination (60%).

7. CENTRES OF TEACHING

The curriculum shall be offered only by those training institutions either registered with the Ministry of Education, or the Directorate of Industrial Training, Ministry of Trade and Industry, or the Ministry of Labour and Human Resources Development, or Ministry of Culture, Gender and Sports Development.

8. COURSE CONTENT

Topic 1: Introduction to EIA/EA
Topic 2: Policy, Legal and Admin Frameworks for EIA/EA in Kenya
Topic 3: Stakeholder and Public Participation EIA/EA
Topic 4: Environmental economics
Topic 5: Environmental Management Systems Standards
Topic 6: Environmental Information Systems for EIA/EA
Topic 7: EIA Methods
Topic 8: Environmental Audits
Topic 9: Strategic Environmental Assessment
Topic 10: Report Writing
Topic 11: EIA/EA Project Report
Topic 12: EIA/EA Review and Decision-Making Process
Topic 13: Environmental Management Plan
Topic 14: EIA/EA Project Management
Topic 15: Social Impact Assessment (SIA)
Topic 16: Industrial Ecology
Topic 17: Occupational Health and Safety Management
Topic 18: Mainstreaming EIA/EA in Orgs: Opps and Challenges
Topic 19: Multilateral environmental treaties, protocols & agreements
Topic 20: EIA Case Studies
Topic 21: EA Case Studies
Topic 22: Site Visits and Practicals

9. COURSE DESCRIPTION

Topic 1: Introduction to EIA/EA (6 hours)

- Environmental and Sustainable Development
- Environmental Management Paradigms
- Integrated Environmental Management
- Historical Development of Environmental Impact Assessment
- Theory and Principles of EIA

Topic 2: Policy, legal and administrative frameworks for EIA/EA in Kenya (6 hours)

- Environmental policies and laws: EMCA, Forest Act, Wildlife Act ,Public Health Act, Land Adjudication Act, Agriculture Act, Water Act 2000,etc
- Policy, legal and administrative framework for EIA/EA in Kenya (Legal Notice 101 of June, 2003)

Topic 3: Stakeholder and public participation EIA/EA (6 h)

- Need for public involvement
- Typology of public participation
- Types of conflicts
- Framework for conflict resolution

Topic 4: Environmental economics (6 hours)

- Concept of economic value
- Cost Benefit Analysis (CBA)
- Total economic value
- Environmental valuation techniques
- Incentives and disincentives for EIA/EA
- Indicators of sustainable development

Topic 5: Environmental management systems standards and practices (6 hours)

- Best management practices
- Standards of environmental management: ISO series, KEBS
- Effectiveness of environmental management systems

Topic 6: Environmental information systems for EIA/EA (6 hours)

- EIA/EA information & dissemination documentation
- Sources of EIA/EA information
- Application of IT in EIA/EA e.g. GIS, IDRISI,GPS
- Database management systems (DBMS)

Topic 7: EIA methods (6 hours)

- Development of EIA/EA terms of reference
- Risk management
- EIA process (screening, scooping, impact analysis, Risk Assess.)
- EIA study team
- Risk Assessment

Topic 8: Environmental Auditing (6 hours)

- Nature and principles of EA
- Procedure and monitoring of EA results
- Developing, conducting and evaluating an EA

Topic 9: Strategic environmental assessment (6 hours)

- Scope and objectives
- Policy, institutional and legislature frameworks for SEA
- SEA process/steps
- Case studies

Topic 10: EIA/EA Report writing (6 hours)

- Objectives of EIA/EA report
- Types, structure &form of EIA/EA reports
- Content of a EIA/EA report-NEMA format
- Appendices to EIA/EA reports
- Common shortcomings EIA/EA reports

Topic 11: EIA/EA project report (6 hours)

- Each candidate will identify a case study and develop a comprehensive EIA/EA
- Report for evaluation

Topic 12: Review and decision making process (6 hours)

- Objectives, methods & criteria: EIA/EA reports review
- Decision-making and communication

Topic 13: Environmental Management Plan (6 hours)

- Components of an Environmental Management Plan
- Preparation of Environmental Management Action Plan
- Roles and mandates of environmental mgt institutions
- Monitoring of Environmental Impacts and Participatory Monitoring and Evaluation

Topic 14: EIA/EA Project Management (6 hours)

- EIA/EA ToRs and selection of multidisciplinary team
- Project cycle Management (PCM)
- Budgeting and cost control
- Case studies

Topic 15: Social Impact Assessment (SIA) (6 hours)

- Link between EIA/EA and SIA
- SIA in project management
- Case studies

Topic 16: Industrial Ecology (6 hours)

- Project siting
- Waste management
- Industrial infrastructure
- Cleaner production and energy conservation
- Pollution control

Topic 17: Occupational Health and Safety Management (6 hours)

- Occupational health and safety regulations (public health, industrial, factories, labour, worker's compensation, etc.)
- Incident reporting, records and analysis
- Working conditions and health
- Accident minimization

Topic 18: Mainstreaming EIA/EA in organizations (6 hours)

- Incentives for compliance to EIA/EA registration
- Integration of EIA/EA in project cycle: legal requirements
- Challenges and opportunities of mainstreaming
- Role of Environmental Inspectors in ensuring compliance

Topic 19: Multilateral environmental agreements & EIA (6h)

- Review of major MEAs such as Cartagena, Kyoto, UNCBD, RAMSAR, CITES, UNFCCC, UNMDG, UNWCSD, etc.
- Domestication of MEAs-link to national policies and legislation
- Case studies

Topic 20: EIA case studies (6 hours)

- EIA Case Studies of at least 5 major sectors and presentation of seminars e.g. manufacturing, mining and service sectors

Topic 21: EA case studies (6 hours)

- Case Studies of at least 5 major sectors and presentation of seminars e.g. manufacturing, mining and service sectors

Topic 22: Site visits and practicals (48 hours)

- Trips conducted to selected project and industrial sites
- Reports will be prepared for each visit for assessment
- Practicals will be undertaken or demonstrated where necessary

Multiplication and Commercialization of Seeds and Planting Materials of Locally Adapted and Preferred Crops: Case of AIVs and Small Fruits

by C. A. Omukoko, D. K. Isutsa, G. K. Gathungu, S. Mulambula, L. G. M'Itunga[1], J. W. Kiharason, J. M. Makau[2], J. K. Kiramana, G. K. Kosgei and C. M. Marangu[3; 1]Department of Plant Sciences, Chuka University, P. O. Box 109-60400, Chuka; [2]Environment and Resources Development, Chuka University, P. O. Box 109-60400, Chuka; [3]ASDSP, Tharaka-Nithi County Coordinator, P. O. Box 3-60400, Chuka

Abstract

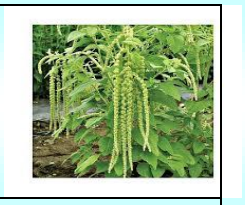
Vegetables and small fruits play important roles in nutrition since they have high nutritive qualities in proteins, vitamins, oils, and nutrients, and also contribute to household incomes. Despite these benefits, improved productivity and agribusiness opportunities are constrained by marginal agro-ecological conditions, lack of quality planting materials, agronomic packages, value addition, postharvest handling technologies, acceptability, organized marketing and distribution channels. These constraints lead to low availability and hence consumption of these crops in ASALs such as Tharaka-Nithi County. Subsequently, the vegetables and fruits prioritized in the present research are kales, pumpkins, cowpeas, black night shades, amaranthus, tree tomatoes and passion fruits. The study will employ participatory rural appraisal method to select contact farmers and identify major constraints in the value chains. Seed multiplication, crop production and produce value addition will follow standard procedures and protocols. Farmers will be trained in modern seed multiplication, crop production, crop protection, postharvest handling, processing, and marketing practices to enhance productivity, income and utilization. The research will entail the following activities: survey of markets and households to obtain baseline trends, establish demonstration nurseries on-station, produce seeds and planting materials for sale, identify contact farmers, establish nurseries on farmers' plots, establish kitchen vegetable and fruit gardens on contact farmers' plots, identify household groups, demonstrate recipes to the groups, monitor and evaluate impact of the project. Data collected will be subjected to chi-square and variance analyses for qualitative and quantitative parameters, respectively. Significantly different means will be separated using LSD test at $P = 0.05$. The expected beneficiaries are small-scale households and consumers in Tharaka-Nithi County.

Introduction

Horticulture is among the four key sub-sectors in the Kenyan Agricultural industry, contributing 33% of total GDP and 38.5% of exports. Vegetable and fruit exports account for a high percentage of total horticultural exports. Vegetables and fruits are high value crops with potential to contribute significantly to the growth of the horticultural sub-sector and the transformation of Agriculture under Vision 2030 and ASDSP 2009-2014 (RoK, 2004). The vegetables and fruits produced in the country are destined for domestic, regional and international markets. The majority of workers, producers and transformers of vegetables are women, while men participate mainly in some fruit production activities. Men and youths play a supportive role in transportation and marketing of the produce. Of the total country production, approximately 96% is consumed locally (HCDA, 2009). The major categories of vegetables and fruits produced in Kenya include exotic, indigenous, Asian and other emerging ones. Kenya is well endowed with a wide range of agro-ecological zones from the coastal lowlands to upper highlands, which allows production of a wide range of vegetables and fruits.

African Indigenous Vegetables (AIVs) and small fruits, neglected for a long time, have in recent years gained popularity and demand due to campaigns on their medicinal and nutritional value (Holland et al., 1991). About 220 indigenous vegetables are used in Kenya (Maundu et al., 1999). Of the AIVs grown countrywide, cowpea (*Vigna unguiculata* (L.) Walp., amaranth (*Amaranthus* spp.), pumpkin (*Cucurbita* spp.), spider plant (*Cleome gynandra),* night shades

(Solanum complex*)*, jute mallow (*Corchorus* spp.), and slenderleaf (*Crotalaria brevidens* and *C. ochroleuca)* are the preferred species grown by many communities (Maundu et al., 1999). The small fruits include passion fruits, tree tomato, cape gooseberry, quava and loquats. However, scanty information is available on actual production and trade value of these vegetables and fruits. A survey on the commercial potential of cowpea, nightshade and amaranth in the Nairobi and Kisumu markets in 2006 reported an annual traded volume of 4.3 tonnes worth KES 142 million (Weinberger and Pichop, 2009), indicating great potential in income generation, food insecurity and poverty alleviation in Kenya. The AIVs and small fruits are mainly produced by small-scale farmers who comprise majority of the poor in farming communities (IPGRI. 1997).

				
Kale	Pumpkins	Cowpea	Black night shade	Amaranthus

The majority of actors in the AIVs value chain are women. Apart from contributing to incomes of the small-scale farmers, these AIVs and small fruits play important roles in nutrition and other benefits since they have high nutritive qualities in proteins, vitamins (A&C), oils, and macro- and micro-nutrients (Holland et al., 1991; Grubben and Chigumira-Ngwerume, 2004; Hutchinson et al., 2010). Improved productivity and agribusiness opportunities in AIVs are constrained by lack of quality planting materials and agronomic packages, limited value addition, poor postharvest handling technologies, negative perception and low acceptability, and poorly organized marketing and distribution channels (IPGRI, 2006). Rural farmers in Africa grow their own vegetable and small fruit landraces (Abukutsa-Onyango, 2003 and 2007) using seeds. Splits or suckers may be used for kales.

	Passion fruit is expanding to replace low value crops (MOA, 1997). Purple passion fruit (*P. edulis* var. *edulis* Sims.) is the most important in the Kenyan juice industry (MOA, 1997). It is consumed locally as jam, jelly and dessert, or used to flavour yoghurt, ice cream and other food products (MOA, 1997).

In 100 g of edible purple passion fruit portion, there is 75.1 g moisture, 2.2 g protein, 0.7 g fat, 21.2 g carbohydrate, 0.8 g ash, 13 mg calcium, 64 mg phosphorous, 1.6 mg iron, 28 mg sodium, 348 mg potassium, 20-700 IU vitamin A, 0.13 mg riboflavin, 1.5 mg niacin, and 20-30 mg ascorbic acid/vitamin C (Tindal, 1969). The seeds yield 23% oil, similar to sunflower and soybean, with industrial value (Morton, 1987). It has 8.9% saturated and 84.1% unsaturated fatty acids, with 6.8% palmitic, 1.8% stearic, 0.34% arachidic, 19% oleic, 59.9% linoleic, and 5.4% linolenic acids (Morton, 1987). Passion fruits have medicinal value in the glycoside passiflorine - a sedative or tranquilizer, extracted from air-dried leaves of *P. edulis*. The juice is used as a digestive stimulant and gastric cancer treatment (John and Violet, 1979; Morton, 1987). Most passion fruit producers use seedlings to establish plantations (Nakasone and Paull, 1998). Use of cuttings and grafting on yellow passion fruit is occasionally practiced (Lippman, 1978). Tissue culture is used to propagate disease-free passion fruit planting materials (Isutsa, 2006).

In growing passion fruits, the suitable frost-free altitude ranges from 1500 to 2500 m asl, average temperature is 24^{o}C and range is 15^{o}C to 26^{o}C, adequate rainfall ranges from 750 to 1500 mm per year, and soil should be highly fertile (nitrogen-rich), not waterlogged, and with a pH ranging from 5.5 to 7.2 (Nakasone and Paull, 1998; Isutsa, 2006). Soon after planting, T-trellis is established to support passion fruit vines (Nakasone and Paull, 1998) or they may be grown along the farm fence for support. At the end of fruit harvesting, old laterals are pruned off from the main shoots along the wire, at the third to the fifth node to help rejuvenate the plants for fresh fruiting (Nakasone and Paull, 1998). If passion fruit plants are irrigated regularly, growth and flowering can continue almost throughout the year. Passion fruit plants require between 300 and 400 litres of water per vine per week in extremely dry conditions (Nakasone and Paull, 1998). One bucket, measuring of 20 L of water per vine twice a week prevents wilting only. Fertilizer application rate recommended is 70, 100 and 170 g N per plant in the first, second and third years, respectively, or whenever deficiency symptoms are detected in three splits each, at the beginning of active growth period, during the main growth period, and after harvesting passion fruits to help rejuvenate the vines for next fruiting (Nakasone and Paull, 1998).

	The tree tomato [*Solanum betaceum (Cyphomnadra betecea*)] plants are small attractive, half woody and evergreen growing to a height of 3 m to 5.5 m. The fruits are long stalked and dangling, in clusters of 3 to 12 smooth, egg shaped and pointed at both ends. The skin colour may be deep purple, blood red, orange or yellow.

The shrubs are subtropical rather than tropical and grow well in altitudes of between 1,500 m to 3,000 m, and grow best where the temperature remains above 50ºF with well drained soils. The shrub requires fertile light soils rich in organic matter for vigorous growth. It cannot tolerate prolonged drought and therefore mulching and supplementary irrigation are beneficial. A compound fertilizer or 10 g DAP per seedling may be applied at sowing time if necessary. Seeds and cuttings may be used for growing tree tomato. Seeds develop into high-branched erect shrub while cuttings develop into shorter bushy plants with low lying branches.

The plants from seed are not always true to type but are most likely if care is taken to extract seed from red fruits with black seed pulp or yellow fruits with yellow seed pulp. Germination is accelerated by placing washed and dried seeds in a freezer for 24 hours before sowing. Cuttings should only be from plants which are 1 - 2 years old with a thickness of 1.5 to 2.5 cm (3/8 to 1 inch) and a length of 45 to75 cm (18 to 30 inches)The leaves are removed and the base cut square below a node. When the plants are about 1-1.5 metres, cut the roots on one side and lean the plants to the other, in the direction of the midday sun at about 30 to 45 degrees. This allows bearing braches to grow along the trunk rather than just at the top.

The plants can grow up to 6 m high but are easily damaged by wind and needs shelter. Plants cuttings can be sown directly at a spacing of 3 m × 3 m in the ground, but should not be permitted to bear the first year. Newly grown tree tomatoes should be pruned to a height of 90-120 cm. Yearly pruning thereafter is recommended to eliminate branches that have already borne because fruits are produced on new growth. The tomato tree plants will bear fruits after 2years and up to 5 years. Tree tomatoes are generally pest resistant. Tree tomatoes are ready to harvest when they develop the red or yellow colour leaving the stalk attached. The fruits can be stored in the refrigerator for up to 10 weeks, but temperatures below 38ºF can cause the skin to discolour. The fruits can be eaten fresh by scooping the flesh from halved pieces. For other uses the skin must be removed which is easily done by pouring boiling water over the fruits and letting it stand for 4 minutes before peeling. The tree tomato flesh can be added to stews to make unique

flavour. The tree tomato fruits are tasty and decorative in salads making appetizing desserts. Fresh tree tomato is frequently blended with sugar and water to make refreshing juice. The fruits should not be cut on wooden or other permeable surface as the juice will make an indelible mark (Margarate Gitau. Agro-Environment Initiative. Email yagrein@gmail.com. http://yagrein.blogspot.co.ke/2012/06/growing-tree-tomato-plants-tamarillo.html).

Tamarillos are very low calorie fruits, 100 g of fresh fruit contain just 31 calories, dietary fiber (3.3 mg or 9% of RDA), minerals, anti-oxidants, and vitamins. Acidic flavour (sourness) of tree tomatoes mainly comes from citric acid and malic acid. The ORAC value (antioxidant strength) of 100 g fresh tamarillos is 1659 TE (Trolex equivalents). Their antioxidant value largely derived from poly-phenolic, flavonol and anthocyanidin compounds. Some of these phytochemicals include chlorogenic acid, kaempferol, and anthocyanin pigments such as cyanidin glycosides, especially concentrated in their skin. Scientific studies suggest that chlorogenic acid help lower blood sugar levels in type-II diabetes mellitus. Yellow and gold variety tamarillo contains more vitamin A and carotenes than red varieties. However, red variety has more anthocyanin pigments. In addition, yellow tamarillos are a good source of carotenes, and xanthins. These compounds possess antioxidant properties and, together with vitamin A, are essential for good visual health. Further, vitamin A is also required for maintaining healthy mucusa and skin. Consumption of natural vegetables and fruits rich in flavonoids help protect from lung and oral cavity cancers. Tree tomato is an average source of B-complex vitamins such as thiamin, riboflavin, and pyridoxine (vitamin B-6). Together, these vitamins help as co-factors for enzymes in metabolism as well as in various synthetic functions inside the body. They are indeed very good source of electrolyte, potassium. 100 g fresh fruit has 321 mg or 7% of this mineral. Potassium is an important component of cell and body fluids helps controlling heart rate and blood pressure; thus, counters the bad influences of sodium. In addition, the fruit contains a small amount of minerals such as copper, manganese, magnesium, phosphorus, zinc and iron. (http://www.nutrition-and-you.com/tamarillo.html).

Certain regions in Kenya, including Tharaka-Nithi County, have virtually no AIVs and small fruits on their markets, homesteads or diets. If any, the source is bound to be distant and supply seasonal. Very few of these vegetables and fruits are produced and supplied by local farmers. This scenario makes their diets and nutrition very monotonous and deficient in these otherwise very nutritious crops. The households end up relying on exotic vegetables such as cabbages and spinach only, exported fruits such as mango and oranges, or none all year round. This research shall endeavour to change this scenario by promoting production and consumption of diversified AIVs and small fruits. The goal of the present study is to develop participatory seed and planting material multiplication, distribution, production and consumption of AIVs and small fruits to enhance food nutrition and security in Tharaka-Nithi County.

Statement of the Problem

Although AIVs and small fruits are appreciated for their nutritional qualities and economic potential, their production, marketing, and consumption face a number of problems in Kenya. Key among these problems include inadequate good quality planting materials (Abukutsa-Onyango, 2003 and 2007), low yields and quality of produce, high post-harvest loses, poor food safety, limited value addition (Grubben and Chigumira-Ngwerume, 2004), agribusiness opportunities, awareness and acceptability. Production of AIVs and small fruits is seasonal and localized despite the potential for use of low inputs. Very little processing and packaging is done, hence their prolonged availability is curtailed. Addressing the binding constraints along the AIVs and small fruit value chains will enhance productivity, sustainability, food and nutritional security among the rural poor.

Justification

This research will address the major constraints in the AIVs and small fruits value chains through pragmatic multiplication of seed and planting materials, mainstreaming of consumption, postharvest handling and diversification of the range of products and recipes. The project will adopt stakeholder participatory, collaborative, multi-disciplinary and inter-disciplinary approaches to ensure the interventions are responsive to cross-cutting issues, including environmental safety, social and gender welfare.

Collaboration and Partnerships

The researchers will be: C. A. Omukoko, D. K. Isutsa, G. K. Gathungu, S. Mulambula, L. G. M'Itunga, J. W. Kiharason, J. Mwikali, J. K. Kiramana, G. K. Kosgei and C. Marangu, of Department of Plant Sciences, Chuka University, P. O. Box 109-60400, Chuka-Kenya, [2]Department of Environment and Resources Development, Chuka University, P. O. Box 109-60400, Chuka-Kenya, and ASDSP, P. O. Box 3-60400, Chuka.

The team will be involved in conception, seed and planting systems development, multiplication and distribution. It will also address recipe development, consumption sensitisation, and demonstration. Finally, it will engage in technology transfer and training along the respective AIVs and small fruits value chains.

Goal

To contribute to increased production, marketing and utilization of AIVs and small fruits (kale, pumpkins, cowpea, black night shade, amaranthus, tree tomato and passion fruits) to contribute to enhanced seed and planting material multiplication, distribution, production and consumption, food and nutrition security.

Overall Objective

The overall objective of the present study is to increase seed and planting material multiplication, distribution, production and consumption of AIVs and small fruits to enhance food nutrition and security in Tharaka-Nithi County

Specific Objectives

1. To increase seed and planting material multiplication and availability for AIVs and small fruits in Tharaka-Nithi County, Kenya.
2. To improve postharvest handling, value addition and utilization of AIVs and small fruits in Tharaka-Nithi County, Kenya.
3. To develop marketing opportunities for seeds, planting materials and produce of AIVs and small fruits in Tharaka-Nithi County, Kenya
4. To develop mechanisms for information, communication and knowledge sharing along the seed, planting material and produce value chains for AIVs and small fruits in Tharaka-Nithi County, Kenya.

Hypotheses

1. There is no significant difference in expected and observed seed and planting material available for AIVs and small fruits in Tharaka-Nithi County, Kenya.
2. There is no significant difference in postharvest handling, value addition and utilization of AIVs and small fruits in Tharaka-Nithi County, Kenya before and after the project.
3. There is no significant difference in marketing of seeds, planting materials and produce of AIVs and small fruits in Tharaka-Nithi County, Kenya before and after the project.

4. There is no significant difference in mechanisms for information, communication and knowledge sharing along the seed, planting material and produce value chains for AIVs and small fruits in Tharaka-Nithi County, Kenya before and after the project.

Expected Outputs

1. Production of AIVs and small fruits seeds and planting materials increased.
2. Postharvest handling, value addition and utilization of AIVs and small fruits increased.
3. Marketing opportunities for AIVs and small fruits products developed.
4. Strategies for information, communication and skills sharing for these crops developed.

Expected Outcomes

1. Availability of high quality seed and planting materials for AIVs and small fruits.
2. Reduced vegetable postharvest loses along the value chain and increased volumes of high quality AIVS and small fruits in local markets.
3. Increased range of products and per capita consumption of AIVS and small fruits.
4. Increased smallholder and community awareness and consumption of AIVS and small fruits; and overall improved incomes from the enterprises disaggregated by gender.
5. Improved food safety and acceptability of the AIVS and small fruits along the value chains.

Beneficiaries of the Outputs and Outcomes

The primary beneficiaries of the outcomes of the project will be small-scale producers/farmers in Tharaka-Nithi County. Improved productivity is expected to stimulate value addition and marketing activities targeting local markets, thereby creating employment opportunities especially for the youth and women within the target communities. Efforts will be made to collect gender disaggregated data during surveys, and inclusion of women and youth in all project activities including trainings. It is anticipated that improved production, value addition and marketing of AIVS and small fruits will stimulate and attract investments by small-scale entrepreneurs. Similarly private sector involvement for the provision of inputs and services will be enhanced. The Government will also benefit through the collection of revenue, from various players along the AIVS and small fruits value chains.

Research Methodology

Initial project screening will be conducted with a view to identifying baseline data. Subsequently, modern practices that must be shared and implemented amongst the various collaborators as well as shared and imparted to the other stakeholders who will be involved in this research will be developed collaboratively. All activities shall employ established standard procedures, protocols, designs and data collection methods (Abukutsa-Onyango, 2003 and 2007; Grubben, G.J.H. and Chigumira Ngwerume, F. 2004; Nakasone H.Y. and R.E. Paull. 1998; Kiharason et al., 2015; Kiramana et al., 2016; Kiharason et al., 2017a; Kiharason, et al., 2017b). The activities under the methods will include: Survey of markets and households in Tharaka-Nithi County; Establishment of demonstration nurseries for AIVs and small fruits on-station for training of farmers; Production of seedlings and planting materials for AIVs and small fruits for sale to the farmers; Identification of contact farmers who shall serve as trainers of trainers (TOTs) for enhancing AIVs and small fruits production and consumption; Establishment of AIVs and small fruits nurseries on farmers' farmers to ensure sustainability of the enterprises once the research ends; Establishment of kitchen vegetable and fruit gardens on contact farmers' farms to ensure sustainability of the AIVs and small fruits once the research ends; Identification of household groups to train; Demonstration of recipes to households groups; Monitoring and evaluation of impact of the project; Development of food preparation recipes using the AIVs and small fruits through: mixing, blending, juicing, frying, drying, milling, or baking.

Data Analysis

Data will be collected at all stages of the research project and analyzed through quantitative and qualitative statistical methods such as ANOVA, regression, correlation, Chi-square, and gross-margin (cost-benefit) analysis, as appropriate. The significantly different means will be separated using the LSD test at $P = 0.05$. In this regard, AIV sale price will be kept minimal to encourage uptake; thus: kale, pumpkins, cowpea, black night shade, and amaranthus @ 5 per 5 suckers or 100 g seeds. Fruits sale price will be: tree tomato and passion fruits @ 5/= per seedling. Other agricultural inputs such as seeds, fertilisers, pesticides, packaging materials and processing supplies will be costed at prevailing market price.

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Work Plan

Item	Timeframe
Survey markets and households	July-Sept 2017
Establish demo nurseries on campus	October 2017
Produce seedlings and planting materials for sale	Nov-Dec 2017
Identify and train contact farmers	Jan-Feb 2018
Establish nurseries on farmers' farmers	Mar-Apr. 2018
Establish kitchen gardens on contact farmers' farms	May-June 2018
Identify household groups	July-Aug 2018
Demonstrate recipes to households groups	Sept-Oct 2018
Monitor and evaluate impact of the project	July 2017-Oct 2018
Draft final progress report and manuscripts for publication	Nov-Dec 2018

Proposed Budget

Expenditure Item	**Quarters (KES) July 2017 to December 2018**				**Total (KSh)**
	Q1&Q2	**Q3&Q4**	**Q5**	**Q6**	
Casual labour (days)	97,136	90,064	94,416	97,344	378,960
Fuel	21,250	16,950	15,050	5,700	58,950
Subsistence allowance	20,000	9,500	19,600	12,650	61,750
Supplies for production	93,150	67,000	94,550	63,000	317,700
General office supplies	10,540	7,150	7,150	7,000	31,840
Mini-equipment	8,400	0	2,400	0	10,800
Farmers' seminars, field schools, and workshop	60,000	20,000	40,000	20,000	140,000
Total	**310,476**	**210,664**	**273,166**	**205,694**	**1,000,000**
Expected Income Item	**Rate**		**Quatity**		**Income**
Kale	@ 5/= per 5 suckers		1,000,000 pcs		1,000,000
Pumpkins	@ 5/= per 100 g seeds		5,000,000 g		250,000
Cowpea	@ 5/= per 100 g seeds		5,000,000 g		250,000
Black Night Shade	@ 5/= per 100 g seeds		5,000,000 g		250,000
Amaranthus	@ 5/= per 100 g seeds		5,000,000 g		250,000
Tree Tomato	@ 5/= per seedling		1,000,000 pcs		5,000,000
Passion Fruits	@ 5/= per seedling		1,000,000 pcs		5,000,000
Grand Total					**12,000,000**

COMMENTS:
Good presentation and photographs

Enhancement of Banana Productivity and Value Addition in Eastern Kenya Region Using Modern Propagation, Agronomy and By-Products Processing Technologies and Innovations

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Abstract

Banana is a major food crop in many communities in Kenya, but it remains commercially under-exploited, with farmers only growing it for subsistence. After realizing its potential, many farmers in the Eastern Kenya region have turned to it. Previously, coffee has been a source of livelihood for smallholders in the region for decades. However, farmers are experiencing constraints, ranging from fluctuating prices, surging pests to low productivity, owing to climate change. Consequently, they have shifted from coffee to banana farming. To increase the commercial potential and sustainable production of banana, it is important to access improved technologies, including biotechnology, irrigation, value addition and new cultivars with high productivity, fast growth rate and resilience to tough climatic conditions. Currently, there is low banana productivity and uncompetitive products due to repeated use of planting materials, manual or semi-automated operations, poorly developed marketing and distribution of products, low up-scaling of production and processing technologies, lack of incentives to growers, minimal value addition activities and low utilization of by-products, often discarded as waste. There is need to improve banana productivity and diversify products to contribute to attainment of Kenya Vision 2030, job-creation, value addition and international trade goals. Agro-processing is one of the key subsectors in the manufacturing industry, contributing enormously to national GDP. Banana processing is still under-developed, leading to limited production of quality and competitive products. Poor performance in Kenya is attributed to low capital investment, use of obsolete technologies, inadequate raw materials and high costs of production. There is need to embrace homegrown solutions by developing and/or disseminating technological innovations relevant to the sector and country. The goal of this research is to enhance sustainable productivity and value addition to banana fruits and by-products in Eastern Kenya region. The specific objectives are: identification and micropropagation of superior sweet, dessert and cooking cultivars; training farmers in improved agronomic practices; production of banana edible and inedible value-added products; enhancing infrastructural capacity in banana value chain; and creating a platform for fostering linkages among banana subsector stakeholders. Information on available cultivars and commercialization potential will be gathered through a structured survey questionnaire. Germplasm will be evaluated in mother and baby trials to identify cultivars superior in high yields, adaptation and quality to be tissue-cultured in standard media and distributed to farmers at subsidized cost. Selected contact farmers will be trained to optimize productivity and value addition. Improved banana fruits and their by-products will be sourced from farmers for prototype value addition using standard laboratory and factory protocols. Most experiments will be set up in completely randomized design. Data will be subjected to chi-square tests, analysis of variance and correlations using the SAS program. Means will be separated using Tukey's test at 5% level. The outputs will include superior cultivars, value added products, processing innovations and prototypes, postgraduate students training, knowledge publication and patenting, and farmer training in entrepreneurship.

1. Introduction

Kenya's blue print for economic development has identified agriculture as one of the key sectors to deliver a 10% annual economic growth rate envisioned under the economic pillar. Achievement of this level of growth requires improvement of agricultural productivity and transformation of the smallholder agricultural sector from subsistence to an innovative,

commercially oriented sector. Smallholder farmers in Eastern Kenya region are shifting their focus to banana (*Musa* spp.) production from coffee which has for a long time been the main cash crop and a source of livelihood. Banana is considered the world's fourth most important staple crop after rice, wheat and maize, with an excess of 100 million tonnes produced annually worldwide (FAO 2013) by mainly smallholder farmers.

Banana is considered a "poor man's apple'', although it is a rich source of vitamin A, provider of appreciable amount of Vitamins C, B, B_1 and cheapest among all the fruits (Talane *et al.*, 2016). The fruit is also rich in bioactive compounds, such as phenolic constituents, carotenoids, and dietary fibre (Mohapatra *et al*., 2010). To increase the crop's commercial potential, it is important for farmers to have access to improved inputs like cultivars, irrigation, and value addition. Bananas are classified into four simple groups: cooking (plantain), dessert (ripening), roasting and beer-production types. They are amenable to value addition to make a range of products that can attract niche markets with high economic value (Albertson, 2016).

Commercialization of bananas in Eastern Kenya requires provision of clean planting materials and training of farmers in improved management practices. In this region, there is little information to promote adoption of improved banana cultivars probably due to the crop previously not being considered a "cash crop". In the recent past, banana cultivation has provided livelihoods and food security in other regions in Kenya. Increasing productivity would also lead to improved food security, well-being, and livelihoods in Eastern Kenya region. Research institutions have released improved cultivars that are high yielding, resistant and tolerant to diseases, insect pests and drought, although the rate of adoption and access is low in most parts of Eastern Kenya. In many parts of the world, banana production has been declining over the years, due to poor crop husbandry practices (Chitamba *et al*., 2016). Consequently, stunted growth, disease attack and low productivity have been reported (Mudyazvivi, 2010).

Despite the development of high yielding banana cultivars, their potential yield is not attained because of both abiotic and biotic factors. Socio-economic constraints also constitute important factors that set back optimum banana production. Banana is propagated through suckers or tissue culture plantlets, but most farmers recycle the material over time because of their low cost and easy accessibility, resulting in low yield due to degeneration. The suckers are sourced from NGOs, private businesses, agricultural extension centres, or other farmers. Fusarium wilt (Panama disease) has become a most devastating disease of bananas throughout most production regions of the world (Zhai *et al.*, 2016). It is, therefore, urgent and necessary to explore novel ways to grow healthy banana plants to maintain the sustainable development of the industry (Fu *et al*., 2016). The disease has ability to cause up to 100% yield loss, which severely compromises livelihoods and food security for banana farming households (Tushemereirwe *et al*., 2003; Ndungo *et al.*, 2005; Blomme *et al*., 2014).

Most Eastern Kenya farmers are unaware of the varieties they are producing and only differentiate them as either plantain or dessert types. Establishment of a systematic banana seedlings production unit in Chuka University will improve access to known planting materials. This will increase banana productivity, national food security and commercialization. Other challenges faced by banana farmers include: high cost of tissue-cultured material, limited technical knowledge on crop nutrition and value addition, poor quality and scarce availability of suckers and information on proper crop husbandry, among others (Pawar *et al*., 2016). These challenges can be addressed through farmer training on appropriate management practices.

Banana consumption is progressively increasing due to the increasing human population, which now stands at over 40 million. However, while the Kenyan population has been increasing, per

capita banana production has been declining, hence an increase in price that makes it unaffordable to many people. Banana is a key food security crop in Kenya since it is tolerant to drastic climatic changes. It is one of the major crops grown in most parts of Eastern Kenya for distribution to major towns such as Nairobi, Nakuru and Mombasa.

Banana is rich in many nutritive elements that can assist in attaining dietary requirements of consumers. Banana fruits are rich in antioxidants, including ascorbic acid, tocopherol, β-carotene, phenolics, dopamine and gallocatechin (Qusti *et al*., 2010). The fruits are also good sources of carbohydrates, potassium, vitamins A, C, B6 and sodium (Khawas and Deka, 2016; Hossain *et al*., 2016). Despite the high nutritive value, 25% to 30% (Nur Hanani and Abdullah, 2016; Talane et al., 2016) is lost at post-harvest handling stage. Agro-processing is, therefore, paramount to improve retention. Processing into a range of product like bread, cake, biscuits, cookies, scones, wine, jam, crisps, pickles, salads, starch and flour is possible, and some of these can be further used in food and industrial applications. Banana fruits are huge sources of lignin, cellulose, hemicellulose and starch when harvested at green stage. Utilization at this stage of maturity by processing into flour increase its functionality (Anyasi *et al*., 2016).

Banana processing is still underdeveloped hence limited production of quality and competitive value added products. Most of the information available in banana production is inclined much to production practices to increase fruit yield. Less emphasis has been put on value addition and utilization of the non-yield components. Most of non-yield components of the banana have not been commercially utilized and are regarded as waste. The peel of banana, which represents 30%-40% of the total weight of fresh fruit (Tchobanoglous *et al*., 1993; Osma *et al*., 2007), is underutilized and discarded as waste, resulting in littering problems, especially in urban and pre-urban centres. Like its pulp flour counterpart, banana peel flour can potentially be formulated into new products with standardized composition for various industrial and domestic uses (Emaga *et al*. 2007). Banana peel is rich in phytochemical compounds mainly antioxidants (Khawas and Deka, 2016). Therefore, this byproduct can be used as a potential source of many functionally important bioactive compounds. This bio-waste has been widely and diversely utilized elsewhere for purposes such as bio-methane production (Pisutpaisal *et al*., 2014), animal feed additive (Widjastuti and Hernawan, 2012; Lumu *et al*., 2013), bio-adsorbent for dyes (Amela *et al*., 2012), heavy metals (Thirumavalavan *et al*., 2009) and pesticides (Mohammad *et al*., 2015), and for clean-up of wastewater (Abdulfatai *et al*., 2012). Banana peel is also a cheap bio-sorbent for removal of mycotoxins and application as a feed additive to avoid toxicoses (Shar *et al*., 2016).

The pseudostem also can be processed into products that can be used in the conditioning of the soil or as propagation media, especially under protected agriculture conditions. The pseudostem fibers is a cattle feed (Ortega *et al*., 2016). Banana can also be used for beer, cooking and desserts that contribute significantly to food security and income (Ndayihanzamaso *et al*., 2016). Value addition to banana fruit and development of different products from no-yield components will lead to improved income earnings and job creation in the banana subsector.

This project aims at closing this gap by creating an opportunity for utilization of the banana fruit and by-products to improve earnings from bananas. The project will enhance banana productivity through provision of clean planting materials to farmers in Eastern Kenya using tissue culture, training on appropriate production practices, development of a number of value-added products from the banana fruit, and utilization of non-yield parts which are often discarded as waste. The products may be environment-friendly, non-polluting, less costly and sustainable. Banana plants are very adaptable to most environments, especially drought, making them valuable in food security programmes particularly in rural communities. Banana farmers need to

be trained in strategies available for yielding promotion and reduction of postharvest loses. This will in turn improve the well-being of the banana-dependent communities through enhanced food security and income generation.

1.1. Project Goal

The project goal is to provide easily accessible disease-free tissue culture banana suckers, systematic good husbandry practices, and value addition technologies for banana fruits and non-yield components (stems, leaves and peels) to enhance sustainability. The aim of the project is to develop environment-friendly homegrown solutions for banana-processing subsector by creating and/or disseminating technological innovations. The project plan is to enhance competitiveness at farm level banana production through dissemination of appropriate agronomic technologies and post-farm level banana fruit and non-yield components value addition for job creation and improved income generation to banana farming communities in Eastern Kenya.

This will be achieved through the following specific objectives:

1. To identify and build capacity to propagate and grow superior cultivars in Eastern Kenya.
2. To design, develop and commercialize technologies to diversify banana high-value products.
3. To enhance human and infrastructural capacity for sustainable growth of banana value chain.
4. To increase business and employment opportunities in the banana industry.
5. To create a platform for fostering linkages among stakeholders in the banana industry.

1.2. Expected Outputs of the research

It is expected that at the completion of the project:

(i) New value added banana plantlets and products developed and commercialized.
(ii) New innovations/prototypes for banana processing developed.
(iii) Equipment for banana value addition acquired and operationalised.
(iv) Research findings in banana value chain published and patented.
(v) MSc and PhD students, specializing in banana products value addition trained.
(vi) Innovations in the banana value chain development Filed and/or Patented.
(vii) At least 100 persons in SME trained on value addition and commercialization.

Once the above outputs are achieved the following outcomes will result:

(i) Enhanced capacity for research, knowledge and skills in banana value chain.
(ii) Competitive and marketable value added banana produce and products.
(iii) Value addition at the rural farm households will lead to creation of SMEs and cottage industries to modernize rural livelihoods (electricity, clean water, roads, and structures).
(iv) Increased employment, business and wealth creation opportunities in the banana subsector.
(v) Value addition will create better markets for crops, stimulate crop production and enhance food security.
(vi) Banana stems, leaves and peels will generate propagation media and beautification products hence conserve the environment and increase income generation to the players.

2. Methodology

2.1. Implementation of Activities (*scientific methodologies*) to achieve the Objectives

a) To identify and build capacity to propagate and grow superior cultivars in E. Kenya

There have been past attempts to promote tissue culture bananas in the country by JKUAT, KALRO at Thika, Njoro and Kakamega Centres. However, the tissue culture materials produced in these Centres have not been accessible to most farmers in Eastern Kenya due to the long distance involved and insufficient quantities produced. The initiation of this project in Chuka University will be beneficial, since it is strategically located and accessible to the neighbouring

counties of Kirinyaga, Embu, Tharaka-Nithi, and Meru, which are major banana producers. The outcome will be rapid multiplication and increase in banana production in the region.

(1) This will be accomplished through:

i) Surveying and collecting banana in the region. Characterizing using morphological traits and making an inventory of the germplasm. Identifying and selecting clean, high yielding, adapted and preferred cultivars for rapid micropropagation to provide required quantities to farmers. Data will be collected on location using GPS, cultivar name, local name, clone name, date, crop characters, farmer opinion, yield characters, disease incidence, finger and sucker characters.

ii) Equipping a regional tissue culture laboratory. This will entail procurement of tissue culture laboratory accessories such as glassware, stores, water supply, lighting, and fencing. This is aimed at establishing an efficient in-vitro banana propagation system in Chuka University, capable of providing enough phytosanitary planting material for the entire E. Kenya region.

iii) Procurement of basic chemicals, detergents and disinfectants; equipment such as vat, airflow system, distiller, growth chambers, incubators, propagation media and growth room shelves

iv) Construction of a plantlet hardening unit [shade houses and crates for packaging]

v) Administrative costs [research assistants, casuals, travel, communication and miscellaneous]

(2) Train farmers on best banana management practices through:

(i) Sensitization on the importance of tissue culture in *barazas* (public meetings)

(ii) Reach out to contact farmers identified by the community in barazas to recruit project participants in the pilot phase [10 farmer households per administrative unit (sublocation)]

(iii) Initiation of self-help groups for sustainability [credit access + bargaining power]

(iv) Training will be conducted in Farmer Field School (FFS) where exhibitions will be done.

b) Design, develop and commercialize technologies to enhance development of a variety of banana value added products.

This will be realised through:

(i) Establishing banana processing unit in Chuka University in collaboration with the farmers [Set up in existing buildings for packaging, ripening, gathering raw bananas and wastes]

(ii) Expanding the income from banana production by introducing the utilization of stems and leaves [innovations and patents].

(iii) Value added banana products like breads, cakes, scones, cookies, biscuits, wines, jams, crisps, pickles, salads, starch and flour from fruit, soil conditioners, propagation media, and beautification products from peels, stems and leaves.

(iv) Meetings will be held regularly to create awareness on the expected benefits among the farmers and traders [stable market]

c) Enhance human and infrastructural capacity for sustainable growth of the value chain

This will be achieved through:

(i) Assessing the training needs of various stakeholders

(ii) Developing training material for the identified needs

(iii) Conducting short and long-term training of stakeholders within the banana value chain

(iv) Enhancing the infrastructure for sustainable capacity building

(v) Developing a feedback mechanism for trainings

(vi) Involving postgraduate students to test the innovations developed

d) Increase business and employment opportunities in the banana industry

This will be attained through:

(i) Identifying private partners for commercialization of developed technologies/innovations

(ii) Sensitization of stakeholders on new technologies developed in banana value chain
(iii) Policy advocacy within the relevant line Ministries and county governments
(iv) Recruit more participants in the Tharaka-Nithi County and beyond
(v) Expand the banana products market beyond Kenya to regional and international levels
(vi) Increase farmer income generation avenues via value addition and products diversification

e) Create a platform for fostering linkages among stakeholders in the banana industry
This will be enhanced through:
(i) Conducting biannual stakeholder meetings
(ii) Organization of and participation in conferences and workshops
(iii) Carrying out annual monitoring and evaluation
(iv) Joint resource mobilization and supervision of students
(v) Engagement of stakeholders in decision-making
(vi) Sharing of experiences and lessons learnt within the banana subsector
(vii) Organising and hosting of the exit meeting and project handing over workshop to the host

2.2. Statistical methods, experimental designs and analysis to be used
A survey research design will be used to collect information on available banana cultivars, indigenous technologies, and banana commercialization potential. A structured questionnaire will be employed to collect the information. Field experiments to characterize banana germplasm will be conducted using completely randomized block design and replicated four times at two locations, Chuka University research farm in Kairini and Chuka University demonstration farm in main campus. To facilitate farmer exchange and interactions with the researchers, mother and baby trials will be used in evaluation to identify superior banana germplasm.

The "mother" replicated trial will be set up in Chuka University main campus demonstration farm to test a range of banana germplasm and their optimal uses (innovative technologies) under researchers' management. The "baby" trial will be conducted on farmers' farms. Four farmers will be identified in each of the target counties (Kirinyaga, Embu, Tharaka-Nithi, and Meru). Tissue culture of plantlets and processing of value added products will be set up in completely randomized designs in the laboratory and workshops, respectively.

Data collected will be analyzed using both descriptive and inferential statistics. Data on farmers' scores on preferred banana varieties and their potential uses will be subjected to Mann-Whitney U test and spearman rank correlation.

The morphological, tissue culture and value addition data collected will be subjected to ANOVA using Statistical Analysis Software (SAS) version 9.3 (SAS, 2004). Significantly different means will be separated using Tukey's test at 5% significance level.

Principal component and cluster analyses will be used to determine the joint variation among the set of morphological variables used in characterizing banana germplasm. They will be done on both qualitative and quantitative characters to classify and measure the pattern of genetic diversity in germplasm. The data will be analysed using the Number Cruncher Statistical System, NCSS, 2000 (Hintze, 1998).

In the hierarchical clustering, the unweighted pair group method of arithmetic average will be used. Phenotypic frequency distributions of the characters within and among regions will be determined to establish the banana germplasm diversity in Kenya. The Shannon wavers index (H) according to Hutchenson (1970) will be used.

Budget

Project activities	Indicator	Target	Y1	Y2	Y3
Farmer and stakeholders' inception workshop in Chuka University	1 workshop	50 farmers + 20 stakeholders	300,000	0	0
Baseline/reconnaissance survey	1 survey in Chuka & Maara sub-counties	100 banana farmers	1,200,000	0	0
Procurement of tissue culture consumables	Assorted	Various	600,000	400,000	100,000
Procurement of equipment (mixing vat, airflow system, distiller, growth chambers, incubators)	Assorted	Various	3,000,000	0	0
Casual Labour	5250 work days	400	640,000	960,000	420,000
Research Assistant	36 months	30,000	360,000	360,000	360,000
Travel costs	Assorted	Various	200,000	200,000	200,000
Construction of a seedling handling unit	1 shade house	Hardening seedlings	300,000	0	0
Establishment and maintenance of banana processing unit in Chuka University	An area established from existing buildings	Install value addition kits for edible & non-edibles	550,000	300,000	200,000
Training and dissemination of best management practices (meetings and workshops) to enhance stable market	Trainings, meetings and workshop attendance	Recruit contact farmers, make training materials, and farmer groups	421,000	439,500	439,500
Training & dissemination of best banana practices (Stakeholder meetings by CU staff			320,000	350,000	380,000
Test the innovations made by postgraduate students	3 students projects	Fund student research	400,000	400,000	400,000
Development of prototypes and dissemination materials	2 prototypes		0	0	200,000
Patenting & publications fees and dissemination materials	Manuals, pamphlets, articles		0	0	250,000
Conference fees			0	0	200,000
Administration fee (10%)			700,000	700,000	600,000
Monitoring & Evaluation fee (5%)			400,000	400,000	300,000
TOTAL BUDGET			**9,391,000**	**4,509,500**	**4,049,500**

Budgetary notes

- A 1 day at least 20 banana farmers from four target counties (Kirinyaga, Embu, Tharaka Nithi and Meru) and stakeholders' (MoA, HCD, KEPHIS) inception workshop will be held

in Chuka University during the first quarter after funding. Costs will include payment of transport refunds, facilitators, refreshments and meals at cost-shared and market rates.

- Baseline survey. The costs will include fuels, fare/mileage transport, per diem, stationeries for questionnaire production at market and institutional research rates. At least 200 questionnaires will be administered per selected county to collect the baseline data.
- Procurement of tissue culture and molecular characterization consumables. Costs include procurement of glass ware, autoclave, reagents, propagation media, and other consumables using quotations competitively sourced by procurement section from prequalified suppliers.
- Procurement of equipment (mixing vat, airflow system, distiller, growth chambers, incubators). Costs will involve procurement of these equipment as currently they are not in the tissue culture and value addition laboratories using at least 3 quotations
- Casual Labour. The cost will involve payment of 4 casuals each at KSh 400 per day for the 3 years or other Government-approved rates to maintain the tissue culture and value addition laboratories. Each laboratory will be maintained by 2 casuals per day.
- Research Assistant. The research assistant will manage production in tissue culture and value addition laboratories on annual contract at flat rates of KSh 30,000per month for 3 years.
- Travel costs. Include transport cost used in sourcing of explants, selection of contact farmers, value addition materials, and sensitization of stakeholders at public fare rates or fuel costs.
- Construction of a plantlet handling unit. Costs include constructing a shade house for acclimatizing and hardening tissue culture banana plantlets, which currently does not exist. The handling unit will serve the purpose of acclimatization and also act as a channel for dissemination of the seedlings to communities at affordable farmgate prices.
- Establishment and maintenance of banana processing unit in Chuka University. Includes costs for internal designing and demarcation of rooms within an existing building of a facility to initiate banana value addition experimentation and commercial unit for sustainability.
- Training and dissemination of best banana management practices. Involves fare, fuel and per diems to Farmer Field Schools and contact farmers' farms at institutional and market rates.
- Testing of the innovations developed by postgraduate students. Involves support to student projects each at a cost of KSh 400,000 in areas of banana agronomy and value addition.
- Development of prototypes and dissemination materials. Cost involves development of two prototypes (tissue culture banana production and value addition) each at KSh 100,000.
- Patenting, publications and conference fees. Involves costs of developed product registration at KEBs or other patenting organisations' and dissemination of information acquired along the banana value chain in workshops at organisers' rates, publication or publishers' fees.
- Administration fee (10%). This is as per research policies of the participating institutions to offset some overhead costs during the administration of the project.
- Monitoring & evaluation fee (5%). To facilitate checking on progress of realization of research objectives in different collaborating institutions and locations. It will also be used to fund the exit meeting (transport refunds, refreshments and meals) of stakeholders from the four participating counties to evaluate the outputs of the project compared to the objectives, and a workshop of the same stakeholders to handover the project to the host institution for continuation. The meeting and workshop will assist in making sustainability decisions.

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COMMENTS:

How will sustainability in production be done/carried out in this research? Is it a field need in the study area? A survey to ascertain market of these products is important.

PICTORIAL: University's Role in Enterprising Horticulture: Case of Banana Value Chain Approach

by Dr. Geoffrey K. Gathungu et al., Department of plant Sciences, Chuka University, P. O. Box 109-60400, Chuka, Kenya

Banana crop and bunch

Ripe Banana

Value added banana products for income generation

Value addition to Banana Crop Byproducts

High value products from Banana Pseudostems

Leaves **Fodder** **Compost**

Value Addition in Banana Products and Wastes (By-products)

Obunga Stephine Valentine, DB7/12663/13, Guya Felix Odhiambo, DB7/12622/13, Martha Nyambura Kama, DB7/12630/13, Ruiru Grace Nyokabi, DB7/12646/13, Muthoni Lucy, DB7/12629/13, Dominic Kipkoech Kiru, DB7/12626/13, Ruth Cheserek, DB7/12652/13, BSc. in Horticulture, Department of Plant Sciences, Chuka University, P. O. Box 109-60400, Chuka

Introduction

Banana (*Musa* spp.) is a horticultural crop grown in plantations and which has many uses. Banana products are classified under primary products (cooked and ripe banana fruits as well as banana juice) and secondary products that arise from the other parts of the plant, for example, the banana stem used in the weaving industry.

Banana is an important crop in most parts of the world as it earns farmers income and in some cases, it is an export crop. It is also an important staple food in some communities where it is grown for subsistence use. According to statistics, banana is a major crop in Tharaka Nithi County and some parts of Mount Kenya Region. However, it has been found that most of the banana farmers do not get value from the cultivation of the crops. This is because most of the farmers have concentrated on the primary products that are obtained from the plant and thereby ignoring the secondary products that can be obtained from the crop. This is in complete disregard of the additional income that can come from the sale of some of these products as well as the other profits that the farmer can get from properly utilizing them.

These gaps and limitations in banana production, therefore, call for the university and the region to create awareness for farmers so that they can be able to utilize their resources so as to maximize their profit margin using the same inputs.

Banana Products

Primary products

- Matoke
- Ripe bananas
- Blended banana juice.

Secondary products

Below are some of the secondary products that are made from the banana stem peels which can be an additional source of income for the farmers.

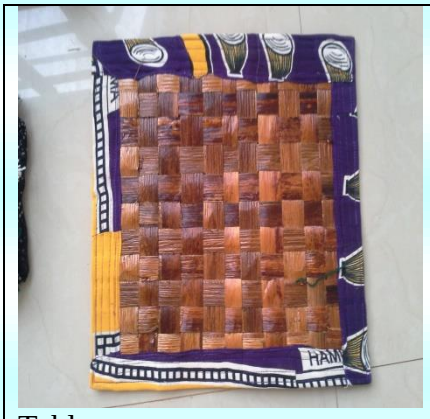
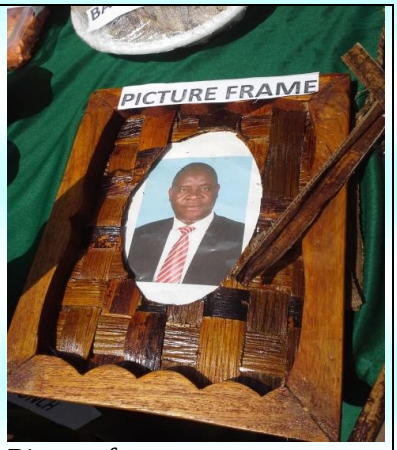


Table mat

Doormat

Wall hanging

 Backrest	 Table mat	 Picture frame
 Pen holder		

Marketability

These products made from the banana stem peels are highly marketable with low cost of making them. This is due to the growing market trend where most of the people all over the world now prefer using naturally made products instead of the synthetic ones. In addition to that, they are also durable especially when they are carefully handled. The cost of purchasing them is relatively low since the farmer uses available materials to make them thus giving them advantage over the other goods of similar form.

Conclusion

In conclusion, banana has many uses some of which involve the use of its wastes that may be deemed useless by most people. However, if they are put to use, they can earn the farmers more income by supplementing the income they get from the sale of the primary products. This shows that the use of banana products has not been fully utilized.

Recommendation

The university should collaborate with the farmers and the other locals and enlighten them on the various uses of the crop which so far has not been exploited. The university should also provide the students with the needed resources that will enhance innovation among them and help them to maximize their knowledge in the field.

Soil and Water Conservation for Increased Crop Productivity and Environment Protection

By Dr. Gathungu G.K and H.O. Ndukhu, Department of Plant Sciences, Faculty of Agriculture and Environmental Studies, Chuka University, P. O. Box 109-60400, Chuka

Abstract

Natural resources including soil, water and biodiversity are necessary for human survival and wellbeing. Sustainable management of these resources in a changing climate to care for over 9 billion people by 2050 remains a challenge. Require to use production practices that enhance resource management to minimize environmental pollution. Communities should mitigate and adapt to climate change and variability through sustainable intensification, resource use efficiency, for enhanced food and nutrition security and improved livelihoods. Good soil management enable the continuous cultivation on the same land and ensure competitiveness and economic viability. There is need for correct identification of soil and water limitations in order to determine the most appropriate management practices required to fully exploit the yield potentials of the crops. This paper reviews the relevant soil management practices that can be used to improve agricultural productivity

Background

The main purposes of soil and water management is to maintain and improve soil fertility, nutrient and water use efficiency and synchronize these factors with crop requirements for high sustainable growth and yields. Water and nutrients are probably the most limiting agronomic factors to growth and yield of most crops. There is need to assess the severity of soil properties which are limiting yield performances to enable overcoming or alleviating them to upgrade the yield performances. Over- or under-application of fertilizers effects include; poor crop productivity due to lack of fertilizer or imbalance, less in profit due to excess fertilization, soil acidification and degradation, environmental pollution due to excessive leaching and run-off losses. Major soil management requirements includes: soil and water conservation management, soil fertility management, soil acidity management, soil water management

Soil fertility management

Nutrient requirements-equating nutrient removal against nutrient supply, that requires effective fertilizer management programme. The farmers should be able to determine growth and yield targets, assess the action required in relation to nutrients needed, application rates, most efficient and cost effective application methods and the source of the nutrients. Farmers should be able to carry out economic analysis to enhance efficiency in fertilizer use.

Soil acidity

Growers need to be aware of two major issues: one, soils with low pH and two, soils acidified by management practices such as manuring and terracing. The low pH is characterized with high Al saturation while high soil pH with high exchangeable Ca and Mg that influences crop sensitivity. Soil acidity changes due to; leaching of nutrients, nutrient uptake by plants and pollutants, fertilization with acidifying fertilizers such as ammonium sulphate. Farmers should perform simple on-farm soil and water analysis tests to determine their effect on crop performance.

Soil water management

In most production areas there exists inadequate rainfall of less than 1000 mm per year, poor rainfall distribution pattern, or very shallow soil that results to restricted rooting. Water conservation measures should be aimed at maintaining maximum use of rainfalls, minimizing run-off and erosion, and maintaining or improving infiltration of water into the soil. The

irrigation and drainage systems used by farmers should be easy to maintain, prevent flooding and increase water use efficiency.

How do we address critical soil and water conservation constraints?

For effective soil and water conservation there is need for Innovative development systems approach involving multiple players; Conduction of biophysical research on soil, water and plant parameters; Socio-economic research on feasibility, viability, profitability, risk and adoption; Knowledge generation and capacity building; Use of adaptive, participatory research systems with farmers; and Generation of evidence through publication of findings.

What the university should do to improve on soil and water conservation

Healthy soil is the real key to feeding the world and it is important to embrace strategies that Save water as every drop counts. The university should popularize appropriate innovative soil and water conservation technologies through;

- Initiating soil and water analysis services to enable communities know their quality
- Initiating Rhizobium production plant to provide inoculants to communities.
- Conduct short-term training with emphasis on soil and water management
- Conduct outreach activities on soil and water conservation and management

Summary Budget of Activities

Activity	**Description**	**Budget**
Establishment of a soil and water analysis laboratory	To test soil samples to local communities at a nominal fee	1,000,000
Initiating Rhizobium production	To test and perform mass production of effective rhizobium for sale to legume crop farmers	500,000
Short-term training on soil and water management	One week training on soil and water conservation practices to both farmers and extension agents at a fee	250,000 (initial funds required for publicity). Future budgets to be from participants fees
Outreach activities targeting farmer groups from the 4 sub-counties through use of farmer field schools	To train farmers on management, sampling and corrective activities	500,000
Total		**2,250,000**
Expected income	**?**	**?**

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Soil and Water Conservation for Increased Crop Productivity and Environment Protection

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Healthy soil is the real key to feeding the world

- Natural resources including soil, water and biodiversity are necessary for human survival and wellbeing.
- Sustainably managing natural resources in a changing climate and a world that needs to feed, clothe and shelter over 9 billion people by 2050 remains a challenge.

Save water, every drop counts

- Use production practices that that enhance soil organic matter content, water infiltration and retention capacity, besides reducing soil erosion to minimize environmental pollution.
- Result is mitigation and adaptation to climate change and variability, sustainable intensification, resource use efficiency, food and nutrition security and improved livelihoods.

Processing Locally Adapted and Preferred Crops for Value Addition and Enhancement of Consumption: Case of Pumpkin Fruits and Sweet Potatoes

by Ms. J. W. Kiharason and Prof. D. K. Isutsa, Chuka University, P.O Box 109-60400, Chuka

INTRODUCTION

Pumpkin Fruit

Pumpkins of the genus Curcubita are natives of Central and South America and since the 17thCentury, they have spread all over the tropics and subtropics. *Curcubita moschata* is the most commonly consumed species, the most heat tolerant and the most common in tropical Africa. It is a multipurpose fruit and leaf vegetable with flowers that are edible as well (Mnzava and Mbewe, 1997). Pumpkins are used widely in most African countries for their food value. The cooked mature fruit of pumpkins is the preferred food product. It is also popular for making pie. In South-East Asia it is made into sweets and desserts, of steamed fruit flesh with grated coconut and sugar, and into crisps made by frying steamed fruit flesh mixed with cassava flour. In Zambia the ripe fruit flesh is dried for longer preservation (Mnzava and Mbewe, 1997). Commercially, in China, India and USA, who have been leading producers, pumpkin is canned. In Nigeria, pumpkin leaves are used to make soup, cassava salad, plantain porridge and '*Asaro* or *Ebe'* (yam pottage). *M'chicha Wa Nazi* in Tanzania is a soup made by blending pumpkin leaves, peanut butter, onion, chili and coconut.

Traditionally, pumpkin was used for treating type 2 diabetes in Mexico where the traditional healers administered crude extract of the pumpkin fruit to the patients (Arimi Foods, 2011). *Cucurbita moschata* has medicinal applications in Thailand and China (Mnzava and Mbewe, 1997). Experimental studies suggest that a higher dietary intake of carotenoids offers protection against lung, skin, uterine, cervical, gastrointestinal tract cancers, muscular degeneration, cataracts, and other health conditions linked to oxidative or free radical damage. Special physiological activity of these compounds as vitamin A precursors and antioxidants provokes increasing interest among researchers in determining their content in different products (Mavek et al., 2007). The beta carotene gives pumpkin its yellow or orange colour and plays a crucial role in prevention of chronic diseases during adult life due to their antioxidant abilities (Blumberg, 1995; Jones and Engleson, 2010).

Pumpkin flour has been used to supplement cereal fours in bakery products, for soups, sauces, instant noodles and spice as well as natural colouring agent in pasta and flour mixes (Ptitchina et al., 1998). Pongjanta *et al*., (2006) indicated that the use of 10-20% pumpkin powder substituted for wheat flour in Thai desserts improved their yellow color and β-carotene content, and would be accepted by consumers. This study revealed that pumpkin powder significantly enhances β-carotene content in supplemented bakery products. A composite of pumpkin powder and wheat flour increased vitamin A from 1.88 to 12.92% per 20 to 40g of the baked products consumed. Chiffon cake, sandwiches bread, sweet bread, butter cake, and pumpkin cookies were accepted by the consumers at the level of "like moderately" to "like very much". Most of the respondents (90-100 %) would accept and buy the products (Pongjanta *et al*., 2006).

Pumpkins are very rich in macro- and micro-nutrients, including calcium, iron, vitamin A, specifically unsaturated oleic and linoleic acid oil, protein, with high amounts of arginine, aspartate and glutamic acid (Usha et al., 2010). The rich nutrition base of pumpkin can be tapped to improve the nutritional quality of baked products, soups and sauces. Pumpkin powder contains 40% cellulose, 4.3% hemi-cellulose and 4.3% lignin, the main components of insoluble dietary fibre (Ptichkina et al., 1998). Consuming this fibre is reportedly protective against degenerative

disorders such as diabetes mellitus, cardiovascular diseases, constipation, appendicitis, hemorrhoids and colon cancer. The fibre buffers the stomach pH by binding to the excess acids produced by the digestive system, helps in fecal bulking and intestinal emptying (Vergara-Valencia, 2006).

Sweet Potato

Sweet potato (*Ipomea batatas*) is a root crop belonging to the family Convolvulaceae. It originated from the tropical Americas and spread to most of the world's tropical, sub-tropical and warmer temperate regions. It is a perennial crop, sometimes planted annually (Nyabok, et al., 2011). It has been ranked among the world's most important crop after rice, wheat, maize and sorghum (FAO, 2004). In Kenya it is fourth important staple food from maize, Irish potato, banana, and then cassava as fifth (Tedesco and Stathers, 2015), and has been established as one of the important food security crops when maize is in short supply or during drought. This is because of its ability to adapt to a wide range of climatic conditions, including those found in marginal areas where there is chronic crop failure and low soil fertility. The growing crop is not affected by insect damage and fungal diseases hence insecticides and fungicides are unnecessary. Ability to grow in relatively dry conditions makes it require no irrigation (it is a drought-resistant crop). It is also a fast-maturing crop (takes 3-5 months to get ready); early maturity is important for food security and enabling people to get income early to meet cash obligations such as school fees (Mutuura et al., 1992; Nyabok, et al., 2011).

Furthermore, it does not require high levels of input since the rapid growth of vines to form ground cover eliminates the need for cultivation. The crop can be planted over a broad range of time without considerable yield loss. Also, its ability to establish ground cover fast enables it to suppress weeds, control soil erosion and maintain soil fertility; making it an attractive crop for Kenya's farming systems. Besides, the sweet potato has a cornucopia of uses; these range from direct consumption of fresh roots/ leaves to processing into animal feeds, starch, flour, candy and alcohol (CIP, 1996).

The sweet potato serves a key role as an energy-dense food often in post-disaster contexts (Kapinga et al., 2005). The general composition of the tuber is as follows: water (70-80%), carbohydrates (10-30%), protein (1-3%) and fats (0-1%) but nutrient content varies with variety (Nyabok, et al., 2011). There are many different varieties of sweet potato cultivars e.g. white-fleshed dry-tasting cultivars (over 30% dry matter) and orange-fleshed (OFSP) soft-tasting cultivars (about 20-25% dry matter). Other cultivars have yellow, cream or even purple flesh colour, and each of these varieties have different contents of beta-carotene. International Potato Centre (CIP) and its partner organizations have taken up the food-based option to combat VAD in Sub-Saharan Africa (SSA) through promotion of OFSP variety which has the highest beta carotene content (Takahata et al, 1993; Tedesco and Stathers, 2015). Beta carotene, a precursor of vitamin A is easily converted into the retinoids required by the body for eye, skin, and immune health (Bai et al, 2011). A child who is 5year-old or younger needs to consume only 100 g/d (half-cup) of OFSP roots in order to receive the recommended daily amount of vitamin A (Low et al, 2000; Mwanga et al, 2009). Introduction of OFSP into a community in Mozambique which led its consumption 3 or more days a week, reported a reduction of vitamin A deficiency (as indicated by serum levels) from 60-36% among otherwise healthy intervention children (Jenkins, et al., 2015). OFSP is also drought resistant and easily cultivated (Low et al., 2007), maturing very fast at 3-3½ months compared to local strains (white and yellow-fleshed) which take 5 months (Tedesco and Stathers, 2015).

The yellow and white fleshed varieties which are, ironically, the most widely consumed and cultivated in SSA, have very low carotenoid content (Hagenimana et al., 1998; Low et al., 2000;

Mwanga et al., 2009). OFSP was introduced through SASHA (Sweet Potato Action for Security and Health in Africa) project launched in 2009, to improve food security and heath conditions of poor families in Sub-Saharan Africa by supporting them to exploit the full potential of the crop. The benefits of the project included higher concentrations of pro-vitamin A intake through the OFSP among young children and pregnant women, and positive experience on the large scale commercial production and marketing of bakery products which incorporated OFSP puree in their recipes. Where cultivated (Busia, Kabondo and Siaya), the OFSP gave higher profits per acre compared to the traditional white or yellow-fleshed (Tedesco and Stathers, 2015).

As market increases, the demand for OFSP has increased making it necessary for more OFSP processors as well as multiplying the sweet potato production sites to supply the harvest into the value chain. Market costs for the OFSP tuber also tend to be affordable, between KSh. 12-20/kg in the growing zones. The project focused on western parts of Kenya including Homa Bay, Mogori, Siaya, Busia and Kericho (Tedesco and Stathers, 2015). A study by Low and colleagues showed that substitution of wheat flour with 38% OFSP puree created golden bread to which consumers demonstrated a strong preference over white bread due to its heavier texture, superior taste and attractive golden appearance. This substitution provided an important source of higher profits by up to 92% as the result of using locally available sweet potato to replace expensive imported wheat flour. The puree proportion could be safely increased up to 45% in other products like cakes, cookies and biscuits (Low et al., 2008).

STATEMENT OF THE PROBLEM

Pumpkin

Traditionally, pumpkin has not been regarded as a delicacy by many in Kenya (it is 'a forgotten super food'), and the fruit is only consumed due to lack of potatoes, while the leaves are used in absence of cabbage or kales (Arimi Foods, 2011). International trade of pumpkin leaves, fruits and seed is very minor or non-existent, but at national level the leaves and fruits and often the seeds are important products on the local markets. *Cucurbita moschata* is most probably cultivated in all countries of tropical Africa, but it is more important in Southern Africa than in East and West Africa (Mnzava and Mbewe, 1997). Available data for Kenya indicates pumpkin as a crop which is not valued as a sales crop as compared to other horticultural crops which are widely grown for household consumption as well as for sale (Muendo and Tschirley, 2004). It is referred to as a crop with virtually no commercial importance in Nigeria (Blessing *et al*., 2011). Pumpkins are basically under-utilized in Kenya, with very few pumpkin-produce recipes. This leads to low demand and consequently low production. Many households including those who produce pumpkins still suffer from hunger and malnutrition since they do not know how to utilize pumpkins.

Sweet potato

In spite of the benefits associated with sweet-potato, its production and utilization has been rather low in most parts of the world. This is due to the low status accorded to both roots and vines because of their image as a substitute crop, a "poor man's" food, a women's crop or an insurance crop (Kapinga et al., 2005). Sweet potato consumption has been found to decline as income increases. In most parts of Kenya, people do not perceive it as part of the main family diet: in central Kenya, it plays only a minor role as an alternative breakfast food or snack. In western Kenya, however, it is a supplementary staple and many people consume it boiled whole or mashed with legumes. A study in western Kenya reported that the OFSP seemed to give higher profits per acre than the traditional white or yellow fleshed varieties. Consumption of OFSP in the study area appeared to be more popular when the roots were incorporated into processed products as opposed to boiling the root, which is more common for the traditional white or yellow fleshed (Tedesco and Stathers, 2015). In Kenya, sweet potato cultivation is

mainly concentrated in Western Kenya, while in Central and Coast the crop is grown at small scale (Tedesco and Stathers, 2015). Very little has been happening in all other regions of Kenya, where this crop can be tapped and promoted as an avenue to improve food and nutrition security among community members.

Traditional food crops face poor consumption especially in urban and cosmopolitan centers where dwellers tend to purchase processed and packaged food for convenience (Onyango *et al*., 2008). Given that Kenya, along with other SSA countries is rapidly urbanizing, there is, therefore, need for value addition of these traditional, poorly consumed yet highly nutritious food crops so as to be incorporated (as convenience foods) into the dietary systems of the urban population. This way such food based interventions towards improving food and nutrition security of individuals will target all Kenyan populations including those in the urban who are equally affected.

OBJECTIVES

This project is guided by the following two objectives:

1. To demonstrate value addition to pumpkin (*C. moschata*) fruit and application in enhancing consumption in convenience foods (cakes, cookies, *mandazi*, bread, scones)
2. To demonstrate application of orange-fleshed sweet potato in diversifying and enhancing consumption via diverse convenience foods (cakes, cookies, *mandazi*, bread and scones)

METHODOLOGY

Value addition of pumpkin fruit involved preparing pumpkin fruit flour which was then used as a substitute for wheat flour at some ratio, in the preparation of five convenience foods common in the local market as wheat products (cakes, cookies, *mandazi*, bread and scones). The substitution ratios were used following previous consumer tests showing the most likable substitution level (Kiharason et al., 2017). On the other hand, diversification of OFSP to enhance consumption through the same products was done by substituting a portion of wheat flour with boiled, mashed OFSP (puree). Substitution rations used were decided upon following a study by Low et al (2008) who reported strong likability of 38% substitution for bread and indicated higher substitution levels for other bakery products.

Wheat and pumpkin-flour blended products:

The pumpkin-blended products were prepared following the recipes below:

Wheat and Pumpkin Flour-Blended Cake

The ingredients were 800g (80%) self-rising wheat flour, 200g (20%) pumpkin flour, 500g margarine, 500g sugar, 2 medium lemons, 20g baking powder and 6 eggs. The flours and baking powder were sifted, margarine rubbed in followed by sugar addition and mixing. Eggs were then beaten, added to the mixture and mixed thoroughly. The mixture was poured into tins and baked at 135^{o}C for 35 min until a distinct scent and golden brown crust developed.

Wheat and Pumpkin Flour-Blended Cookies

The ingredients were 760g (95%) self-rising wheat flour, 40g (5%) pumpkin flour, 80g butter at room temperature, 320g margarine, 400g sugar, 4 eggs at room temperature and 1 teaspoon salt. The butter and shortening were mixed together using a wooden spoon until uniform. Sugar was added and mixed until ingredients were light and fluffy. Eggs were added and the mixture stirred until ingredients were well combined. The flour, baking powder and salt were whisked together in a separate bowl and ⅓ of the dry ingredients added to the bowl of wet ingredients and stirred until they were just combined. Dry ingredients were gradually added continuously while stirring. The oven was pre-heated to 205°C and a baking sheet lined with parchment paper. The dough

was scooped out using a tablespoon and shaped into balls using clean hands. Each ball of dough was placed onto the baking sheet, leaving about 5cm of space all around for spreading as it cooked. The cookies were baked for up to 10 minutes, removed from the oven, cooled for 2 minutes, loosened using a spatula and placed on wire racks to cool down.

Wheat and Pumpkin Flour-Blended Mandazi

The ingredients were 950g (95%) wheat (*mandazi*) flour, 50g (5%) pumpkin flour, 50g margarine, 100g sugar, 4 eggs, 5 teaspoons baking powder, 300ml milk and 2L cooking oil. All ingredients were mixed by combining dry ingredients well, then adding the beaten eggs and milk. The dough was left to stand for about 15 minutes to rise. Meanwhile, oil was heated in a deep frying pan. Dough was rolled over a lightly floured surface into 0.625cm thickness, cut to size and shape, deep-fried until golden brown and then drained on paper towels.

Wheat and Pumpkin Flour-Blended Scones

The ingredients were from 950g (95%) all-purpose flour, 50g (5%) pumpkin flour, 30 fat, 125ml milk, 20g sugar, 12.5g baking powder, and 2.5g (½ teaspoon) salt. The flour was sifted with other dry ingredients into a large mixing bowl and rubbed in fat while aerating at the same time. A deep well was made in the flour where almost all liquid ingredients were poured and mixed to soft dough with a palette knife. The remaining liquid ingredients were added. On a floured surface, dough was kneaded very lightly until it was just smooth and divided into two pieces that were each lightly shaped into a ball. Each piece was then flattened to 2cm thickness and cut into 6 triangles. The oven was pre-heated and scones brushed with beaten eggs for a glossy crust. Scones were left to rest for 10 to 15 minutes before baking at 245^{o}C at the top oven, until well risen and brown.

Wheat and Pumpkin Flour-Blended Bread

Wheat and pumpkin flour blended bread The ingredients were 760 g (95%) strong flour, 40g (5%) pumpkin flour, 10g vegetable fat, 480ml water, 5g fresh yeast, 10g sugar and 8g salt. Baking tins were lightly greased. Flour and salt were shifted into a large bowl. Fat was added and rubbed into flour using finger tips. One-third of water was boiled and added to the remaining cold water to make it warm. Fresh yeast and sugar were put into a basin and mixed with the liquid. A deep hole was made in the flour and the liquid mixture added and mixed thoroughly using hands with a clawing movement for 3 minutes until the dough freely peeled off fingers. Dough was turned onto lightly floured surface and kneaded for 10 minutes until smooth and elastic. Dough was shaped, covered with greased heat-proof polythene and left to rise for 45 minutes. The surface was dusted with flour and baked in a hot oven at 245^{o}C until golden brown.

Wheat and OFSP-Blended Products

The OFSP-blended products were prepared following the recipes below:

Wheat and OFSP puree-blended cake

The ingredients were 550g (55%) self-rising wheat flour, 450g (45%) OFSP puree, 500g margarine, 500g sugar, 2 medium lemons, 20g baking powder and 6 eggs. The flours and baking powder were sifted, margarine rubbed in followed by sugar addition and mixing. Eggs were then beaten together with the puree, added to the mixture and mixed thoroughly. The mixture was poured into tins and baked at 135^{o}C for 35 minutes until the cake developed a distinct scent and golden brown crust.

Wheat and OFSP puree-blended cookies

The ingredients were 600g (60%) self-rising wheat flour, 400g (40%) OFSP puree, 80g butter at room temperature, 320g margarine, 400g sugar, 4 eggs at room temperature and 1 teaspoon salt.

The butter and shortening were mixed together using a wooden spoon until uniform. Sugar was added and mixed until ingredients were light and fluffy. Eggs and puree were beaten together, added to the mixture and stirred until ingredients were well combined. The flour, baking powder and salt were whisked together in a separate bowl and ⅓ of the dry ingredients added to the bowl of wet ingredients and stirred until they were just combined. Dry ingredients were gradually added continuously while stirring. The oven was pre-heated to 205°C and a baking sheet lined with parchment paper. The dough was scooped out using a tablespoon and shaped into balls using clean hands. Each ball of dough was placed onto the baking sheet lined with grease proof paper, leaving about 5cm of space all around for spreading as it cooked. The cookies were baked for up to 10 minutes, removed from the oven, cooled for 2 minutes, loosened using a spatula, separated from the grease proof paper and placed on wire racks to cool down.

Wheat and OFSP puree-blended mandazi

The ingredients were 700g (70%) wheat (*mandazi*) flour, 300g (30%) OFSP puree, 50g margarine, 100g sugar, 4 eggs, 5 teaspoons baking powder, 300ml milk and 2L cooking oil. All ingredients were mixed by combining dry ingredients well, then adding the beaten eggs, puree and milk, then kneading till soft and well combined for easy rolling. The dough was left to stand for about 15 minutes to rise. Meanwhile, the oil was heated in a deep frying pan. Dough was rolled over a lightly floured surface into 0.625cm thickness, cut into desired size and shape, deep-fried until golden brown and then drained on paper towels.

Wheat and OFSP puree-blended scones

The ingredients were from 520 g (65%) all-purpose flour, 280g (35%) OFSP puree, 30g fat, 125ml milk, 12.5g baking powder, and 2.5g (½ teaspoon) salt. The flour was sifted with other dry ingredients into a large mixing bowl and rubbed in fat while aerating at the same time. A deep well was made in the flour where almost all liquid ingredients and puree were poured and mixed to soft dough with a palette knife. The remaining liquid ingredients were added. On a floured surface, dough was kneaded very lightly until it was just smooth and divided into two pieces that were each lightly shaped into a ball. Each piece was then flattened to 2cm thickness and cut into 6 triangles. The oven was pre-heated and scones brushed with beaten eggs for a glossy crust. Scones were left to rest for 10 to 15 minutes before baking at 245^{o}C at the top oven, until well risen and brown.

Wheat and OFSP puree-blended bread

The ingredients were 520 g (65%) strong flour, 280g (35%) OFSP puree, 10g vegetable fat, 480ml water, 5g fresh yeast, 10g sugar and 8g salt. Baking tins were lightly greased. Flour and salt were shifted into a large bowl. Fat was added and rubbed into flour using finger tips. One-third of water was boiled and added to the remaining cold water to make it warm. Fresh yeast and sugar were put into a basin and mixed with the liquid. A deep hole was made in the flour and the liquid mixture together with the puree added and mixed thoroughly using hands with a clawing movement for 3 minutes until the dough freely peeled off fingers. Dough was turned onto lightly floured surface and kneaded for 10 minutes until smooth and elastic. The dough was shaped, covered with greased heat-proof polythene and left to rise for 45 minutes. Dough surface was dusted with flour and baked in a hot oven at 245^{o}C until golden brown.

MARKETABILITY

The authors of this paper aspire to intensify community awareness of the two food crops, taking part in promoting their cultivation alongside availing interesting recipes to local community, thus enhance consumption of these nutrient-dense food crops. The following are the suggested milestones for each food crop through donor support:

Pumpkin fruit:

- Setting up a processing plant for pumpkin fruit into flour (installation of a slicing and drying unit) to help diversify use of the fruit in form of flour in various commercial products
- Developing a production unit (bakery) for continued production of University-branded pumpkin products to be availed in the local market through the university market chain

Sweet potato:

- Introduction of OFSP variety into the university farm for increased production of the crop (vines can be sourced from surrounding agricultural research centres)
- Rolling out of the crop into the neighbouring and wider community and promote its cultivation and consumption for improved nutrition, which will be done in collaboration with the agricultural extension services (an increase in production will drastically reduce market price of the harvested crop, down from current OFSP price of KSh. 100/kg, being sourced as far as from a neighbouring County)
- Production of OFSP blended products of wheat and OFSP puree, and availing the OFSP University-branded products to the local community through the university market chain

COST EFFECTIVENESS

This section covers budgetary approximations of the budget in terms of expenditure that would occur during food production from the two food crops, as well as indicating proposed selling prices of each 1kg recipe yield. This will make it possible to calculate the profits that would be earned from such production. Assumptions are further made on total amount of production of the specific product per day (at least for a beginning when market outlet is not strong enough), this is then converted to weekly production and finally per month in order to calculate approximated monthly profits. Assuming four people are hired on 3 months contract to provide labour for the beginning (two at diploma level (in charge of production) earning a wage of KSh. 400 per day and two casuals (to provide manual/ preparation work) earning KSh. 379.30).

NOTE: The budget is made following the local costs of ingredients (e.g. converting the cost of 800 g wheat flour required for cake using the current price of a 2 kg packet of wheat flour), while approximating that pumpkin flour would retail at KSh. 70/kg and OFSP puree at KSh. 50/kg.

Budgetary Cash Flow of Expenditure vs Income from Pumpkin and OFSP Products

Pumpkin-blended products						
Product	Expenditure for 1kg flour/s recipe (ksh)	Selling price of 1kg yield	Profit from 1kg yield	Estimated total daily production	Total profit per day	Total weekly profits (6 days)
Cake	353.20	500 (10pcs @50/-)	146	10kg	1,460	8,760
Cookies	279.65	420 (10pc pkt @35/-)	140	10kg	1,400	8,400
Mandazi	283.15	450 (1 pc@ 15/-)	167	10kg	1,670	10,020
Scones	85.70	150 (6pc pkt @30/-)	64	10kg	640	3,840
Bread	56.67	90 (45/- per loaf)	33	10kg	330	1,980
				Total	**5,500**	**33,000**
					Profit/month	**132,000**

OFSP-puree blended products						
Cake	346	500	153	10kg	1,530	9,180
Cookies	286.65	420	133	10kg	1,330	7,980
Mandazi	279	450	171	10kg	1,710	10,260
Scones	72.50	150	77.50	10kg	775	4,650
Bread	55.91	90	34	10kg	340	2,040
				Total	**5,685**	**34,110**
					Profit/month	**136,440**
Grand total profit/month (for both sets of products)					136,440+ 132,000	**268,440**
Labour expenditure						
Level of labour	Number of people	Wages per day	Weekly wages	Monthly wages	Total wage bill	**37,406**
Diploma	2	400	4,800	19,200		
Casual	2	379.30	4,551	18,206		
Approximated packaging and branding costs (per month): sh.**4,000/**						
Total monthly expenditure						**41,406**
Net monthly profits (ksh)						**227,034**

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COMMENTS:

Check on adaptability to other counties in Kenya.

Survey on acceptability of sweet potatoes is important. Answer: Already done. Nice presentation.

Value Addition in the Processing of Horticultural Products and Food Preservation Methods

By Joyanne Wambui Karuma, DB11/21666/15, B.Sc. in Food Science and Technology, Department of Plant Sciences, Chuka University, P. O. Box 109-60400, Chuka

Introduction

Food Science and Technology is an integration of sciences to develop process and produce with the help of the skills. Food scientists can provide safe and nutritious foods while still maintaining the original sensory qualities of foods. It enables the use of readily available resources to develop while adding value to horticultural products. From the products presented there is fruit jam, marmalade, tomato sauce and potato crisps.

Food Science and Technology deals with horticultural produce which is prone to spoilage. Kenya lags behind in exporting its indigenous produce. This results from inadequate post-harvest measures and processing as well as poor infrastructure. These cause a lot of losses to the produce, money and also time. To curb this, food science helps to prevent losses by innovating new methods of food preservation. These measures are against food spoilage with occurs at the post-harvest stage.

Value addition deals with the phase structure of the original material to other forms, for example, changing the potato or banana to crisps. Its aim is to increase consumer preference and also to enhance conveniences like in making snacks from potatoes.

Sauerkraut, banana and watermelon wine

Fruit jam, marmalade and tomato sauce


Crisps

With the knowledge of making the above homemade products, it will help in earning of incomes to both Chuka University students and also to everyone at home. These products are made from a simple concept that is easy to follow and understand.

Food science equips students with knowledge and skills that help them to produce products at low prices. This helps in filling the gap of unemployment in Kenya by coming up with projects after the completion of their course to innovate new products in the market gaps.

One of the methods is fermentation which is the chemical breakdown of sugar in the presence of water. The process occurs with the help of anaerobic bacteria such as yeast to produce alcohol and carbon (IV) oxide. The fermentation process may take some weeks depending on the plant type. After the process, organoleptic characteristics e.g. taste, color, texture, and smell do not change. Fermentation as a method of food preservation helps in filling the gaps of off-seasons of cabbages or any vegetables thereby increasing their shelf life and also creating income to small-scale traders. With the knowledge in fermentation, scientists have increased consumer preferences by inventing banana and watermelon wine. This is to make use of the readily

available resources like bananas, watermelons or pineapples. These are produced in large quantities which may force the farmer to sell the surplus at throw away prices. The alternative to this, one can make homemade banana, watermelon or pineapple wine and sell at a profit.

In addition to increasing consumer preferences, fermentation of readily available has helped in solving the problem of importing expensive grapes (commonly used) for making wine since grapes are prone to offseason. The process is simple and involves washing the produce, removing the peels, blending and filling in glass jars which are then tightly closed to provide anaerobic environmental conditions. A hole is then made at the top of the lid and a tube fixed then connected to another bottle to facilitate the collection of carbon (IV) oxide under water since the wines are not supposed to be carbonated.

After a period of some weeks, fermentation occurs and the by-product (alcohol) is left in the container, and the wine is ready. The alcoholic percentage of the drink is still not known since the innovation is under experimentation. The above processes of fermentation are under experimentation to help in determining the shelf life of fermented cabbages.

Value addition can also include making cakes, bread, mandazi, cookies, and scones from sweet potatoes and pumpkins. The pumpkin is dried, grounded into flour and then mixed in the dough at the ratio of 1:1. Sweet potatoes are boiled, the peel removed, mashed and added to the dough in the making of the varieties.

Conclusion

The processes explained above have proven practical and efficient and reduces the chances of losses that small-scale farmers in the horticultural sector get as a result of spoilage of the produce. By increasing the shelf life of products, the farmers can store for long and release their products when the market prices are favorable. They are also able to earn more income from the value added products such as the fruit jams and the cakes.

Recommendation

The university should take food preservation seriously and work towards nurturing students with the capability of coming up with various innovation in this field of food science as this will help in saving the country and the small scale farmers and traders from excessive spending in importing food from other nations which have so far proved very expensive.

Manual Publication: Food Science and Technology Practicals Manual

by Mr. Stephen Wachira Kariuki, Department of Plant Sciences, P. O. Box 109-60400, Chuka

INTRODUCTION

- This Laboratory manual is a collection of experiments designed for Food Science and Technology at the University level.
- The practical's, are aimed at Bachelors students in Food Science and Technology, but many are suitable for post graduates as well.
- They cover a representative sampling of the important type of experiments in developing experimental as well as observational approach in principles of Food Science and Technology that extend beyond the particular food products used.
- The manual will also serve as a guide for the necessary laboratories infrastructure requirements.

OBJECTIVE

Develop a comprehensive manual to be used as a standard operating procedure (SOP) in food science & technology laboratories, the food processing pilot plant and training guide.

BUDGET/ REQUEST FOR REIMBERSEMENT OF COSTS

SN	PARTICULARS	Unit	Unit cost	COST KSh.
1	Stationery			10000
2	Production of draft electronic copy: Type setting	245	40	9800
3	Production of Final electronic copy: Editing	245	10	2450
4	Local travel (Sourcing and collection of materials)			6000
	Nairobi Per diem (6 days @ 11,200 =)	6	11,200	67,200
	Total costs incurred: KSH			95,450

PROJECTED INCOME

- Copies of the Manual to be printed and bound in the library and will be a course requirement for all food science students
- Assuming costs per manual Ksh. 300
- Assuming selling price to all first years at Ksh. 1000
- Net = Ksh. 700 per copy projected multiply by number of new students for every intake and short courses offered.

COMMENTS:

Good work.

Faculty of Arts and Humanities
Moderator: Dr. Nancy Mbaka
Rapporteur: Dr. Humphrey Ireri
Judges: Prof. Z. N. Waita, Prof. S. K. Wambugu, Dr. Christine A. Peter

Short Course: National Integrity and Cohesion Values and Principles of Good Governance

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1. INTRODUCTION

Although Kenya, just like the rest of Africa (Kunhiyop, 2008) had previously encountered numerous ethnic conflicts, it was the 2007/08 Post-election violence (PEV) that impelled Kenyans to think in terms of one nation or family rather than forty two tribes stuck in various regions of the country. The violence was so grave that about 1,133 Kenyans lost their lives, at least 350,000 were internally displaced, more 2000 became refugees, there as unknown number of sexual violence victims, 117,216 private properties were destroyed and 491 government-owned property (offices, vehicles, health centers, schools) were annihilated (Center for Strategic and International Studies, 2011). The 2007/08 ethnic tension was a major setback to the Kenya Vision 2030 which had just been launched after many years of economic meltdown, social injustices and political instability (Wasonga, 2016). The aim of Vision 2030 was 'To transform Kenya into a newly industrializing, middle-income country providing a high quality life to all its citizens by the year 2030' (Kenya Vision 2030, 2007), a dream that was fatally shattered by the 2007/08 PEV.

Adeyemo (1990, pp. 15-16) attributes the many ethnic conflicts in Africa today to unequal distribution of national resources (80% of the national cake/wealth is enjoyed and controlled by only 5% of the population), land tenure and ownership (land is owned by the rich/elite minority), socio-economic and political struggle (bribery and corruption is on the increase) and power, poverty and class struggle (power controlled by a small elite, national leaders treat national offices as an exclusive right rather than an open responsibility, the common people are gripped by poverty across the whole shapes of their lives and as a result two distinct classes have emerged: the rich and the powerful minority and the poor and the powerless majority). While the 2007/08 Post-election in Kenya is highly attributed to the disputed Presidential election results, the truth of the matter is that it was a manifestation of a failed state than just election results. It was caused by the factors raised by Tokunboh Adeyemo above. This can be confirmed by the report of the Commission of Inquiry on Post-Election Violence (2009) that investigated Kenya's 2007/2008 Post-election violence which attributed the county's history of electoral violence to a combination of long-standing conflict drivers (Cho, et. al. 2015).

Among the contributing factors according to the Commission were:

i) The perception of historic marginalization by certain ethnic groups as a consequence of alleged inequalities associated with the allocation of resources – in particular land.
ii) A system of governance based on highly centralized and personalized executive, where the President and his ruling circle had historically maintained enormous control over the institutions that would normally serve as checks and balances, including judiciary, legislature as well as the police.
iii) The longstanding problem of high youth unemployment.
iv) Entrenched culture of impunity, where despite Kenya's history of electoral and other sectarian violence, the country has failed to bring justice to anyone responsible for abuses.

Although the 2007/2008 conflict was a dark moment for this country, it made Kenyans to start thinking in another dimension- One nation. Thus issues of national cohesion and integration, values and principles of good governance became paramount in a country which was going through what Jesse Mugambi refers to as 'Reconstruction' (Mugambi 1995). Mugambi (1995, p.198) suggests that since the word 'tribe' has no equivalent of any of African languages, it the high time that Kenyans stop thinking of their identity in terms of 'their tribes'. He proposes the words, 'nation' or 'community' as ideal in reconstructing a country which has gone through a sad history of bad governance.

2. THE GOVERNMENT'S STRATEGY

2.1 The Constitution of Kenya 2010

The Constitution of Kenya enacted on 27th August 2010 is a major guide to Kenyans as they strive to build one nation or community. It provides a conducive environment for citizens to live harmoniously. When fully implemented it is expected that the nation will be more cohesive and integrated (National Cohesion and Integration Training manual, 2011). Article 10 espouses the national values and principles of governance that bind all State organs, State officers, public officers and all persons. These include:

a) Patriotism, national unity, sharing and devolution of power, the rule of law, democracy and participation of the people.
b) Human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination, and protection of the marginalized.
c) Good governance, integrity, transparency and accountability
d) Sustainable development

2.2 Formation of the National Cohesion and Integration Commission (NCIC)

The NCIC was established by the Government of Kenya under the National Cohesion and Integration Act No. 12 of 2008. Its overall mandate is to facilitate and promote equality of opportunity, good relations, harmony and peaceful coexistence between persons of different ethnic and racial backgrounds in Kenya and to advice the government with recommendations on possible interventions (Kibunja, 2011). This Commission was formed in the then ministry of Justice, National Cohesion and Constitutional Affairs whose main mandate was to facilitate the education and sensitization of Kenyans on matters relating to national cohesion and provisions of the National Cohesion and Integration Act, 2008 (Kibara, 2011). National cohesion and integration constitutes unity, equality, freedom, democracy, absence of war, just peace, social justice and the rule of law. It helps cultivate in members of a community shared values, challenges and opportunities. These are the key values emphasized by the NCIC (Kilonzo, 2011).

The NCIC's vision is a peaceful, united harmonious and integrated Kenyan society and its mission is to develop and sustain processes that alleviate all forms of ethnic discrimination and promote diversity through knowledge creation, capacity building, advocacy and pertinent policy development. Its motto is One People, One Nation and One Destiny (NCIC, 2011). Its current chairman is Hon. Francis Ole Kaparo and the previous one was Dr. Mzalendo Kibunja. What is very encouraging is that the Government of Kenya which instituted NCIC has been a key supporter its mandate and activities (NCIC, 2016).

2.3 Integration into Education System

In 2015 the Government of Kenya through the Ministry of Education recommended that the national cohesion, values and principles of governance be incorporated into the curricular for learning institutions.

3. HIGHER LEARNING INSTITUTIONS' RESPONSE: CASE OF CHUKA UNIVERSITY

3.1 Background of Chuka University

Chuka University is a prophetic, public University located on the eastern slopes of the snow - capped Mount Kenya in Tharaka Nithi County. The University is in a setting that has escaped the mundane effects of urbanization, thus providing a tranquil for learning and interaction between students and staff from all walks of life (Chuka University Profile, 2014). It became the ninth public university in Kenya on 8th January, 2013. The University is designated as centre of excellence in environmental and renewable energy studies and offers university education, training and research at certificate, diploma, bachelors, masters and doctorate degree levels in Education and Resources Development, Business Studies, Agriculture and Environmental Studies, Arts and Humanities, and Science and Technology (Chuka University Programmes' Booklet, 2014). The university offers programmes that are relevant to the emerging needs of the society. This can be confirmed from the functions of the University. The third function is to "Engage in teaching, training, scholarship, entrepreneurship, research, consultancy, community service, among other educational services and products, with emphasis on technology and its development, impact and application to society". The fifth is to ''Facilitate development and provision of appropriate academic programmes'' (see Students' Information Handbook ,2015).

3.2 A Short Course on National Cohesion, Values and Principles of Good Governance

In line with the University's Mandate, Philosophy, Vision and Mission and as a response to government's call, Chuka University has developed a Short course on national cohesion, values and principles of good governance. The course is housed in the Faculty of Arts and Humanities and has been developed with the aim of producing leaders and citizens with the values and principles enshrined in Article 10 of the Constitution so as to build a cohesive nation. The course which targets leaders and workers in all sectors including national and county governments, non-governmental organizations, religious organizations, education, health, banking sector, Justice System, companies, Business etc imparts learners with knowledge on national cohesion and integration, values and principles of good governance so as to make them effective servants of the people of Kenya, thus building a cohesive Kenyan society.

Philosophy: Helping the trainees acquire knowledge and skills in national values and principles of good governance that will enable them participate in building a cohesive nation as they practice them in their various areas of service.

Justification

It is first of the kind in Kenya. So far none of the universities in Kenya has this type of the course. For a stable society or nation the national values and principles of governance outlined in our constitution are paramount. The course is thus necessary for all the people working in various sectors in this country or even those aspiring to work in such areas.

Goal: The main goal of the course is to contribute to national cohesion and integration by producing leaders and citizens who incorporate the national values and principles of good governance in their service to the people of Kenya and beyond.

Minimum Requirements

Leaders and citizens who can communicate effectively in English and Kiswahili qualify to do this course. Applicants who have completed Secondary Education and obtained an 'O' level certificate or equivalent and above will have an added advantage.

Mode of Delivery/ Training Schedule
The course will take one week/five days of intensive learning during which the following topics will be covered.

Day	Topic
Day 1	Introduction to National values and Principles of good Governance- Article10 of the Constitution// Foundations of Citizenship
Day 2	National Cohesion and Integration (meaning, dimensions, status, Significance, challenges)/Nationhood, Nationalism, Statehood, Community, etc
Day 3	Leadership and Governance/ Ethics and integrity in leadership and governance.
Day 4	Devolution and public Policy
Day 5	Sustainable Development/ Human rights and social justice in developing a cohesive nation/Environmental Conservation for Sustainable Development and cohesive society.
Day 6	Award of Certificates

Course Coding and Course Descriptions
The Course uses the coding "NCOG" for National Cohesion, Values Principles of Good and Governance. The Units are as follows:

NCOG 001 INTRODUCTION TO VALUES AND PRINCIPLES OF GOVERNANCE
Course Purpose
The course introduces students to the national values and principles of good governance as enshrined in the Constitution of Kenya Article 10.

Expected Learning Outcomes
By the end of the course students should be able to:
i) Explain the national values and principles of governance that bind state organs, state officers, public officers and all other leaders in Kenya
ii) Apply the core national values and principles of good governance in their service to the people of Kenya

Course Content
Definitions; Characteristics of good governance; National Values and Principles of governance: patriotism, national unity, devolved government: sharing of power and resources; Rule of law, democracy and people's participation in governance; human dignity, equity and social justice; Integrity, transparency and accountability in public service; National symbols and their significance: Flag, Seal, Coat of Arms. Foundations of good citizenship.

Methodology
Lectures, group discussions, library and field research, c presentations, Case Studies

References
The Constitution of Kenya, 2010
Stuckulberger, C and Mugambi, JNK (2005). Responsible Leadership Nairobi: Acton
D'Souza, A. A (2011) Leadership, 13th ed. Nairobi: Paulines
Burke, Cormac (2007). Man and Values: A Personalist Anthropology. Scepter: Limuru.
Omosa, Mary et al (2006). Theory and Practice of Governance in Kenya: Towards Civic Engagement. University of Nairobi press: Nairobi.
Uvin, P., (2010) Human Rights and Development. University of Melbourne. Australia
Rawls, J.A. (1999). A Theory of Justice. Revised Edition.The Belkenap press

Shenk, D.W. (1983). Justice, Reconciliation and peace in Africa. Nairobi: Uzima

NCOG 002 NATIONAL COHESION AND INTEGRATION

Course Purpose

Imparts learners with the necessary values for building a cohesive nation

Expected Learning Outcomes

By the end of the course students should be able to:
Explore the various ways of building a cohesive nation

Course Content

National Cohesion and Integration, Indicators of a Cohesive Society, Dimensions of Cohesion and Integration, Benefits of a Cohesive and integrated Nation, Challenges to National Cohesion and Integration, Concepts of Nationhood, Nationalism, state, Statehood, Community

Methodology

Lectures, group discussions, library and field research, presentations, Case Studies,

References

The Constitution of Kenya, 2010
National Cohesion and Integration Training Manual (2011). Nairobi: GoK

NCOG 003: HUMAN RIGHTS AND SOCIAL JUSTICE

Course Purpose

The course is aimed at imparting learners with knowledge and skills in human rights and social justice with the aim making them effective citizens and leaders.

Expected Learning outcomes:

At the end of this course the learners will be able to:

- Have increased knowledge and appreciation on human rights and social justice
- Apply human rights across a range of development related issues
- Describe issues affecting and influencing human rights and social justice

Course Content

Foundations of human rights, Rights and Fundamental Freedoms, Universal Declaration of human rights, and human rights based approach across a range of areas such as in gender, children, right to development, refugees, and health education and civil rights; Social justice, principles of social justice, the challenges and response: tribalism, corruption, nepotism, poverty

Methodology

Lectures, group discussions, library and field research, presentations,

References

Constitution of Kenya (2010)
The Universal Declaration of Human Rights. The UN
Devine, C & Wilde, R. (2004) Human Rights: The Essential Reference. Oryx Press
Mbaku, J.N. (2007) Corruption in Africa: Causes, Consequences and Cleanups. Lexington Books
Uvin, P., (2010) Human Rights and Development. University of Melbourne. Australia
Gibney, M. (2010) Global Refugee Crisis: A reference Handbook. Lexington Books
Otto, D. Gender Issues and Human Development. Melbo

NCOG 004 LEADERSHIP AND GOVERNANCE

Course Purpose

The course introduces students to the general concepts of leadership and governance and imparts them with the necessary leadership and ethical skills to enable them serve their communities

Expected Learning Outcomes

By the end of the course students should be able to:

i) Show the main concepts in leadership and governance

ii) Explain the main characteristics of a leader with integrity

iii) Gain the necessary skills in leadership and governance to enable them become effective and reliable leaders

Course Content

Definition, nature and importance of leadership; principles of leadership; ingredients of leadership; leadership traits; leadership styles like democratic, autocratic, free-rein; types of leadership; functions, responsibilities and challenges of leadership; characteristics of effective leaders; leadership and management; leadership and power; servant leadership, community leadership, strategic leadership, group leadership, transformative leadership; functional leadership; African traditional leadership; Definition and importance of good governance; aspects and principles of governance, Importance of national cohesion. Ethics and Integrity in leadership and governance.

Methodology

Lectures, group discussions, library and field research, CATs, class presentations, essays and assignments.

References

Gitari, D (2005). Responsible Leadership Nairobi: Acton.

Githiga, G (2009). Effective Church Leadership Nairobi: Uzima.

Ngara, E (2004). Leadership. Nairobi: Pauline's Publication.

Stuckulberger, C and Mugambi, JNK (2005). Responsible Leadership Nairobi: Acton

D'Souza, A. A (2004). Leaders for Today and Tomorrow. Nairobi: Paulines

D'Souza, A. A (2011) Leadership, 13th ed. Nairobi: Paulines

Nkonge, D.K (2012). Developing Church Leaders in Africa for Reliable Leadership: Kenyan Perspective. Dutch Reformed Theological Journal, Vol.53, No. 3& 4.

NCOG 005: DEVOLUTION AND PUBLIC POLICY

Course Purpose

This courses aims to provide a background and understanding of devolution and public policy in Kenya. Learners will develop knowledge and competence in devolution matters and public policy making

Expected Learning Outcomes

By the end of the course students should be able to:

i) Demonstrate understanding the concept of devolution

ii) Demonstrate understanding of the functions of each level of government according to the laws of Kenya

iii) Demonstrate understanding of the process of public policy making

iv) Discuss challenges of policy formulation and implementation.

Course Content
Definition, role of devolved governments, partnership of devolved governments and national governments. Challenges faced by devolved governments, laws on devolution. Critical analysis of public policy. The process of public policy analysis, current issues in funding and monitoring, Challenges in policy Implementation, policy monitoring and evaluation.

Methodology
Lectures, Seminars, discussions, library and field research, presentations, Case studies

References
Constitution of Kenya (2010)
Caro. F & Morris. R (2012) Devolution and Aging Policy. Harworth Press
Gerston N. Larry, (2009) Public Policy Making In a Democratic Society (A Guide to Civic Engagement), New Delhi, PHI.
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Manski Charles (2013) Public Policy in an Uncertain World: Analysis and Decisions. Residents and fellows of Harvard College
McCain, Roger (2009) Game Theory and Public Policy. Drexel University

NCOG 006: SUSTAINABLE DEVELOPMENT FOR A COHESIVE SOCIETY
Course Purpose
This course seeks to engage participants in understanding the importance of sustainable development in the era of declining resources, competing needs and increasing conflicts.

Expected Learning Outcomes
By the end of the course students should be able to:
i) Demonstrate understanding the concept of sustainable development
ii) Appreciate the role of local communities in sustainable development
iii) Appreciate the role of donor aid in sustainable development
iv) Explain the aspects and economics of sustainable development

Course Content
Introduction to Sustainable Development, Ideas and Identity Sustainability, Ecology and Communities, Overseas Aid and International Development, Global and Regional Sustainability, Economics of Sustainability, Sustainable Urban Communities, Resilient Regions: Sustainability in Practice, Society, Culture and Ecology in East Africa, Country, Nature and Identity: Indigenous Sustainability

Methodology
Lectures, Case studies, discussions, library and field research, presentations.

References
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Baker Susan (2015) Sustainable Development. Second Ed. Routledge Newyork
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ESTIMATED BUDGET FOR 25 TRAINEES

DESCRIPTION	QUANTITY	UNIT COST (KSH.)	TOTAL (KSH.)
1. INCOME			
Registration	25 trainees	500 per head	12,500
Fees	25 Trainees	15,000 per head	375,000
TOTAL INCOME (I)			387,500
2. EXPENDITURE			
i) Training Materials			
Note books	25 Pcs	50	1,250
Pens	25 Pcs	10	250
Charts	10 Pcs	250	2,500
Training Manuals/Books	25 Copies	400	10,000
Marker Pens	12 Pcs	100	1,200
Dusters	4 Pcs	70	280
Handouts			2,000
Printing of Certificates	25 Pcs	50	1,250
Posters	10	1,000	10,000
Sub-Total			28,730
ii) Feeding (Trainees and Trainers)		30 pple x 100 x 5 days	15,000
10 O'clock tea		30 pple x 100 x 5 days	15,000
Lunch		30 pple x 150 x 5 days	22,500
4 O'clock tea		30 pple x 50 x 5 days	7,500

Drinking water Sub Total	10 dozens	250	2,500 62,500
iii) Facilitation Honorarium for Trainers TOTAL EXPENDITURE (E) PROFIT: I – E (70%)	5 days 387,500-116,230	5,000 per day	25,000 116,230 271, 270

COMMENTS:

Okay and Implementable. Need to benchmark with other institutions that offer similar or related courses. Relevant especially at the moment, need to fast track this training.

Short Course: Public Administration and Governance Skills for County Government Staff and Other Stakeholders

by Mr. Christopher Kiboro, Chuka University, Faculty of Arts and Humanities, Department of Arts and Humanities, P. O. Box 109-60440, Chuka

1.0 INTRODUCTION

The devolved system of governance in Kenya is meant to make Counties centers of development by giving them the autonomy in setting their priorities. Devolution has effectively shifted the responsibility for identifying, planning and implementing development projects and programs from the central government to the County governments. Consequently, service delivery has been brought closer to the people. In order to deliver services to the public, a well-trained civil service is the most important factor that could make counties in Kenya to become centers of effective service delivery to the public. Therefore, there is need for partnership between the county governments and the universities in the development of human capital for the counties. The enhancement of new knowledge and skills in public administration and governance skills for the county staff will facilitate the development of homegrown solutions to problems of governance, as well as economic and social challenges facing the counties in Kenya today. It is this basis that a short course on public administration and county governance skills for county staff has been developed.

2.0 GOAL

A short course on public administration and county governance skills for county staff aims at equipping professionals already working with the county governments with the up-to-date knowledge, skills and techniques on public administration and governance.

3.0 LEARNING OUTCOMES

On completion of a short course in Public Administration and Governance Skills for County Government Staff, participants should be capable of:

i. Understand and apply public sector principles, policies and ethics in service delivery at the county level
ii. Understand administrative principles in public administration
iii. Enhance the application of sound communication principles and good customer service to achieve objectives of devolution
iv. Demonstrate knowledge and insight into the role of supply chain management in the public sector environment

4.0 METHOD OF DELIVERY

The course will be delivered through a combination of presentations, facilitated discussions and group workshops.

5.0 COURSE EVALUATION

This is not an exam-based course. The participants will only be issued with a certificate of attendance upon successful completion of the course.

6.0 DURATION

This short course in Public Administration and Governance Skills for County Government staff and other leaders will be covered in 3 days.

SCHEDULE OF UNITS

SN	Units	Time (hours)	CPD Credits
1	Introduction to Public Administration	3	3
2	Strategic Management in the Public Sector	3	3
3	Public Procurement and Supply Management	3	3
4	Ethics and Governance	3	3
5	Management of Public Information Systems	3	3
	Certificate presentation	**Total**	**15**

INTRODUCTION TO PUBLIC ADMINISTRATION

Course purpose

The main purpose of this course is to provide participants with a range of relevant and essential management and administrative skills that will increase their capacity to successfully contribute to service delivery at the county level.

Learning outcomes

On completion of the course participants should be able to:

i. Describe the functions of county government and the role of public administrators in carrying out those functions.
ii. Apply basic concepts and techniques relevant to the field of public administration.

Course content

Meaning, scope and significance of public administration, Public And Private administration, Principles of administration, structure and formation of various agencies and units of government-ministerial departments; public enterprises; local authorities; national, state and municipal governments; bureaucracy; budgeting; personnel and administrative leadership, Integrity in public administration.

Method of delivery

The course will be delivered in form of presentations, facilitated discussions and group workshops.

Reference materials

Barber, Michael P. (1972). *Public Administration.* London: McDonald and Evans Limited.
Harris, and Corson. (1963). *Public Administration in Modern Society.* London: McGraw Hill.
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Mukhi, H. R. (1998). *Comparative Public Administration.* Delhi: Surjeet Book Depot.
Rodgers, Barbara N., John Greve, and John S. Morgan. (1968). *Comparative Social Administration.* Edited by Brian Chapman. London: George Allen and Unwin Ltd.

STRATEGIC MANAGEMENT IN THE PUBLIC SECTOR

Course purpose

The purpose of this course is to introduce to students the steps and tools needed to identify and conduct initial feasibility analysis and project planning.

Learning outcomes

On completion of the course students should be able to:

i. To deepen the participants' understanding of their roles as planner, decision-maker and leader.

ii. To introduce specific tools, processes, and frameworks that serve to analyze short- and long-term issues in developing strategic plans and management systems that produce results.

Course content

The rationale for strategic management; strategic planning in the counties, vision, mission and goals in strategic management, environmental (social, cultural, political, physical, economic) analysis in strategic planning; strategy formulation and implementation in the context of national and global national development agenda (Vision 2030 and SDGs); monitoring and evaluation of strategic plans.

Method of delivery

The course will be delivered in form of presentations, facilitated discussions and group workshops.

References

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Hunger, D. J. and Wheelen, T. L. (2006). *Essentials of Strategic Management*. Prentice Hall.

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Kevin, P. K. (2000). *Private Sector Strategies for Social Sector Success: The Guide to Strategy and Planning for Public and Nonprofit Organizations*. Jossey-Bass.

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PUBLIC PROCUREMENT AND SUPPLY MANAGEMENT

Course purpose

The purpose of this course is to equip the county staff with the knowledge and skills relevant for accomplishing their functions in the procurement and supply chain.

Learning outcomes

At the end of this course, students should be able to:

i. Develop effective procurement plans
ii. Source for the right suppliers
iii. Apply legal principles in procurement process

Course content

Concepts of strategic supply chain management; Public procurement reforms, Public procurement processes, Public procurement institutional framework, Contracting in Government, Procurement legal framework, procurement records management, e-procurement and supply chain management, ethical issues.

Method of delivery

The course will be delivered in form of presentations, discussions and group workshops.

References

Jackson, P., Crocker, B., and Carter, R. (2016). *101 Models of Procurement and Supply Chain Management.* Liverpool Academic Press.

Lysons, K. (2016). *Procurement and Supply Chain Management.* Pearson.

Ochonma, E. (2015). *Procurement and Supply Chain Management: Emerging Concepts, Strategies and Challenges.* AuthorHouse.

Sagwa, V. E. (2016). *Procurement and Supply Chain Management.* Createspace Independent Publishing Platform.

MANAGEMENT OF PUBLIC INFORMATION SYSTEMS

Course purpose

The purpose of this course is to equip participants with the knowledge and skills to understand and deploy effective and appropriate information systems irrespective of their functional areas.

Learning outcomes

At the end of the course, the students should be able to:

i. Understand and suggest efficient information systems
ii. Analyze information technology (IT) needs in their respective departments

Course content

Information systems; information technology and organizations; sources and types of business information; information systems approach to management; management Information Systems (MIS): development and design approaches; business information systems: types, analysis and design; automation requirements; case studies on issues involving the design of a selected Management Information System.

Method of delivery

The course will be delivered in form of presentations, facilitated discussions and group workshops.

References

Laudon, C. K. (2012). Essen*tials of Management Information Systems*. Pearson Education.
Oz, E. (2006). *Management Information Systems*. Course Technology.
Rocheleau, B. (2010). *Public Management Information Systems.* IGI Global.
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ETHICS AND GOVERNANCE

Course purpose

The aim of this course is to equip the participants with a variety of conceptual and theoretical ethical resources which are geared at enabling them to understand and deal with most moral issues and problems that they encounter in their daily life and at work places.

Learning outcomes

At the end of the course, the students should be able to:

i. Understand ethical terms, concepts and principles.
ii. Explain the nature of moral reasoning, the meaning and functions of ethical principles and theories in public administration.
iii. Identify and discuss contemporary moral problems and issues public administration.
iv. Use ethical theories to tackle and solve ethical problems at the work place.

Course content

Basic concepts of ethics and governance; theories and principles of ethics and governance; ethical decision making; ethics and law; players in governance, power and authority; leading and governing; ethical issues in governance: justice, equity, common good; Governance virtues: integrity, accountability, transparency, human rights and good governance, creating an ethical culture.

Method of delivery
The course will be delivered in form of presentations, facilitated discussions and group workshops.

References

Armstrong S.J. and Botzler R.G. (1993) *Environmental ethics: Divergence and convergence*. New York, McGrawhill Inc.
Freeman S.J. (2000). *Ethics: an introduction to philosophy and practice*. Ontario, Wads worth,
Velasquez M.G. (2002). *Business Ethics: Concepts and cases.* Patparganj, Delhi, Pearson Education.
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Liszka J.J. (1999). *Moral Competence: An integrated approach to the study of ethics*. New jersey, Prentice Hall.
Frankena W.K. (1973). *Ethics*. New Delhi, Prentice Hall of India.

ESTIMATED BUDGET

S/N	Expenses	Item	Amount in K.sh.	Quantity	Total in K.sh
1	Developing Course modules	@ Module	15,000	5	75,000
2	Facilitation fee	@ Facilitator	4,200	5	21,000
3	Printing of certificates	@ Certificate	300	Approx. 20	6,000
	Grand total				**102,000**
	Revenue				
4	Registration	@ Participant	1,000	Approx. 20	20,000
5	Attendance fee	@ Participant	10,000	Approx. 20	200,000
	Total Revenue				**220,000**
	Net Revenue				**118,000**

COMMENTS:
Okay and Implementable. Need to benchmark with other institutions that offer similar or related courses. This should be initiated as soon as possible, let the beneficiaries get training before the next government.

Short Course: Hands-On Disaster Preparedness and Management Skills for Learning Institutions Administrators and Other Stakeholders

By Dr. Anne Sande, Department of Arts and Humanities, Chuka University, P. O. Box 109-60400, Chuka

Preface

The ability of administrators to demonstrate disaster preparedness and management skills in learning institutions and through professional certification has gained significance in the process of adaptation and resilience to disasters in the world. This course expands on the basic concepts in disaster preparedness and it also provides job-related approach to disaster management in institutions and across communities.

Target Audience

This course is designed for administrators who intend to expand their knowledge and skills in disaster preparedness and management, apply a standard-based approach to disaster management and acquire professional certification.

Course Schedule

Day 1

Concepts in disaster management

- Definitions
- Significance of disaster management
- principles of disaster management
- theoretical disaster models

Classification of disasters

- Natural and manmade disasters
- Fast on-set and slow on-set disasters
  - Climate related disasters (e.g. drought, floods, cyclones)
  - Geological disasters (e.g. landslides, earth quakes, volcanoes, tsunamis)
  -Environment related disasters (e.g. environmental pollution, desertification, deforestation, pest infestation)
  - Epidemic disasters (e.g vector borne, water/food borne, person to person)
  - Chemical/Industrial explosions (e.g. fires, explosions)
  -Mass movement disasters (e.g. war, terrorism, riots, hysteria, panics)

Disaster Cycle

- Phases of the disaster cycle and their significance
- Preparedness mitigation, response and recovery activities in learning institution
- The role of learning institution administrators in risk reduction

Day 2

Administrative roles in disaster preparedness

- Assessment and planning
- Formulation of Policies and procedures
- Staff development
- Performance standards and quality control
- Remodeling and reconstruction
- Safety institutional codes

The disaster preparedness and management plans

- **Contingency plans**
  - significance and objectives
  - Disaster management committee/team
  - Forecasting and planning for institutional disasters
  - Reporting emergencies
  - Evacuation procedures
  - Accountability of persons and resources
  - Emergency contacts
  - Community participation and social link
  - Rehabilitation and reconstruction
  - Monitoring and evaluation
- **Emergency plans**
  - Distinction between contingency and emergency plan
  - Emergency plans for fires, terrorism, floods, famine, technological accidents etc.
  - Preparedness checklists for institutions
  - Emergency kits

DAY 3

Preparedness and management skills

- Firefighting equipment and installation
  -Fire detection and alarm system
  - Fire suppression system (sprinklers, hydrants, extinguishers)
- Institutional drills
  -fire drills
  - terrorism drills
  - flood drills
- First Aid skills in learning institutions

EXAMINATION

COURSE DESCRIPTION

Introduction

Kenya's disaster profile is dominated by frequent fires, floods, terrorism, mudslides, bandit attacks, cattle wresting violence, famine, technological accidents, tribal and religious clashes, diseases and famines. The disasters have caused disruption in livelihoods, destroyed property, interrupted economic activities and further caused institutional unrests. This course will focus on equipping institutional administrators with knowledge and skills on disaster preparedness and management.

Rationale

Learning institutions have experienced frequent disastrous episodes that have led to loss of lives and property as well as unrest in the society. The various forms of potential disasters pose a major challenge to institutional processes of development as well as the society at large. The vulnerability of the institutions is often compounded by factors such as lack of knowledge and skills among the institutional administrators. There is need for empowerment of the administrators by equipping them with skills and knowledge on disaster preparedness and management in bid to enhance resilience and sustainability.

Learning Objectives

At the end of this course learners will be able to:

1. Define concepts in disaster preparedness and management
2. Classify potential disasters
3. Describe the disaster cycle and the activities within it.
4. Demonstrate understanding of contingency and emergency plans
5. Show understanding of the role of administrators in disaster preparedness and management
6. Practice preparedness and management skills for potential disasters in institutions

Content

1. Concepts in disaster management
   - Definitions
   - Principles
   - theories
2. Classification of disasters
   - Natural and manmade disasters
   - Fast on-set disasters and slow on-set disasters
3. The disaster cycle
   - Pre-disaster phase: preparedness, mitigation, disaster.
   - Post disaster phase: emergency/relief, rehabilitation, reconstruction.
4. The roles of institutional administrators in disaster preparedness
5. The preparedness plans
   - Contingency plan
   - Emergency plan

6. Practical skills for disaster preparedness and management

- Fire fighting
- Institutional drills
- First aid

Teaching and Learning Methods

The course will be taught through lecture method, illustrations and demonstrations. Participatory approach will also be used in order to reinforce understanding of skills. Students are expected to actively participate in order to achieve the course objectives. The students will be evaluated using practical and theory examinations. Certificates will be awarded to every student upon completion of the course.

References

ADPC (2007). RCC Guideline Mainstreaming Disaster Risk Reduction into School Curriculum Consultation Version. Regional Consultative Committee on Disaster Management, Asian Disaster Preparedness Centre. Bangkok. http://www.adpc.net

Alunga L. (2009): Ministry guidelines on safety in institutions; published on 04/04/2009 in The East Africa Standard Newspaper. Nairobi, Kenya.

Asian Disaster Management News (2008), Mainstreaming Disaster Reduction into Education Sector, Vol, 13 No. , Asian Disaster Preparedness Centre, Bangkok.

Benour, D. (2007), Prevention, Education and Training for Disaster Risk Reduction: The Algerian Experience, International Conf. On School Safety, 18-20th January 2007, Ahmedabad.

Chawla P.S. (2008): *Natural Hazards and Disaster Management:* New Delhi Pearl Books pp 39-43

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Sinclair, M. (2001). Education in emergencies. *Learning for a future: Refugee education in developing countries*, 1-84.

Talwar K. (2009): *Flood Disaster Management:* New Delhi, Common Wealth Publishers; pp 61-79

Von Kotze, A., & Holloway, A. (1996). *Reducing Risk: Participatory teaming activities for disaster mitigation in Southern Africa*. Oxfam GB.

ESTIMATED BUDGET

No. of days: 3 No. of Trainers 5 No. of Trainees: 20 Venue: Chuka University

	Activity/Item	Quantity	Total (Ksh)	Income (Ksh.)
1.	Fee by participants	20 people x Ksh. 30 000		**600 000**
2.	Booklets	75 x 100	7 500	
3.	Hand outs	100 x 400	40 000	
4.	Posters	20 x 1000	20 000	
5.	Pens	25 x 20	500	
6.	Marker pens	30 x 100	3 000	
7.	Fire extinguishers	5 x5000	25 000	
8.	Emergency kit items		15 000	
9.	Manila paper	30 x 50	300	
10.	Masking tape	3 x50	150	
11.	Exams	25 x 4 x 50	5 000	
12.	Certificates	25 x 300	7 500	
13.	Food (tea break, lunch and 4 o'clock tea)	25 pax x Ksh. 500 x 3 days	37 500	
14.	Honoraria for trainers	5 pax x Ksh. 5000x 3 days	75,000	
	Total		25,2650	
	Contingency (10%)		25,265	
	Grand Total		**277,915**	**600 000**

COMMENTS:

The course is good and appropriate but it needs a version for effective level of costing and expenditure. Need to benchmark with other institutions offering similar courses. Need to understand the participants. A very crucial course. Market this course further. You need to start as soon as possible.

Disaster Preparedness and Management Summary

DISASTER MANAGEMENT PREPAREDNES

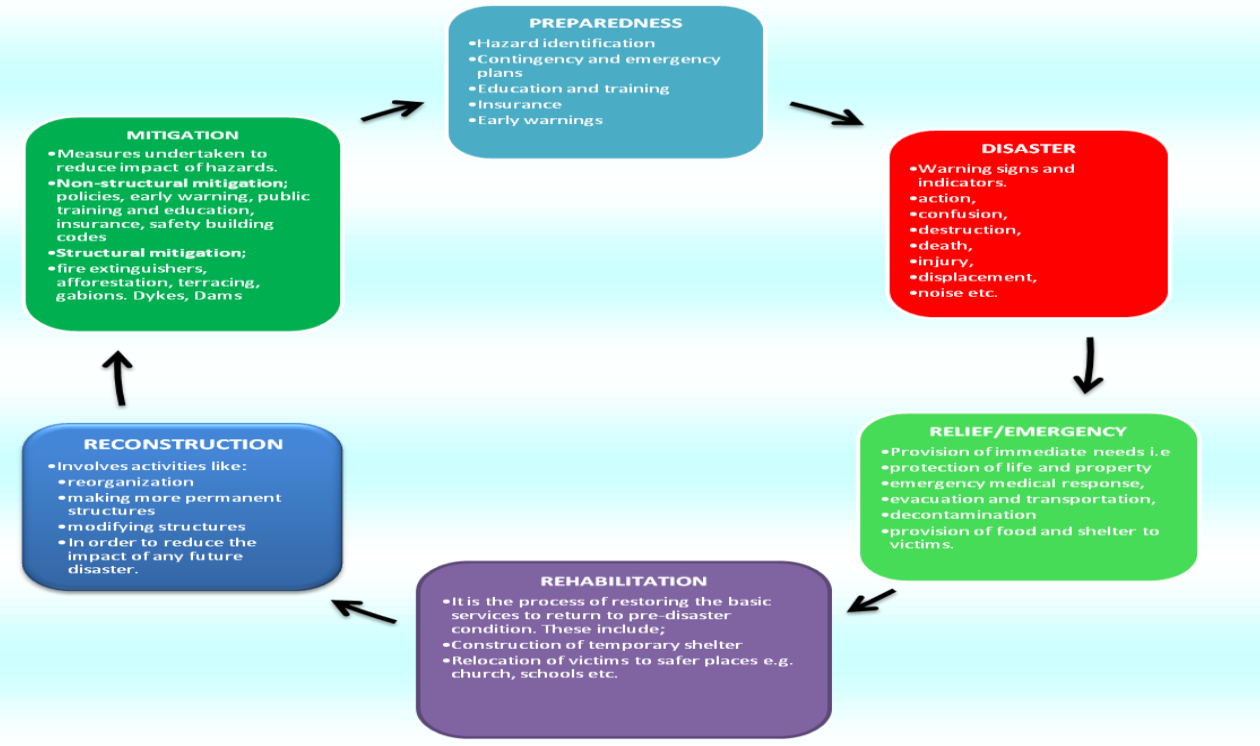
EMERGENCY KIT CHECK LIST

1. Water (in gallons)
2. Food (non-perishables)
3. Soap, Colgate, toilet paper
4. Small bucket(s)
5. Feminine hygiene products (e.g. pads)
6. First Aid Kit
7. Blanket/sleeping bag
8. Disposable/plastic dishes and cups
9. Knife
10. Strong polythene paper
11. Whistle
12. Cash and some change
13. Torch and batteries
14. Matches in a waterproof container
15. Candles
16. Rope
17. Clothes
18. Small stove and mini propane bottle
19. Notebook and pencils
20. Phone and power bank
21. Battery operated radio and batteries
22. Emergency and important contacts
23. Documents in a water-proof safe

HAZARD/DISASTER CLASSIFICATION

1. Climate Related Disasters
a) Floods
b) Droughts
c) Cyclones
2. Geological Hazards/Disasters
a) Earth quakes
b) Tsunamis
c) Volcanic eruptions
d) Land Slides
3. Environment Related Hazards/ Disasters
a) Environmental pollution
b) Desertification
c) Deforestation
d) Pest infestation
4. Epidemic Hazards/Disasters
a) Water and/or food-borne diseases
b) Person to person (Contact and respiration)
c) Vector-borne diseases from wounds
5. Chemical/Industrial Accidents
Fire and Explosions
6. Mass Movements Related Disasters
a) Riots/b) Panics
c) Mass hysteria/Mob justice/e) Terrorism

DISASTER CYCLE



Contingency Plan Fundamental Components

It is a **forward** or **long term preparedness** plan for disasters. It is often a 5 year plan.

1. Detecting and preparing plans for potential Hazards/Disasters

Forecast all the potential hazards/disasters. The forecasting should be hazard specific and site specific (each hazard e.g. fire. Flood and site e.g. fire in a small building, fire in an industry, fire in a home etc.)

2. Reporting emergencies

Provide detailed information on how to report emergencies i.e.:

*Whom to contact *Numbers to call *Steps to be taken to protect oneself etc.

3. Emergency evacuation procedures

Include diagram of the space (e.g. institution or building) layout showing and describing:

- Escape routes; * Where to assemble at a pre-designated safe location
- Note that special considerations must be given for evacuation of handicapped individuals.

4. Employees/residents conducting critical functions

Provide for proper training of some employees and students on how to carry out those critical processes and operations during emergencies e.g. *Switching off power; *Clearing escape routes; *Giving directions etc.

5. Accounting for persons

Put a system of accounting for all persons after emergency evacuation e.g. a roll call at the designated safe area.

6. Contact persons for information about emergency

List names, titles, departments and phones of those to contact for information about the plan.

7. **Creation of standby disaster management team.**

Constitute a disaster management team of workers to be responsible for the recovery, planning, implementing, monitoring and evaluation of the recovery process since the onset of disaster.

8. Enhancing community participation

Include roles to be played by other community members like other organizations, leaders, parents etc. Community participation must be recognized, harnessed and given power. This is because healing and recovery are rapid if the community is fully involved from the beginning.

9. Maintaining the social link

Plan for a common place for disaster victims. Disaster victims should be made to stay together for faster emotional recovery. When taken away from others take longer to recover emotionally than those who stayed with others who were going through the same experience.

10. Reconstruction broken structures & institutions

Provide for the reconstruction process and specify the future sources of the required resources. Reconstruction is necessary for both healing and development

11. Review of the Contingency plan

The plan should be flexible enough to allow periodic reviews and adjustment.

FIRE DISASTERS IN KENYA

Kyanguli Secondary School Fire Disaster
Over 65 students died

FLOOD DISASTERS IN KENYA

St. Elizabeth Primary Nairobi flood disaster

WAR/TERRORISM IN KENYA

War due to tribal clashes in Mt. Elgon

Westgate Mall Terror Attack

Garissa University College Terror Attack

DROUGHT/FAMINE DISASTERS

Drought Disaster in North-Eastern Kenya

Woman waits for relief food during Famine

Famine affects institutions in Turkana

Short Course: Geographic Information Systems and Remote Sensing Applications for Field Researchers and Extension Officers

by Mr. D. Kinoti Kibetu, Department of Arts and Humanities, Chuka University, P. O. Box 109-60400, Chuka

Introduction

- Geospatial technologies are receiving mainstream attention across the world
- Nearly all data in current use contains some spatial dimension
- GIS and remote sensing enables the capture, management, analysis and presentation of geo-referenced data
- Increased applications of these tools has generated a great demand for well-trained GIS and Remote sensing personnel

Conceptual and Pragmatic Problem

- Application of geospatial tools in education is minimal as compared to other sectors
- Lacking is industry specific Geospatial applications course training programs in Kenyan Universities
- Currently no short courses on GIS and RS for research application or field based studies
- Significant gaps in the advancement of geospatial technologies in the field of research and training

Objectives and Aim of the Course

- Provide theoretical and practical knowledge of Earth observation and modeling
- Instill skills essential for effective participation in GIS based research projects.
- Introduce Geospatial data processing and field data collection techniques.
- Prepare students to have the core knowledge and skills needed deal with Geospatial tasks

Teaching Approaches and Methodology

Approach based on geographic inquiry, application of interdisciplinary content knowledge and basic research skills.

Curriculum

- Selection of a Topic.
- Development of a Case Scenario.
- Decision on the products and possible Outcomes.
- Creation of a suitable work plan.
- Analysis and presentation of the Results/Findings

Instruction

Various teaching methods used include lecturing, field work and lab practical s

- Lesson Introduction
- Lesson Materials and Time
- National Geography standards covered in the lesson.
- Lesson Objectives
- GIS Skills Useful for the lesson
- Student Activity (Hands on using GIS Software)
- Conclusion

Assessment

Students will be assessed using performance essay tests and performance-based evaluation criteria including product creation and portfolios

- Student's products and performance incorporating short-answer assessment tools using scoring rubrics for beginning trainers.
- The outcome of these assessment tools will be to measure content knowledge, results communication and mastery of GIS Skills

Target Groups and Users

- Targets people employed in public, private and non-governmental organizations
- Other people who wish to gain knowledge, skills and attitudes in Geospatial industry(are researchers, students, county planners, resource managers and administration personnel)
- Those eligible should be knowledgeable in Geography, IT and computer science or a person from Earth science disciplines.
- This course is intended to last for 8 weeks (2 months)

Cost-Benefit Course Analysis

Allowances for the trainers = 45,000; Learning materials = 25,000; Refreshments and lunch= 60,000; Industrial visits = 30,000; Fee charges @ 30,000 per head x 20 = 600,000.

Initial Expenditure	**Income/year**
30 computers @ 45,000= 1,350,000	30 students fees@ 30,000 = 900,000 x 4 intakes = 3,600,000
Upgrade Arc GIS 10.1 to Arc GIS 10.5 Licenses =72,000	
Multi seat Image processing Soft ware	
(Erdas Imagine II) =902,780	
Geospatial Data sets(Images, vector files, digital maps) = 100,000	
2 industry based visitation and exposures = 80,000	
Annual license upgrading and maintenance =140,000	
3 Hand-held Garmin GPS receivers@ 30,000 = 90,000	
1 medium Digitizer = 200,000	
Total Expenditure = Kshs 2,792,000	Income = Ksh 3,600,000

References

County Government Act of 2012

Kenya Vision 2030

Kibetu, D. K. and Murungi, M. M. (2016). Bridging Geo technology Competence Gaps among Kenyan Undergraduate Students: An Interdisciplinary GIS Training Model at Chuka University. *International Journal of Education, Culture and Society. 1*(3), 70-74.

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COMMENTS:

This course is detailed, can work well for a postgraduate diploma or diploma courses. Initial cost is high. There is need also to benchmark with institutions that offer this and similar courses. It appears rather expensive and if it can be subsided then the course will be okay.

Short Course: Hands-On Project Planning, Monitoring and Evaluation Skills for Community Development

by Ms. Catherine W. Thiong'o & Ken Mwiti Murungi, Department of Arts and Humanities, Faculty of Arts and Humanities, P. O. Box 109-60400, Chuka

1.0 Introduction

Project planning, monitoring and evaluation is an essential part of all projects. The failure of many projects today results from poor planning, poor implementation or poor monitoring. It is therefore essential that project managers be equipped with skills to help them demonstrate best practices in project planning, monitoring and evaluation. This course is developed to deepen critical understanding of the strategies, processes, techniques and issues involved in taking ideas for development and turning them into practical realities with identifiable outcomes and benefits.

2.0 Philosophy

Training in project planning, monitoring and evaluation enhances capacity in the formulation, and execution of projects.

3.0 Rationale

The application of appropriate processes, skills, technique and tools can have quite a significant impact on project success and sustainability. The skills, techniques and tools should be applied appropriately depending on the project and organization. This, however, does not always happen as many mangers do not have this knowledge. In the last seven years the Kenyan government has decentralized its functions through the county governments. This has effectively shifted responsibility of project processes from the central to county government. International and local non-governmental organizations are also actively involved in project planning, monitoring and evaluation. It is therefore imperative that all stakeholders are equipped with the requisite capacity for hands-on project planning, monitoring and evaluation.

4.0 Goal

Produce human resource with requisite capacity in the formulation, implementation, monitoring and evaluation of development projects.

5.0 Expected Learning Outcomes

On completion of short course in Project Planning, monitoring and evaluation, students should be able to:

1. Describe the basics of effective project planning, monitoring and evaluation.
2. Create strategies and techniques for monitoring and evaluating projects.
3. Demonstrate knowledge of monitoring and evaluation systems & plans.
4. Implement monitoring and evaluation systems & plans.
5. Apply theory and practice of management skills for project and program management.

5.0 Minimum Admission Requirements

5.1 Candidates admitted into this course must fulfill the minimum general University entry requirements for a short course.

5.2 Applicants must have completed Secondary Education and obtained an 'O' level certificate or its equivalent.

6.0 Mode of Delivery

The course shall be offered on full-time basis for five days or part-time for three weeks.

7.0 Loading and Duration of the Study

7.1 To graduate, the student must complete a minimum of 40 (forty) contact hours.

8.0 Rules and Regulations Governing Examinations

8.1 Examination for this course shall be conducted in accordance with rules and regulations governing the examinations of the University.

9.0 Target Participants

This course is a must for project team members from both governmental and non-governmental organizations; business and technical professionals wishing to gain skills in project planning, monitoring and evaluation. Any other person wishing to provide significant contributions in effective project monitoring and evaluation.

Description of Content

Day one: Introduction to Project Planning, Monitoring and Evaluation

Purpose: Understanding the basics of any concept is key to success. Learners will be equipped with knowledge of the basics of project planning, monitoring and evaluation. This will help form a strong foundation for the rest of the course

Objectives

At the end of this section the student should be able to:

1. To demystify project planning, monitoring and evaluation
2. Demonstrate understanding of the project Management framework
3. Demonstrate understanding of the roles of a project manager in successful project planning, monitoring and evaluation

Content

Define projects, types of projects, Project and strategy planning, Who a project manager is; roles and skills of a project manager; Organizational influence and project life cycle: organizational influence on project, project stakeholders, governance and success, formation of project team.

References

Beer, F. D & Swanpoel, H (2011) *Community Development: Breaking the cycles of poverty* (5th Ed) Lansdowne, South Africa

Dinsomore, P. C. *Human Factors in Project Management* (Revised Edition) New York, NY: American management association

Levin, G. And Flannes, S, *Essential People Skills for Project Management*, Newtown Square, PA: PMI 1995

Verman, V. K. *Managing the Project Team*. Newton Square, PA: PMI 1997

Day two: Project life cycle

Purpose: Project management processes when poorly managed can lead to project failure. The learner will be equipped with knowledge on these processes and how they may influence the success of projects

Objectives:

At the end of this course, students should be able to:

1. Explain the project life cycle;
2. Discuss projects management processes;
3. Demonstrate understanding of stakeholder dynamics

Content:

Project life cycle, product life cycle. the five group processes including: initiation: develop project charter, identify stakeholders; planning: project plans, problem tree, scope, activities,

sequence of activities, communication/procurement plans. Process: direct and manage project, develop and manage project team, distribute information, manage stakeholder expectations

References

Beer, F. D & Swanpoel, H (2011) *Community Development: Breaking the cycles of poverty* (5th Ed) Lansdowne, South Africa

Dinsomore, P. C. *Human Factors in Project Management* (Revised Edition) New York, NY: American management association

Levin, G. And Flannes, S, *Essential People Skills for Project Management*, Newtown Square, PA: PMI 1995

Verman, V. K. *Managing the Project Team*. Newton Square, PA: PMI 1997

Day three:

Monitoring, Evaluation and Control

Purpose: Project monitoring, evaluation and control is the process of tracking, reviewing and regulating progress to meet objectives as stipulated in the planning process. In this section the learner will be equipped with skills to help them successfully execute these processes.

Objectives:

At the end of this section the learner should be able to:

1. Describe the relation between monitoring, evaluation and control
2. Demonstrate understanding of theory of change
3. Develop a Logical Framework Matrix

Content

Monitoring, evaluation and control: developing indicators, developing Means of Verification, verify scope, control schedule, monitor and control risks, Monitoring and Evaluation methods and tools, theory of change approach, types of monitoring and evaluation, result based monitoring and evaluation; closing process group, perform integrated change control: close project/phase, close procurement; Logical framework matrix

References

Beer, F. D & Swanpoel, H (2011) *Community Development: Breaking the cycles of poverty* (5th Ed) Lansdowne, South Africa

Dinsomore, P. C. *Human Factors in Project Management* (Revised Edition) New York, NY: American management association

Levin, G. And Flannes, S, *Essential People Skills for Project Management*, Newtown Square, PA: PMI 1995

Verman, V. K. *Managing the Project Team*. Newton Square, PA: PMI 1997

Day Four

Log frame matrix, earned value analysis

Purpose: to equip the learner with knowledge and understanding of log frame matrix and earned value analysis

Objectives

At the end of this section the learner should be able to:

1. Explain the purpose of a log frame matrix
2. Develop a log frame matrix.
3. Demonstrate understanding of the earned value matrix.

Content

Understanding the log frame, objectives, developing log frame structure, applying the log frame structure; understanding earned value analysis, assessing earned value, tools and techniques of earned value analysis.

References

Beer, F. D & Swanpoel, H (2011) *Community Development: Breaking the cycles of poverty* (5th Ed) Lansdowne, South Africa

Dinsomore, P. C. *Human Factors in Project Management* (Revised Edition) New York, NY: American management association

Levin, G. And Flannes, S, *Essential People Skills for Project Management*, Newtown Square, PA: PMI 1995

Verman, V. K. *Managing the Project Team*. Newton Square, PA: PMI 1997

Day 5

Data collection and Communication

Purpose: this section seeks to equip learners with skills on participatory data collection, data organization and communication of reports.

Objectives

1. Demonstrate understanding of participatory data collection techniques
2. Demonstrate ability to control project communication
3. Demonstrate ability to prepare a communicative report

Content

Participatory data collection methods, analyzing and storing data, managing communication, controlling communication. Reporting

Student evaluation

References

Beer, F. D & Swanpoel, H (2011) *Community Development: Breaking the cycles of poverty* (5th Ed) Lansdowne, South Africa

Dinsomore, P. C. *Human Factors in Project Management* (Revised Edition) New York, NY: American management association

Levin, G. And Flannes, S, *Essential People Skills for Project Management*, Newtown Square, PA: PMI 1995

Verman, V. K. *Managing the Project Team*. Newton Square, PA: PMI 1997

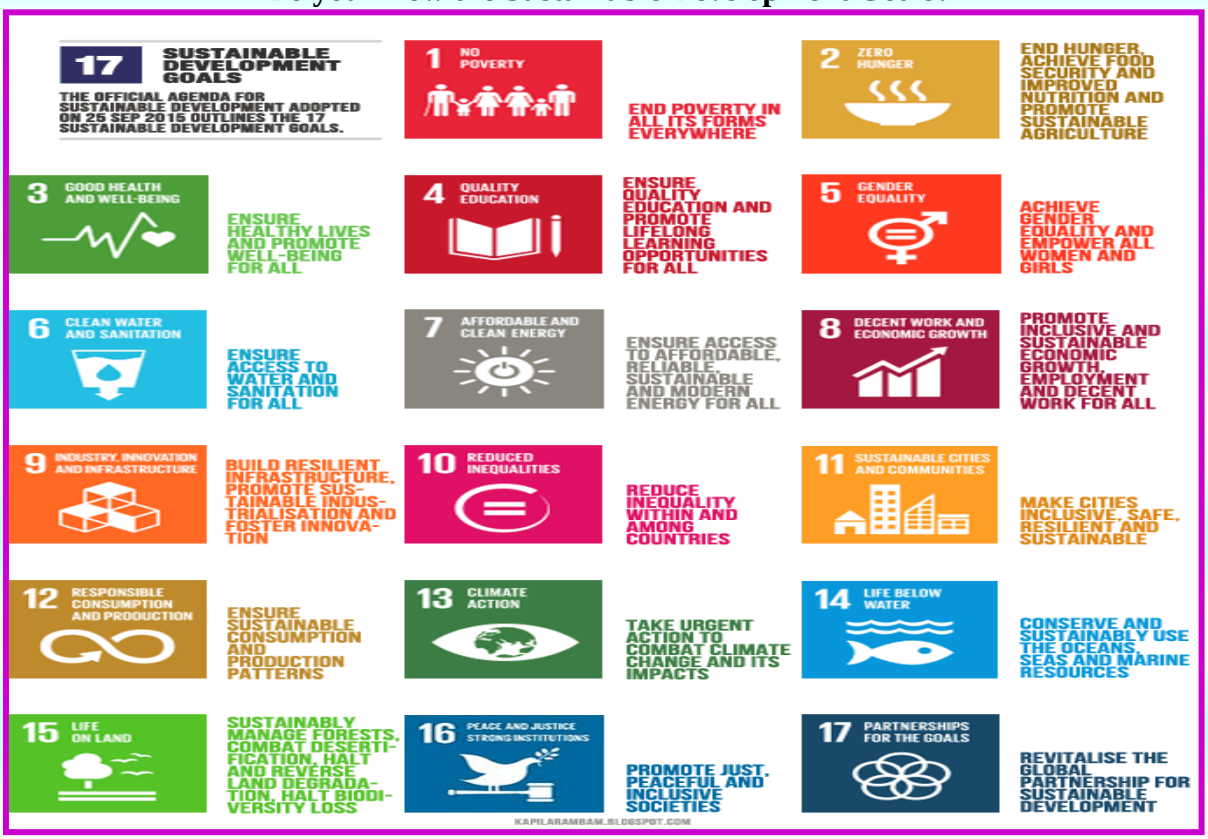
10.0 Recommended Course Fee

Ksh. 100,000 for locals and US$ 1,500 for foreigners - per person, net into our account

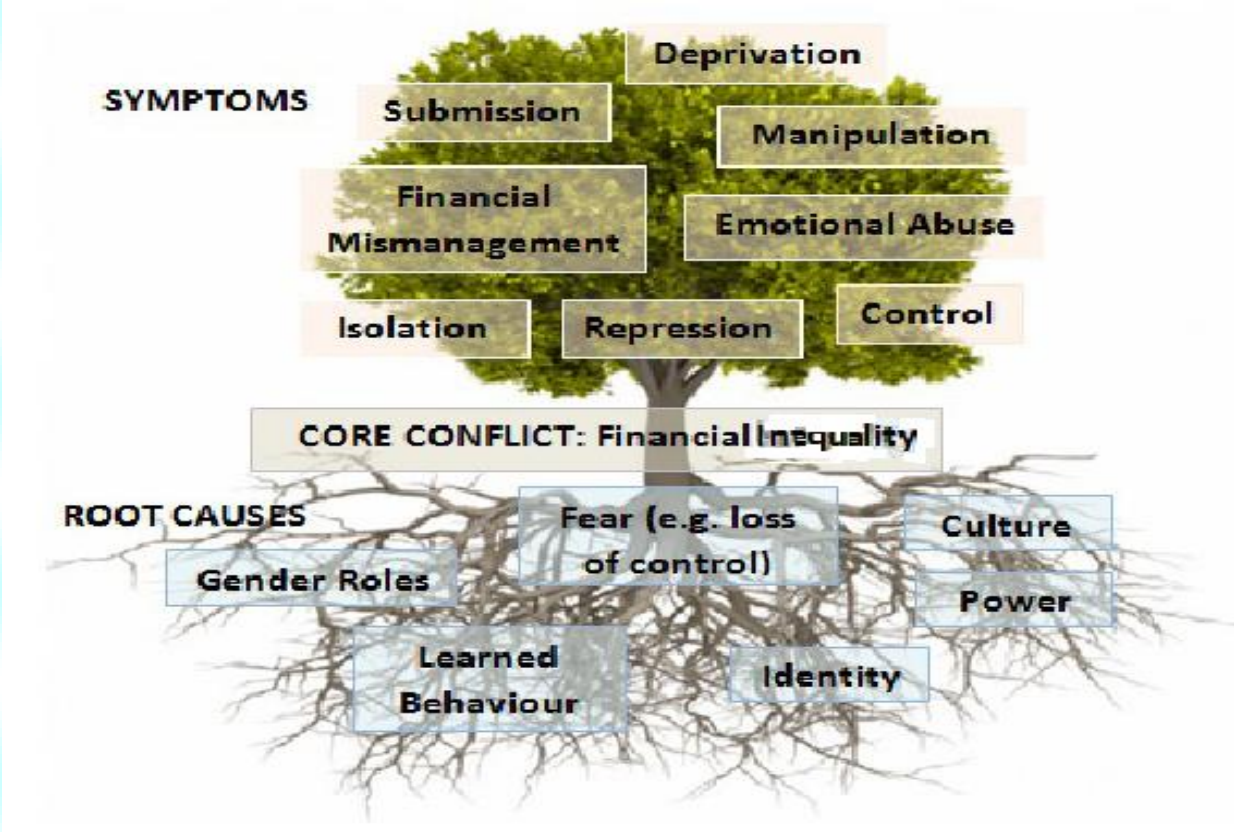
COMMENTS:

Well concluded, implementable project. Need to benchmark with other institutions that offer this and similar courses. Useful and should be started as fast as possible. This course is detailed, can work well for a postgraduate diploma. It appears rather expensive and if it can be subsided then the course will be okay.

Do you know the Sustainable Development Goals?

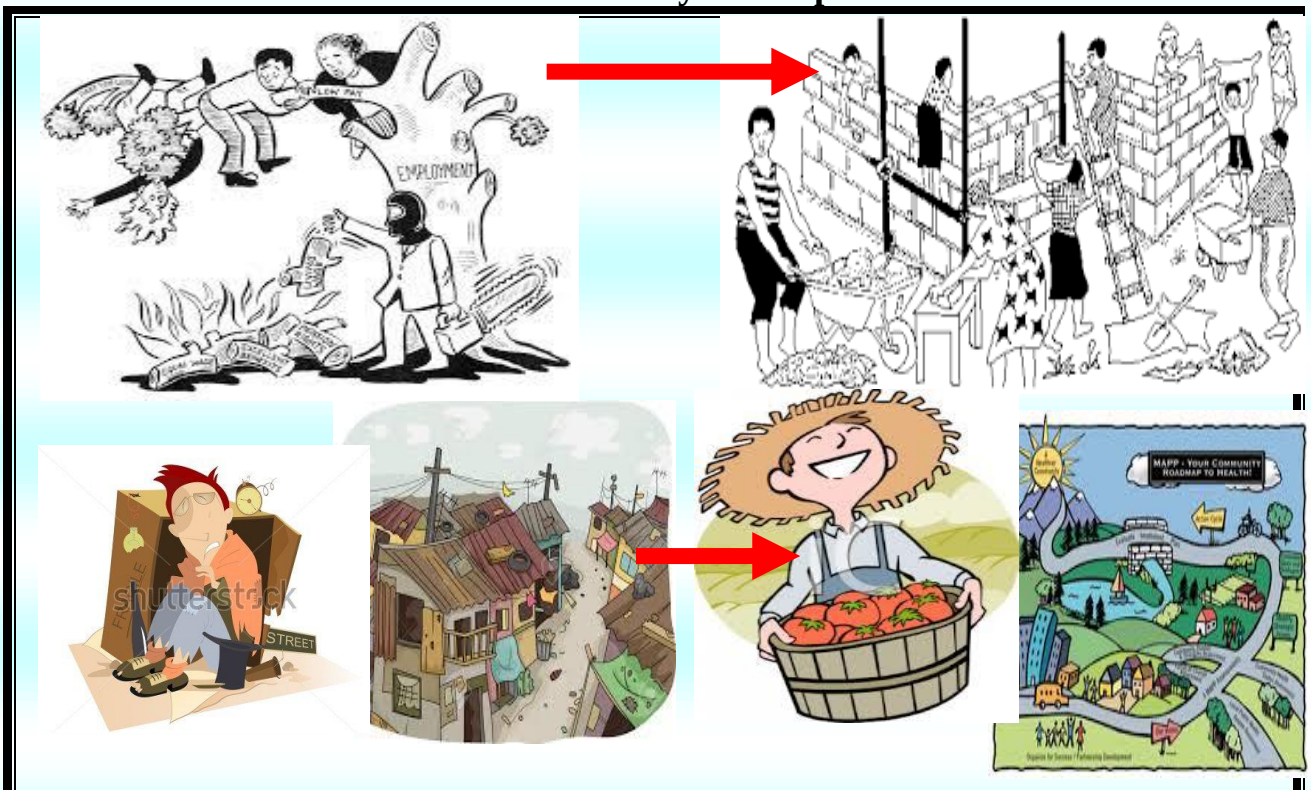


PROBLEM TREE



Effective Community Outreach

What is Community Development?



Community Development helps communities move from a less desirable situation to a more desirable situation. It improves living standards of people

Charcoal-based Evaporative Refrigeration System for Storage and Preservation of Fruits and Vegetables

by David Mbaru, CB5/12960/13, Department of Arts and Humanities, P. O. Box 109-60400, Chuka

Introduction, back ground and the problem

Vegetables, fruits, milk and water play an important role in human nutrition by providing essential nutrients for growth and good health. Deficiency of these nutrients can lead to widespread of diseases and on the long run, lead to death. Global Burden of Disease project (2000), up to 2.7 million deaths worldwide and 1.8% of the total global disease burden are attributed to inadequate consumption of fruits and vegetables (Lock et al., 2004). These produce are not only seasonal but also highly perishable pausing a great storage challenge to producers, marketers and consumers. Proper storage and preservation is vital to ensure their continuous supply even during off seasons. Though, the hi-tech refrigerators are more effective cold storage, are not applicable in rural areas with no electricity, expensive, etc. Therefore, the need for alternative cost effective and simple systems that are adaptable for storage of fresh farm produce at the rural level. The charcoal-based evaporative cooling system is seen to be an efficient, effective and economical alternative means for cold storage.

Justification

- Currently, more effort in rural areas by the government and NGOs is being directed towards the production of farm raw produces in mitigating hunger.
- However, little emphasis has been put on the storage and preservation, of such produce.
- Thus the need to promote storage technologies to secure markets and promote production while improving farmers' income.
- This in general will help to beat the hunger experienced in the rural areas hence achievement of SDGs 1&2 (No poverty & Zero hunger)

Originality of the concept

- The concept of using water for air cooling has been around for millennia.
- The first rigorous analysis of the evaporative systems was developed by Dr. John R. Watt, who worked for the Research Laboratory of the U.S. Navy who built and studied four prototypes of plate evaporative coolers
- During Middle Age, the Islam spreads this technology all throughout the Occidental/European countries, and evaporative cooling systems start being used in Mediterranean areas.
- Egyptians portraying large, porous jars of water being fanned to force evaporation and subsequent cooling have shown the prevalence of evaporative cooling since ancient times.
- Egyptians portraying large, porous jars of water being fanned to force evaporation and subsequent cooling have shown the prevalence of evaporative cooling since ancient times.

Goal: hunger reduction in the rural areas offering storage and preservation technologies.

Objectives

1. To avail a storage system that is cheap, non-electric, simple, using locally available materials.
2. To increase the shelf life of fruits and vegetables hence their continuous availability.
3. To improve the overall quality of lives of the rural dwellers by reducing hunger, malnutrition and improved income.

Expected outcomes

i. Increased shelf life of fruits and vegetables by 2-5 weeks hence their continuous supply.

ii. Minimized losses/wastage of perishable farm produce and increase farmers' income.
iii. Reduced cases of hunger and malnutrition which is rampant in rural areas.
iv. Availability of cold water for drinking and cold storage for milk and honey for several days before used/marketed.
v. Improved overall quality of lives of persons residing in the rural areas at large

Advantages

i. It uses simple passive cooling features to achieve low temperatures for the preservation of fruits and vegetables.
ii. Preservation of crops through refrigeration can help with hunger and starvation in the developing world by keeping foods fresh longer
iii. It requires no special skills to operate and therefore is most suitable for rural application.
iv. Economical, uses locally available materials e.g. timber, charcoal, water, and wire mesh.
v. Dry wind (that is not too humid) is the main source of energy.
vi. Simple, unexpansive and easy to construct and maintain.
vii. handling of over production, sustainability and continuity of farm operations

Disadvantages

i. Only works well during strong and dry windy days.
ii. Needs frequent watering incase a hose pipe is not used.
iii. Not effective in areas with high relative humidity.
iv. The device offer short storage services.
v. Charcoal used is dirty to handle, some people may shy away from it

Operations/how it works

- The device operates on the basic scientific principle of evaporative cooling or evaporation causes cooling.
- This principle states that when water (liquid) evaporates it draws energy from its surroundings which produces a considerable cooling effect.
- This occurs when air, that is not too humid, passes over a wet surface
- When the tap is opened, water flows into the charcoal cavities through the perforations of the horse pipe, and absorbed by the charcoal.
- dry blowing air causes evaporation and the air temperature is decreased due to the loss of sensible heat.
- This cooling effect is felt in the fridge where fresh produce are placed, cooling the produce and stay longer as pathogens responsible for rotting are deactivated

Factors determining its operation efficiency

- Efficiency of this technology depended on the rate of evaporation which depends on:

i. **Ambient/Surrounding Temperature**; must be high enough to allow for evaporation.
ii. **Ambient Humidity**; must be low enough to allow for more water vapor to enter the air.
iii. **Surface Area;** large S.A increases evaporation rate.
iv. **Evaporative Media**; e.g. the charcoal should be porous enough to allow for easy movement of moisture through it. small chunks (about 0.5cm) in diameter and not compressed because this would reduce air movement across the wall.
v. **Air Movement (natural or artificial**); adequate air flow sweep away accumulated moisture.

Target population

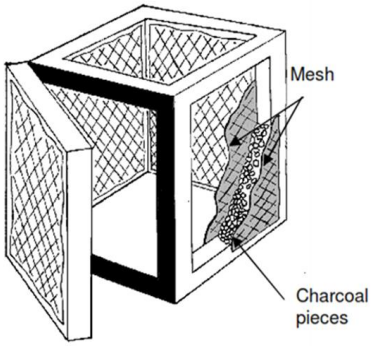
- This appropriate technology targets all the local farmers and marketers of farm produce in rural communities,

- specifically those who are not served by the National Electricity Grid with the purpose of availing of a cold storage system which is cheaper, non-electric, simple and make use of locally available materials that has the ability to increase the shelf life of their farm produce and minimize wastes.

The design description

- The cooler is basically a small box-room with charcoal walls reinforced by wire mesh.
- The structure has a wooden frame which supports the walls and ceiling.
- The charcoal walls are constructed from a wooden frame covered with wire mesh, inside and out, separated by about 5 cm with the interior being filled with small pieces of charcoal.
- The cooler has a hinged and lockable door for security purposes and the roof is made from removable softwood covered with wet cotton cloth.
- The floor will be made of a solid board or wooden pallets to keep produce off the ground
- Wooden shelves are put in the cooler and used as placement surfaces for the produce.
- The water supply will be from a bucket raised 2.0 m and 1.0 m above the ground and charcoal cooler, respectively

Photos and illustration



Construction required materials

i. Timber/wood (2*2) and Charcoal (approximately 4 kg)
ii. Wire mesh (e.g. diamond weave with 1.5 – 2.5 cm holes)
iii. Nails (Finishing and carpentry nails) and 2 Hinges for the door
iv. Solid board (for the floor) and Cotton cloth.
v. 1 Plastic Hose. Approximately 10ft with ½ to 1 inch in diameter.
vi. One Bucket (Any size). Or any device that can hold water can be used.
vii. Oil paint and insecticide or used engine oil.
viii. **Tools:** A hammer, saw and scissors or wire cutters, tape measure are required.

Dimensions and cost effectiveness

Dimensions:

- The dimensions of the cooler 1.5 ft. long x 1.2 ft. wide and 2.0 ft. high.
- The capacity of the cooler was approximately 30 to 50 kg of fresh produce.

Cost effectiveness:

- The project is economical as it uses locally available materials and simple skills.
- A small technology with dimensions given cost about 1500/= and a return of 5000/=

Steps Construction:

Step 1: Main Frame and Floor
Step 2: Charcoal Walls
Step 3: The door
Step 4: Roof/Ceiling
Step 5: Watering system
(*For more details on construction*: +254710658910)

Instructions and precautions when using

Instructions:

i. Open the door and place your products at the floor and shelf of the cooler.
ii. Close the door and open the tap to water the charcoal.
iii. Leave produce for a considerable period of time before you attend them for use or marketing.
iv. For the milk, honey and water it should be cold enough for drinking even in high temperatures.

Precautions:

i. Diseased or damaged produce should not be kept in the cooler.
ii. Device Placed at a shady position and protected from direct sunlight
iii. The charcoal should be kept continually moist, but should not be so wet that it is dripping out the bottom of the cooler.

Sustainability

- sustainability of the technology can be ensured by considering the following factors and strategies:
  - Community participation/involvement and investment
  - Consideration of environmental appropriateness;
  - Community capacity building
  - Addressing immediate felt need
  - Simplicity
  - Use of locally available materials

Its contribution to community development

- Starvation and hunger reduction
- Capacity building, skill development and awakening of local knowledge
- Resource mobilization
- Stabilization of market prizes and increased income
- Improving the overall quality of lives of the community
- Creation of rural employment opportunities
- Reduced Malnutrition levels
- Health improvement

Conclusion

Vegetable and fresh produce storage has proven to be a good application for the charcoal-based evaporative cooling.

Reference

The technology was implemented by the student in Mbeere South at Siakago market during the month of January 2017 with success. Several farmers and marketers promised to adopt and use it in their homes.

COMMENTS:

The project weakness is mainly marketability as cost effectiveness is specific areas. Include a diagram to show how the CBRS works. Project is not completely novel. However, coming from an undergraduate student this is good. The project appears to have been used earlier. Aspect of originality was lacking. Developing it should be worked on further.

Designing and Making of Recycled Plastic Bag Bracelets

by Fredrick Odongo Barasa, CB5/ 13003/13, , Department of Arts and Humanities, P. O. Box 109-60400, Chuka

Introduction

Poverty is real. In the current world, three families out of ten leave in abject poverty according to the UN. The main contributor to poverty is lack of enough income to provide the basic requirements of life to oneself. Low income levels are usually as a result of unemployment or underemployment. The design of a recycled plastic bag bracelet is meant to help curb the problem of unemployment. This is through making and selling of the bracelets hence boosting the level of income of the individuals involved. This project will also help in the recycling of the plastic bags that lead to pollution hence helping in the process of curbing pollution. This makes the whole project to be environmental friendly

Problems addressed by this project

- Pollution that can lead to disease outbreaks like cholera, and unpleasant environment.
- Low income levels.
- Unemployment that sometimes leads to insecurity.
- Underemployment

Objectives of the project

This project will aim at meeting the following objectives in the region where implemented:

- Reduction of pollution rates.
- Provision of an alternative source of income to the residents.
- To improve the overall quality of lives of persons residing in the region.
- Act as an alternative source of income

Target population

The main target population for the project is the youths and women. This is because these are the two major groups that are highly affected by unemployment and underemployment and hence experience low income rates crisis. This makes them the most suitable population for the project to help them acquire these skills and knowledge to help them be self-employed and earn themselves income to make them active members of the society in the process of community development.

Justification/Significance of the project

Based on several research and findings, good health and sanitation is one of the most vital basic needs in our society. This is usually supported by the ability of an individual to support oneself. This simple bracelet is going to act as a source of employment and source of income hence substituting the more complex and demanding employment. The bracelets will also substitute the more expensive ones that can't be affordable to the common man in any region. High poverty level and high pollution rates were also a driving force towards me designing these simple bracelets.

Project originality

This technology was first introduced in India among the women to help them be self-employed.

- This was back in the year 1984.
- This was mainly because of the fact that many women were unemployed and always remained at home while their husbands were at work.
- This prompted one women group from the east of India to come up with income generating activities to help engage these women.

- The design and making of the bracelets was among the products that were designed.
- This project is not common in Kenya because it is only practiced in Kangemi in Nairobi.
- This reason motivated me to design and implement this technology in Mukuru Kwa Reuben slum in Nairobi County between February and April 2017.
- Several individuals and groups responded positively and the technology took up well

Project design

This project is designed in one phase. The steps are as follows: First, you find the resources for the project. Secondly, you cut out the middle section of the plastic bag. Then cut three strips that are equal to each other in size but you make them thick. This is to make sure you have a strong bracelet. You make sure not to include the handles. Thirdly, you tie the strips in a knot. Fourthly, you braid the strips until you have braided about 2.5cm.Fifthly, you add a bead to the middle strip. Then push it all the way to the braid not the knot. Then you repeat four more braid and bead actions until your bracelet is long enough. Then you tie another knot at the end. Finally you tie the two sides together. At this point you make sure that you or your customer is able to slip his or her hand through the bracelet. You should check well to make sure that it fits.

Materials required:

Locally available quality plastic grocery with no holes, tears or decomposition. Then you require plastic beads with large holes. Finally you must have a pair of scissors or scalpel for cutting.

Photos and illustrations

Sustainability

- This project is highly sustainable considering the fact that it uses locally and cheaply available resources.
- This is due to the fact that it uses waste products in waste plastic bags that are obtained at no or low cost.

- It also uses beads that are cheap and affordable.
- This project being a community project, it must be implemented in the community, be in line with the culture of the community and also community members be involved in the process of implementation and dissemination hence be accepted fully by the community members.
- The project is also sustainable because of its economical acceptance and advantage.

Implementation and dissemination:
It can include the use of the following techniques;

- Sampling
- Household visitations
- Formation of groups
- Training.

Dissemination can be as follows:
The well trained and equipped ladies and gentlemen are used to disseminate the technology into the whole community.
This is done through conducting home visits, community barazas, conducting meetings and also the use of samples by selling them at an extremely low cost and offering others for free to help build the sense of reality and admiration in the target pollution.
The samples were to help create the urge to know from the community members.

Marketability

- This project is easily marketable since it uses the locally available resources, it addresses human problems like pollution, unemployment and underemployment.
- The processes involved from is design up to the implementation and dissemination stage does not command a lot of cash and hence makes the whole project and the end product which is the bracelet very cheap and affordable for the adopters.
- The proposed upgradation and modifications are also simple and affordable and still makes use of local materials hence making the project marketable among the up-scalers.

Cost effectiveness

- The budget for the design and implementation of this project is highly affordable and achievable.
- The total cost of the materials required and the cash required for implementation in relation to the expected outcome is very encouraging.
- The project outcomes which include creation of employment, generation of income through the selling of the bracelets and also its ability to address the pollution problem makes it a high cost effective project.
- This is because the project benefits surpass the cost, hence making it cost effective. i.e,
- Cost of beads is 200beads @ Ksh.100, one bracelet uses 6 to 10beads, 200beads can make 20 to 25bracelets, 1bracelet costs Ksh.30.
- The profit equals; Ksh.500 to Ksh.600.

Advantages

- Economical since it made use of locally available materials.
- An alternative source of income.
- Easy to design and make.
- Affordable hence marketable

Disadvantage

- The bracelet can easily break if made of decomposing plastic bags.

Challenges that can be faced and the possible solutions

- High illiteracy levels can make it difficult for some community members to fully accept and embrace the concept of the technology. This can be addressed by use of very simple and clear ways of implementation.
- Occupation. Considering the fact that many individuals in regard to the target population depend on casual labor, this may make their availability for participation in the implementation and dissemination process wanting. This can be solved by embracing proper awareness creation exercise on the importance of the project.
- There may also be opposition from other producers and entrepreneurs who produce and sale bracelets who might feel that the competition is unfair and that their businesses is at risk. This can be addressed by involving such entrepreneurs all the way from preliminary studies in the area of implementation up to the dissemination stage to make them feel valued and feel part of the whole process.
- Lack of enough capital to purchase plastic beads can also be a challenge. Here, you should make sure that you do proper outsourcing for the resources required in the project design, implementation and dissemination.
- It can also be very tedious and time consuming to train the volunteers how to design the bracelets in the process of implementation. Here, you should make sure you do proper planning so that you don't run out of resources.

Conclusion and recommendations:

- This project is able to establish and enlighten the residents of any region it is implemented in the need for an alternative source of income that they can use to meet their needs and also substitute it with the casual labor they depend on for their income.
- The project is also able to help the locals of the target region participate partially in preventing pollution in their midst.
- The overall cost and choice of materials also promotes mass production and hence can be a substitute to the expensive bracelets and employment positions that command a lot of requirements in relation to who lands the job.
- The project is also able to help individuals be self-employed and self-dependent.

References

This project was designed, made and implemented and disseminated in Mukuru Kwa Reuben slum in Nairobi County, Kenya between February and April 2017. It mainly targeted youths and women in the slum who are the most affected population when it comes to unemployment. Men were not sidelined because those who were interested were allowed to participate in the process. It was able to reach 200 women and 85 youths in the slum who were equipped with the skills and knowledge in the design, making, marketing and selling of the plastic bag bracelets. This project has also worked in several parts of India where women are equipped with these skills and knowledge and hence become self-employed.

COMMENTS:

Though this is not an original idea, it was well presented and can be implemented easily in many parts of Kenya. Idea not completely novel but coming from an undergraduate student this is good. What happens with the project with enforcement on the ban on plastic bags and related products. This is a good innovation. It should be encouraged to overcome the menace in the society. Need to enhance the aesthetic value of the product.

Design and Development of a Rat Catcher

by Joseph Kimathi Naibae, AB1//12283/13, Department of Arts and Humanities, P. O. Box 109-60400, Chuka

Introduction

Most people are sounding an alarm due to increased effect of the storage pests, especially rats. I as a researcher have come up with another effective way of eradicating the pests or stem the tide without harming the organisms or effects caused by the chemicals used to control the same pest. I carried out the research about this crucial matter and found that it is possible to collect healthy and live rats without the use of the bait traps or the agricultural chemicals such as the pesticides (Rat and Rat). I also realized that it is crucial to collect live Rats that can be used in Biology Practical when studying the Transport and digestive system in animals especially the study of the heart, this is made possible by dissection of the live rats. I found that in some communities Rats are used as food and in most schools they are preserved in the laboratories for study purposes hence, this motivated us to come up with effective way of collecting Rats so that learners especially the biologists can study live rats and note their behavior which is important than when collected dead. Rats also cause effect to the farm produce and also causes health hazard when human beings feeds on the affected farm produce .Rats are responsible for the transmission of many diseases. Their feeding habits are destructive, and their nesting can compromise the structure of infested buildings, rats also tend to leave dirt or grease marks along walls and floors. I come up with this method which will not pollute the environment.

Negative effects due to excessive use of pesticides are increasing globally, in Africa, in Kenya and in this area of Tharaka Nithi and Meru County impacting on both long-short term declines in agricultural produce. Pest control is an important contemporary Biological and agricultural priority since it is the greatest snag to better yield and a proper living condition especially to those affected and is firmly on the urgent issue in this area. Prevention involves addressing the main risk factor of the pest and the image to the society and the nation as a whole, which have considered the use of mechanical methods as best way of eradicating the storage pest especially the rats.

Statement of the Problem/Originality

Statistical analysis indicates that severe effect of storage pest in Kiirua Area Meru County is currently a good reason to alarm people in Kiirua and even the whole country about the negative effect of using chemicals to eradicate Rats. More than two years of progress, this area has not been able to stem the tide. Its increasing prevalence has seen policy makers rank it as one of the challenge posed to the Farmers (Agricultural sector Year 2017).Thus, there was a doubling of a number of farmers who were affected. Statistics also shows that, there is a general increase in the number of farmers in the whole Meru County. Tackling the problem of poor yield due to effect of Rats requires concerted effort in many areas. One tried and tested means of tackling many problems caused by Rats has been the use of Agricultural chemicals and mechanical methods which destroy the Pest yet the pest can be used for other beneficial purposes such as Biological study. We come up with a concept which encompasses pertinent aspects of the problem that need to be solved. It could be that a crisis is persisting just because people are not well informed of what need to be done.

Project Objective

This research was sets out to look into how the issue of Positive Rat eradication can be addressed. It did so by looking at the level of

a) Effectiveness of the rat catcher box as the pesticides in elimination of the Rats:
b) Development of positive attitudes and interest towards eradication of the Rats.

c) Demonstration of resourcefulness, relevant technical skills and scientific thinking necessary for economic development especially in eradicating the effect caused by the Rats.
d) Apply the knowledge gained to improve and maintain the health of individual, family and the community.

Advantages

- ✓ More effective in trapping live rats that can be used for other purposes e study and food.
- ✓ Can be used to trap many rats at the same time.
- ✓ It is environmental friendly as compared with the use of chemicals.
- ✓ It is health friendly as compared with the use of chemicals which have conditions for usage
- ✓ Less costly as compared with the trap for live rats.

Materials

1. Pieces of timber
2. Nails
3. Food such as meet

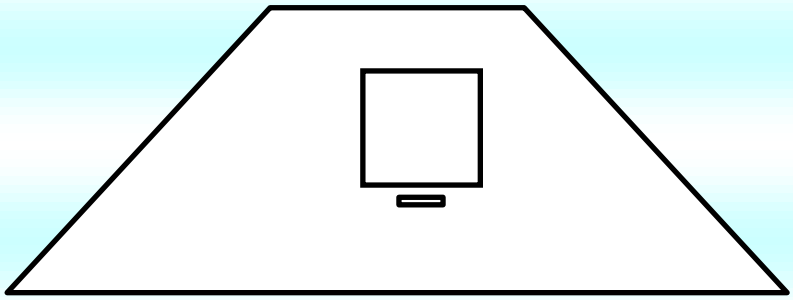
Procedure

A trapezium shaped wooden box of 30cm high is made with an hole size10cm by 10cm at the middle-top and wooden seal which can rotate at an angle of 360^0.
Food is placed in front of the hole made in the opposite direction to the suspected rat path

Observation

The live rat was captured in the trapezium shaped box; the seal rotates at angle of 360^0 when the rat steps on it.

Design (Pictures)



Analysis of the Project/Functionality

The live rat is captured. The seal is made in such a way that a slight weight applied leads to rotation. When the rat aims at the food in front of the hole, before reaching the food it steps into the clip and then rolls into the trapezium shaped box, hence collected alive.

Conclusion

The effectiveness of this method is an alternative way of controlling the storage pests ,therefore the project has successfully achieved all its objectives and that it can be used to effectively control storage pests to enhance high productivity and collection of live rats for biological purposes and also as a source of meal.

Recommendation/Prospective Users

I recommend for further research from the society and the Chuka University and also the government at large to employ this idea for effectiveness of RAT CATCHER BOX as an alternative mechanical way of controlling rats and can be more useful to both the rich and poor to remove the social bridge between them. The farmers and heads of institutions can embrace this project for controlling pests and scientific study respectively since it is cost effective as compared with other methods.

Cost Effectiveness

The actual rat trap for live rats costs 64.57 US dollar which is approximately Ksh. 7425.
This project costs approximately Ksh. 600 but one can make locally using less cost.
Meaning if the institution embraces it can save or make a profit of around Ksh. 6825.

References

i. www.global world project.com
ii. Secondary Agriculture form three *Kenya literature bureau*
iii. Secondary Biology form one *Kenya Literature Bureau (on apparatus for collecting specimen)*

COMMENTS:

Novel and can be put to use immediately. Good project coming from an undergraduate student. Coined the idea when he was on attachment. A good and observant student. I think that it is rather cumbersome; it should be made lighter or smaller for convenience.

Formulation of Charcoal-based Shoe Polish

by Edna Mumbi Kimani, CB5/12962/13, , Department of Arts and Humanities, P. O. Box 109-60400, Chuka

Introduction

Charcoal shoe polish is polish made from charcoal and is used to apply on leather shoes. I discovered that charcoal can make very good shoe polish because charcoal is black and that is the best characteristics of black shoe polish. Charcoal shoe polish makes shoes clean, smooth and shiny all day.

Objectives of the technology

1. To produce shoe polish at low cost using locally available materials.
2. To provide self-employment to low income earners.

Materials required

- 1. charcoal
- 2. bar soap
- 3. water
- 4. liquid paraffin (preferably one can use melted cooking oil)
- 5. citric acid or lemon
- 6. kerosene

Preparation

1. grind the charcoal into very fine powder.
2. sieve the powder using a kitchen sieve.
3. Measure one and a half glasses of water.
5. Cut one square of the bar soap into four quarters. Only one quarter for the polish is required.
6. Cut this quarter into small pieces and dissolve it in the water.
7. Add two glasses of sieved charcoal powder to the water dissolved in soap.
8. Heat the mixture on a fire until it boils, stirring so that it does not clot.
9. Remove the pan from the fire.
10. Add five drops of kerosene. Keep stirring.
11. After two minutes add one sachet of citric acid and one capful of liquid paraffin.
12. Pour into a container. The mixture needs to settle for four hours before being used.

Application

Charcoal shoe polish works by applying a small amount of polish on a piece of cloth or shoe brush. The polish is then rubbed gently on the shoe after which it is left to dry.

Advantages

- Cost effective
- The polish does not attract dust as much as the shoe polish bought in shops
- It leaves the shoe shinning all day through
- It is chemical free
- It uses readily available materials
- Income generating

Disadvantages

- Charcoal is dirty to handle
- It is time consuming

Budget

- 100 ml liquid of paraffin at Ksh. 90
- one packet of citric acid at Ksh. 40
- Total Ksh. 130

References

COMMENTS:

A good project coming from an undergraduate student. Need for a cost benefit analysis vis-a vis the normal shoe shine. It is not messy in usage. This is a very good and innovative project.

Design and Development of a Solar Box Cooker

by Ruth Timina Imbaya, CB5/ 12992/13, , Department of Arts and Humanities, P. O. Box 109-60400, Chuka

Introduction

Solar box cooker was invented by a Swiss Physicist in 1767 but he had no idea that his invention would help people prepare their dinner two and a half centuries into the future.

Objectives

- ✓ To reduce deforestation.
- ✓ To improve both indoor and outdoor air quality.
- ✓ To reduce cost of fuel by using solar energy, which is cheap and always available.

Target Group

The group being targeted by this technology are mostly women in our homes who spend a lot of resources on fuel.

Materials

The materials used in construction is 2 cardboard boxes, clear glass, aluminium foil, black paint.

Modification of the Technology

The technology can be altered and still provide the same results, for example in a rural set up where they cannot access dark paint, they can use a black plastic bag and it will still work in the same way. Also instead of clear glass that is delicate, an acrylic can be used.

Advantages of the Technology

- ✓ It is easy to construct.
- ✓ It is relatively cheap.
- ✓ It is portable.
- ✓ It does not pollute the environment meaning it is eco-friendly.
- ✓ It allows the woman out there to save some coin because she will be using solar as the main source of heat.

Disadvantages of the Technology

- ✓ Since it depends on sunlight, during the rainy days it may be impossible to prepare food.
- ✓ It is relatively slow compared to other types of cooking techniques.
- ✓ It is mostly used for boiling, baking but it cannot be used to deep fry.

Budget

References

COMMENTS:

An old innovation that is rarely used, it has been neglected. Getting used to it would be a challenge to overcome. It is a very good innovation. A good idea given that the idea was conceived during attachment. The student is innovative and observant. Gender friendly innovation, targets women specifically given their chores. Is this crucial? Kindly partner, network with companies to get funding and use procedures. Widen the target group. We have names where young girls and boys and even men do the adjusting.

KNOWLEDGE MANAGEMENT, DISSEMINATION AND COMMERCIALIZATION

Kiswahili Books by Chuka University Dons

SN	Title of the book	Author	Publisher
1.	Tumbokarai	John Kobia	Jomo Kenyatta Foundation
2.	Usicheze na nyembe	John Kobia	Jomo Kenyatta Foundation
3.	Fisi mtunza miti	John Kobia	Jomo Kenyatta Foundation
4.	Kiparangoto	John Kobia	Jomo Kenyatta Foundation
5.	Nikate sikio	John Kobia	Jomo Kenyatta Foundation
6.	Kamusi bora ya watoto	John Kobia	Longhorn
7.	Masalia	John Kobia	Longhorn
8.	Siku ya ukimwi	John Kobia	Longhorn
9.	Maskini punda	John Kobia	Kenya Literature Bureau
10.	Msitu wa uma	John Kobia	Kenya Literature Bureau
11.	Usiku wa manane	John Kobia	Kenya Literature Bureau
12.	Asiyesikia la mkuu	John Kobia	Kenya Literature Bureau
13.	Kusema ukweli	John Kobia	Kenya Literature Bureau
14.	Sungura mpanda ngazi	John Kobia	Kenya Literature Bureau
15.	Likizo ya mauti na hadithi nyingine	John Kobia	Kenya Literature Bureau
16.	Top mark kcse kiswahili maswali na majibu	John Kobia	Kenya Literature Bureau
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18.	Dira ya uandishi wa insha kwa shule za upili	John Kobia	Kenya Literature Bureau
19.	Distinction kiswahili for primary teachers education	John Kobia	Kenya Literature Bureau
20.	Alpha ecde diploma kiswahili	John Kobia	Kenya Literature Bureau
21.	Isimujamii: nadharia na mbinu	John Kobia	Kenya Literature Bureau
22.	Maskini milionea na hadithi nyingine	John Kobia	Oxford University Press
23.	Yawezekana	John Kobia	Focus Publishers
24.	Kurudi nyumbani na hadithi nyingine	John Kobia	Focus Publishers
	TOTAL		

Book Title	Author	Publisher
Musa	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Mildred	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa Mashakani	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Watekanyara	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa Mashakani	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Pepo	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa kwenye Harakati	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Rafiki wa Barua	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa Mpigakambi	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Bahati Nasibu	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Musa na Shamba la Shule	Barbara Kimenye (Enock Matundura/Translator)	Oxford University Press
Safari ya Maskauti	Enock Matundura	Oxford University Press
Adhabu ya Joka	Bitugi Matundura	Longhorn

Sitaki Iwe Siri	Bitugi Matundura	Longhorn
Neema	Bitugi Matundura	Longhorn
Adha ya Kisauni	Bitugi Matundura	Longhorn
Mkasa wa Shujaa Liyongo	Bitugi Matundura	Phoenix
Mwepesi wa Kusahau	Bitugi Matundura	Phoenix
Jumamosi ya Mkosi	Bitugi Matundura	Phoenix
Masagisa na Zimwi Mbilikimo	Bitugi Matundura	Phoenix
Kangaruu wa Samawati	Bitugi Matundura	Queenex
Sifuri Nyani Mtalii	Bitugi Matundura	Queenex
Mamba Mnafiki	Bitugi Matundura	EAEP
Sungura na Mbwa	Bitugi Matundura	EAEP
Kisa cha Nyange	Bitugi Matundura	EAEP
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Maria Analia	Bitugi Matundura	KLB
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Rapporteur: Ms. Mellisa Akenga
Judges: Mr. Martin Warutere, Mr. J. Simiyu, Mrs. Lenity Maugu

Short Course: Value Chains and Agribusiness Management Skills for Producers, Sellers and Other Stakeholders

by Mr. Kenneth Nthuni and Mr. Erick Apind, Department of Business administration, Chuka University, P. O. Box 109-60400, Chuka

What is a 'Value Chain?'

A value chain is a high-level model developed to describe the process by which businesses receives raw materials, adds value to the raw materials through various processes to create a finished product, and then sells that end product to customers. A value chain is a model that breaks down the flow of production activities into several categories.

Value addition

Adding value to products can be accomplished in a number of different ways, but generally falls into one of two main types:

- Creating Value
  - Innovation
  - Industrial innovation
- Capturing Value
  - Coordination

Creating Value: occurs with actual/perceived value to a customer for a superior product/service

- Innovative new products
- Enhance a product's characteristics
- Enhance services
- Create brand names
- Develop unique customer experiences

Creating Value through - Innovation: Improving existing processes, procedures, products and services or creating new ones

- Market unique or branded products
- Produce identity-preserved or specialty crops
- Combine family activities or recreation associated with direct on-farm marketing

Creating Value via Industrial innovation: Processing traditional crops into non-food end products

- Ethanol from corn
- Biodiesel from soybeans
- Particleboard from straw

Capturing Value: Changing the distribution of value in the food/fiber production chain.

- Meant to 'capture' more of the consumer dollar through:
  - Direct Marketing
  - Vertical Integration
  - Producer Alliances
  - Cooperative Efforts

Key Components

- Many times adding value requires a combination of techniques
- These techniques provide producers with a competitive advantage in the marketplace
- There are 6 strategies for adding value
- Changing the physical state / form of products
- Producing products in ways that enhance value
- Differentiating agricultural products in order to enhance their value
- Bundling Products
- Producing & marketing commodities that improve operating efficiency up the supply chain
- Owning assets somewhere up the supply chain for further processing

Conclusion

Producers who add value will become more than commodity producers –

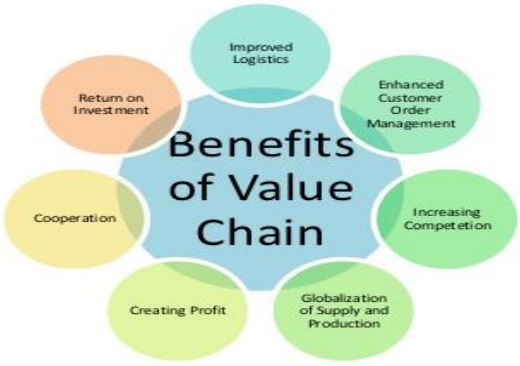
- They prepare food for end-users
- Quality, variety & packaging are important
- Price is not as important as quality

Producers will be producing consumable products – (steaks, hamburgers, bread, Poptarts etc.)

2.3 BENEFITS OF VALUE CHAIN:

Creating a Profit

Primary and secondary activities in a business relate to production, distribution and support. Primary services focus on producing and distributing a product or service. Secondary activities support production and distribution. If managers can successfully manage the connections between all of these primary and secondary activities and keep total costs in the value chain (including production, delivery and support) below the total a customer will pay, a value is created for the customer and a profit is created for the company.



Cooperation

A company in a value chain such as a food market might work with other producers,processors and retailers to create a better connection with customers. Working together, different players in the same market benefit the customer and each other. They generate interest in their products and services in the market, and each player develops a specialty. The relationships with all businesses in the value chain work to maximize value for customers. These companies also maximize their profits within their specialty.

Return on Investment

Whether a business is a producer/supplier, processor, distributor or retailer, it will seek a return on investment for its participation in a value chain. This investment might seem far off when an organization first joins a value chain. Remember that the success of the value chain depends on the ability of its different members to work together toward common goals, such as increasing product value for customers. Get a bigger return on investment by improving communication among members of the value chain, by getting more players involved and by suggesting new ideas that will benefit customers.

Increasing Competition and the Primacy of Strategy

The value chain is first and foremost a strategic concept, arising from a strategic theory of firm competition. As companies struggle to compete in an environment of globalization and intense competition, the focus shifts to alternative means to remain competitive. This creates an increasing interest in Value Chains as a tool to model the extended enterprise and formulate strategies for how to remain competitive.

3

Categories of primary value chain activities

- ***Inbound logistics,*** which includes all receiving, warehousing and inventory management of raw materials ready for production.
- ***Operations*** -It encompasses all efforts needed to convert raw materials into a finished product or service.
- ***Outbound logistics*** -It occurs after all operations are completed and the end product is ready for the customer. Activities required to deliver a product to the end user are considered part of outbound logistics.
- ***Marketing and sales*** -include all strategies used to get potential customers to purchase a product, such as channel selection, advertising and pricing.
- ***Service*** -describes all activities that create better consumer experiences, such as customer service and repair services.

Example of an Agricultural Commodity

Value Added Products from Cassava (Food Business)

Cassava is a shrubby, tropical, perennial plant that is not well known in the temperate zone. The plant grows tall, sometimes reaching 15 feet, with leaves varying in shape and size. The edible parts are the tuberous root and leaves. The tuber (root) is somewhat dark brown in color and grows up to 2 feet long.

Cassava Flour

There are two ways of making cassava flour:

I. First Method

1. Cut into thin pieces the peeled root crop.
2. Place in a basin of water.
3. Spread the thin pieces on a tray to dry under the sun or in a solar dryer.
4. Grind the dried cassava and sieve fine.
5. Seal in a container with a tight cover.

II. Second Method

1. Clean the root crop, peel off the outer skin.
2. Grate and squeeze out the juice.
3. Spread the grated (squeezed) cassava on a tray to dry under the sun or in a solar dryer.
4. Grind fine and dried cassava and sieve.
5. Keep in a container with tight cover.

Cassava Chips

Materials:

1 kilo cassava
1 tsp vetsin
2½ tsp.barbecue spice (for flavoring)
3 tb sp.and 1 pinch salt
9½ cups water

Procedure:

1. Wash cassava well, peel and slice very thinly.
2. Soak in 2% salt water with flavoring.
3. Spread on a tray and steam for 5 minutes.
4. Dry in a solar drier at 60°C for 5 hours.
5. Seal in plastic bags until ready for frying before serving

Cassava Coconut Cookies

Materials:

2½ cups wheat flour
2½ cups cassava flour
½ cup butter or margarine
2 cups desiccated coconut
2 eggs
5 tb sps baking powder

Procedure:

1. Sieve together flour and baking powder
2. Add desiccated coconut
3. Cream butter in a separate bowl
4. Add sugar and egg gradually to the creamed butter
5. Add flour and baking powder and knead well until a soft dough is formed
6. Shape the dough into balls
7. Grease the tray with oil or margarine (about 5 gms)
8. Flatten the balls with the aid of a fork and arrange on the tray
9. Bake in pre-heated oven until golden brown
10. Remove tray from oven Detach cookies while hot to keep them from sticking to the pan
11. Cool, serve or seal in a plastic bag

Managerial skills for Agribusiness producers

Technological developments in agricultural production systems are driving the need for more specialist skills, particularly in the areas of science, technology.

These skills include:

- Planning
- Organizing
- Staffing
- Directing
- Controlling

More so current and future needs for innovations, automation and digitization that drive higher efficiency in farm management require other skills necessary to improve efficiency in agribusiness sector. These include:

Booking keeping and accounting skills (keeping of farm records)
Safe operation of existing and emerging machinery and technology
New Pest and disease management skills
Environmental management skills and farm Sustainable practices

Agribusiness skills for sellers

- Business finance
- risk management
- Safety
- Product marketing
- Product development
- brand management

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Womack, James and Daniel Jones, *Lean Thinking*, The Free Press, New York, 2003.

COMMENTS:

The problem was not clear; also the power point presentation was not visible for some slides; the marketability or application was not well brought out. Otherwise, if the topics can be reorganized and improve them, it is very good and can help the community & Chuka University

Short Course: Tips on Do's and Don'ts for Successful Entrepreneurship

by Dr. Gilbert Mugambi Mwiti, Department of Business Administration, Faculty of Business Studies, Chuka University, P. O. Box 109-60400, Chuka

Contents

Introduction

Small and Medium Enterprises (SMEs) which majority are creation of entrepreneurs play an important role in the social and economic development of the country. The important of the sector is underlined in Kenya's Vision 2030 the development blueprint seeking to transform the country into a middle-income country providing high quality life to all citizens by 2030. The sector is widely recognized as a major source of employment to many, poverty alleviation and contributing significantly to higher income and wealth as well as providing variety of affordable goods and services. In recognition of this role several initiatives by both government and non-government organizations have been taken to stimulate the growth of the sector but yielded little impact. Earlier studies on entrepreneurship training indicate that skills and knowledge acquired helps in improving profit and business longevity. It is in this view that entrepreneurship training is increasingly becoming recognized as a critical element in the broader effort in tackling unemployment and improved business performance.

Problem

According to Micro, Small and Medium Enterprises (MSME) establishment survey of 2016, KNBS, (2016) the sector created 716,600 new jobs accounting to 84.8% of all new jobs. The MSME sector also constitutes about 80% of all the businesses in the country. Despite this dominance and contribution to job creation and economic development about 60% of the businesses fail within a few years of operation. This is a great concern when the country is already facing high unemployment levels. A study carried out in Maara sub-county in Tharaka-

Nithi County by Miriti, G.M and Akwalu, P (2015) indicated that there is a positive relationship between entrepreneurship training and profits gained by SMEs, with content and mode of delivery being critical. This training module is expected to fill the skills and knowledge gap with the hope that it will minimize business failure, contribute to improved business performance and creations of new businesses.

Proposed Duration and Purpose of Training

This is a three day training course that is expected to equip the trainees with the necessary skills and knowledge to identify new business opportunities, start their business and help those in business grow their business and minimize business failure rate.

Target Group

The module1 training manual targets Small and Medium Enterprises (SMEs) Owners/Managers, those in formal employment wishing to start their own businesses, students in business and non-business courses wishing to gain the skills of entrepreneurship.

The module 2 proposed will be on corporate entrepreneurship and targets CEOs/ Managers of private and public institutions, County and National government officials and heads of NGOs.

Course Rationale

Business growth and economic development heavily relies on entrepreneurship hence the need to acquire entrepreneurial skills and knowledge.

Training Benefits

It is hoped that the entrepreneurship training will foster innovation and other skills necessary for transforming Kenya by raising productivity, job creation, and poverty reduction as well as increasing owner's income and wealth.

- Helps the trainee identify and evaluate attractive business opportunity
- Minimizes business failure and improve business performance
- Increases revenue and profit
- Increase market coverage
- Improves competitive advantage

Course Description

This short course provides an overview of the nature of entrepreneurship, entrepreneur characteristics and the business plan process. The course also examines the process of identifying and evaluating an attractive business opportunity as well as the process of starting and growing a small business.

Course Objectives

1. To understand the nature of entrepreneurship and small business ownership.
2. To identify and evaluate an attractive business opportunity.
3. To acquire knowledge on business planning process.
4. To learn the steps in starting and growing a small business.

Introduction

This module is structured for trainees to demonstrate an understanding and appreciate the various key concepts in entrepreneurship which is key in the success in any enterprise. This is a four day course that targets those who may wish to start a business and those already in the business who wish to grow their businesses.

Topic 1
Understanding the nature of Entrepreneurship
Topic and Activities

1.1 What is entrepreneurship

To define entrepreneurship as a process bringing out the activities involved and the elements of creativity and innovation, the chance for gain under risk and uncertainty. Entrepreneurship is the practice of identifying, evaluating and starting a new business, organization or revitalizing existing enterprises through creativity and innovation.

1.2 who is an entrepreneur

An entrepreneur is a person who identifies a new opportunity, starts a new enterprise or improves an existing business using creativity and innovation while facing risk and uncertainty for the purpose of making profit and growth. Carl Menger (1921) considered an entrepreneur as change agent who transforms resources of lower value to high value leading to industrial growth which is the concept of value addition. Joseph Schumpeter (1934) on the other hand viewed entrepreneurs as a force of creative destruction whereby they do away with old ways of doing things and replacing them with new and better ways of doing things. It involves introduction of new products/services or their improvements, new markets or marketing methods, new production methods and new forms of organizations. This is the concept of innovation which is driving the growth of businesses. Brainstorm the difference between an entrepreneurs a business person and a manager.

1.3 Characteristics associated with a successful entrepreneur.

There are certain characteristics that are associated with successful entrepreneurs. These include; ability to identify new opportunities, taking calculated risk, creativity and innovation, being persistent, achievement oriented among others. Brainstorm on the characteristics that would make a successful entrepreneur.

Exercise

1. What is your entrepreneur potential?

Trainees to fill out a questionnaire to establish their entrepreneurial potential.

1.4 Why do people start their own businesses or become self-employed.

Trainee to pair up and discuss the reasons why people get into business or in self-employment. The trainees to list the advantages and disadvantages of self-employment and salaried employment.

Topic 2
Generating new Business ideas and their Evaluation

2.1 Generation of new business ideas
Introduction

The process of starting a new business is embodied in the entrepreneurial development process. In this process, an entrepreneur must find, evaluate, and develop an opportunity by overcoming forces that resist the creation of something new.

Finding a new business idea is the first step in transforming the entrepreneurs' business opportunity. There are several sources from which entrepreneurs can generate new ideas and some of these include:

- Identifying a need

A need can be an opportunity and consumers buy goods or services to satisfy needs. Abraham Maslow of the hierarchy of needs theory says that needs range from the very basic to the very

high level needs. Identifying an unfulfilled or unsatisfied need is a sure way of generating new business ideas.

- Identifying a problem facing consumer's

Finding solutions to problems that consumers face in their day to day life is a sure way of finding a business idea. Entrepreneurs see opportunity where others see problems.

- Spotting a market niche or gap.

Entrepreneurs usually look for gaps in growing markets. They try to identify needs of sections of markets which are not being utilized for existing business (market segments)

- Other possible sources of generating business ideas include:
  - -Listening to customer's suggestions, comment or complaints.
  - -Observing what competitors offer in view of improving on their offerings.
  - -Attending trade fairs and shows to see what's new.
  - -Reading journals, magazines newspapers or T.V. Programs to see what others are doing.
  - -Friends, family, learning and research institutions can also be good sources of generating new business ideas.

Exercise

Trainees to form groups and brainstorm on possible sources of business ideas e.g. Identify problems/changes taking place in the environment and for every problem suggest a solution in form of a business idea.

2.2. Identifying opportunities

Introduction

Most good business opportunities do not suddenly appear, but rather result from an entrepreneur's alertness to possibilities. This alertness to identify opportunities is one of the characteristics of entrepreneurs. Entrepreneurs are quick to identify change in the environment and respond. They endeavour to satisfy new needs as well as providing solutions to problems that emanate from the environment. A business opportunity has four essential features. It is attractive, timely, durable or sustainable and its anchored in a product, service or business that creates or adds value
for the buyer or user.

Exercise

Trainers to distinguish between a business idea and a business opportunity. Several guidelines can be used in helping identify or recognized opportunities:

- Observing environmental trends to detect change that creates opportunities.
- Study current imports to identify what can be made locally at lower cost for untapped market abroad.
- Study available skills and locally available resources that can be utilized.
- Examine inter-industry relationships to identify what services or goods that can be provided to other firms.
- Evaluate national developments plans and policy to identify incentives and policy favourable to business or value addition e.g. Kenya's Vision 2030.

2.3 Evaluating business ideas and opportunity for attractive business.

After generating of business ideas and identifying opportunities, they must be evaluated to ensure they represent an attractive business opportunity. The guidelines for evaluation include the following:

- Industry factors – Identify factors within the industry that make the business idea or opportunity attractive and profitable.
- Market factors – The product/Service must have a clearly identifiable target market with a need to satisfy.
- Economic factors – It must offer good return on investment
- Resource availability – Raw materials, finance and technology must be available, reliable and affordable.
- Personal factors – personal interest and commitment to the business.
- Competitive factors- must offer superior product/service than the competitors.
- Legal factors and government policy requirement – The business must be legal and in compliance with government policy.

Exercise: Based on the new business ideas generated and business opportunities identified rate them on the above evaluation criteria and suggest ones that are more attractive,

Topic 3
Business Planning
Learning objectives

- To explain the functions and importance of a business plan.
- To describe the preparations and activities carried out before writing a business plan.
- To identify and explain the business plans components.

3.1 Understanding the Business plan function
Introduction

In this study session, we lean the need for entrepreneurs to develop a business plan, the preparation that need to be done before writing the plan and learn how to compile the business plan. The business plan is one of the activities carried out by entrepreneurs in the entrepreneurship process. It is a written document that describes the entrepreneurs proposed business venture, its operations, financial details, its marketing opportunities, capability.

When to plan:

- During start-up
- Business purchase
- On-going review
- Major decisions

Why produce a plan

- As guide – a way of providing direction to where the business is heading.
- A plan provides details of where the business is, where it is going and how to get there.
- Provide information which forms the basis for obtaining finance.
- Offers guidelines for organizing various operations of business by clarifying ideas, finding out the unknown and building a team.
- Assists in communicating the affairs of the business to interested parties.

Who benefits

- Owners
- Managers
- Lenders and investors

Benefits

- Reduces impact and likelihood of failure
- Improves processes

- Helps reduce wastage
- Provides direction
- Creates competitive advantage
- Increases confidences in the future

Outline of a business plan:

The format depends on the type of business and the intended audience of the plan but three key features of the plan will answer;

- Where are we now?
- Where do we intend to go?
- How do we go there?

To answer these questions are the following major components of a business plan.

1) **Description of the business.**

This section covers the current business situation, a general description of the nature of the business and its founders.

2) **Marketing plan section**

This section covers the target market and its characteristics, market share, trends and growth potential. It also covers the marketing SWOT analysis, goals and objectives, strategies.

3) **Organization and Management section**

This section describes the qualification and experience of the key personnel, their duties and responsibilities.

- A management team with industry experience and a proven record of success goes a long way in adding credibility of the new venture.
- Provide an organization structure for the venture and details of the key personnel.
- Provide details on recruitment, training and promotion as well as remuneration and incentive schemes.

4) **Production and operations section**

The following are addressed under this section:

- Describe the development of the product
- Describe the kind of facilities and equipment required to provide the product of service.
- Describe the manufacturing process and the production layout.
- Indicate government regulation, compliances and approval.

5) **Financial Plan Section**

A financial plan is a course of action which an entrepreneur intends to implement in order to achieve business objectives.

- It represents the entrepreneur's best estimates of operations in quantitative terms
- It is also a tool for assessing the performance of a business over a period of time.
- This section comprises the following:

- Analysis of the pre-operation cost
- Sources and uses of funds
- Projected cash flow statement
- Project income/loss statement
- Pro-forma balance sheet
- Break-even analysis
- Desired financing

- Profitability ratios
- Critical risk factors and contingencies.

Once all is done an executive summary is prepared and appears in the first pages of the plan. It is a summary of the major highlights of the business plan.

Exercise:

i. Trainees to brainstorm on the activities they have ever done with or without a plan and share experiences.
ii. Trainees to identify a business they are interested in and develop a business plan. This should include business objectives, nature of the business and justify the opportunity.

What makes entrepreneurs successful?

An entrepreneur is usually successful when he/she is competent in entrepreneurial skills, excellent in management, leadership and marketing. It should be understood that no magic solutions will guarantee a business success. However, the following should assist in the improvement of chances of success.

- Profile your target customer, identify their needs and satisfy them.
- Development of business plan.
- Obtain accurate financial information about the business in a timely manner.
- Network with other business owners in similar industries.
- Be creative and innovative in the way you operate the business.
- Understand your environment and respond in a timely manner- identify opportunities, deal with threats and comply with government regulations and policy.
- Having the ability to manage the human resource- hiring, supervising, training, fair compensation and motivation.
- Managing the finances-keeping records and managing cash flows and credit.
- Making sure that sales and marketing is done effectively- having good product, proper pricing, promotion and efficient distribution system.
- Always ensure your product/service delivers superior value than the competitor.

Estimated Charges and Costing

- Proposed fees charges per trainee per day @ Ksh. 5000 total for 3 days= Ksh. 15000
- Assume minimum of 20 trainees@15000= Ksh. 300,000

Training Expenditure

- Two facilitators @ 5000 per day for 3 days = Ksh. 30,000
- Trainees feeding: lunch, tea and snacks per person = @ Ksh. 700
- Assume a minimum of 20 @700 for 3days = Ksh. 42000
- Promotion- posters, advertisements and preparations = Ksh. 100,000
- Training materials: handouts, booklets, pens, marker pens and flipchart = Ksh.10,000
- Miscellaneous costs = Ksh. 10,000

  Total cost =Ksh. 192,000.00

  Total profit (total revenue less cost) = Ksh.108, 000

  Return on investment is 56.25%

Minimum number expected to break-even 13 Trainees

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COMMENTS:

The presentation was clear with very clear problem statement, methodology and also marketing. Overall presentation is clear experience due to skills acquired in course during lecturing. It is open training for management and consultancy Division of Chuka University. Provide a suggestion of how the trainers will also benefit.

Short Course: Advances in Book Keeping and Business Accounting for SMEs

by Mr. Joseph Masinde, Department of Business Administration, P. O. Box 109-60400, Chuka

Introduction and Rationale

The need to apply a common set of high quality, clear and transparent accounting standards for Small and Medium Enterprises (SMEs) cannot be overlooked. By conforming to the International Financial Reporting Standards for SMEs (IFRS for SMEs) firms can gain exceptional growth occasioned by increased reporting transparency and efficiency. It is for this reason that Chuka University has organized a 5-days' short course with a view to develop a strong platform for the SMEs transparent and efficient financial reporting culture that supports credible financial information for reliance by investors and other key stakeholders. This short course, facilitated by experienced facilitators will give in-depth knowledge on IFRS for SMEs with a bias to those standards that have a great footing in the context of Kenya.

Expected Learning Outcomes

After studying this course, you should be able to:

- Apply the essential skills required for bookkeeping and accounting
- Explain the relationship between the accounting equation and double-entry bookkeeping
- Record transactions in the appropriate ledger accounts using the double-entry bookkeeping system
- Balance off ledger accounts at the end of an accounting period
- Prepare a trial balance, Statement of financial Position, Comprehensive Income Statement and statement of Cash flows.
- Interpretation of Financial Statements

Target group(s)

Owners of SME, Accountants, Book-keepers.

Application

Applied in Determining of Profitability of the Venture, Provide Information to Lenders, Taxation, Used in Financial Planning and Decision Making

Mode of Delivery

PowerPoint presentations, Practical Exercises

Lesson 1: An Overview of Accounting

Objectives

At the end of this topic, you should be able to;

1. Define the term accounting and differentiate it with bookkeeping.
2. Explain the nature and purpose of accounting.
3. Identify the users of accounting information and mention the specific information that users require from accounting reports.
4. Describe the purpose of financial statements in general terms.
5. Explain the various forms of financial statements.
6. Describe the desirable characteristics of accounting information.

Introduction

Accounting presents the financial state of affairs of the business in a suitable form for the users to make appropriate inferences from them. The end-result of accounting is a set of self-explanatory reports, which include the Trading, Profit and Loss Account (Income statement), Balance sheet, Cash flow statement, Directors report, and Value Added Statements. It involves collecting, recording, summarizing and presenting financial information for use by the interested persons.

Book keeping is the part of accounting that is concerned with recording data. Internal users of accounting information are employees and shareholders whereas the external users are the shareholders, government, lenders, the stock exchange, potential investors and trade unions.

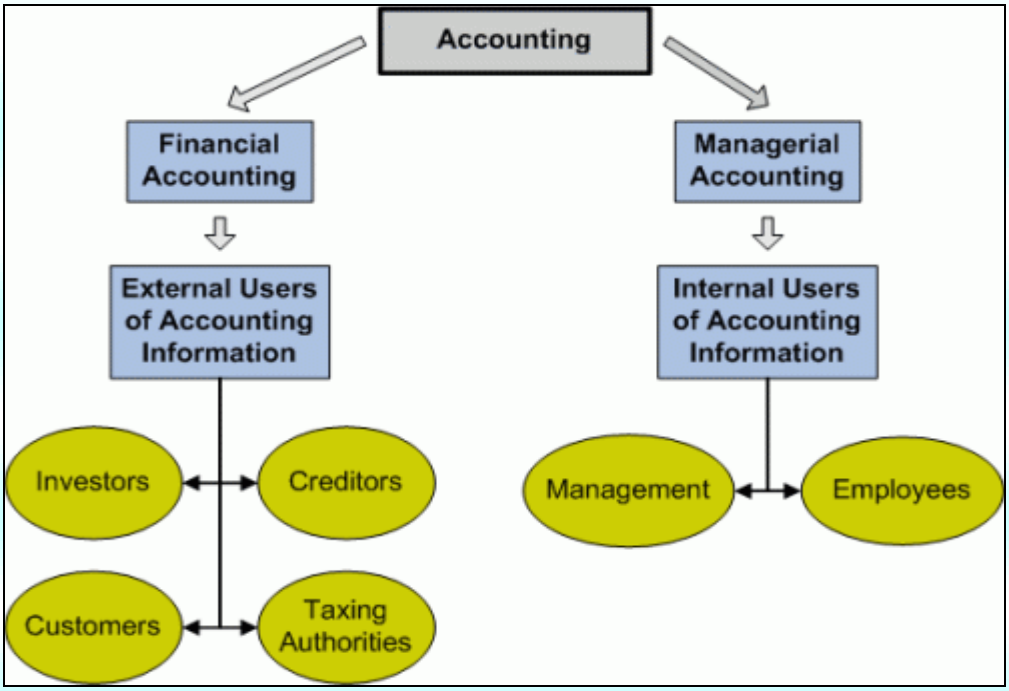

Figure 1.1: Classification of Accounting and Accounting Information Users

Adapted from: http://www.simplestudies.com/accounting/lec/p0101.htm**.**

To be useful to the users, accounting information must be; understandable, relevant, consistent, comparable, reliable and objective.

Financial statements are the specific reports that are prepared for the users of financial information who later read and interpret them to enhance their decision-making. The reports are prepared in line with the Generally Accepted Accounting Principles and the International Financial Reporting Standards in use in any country. The financial statements include; the income statement, statement of changes in equity, Statement of financial position and the statement of cashflows.

Lesson 2: Accounting Terms, Accounting Equation and the statement of Financial position

Objectives:

At the end of this topic, you should be able to:

1. Explain the nature of assets, liabilities and capital.
2. Write up the accounting equation and explain the dual aspect nature of the accounting transactions.
3. Prepare a statement of Financial Position.

Introduction

Every business organization must take stock of the changes that have taken place in the financial year. There may be addition of capital goods, capital, and liabilities. The effects of these changes are summarized in a Statement of financial Position, which reflects cumulative balances of assets, liabilities and capital at a certain date usually the end of the accounting year.

Assets refer to anything in the business that has monetary value and can be classified as either current or non-current depending on how long they will generate economic resources to the business. While the current assets will be realized within one accounting period, non-current assets will be used for longer periods.

Liabilities are the obligations of a business enterprise and can be categorized as either short term or long term liabilities. While the short term liabilities are due within the accounting period, long term ones are due in longer periods.

Capital refers to the owner's funds employed in the business. In the case of companies, the capital is referred to as "owner's equity." The excess of current assets over current liabilities is the "working" or "operating capital."

The dual aspect of accounting relates assets with liabilities and capital in what is popularly known as the accounting equation. The equation shows that the total business assets are financed from owner's capital as well as long-term and short-term liabilities.

Drawings imply a reduction in owner's capital through withdrawals of cash or goods in trade.

Lesson 3: The Ledger and the Double Entry System

Objectives:

At the end of the topic you should be able to classify accounts and record business transactions in the ledger.

Introduction

There are two basic books of accounts commonly used in recording business transactions. These contain important records relating to the monetary transactions undertaken in a particular accounting year. They go further to present the true financial position of a business for a particular year, as they will be used in preparing financial statements. These financial statements include the trading, profit and loss account, which is used to establish the profit or loss made during the financial year and the balance sheet used to show the financial position as at a particular date. The two books of account are the **Ledger** and the **Subsidiary books**.

The Ledger

This book houses accounts of a business undertaking. A page in the ledger is known as an account. The page is divided in to two sides with the left hand side being the **Debit side** and the right hand side the **Credit side**. When the pages (sheets) are attached in to a book, it is described as **bound book ledger** but if it is in loose pages so that one can be extracted and replaced, it is described as **loose-leaf ledger**. Moreover, the ledger may be in the form of stiff cards each containing the name of an account arranged in files thus known as the **card ledger**. The ledger records the sources and application of funds of the business in the accounting year. Funds must be distinguished from cash in that a fund means a resource whether tangible or intangible applied in a function to give a return. On the other hand, cash is tangible liquid money flowing in to or out of the business. An account is opened in the ledger wherever there is an application or a source of funds.

Application of funds is the use of business resources to generate returns e.g. purchase of goods for resale, purchase of fixed assets, payment of expenses etc. Sources of funds means inflow of resources in to the business whether from the owner or from outside sources e.g. capital injected by the owner, sale of goods, receipt of incomes, sale of fixed assets etc. Application of funds will appear on the debit side of the account opened in the ledger for such purpose while source of funds will be recorded on the credit side of the account opened for the purpose.

Every business transaction involves two aspects from the business point of view i.e. giving and taking of value. The two are recorded on the two sides of the ledger. The giving of value is recorded on the credit side e.g. If goods are sold, a sales account is opened in the ledger and the amount entered on the credit side (credited). Taking of value is recorded on the debit side e.g. if cash is received in to the business a cash account is opened and the amount debited. A page in the ledger is ruled with four columns on either side. This is described as the T format of an account illustrated below.

Ledger account

Debit side				**Credit side**			
Date	Particulars	F	Amount	Date	Particulars	F	Amount

Date: shows when a transaction actually took place.
Particulars: Shows the name of the other account affected by the same entry.
F (Folio): Contains the reference page of the account named in the particulars column. In general, this column is a reference column for the corresponding entry in the same or different ledger.
Amount: Indicates the monetary value of the transaction.

Due to the automation of the office, the T format of an account is being replaced by the three-column ledger, which has three amounts column as shown below.

Title of the Account					
Date	Particulars	Folio	Debit	Credit	Balance

These types of ledgers have the following advantages;

(i) They can be used with accounting machines.
(ii) They show the balance in an account at a glance after every transaction.
(iii) It serves as an account and a statement, which can be sent to the business customers.

Posting Transactions to the Ledger
Posting is the act of recording transactions in the ledger accounts. The aggregates of subsidiary books are usually posted to the ledger accounts. Some transactions may however not be recorded in the books of original entry but will be posted directly from the source books to the ledger. An account is debited when the amount and details are entered on the debit side. An account is credited if the amount is posted to the credit side. Entries in the ledger are based on the double entry concept depending on whether it is a cash or credit transaction.

Cash and Credit Transactions

Business transactions may be either in cash or in credit. A cash transaction is one whose payment is immediate on offer of the services. There is said to be prompt payment for the goods or services offered e.g. when cash is paid against the purchase of goods on the date of the purchase. Credit transactions on the other hand involve payment at a future date after the transaction has been effected. Goods or services are offered but the transaction remains open for some time before payment of cash. All the transactions will be recorded in accounts opened in the ledger(s). The nature of the transaction will dictate the type of account to be open and the entry to be made in the account i.e. whether debit or credit.

Classification of Accounts

For simplicity in posting transactions in the ledger, accounts are grouped in to classes. Each class contains accounts of similar nature. Broadly, there are two classes of accounts based on their names and transactions they reflect. The two categories are; **Personal** and **Impersonal** accounts.

Personal Accounts

They are ledgers, which contain accounts of persons or firms dealing with the business. They are usually in the names of firms or individuals. They record all transactions between the business and other individuals or firms outside the business enterprise. They are accounts of credit buyers (customers) or (debtors), credit suppliers (creditors) and account of the owner's dealings with the business (capital and drawings).

Impersonal Accounts

These are accounts, which are not in personal names as opposed to personal accounts. They are accounts of tangible and intangible assets and liabilities, incomes and expenses not in personal names. They are further grouped in to two: **real** and **nominal** accounts.

Real accounts are accounts of physical and tangible items of the business. Mostly these are assets both fixed and current owned by the business. Examples include land and buildings, motor vehicles, stock furniture and fittings, cash etc.

Nominal accounts are accounts of intangible items. They are accounts of incomes and expenses earned and incurred in the trading period of the business. These accounts cease at the end of the financial year since they are used in the preparation of the income statement. They include income accounts as the sales account, Rent received account, interest earned account etc and expense accounts as purchases, water, electricity, insurance, rent and rates etc.

The Double Entry Concept

Every transaction effected in the business has a dual aspect i.e. the giving and taking of value. These two aspects form the basis of making entries in the accounts. Thus, the transaction has a dual effect on the ledger, which is described as double entry. The giving aspect is usually debited in the account opened for the same while the taking of value is credited.

Example: Sales of goods in cash involve gaining of value in cash and loosing of value in the goods sold. As such, a cash account is opened and the amount debited as a gin in value. Moreover, a sales account is opened and credited as loss in value in the goods. Before making the double entry of a transaction, three questions have to be answered:

(i) What two accounts are affected?

(ii) What kind of accounts are they?

(iii) Which account is gaining value (to be debited) and which one is losing (to be credited)?

The dual aspect of a transaction involves either the source of funds or application of funds. The account recording a source is usually credited while that recording an application will be debited. A sale is a source since some value (income) is received hence the sales account will be credited. Purchases being an application where some value is lost (expense incurred) should be debited in a purchases account.

In summary, while making entries by the double entry concept observe the following rules:

(i) Every debit must have a corresponding credit entry in a ledger account.
(ii) In an account, debit the receiving of value and credit the giving of value.
(iii) The source of fund should be credited in the ledger account while an application should be debited.
(iv) For every entry in a nominal account, there is a corresponding entry in a real or personal account.
(v) For personal accounts, debit the receiver and credit the giver.
(vi) For real accounts, debit account receiving value and credit account giving the value.
(vii) For nominal accounts debit expenses or losses and credit incomes or gains accounts.

Balancing of Accounts in the Ledger

At the end of the financial year (or period to which account balances are required), accounts will usually be closed in the ledgers. This is done to facilitate calculation of profits and preparation of the balance sheet. To close off an account, the debit and credit sides are added up separately. If the two sides equals then the account is said to be self-balancing. If the two sides do not equal, then the difference is termed as a balance carried down (forward) and can be on either side of the account. The amount is then brought forward in the reverse side for continuity of operations in the next period.

The Trial Balance

This is a list of balances that is used to ascertain the arithmetic accuracy of the double entry system. The debit balances are listed on one side while the credit balances are listed on another. Both sides of the trial balance should sum to the same amount because the accounts are prepared on dual aspect concept. As a rule, asset and expense balances will appear as debits while incomes and liability balances will appear as credits. Accounts without balances will not be recorded in the trial balance.

Lesson 4: Accounting Cycle

Objectives:

After studying this topic, you should be able to:

1. Understand the nature of the accounting cycle.
2. Clearly distinguish between the general, purchases and sales ledgers.
3. Record transactions in the ledger after passing the transactions through the daybooks and the three-column cashbooks.
4. Extract a trial balance.
5. Prepare a simple trading profit and loss account and Statement of Financial Position.

Introduction

Accounting is a systematic procedure that involves extracting financial statements from the information contained in the source documents. This topic inter-relates the materials learnt in the previous topics and shows how the final accounts are extracted from the trial balance.

Accounting Cycle

The accounting cycle is a clear and orderly process used to identify, record, and report financial information about a business entity during a specific period. The purpose is always the same: capturing transaction data – the inputs – and processing that data through a cycle that results in the production of financial statements – the outputs.

The accounting cycle involves a series of basic steps that transform business transactions into financial reports. These steps are repeated every accounting period. The cycle begins with making accounting entries for each transaction and goes through to closing the account for that accounting period.

The length of time covered by an accounting period is determined by the needs of the individual organization. Accounting periods could cover a month, a period of several months, or a calendar or fiscal year.

Although the purpose of the accounting cycle remains the same, different organizations use different methods to capture and record their business activity. The number of steps in the cycle, and the implementation of each step, will vary depending on the nature of the business, the level of detail required, the preferences of the accountant, and the requirements of the software used.

There are six basic steps in the accounting cycle:

1. **identify and analyze transaction** – This requires that you think logically about each transaction and the effect it will have on specific accounts.
2. **make journal entries** – This is called "journalizing." A journal is a chronological record of all the transactions of an organization. The main journal of an organization is called the general journal. Journals are books of "first entry", meaning all transactions are recorded there for the first time.
3. **post to ledger** – Ledgers contain records for each account, organized by account code. Periodically throughout the accounting period, transactions recorded in the journals are transferred to the ledgers. This process is called posting. The purpose of posting is to determine the balance of each specific account.
4. **do trial balance** – The basis of double-entry accounting is that for every credit there must be an equal debit. This means that the sum of all debits for all accounts in the ledger must equal the sum of all credits. If debits don't equal credits, an error has been made. The method for detecting these errors is the trial balance.
5. **prepare financial statements** – Once all the transactions in the accounting period have been analyzed, journalized, posted, and adjusted, the information in the accounts can be used to prepare the financial statements.
6. **make closing entries** – Once the ledger accounts have been reconciled and adjusted, it's time to close the accounting books. Closing the books locks the data by disallowing changes or additional postings for the accounting period covered by the financial statements. To close the books, make a series of closing entries to the ledger accounts.

Lesson 5: Interpretation of financial Statements: Accounting Ratios

Objectives:

At the end of the topic, you should be able to:

1. Calculate and interpret liquidity, profitability, turnover and other ratios relevant to the shareholders of a company.
2. Discuss the advantages of accounting ratios in the interpretation of financial statements.
3. Elucidate the inherent limitations of accounting ratios.

Introduction

After preparing the final accounts, the users of accounting information may be interested in knowing how the business is performing relative to other businesses or over time. In this regard, the financial statements cannot be used in their raw form and must be put in to some quantitative expression. These quantitative expressions are called **Accounting Ratios**. The ratios give a common measure of business performance.

Classification of Accounting Ratios

Accounting ratios are classified according to the needs of the users of the accounting information. The most widely used category of ratios is the **Profitability ratios**. These ratios are used to measure the profitability of the business. These ratios are relevant to the existing owners (shareholders) of the business, potential investors and the management. Basically, the higher the profitability ratio is, the better for the business. The following table shows the various profitability ratios and their implications in accounting.

	Ratio	Formula %	Interpretation
1	Gross profit margin	Gross profit / Total Sales	It shows the amounts of gross profit earned in every Sh. 100 of sales.
2	Net profit margin	Net profit after tax / Total Sales	It shows the amounts of net profit earned in every Sh. 100 of sales.
3	Return On Capital employed	Net profit after tax / Capital employed	It shows the rate of profits generated from the capital invested in the business.
4	Return on investment	Net profit after tax / Total share capital + Reserves	It shows the rate of profits generated from the capital invested in the business.

NB:

- Total sales is the sum of both credit and cash sales sometimes referred to as turnover.
- Total purchases are the sum of credit and cash purchases of goods for resale.
- In calculating the Return on Capital Employed, the Net profit before interest and taxation may also be used depending on the specific requirements of the user.
- Capital employed by a sole trader is the average of the sum of opening capital, net profit (loss) after deducting drawings. To make it more representative, a reasonable average can be calculated and used in the computation of the ratio.
- Gross capital employed may also be calculated as the sum of fixed assets and current assets.
- The capital employed in case of a limited company is the sum of ordinary share capital; share premium, retained earnings and reserves and long-term borrowings.
- The capital employed can also be ascertained as the sum of the book value of fixed assets and working capital. [Fixed assets + (current assets – current liabilities)]. In case of a limited company, the net profit may be before preference dividends and interest on long-term borrowings.
- Potential investors can use the profitability ratios to assess the viability of a business and its potential for growth in profitability.

Liquidity ratios indicate the ability of a firm to settle its obligations or debts. A business that is not able to honour its debts is said to be insolvent or illiquid. This category of ratios is useful to the purchasers of the business and the lenders. An insolvent business would find it difficult to access finance from lenders or the lenders would have to charge relatively higher rates of interest

to account for the high credit risk they would have to undertake. The following table shows the ratios that can be used to evaluate the short-term liquidity of the business.

	Ratio	Formula	Interpretation
1	Current Ratio	Gross Current assets / Current Liabilities	It shows the number of times the current assets can cover the current liabilities. A ratio of 2:1 is desirable.
2	Acid test ratio (Quick Ratio)	Current assets - Stock / Current Liabilities	It shows the number of times the relatively liquid current assets can cover the current liabilities. A ratio of 1:1 is desirable.

The current assets in the above ratios include debtors at book value, stocks at book value, prepayments of expenses, accruals of incomes, cash at bank, cash in hand e.t.c. The current liabilities include trade creditors, expense creditors, bank overdraft e.t.c. In calculating the quick ratio, stock is usually deducted as it takes a relatively longer time to realize.

Efficiency ratios indicate the vigorousness with which the business is runs its operations. Ratios in this category can demonstrate managerial laxity or efficiency and the suitability of the business policies in use. The table below shows the various efficiency ratios, how they are computed and their respective interpretations.

	Ratio	Formula	Interpretation
1	Debtors turnover	Debtors x 365 days / Credit Sales	It shows the number of days it takes to collect cash from the credit customers after making a credit sale. The lesser the number of days, the more efficient is the debtor policy.
2	Creditors turnover	Creditors x 365 days / Credit Purchases	It shows the number of days it takes the business to pay the suppliers after purchasing goods from them on credit. The longer the credit period the better.
3	Stock turnover	Cost of sales / Average stocks	The ratio shows the number of times it takes to realize stocks in a year. The higher the ratio, the better.
4	Sales/Fixed assets	Sales x 100 / Fixed assets	The ratio shows whether the trading value of a company is large enough to justify its investment in fixed assets

The debtors' turnover is important in the evaluation of the unnecessary amounts tied up in the debtors. As a rule, cash should be realized from the debtors as fast as possible. Incentives such as cash discounts can be allowed to the debtors to enable them to honour their obligations promptly.

The creditors can use the creditor's turnover ratio to assess the payment policy of the firm. As a rule, the number of days should not be so few as to strain the business in honouring its obligations and they should not be so many as to discourage creditors from supplying goods on credit to the firm. The creditors turnover should preferably be shorter than the debtors' turnover.

The stock turnover is a measure of efficiency in the selling of the business supplies. A lesser number of times of stock turnover indicate that stock is being tied up unnecessarily in the business. The Average stock implied in the ratio is the arithmetic mean of the opening and closing stocks of the firm. In a manufacturing firm, it implies the stocks of finished goods.

Investor ratios indicate the relative attractiveness of the company to the potential investors. The purchasers of ordinary shares at the stock exchange broadly apply these ratios. Investors will be attracted to companies whose rates of return on investments are high. Investor ratios are also referred to as the stock exchange ratios. The following table shows the ratios that would be of particular relevance to potential investors.

	Ratio	Formula	Interpretation
1	Dividend per Share	Total dividends / Total number of shares	It shows the return per share. i.e. the amount of dividends earned per share.
2	Dividend yield	Dividend per share / Market price per share	It shows the real rate of return on the investment made in the company.
3	Earnings per share	Profits attributable to ordinary shareholders / Total number of ordinary shares	It indicates the approximate amount earned by one ordinary share assuming that there was no retention of profits.
4	Dividend Cover	Profits attributable to ordinary shareholders / Ordinary dividends	The ratio indicates the proportion of the ordinary dividends that are distributed to the ordinary shareholders
5	Price-Earning Ratio	Market price per share / Earnings per share	It shows the number of times that the market price can cover the earnings per share.
6	Pay Out ratio	Total dividends / Total earnings attributable to the ordinary shareholders	It shows the proportion of profits that are distributed as dividends.

The dividend per share gives the actual amount of dividends receivable by a shareholder for every share that he holds in the company. The higher the share the better as it shows that the company has a high payout ratio. The dividend yield of a company is compared with other companies in the industry and an appropriate investment decision made.

The EPS approximates the amount that each ordinary share would earn assuming that all the profits were distributed to the existing shareholders (holders of all the shares issued). Sometimes, the EPS is calculated using the authorized number of shares (both issued and unissued). In that case, it's called **Diluted EPS**. The nominator used is the profits after tax and after preference dividends. The dividend cover indicates the proportion of dividends that are distributed. A dividend cover of 4 times implies that the company distributes one-quarter of its profits as

dividends. The price earnings ratio is a measure of the number of times of return expected from an investment in a share. If the P/E ratio is high, then this means that the shares are in high demand. Another category of ratios in use is the **Gearing ratios**. These ratios are used to evaluate the long-term solvency of the firm. The ratios therefore focus on the capital structure of the firm. Ratios in this category are explained in the following table.

	Ratio	Formula %	Interpretation
1	Capital gearing ratio	Long-term loans + preference shares / Owners capital + borrowed capital	Shows the proportion of borrowed capital relative to the total capital
2	Debt / Equity ratio	Total Debt / Equity capital	It shows the proportion of debt capital relative to the owners capital
3	Times interest earned ratio	Profits before Interest and tax / Total interest charges	It indicates the ability of the business to finance interest charges on long term loans
4	Equity Ratio	Total capital employed / Equity Capital	It indicates the proportion of capital that is owner generated.

Any item of cost can be expressed as a percentage of the sales revenue. Cost ratios should ideally be less implying that lesser costs are used to generate more sales. Cost ratios are becoming more important in these days of cost cutting or cost saving in the business organizations. Specific cost ratios include:

1	Cost of sales ratio	Cost of sales x 100 / Sales
2	Selling and distribution	Selling and distribution expenses x 100 / Sales
3	Total cost	Total cost x 100 / Sales

Application of Accounting Ratios

Accounting Ratios are used in different ways. An accounting ratio can be calculated and compared with the same ratio in the previous periods and a decision made on whether the business position evaluated by the ratio has improved or not.

Accounting ratios computed by a firm can be compared with the industry ratio and an observation made if the business performance is in line with the industry or otherwise.

Accounting ratios can also be compared with the conventionally accepted standards. For instance; a current ratio of 2:1 is deemed appropriate.

A comparison can also be made between the ratios computed in a business with those of other businesses in different industries for a potential investor to evaluate which industry to invest in.

Merits of using Accounting Ratios
The key advantages of using accounting ratios is that they show how the business is performing over time, indicates instances of failing business policies for appropriate action to be taken, act as a guide to decision making and act as a measure of managerial targets.

Limitations of Ratio analysis
Ratios are computed using historic information and so only reflect the past performance of the business. Accounting ratios do not take in to account the effects of inflation over time, they cannot be used as accurate measures of comparison between businesses as different businesses adopt different accounting policies and are too shallow i.e. they do not disclose the actual figures to the users of the accounting information. Despite their limitations, accounting ratios are broadly used to analyze the data contained in the financial statements.

Lesson 6: Interpretation of financial Statements: Cash flow statements
Objectives:
At the end of the topic, you should be able to prepare cash flow statements in line with the requirements of IAS 7.

A cash flow statement is prepared to show the sources of funds for a business organization together with the corresponding application. The statement is prepared basically to portray the movement of cash and cash equivalents within a given period of time.
The cash flow statement shows the actual cash receipts and the corresponding cash payments made within a given period of time. IAS 7 gives guidance on the presentation of the cash flow statement. The statement can be prepared in either of two ways; i.e. the direct and the indirect approaches.

Using the direct approach, the statement resembles the cashbook i.e. it's made up of the cash and bank receipts less the payments.

When using the indirect approach, the cash flow statement is prepared after the final accounts (profit and loss account and balance sheet) have been prepared. It's called indirect because, it involves adjusting the profits or losses made to their cash flow equivalents. IAS 7 recommends the cash flow to have the following classes.

Class I: Cash flows from operating activities: This class is used to record the cash inflows and out flows arising from the usual activities of the business.

When using the direct method to prepare the cash flow statement, items that would ordinarily be listed in this class would include;

(i) Cash sales;
(ii) Cash received from debtors;
(iii) Rent received;
(iv) Cash paid to suppliers for goods supplied;
(v) Cash operating expenses; and
(vi) Any other revenue receipt or payment arising ordinarily in the conduct or operation of the business.

When using the indirect method, the above items would ordinarily not be in the picture because the final accounts have already been prepared. The net profit (loss) is therefore adjusted to reflect the cash flows from operating activities as follows:

	Sh.
Net profit (loss) before tax	X
Adjustments for items not involving the movement of funds	
Depreciation charged in the profit and loss account	X
Loss on disposal of fixed assets	X
Gains on disposal of fixed assets	(X)
Increase in provision for bad debts	X
Decrease in provision for bad debts	(X)
Any other item affecting profitability but not cash flows	
	X
Less tax paid	(X)
Working capital adjustments:	
Increase in current assets	(X)
Decrease in current assets	X
Increase in current liabilities	X
Decrease in current liabilities	(X)

Sometimes the net profit is calculated as the difference between the retained profits of the current year and the retained profits of the last year i.e. the retained profits for the year after tax and dividends. In this case, the dividends (both interim and proposed) as well as the annual taxation charge charged in the profit and loss account must be added back to the retained profits (to arrive at the figure profits before tax).

Class II: Cash flows from the investing activities: Investing activities are those, which involve the commitment of business funds on issues with long-term implications to the business together with their corresponding rewards. Items in this class would be:

	Sh.
Purchase of fixed assets	(X)
Sales proceeds of fixed assets	X
Purchases of investments	(X)
Investment income	X

Class III: Cash flows from financing activities: These are issues, which relate to how the business assets are funded. Generally, the business assets are funded by the owner's capital and the borrowed capital. Items in this category are recorded alongside the amounts paid to maintain the capital in the business. Specific items in this category would include:

	K. Sh.
Issue of shares	X
Premium earned on issue of shares	X
Redemption of shares	(X)
Redemption of debentures	(X)
Repayment of loan	(X)
Loans borrowed	X
Dividends paid	(X)
Loan interest paid	(X)
Finance charges on lease paid	(X)

The results are then added to the cash and cash equivalents at the beginning of the accounting period to arrive at the cash and cash equivalents at the end of the accounting period.

Sometimes, it may be necessary to reconstruct the ledger accounts to determine some of the items to include in the cash flow statements. Some of the accounts that may need reconstruction are shown below.

Provision for depreciation account				***Taxation account***			
Disposal	X	Balance b/f	X	Bank	X	Balance b/f	
Balance c/f	X	P& L	X	Balance c/f		Corporation	X
	X		X	Deferred	X	Deferred	X
Dividends account				Corporation	**X**	P& L	**X**
Bank	X	Balance b/f	X		X		X
Balance c/f	X	P&L	__				
	X		X	***Property account (land and buildings)***			
Plant and machinery accounts				Balance b/f	X	Disposal	X
Bal b/f	X	Disposal	X	Bank	X	Revaluation (loss)	X
Bank	X	Bal c/f	X	Finance lease	X		
	X		X	Revaluation (gain)	X		
Share capital account				Share capital	X		
		Balance B/F	X	Debentures	**X**	Balance c/f	**X**
		Bonus issue	X		**X**		X
Balance c/f	**X**	Cash	**X**				
	X		X				

Budget for a one week SME Training in Chuka University for 50 Persons

Item	Item description	No. of units	Unit cost	No. of Days	Total Cost (Ksh.)
Income	Fees Charges for Participants	50	7500	5	1,875,000
Meals Cost	Lunch and 2 teas	50	1,500	5	375,000
Stationery	Pens	100	30		3,000
	Notebooks	50	100		5,000
	Whiteboard Markers	6	100		600
	Flipcharts	2	500		1,000
Facilitators		3	5,000	5	75,000
Hall Hire		5	5,000	5	125,000
	Total budget cost				584,600
	Total cost Per person				11,692
	Profit				1,290,400
	Profit in Percentage (%)				69%

References

COMMENTS:

The presenter did good work. The problem was clear, methodology & marketing were also well shown. However the power point was not done/visible for some in some slides. Oral presentation is clear due to job of a lecturer. We launch a short training management & consultancy services unit in Chuka University from the short courses. Show how informal businesses owned by people with low levels of education and how they can make use of the programme. Think of how to make the course to be continuous so that it can be well understood by the trainees and also to facilitate giving feedback. Will the facilitators benefit?

Short Course: Contemporary Human Resource Management Skills for County Government Staff and Other Leaders

By Ms. Catherine Kaimenyi, Department of Business Administration, Faculty of Business Studies, Chuka University, P. O. Box 109-60400, Kenya

1. INTRODUCTION

This contemporary human relations course is designed for managers, supervisors and team leaders who are aspiring to successfully manage people and bring the best out of their teams. The course is premised on the belief that in the modern challenging and competitive global market, employee engagement is paramount, as is retaining talent within the organization, both of which are possible where human relations are effectively managed. It recognizes that the workplace is not just about work but relationships too. The course appreciates the changing psychological employment contract from the traditional management era where the superior played a 'boss' role to one where he serves as employee partner.

The better a manager or supervisor is at managing relationships, the smoother the workplace will function. Thus anybody with a responsibility for managing staff at whatever level requires an understanding of human relations management best practices in order get the best out of their team, avoiding pitfalls along the way and creating a people attractive atmosphere where a strong bond exists. The course provides the essential practical knowledge and tools to enable leaders to skillfully maintain organizational relationships and tackle Human Resource Management issues before they escalate to turn into disorder.

In the recent past, there has been numerous labour unrests particularly in the public sector most of which have tampered with service delivery drawing behind the economy. To stir sustainable development envisaged in the Sustainable Development Goals as well as Kenya's Vision 2030, a concerted effort by all sectors is crucial. Such efforts would assist to inculcate people-oriented management values where positive relations that encourage dialogue prevail. Empowering county government staff and other stakeholder with relational skills would therefore be a proactive measure to bring the much needed peace at the workplace. This course therefore becomes timely in addressing this notorious unbecoming labour behaviour.

Contemporary human relations skill course provides participants with a clear understanding of individual and group behaviour so that they are able to relate and respond in a well-informed manner. It also builds their skills in communication; leadership and decision making to enable them effectively transmit and receive information, inspire and motivate their teams and make good decisions that attracts support and goodwill from the subjects. Moreover, conflict management skills are imparted which help in identifying potential conflict areas to consciously monitor for timely intervention. Participants will also be exposed to various conflict resolution strategies including negotiation skill building to enable handle actualized conflict. The course ends by introducing mediation as an assisted form of dispute resolution which can be used not only between superior and subordinate but also among peers themselves. Mediation has recently been accepted by the judicially as an alternative to litigation which makes it vital to introduce the concept at the workplace.

2. COURSE OBJECTIVE

This course aims to enable participants to achieve the following objectives:

i. Build a good working relationship with their staff
ii. Develop strong conflict management skills
iii. Build confidence and effectiveness in a variety of management relationships

iv. Communicate effectively with both superiors, peers and subordinates

3. COURSE TARGET

The course is ideal for workers holding leadership roles as team leaders, supervisors, middle and senior management in both public and private sector.

4. TRAINING METHODOLOGY

This 3-day short course will be highly interactive facilitated by experienced Human Resource personnel through lectures, workshops, case studies and role plays. Discussions and guided group work will allow participants to get fully involved and understand the practical implications of the learning.

5. COURSE SUMMARY

This exciting course will allow participants to explore a complete overview of People Management best practices that create a harmonious working environment. It particularly covers the following areas.

5.1 UNDERSTANDING INDIVIDUAL DIFFERENCES AND GROUP BEHAVIOUR

This topic explores the components that shape behavior of an individual as well as those that play when people are in teams or groups. Key among individual differences are personality and perception while the power of informal groups shape people behaviour.

5.1.1. Personality

Personality is an individual difference that lends consistency to a person's behavior. Both heredity and environmental forces shape personality. Several personality characteristics have been identified that are relevant work behaviour. The key characteristics with interesting implications in organizations are locus of control, self-esteem, self-efficacy and self-monitoring. An individual personality is static though with an effective leader it can gradually change to take the shape advocated by the leader.

5.1.2 Perception

Perception is the process of interpreting information about other people, a process heavily used by management. It affects the way we view the world around us. It is the process by which individuals organize and interpret their impressions in order to give meaning to their environment. Perception is important because behaviour is based on perception of what reality is, and not on reality itself. An individual perception is distorted by various factors like stereotyping, prejudice, halo effect and contrast effect. A manager can thus have conflict with subordinates if he allows himself to be influenced by such error/distortions.

5.1.3 Informal Groups

Every organization is made up of both formal (intentionally created) and informal (spontaneously emerging) groups. Since formal groups are consciously created, the management has total control over their operations unlike the informal ones. The management can use informal groups to their benefit if they understand their dynamics and the reasons for existence.

5.2 ENHANCING EMPLOYEE ENGAGEMENT

Employee engagement is a workplace approach resulting in the right conditions for all members to give of their best each day, committed to their organization's goals and values, motivated to contribute to organizational success, with an enhanced sense of their own well-being. This can be enhanced through effective communication, leadership and decision making

5.2.1 Communication

Communication is an effective and important tool of management. All communication have to be originated, produced, transmitted, received and understood if they are to serve the intended purpose. Communication can be formal or informal; downward, upward or sideward; or oral, written or gesture. It is however faced with numerous barriers that every supervisor must watch against to make communication effective.

5.2.2 Leadership approaches

Leadership is one of the most important means of directing people. It is the process by which a superior influences the work and behaviour of subordinates in choosing and attaining specified objectives. A person is said to have an influence on others when they are willing to carry out his wishes and accept his advice or guidance. It is important as it build employee morale, motivates them and creates their confidence. Leadership also facilitates change and unifies the efforts of people. Various styles can be adopted for effective leadership and every superior must understand them and know when each can be applied for greater impacts.

5.2.3 Decision making

Decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions. Using a step-by-step decision-making process can help one make more deliberate, thoughtful decisions by organizing relevant information and defining alternatives. Effective decision making involves the ability to recognize risk, formulate strategies for action and coordinate with others in an effort to quickly bring a situation under control. An understanding of pros and cons of group vis avis individual decision making is necessary for the superior to know when to or not to involve his subject.

5.3 EMPLOYEE CONFLICT AND DISPUTES

Conflict is a normal, neutral and natural phenomenon in human existence and so cannot be wished away or completely ended. Although most conflicts may not have a legal stance, disputes mainly occur in relation to issues that have a legal bearing. Conflict is best resolved informally directly between an employee and the supervisor. This topic discuss the concepts of conflict management, conflict handling strategies and mediation.

5.3.1 Conflict Management

Conflict management is the process of limiting the negative aspects of conflict while increasing its positive aspects. In encompasses all interventions aimed at alleviating or eliminating discord through conciliation. While functional conflict can be good for the organization, the supervisor must be aware of dysfunctional conflict which has potential to disrupt the life of the organization. Skills to identify symptoms of potential conflict are essential for anyone in leadership position.

5.3.2 Conflict handling Strategies

Interpersonal conflict occurs in any setting where two or more people must work together. While there are several styles of handling interpersonal conflict, some are more effective than others. The style chosen can affect the resolution of conflict, as well as the willingness of participants to work together. It is important to understand the styles and implication of each to be able to chose an appropriate one with higher chances of settling conflicts.

5.3.3. Mediation

Mediation is a process by which a third party helps the conflicting parties to resolve their conflict. Mediation can only occur if both parties are willing to find a solution and if the mediator is respected by both. The role of the mediator is then to help them understand their

shared interests. Mediation is more of an interest based than a right oriented approach to settling disagreements. The conflicting parties keep control of the decision making process. Mediation has been accepted in Kenya as an alternative dispute resolution mechanism besides litigation. Having mediation skills would help a superior reconcile his subordinates who have conflicting matters. It can also help in controlling meetings where members become confrontational.

6. COURSE DURATION

This is a three day course. The ideal number of participants is 25 – 30. A number larger than that may reduce delivery effectiveness particularly in practical sessions which are more interactive. A smaller number may not be economical, unless the training fee is increased which may in turn discourage participation. Ideally the frequency of the course is three per academic year.

7. TRAINING COST

Participation fee for the three day training is Ksh. 9000 to cater for meals, refreshments, training materials, certificate and facilitation allowance for 2 trainers.

8. BUDGET

INCOME	EXPENDITURE	EXPLANATION
25 PP X 9,000 **225,000**	Meals and refreshments 75,000	@1000 per day per person for Lunch and two teas/snacks
	Training material and certificates 10,000	@400 for photocopies, printing, certificates, stationery
	Facilitation 56,000	This is 40% of the balance after the above two items. The percentage remains regardless of the number of participants. Shared between the Lead and Co-trainer at the ratio of 6:4
	University 84,000	60% of the training fee less item 1 and 2

9. PROGRAMME

DAY/TIME	TOPIC	METHODOLOGY
DAY 1	**Understanding Individual Differences and Group Behaviour**	
Morning	Personality	Lecture, Q & A
Mid-morning	Perception	Lecture, Role Play
Afternoon	Informal Groups	Lecture, group discussion, plenary
DAY 2	**Enhancing Employee Engagement**	
Morning	Communication	Lecture, Q & A, Role Plays
Mid-morning	Leadership	Lecture, Q & A
Afternoon	Decision Making	Lecture, Group-work, presentations
DAY 3	**Managing Employee Conflict and Disputes**	
Morning	Conflict Management	Lecture, Q & A
Mid-morning	Conflict Resolution	Lecture, Role Play
Afternoon	Mediation	Lecture, Role Play

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COMMENTS:

The presenter is very clear & the course is marketable. Oral presentation is clear due to job of a lecturer. We launch a management training and consultancy unit in our Chuka University. Provide a summary of the expected income and expenditure for a small sample to clearly show the cost effectiveness, provide a practical application of your work in the community around.

Di-Traco Software

By John Kingau Wambugu, BB5/13276/13; Julius Kamau Murigi, BB5/13288/13; Jefferson Kamau Mwangi; DB3/12490/13 and Dr. Gilbert Miriti; Faculty of Business Studies; Department of Business Administration, Chuka University, P. O. Box 109-60400, Chuka

Abstract
DI-TRACO system aims at tracing parking slots and reducing traffic and congestion in cities in Kenya. This system will also enhance utilization of parking spaces and help individual check the availability of parking slot available to them in intended that are nearby. It is to be found on App store and Play store of mobile phones making it easy to get install it in the phones.

Introduction
The Digital Traffic Controller (Ditraco) system is a software (mobile app) that we intend to implement so as to easily locate a parking slot in any city in Kenya. Through the use of this software we could contribute to the decongestion of the cities. Also the government will reduce its spending in deploying traffic officers in roads.

During the three day we were able to clearly explain to students, members of staff of Chuka University and members of public our ideas on how we could eliminate the major problem in our cities. We presented our ideas before judges in the Pavilion Dias.

Objectives
- ✓ Creation of employment and foster innovation in the country.
- ✓ Reduce corruption in county government through direct payment.

Benefits
It is user friendly and saves time. It is also helping to reduce corruption in county governments since it is eliminates county officers

Limitation
It is quite resource intensive in terms of human and financial resources. It requires professional programmers, building and construction engineers willing to cooperate.

Conclusion
Despite the many challenges we faced during preparation including the funding of the material to use during the presentation, we were able to give what we regarded as the best. In general the in the three days we were able to explain our idea to the all individual who asked question or visited us in the tent. We look forward for implementing our entrepreneurial idea to help solve the problem of traffic in the city.

Recommendation
1. The university should communicate prior of such programs to the student to give ample time for preparation of their presentations
2. The university should assist the student with finance resources to cater for their presentation
3. The students should corporate from all faculties in order to make exhibition more successful
4. More similar programs should be held in the university to foster innovation and creativity

Integrated Financial Management and Procurement Information Systems for Enhancement of Visibility and Transparency in the County Government Financial Systems

By Amos Karanja Ng'ang'a, BB6/13032/13; Charles Ngigi Mwangi, BB6/13526/13; George Ochuonyo, BB6/13074/13; Keith Stephen Ambayo, BB6/13080/13; Lenox Oganda Omondi, BB6/13075/13; James Wang'ombe, BB6/13018/13; Bachelor of Purchasing and Supplies Management; Faculty of Business Studies; Department of Business Administration, Chuka University, P. O. Box 109-60400, Chuka

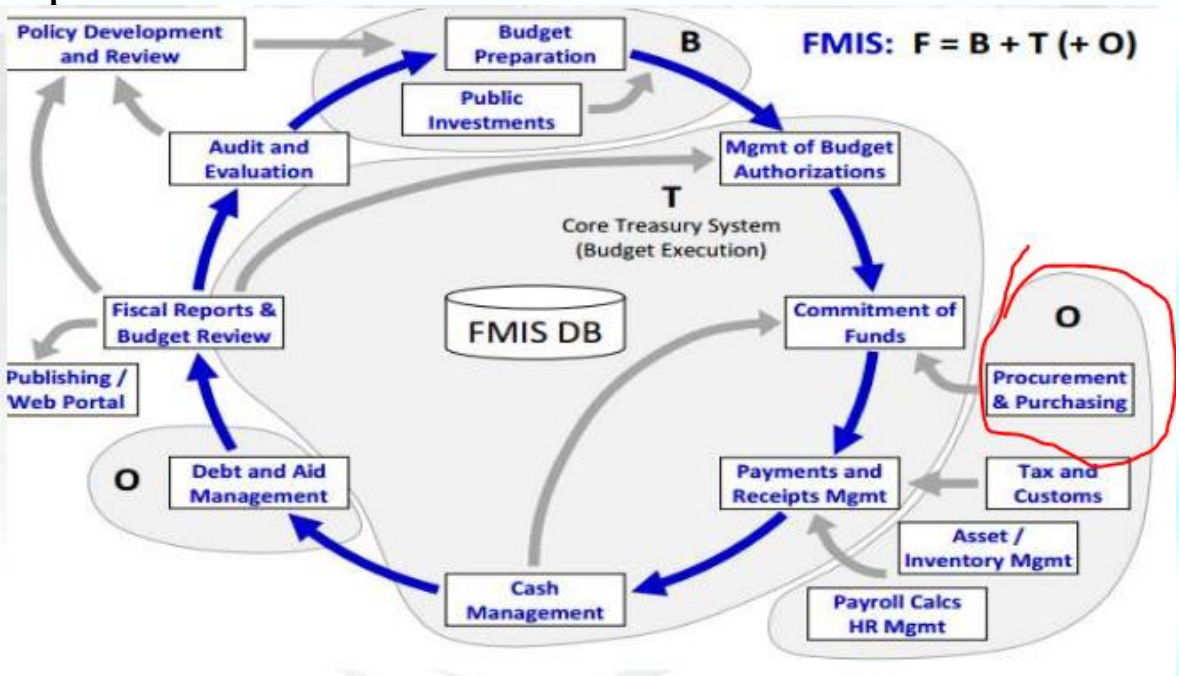
Introduction

In the realm of the government operations, IFMIS or the Integrated Financial Management Information System refers to the computerization of public financial management processes, starting from the budgeting process and execution down to the accounting and reporting, with the help of an integrated system for the purpose of financial management. The primary purpose of the system is to improve budget planning and execution by providing timely and accurate data for budget management and decision-making. However, less concern has been given on how the system can be applied to enhance the visibility and transparency in the government sectors including the county government and this is what forms the basis of our research.

Objective

The primary objective of this research will focus on understanding the current IFMIS systems in the public sectors and provide a recommendation on how the county government in Kenya can successfully adopt IFMIS system to enhance visibility and transparency in their operation. It is our believe the findings of the this will not only provide the mechanism successful adoption of IFMIS in the county governments in Kenya but also other public and private institutions the want embrace system automation as an apparatus for value addition.

Proposed Structure



Green Procurement for Sustainable Development

By Spirian Ndichu Macharia, BB6/13036/13, Maryann Wangari Mbugua, BB6/13016/13, Peter Maritim Kibet, BB6/13061/13, Wycliffe Muneeni Nzomo, BB6/12279/13, Esther Nzambi Manzi, BB6/13291/13, Rose Mumbe Mwangangi, BB6/13293/13, Bachelor of Purchasing and Supplies Management, Faculty of Business, Department of Business Administration, P. O. Box 109-60400, Chuka, Kenya

Introduction

Green procurement also called sustainable procurement or environmental purchasing is the idea of purchasing and producing environmentally products and services; the selection of contractors and setting up environmental requirements in a contract. Green is the process of becoming active about protecting the environment. The exhibition basically addressed pollution prevention principles in purchasing and the various avenues for adoption. The idea also sought to compare price, technology, quality and the environmental impact of product, service or contract. Green procurement is applicable in all organizations, regardless of the size for it starts just from as simple as purchasing renewable energy or recycled office paper. Products or services are considered green when they have lesser or reduced effect on human health and environment than competing products that serve the same purpose.

Walker (2008) suggests that "green" products/services utilize fewer resources and are designed to last longer and minimize their impact on the environment from inception to grave. Kenyan government in its vision 2030 statement aim to build a just and cohesive society with social equity in clean and secure environment. Such kind of environment can only be found through green procurement. Green purchasing therefore is a building stone for a happy healthy society.

Statement of the Problem

Kenya is a developing country with a lot of manufacturing and industry operations taking place in major towns such as Nairobi, Thika, Kisumu, etc in a bid to satisfy the ever escalating customer wants. However, the Kenyan government have not put into place stringent measures to control the type of input materials, conversion processes and output products that these companies are using (Standard Chartered 2012). Although some companies have taken a stride toward green procurement, others have not. This has resulted to for instance large heaps of waste in the stinking frowned dumping sites; take for example the Dandora dumping site in Nairobi, there are a lot of non-biodegradable wastes such as polythene materials, plastics, disposable diapers, electronic wastes, light bulbs, Ziploc bags, Styrofoam etc. These wastes also release poisonous gases that are a threat to ozone and environment. If green procurement was properly integrated in the supply chains, such ailments would be reduced or even eliminated. In the construction sector, some buildings collapse or even become unsafe due to exclusion of green procurement. The above examples indicate that there is need to come up with techniques and measure to integrate environmental purchasing in chain activities for a sustainable society. If only this can be fully absorbed, the high cost of dealing with negative environmental impact could be reduced. The supply chain can be greened in areas such as designing of products, production, material purchase, packaging and disposal of end products at salvage.

Objectives

During the three-day exhibition on green procurement, we aimed to bring into attention the current issues in green procurement and to provide some insight on the best practices. The following were among the objectives

i. To make the public understand and appreciate the importance of environmental purchasing.

ii. To demonstrate the various avenues where green procurement can be accommodated within institutions.
iii. To show the role of customer as an agent/driving force towards green purchasing.

Justification

The following are the reasons why supply chains are going green;
1. To comply with ever increasing demand for environmental regulations.
2. To improve satisfaction of customers who prefer to do business with companies having an environmental friendly reputation.
3. To reduce all types of waste.
4. To reduce the impacts to production and service activities on the environment
5. Promote or improve operate efficiencies and reduce operating cost thus increasing profitability
6. To have product differentiation in the market by having distinctly unique environmentally sustainable supply chain practices

Applicability of green procurement

Green procurement is applied when the procuring organization takes into consideration the practice of buying products that are less toxic, more durable, re-usable products, recyclable products, biodegradable products, energy saving electronics, etc. All these factors should be included in contracts and supplier performance rating. Customer should have market intelligence and push for green product for them to purchase, otherwise the customer will not buy products that are not green. The customer should also commit to being green, for example, the polybags that the customer is always demanding for packaging should be put into an end. The customer should carry a reusable bag or basket for product packing. The polybag will finally lose demand and eventually stoppage of their manufacture. Otherwise the price for that polythene paper should be made very expensive in order to force the customer to shy away from it

The following are steps that organizations while implementing environmental purchasing:

1. Commit to Being Green

Make Green a corporate mandate and create a green policy. Green is a top priority, and all procurements for products and services must have minimum green requirements, and written authorizations to choose a product that is not among the greenest possible choices. Make it everyone's responsibility and make it a key component of compensation reviews and allocations**.**

2. Identify and Categorize Your Needs

Ask yourself: what are we buying, what do you need to buy, what environmental impacts does each of the products or services have, and do they have any similarities? Once you answer these questions, you can see where you can make a big impact. Then you can do something about it.

3. Develop Green Specifications and Standards

The first step is to develop green specifications and standards for every product you buy. If you buy a lot of office paper, you can insist on a minimum amount of recycled content and unbleached/non-chlorinated paper that is easily recyclable.

4. Establish Green Selection Criteria and Their Impact on Award Decisions

Once you have identified the standards you are going to use for each category, you have to outline the selection criteria, weight and prioritize them, and figure out how much of an impact they are going to have on your decision. What percentage of the decision must be based on green considerations?

5. Focus on Identifying Products and Services which are Green

If a supplier isn't green, or making an effort to go green, that supplier should not even be invited to bid. Make it a policy that a non-green supplier should not be allowed to enter a bid. Also, don't be afraid to show preferences to manufacturers and distributors who actively advance environmental conservation practices**.**

6. Always Use a Life-Cycle Costing Approach

Consider the total environmental impact of the product you are considering from the harvesting and processing of the raw materials through its final disposal before making a decision. Be sure to include efficiency, waste, recyclability, and material composition into your analysis. With regards to services, consider the total environmental impact of the equipment utilized in the performance of the services as well as any impact of the services themselves.

7. Include Green Performance Clauses in Every Contract

Be sure to incorporate clauses into every contract that allow you to enforce penalties or terminate the contract if the supplier does not meet the minimum green and sustainability requirements that they commit to. Also consider incorporating clauses that reward the supplier with more business or bonuses if they exceed green requirements

8. Communicate and Inform

Once you have policies and practices, it's important that you communicate them, explain them and offer your buyers training on the complex categories that they have to manage on a regular basis so that they can differentiate the products that are truly green from those that are coated in green washing.

9. Use Green Technology

Use e-procurement, e-sourcing, and other e-systems, run on energy-efficient technology, to buy online rather than using reams of paper that result in the unnecessary destruction of forests to research, contract, and buy products and services. Also, maintain all of your manuals, and policies, in easy to access e-documents on your indexed, searchable, and easily accessible corporate intranet.

10. Make it Easy

Design every policy, process, and system developed and deployed in support of green to be easier to use than the alternatives. People like easy. If you make purchasing green easy, it will happen naturally.

Marketability/Uptakers

Green procurement is not an exemption to anybody; it is addressed to individuals, SME's, institutions, companies, corporations and the state. It is all about adoption in our supply chains. However a robust green marketing should be done for overall involvement.

Policies of Sustainable Procurement

1. Every purchasing decision made has an impact on the environment, economy and on society, from the energy our computer consumes to conditions of the workers who made our clothes.
2. Sustainable procurement is used by both public and private sector organizations to ensure that their purchasing reflects broader goals linked to resources efficiently and social responsibility
3. Sustainable procurement seeks to achieve the appropriate balance between the three pillars of sustainable development i.e. economic, social and environmental.
4. Effective action to reduce a carbon footprint can save an organization a lot of money
5. Ongoing effects to increase service levels, cost reductions and asset utilization must incorporate the environmental impact of each decision across all phases of the product lifecycle

6. A properly designed and implemented governance structure plays a pivotal role by driving performance and transparency for the collection and measurement of governance
7. Best-in-class procurement organizations have realized cost-savings of up to 12%. These procurement organizations have achieves these savings through various green initiatives including energy, supply, operations and logistics.

Cost effectiveness

It is costly to lay down a green procurement infrastructure if the organization does not have a long term strategic plan. The following are the improvements/benefits by green procurement;

- ✓ **Improves Agility –** helps mitigate risk and speeds innovations
- ✓ **Increase Adaptability –** Green supply chain analysis often leads to innovation process and continuous improvements
- ✓ **Promotes Alignment –** Green supply chain management involves negotiating policies with suppliers and customers, which results in better alignment of business process and principles

Other benefits includes

Reduce any negative and unintended impacts on the environment like pollution and deterioration of local air quality; Support companies that provide products and services that have fewer environmental impacts and stimulate "green," innovative product development and business development; Save the amount of money spent on cleaning up pollution, by preventing it in the first place; also this Sends a message to manufacturers and service providers that consumers will recognize their environmental efforts; Create a scale effect, thus reducing production costs by the sheer scale of demand for green products.

The following are reasons why organizations are reluctant to go green;
1. Resistance to change.
2. Poor policy communication: process of information flow is hindered or not as smooth
3. Some environmentally preferred products are not as readily available.
4. Estimating hidden costs and potential savings by reporting material handling and disposal.
5. Lack of clear definitions: well intentioned environmental groups may not understand the full picture and will send conflicting messages on the part of the procurers.

Conclusion

In conclusion, all organizations that have a supply functions should commit to procuring the right green products first time and always for overall efficiency downstream. The companies should also invest in innovations that aim at creating ecologically products or services. The government and NEMA should set stringent measures to ensure that organizations adhere to green procurement regulations.

Faculty of Education & Resources Development
Moderator: Dr. Susan M. Kinyua
Rapporteur: Ms. Monica Oundo
Judges: Mr. Eric M. Elias, Mr. Gilbert Odilla, Ms. Lucy N. Kiriungi

Short Course: Contemporary Guidance, Counseling, Mentoring and Academic Advising Skills for Managers of Learning Institutions

by Prof. Veronica K. Nyaga, Department of Education, P. O. Box 109-60400, Chuka

DEFINITIONS
Career -It is the progress and actions taken by a person throughout a lifetime, especially those related to that person's occupations. A career is often composed of the jobs held, titles earned and work accomplished over a long period of time.

Career guidance refers to services and activities intended to assist individuals, of any age and at any point throughout their live, to make educational, training and occupational choices and to manage their career.

Mentor- An experienced and trusted adviser.

Academic advising is an on-going educational process that connects the student to the University/school. It is an opportunity to exchange information designed to help students reach their educational and career goals.

Advising is a shared responsibility between an adviser and the student.
The ultimate responsibility for making decisions about educational plans and life goals rests with the individual student.

Counselling -It is the process of assisting people to deal with personal, social and psychological challenges in an attempt to help them live wholesome well-adjusted lives.

- It is the "heart" of psychotherapy.

Guidance-It involves the following:

- Listening and giving advice
- Instructing and directing clients
- Giving suggestions
- Providing of information – cognitive based
- It is the body of psychotherapy

INTRODUCTION

Academic advising is an on-going educational process that connects the student to the University/school/College. Academic advising supports the learning institution mission of preparing the student for learning beyond the confines of the academic programmes. Academic advisors represent and interpret institutional policies and procedures to the student and help the student navigate the academic and organizational paths of the learning setups. To ensure that student receive both personal and professional assistance in navigating through curricular and University/School/college requirements toward completion and graduation, each student is assigned to an academic advisor (either professional or faculty advisor).

Career and academic advising are emphasized in learning set ups on the basis of the following:

- Student success must be at the core of all institutional work and decision making; therefore, academic advising is critical to the success of the student education.
- Just as valuable time and effort is put into student's coursework, the same way institutions need to support strategies that connect students to the institution environment and high-impact learning experiences.
- While all educators and managers need to focus attention on helping students recognize and achieve the larger outcomes of education, academic advisors are in a strategic position to engage students in thinking about the larger purposes of their educations.
- Advising must help students see beyond their immediate occupational goals to the world outside their jobs.
- Learners should be prepared to take their place as an active participants in a democratic society rather than as a passive consumers of civic goods and services

PROBLEM

The continually changing trends in educational systems, curriculums and technological advancement in modern set ups, creates a dire need for provision of academic and career guidance in learning institutions, to enable learners make appropriate educational plans and progress**.** Therefore, the delivery of career guidance and academic advising is an integral responsibility of the learning set ups. This course is designed to offer knowledge and skills on academic advising and career guidance to managers of learning institutions. Additionally, the course is appropriate as professional development for academic advisors, counseling supervisors, counsellors and career advisors in educational set ups.

GOALS

- To equip the participants with knowledge of models and methods that can utilized in preparing individuals to enter the workforce and navigate their careers.
- Enable participants develop practical skills in providing developmentally appropriate theory based academic and career advising services that assist individuals add meaningful and purposive work into their lives.
- Participants acquire knowledge about interpersonal, group and inter group dynamics in work place settings.
- Acquire knowledge in basic skills in guidance and counseling that are necessary for students career and academic advising.

OBJECTIVE OF THE COURSE

The general objective of this course is to equip the participants with knowledge and essential skills in practice of career guidance and academic advising in learning set ups.

EXPECTED LEARNING OUTCOMES

At the end of the course the participants should be able to:

Apply career guidance and academic advising skills to Promote student educational success. This will involve making informed choices on career and academic progress

- Utilize career advising approaches based on individual learners' needs
- Recognize institutional and government laws and policies that affect their ability to provide effective career guidance and academic advising to learners.
- Refer students appropriately to institutional and community resources

MARKETABILITY

This course is designed for practicing academic advisors and those who plan to enter the field. It assumed that learning setups have members of staff who in various ways guide learners on academic and career matters. The prospective target group include: Institutional managers, teachers, lecturers, student counsellors, career advisors and placement officers

DELIVERY METHODOLOGY

- It will be done by use of lectures, readings, presentation, participation in discussions and practical activities.
- Generally discussions will be based on instructor guided questions and areas.
- Participant will be encouraged to make use of library and utilize other readings available in their own work place.
- Individual and group participation in learning activities will be encouraged.
- The course shall be offered in one full week in every three months

COURSE SUMMARY AND DELIVERLY STRUCTURE

	Morning session	**Mid-morning session**	**Afternoon session**
DAY 1 Career Guidance and counselling.	• The world of work • Theories of career choice • Techniques in career guidance & counseling.	• Human resource and personnel. • Student mentorship	• Practice of counselling skills for career guidance and counseling • Discussions
DAY 2 Academic advising	• Concept • Curriculum • The Pedagogy	• Models of academic advising	• Discussions /Presentations
DAY 3 Academic advising	• Academic adviser's function • Process and techniques	• Effective academic advising of students. • Benefits of academic advising	• Academic adviser/student attachment • Discussions
DAY 4 Interpersonal And Group Dynamics	• Approaches to group dynamics	• Approaches to group dynamics and interpersonal relationships.	• Group Work
DAY 5 Collaborative activities and ethical concerns	• Consultation • Referral	• Ethical and legal responsibilities in academic advising	• Wrap-up • Integrating career guidance and academic advising

Estimated Budget Summary

Expected Fees	**Amount Paid**	**Total**
Each student @Ksh 20,000	400,000	400,000
Total Amount paid	**400,000**	**400,000**
35% Total Amount paid **140,000**		
Profit to University	260,000	
Expenses (to be shared from 35%)	**140,000**	
Brochure Expense		
Administrative Expenses (*Admission, Certification*)		
Facilitator(s)		

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COMMENTS:

The short course needs more of guidance and counselling and little on academic advising, more on workplace environment (workplace counselling and less content on academic advising. Ksh. 20,000 could be reviewed for the students, a good presentation all the same and can be at great help for career growth in the institutions. Good presentation, duration in terms of hours not clear it was on days. Give examples on the changes in education be explicit; the course should be offered as an in-service course, since teachers have done many psychology courses. Some references would have done good. A well-presented paper, however you are needed to focus more on the content; for career, it is best offered since at university level people have already been selected into careers. The course should focus on students either at primary level or early years in secondary schools

Short Course: Demystifying Early Childhood Development Education Skills for Kindergarten and Day Care Managers

by Ms. Bornace J. Kimeli, Department of Education, Chuka University, P. O. Box 109-60400, Chuka

Introduction

It is amazing that most of the people do not actually understand the concept of early childhood. Many people out there are mis-informed thus they view children in different perspective and holds different beliefs. This misconception of early childhood has led to a significant denial of children great opportunities that would have resulted to people's realization of their highest potential. Any human being irrespective of race, gender or status must pass through the stage of early childhood yet many tend to ignore and assume they were just "born adults" but the truth is that at a time they went through early childhood. Understanding what early childhood development and education entails is a very critical element since it is very fascinating and the backbone of every nation aspiring to produce the best brains for now and the future. This calls for every individual to get a clear picture and understanding of what early childhood development and education entails, how it has evolved, its critical importance, challenges and emerging issues.

The Concept of ECDE

Early Childhood Development and Education (ECDE) refers to a comprehensive approach to policies and programmes for children from birth to eight years of age geared towards developing ones holistic aspects as full cognitive, emotion, social and physical potential. The concept takes into account the child in the mother's womb soon after conception, through pre-school and transition period into the first three years of primary education. It is a time of remarkable brain growth that lay the foundation for subsequent development. Early childhood care and education is more than a preparatory stage assisting the child's transition to formal schooling. It places emphasis on developing the whole child - attending to his or her social, emotional, cognitive and physical needs - to establish a solid and broad foundation for lifelong learning and wellbeing. In line with the Education 2030 agenda, UNESCO supports national, regional and international efforts to expand and improve ECCE provision equitably so as to provide every child a best start in life. Children in preschool learn both academic and social-based lessons. They prepare for school by learning letters, numbers and writing. They also learn socialization skills as sharing, cooperation, taking turns, and operating within a structured environment.

Perceptions and Treatment of Children in Traditional Societies

- In some communities, children were regarded as inferior that's why they could not be fed before their father had eaten and in some other communities, male children slept in the same place with goats.
- Children had no say and were treated the way the adults deemed fit, thus could not question adults decisions or talk when parents were talking.
- Boys were more highly regarded as they carried the family name forward, while girls were valued as a source of dowry, while children with disabilities as well as twins were seen as bad omen, thus thrown into the bush.
- Phillippe Aries (1962) argued that in the medieval times, children were viewed as miniature adults dressing like adults, sharing adult work and leisure. Their needs were not assumed to be distinct from adults while knowledge of sexual relations was not considered harmful to them i.e. public executions were attended by people of all ages including children.

The Educationalist View - Modern Philosophers and ECDE

- Contrary to the traditionalist views **John Locke** believed that children's mind is "tabula rasa" meaning "blank slates" thus their lives are morally neutral, inherently good or inherently evil.
- Adults surrounding a child could potentially have a very long lasting effect on overall personality. Since the child's mind is malleable (compliant), a parent can write good moral sense upon a blank slate as well as numerous faults.
- He believed that a sound education began in early childhood and insisted that the teaching of reading, writing and arithmetic be gradual and cumulative.
- **Friedrich Froebel**, a pioneer of early childhood education and a father of kindergarten system believed that every child is a **unique** individual with an educational potential. If it is appropriately nurtured within a stimulative environment, the child can achieve the optimal holistic development.
- Play is the child's best way of learning and not a waste of time. This is a misconception that needs to be demystified. The child uses all its imaginative powers, thoughts, physical movements, own images and educational interests while playing.
- Froebel upholds that any individual child should never be rushed or hurried in his development as many lay persons or parents assume. Development is continuous and sequential with one stage building upon each other.
- **Maria Montessori** was a key promoter of education for young children and specifically sought to look for educational solutions to problems for exceptional children.
- Her key perceptions and principles included: -
  - **Respect** for every child as a unique being with own educational needs. Contrary to medieval times where children were perceived as miniature (small) adults, she opined that it should not be so but rather adults must not impose their ideas, wishes, dreams, and direct children to behave in certain ways or suppress the development of the child's personality.
  - They should be encouraged to do things for themselves to develop autonomy and positive self-esteem.
- Children possesses "**absorbent mind**" thus they are able to absorb learning experiences just the way a sponge **absorbs** water or a magnet attracts a metal particles.
- Children do not learn certain skills any time as the lay people may misconceive but rather, they have **sensitive** or **critical periods** when they learn certain skills best. This implies that the teachers (educators) and parents should detect these periods and provide the best experiences for best results failure to which if the **sensitivity** for acquisition of certain skill is not detected at appropriate level, it does not occur again with the same intensity. For example language has its critical period during early childhood years.

- **Prepared** and **conducive environment** must be provided for the optimum gain and full realization of each child's potentiality. Attractive and friendly environment must be embraced at all times. Irrespective of the critical importance of the benefits accrued to a conducive child friendly and prepared environment with attractive material, what is the picture painted in our local pre-schools schools? Some are in horrible and pathetic situation characterized by very de-motivating learning situation for our young learners. They are in bad conditions yet children are sensitive individuals who can be greatly affected by such factors. The difference between their home environments is so big that they find the learning institutions horrible places to stay.

Characteristics of a Good Early Development and Education Programme

- Children have a safe, nurturing and stimulating environment, with the supervision and guidance of competent, caring adults.

- Teachers plan a balanced schedule in which the children do not feel rushed or fatigued.
- The school provides nutritious meals and snacks.
- The program includes a strong foundation in language development, early literacy, and early math.
- The program contains a clear statement of goals and philosophy that is comprehensive and addresses all areas of child development.
- The program engages children in purposeful learning activities and play instructed by teachers who work from lesson and activity plans.
- Balance exists between individual, small-group, and large-group activities.
- Teachers frequently check children's progress.
- The staff regularly communicates with parents and caregivers so that caregivers are active participants in their children's education

CHILD DEVELOPMENT

Child development is a process every child goes through. This process involves learning and mastering skills like sitting, walking, talking, skipping, and tying shoes. Children learn these skills (developmental milestone) during predictable time periods that are developed in five main areas of development:

1. **Cognitive Development**
   This is the child's ability to learn and solve problems. For example, this includes a two-month-old baby learning to explore the environment with hands or eyes or a five-year-old learning how to do simple math problems.
2. **Social and Emotional Development**
   The child's ability to interact with others, including helping themselves and self-control. Examples of this type of development would include: a six-week-old baby smiling, a ten-month-old baby waving bye-bye, or a five-year-old boy knowing how to take turns in games at school.
3. **Speech and Language Development**
   The child's ability to both understand and use language. For example, this includes a 12-month-old baby saying his first words, two-year-old naming parts of her body, or a five-year-old learning to say "feet" instead of "foots".
4. **Fine Motor Skill Development**
   The child's ability to use small muscles, specifically their hands and fingers, to pick up small objects, hold a spoon, turn pages in a book, or use a crayon to draw.
5. **Gross Motor Skill Development**
   The child's ability to use large muscles. For example, a six-month-old baby learns how to sit up with some support, a 12-month-old baby learns to pull up to a stand holding onto furniture, and a five-year-old learns to skip.

Brain and its Impact on Overall Growth in Human Life

- Early childhood is the most important and rapid period of development in human life.
- The years from conception through birth to eight years are critical to the complete and healthy cognitive emotional and physical growth of children.
- Environment in which a child is raised has an important impact on determining how the brain and general nervous system grows and develops. Environment affects the number of brain cells and the number of connections and the way these connections are wired.
- Research evidence suggests that if the brain lacks appropriate stimulation and sensory experiences during this critical window, it is very difficult for the brain to rewire itself later in life.

- ❖ Infants exposed to good nutrition, adequate psychosocial stimulation, have better brain functioning at later stage than those raised in a less stimulation environment.

Misconception about the Brain

- ❖ There are misconceptions that brain development depends on the genes one is born with but the truth is that brain develops through a complex interplay between in-born genes and experience (environment) under which the child is raised in. It's mis-conceptualized that experience before age three has a limited impact on later development.
- ❖ However, early experiences have a crucial impact on the architecture of the brain, its nature and extent of adult capacities. Brains capacity to learn and change does not grow steadily as the infant progresses towards adulthood as thought of. However, there are **prime** times for acquiring different kinds of knowledge and skills. It is important to note that the brain reaches half (50%) its mature weight by about six months and 90% of the final weight by age eight.

Significance of the Early Years of Development

Early Childhood is a time period that is widely considered the most vulnerable and crucial stage of a person's life. The World Conference on Education for All (EFA) Jomtien, Thailand, in March 1990, articulated the significance of the early years as the foundation for the life of an individual. Recent research on brain development by Shore Rima, 1997; Mustard, 1998; O'Donnell, 1999; Stephens, 1999), emphasizes that the first six years of life are significantly important for the following reasons:

(i) The environmental experiences during this period are significant in influencing one's life

The experiences of this period either enhance or inhibit realization of the child's potential in life referred to as early stimulation.

(ii) This is the fastest period of growth and development in all aspects.

(iii) Brain development is most rapid in the early years.

By the second year of life the brain of the child is 70% of an adult brain. By six

Years of age it reaches 90% of its adult weight and size, by the end of six years the brain of the child has developed maximum connections, all which is left is to make these connections permanent through providing early stimulation and quality care.

(iv) All the "critical windows of opportunity" are open during this period.

These are the periods when children are able to learn and acquire certain knowledge, skills and attitudes very quickly with minimal effort. Parents, other caregivers and teachers need to make use of this period in order to maximize children's holistic development and hence their potential in life.

(v) This is the period when the brain is most malleable and also highly impressionable.

Environmental influences, especially care, nurture and stimulation, have the greatest impact on the brain.

(vi) This is the period when it is very easy to mould the character of children by inculcating social norms, values and habits as well as regulation and control of emotions.

(vii) This is a vital period for ensuring proper physiological growth and a crucial period for significant health and nutrition interventions to put the child on the right track for life.

Benefits of Investing in the Early Years of One's Life

With the proven importance of the early years, Kenya would reap substantial benefits with increased investment in programs for infants and children. It is beneficial to invest in early childhood for the following reasons:

(a) Investing in early childhood promotes **early identification and intervention** of children who have special needs because of disabilities. A large proportion of children are vulnerable because

of discrimination and marginalization. Opportunities for early identification and intervention of vulnerable children, especially those with special needs, ensure that these children maximize their potential and contribute according to their talents.

(b) Investing in early childhood ensures **enhanced enrolment in primary schools on equal grounds.** Free primary education has increased the potential for all children to attend school hence adequate foundation for education. Presently, there is low access to pre-schools (40% nationally and in some districts less that 20%) necessitating increased support for this age sector.

(c) Investing in early childhood ensures **increased productivity since** parents are supported adequately to raise children who are healthy and who will grow up to be productive and contribute effectively to their families, communities and the nation.

(d) **Cost savings for both the families and the nation.** Increased investments in this sub-sector will support parents so that they are able to provide quality care for their children. Quality care will translate into children being healthier. They will have fewer incidences of disease. They will also have better academic performance and fewer school dropouts and repetition as a result of having been exposed to stimulating learning experiences both at home and in the early childhood development centers. The money saved by families and the Government in health care and education services could be used in development programs. (Schwinhart and Weirlart, 1980).

(e) **Poverty Reduction.** Quality early childhood development experiences contribute to more productive human resources since children who are exposed to such experiences have better success in school and hence they grow up to get better paying jobs when they enter the labor market. Such adults have higher living standards.

(f) **Reduction of social inequalities.** Quality early childhood development programs help children with special needs and those from poor families to maximize their potential, minimize the progression of disabilities and get out of the **cycle of poverty**. When children with special needs and those from disadvantaged backgrounds are exposed to stimulating early childhood development experiences, their placement, retention and academic performance are enhanced. This means that they are more likely to enter at the right time and complete school successfully, get better paying jobs and therefore live higher quality lives.

(g) **Improved chances for the girl child**. Girls who enroll in early childhood development centers are more likely to proceed to primary school and higher levels of formal education. This is because their parents have been sensitized on the importance of formal education for both boys and girls through parental and community education programs.

(h) **Improved moral values in the community.** Increased investment during this period will support parents so that they are able to inculcate values and morals in their children. The **window** of **moral** and **values** training is open during the early years. Such children tend to grow up to be disciplined, well-adjusted, socially and morally upright youth and adults.

(i) **Improved family welfare.** Parents and communities acquire more knowledge, skills and positive attitudes on various issues especially needs and rights of children as well as families. Parental and community education training carried out within the early childhood development programs contributes to community development.

(j) **Increased opportunities for parental and community empowerment.** Early childhood development programs offer very good opportunities for mobilizing and empowering parents and

local communities. In addition, parental and community mobilization programs provide good opportunities for creating awareness on other development issues, for example those relating to various methods of improving living standards.
The intellectual, emotional, social, physical development of young children has a direct effect on their overall development and on the adult they will become.

(k) Investing in young children is a very critical element so as to **maximize their full potential and future well-being**.

(l) ECDE is the key to a full **and productive life for a child and progress of the entire nation.**

(m) It is a critical and crucial stage of development that forms the foundation for each and every human being's future well-being and learning.

(n) Early childhood interventions can have long lasting effects on intellectual capacity, personality development and social behavior.

(o)Failure to invest in ECD can result in developmental delay and disability thus inhibiting the optimum development and performance of children throughout their lives.

Emerging Issues, Trends and Challenges in ECDE

- **Changing family structure**

Communal lifestyles largely influenced by western culture have been broken down resulting to nuclear and single parent families. There has been shortage of land due to increased population. Increased western education and rural urban migration have greatly influenced the quality of children we have today. In many nuclear and single parent families children are lonely and live in crowded environment limiting their physical development, creativity and innovations is highly limited as most play materials are readily made. Lack of father or mother figure in single parents home has increasingly affected children's socialization.

- **Child abuse**

These can be inform of sexual molestation, FGM, beatings or exposure to domestic violence, canning, drug trafficking, using a child to beg, child labour, witnessing killings, recruitment of child soldiers, early marriages, all of which have led to the abuse, trauma, dropping out of school, low enrollment, orphaned children, child headed families. All these are detrimental to the development of children. The abused child may grow up to be an abuser and the cycle repeats.

- **Rural urban migration due to drought, ethnic clashes and insecurity in rural areas.**

There is increased resettlement of families in urban set ups in favor of better social services. Some families move to the nearest town and markets in search of better living conditions as a result of the effects of prolonged droughts and unpredictable weather conditions. The most common occurrences in the recent past are ethnic and territorial clashes including political differences among the community members.

- **Urbanization**

This has resulted to proliferation of street families, and slums in towns characterized by poverty, unemployment, overcrowding, moral decay, HIV/AIDS, giving rise to orphans who lack care and support. As a result, children are exposed to western cultures, technologies such as internet, some filthy TV channels, pornographic materials, thus leading to moral decay. Urbanization also poses an increased challenge in high crime rate, poor hygiene, over-crowding and child abuse.

❖ **Poverty and hunger**

Inability to feed self and family, lack of proper housing, poor health, inability to educate children and medical bills poses a great challenge to over 56% of Kenyans who live below the poverty line. Poverty is likely to result to vicious cycle since the children from poor do not access quality education resulting to poor grades; poor education hence no formal employment.

❖ **Free primary Education (FPE)**

Exclusion of children below six years in enjoying free education has a lot of negative impact to ECDE such as parents keeping children at home until they are six years, non-payment of fees for those in school arguing that the education is free, non-payment of ECDE teachers hence demotivation, feeding programme stopped, neglected and poorly maintained ECDE centres, payments of extra fees for parents opting for private ECDE centres.

❖ **Pastoralism**

Children are subjected to harsh environment, rigid cultural practices, inaccessible pre-schools due to long distances, attack by wild animals, failure to recognize the relevance of ECDE, semi-permanent structures due to nomadic lifestyles, gender inequalities since girls are married at an early age to bring more cattle to the family, notorious cattle rustling menace resulting to killings and child trauma.

❖ **Female Genital Mutilation (FGM)**

This has affected pre-school enrollment and retention rates, high drop out rates for girls since after initiation ceremony, the girls perception is changed as they view themselves as adults and are not supposed to be in school.

❖ **Early marriages**

Girls who have undergone FGM are assumed to be mature and ready to take wifely and motherly duties. Most of these children are withdrawn from schools to get married to a prospective husband. These ignorant parents view girls as a source of wealth through dowry.

❖ **HIV/AIDS**

The menace has negative impacts in the following ways:

1. Orphaned children leaving them homeless and in need of basic needs.
2. Child rearing by elderly grandparents who may lack proper care and services.
3. Child headed families where children lack opportunity to be children.
4. Infected children may be weak and prone to opportunistic diseases interfering with their normal growth.
5. A lot of resources spent on the infected children for their upkeep and treatment.
6. Infected or affected children may not be enrollment in pre-school thus affecting enrollment.
7. Failure to cope with activities in pre-school especially the infected children.
8. Stigmatization, rejection and discrimination leading to the child's anti-social behavior.
9. Risk of infection in communities that believe that engaging in sexual intercourse with a child may result to cure
10. Huge amount of resources and time is spent by caregivers caring for the infected leading to financial constraints.

❖ **Gender issues**

Gender inequality is an issue of concern in ECDE. The number of school dropout rate is higher in girls than boys thus girls may not get equal opportunities. Girls spend more time performing domestic chores, taking care of other siblings, denying girls' opportunity to enroll in ECDE.

CONCLUSIONS

Early Childhood is one of the most important stages in human beings. Failure to understand the importance of this stage is likely to lead to a child's underdevelopment in all domains of development. It is important to invest in early childhood when critical windows of opportunity are open.

EXPENDITURE

ITEM	QUANTITY	ITEM COST	TOTAL COST
-Note book	200	@50	10,000
-Pens	200	@10	2,000
Typesetting and printing had-outs	200	15pages10x200	30,000
Flip Charts	3	@30	90
Mark pens	I dozen	600	600
Subsistence and facilitation for trainers	2	@2000x3days	120,000
Tea and Lunches	100	@200	20,000
Certificates	200	@100	20,000
Badges	20	@50	1,000
Posters	200	@200	40,000
SUBTOTAL			**243,690**
INCOME			
Training Fee for participants	200	@3,000	600,000
PROFIT(**Income –Expenditure)**			**356,310 (59.3%)**

COMMENTS:

Benefits of investing in ECDE are not clearly/ directly tied to ECDE – let them be more specific. Separate emerging issues, and challenges of ECDE. A good presentation and very helpful for ECDE programme. Not cost effective i.e. only Ksh. 3,000. However it's a relevant course. The gap filled is not clear. Good presentation, however the course will be overwhelming especially for parents and secondary schools. It needs to be simplified. The course does not capture the day care Centres where care givers need a lot of information on how to care for the babies in the absence of parents. There is need to teach first aids especially for choking and accidents.

Short Course: Elucidation of Gender and Disability Mainstreaming Skills for Managers of Learning Institutions

by Dr. Beatrice M. Mburugu, Department of Education, Chuka University, P. O. Box 109-60400, Chuka

INTRODUCTION

This is a three day short course for managers of learning institutions to help them in mainstreaming gender and disability in their institutions at all levels .It will equip them with knowledge and managerial skills that will be of use in these two areas. Oral and audio-visual aids methods will be used to deliver the content including posters on GBV

OBJECTIVES OF THE SHORT COURSE/TRAINING

1. To develop curricula and conduct training programmes which still facilitate integration of gender/disability and development in policy formulation and decision making in learning institutions
2. To engage in outreach programmes and advocacy in gender and disability related issues through public lectures, short courses, seminars, workshops and mass media.
3. To promote gender and disability mainstreaming in the learning Institutions and communities through curriculum, research and career development in order to achieve gender equality.
4. To help managers of learning institutions acknowledge their multidimensional roles in relation to gender and disability mainstreaming in learning institutions through mass media, public lectures and workshops.

DAY ONE

GENDER MAINSTREAMING

Definition of terms

Gender

Is the social construction of roles, responsibilities and behavior Patterns assigned to men and women, boys and girls in a given Society in time.

Through process of socialization society provides gender identity to males and females .Differs from culture to culture and changes in time

Gender mainstreaming?

Is a strategy for achieving gender equality. It is a Strategy to end gender blindness in development process. It Ensures women & men, girls & boys have equal access to & control over resources, opportunities & benefits at all levels.

Gender Equality

Refers to equal chance for women, men, girls and boys in allocation and access to resources and services. G/M is measured in terms of equality of opportunities and equality of results or reward for labour. Exists where sex-based discrimination is non-existent. Is necessary for achievement of other development goals i.e. poverty reduction (ref. MDGs).

Gender Equity

- Women's empowerment is important so that they can influence this distribution by participating in decision making at all levels.
- Refers to fairness or level playing field, where fair treatment is accorded to both men and women. Equity sometimes calls for affirmative action to allow fair play, especially where two groups are competing for same resources and one has an advantage over the other. Example in a mining industry where employees are digging a mine within a given

timeframe, it would be fair to allow women more time to complete their task. They are biologically weak in strength as compared to men.

Sex

Is the biological differentiation between women and men and
is Natural and Permanent

Gender roles

These are roles determined by our biological endowment and are natural roles that cannot be interchanged e.g. Males release sperms while females conceive ,give birth and breastfeed

Gender Roles

- Socially defined tasks/activities/ duties/responsibilities ascribed to men/women based on perceived differences and affect division of labour in development.
- Most cultures define child rearing solely as female role excluding males.
- Role of heading family solely for men yet it can be performed by either sex.
- Change over time & differ between cultures i.e. in most communities the role of building houses is ascribed to men; in Maasai community it is women's duty.

Gender stereotypes

- Are common perceptions or assumptions about the characteristics of a person based on false and unproven hypothesis
- Are based on sexism or sexual discrimination
- Statements like women's place is in the kitchen, women cannot make leaders, scientists, men do not cry etc. are stereotyped.
- Consequences of stereotypes are violence ,resentment, Sexual harassment, Sexual assault and rape, Discrimination (in the family, workplace, community)

Gender responsiveness

- Refers to taking into account gender gaps and gender issues to inform plans, implementation and design of any processes
- A gender responsive budget would require an analysis of actual expenditure and revenue of men versus women and adjusted appropriately to address any gender inequality.

GOVERNMENT AND GENDER MAINSTREAMING

Government of Kenya is committed to promotion of gender equality and women's empowerment in compliance with; several global and regional instruments, conventions, resolutions and declarations that she is signatory to. These includes:

- Convention on Elimination of All Forms of Discrimination Against Women (CEDAW), 1981.
- The Beijing Declaration and Platform for Action, 1995
- Millennium Development Goals (MDGs), particularly Goal No.1& 3 (Eradication of poverty, G/ Equality and women's Empowerment).
- Protocol to the African Charter on Human and Peoples Rights on the Rights of Women in Africa, 2003
- The AU Solemn Declaration on Gender Equality in Africa- 2004
- Vision 2030 and Medium Term Plan (2008 – 2012)
- National Policy on Gender & Devt, 2000
- Presidential Directive on 30% A.A. for women

BRIEF BACKGROUND ON GENDER MAINSTREAMING IN KENYA

- In pre-independence days white female philanthropists supported women specific activities (WID)
- 1960s into 1970s Government enhanced the programme
- 1975 UN Women's Conference demanded all governments set up instruments to deal with women's issues
- 1976 the government established the Women's Bureau in the department of Social Services
- 2007 Min. of Gender, Sports, Culture and Social Services created.
- Now Ministry of Gender, Children and Social Development.
- Its mandate is to spearhead mainstreaming of gender in public policy, plans and programmes.
- Gender and Equality Commission (NGEC) established to play oversight role over public institutions in G/M
- Social, political and Institutional resistance to G/M witnessed
- In 2006 Head of Public service asked all ministries and state corporations to appoint gender officers and establish gender units.
- In July 2009 gender mainstreaming became a requirement in the performance contract of all Permanent Secretaries & CEOs of all state corporations.

GENDER MAISTREAMING AT POLICY LEVEL

- From July 2009 there exist clear guidelines and all ministries now formulating sector specific gender policies to guide programmes and gender responsive activities from the top to the district level.
- MGCSD mandated to play advisory role to all ministries and state corporations to ensure G/M is appropriately done at all levels.

POLICY ACHIEVEMENTS

- The National Policy on Gender and Development (2000)
- Sessional Paper No. 2 of 2006 on Gender Equality and Development
- Plan of Action to implement the policy (2008-2012)
- Presidential directive on 30% Affirmative Action for women in appointments & promotions
- Establishment of National Commission on Gender and Development.
- Establishment of Department of Gender and Social Development.
- Establishment of Gender Units in Government organisations
- Enactment of the Children's Act, 2001
- Enactment of the Sexual Offences Act of 2006. It is being implemented – *the first conviction saw life imprisonment of a child defiler*

The Employment Act, 2007:

- *Prohibits termination of employment on basis of pregnancy, extends maternity leave from 2 to 3 months with full pay (exclusive of annual &sick leave)*
- *Outlaws discrimination on basis of training, promotion, terms & conditions of employment*
- *Equal pay for equal work value, prohibits sexual harassment*
- *Provides for 2 weeks paternity leave*
- Reforms in military and Kenya police where Women given equitable opportunities with men. Women also serve alongside males in Army, Navy, Air force & police
- Overall figures for recruitment of men & women in public sector show women are 30.9% vs men 69.1% of workforce.

- Employment and promotion of women in civil service tilted in favour of men.
- Though ministries and State corporations have made efforts to employ & promote women, gender equity still far from realization.
- 72% of women employed in civil service work in lower cadres (J/G H and below).

To effectively mainstream gender in Learning institutions and programmes:

- Increase staffing of public institutions with qualified female officers in top management to participate in decision making
- Establish gender Units in all targeted institutions
- Empower gender units to have enough authority to influence opinions and change attitudes
- Provide adequate resources for G/M work
- Mainstream Affirm. Action in constitution
- Partner with like-minded stakeholders

NB: **DISCUSSIONS AND REACTIONS AFTER EVERY SESSION**

DAY TWO
GENDER BASED VIOLENCE (GBV) AT WORK PLACE
What is GBV?

- Gender based violence is physical, mental or social abuse that is directed against a person because of his her gender or gender role in a society or culture. In this case the person has no choice to refuse or pursue other options without severe social, physical or psychological consequences.

Forms of GBV

- Rape, attempted rape
- Trafficking, prostitution
- Manipulation within home , workplace, school
- Domestic violence, battery, confinement
- Emotional abuse, pornography
- Harmful traditional practices(FGM, forced/early marriages, widow cleansing)
- Denial of education based on gender

Causes of GBV

- The root cause is inequality .This is reflected in;
- Traditions
- Poverty
- Illiteracy/ ignorance
- Lack of policies

Perpetrators of GBV;

- Husband, wife, father mother, uncle, workmate, employer, cousins, elders, teachers, lecturers for Sexually Transmitted Grades etc.

Consequences of GBV

Health - Injury to the reproductive system leading to child bearing problems, miscarriages, STI infection including HIV/AIDS,

- Depression
- FGM leads to shock, infection, excessive bleeding or even death
- Emotional damage(anger, fear, resentment)

- Loss of desire for sex
- Difficult pregnancy and labour
- Drug abuse

Psychosocial effects

- Emotional damage, self-hate ,Insecurity, Shame, Stigma, isolation

Security/physical environment and community

- Victims feel insecure, threatened and afraid of traveling
- Violence as revenge

GBV often leads to;

- Drug abuse as victims try to cope, HIV/AIDS infections increase among IDU's and other drug users.

Barriers and issues in GBV

The barriers to seeking care and justice have been widely observed. They include:

- Lack of awareness among survivors of medical and legal services
- Lack of trust in legal and justice systems
- Absence of clear guidelines on issues of SGBV for the police and the judicial system
- Lack of sensitization among the police and judiciary
- High dismissal of cases by the police and the judiciary
- High withdrawal cases by victims
- Low prosecution conviction rates
- Lack of legal aid
- Failure of courts to apply uniform criteria, particularly in relation to measures to protect victims

GBV Interventions

- National budgetary allocation
- Comprehensive medical care
- Psychosocial support for survivors
- Increase access to legal and justice systems
- Training service providers on how to handle GBV victims
- Community awareness programmes
- Put shelters for GBV survivors
- Develop legislation to address GBV
- Analyze various forms of negative masculinity and work towards changing them

NB: **WATCH A HD DVD ON GBV BY USAID & PATHFINDER FOR 17 MINUTES DISCUSSIONS AND REACTIONS AFTER EVERY SESSION**

DAY 3

DISABILITY MAINSTREAMING IN LEARNING INSTITUTIONS

Definition of terms

Disability: This is lack or restriction of ability to perform an activity in the manner within the range considered normal within the cultural context of the human being.

Disability Mainstreaming

Is a strategy for achieving equality irrespective of one's disability. It is a strategy to end disability blindness in development process. It Ensures women & men, girls & boys who are disabled have equal access to & control over resources, opportunities & benefits at all levels with those who are able.

Inclusion: This is a philosophy which focuses on the process of adjusting the home, the school, and the society so that all the individuals, regardless of their differences, can have the opportunity to interact, play, learn, work and experience the feeling of belonging and experiment to develop in accordance with their potentials and difficulties.

Inclusive Education: This is an approach in which learners with disabilities and special needs, regardless of age and disability, are provided with appropriate education within regular schools.

Background Information

About 600,000,000 people live with disabilities in the world, with 80% of this total living in low income countries in 2014. **10%** of Kenyan population (approx. 42 million) indicates that there are **4 million** people living with disability (PWD). The Kenyan government spends **less than 1%** of its health budget on mental health. Many PWD in Kenya live in poverty and have limited opportunities for accessing education, health, rehabilitation, suitable housing and employment. **51%** of PWD are **female**, while **49 %** are **male**. The most **prevalent forms of disability** are visual (30%) and physical (30%), followed by hearing (12%) and mental (11%).

Status of Special Needs Education in Kenya

Special needs education started in Kenya after the end of the Second World War and has since been offered mainly to four categories of children with disabilities, namely; children with hearing impairment, mental handicap, visual impairment and those with physical handicap.

Education to these children was only offered in special schools until the 1970s when units and integrated programmes were initiated. Special needs education has continued to expand and currently includes Learners with/who:

1. Hearing impairments
2. Visual impairments
3. Physical impairments
4. Cerebral palsy
5. Epilepsy
6. Mental handicaps
7. Downs Syndrome
8. Autism
9. Emotional and behavioral disorders
10. Learning disabilities (LD)
11. Speech and language disorders.
12. Multiple handicaps
13. Albinism
14. Other health impairments
15. Are gifted and talented
16. Are deaf blind
17. Are orphaned
18. Are abused
19. Are living in the streets
20. Are heading households
21. Are of nomadic / pastoral communities
22. Are Internally displaced

However, educational opportunities for learners with special needs and disabilities are a major challenge to the education sector. Majority of learners with Special Needs and Disabilities in Kenya do not access educational services. For instance, in 1999 there were only 22,000 learners with special needs and disabilities enrolled in special schools, units and integrated programs. This number rose to 26,885 in 2003 and 45,000 in 2008, which compares poorly with the proportion in general education.

In 2008 there were 1341 special units and 114 public special schools in the country which include vocational and technical institutions that cater for learners with special needs and disabilities. This is still inadequate despite the government's commitment to support the provision of equal access to education by all children.

The government's commitment to special needs education has been demonstrated through establishment of a special needs education section and the appointment of a Special Needs Education Inspector in 1975 and 1978 respectively at MOE headquarters.

The government further posted a special needs education specialist at the Kenya Institute of Education (KIE) in 1977. Other developments included the preparation of teachers of learners with special needs and disabilities that have led to the establishment of Kenya

Institute of Special Education (KISE) and departments of special needs education at Kenyatta, Moi, Maseno and Methodist Universities. In view of the above, this situation calls for a re-appraisal of available approaches to expand Special Needs Education services so as to achieve an enrolment rate at par with that of other children. To attain this, Kenya needs to ensure the realization of inclusive education and simultaneously develop and implement guidelines that mainstream special needs education at all levels of the education system.

Gender Mainstreaming in Special Needs Education

Background

Gender mainstreaming to ensure equity and equality in SNE is a challenge. According to the Gender Policy in Education (July 2007), gender differences in favor of males are considerable.

In 2003, out of the 23, 459 learners with special needs and disability enrolled in primary education, only 10, 106 (43%) were girls. In secondary schools, there has been a decline in the girl child enrolment resulting in gender disparity in favor of boys. Generally, the national education system has been characterized by gender disparities at the national level and across regions. SNE has not been spared. The widest gender gaps exist at higher education levels ie universities and hence the need to address gender issues in SNE.

Issues and Constraints

While education has grown rapidly in Kenya over the last 40 years, the SNE sub-sector has lagged behind. There are 116 primary, 8 secondary, 4 technical, 3 integrating teacher training colleges and one resource centre for the blind special education programmes, including vocational and technical institutions with an enrolment of 49,000.

These, viewed against the background that an estimated 1.8 million people in Kenya aged between 0 – 19 years have special needs and disabilities (National Development Plan 2002 – 2008) show big disparities in the development of SNE.

The community and society in general has a negative attitude towards people with special needs. The situation is worse for the girl child with special needs and disabilities. They face a bigger challenge than their male counter-parts. The dropout rate for girls with special needs and disabilities is high due to teachers who may not be sensitive to the needs of these kinds of learners. These learners are also sometimes left out of sex education, HIV and AIDS and life skills education programmes because people believe that they do not engage in social activities and sex.

Objectives

- To enhance gender mainstreaming in SNE programmes at all levels and
- Ensure increased enrolment, participation and completion rates for both
- Girls and boys, men and women with special needs and disabilities in education.

Capacity Building and Human Resource Development

Background

The government is aware of the fact that capacities and skills of staff at all levels within SNE should be commensurate with the tasks they perform.

The success of special needs services and education depends on provision of specialized human and institutional capacity.

SNE teachers in the country are trained at Kenya Institute of Special Education (KISE), Kenyatta and Maseno universities among others.

The government is focused on the development and implementation of an effective criterion for appointment and deployment of education managers at all levels of the education system.

Issues and Constraints

Insufficient number of trained teachers/Lecturers has an effect on teacher-learner ratio in learning institutions. While some special institutions are lacking teachers, sometimes special needs trained teachers are posted to schools where their services are not required or are not posted at all. SNE teachers do not have an established promotional structure or scheme of service and this could be the reason why many of them opt for other forms of employment after training. There is need for other personnel like teacher aides, house mothers/fathers, sign language interpreters, readers among others in institutions. Services of these professionals are lacking in the education system either due to lack of training or funds for their remuneration.

Learners with special needs and disabilities in schools and institutions are sometimes marginalized and are not represented in areas like management and decision making processes. Learners with special needs and disabilities have not been actively involved in sporting, cultural and recreational activities, thus denying them solidarity and team building. Their participation is limited due to inaccessibility and/or unsuitability of the facilities. Issues related to special needs and disabilities are often not adequately addressed within the educational system and other fora.

DISCUSSION: After Every Session: A Case of Ashura 2013/2014 PWD of the Year

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BUDGET

ACTIVITIES/ITEM	**QUANTITY**	**UNIT COST**	**TOTAL COST (KES)**
EXPENDITURE			
-Medium note book	100	50	500
-Pens	200	18 pages*10	36,000
Typesetting and printing had-outs	60	30	1,800
Flip Charts	1 dozen	600	600
Mark pens			4,000
Subsistence/facilitation for	2	1,000*2*3days	60,000
trainers	100	300*200	60,000
Tea and Lunches	200	@100	20,000
Certificates	20		
Badges	205	@200	41,000
Posters			
SUBTOTAL			**223,900,**
INCOME			
Training Fee for participants	200	@ 3000	600,000
PROFIT(**Income –Expenditure)**	200	@1880.50	**376,100 (62.7%)**

COMMENTS:
Let the skills that the managers will learn be very specific and needs to come out very clearly. Isolate the themes that will be covered in the short course. A good presentation. A good course for the managers. Budget not presented in the document but was verbally presented. Relevant course supported by several policies both nationally and internationally (globally). In line with the SDGS or VISION 2030. MDGS are obsolete we have SDGS (Sept, 2015). Be current. Provide the budget in writing. The course is thoroughly researched and presented. There is need to separate the two courses since they are wide enough to each take 5 days. However, the course is a good one and should be offered in the University.

Short Course: Contemporary FGM Mainstreaming Skills for Social Workers

by Dr. Susan M. Kinyua, Department of Education, Chuka University, P. O. Box 109-60400, Chuka

"ALTERNATIVE RITE OF PASSAGE FOR THE AMERU GIRL-CHILD": A SEMINAR SYLLABUS FOR EMBRACING CHANGE FOR A BETTER LIFE

CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

FGM = Female Genital Mutilation
MYWO = Maendeleo Ya Wanawake
UNICEF = United Nations for Children's Fund
WHO = World Health Organization

BACKGROUND OF THE STUDY

Female Genital Mutilation (FGM) or female genital cutting also known as clitoridectomy is a traditional practice that involves the partial, total removal or alteration of girls' or women's genitalia ((WHO, 2006). The practice has been practiced for a long time among diverse communities in the world (Toubia, 1994). It normally acts as a traditional rite of passage from childhood to adulthood among the communities that practice is common in Africa; but through immigration and population movements, it has also spread to Europe, North and South America, Australia and New Zealand, thus becoming a worldwide issue (Pillinger, 2007). According to World Health Organization, it is estimated that about 130 million girls and women living today in the world have undergone the practice and yet every year another 2 million girls and young women are at risk of undergoing the practice despite its many adverse consequences (WHO, 2006). UNICEF Innocenti Digest (2008) explains that, whereas much attention has been paid to FGM eradication strategies, its gross consequences experienced by the girl-child, after the FGM process have been neglected. As a consequence, the girl-child has suffered psychologically, socially and their physical health has also been affected.

Physical Effects

Essentially, there are diverse FGM physical health effects experienced by initiated girls. The effects may be immediate including excruciating pain, shock, wound formation, urinary tract infection, fever, septicemia and at times death due to haemorrhage or septic shock; intermediate effects like delay in wound healing, anaemia, pelvic infections, irregular bleeding and vaginal discharge; and eventually late effects like delay in wound healing , anaemia, pelvic infections, irregular bleeding and vaginal discharge; and eventually late effects such as infertility, difficulty in urinating, rectovaginal fistula, anal incontinence and urinary incontinence (Wabaki, 2007; WHO, 1996). While these effects may not be experienced by some initiated girls and that the effects tend to differ from one person to another, there are initiated girls who experience some of the physical health effects on a daily basis (Abusharaf, 2000). Unfortunately, many initiated girls may be suffering from FGM physical health effects in silence partly because of the cultural explanations of such effects and possibly due to fear of victimization by the authority when

medical care is sought from public health facilities. In particular; some cultures rationalize the physical health effects of FGM as part of life and that the initiated girls should persevere for the purpose for the purpose of preserving personal social identity (Valderman, 2002). Similarly, the Nandi community of Kenya advocate for FGM because the clitoris is culturally perceived as being filthy, foul smelling and can grow very long even develop branches if not cut (Nyangweso, 2001) thus, nullifying the physical health effects of FGM. Besides, in Sierra Leone physical health effects of FGM are attributed to witchcraft, supernatural powers and general bad luck (Toubia, 1999).

Psychological Effects

Other effects the girl chid goes through are the psychological effects. Masterson, (2000) points out that FGM practice is mostly remembered as an extremely painful event that leaves an emotional scar for life. This explains the psychological disturbance suffered by the girl child who has been subjected to the FGM process. This emotional pain may settle deep in the subconscious mind and later lead to disturbing behavior. The loss of trust and confidence in care givers such as parents and other family members who allow the procedure to go ahead and sometimes assist during the operation is another potentially serious psychological consequence (Hayes, 1975).

WHO (1996) explains that FGM practice has a range of psychological and psychosomatic disorders. These effects of FGM on psychological wellbeing may lead the girl child to experience disturbances in sleep patterns, mood and cognition. Such difficulties extend into adulthood with feelings of incompleteness, low self-esteem, depression, chronic anxiety, phobia, panic or even psychotic disorders. FGM practice also leads to deaths of innocent youths which may be traumatic to the colleague initiates and friends (Tabe, 2001). Still, Grenbaum (1996) points out that apart from the direct pain of the event and its psychological effects, FGM works at a mere subtle level to shape the self-perception and self-esteem of the girl child. Hermlund and Shell-Duncan (2007) are in agreement with this sentiment by adding that in long term, girls may suffer feelings of incompleteness, anxiety, depression, chronic irritability and difficulty in relating to their husbands. This explains why many FGM initiates suffer in silence and we are unable to express their feelings and fears because doing so is a taboo (Tabe, 2001). Thus there is need to ascertain the effects of FGM on the psychological wellbeing of the girl child among the Ameru community in Kenya where the practice is still practiced amid vehement campaigns against it. This is anticipated to assist in designing evidence based techniques and strategies for mitigating the psychological effects among the already initiated girls.

Social Effects

FGM was also found to have moderate effect on the girl child's social life with respect to marriage, relationships, competence in social interaction and personal advancement. FGM also violated the rights of the Ameru girls but still the girls opted for FGM because this made it easier for them to get a husband and be accepted in the community. In addition, the initiated girls were reported as having difficulties interacting with the uninitiated peers and teachers at school. This problem may be attributed to the change in attitude perpetuated by the FGM process, which causes the initiates to regard themselves as adults who are ready for marriage and child rearing, thus school as institutions for children. As a result, the initiated girls focus more on sexual relations with older men eventually opting out of school in favor of marriage. (Mwaniki, 1985). Generally, a lack of competence in social interactions especially at school may be blamed in part for the ability by initiated Ameru girls to advance academically. Consequently, the initiated girls' inability to complete school and their academic under-achievement as well as early marriages culminated in economic adversity among the initiated Ameru girls who struggled to raise families with meagre resources (Ondieki, 2010). In retrospect, although most initiated girls felt that FGM did not uptake of responsibilities in society, the focus group discussions pointed out

that initiated women lacked confidence in executing such responsibilities. According to Rushwan (2000) internalized shame and embarrassment may result in anxiety and complexes may lead to deficits in self confidence among the initiated girls who take up leadership positions in society. These FGM victims had their rights violated with regard to life, privacy, protection and freedom from discrimination. In line with these sentiments, Ondieki (2010) explains that FGM was identified as a basic human right violation and a life-long threat to women and girls specifically, those Ameru girls who died due to FGM complications were denied the right to life and protection from harm which are fundamental rights for all human beings (Sohn, 1982). In addition, FGM among the Ameru was conducted openly within homesteads, a practice that invaded the initiates' rights to privacy. Eventually, rumors spread and sooner than later the entire villages was aware of those girls who were initiated and how each braved through the entire process. As a result, the initiated girls lost their privacy and had to contend with emanating feelings of embarrassment and low self-esteem based on how they braved the initiation process. It is against this background that the researcher has come up with the attached syllabus on contemporary FGM mainstreaming skills for social workers: to elevate the lives of FGM victims in our communities.

CONTEMPORARY FGM MAINSTREAMING SKILLS FOR SOCIAL WORKERS

Introduction

The human rights of approximately 130 million girls and women alive today have been violated through FGM in Kenya, the prevalence rate for FGM ranges from 18-32%. Female Genital Mutilation has become a contemporary issue of concern in recent times. This is because the Female Genital Mutilation rite is a harmful traditional practice that not only affects girls and women, but also negatively impacts on the lives of others in the communities. Every year thousands of girls and women in the Ameru Society undergo female Genital Mutilation, according to the Meru tradition. This is a traditional cultural practice, which has two components: the actual surgical operation and education, guidance and counselling during seclusion and healing process. Largely, the education that is given to the girls during this period contains some positive aspects, which are beneficial to them and the community and therefore should be encouraged. However, the physical cut, which is harmful and potentially life threatening and causes distressing pain and suffering should be abandoned. This practice violates girl's and women's basic human rights and undermines their God-given dignity. It compromises the rights to life, right to physical integrity, the right to the highest attainable health, as well as the right of freedom from physical or mental violence, injury or abuse for the girls and women. The practice is also is also a violation of the rights of the child to development, protection and participation. FGM is a global concern.

Problem/Task

Although concerted advocacy work over the recent decades has generated widespread commitment to end this practice, success in eliminating it has been minimal. For instance, despite the government ban on the practice in Kenya, FGM prevalence level has dropped from 37.6% recorded in 2005 to 33.7% recorded in 2008. As a result, FGM has continued to be prevalent among some Kenyan communities, including the Ameru. In 2008 for instance, over 1500 girls aged between 12 and 15 years underwent the 'cut' in Matiri, Mukothima and Magumoni Regions of Ameru Community. Driven by insight from the changing trends in socio-cultural environment in the country and internationally, the Kenya government through presidential decrees in 1979 and 1982 condemned FGM. This was later followed by the total ban of the practice in 1990. In 1999, the Ministry of Health developed a national health plan to eliminate FGM in Kenya by the year 2019.

Objectives

The purpose of this seminar syllabus is to help the learners/participants in acquiring relevant knowledge and skills, which will contribute to a healthy lifestyle and responsible behavior for girls in the society without undergoing the physical cut (bodily operation). The training ("seclusion") will target girls who are within 9-18 years age bracket. In order for the alternative rite of passage to succeed, this seminar syllabus will also focus on secondary targets for change. These include the girls' parents and other close relatives, the boys, community opinion leaders, religion leaders, politicians, government officials, the circumcisers and the wider community through awareness creation and sensitization forums.

The seminar syllabus has adhered to principles that make it accessible and usable by all categories of social service providers, resource persons, facilitators and learners. The flow of items is designed to influence change of attitude and practice by the community members at individual, relational, structural and cultural levels. The subject matter of is seminar syllabus respects the culture of the Ameru people and strengthens the positive values while at the same time working to eliminate the negative elements that violate human rights and dignity of the human person.

Each lesson hhas subject context, objectives and content. The syllabus should be used alongside a training manual. It recognizes the fact that learners already have some knowledge and experience of the relevant issues. Thus, its aim is to facilitate learners to experience and acquire the necessary knowledge, skills and develop attitude that will lead to socio-cultural change and transformation of Ameru community in general, and in particular as far as FGM is concerned.

The syllabus focuses on both the primary targets who are the girls, as well as the secondary targets who are the girls' parents and other close relatives, the peers (boys and girls), community opinion leaders, religious leaders, politicians, government officials and the circumcisers. The girls will be targeted for individual change aimed at transforming them into responsible individuals in their community. That is, individuals who uphold positive values and possess a strong sense of self-awareness and duty in relation to others. Secondary groups will be targeted mainly through sensitization and involvement in ways that cause change at the individual, relational, structural and cultural levels.

APPLICABILITY/METHODOLOGY

Community Awareness and Sensitization

Experiences have shown that though people may deeply cling to their traditional practices, they are often willing to adopt new attitudes, behaviors or practices if they are convinced that such a change will improve their lives. To foster change at the individual, relational, structural and cultural levels in Meru, a range of community awareness and sensitization campaigns highlighting the dangers of FGM will be undertaken for various categories of people. It is important to note that these four levels of change are interlinked and it is very difficult to draw a clear bou8ndary between one level of change and the other. Change occurring in one level may influence other levels of change as well. However, the four levels of change are presented separately in this syllabus for purposes of directing where the focus of change is.

A. Change at the Individual Level

Introduction

Prior to the seclusion period, community sensitization forums for various groups will be conducted. These will be aimed at equipping the various stakeholder with knowledge and skills that will enable them to change their attitudes towards woman adulthood as well as their

individual behavior in supporting FGM as a rite. The focus will be to enable the target group to change their perceptions about marriage and the importance attached to FGM. They would be able to realize that girls can become mature, get married and be responsible adults without undergoing the cut. Gradually, the larger community would be able to change their individual perceptions, abandon FGM, and adopt alternative rites of passage. For this level of change to be realized, the following stakeholders will be sensitized as explained below:

a) Parents, Relatives and Sponsors

The parents are an important category of target group that plays a key role in influencing girls to be circumcised. They are perceived as key custodians of the traditional practice. To end the FGM practice, the parents will be sensitized on the following to change their perceptions and attitudes about FGM.

- Effects of FGM as a rite of passage
- Human and Children's rights, needs and priorities such as education and life skills
- Roles and responsibilities of parents and relatives in upbringing of responsible and healthy children
- Alternative Rite of Passage

b) Circumcisers

The circumcisers will be engaged through the following ways:

- Identify them, appreciate them and talk to them in a non-threatening manner
- Acknowledge their skills, involve them in community sensitization programs such as open forums, and focused group discussions.
- Sensitize them on effects of practicing FGM as a rite of passage.
- Sensitize them on the children rights and implementation of their violation
- Encourage them to adopt alternative methods to adopt alternative methods of income generation.

c) Government of Kenya Administration Officials.

Train specific individuals from relevant government departments and provincial administration to be change agents and support alternative rites of passage. The following to influence change at individual level:

- Individual responsibility in the society in curbing FGM as a rite of passage.
- Role of various government officials in enforcing provisions of the Children's Act
- Significance and effects of FGM
- The importance of alternative rites of passage for girls in the society
- Value and appearance the need for law enforcement by administration officers.

B. Change at the Relational Level.

Introduction

The secondary targets include peers (age-mate boys and girls), parents, relatives, religious and community leaders, provincial administrators, Children's Officers and members of the wider community. These targets are critical to the success of alternative rites of passage initiatives because they are the perpetrators of FGM or they allow and usually encourage the practice to continue. Sensitization of these targets will be aimed at changing the way people relate with each other in the community so that there is a conducive environment in which respect for human rights is a collective responsibility of the community. This means that FGM will be a community concern and that everyone will have a role in advocating for alternative rites of passage, and particularly in supporting and encouraging the graduates of those new systems.

a) Community Awareness and Sensitization Forums

Parents, peers, relatives, and community leaders, circumcisers, provincial administrators and Children's Officers are critical in ensuring sustainability of the alternative initiatives. They will therefore be sensitized so that they change the way they relate with the girls graduated through the alternative rites of passage, accept them as responsible individuals in the community, and treat them with respect

The following areas will form a critical component of sensitization campaign.

- Encourage mutual respects among peers, especially those of opposite sex
- Encourage use of civil and respectful language by siblings when communicating to the initiated girls.
- Challenge parents and relatives to act as good role models for girls in their families
- Create awareness among all stakeholders on what initiated girls go through during seclusion and encourage them to treat the graduates from the alternative initiative with respect as responsible individuals in the community
- Sensitize the parents, relatives and community members that initiation and seclusion is not a gateway to marriage for the girls but a fornication stage towards responsible adulthood

The following are entry strategies for community awareness creation and sensitization:

- Chief's public meetings (Baraza)
- Church congregations
- Sports and games events
- Family life seminars
- Meetings in schools
- Cultural festival events
- Community group meetings

b) Boys

Boys are a critical group to the success of alternative initiative. They will therefore, be sensitized to change their attitude towards FGM and accept, respect and recognize alternative rites of passage graduates as responsible individuals with status in community and as potential wives. The boys will be sensitized on the following:

- Self-awareness
- Human/Children's Rights
- Ameru cultural values
- Effects of FGM
- Importance of alternative rites of passage
- Social relationships
- Sexuality

C. Change at the Structural Level.

Introduction

To foster a supportive structural system for the alternative rites of passage, local structures will be strengthened. These include: the County Administrators, Children's Officers, Chiefs and other relevant Government Officers, religious and community leaders, politicians, *Njuri Ncheke*, Maendeleo ya Wanawake (MYWO) among others. The strategies to be undertaken are aimed at bringing about change at the structural level.

a) Local Structures and Children Rights

This provides learners with an opportunity to gain a greater awareness on children's rights. This will increase the ability of individuals to understand the meaning of "human rights", the rights of the child and the existing legal structures and systems that are protective to children's rights. The session also aims at examining cultural beliefs, values, taboos and practices that violate human/children's rights and in doing expose, FGM as a violation of children's rights that need to be discarded. The overall objective of this session is to enhance the enforcement of the legal policies that support FGM. The main target group will be the parents, close relatives, politicians, religious and community leaders, and the county administration.

Objectives

By the end of this unit, the learner should be able to:

- Define children's rights, and give examples
- Identify cultural beliefs, values, taboos and practices that violate children's rights
- Discuss FGM as a violation of children's rights

Session 1 Children's Rights
Session 2 Local Structure and Systems

Session 1: Children's Right

Introduction

This session highlights the rights entitled to a child. This will in turn create an awareness and ability of individuals to understand and appreciate the fact that children just like adults are entitled to human rights that are supposed to be protected.

Objectives

By the end of this session, the learners should be able to:

- Give definition of a child
- Define the term "children's rights"
- Give a brief historical background of the ban of FGM in Kenya
- Give categories and examples of children rights
- Discuss alternative rites for girls

Content

- Definition of the term "a child"
- Definition of the term "children rights"
- Historical background of FGM in Kenya
- Categories and examples of children rights
- Alternative rites of passage for girls

Local Structures and Systems

Introduction

This session highlights strategies used to strengthen the local structures as highlighted in previous session. The girls in seclusion having been trained in life skills and exposed to policies and support systems put in place to ensure their protection should find effective legal, social and administrative structures in the society capable of facilitating their protection. The representatives from the local structures will be sensitized on the Human Rights, Children's Rights and alternative rites of passage. The local leaders will also be lobbied to support alternative rites of passage, protect children from FGM and other forms of abuse. They would be able to enforce the laws that protect the children.

Objectives

- To sensitize the local leaders to support the alternative rites of passage.
- To lobby the government officers to enforce the laws and policies that the protect the children's rights

Contents

- Laws and policies that protect children and women from FGM
- Roles and responsibilities of the Children's Officers, the Police Administration, politicians, Judicial systems, teachers and education officers, parents, religious and community leaders in protecting the children from FGM and other harmful cultural practices.
- Role modelling and mentoring of the youth as a social responsibility of adults in the society
- The importance of advocacy, lobbying and citizen coalitions/associations

D. Change at the Cultural Level

Introduction

This unit focuses on the cultural beliefs, values, taboos, practices and how they are linked with FGM. It aims at isolating the harmful beliefs, values, taboos and practices from the beneficial ones. It also aims at integrating the beneficial beliefs, values and practices in the alternative rites of passage. The following topics will be covered under this unit:

Session 1 Cultural Beliefs, Values, Taboos and Practices
Session 2 FGM and Children's Rights

Session 1: Cultural beliefs, values, taboos and practices

This session focuses on the Ameru Cultural values, beliefs, taboos and practices. It highlights the need to phase out retrogressive cultural practices. It also identifies the cultural practices that violate human rights and suggest ways of overcoming resistance to change.

Objectives

By the end of the session, the learner should be able to:

- Identify and explain the Ameru cultural values, beliefs, taboos and practices.
- Explain how some cultural values, beliefs, taboos and practices violate children and human rights
- Identify causes of resistance to change at the individual, relational, structural and cultural levels
- Suggest ways of overcoming resistance to change.

Content

- Ameru Cultural values, beliefs, taboos and practices
- Cultural values, beliefs, taboos and practices that violate children and human rights
- Cause of resistance to change at the individual, relational, structural and cultural levels
- Overcoming resistance to change

Session 2: Alternative Rite of passage

Introduction

Alternative rite of passage is aimed at replacing FGM. It utilizes strategies such as community awareness creation aimed at cultural change of attitudes, behavior and practices that support FGM. The alternatives rites of passage aim at preserving the positive socio-cultural aspects of the ritual, discarding the negative aspects without requiring the girls to undergo FGM.

Objectives
By the end of this session, the learner will able to:

- Discuss the values taught during FGM and isolate the harmful from the beneficial values
- Discuss the importance of alternative rites of passage
- State the role of various stakeholders in supporting alternative rites of passage

Content

- Values taught during FGM
- Why alternative rites of passage
- Alternative rites of passage values taught to girls during seclusion
- The role of various stakeholders in supporting the initiative

Strategy for Sustainable Social Change at Cultural Level
For this new cultural dimension for girls to be sustained, the following strategies will be added:

- Sensitize stakeholders on changing trends of culture where education and morality takes priority over other traditional practices as girls' circumcision and under age marriages.
- Continuous training stakeholders on the advantages of the alternative rites of passage and the dangers of FGM
- Mainstreaming alternative rites of passage in socio-cultural programs and activities.
- Involve the members of the wider society I the sensitization campaigns, Planning process, monitoring and evaluation
- Enlighten members of the wider community on the importance of putting girls in seclusion and enlightening them on the effects of FGM, offering them guidance and counselling as well as family life education
- Use the Ameru cultural festivals and public forums to promote values of alternative rites of passage as dangers of FGM are highlighted.

Conclusion
At this level, it is envisaged that guidance and counselling on Kimeru cultural practices, training on life skills and responsible lifestyle will have replaced the traditional circumcision for girls as the preferred way of graduating girls from childhood to adulthood. The initiated girls will assume new roles in the society and the community will appreciate their new status while the young men will readily accept them as potential marriage partners without cultural prejudice.

PROSPECTIVE USERS/ADOPTERS
These will include, Community Opinion Leaders, Social Service Providers, Politicians, Girls' parents. Government Officials, Close relatives of the girls, Boys in the Community, Circumcisers and Religious leaders among others.

COST EFFECTIVENESS
The income will come from what the seminar participants will pay as seminar fees. The expenditure will be the money used by the seminar organizers in buying writing materials i.e. notebooks and pens for the participants.

BUDGETARY CASH FLOW OF EXPENDITURE VERSUS INCOME
Seminar for 50 persons for 4 days

SN	Expenditure Item	Quantity	Days	Rate	Total
1	Tea	50	4	70	14,000
2	Lunch	50	4	120	24,000

3	Notebooks	50		40	2,000
4	Posters				4,000
5	Training manual/booklet & handouts				15,000
6	Hire of Hall & PAS		4	1,000	4,000
7	Drinking water	1080	4	1,080	4,320
8	Facilitators honorarium	4	4	10,000	40,000
9	Sale Merchandise: (Branded T-shirts, Scarfs, kangas & Key Holders)				50,000
10	Subtotal				155,320
	Income Item				
1	Girls, Mother, Relatives/Guardians, Boys, Circumcisers and other community members	25	4	200	20,000
2	Social Workers, Community Leaders, Politicians, Administration Officers, Religious Leaders, Departmental Heads, Njuri Ncheke, CBO's, Justice and Peace Commissioners, Church organizations, Children's Officers	25	4	1,000	100,000
3	Sale of branded merchandise				100,000
	Subtotal				**220,000**
	Surplus				**64,680 (41%)**

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COMMENTS:

Good presentation but a lot need to be improved in the short course preparation. The course can be very useful if timed well. Relevant course but not feasible especially NGOS don't work for profit. The circumcisers who get their livelihood from the work and it is also cultural. However, it can be tried. Your major objectives are not captured in the title since it a NO TO FGM, not mainstreaming it. There is no room for it in the society. Also the course should be for circumcisers only, since without them the activity will die in all societies.

Design and Construction of a Daylight Solar Water Heater

By Haron Magata Nyariki, AB5/12405/13, Department of Education, P. O. Box 109-60400, Chuka

Objective
To warm water for domestic consumption using sunlight

Background Information
Black materials are good absorbers and good emitters of heat while white or silvery materials are bad absorbers and bad heat emitters. Many people use electrical appliances e.g. heater, coil etc. to heat water for purposes like bathing, washing clothes during cold weather among others. These method has been expensive since it uses electricity hence increasing electric bills which could otherwise been channeled elsewhere to increase the economy of our country. The greenhouse effect is a phenomenon where temperature on the earth's surface increases due to gases like carbon (IV) oxide and nitrogen dioxide which block the terrestrial radiations.

Originality
The project, Daylight water heater is an original idea and has never been presented before. It uses pieces of wood, horse pipe and white polythene paper. It uses the concept that black materials are good heat absorbers and the concept of greenhouse effect. The materials used are easily accessible and renewable. The project will replace the use of solar heaters and other electrical appliances in warming water for domestic consumption. This is because solar heaters and electrical appliances are expensive. The project is easy to set up even by an illiterate person.

Materials Required
2 frames of wood 3 by 10 inches
Two tanks and 2 taps
½ inch black horse pipe 100 inches long
White transparent polythene paper
Water and Plywood

Procedure
The materials required are collected and assembled.
Two tanks are installed on both ends of the large flat cardboard.
The pieces of wood are made in such a way that they form a large flat surface area about 1m from the ground flat surface, with the one where water comes from on a higher position.
The pipe is then connected to the two tanks i.e. storage tank and outlet tank. Water leaves the storage tank to the outlet tank.
The pipe is coiled severally on the flat surface of plywood to be directly exposed to sunlight.
The horse pipe is covered by the transparent polythene paper.
The tap is connected to the outlet tank to allow water out.

Results
Cold water leaves the storage tank and warm water is collected in the outlet tank.
In the morning hours, water collected in the outlet tank is still warm.
The temperature of the water in the outlet tank remains constant.

Discussion/Explanation
- Cold water leaves the storage tank, gets heated by the black pipe which has absorbed heat and reaches the outlet tank while warm.

- The plywood is made flat to reduce the speed of flow of water thus increase the time of heating water.
- The pipe is made thin to allow little water to flow through the large surface area of heated pipe thus increase the temperature of water.
- The pipe is also long to increase the surface area of heating water.
- The pipe is coiled to utilize the available space to the maximum.
- The polythene paper is meant to conserve the greenhouse effect and trap the heat to be very useful in warming water at night. This explains why water is warm even in the morning when the temperature is low.
- The outlet tank is silvery painted to reflect heat thus preserving the temperature of water.
- The storage tank is at a higher position so that water can flow by gravity to the outlet tank.

Demerits

The water in the outlet tank may not be safe for drinking

Cutting down of trees for building the platform may lead to desertification if others are not planted before.

Data Analysis

The temperature of water in the storage tank was measured from 29/5/2017 to 2/6/2017 and an average value obtained was 11°c and the temperature of water in the outlet tank was recorded as in the table below.

DAY	Temperature at 7.00am (°C)	Temperature at 1.00pm(°C)	Temperature at 5.00pm (°C)
Monday	43	62	58
Tuesday	45	65	59
Wednesday	44	63	57
Thursday	44	63	58
Friday	43	61	58

Conclusion

It is sufficient to conclude that this project is very effective in warming water for domestic consumption. It will assist consumers to reduce the cost of electric bills which otherwise could have been used elsewhere.

Recommendation

I recommend the universities to sensitize landlords to adopt this project especially for those with hot shower houses so that they reduce the rental costs at which students pay. I also recommend the government through the ministry of energy to educate Kenyans on this project so that they can reduce electric bills.

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Rapporteur: Mrs. Gladys Njoroge
Judges: Dr. Paul Kamweru, Dr. Silas Kiruki, Dr. L. K. Gitonga

Deployment of Chuka University's High Precision Equipment in Sample Testing and Advisory Services

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Introduction

Many institutions in Kenya have serious problems in providing effective sample testing and advisory services, due to lack of high precision equipment. Chuka University is among Kenyan institutions with some of high precision instruments such as Atomic Absorption Spectrophotometer, High Performance Liquid Chromatography, Elemental Analyser, Ultra violet/visible Spectrophotometer and Fourier Transform Infrared Spectrophotometer among others. Another problem experienced is in some institution is poor equipment maintenance due to absence of trained instrumental engineers/technicians, lack of trained and experienced laboratory technicians to manage the laboratories, and poor capacity to interpret laboratory test data and make rational recommendations for soil resource management.

Instruments coupled with appropriate analytical procedures are a key component of research. A reliable instrument produces consistent results regardless of the setting, yet reliability does not ensure accuracy or validity. Validity refers to an instrument's capacity to accurately measure what the researcher intended to measure. Moreover, the process of quality assurance should demonstrate that the method and the analytical instrument provide accurate and precise results. High precision instrument and quality procedures contribute to the overall quality of analytical results and ultimately to high cutting-edge research. Moreover, there is need for quality control to ensure good comparability of data across laboratory. To achieve this Chuka University has established a good laboratory practice and quality assurance systems and in this 21st century Chuka University intends to build on this technical foundation by offering solutions faster than ever in the fields of environmental measurement, R&D and quality control of fields of clinical, food, beverage and agriculture, semiconductors, life science and other industries. All users of the Chuka University laboratories are strictly to adhere to these guidelines, to assure that adequate quality is achieved.

Statement of the Problem

Over the years, Chuka University have acquired high precision equipment, standardized analytical procedures, exchange information through expert advice with other institutions, human resources training, and improvement of capacity for good data interpretation. Despite these efforts, many faculty members from different fields within and without the University, and members of the communities are presently not aware of the capacity of the acquired equipment. Therefore, there is need to sensitise members of the universities and community at large the available equipment and what they can do, and the advisory services that may be offered by the Chuka university experts.

Objectives

The basic role of Chuka University with respect to high precision equipment is to support research and advisory services with multiple objectives and functions, such as:

1. Analysis of chemical and physical properties of soils, water and tissue samples to identification of elements and other properties as per customer inquiry
2. Assessment and quantification of processes and changes in physical, chemical and biological properties governing samples provided by the customers
3. Determination of the magnitude and type of pollution (contaminants), with particular reference to heavy metals and other toxic or hazardous products (for example, Cd, Zn, Cu, nitrate level in groundwater), monitoring changes and experimentation for minimizing the harmful effects on plants and human and animal health.
4. Assessment of quality and impacts of the use of urban and agro-industrial wastes in agriculture.
5. Support for agronomy, horticulture and livestock research on related soil aspects (deficiency, physical properties, toxicity levels, etc.), breeding programs, especially on biomarkers (metabolomics).
6. Soil, water and plant testing for advisory services to farmers, with practical recommendations for soil improvement and management, and for fertilizers or amendments (for example, N, P, K, trace elements, lime, gypsum, etc.)

Some of the Major Equipment at Chuka University
Atomic Absorption Spectrophotometer (PG 990 (GFAAS))

Atomic absorption spectroscopy (AAS) is a spectroanalytical procedure for the quantitative determination of chemical elements using the absorption of optical radiation by free atoms in the gaseous state. Atomic absorption spectrophotometry detects trace metal content and concentration in aqueous solution. Its analysis sensitivities ranges from as low as <0.01 ppm in flame to <0.01 ppb in furnace. It incorporates 3D double-beam optics and stable hardware that achieve superior stability, giving a long-term stability. For example, for over the course of more

than 600 measurements, the instrument can achieve a relative standard deviation within 1%. An optional autosampler reduces analysis workload. Trace sample analysis using microsampling permits analysis of small sample volumes as well as multi-element analysis of small sample volumes. In addition no blockage of burner slot with samples having a high salt concentration.

The major field of application includes:

1. Elemental profiles of biological samples: Evaluation of soils or tissue samples for specific elements or metals
2. Environment: Evaluation of soil, air and water pollutants – this includes seawater, river water, effluent, sludge, air-borne dust
3. Discrimination of metals or elements, glass, ceramics
4. Drug development and quality control: Evaluation of specific elements in pharmaceuticals. AAS can be used to determine over 70 different elements in solution or directly in solid samples used in pharmacology, biophysics and toxicology research. Can do analysis of samples from blood, animal and plant tissues, food products and pharmaceutical products.
5. Evaluation of specific elements in petrochemicals (petroleum, oil, catalysts, chemical products, biodiesel)
6. Food safety and nutritional labelling: Evaluation of specific elements in food
7. Use in evaluating nano-materials
8. Use in pathology

Services offered: To determine chemical elements such as Cu, Cr, Pb and Cd among others, the customer needs to follow the laid down procedure for sample collection and delivery.

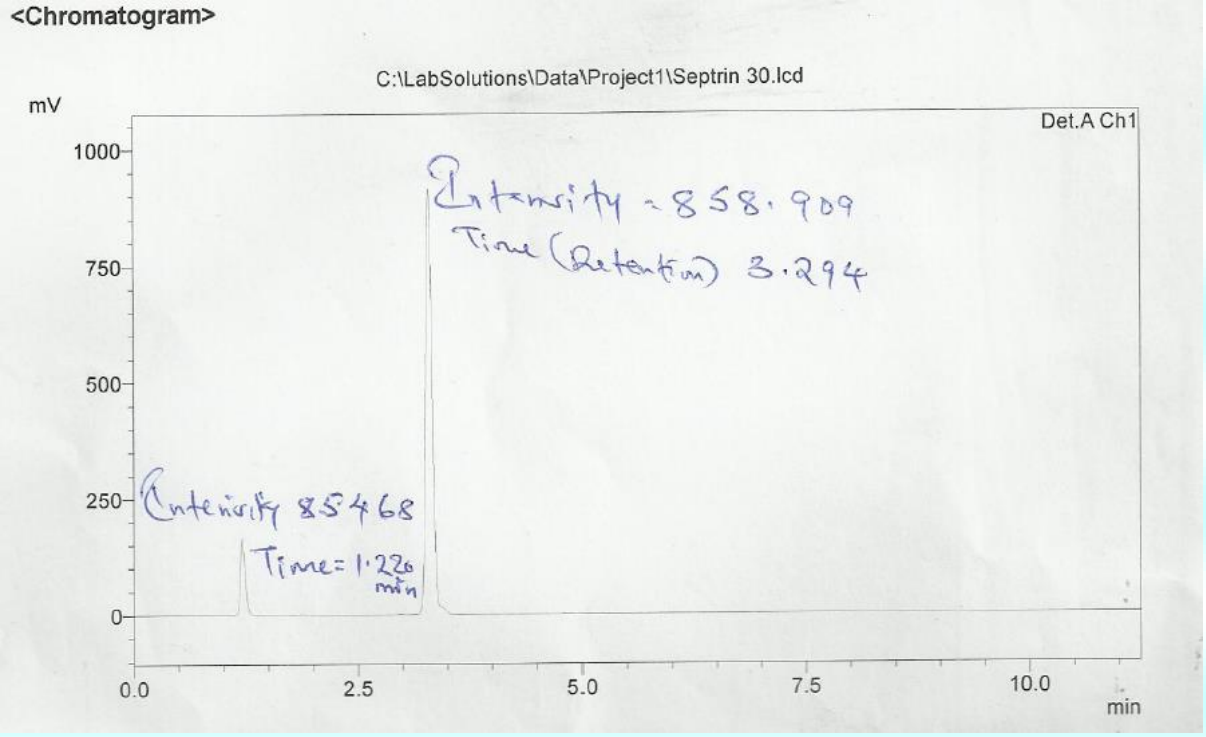
High Performance Liquid Chromatography (UFCL Performance Shimadzu)

High Performance Liquid Chromatography (HPLC) combines high sensitivity (ability to evaluate samples of very minute concentrations like in nano-gram and pictogram) precise detection of closely similar molecules with highest accuracy in the identification of components of complex mixtures. HPLC is used to separate, identify, and quantify each component in a mixture. The equipment finds vast use in food industry for quality control, separation of similar molecules, analytical solutions in environment and pharmaceuticals. HPLC has many uses in clinical diagnosis and health industry, e.g., diagnoses of many disorders related to body metabolism, e.g., estimation of metabolites of purines, pyrimidines or other metabolites from plasma,

cerebrospinal fluid and urine samples in patients. The equipment is used in mycotoxin testing, for example testing for aflatoxins in food. The equipment has application in health and agriculture as it can be used assay for control and presence of various metabolites in samples of interest. HPLC has become an indispensable tool in plant breeding in the assay of metabolites (metabolomics) which can be used as biomarkers for development of breeding prediction models. The equipment support critical research in genomics, proteomics and metabolomics. HPLC is often used in sample analysis to separate and detect additives and contaminants.

Services offered: To extract, isolate, purify, characterise and quantify each component in a mixture, the customer need to follow the laid down procedure for sample collection and delivery.

A sample of a chromatogram of aspirin obtained by HPLC equipment of Chuka University



Ultra violet/visible Spectrophotometer (UV 1800 Shimadzu)

It has a wide variety of applications in the fields of electrical, electronics and optics, food, construction, chemicals, pharmaceuticals, cosmetics and life sciences, textiles. It is a good

equipment in determination of impurities in organic molecules. The equipment can be used to do analysis of nitrate concentrations in drinking water, ground water, and industrial wastewater.

Services offered at Chuka University: for an analysis, the customer has to follow the laid down procedure for sample collection and delivery.

Fourier Transform Infrared Spectrophotometer (Affinity IS)

Fourier Transform Infra-red Spectroscopy (FTIR) is a sensitive technique particularly for identifying organic chemicals in a whole range of applications although it can also characterise some inorganics. Examples include paints, adhesives, resins, polymers, coatings and drugs. It is a particularly useful tool in isolating and characterising organic contamination. An FTIR spectrometer simultaneously collects high spectral resolution data over a wide spectral range. This confers a significant advantage over a dispersive spectrometer which measures intensity over a narrow range of wavelengths at a time.

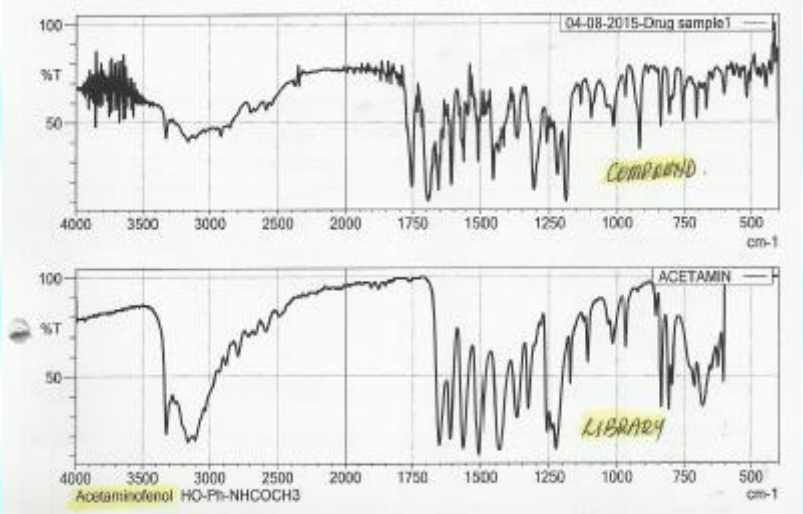
Typical applications of FTIR includes:

1. Identification of simple mixtures of organic and inorganic compounds, as solids or liquids
2. Identification of polymers and polymer blends
3. Indirect verification of trace organic contaminants on surfaces.
4. Analysis of adhesives, coatings and adhesion promoters or coupling agents.
5. Small visible particle chemical analysis.
6. Analysis of resins, composite materials and release films
7. Identification of rubbers and filled rubbers.
8. Determination of degrees of crystallinity in polymers
9. Comparative chain lengths in organics.
10. Extent of thermal, UV or other degradation/depolymerisation of polymers and paint coatings.
11. Analysis of unknown solvents, cleaning agents and detergents.

The equipment finds application in the following fields: automobiles, chemicals, construction, food products, medicine, metals, electricity, electronics and semiconductors, and cosmetics.

Services offered: To determine functional groups of the compound in a sample, the customer needs to follow the laid down procedure for sample collection and delivery.

A spectrum of a drug (paracetamol) compared to the spectrum of the library done in University



	Score	Library	Name	Comment
1	713	5 - IRs Reagent2	ACETAMIN	Acetaminofenol HO-Ph-NHCOCH3 ATR/diamond ATRcorrected
2	661	92 - IRs ATR Reagent2	92	Dibromomethane CH2Br2 ATR/diamond molecular weight:173.83 liquid
3	649	83 - T-Polymer2	PPO	Polyphenylene Oxide(Polyphenylene Ether) Transmission(Microscope)
4	642	12 - T-Organic2	AdipicAcid	AdipicAcid Transmission
5	639	48 - ATR-Polymer2	O_Epoxy3	Epoxy Resin(Electronic Parts-3) OursSample(IR-I)
6	637	45 - T-Polymer2	Epoxy	Epoxy Resin(Electronic Parts-3) Transmission(Microscope)
7	636	129 - T-Polymer2	T_Poly_2_6_Dimethyl_p_Phenyl eneOxide	Poly(2,6-Dimethyl-p-Phenylene Oxide) Transmission(Microscope)
8	634	46 - T-Polymer2	Epoxy	Epoxy Resin(Electronic Parts-4) Transmission(Microscope)

Elemental Analyser (Elementar Vario EL III)

The instrument has many applications in environmental sciences, food safety, and medical sciences. In environmental sciences it has application in determination of Silicon, Mercury in Water Samples, and other heavy metals. In food safety it can be used in determination of Mercury in Milk Powder and Selenium in Fish Meat. In medical sciences it can be used in determination of Trace Metals in Blood, analysing Copper in urine and determination of Bismuth in Cosmetics. Also it finds application in the fields of pharmaceutical drug analysis, agriculture-soil analysis and forensics.

CHARGES FOR USE OF CHUKA UNIVERSITY EQUIPMENT AND APPARATUS

Chuka University has spent a lot of money in acquiring various equipment and apparatus for use for research in our laboratories. These equipment and apparatus will provide good services **ONLY** if they are taken great care of. They **MUST** also be regularly serviced, repaired and maintained to give results to acceptable and comparable standard specifications.

As a result, those who would like to use the equipment to carry out their analysis **MUST** adhere to the laid down rules in this exercise, which includes:

1. All samples must be received at one central place from all clients. (Form for this purpose)
2. The samples should be serialized so that analysis be carried out in order of first come first served.
3. Samples received for analysis with description of how the sample was prepared i.e. extraction preparation and clean-up (protocol) should be supplied along with the sample.
4. Sample will be analysed in order in which they were received.
5. Full payment should be done upon submission of samples. This is via an approved bank account of Chuka University.
6. Once results are obtained they should be reviewed by at least two analysts, who are conversant with interpretation of the result obtained to the owner of the sample.
7. The result should then be sent back to the point of receipt to be released to the client, upon fulfilment of the conditions for analysis.
8. No samples should be given direct or collection of results from the analyst.

Table 1. Some of the bench mark charges for use of the various equipment in our laboratories

1.	High Performance Liquid Chromatography	KSh. 1000/- per sample
2.	Fourier Transform Infrared Spectrophotometry	KSh. 800/- per sample
3.	Ultra Violet/ Visible Spectrophotometry	KSh. 500/- per sample
4.	Atomic Absorption Spectrophotometry	KSh. 300/- per element
5.	Soxtherm (Fat Analysis)	KSh. 600/- per run
6.	Soxtherm and Hydrolysis (Total Fat Analysis)	KSh. 1000/- per run
7.	Protein Analysis (digestion, distillation, Titration)	KSh. 4200/- per run
8.	Electrophoresis (Protein, Amino acids Analysis)	KSh. 1500/- per sample
9.	Elemental Analysis (Per run of 4 elements)	KSh. 1000/- per sample
10	Sample Drying (Oven)	KSh. 100/- per sample

For any enquires on analysis can be addressed to the
Chairman, Physical Sciences Department, Chuka University

analytic functional testing
varioEL CHNS
serial number 11021015

20.02.15

No. Name	Weight [mg]	Date	Time	Info	O2	Prot. Fact.	Prot. [%]	C/N Ratio	User1	User2		Content [%]	Peak Area	Blank Value	Daily Factor
10 rose leaf	5.1270	19.02.15	13:07	Su	1	0.000	0.000	18.40	0.000	0.000	N:	2.397	6838	3000	1.1151
											C:	44.10	49056	0	1.0689
											S:	0.083	37	0	1.0452
											H:	6.203	18006	0	1.0650
11 rose flower	4.9910	19.02.15	13:19	Su	1	0.000	0.000	25.36	0.000	0.000	N:	1.648	5642	3000	1.1151
											C:	41.81	45584	0	1.0689
											S:	0.032	14	0	1.0452
											H:	6.469	18342	0	1.0650
12 rose flower	4.7840	19.02.15	13:32	Su	1	0.000	0.000	21.07	0.000	0.000	N:	2.060	6161	3000	1.1151
											C:	43.41	45365	0	1.0689
											S:	0.005	2	0	1.0452
											H:	6.643	17993	0	1.0650
13 rose flower	5.2020	--.--.--	--:--	Su	1	0.000	0.000	22.05	0.000	0.000	N:	1.833	6068	3000	1.1151
											C:	40.41	45942	0	1.0689
											S:	0.002	1	0	1.0452
											H:	6.162	18253	0	1.0650
14 acetanami	3.0040	--.--.--	--:--		1	0.000	0.000	6.760	0.000	0.000	N:	10.48	14852	4000	1.1151
											C:	70.86	46493	0	1.0689
											S:	0.000	0	0	1.0452
											H:	6.788	10999	0	1.0650
15 acetanami	3.0790	--.--.--	--:--		1	0.000	0.000	6.668	0.000	0.000	N:	10.31	14137	4000	1.1151
											C:	68.76	46246	0	1.0689
											S:	0.000	0	0	1.0452
											H:	6.735	11190	0	1.0650
16 acetanami	3.1300	--.--.--	--:--	Su	1	0.000	0.000	6.976	0.000	0.000	N:	10.11	14598	4500	1.1151
											C:	70.50	48181	0	1.0689
											S:	0.004	1	0	1.0452
											H:	6.516	11182	0	1.0650
17 blank	0.0001	19.02.15	14:31	Su	1	0.000	0.000	0.000	0.000	0.000	N:	46620	4584	3000	1.1151
											C:	0.000	0	0	1.0689
											S:	0.000	0	0	1.0452
											H:	5191	237	0	1.0650
18 blank	0.0001	19.02.15	14:42	CaHu	1	0.000	0.000	0.011	0.000	0.000	N:	50222	4619	3000	1.1151
											C:	536.4	12	0	1.0689
											S:	0.000	0	0	1.0452
											H:	2497	114	0	1.0650

Elementar Analysensysteme GmbH VarioEL V3.00 30.Oct.2003 CHNS Mode Page 2
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Figure 1. Results of rose leave and rose flower sample analysis at Chuka University. Sulphanilic acid was used as a standard.

Production of *Rhizobia species* for Seed and Plant Inoculation for Crop Productivity and Livelihoods Enhancement

by Christopher Mutuku, Julius Mburu, EB2/12072/13 and Chrispino Pius, EB2/12074/13,

Introduction

Nitrogen is one of the essential elements required for the synthesis of amino acids which in turn are used by the plant to form protein. Plants primarily take nitrogen in the ionic form as either ammonium (NH4+) or nitrate (NO3-). Leguminous plants are also able to utilize nitrogen derived from the symbiotic relationship they form with root nodule bacteria (Cleyet et al., 1990). *Rhizobia* are gram negative bacteria which have been widely used in agricultural systems for enhancing the ability of legumes to fix atmospheric nitrogen (Teaumroong and Boonkerd, 1998). They inhabit the root nodules of most legumes which can provide enough nitrogen for their physiological needs (Cleyet et al., 1990). Each major legume is nodulated by different species of Rhizobium. Intensive farming practices that accomplish high yields need chemical fertilizers, which are not only costly but also create environmental problems (Rigby and Caceres, 2001). The extensive use of chemical fertilizers in agriculture is currently under debate due to environmental concern and fear for consumers' health. Consequently there has recently been a growing level of interest in environment friendly sustainable agricultural practices and organic farming systems which include the use of biofertilizers (Lee and Song, 2007). In the development and implementation of sustainable agriculture techniques, biofertilization is of major importance in decreasing environmental pollution and the conservation of nature (Ogutcu, 2008). This work focuses on the production of the rhizobium biofertilizer for seed inoculation for crop productivity for enhancement of livelihoods.

Biofertilizers

Biofertilizers are compounds that enrich the nutrient quality of the soil by using microorganisms that establish symbiotic relationships with the plants. They can also be defined as microbial inoculants which are artificially multiplied cultures of certain soil microorganisms that can improve crop productivity. They are low cost renewable sources of plant nutrients which supplement chemical fertilizers. Biofertilizers generate plant nutrients like nitrogen and phosphorus through their activities in the soil or rhizosphere and make them available to the plants on the soil. They contain living microorganisms which when applied to seed, plant surface, or soil colonize the rhizosphere or the interior of the plant and promote growth by increasing the supply or availability of primary nutrient to the host plant. Biofertilizers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphorus, and stimulating plant growth through the synthesis of growth promoting substances. They can be expected to reduce the use of chemical fertilizers and pesticides because they are environmentally friendly. The chemical fertilizers cause soil degradation and loss of soil fertility. Biofertilizers can promote plant growth and productivity and are alternative source of N-fertilizer. Bacteria known to stimulate plant growth include *Pseudomonas spp, Azospirillum spp, Bacillus spp* and *Rhizobium* (Yanni, 2001). Nitrogen fixation and plant growth promotion by these rhizobacteria are important criteria for an effective biofertilizer.

Rhizobium

Rhizobium is a gram –negative bacterium which inhabits the root nodules of most leguminous crops. They are soil bacteria that fix N_2 after establishing inside root nodules of legumes. They have a unique ability to infect root hairs of legumes and induce effective N_2- fixing nodules in the roots. They are motile aerobic nonspore formers. The Rhizobia complex consists of species of *Rhizobium*, *Bradyrhizobium*, *Azorhizobium*, *Sinorhizobium* and *Allorhizobium*. They form intimate symbiotic relationships with legumes by responding chemotactically to flavonoid

molecules released as signals by the legume host. These plant compounds induce the expression of nodulation (nod) genes in rhizobia which in turn produce signals that trigger mitotic cell division in roots leading to nodule formation (Matiru and Dakora, 2004). Although rhizobia naturally infect legumes as host plants, some Rhizobium stains can form symbiotic relationships with non-legume species such as *parasponia* (Trinick, 1979).

Carrier material for biofertilizers

Most of the bacteria included in biofertilizer have close relationship with plant roots. *Rhizobium* has symbiotic interaction with legume roots, and rhizobacteria inhabit on root surface or in rhizosphere soil. To achieve the successful inoculation of *Rhizobium* or rhizobacteria, large population of the bacterial strain must be placed close to the emerging root, so that the majority of nodules are formed by the inoculated rhizobial strain, and that the inoculated rhizobacterial strain occupies the rhizosphere as major member of rhizobacteria. If the population is not large enough, the native rhizobia / rhizobacteria will occupy most of the root nodules / rhizosphere, leading to unsatisfactory effect of inoculation. The most common way of inoculation is "seed inoculation" in which the inoculant (bacteria-carrier mixture) is mixed with water to make slurry-form, and then mixed with seeds. In this case, the carrier must be a form of fine powder. To achieve the tight coating of inoculant on seed surface, use of adhesive, such as gum arabic, methylethylcellulose, sucrose solutions, and vegetable oils, is recommended. Any locally available sticky material, which is non-toxic to bacteria and seeds, can be used as adhesive. Seed inoculation may not always be successful, i.e. the inoculation may result in low nodule occupancy of the inoculated rhizobial strain, or low establishment of the inoculated rhizobacterial strain. This might be due to low population and/or low survival of the inoculated bacterial strain on the seed surface and in the soil. In such instance, "soil inoculation" will be adopted, whereby a large population of a bacterial strain can be introduced into the soil. For soil inoculation in general, granular inoculant is placed into the furrow under or alongside the seed. This enhances the chance for the inoculated strain to be in contact with plant roots.

Various types of material are used as carrier for seed or soil inoculation. For preparation of seed inoculant, the carrier material is milled to fine powder with particle size of 10 -40 μm. the properties of a good carrier material for seed inoculation are: (1) non-toxic to inoculant bacterial strain, (2) good moisture absorption capacity, (3) easy to process and free of lump-forming materials, (4) easy to sterilize by autoclaving or gamma-irradiation, (5) available in adequate amounts, (6) inexpensive, (7) good adhesion to seeds, (8) good pH buffering capacity and (9) non-toxic to the plant.

Other essential criteria for carrier selection relating to survival of the inoculant bacteria should be considered. (1) Survival of the inoculant bacteria on seed. Seeds are not always sown immediately after seed coating with the inoculant bacteria. The bacteria have to survive on seed surface against drying condition until placed into soil. (2) Survival of the inoculant bacteria during the storage period. (3) Survival of the inoculant bacteria in soil. After being introduced into the soil, the inoculant bacteria have to compete with native soil microorganisms for the nutrient and habitable niche, and have to survive against grazing protozoa. Such carrier materials that offer the available nutrient and/or habitable micro-pore to the inoculant bacteria will be desirable. In this sense, materials with micro-porous structure, such as soil aggregate and charcoal, will be good carriers for soil inoculant.

Statement of the Problem

Over the years, chemical fertilizers have been used in agriculture. The agrochemicals have dominated the market with only a slice of agrobiologicals. Farmers were happy of getting increased yield in the beginning, but slowly chemical fertilizers started displaying their ill effects

such as- Polluting water basins, destroying microorganisms and friendly insects, increased crop susceptibility to disease attack and reducing soil fertility. Biofertilizers which form a microbial green revolution increase the yield without causing the damage associated with chemical fertilizers. Microbes are the next major platform in agriculture that will drive yield and productivity beyond the seed itself. They are not a replacement of other fertilizers but can supplement their requirements. Use of biofertilizers is one of the important components in integrated nutrient management. They sustain soil health/are environmentally friendly as opposed to chemical pollutants, No adverse effect on plant growth and soil fertility, are renewable source of nutrients, decompose plant residues and stabilize C:N ratio of soil, they increase crop yields by 10-40%, stimulate production of plant growth hormones and are cost effective.

Objective

Develop a biofertilizer of *Rhizobium* bacteria for seed and soil inoculation to promote crop productivity and enhance livelihoods.

Methodology

i) Isolation

Uproot legume plants from the soil carefully and wash off the roots without detaching from nodules, Surface sterilize the nodules by immersion in 95% ethanol for 3 seconds and rinse in sterile water, Crush the sterilized nodules in a drop of sterilized water using a sterile glass rod, Streak a loopful of the suspension on the surface of a petri-plate containing Yeast extract mannitol agar (YEMA) and incubate for 3-7 days at 30°C

Culture of *Rhizobium* on agar plate

ii) Seed inoculation

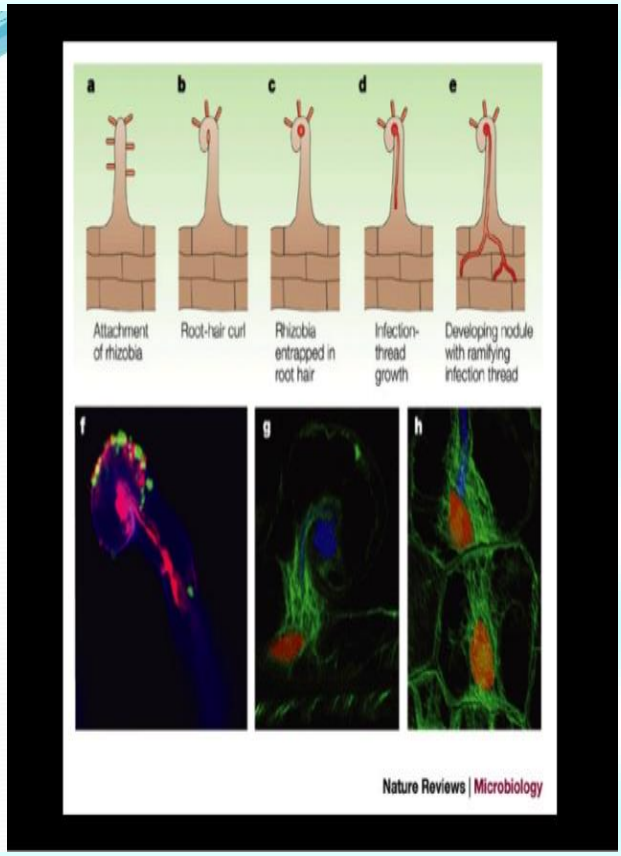
The biofertilizer is prepared as carrier-based inoculants. Incorporation of the bacteria in carrier material (e.g. charcoal powder, farm yard manure) enables easy handling, long term storage and high effectiveness. The bacteria-carrier mixture (inoculant) is mixed with water to make slurry-form and then mixed with seeds. For tight coating of inoculant on seed surface, use of adhesive e.g. sucrose solution, gum arabic, vegetable oils is recommended

Boil about 50g of sugar for 15min and add gum arabic (200g) and cool to form a sticker solution
Mix the solution with the Rhizobial culture in Yeast extract mannitol broth to form inoculum slurry. Mix the slurry with seeds properly. Dry the coated seeds under shade while keeping them covered. Sow in the field.

Sterilization

Sterilization of carrier material is essential to keep high number of inoculant bacteria on carrier for long storage period. Gamma-irradiation is the most suitable way of carrier sterilization, because the sterilization process makes almost no change in physical and chemical properties of the material. Another way of carrier sterilization is autoclaving. Carrier material is packed in partially opened, thin-walled polypropylene bags and autoclaved for 60 min at 121 ºC. It should be noted that during autoclaving, some materials changes their properties and produce toxic substance to some bacterial strains.

Roots with nodules



The root infection process

Commercial production of Rhizobium

- Sterilize growth medium and inoculate with broth of mother culture prepared in advance (starter culture)
- Incubate for 3-4 days at 30-32^{o}c
- Test for purity and transfer to a large fermenter fitted with temperature control and aeration device
- Allow aerobic fermentation for 4-9 days
- Blend the broth with sterile carrier e.g. charcoal powder
- Pack the culture in polythene bags and store at 4^{o}c or supply to the farmers.

Recommendation and future prospect

There is need to produce and upscale commercial production of microbial inoculants that can act as supplements to chemicals already on the market due to their eco-friendly nature and cost effectiveness. A gradual and modest increase in the use of microbial inoculants is to be expected for both greenhouse and farm crops

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Cash Flow

SN	EXPENDITURE/ITEM	COST
1	Media 500g	6,000
2	Charcoal powder 100kg	1,500
3	Pack of Polythene bags	300
4	Inoculum isolation	400
	PROPOSED SALE/PRICE	**COST**
1	1kg of carrier based inoculum material	@ 93 (93×100kg)= 9,300

COMMENTS:

The presentation was well done, but there was lack of originality. All that wok has been done and experimented elsewhere. Why produce them and they are available in the indigenous plant.

Biological Control of Tomato Bacterial Wilt Caused by *R. solanacearum* Using *B. subtilis* in Coated Seeds

By Samuel Odhiambo Juma, Reg. No. EB2/12076/13, Department of Biological Science, Faculty of Science, Engineering and Technology, Chuka University, BSc in Botany, P. O. Box 109-60400, Chuka

Declaration

Abstract

R. solanacearum is the most persistent devastating tomato pathogen which is responsible for the tomato wilt. It has been the most causal agent of a lethal bacterial wilt disease in more than 200 massive losses in tomato production both for domestic and commercial worldwide due to its wide host range and broad geographic distribution. *R. solanacearum* is a soil borne, waterborne disease which lives in the soil as a saprophyte. The bacterium attaches to the root of the tomato immediately after germination and then colonizes inside it. After which it invades the xylem as route .The disease is difficult to control with chemicals and cultural practices. It is because of this that many plant pathologists have really employed much of their efforts to develop biological control to this pathogen, by use of *B. subtilis* bacteria being the most used antagonist to *R. solanacearum*. This proposed project will therefore work diligently on how this antagonist bacteria *B. subtilis* would be isolated packaged and disseminated to the tomato farmers. Pure cultures of both bacteria will be obtained from JKUAT Department of Horticulture and will be inoculated to tomato seeds then will be sowed in prepared plots in the greenhouse of the Chuka University as discuss in the chapter 3 of this assay. Since the *R. solanacearum* is a soilborne bacterium and is present in the soil and other wild varieties as its source of inoculums, inoculated seeds will be ideal seeds for tomato farmers who do not have finances to hire soil analysts and to buy chemicals which are no longer effective bacterial wilt.

Introduction

Background Information

Botanically, tomatoes are berry fruit-fleshly without stone produced from a single flower containing one ovary. Tomato plant is edible fruit of *Solarium lycopersicum* which belong to the nightshade family, solanaceae. This species is widely distributed across the globe from its origin in Central and South America. In temperate climates and cooler area allows its production throughout the year. Tomato is a perennial in its native habitat, however grows as an annual in temperate climates. It can grow to a height of 1-3meters with weak stems that can sprawls over the ground and vines over other plants and objects. [1]Tomato is used in various ways, including being used as ingredient in many dishes, sauces, salads, and drinks and also consumed raw. Tomato grows well in sandy loam soil with well-drained clay subsoil and at pH 6.0 to 7.0 and optimum temperatures are required at different levels of its growth with a successful rainfall [2].

These conditions favour the existence of *Ralstonia solanacearum* bacteria which is anaerobic non spore forming, Gram-negative, plant pathogenic bacteria which is a soil borne and motile with a polar flagella tuft. It colonies the xylem of the tomato plant causing the bacterial wilt which is one of the devastating diseases proved by the Erwin Frink Smith.[3] The pathogen has a wide host range species from tomato representing 44 families [4] and other susceptible crops are potato, eggplant, chilli bell pepper and peanut. The disease has limited the level of production [5] However, the persistence of *B. subtilis* bacteria in avocado roots was studied by F. M Cazorla [6] The *B. subtilis* is non-pathogenic bacteria which can be used to control the Bacterial wilt caused

by *R. solanacearum*. It is Gran-positive bacterium that secretes numerous enzymes to degrade a variety of substrates enabling the bacteria to survive in a continuously changing environment.

Statement of the Problem

Bacterial wilt in tomato plant caused by the *R. solanacearum* which has evolved resistance genes to both commercial chemicals and cultural practices has been a devastating pathogen to tomato farmers across the globe [7] and therefore a special attention should be taken especially in the bio-control to manage this disease. In addition to this as farmers try hard to use more chemicals which are ineffective this not only results to environmental pollution but it also hazard to soil beneficial microorganisms and humans.

Objectives

Testing the efficacy of the bacteria *(B. subtilis)* in reducing bacteria wilt of tomato caused by *R. solanacearum*

Hypothesis

Isolated *B. subtilis* cannot reduce bacterial wilt of tomatoes

Significance and impact of the study

The proposed project will provide a better way of controlling the *R. solanacearum* which has been lethal pathogen to tomato plant resulting to great loses both at domestic and commercial level of production.[7] Since it has proved its resistance to both chemical and cultural practices, my main aim will be to employ bio-control by isolating its antagonistic bacteria *B. subtilis* from the environment and inoculate it to tomato seeds and sow the seeds in an infested soil with *R. solanacearum* bacteria and record the growth behavior of tomato. This will therefore be environmental friendly and increase the tomato production.

Literature Review

Introduction to bacterial wilt in tomato plant

Bacterial wilt in tomato plant is majorly caused by *R. solanacearum* bacteria either race1 or 3, has been economically significant soil borne and waterborne plant pathogen. It's also diseases to other solanaceous plants. The disease is known to occur in the wet tropics, subtropics and some temperate regions of the world [8] The research shows that the pathogen affects more than 200 plant species in over 50 families throughout the world, including a wide range of susceptible crops plants, ornamentals and weeds such as eggplant, pepper, potato, tobacco, chili, bell peanut.[4] Bacteria have a wide host range representing 44 families. [4] The pathogen has not only limited the domestic level of production but as well limit commercial level of production. The disease is difficult to control with chemicals and cultural practices. [7]

Symptoms and Signs

According to the research, [7] the early stages of disease the first visible symptoms of bacterial wilt are usually seen on the foliage of plant. Symptoms include wilting of the youngest leaves at the end of the branches during the hottest part of the day. Only one or half a leaflet may wilt and plants may appear to recover at night when the temperatures are cooler. In young tomato stems, infected vascular bundles may become visible as long, narrow dark brown streaks which make them weak and younger leaves of the plant become flaccid and adventitious roots may appear on stems. The vascular system exhibits a progressively darker brown color as the disease progress.

***R. Solanacearum* gaining resistance to chemicals and cultural practices**

Most effort and resources have been put forward in the control of *R. Solanacearum* in the tomato production. However, the pathogen has evolved to become virulent and resistances to

commercial chemicals such as enrich BM [9] only the phosphorus acid salt, no other pesticide available for the control of the disease which may be under long use would definitely alter the soil pH, affecting the role of the other beneficial soil micro-organisms. The pathogen could be gaining its resistance since most of its strains are competent for genetic transformation.

Natural Genetic transformation is a sexual process involving DNA transfer from one bacteria cell to another through the intervening medium and the integration of the donor sequence into the recipient genome by homologous recombination, *R. Solanacearum* is able to exchange large DNA fragments ranging from 30-90 thousand bases. And it has the genes for all six protein secretion pathogen that have been characterized in Gram-negative bacteria.[10]

R. Solanacearum has also proved its resistance to cultural practices in its control, due to its wide varieties and due to the fact that its soil borne, waterborne pathogen, cultural practices has limited effect on its life circle in plant debris, diseased plants, wild hosts, seeds or vegetative organs like tubers and can survive for a long time in water up to 40 years at 20-25^{o} C.[3]. There seems to be a shift to the idea that biological control can have an important role in the management of bacterial wilt. [11]Biological control strategies may either be applied in the alternative management measures or be integrated with other practices for effective diseases management at the field level. Biological control not only suppresses the disease and increases the crop yield but will be important in preventing the environmental pollution due to pesticides.

Current and prospective bio-control for *R. Solanacearum* in tomato

Several prospective bio-controls have been developed to control the pathogen since the chemical and cultural practices have seemed to be ineffective and useless in the control of the devastating pathogen. Some of the work includes, "Development of Biological control of *R. solanacearum* through antagonistic microbial population" research done by MYINTLWIN in Asian institute of technology. However the research did not show the exact microbial that is responsible for the efficacy of the bio-control [12].

According to Environment microbial 2013 research show that the *Bacillus subtilis* isolated from the natural environment is one of the bio-control of tomato wilt disease depends on conserved gene immediately biofilm formation. The research indicates that *Bacillus subtilis* and other Bacilli have long been used as biological control agents against plant bacterial disease but the mechanisms by which the bacteria confer protection are not well understood. This research managed to identify the bacteria but did not show how the bacteria can be packaged and disseminated to the tomato farmers [6].

Materials and Methods

Major materials

- *Bacillus subtilis* bacteria
- *Ralstonia solanacearum* bacteria
- Tomato seeds
- Tomato seedlings(cultured in the lab)
- Buckets/Plastic bags large enough for planting the seeds
- Garden soil

Both pure cultures of *B. subtilis* and *R. solanacearum* will be obtained from JKUAT department of Horticulture in the CPG agar media. Tomato seeds will be purchased from VET AND AGRONOMIC LTD Nairobi Kenya, griffaton producer grainier France, RIO GRANDE VF. 12

plastic bags will be bought from the nearby supermarket and the garden soil will be obtained from the University garden and sterile before use.

Materials sterilization

The plastic bags will be sterilized in the autoclave by subjecting them to high-pressure saturated steam at 121^{o}C for 15-20 minutes [13]. Soil will be sterilized by container steaming, the collected soil from the garden will be put in the sterilized bags up to height of 70cm then will be subjected to the steam via manifolds for 1 -1.5h as the soil is turn to improve steaming results [14].

Plot setting and soil infestation with *R. solanacearum*

Randomized complete block design will be applied in setting up the plots in the university greenhouse, where three blocks will be used and in each block four plastic bags with sterilized soil will be set at random for both control and experiment. Plate containing the *R. solanacearum* will be washed gently with distilled water and the solution mixed with the two experimental soils in the plastic bags. And for the controls they will not receive *R. solanacearum.*

Seed inoculation by *B. subtilis*

Tomato seeds will be coated with *B. subtilis* isolated in the CPG agar media by Deeping seeds in bacteria in the media overnight for attachment of bacteria to the seeds in Chuka University Botany laboratory .The inoculated seeds will be sowed in the prepared plots soon after the inoculation.

Sowing of the seeds

All seeds will be sowed at a depth of 1.5cm and will be watered regularly from the bottom. This will be done by making 1.5cm holes in the soil in the bags using a sterilized glass rod, placing the seeds in the holes and cover them with a light soil using fingers. Out of the four bags of soil, one will serve as the control and therefore will not receive any treatment (uncoated seed sowed in a normal garden soil), second bag will serve as the experiment and will receive treatment (coated seed with *B .subtilis* in soil with *R. solanacearum*), third bag will also serve as the experiment and will receive treatment (coated seed sowed in soil without *R. solanacearum*) and the fourth bag will serve as the experiment and will receive treatment (uncoated seeds sowed in soil with *R. solanacearum*)

Projection evaluation and analysis

The proposed project will run for 1 month, since tomato plant takes only 5-6 days to germinate at temperatures around 80^{o}C [15] after which the plants should be uprooted and subjected for examination of the tomato vascular wilt in the xylem and also the *R. Solanacearum* bacteria counts in all the plants that will be affected *R. solanacearum*. During the project the following will be observed for data generation at every 3 days for 4 weeks after seeds' germination:

- Symptoms of bacterial wilt
- Plants height as they grow
- Number of leaves
- Dry mass
- Quantify the bacteria in mid stems in plants
- Observe how *B. subtilis* affect *R. solanacearum*

At the end of data collection, ANOVA will be used for statistical data analysis.

Marketability

The improved tomato seeds will be ideal seeds for tomato farmers across the world, further more farmers who do not have finances to buy soil analysts for the presences of the *R. Solanacearum*

bacteria in the soil. The seed will be on high demand by the tomato producers as it lowers the cost of production by saving the money that could have been used to buy chemicals which are in-effective to bacterial wilt. Inoculation can be done through Kenya Seed Company and will be a source of employment for plant pathologist and biotechnologist. Therefore the project will be of great significance to many people and the country as it will improve the country's economy.

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Steam as an alternative to methyl bromide in nursery crops

How to grow your own tomatoes. Modern farmers by Brian Barth on 3/12/2015.

PCR Identification of Aroma, Blast Resistance, Kernel Length and Yield Genes in Pishori Rice Grown in Kenya

By D. Aloo, L. Tanui, Dr. J. Njiru and Dr. S. Kiruki, Department of Biological sciences, P. O. Box 109-60400, Chuka

Introduction

Rice (*Oryza sativa*) is one of the most consumed cereals in the world. It belongs to the grass family. In Kenya, it is the third staple food crop. About 40,000 varieties have been reported worldwide. It ensures food security, creates employment and opportunities for private investment, thus improving livelihoods of people in both rural and urban areas. In Kenya, about 80% of rice is cultivated by irrigation and rain-fed (20%).

Varieties: through irrigation are basmati (pishori) and sindano; in rain-fed ecosystems include NERICA and Dourado Precose. Pishori(basmati) is a special type of aromatic rice with long slender grains, high cooked kernel volume, less sticky soft fluffy texture after cooking.

Challenges: diseases such as blast, counterfeit/adulterated products, quality and quantity. Pishori rice or basmati, is long slender-grained aromatic rice with good yield, tolerance to diseases.

Aroma: The Badh2 gene for expression of aroma is located on chromosome 8, which encodes an enzyme called betaine aldehyde dehydrogenase homologue which regulates production 2-acetyl-1-pyrroline, a principle compound responsible for aroma in rice.

Blast disease: -fungal pathogen known as *Magnaporthe oryzae*. An important way of controlling the disease is to identify and map the blast resistance genes in blast resistance varieties, isolate them then incorporate in blast susceptible rice cultivars (Kovach et al.,2009; Bourgis et al.,2008; Khush and Jena, 2009; Lieu *et al.*, 2010).

Statement of the Problem

Rice is an important cereal consumed in the Kenya -third from maize and wheat. Pishori rice is widely grown and preferred. However, this species faces many challenges ranging from diseases, counterfeit/adulterated products. Pollination-high genetic modification of the parent rice and it will cause loss of best characteristics which market pishori rice. There is need to preserve good genetic characteristics.

Objectives

- To develop a molecular based protocol for identification of pishori rice from counterfeit and non-pishori rice.
- To identify aroma, blast resistance, kernel length, kernel weight, and yield genes of pishori rice.

Justification

- Increasing human population and drought poses food insecurity threat
- Need to preserve/promote good genetic characteristics that will lead to high yield in rice

Materials and Methods

Study site

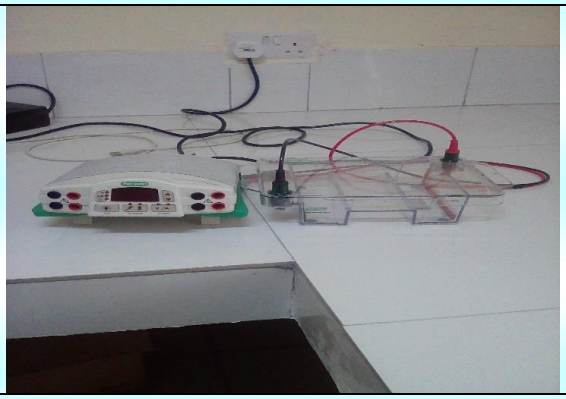
Carried out at KEBS, Molecular and GMO laboratory

Source of Reagents and Rice

Mwea, Kenya. Non-pishori rice sample variety was bought from the market. The reagents used were availed by the KEBS.

Experimental Protocol

- CTAB Method
- Promega kit
- Agarose gel electrophoresis



PCR analysis

- The multiplex PCR was performed.
- PCR mastermix was prepared with five primers(aroma, yield, blast resistance, kernel length, kernel weight).
- The PCR system was set up with rice DNA templates for 35 cycles.

Visualization of the PCR products

- Agarose gel electrophoresis (2.0%)
- UV Transilluminator

(McChouch et al., 2002)

Primers used

1. RMI6-***Kernel length*** (R-5`AACACAGCAGGTACGCGC3`; F-5`CGCTAGGGCAGCATCTAAA3`)
2. RM261-***Yield*** (R-5`TGTACCATCGCCAAATCTCC3` F-5`CTCTTCTCCCCTTGTGTGTCG3`)
3. RM459-***Kernel weight*** (R-5`CACTTTCTCTGCAGCACCAC3' `F-5`CTGCAATGCTGCATGACC3)
4. RM22-**Aroma**, (R-5`CTGGGCTTCTTTCACTCGTC3', F-5`GGTTTGGGAGCCCATAATCT3`)
5. RM168-**Blast Rest** R-5`GAAACGAATCAATCCACGGC3`; F-5`TGCTGCTTGCCTGCTTCCTTT3'

(Chakraboty et al., 2016; Zhu Y et al., 2012)

Experimental Protocol

- CTAB buffer concentrations
- RICE 10% & 2% CTAB

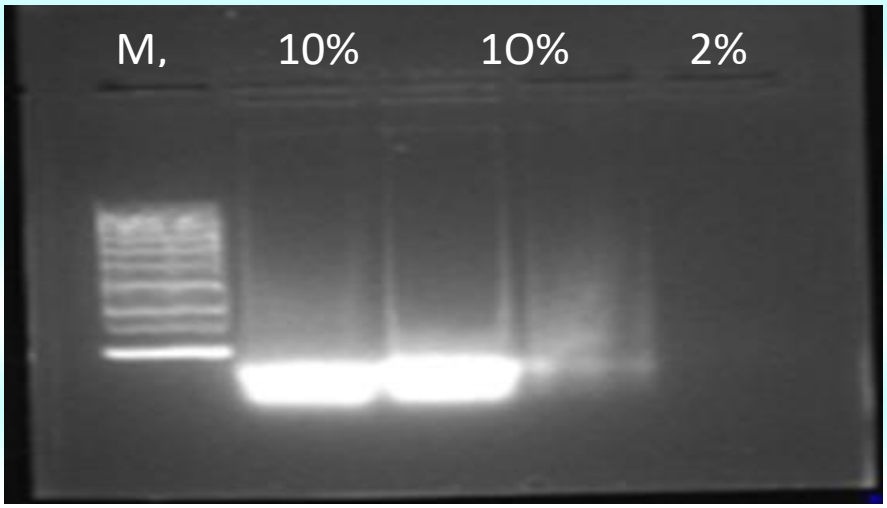
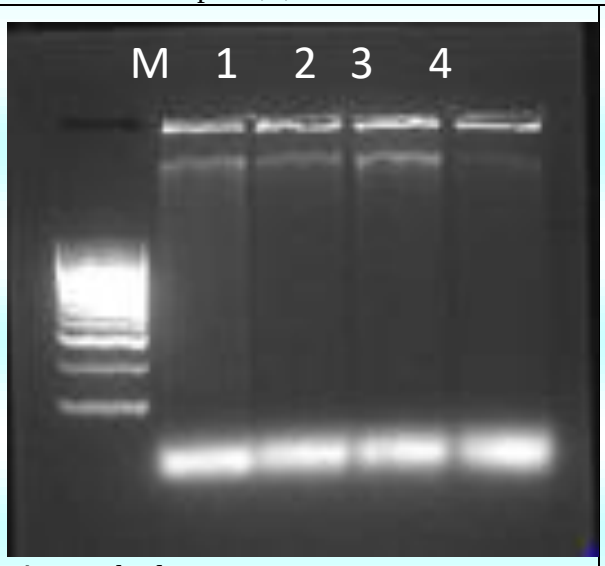
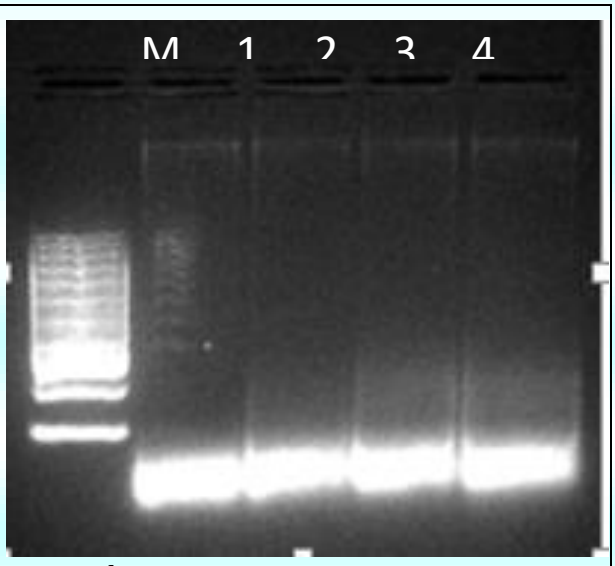


Fig. 1: Agarose gel electrophoresis results for the extraction of genomic rice DNA using 10% and 2% CTAB concentration

Pishori Rice Sample 1,2,3 &4-



CTAB method



Promega kit

PCR Analysis

SSR markers for pishori rice

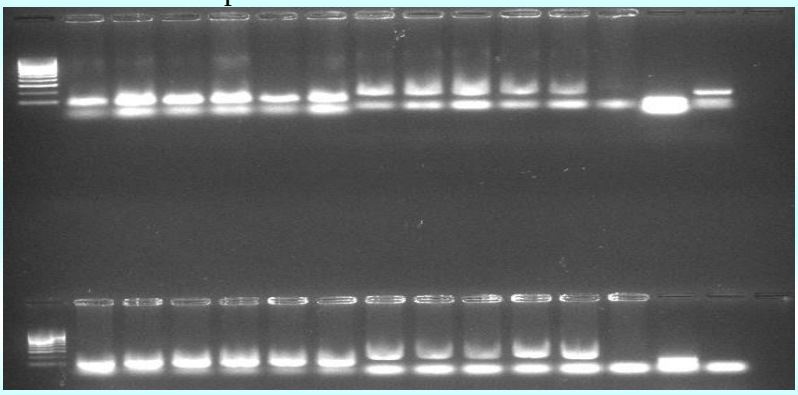


Fig. 4: Agarose gel electrophoresis results for PCR analysis for simple sequence repeats markers in pishori rice

PCR PISHORI (Specific primers)

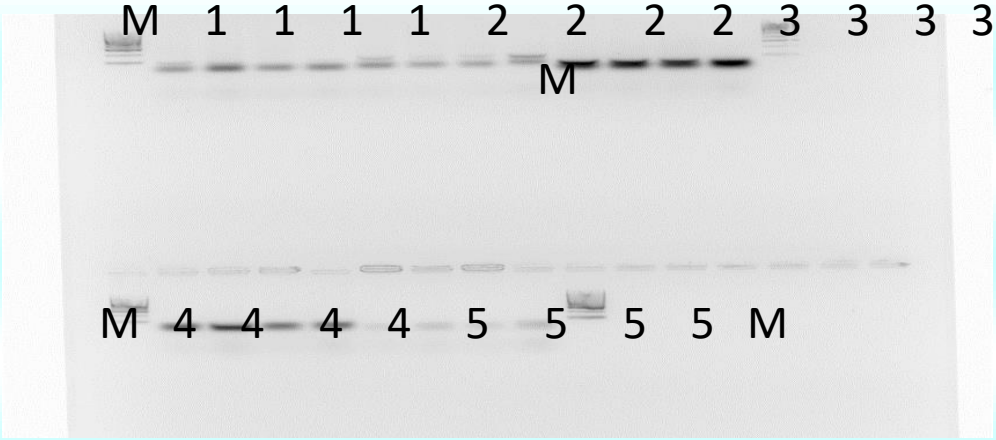
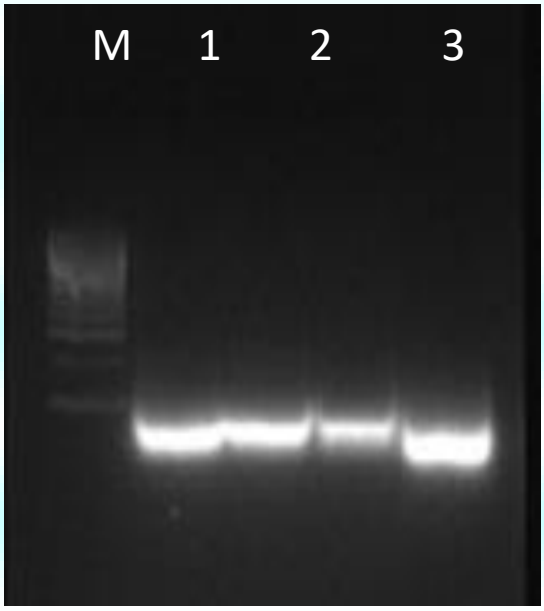
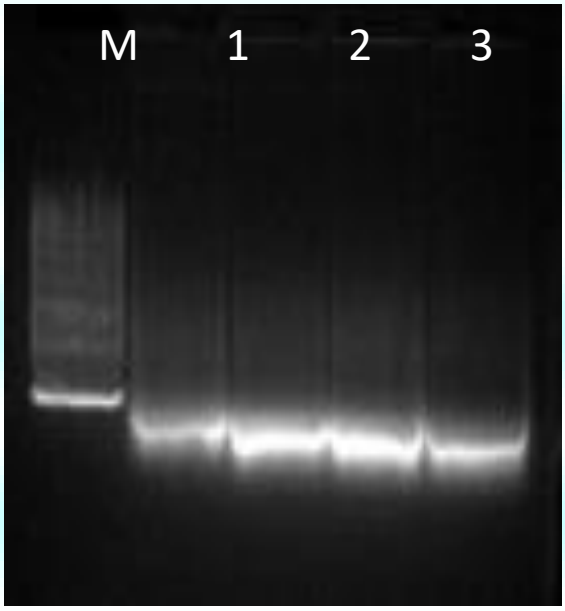


Fig. 5: (M-ladder, 1-kernel length, 2-yield 3-aroma, 4-blast, 5-weight). Agarose gel electrophoresis results for PCR analysis of the kernel length, aroma, blast resistance, kernel weight and yield genes in pishori rice.

Non-Pishori rice sample 1,2,3&4



CTAB method



Promega kit

Fig. 6: Agarose gel electrophoresis results for extraction of non-pishori rice DNA using CTAB and wizard magnetic DNA purification system (promega kit)

PCR-NON-PISHORI RICE

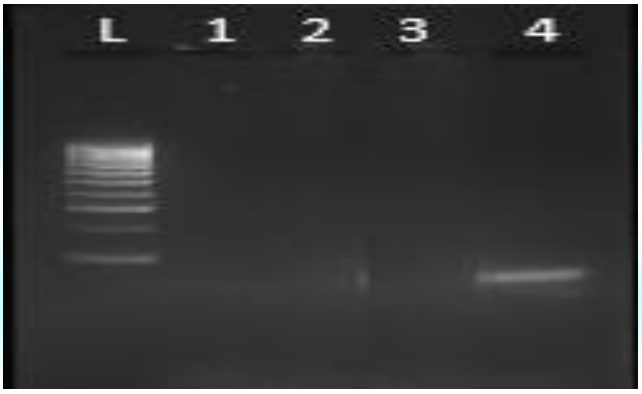


Fig. 7: (L-ladder, 1-aroma, 2-blast, 3-kernel length, 4-yield). Agarose gel electrophoresis results of PCR analysis for the kernel length, aroma, blast resistance genes in non-pishori rice.

Conclusion and Recommendations

CTAB method was the best method for Pishori rice DNA extraction. Pishori rice expressed genes for aroma, blast resistance, kernel length and high yield. Non-pishori rice did not express genes for aroma, blast resistance and kernel length. However, the gene associated with yield was expressed but the intensity was low.

Aroma and blast resistance genes to be sequenced and cloned to improve yield in non-pishori rice. PCR based technique should be used to identify genuine Pishori rice.

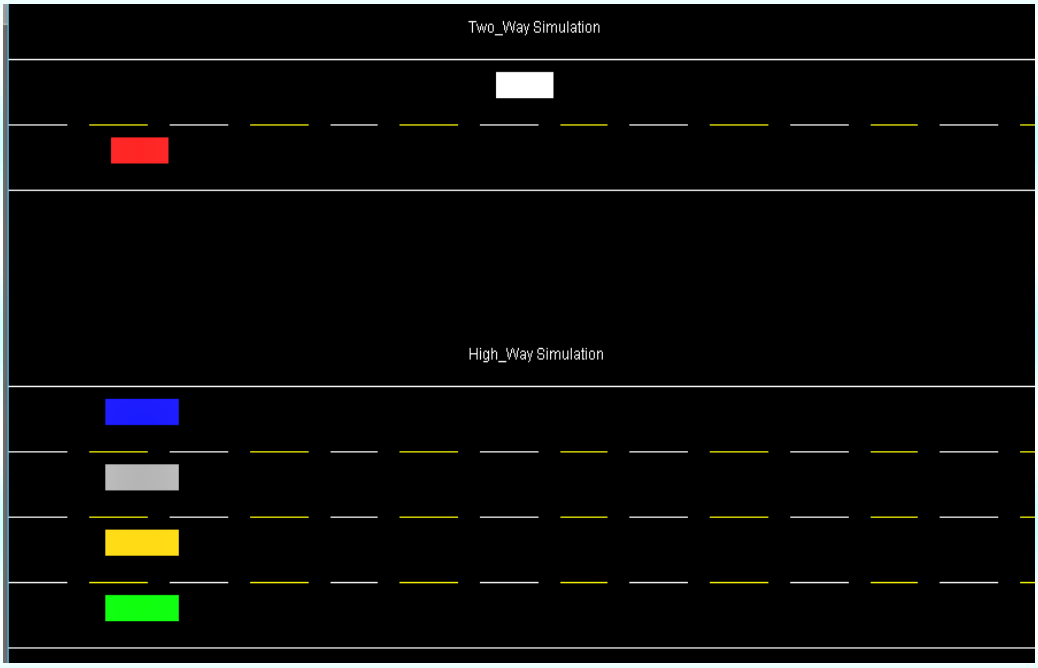
Acknowledgement

KEBS, CU, DPHSC, Supervisors, God

Automobile Collision Advisory Simulation

by Vincent Ososi Oisebe, Simon Makuno and Joram Murage, Department of Computer Science, Chuka University, P. O. Box 109-60400, Chuka

Abstract
After doing our survey, observations and also interviewing by seeking facts from people we observed that due to human (driver) decision in overtaking is a very critical move to life of the passengers and even pedestrians thus we come up with this Automobile Collision Advisory Simulation to assist the vast car manufacturing companies to incorporate such a decision making software that will enhance the critical decision making by drivers in overtaking scenarios.



***Automobile Collision Advisory Simulation*:** Overtaking Simulation

Declaration and Signing
The project has never been presented before at any forum or transmitted by any means and therefore it was our idea to come up with this project.
VINCENT OSOSI OISEBE, EB3/17613/14
SIMON MAKUNO NJENGA, EB3/17571/14
JORAM MURAGE WAMBUGU, EB3/17561/14

Acknowledgement
I take this opportunity to thank our committed administration for the support it gave us and also the department of computer science as a whole which made this project successful to the level that it has reached.

Introduction
We developed the **Automobile Collision Advisory Simulation** due to frequent travelling of day to day activities using vehicles by different people and this exposes them to accidents that may be caused due to critical decision making of driver during an overtaking scenario.

Automobile Collision Advisory Simulation is a simulation that tries to mimic the real world in relation to what driver's do that leads to accidents and tries to give a solution to what the vast

Automobile Companies can incorporate to avoid such decisions that leads to a large number of loss of life on roads in our society.

Originality
Due to the great interest to the field of technology in Aviation Industry we were inspired by the **Air Collision Advisory System** in Airplanes that avoids collision to come up with this **Automobile Collision Advisory Simulation** that can be used in the field of Automobiles to give advisory to drivers in critical scenarios of overtaking. Thus will lead to reduction of accidents in our roads hence save lots of life?

Objectives
There various objectives of the **Automobile Collision Advisory Simulation.**

- ✓ To simulate the real world driver decision making and provide a solution.
- ✓ To give the automobile industry to some of the prevention measures of accidents

Avoidance

- ✓ To save on life's lost on our roads due to critical attempts made by drivers on our roads.
- ✓ To give advisory to drivers on when or not to overtake.

Justification
We take the chance to say that by the automobile industry using the idea show caused by the **Automobile Collision Advisory Simulation** sure that we will be able to save a lot of life's that we lose on our roads due to decision made by drivers.

Assumption
We have assumed that **Automobile Collision Advisory Simulation** has simulated the real world by the use of objects that have been programmed to act like cars on a road that is two way and highway simulation. The simulation will give an example of an advisory.

Precaution
In order to run the simulation you have to have a well installed IDE (Integrated Development Environment) like IntelliJ Idea, NetBeans or Eclipse and JDK (Java Development Kit).

Pros

a) To simulate an alert to drivers.
b) Save life lost in accidents.
c) To give the automobile industry a solution to prevent accidents.
d) To give a location of the accidents place.

Cons: If the system is hacked it may lead to variation of information shared by Vehicle to Vehicle (V2V) thus leading to wrong advisory to the driver.

Literature Review
We wondered how to coup down the vast number of accidents that happen in our roads in a day to day routine so we thought of coming up with the Simulation that will act or simulate the real world road architecture and try to give solutions to the Automobile industry.
Us being in the field of technology and the little learning we have gathered in our studies we were able to batch up our ideas to come up with such an idea. The Simulation has been programmed by the java programming language with help of the Eclipse IDE.

So far due to our observation todays cars have the V2V technology that makes our idea even more real to the Automobile Industry that is if they may use the idea to give an advisory to the drivers to either to proceed to overtake or not.

Methodology

A. Simulation Methodology

a) Apparatus
   i. Laptop or System Unit.
   ii. Eclipse IDE installed
   iii. Java Development Kit Installed
   iv. Graphics Card

b) Procedure
   In order to run the simulation one has to click the jar file on windows while in UNIX and Linux write the following command **./namefile.jar**

c) Explanation
   When the **.jar** file is run the **Automobile Collision Advisory Simulation** will run automatically as programmed.

d) Observation
   When the objects that are used in the simulation are almost colliding, an advisory or alert is given.
   Also when the collision has happened, the simulated objects stops moving and the system automatically contacts the relevant authorities in this case 911 in relation the location of the accidents

B. Actual Methodology

a) Apparatus
   i. HD Cameras
   ii. Motion Sensors
   iii. Power source
   iv. Car
   v. Internet Connectivity
   vi. Service Provider.

b) Procedure
   Install all the various hardware components that are to be used in the Car and are properly working.

c) Explanation
   During Car on motion the system will be analyzing the speed distance and obstacles around it, if an incoming car approaches at speed the system will give an advisory or alert to both the drivers in the cars and provide a solution basing on the data gathered on speed distance and surrounding obstacles.
   However if a collision occurs the system will contact the relevant authorities and also call 911 in our case and also warn other road users to prevent other accidents.

d) Cost

It is cost effective if funded by the government or other financial institutions.

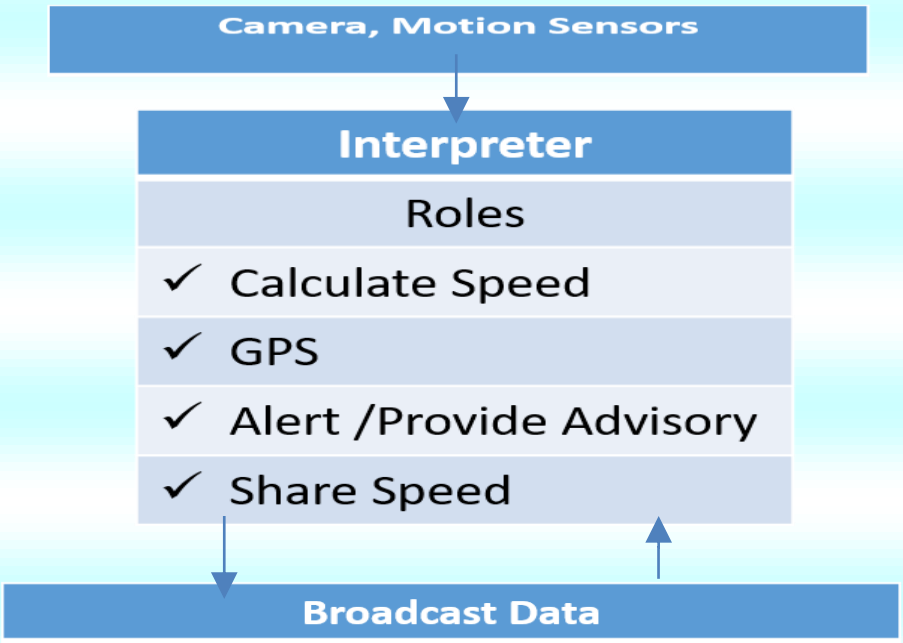
Data Analysis and Interpretation

Diagrammatic Representation

Interpretation

The camera (motion sensors) will feed the interpreter with the distance of incoming and front car. The Broadcast system in each different car will broadcast speed of each car to the others.

The Interpreter will use the distance and speed to calculate the results needed to be used for the advisory/alert. In case a collision/accident occurs the interpreter will use the broadcast system to broadcast the location using the GPS at the place of the accident and also inform the relevant authorities (Police, Nearest Hospital) for help.



Conclusion

In Conclusion **Automobile Collision Advisory Simulation** is an example of various simulation that will help in the advancement of the technology used in the industry of Automobile.

Recommendation

We recommend the automobile industry and the government to incorporate an advisory system that will assist in the critical decision making of overtaking by drivers in our roads. Thus this will help in coupling down the accidents that happen daily in our roads hence save lives.

References

The idea was driven from the technology used in Airplane that is the TCAS Collision Airborne System (https://en.wikipedia.org/wiki/Traffic_collision_avoidance_system).

Cost/Expenditure

Laptop 30,000/=. Specifications:

a) Dual Core and above
b) RAM 6GB
c) Storage 30MB
d) Graphics Card
e) Windows 7,8,8.1,10 Linux and Unix

Income

Not estimated

COMMENTS:

Need to clearly spell out the methodology. The budget needs a lot of work. Students to seek guidance from supervisors in relevant area. And do more interactive review on the study area.

3-D Design

by Maxwell Munene, EBS3/14570/13, Department of Computer Science, Faculty of Science, Engineering and Technology, Chuka University, P. O. Box 109-60400, Chuka

Declaration and Signing
This project has never been presented before the any forum or transmitted by any means and therefore it was my idea to come up with this project.
Name: Maxwell Munene
Registration Number: EBS3/14570/13
Date: 14/06/2017

Abstract
This design venture came because of the problem many people encounter when trying to figure out what to do when they want to landscape a home but without any clue of how to do it. I make use of the 3D Landscaping Architect software that is a trial version as at now.

Acknowledgement
I take this opportunity to thank our committed administration for the support it gave us and the department of computer science as a whole which made this project successful to the level that it has reached.

Introduction
I am a designer, I have been able to develop this design skill over time due to passion and talent and I have been able to successfully design a couple of projects for clients.

Originality
It is a learned skill and creativity that I have developed over time, say 5 years. I have been using the Realtime Landscape Architect trial version.

Relevance to SDGs
A tool to achieving the Sustainable development goal number 9, which is Industry, Innovation and Infrastructure, that aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Justification
I would like to say that, by there being a service like this; it bridges the gap of knowledge between an engineer and an individual with no technical knowledge. It is about placing the idea in your mind before you of you.

Budget

Requirement	**Budget**
Laptop	30,000/=
RAM 6GB	
Specifications	
Dual Core and above	
Storage 30MB	
Graphics Card	
Windows 7,8,8.1,10	
Full version of the software	($400) –KSH 40,000
TOTAL	**70,000**

Explanation

- When designing, I first get to the ground in question (field work)
- Take photos from different angles
- Take measurements of the same
- do sketch work on paper
- Do the actual design on the computer.

Conclusion

In conclusion, let us embrace these upcoming technologies and innovation within our reach, to make the world a better place.

References

1. Ayub muriuki Director vision growers agency; Tel: 0722877447
2. Wapendwa bookshop; Tel: 0722240372

COMMENTS:

The student should be guided on copyright. Good work that may be copied-stolen. Good idea but student should be properly & adequately supervised by qualified staff

Proposal for Secure Electronic Voting System for Chuka University

by Hillary Kinyua & Samson Mwanzia Muthiani, Department of Computer Science, P. O. Box 109-60400, Chuka

Introduction

We present a new electronic voting system that employs the use of web technology along with cryptographic techniques to obtain verifiable results while still retaining voter's privacy. There is a need to update voting technologies to improve trust, reliability, and convenience. We introduce a novel system for electronic voting. This system ensures that encrypted votes are reliably counted, saves time that could instead be used to manually count those votes, while still ensuring voter's privacy. The primary way that students cast their ballots is by using the manual voting method by posting their ballots into the ballot boxes through different Faculties. We designed our system through the following criteria in mind:

- **Privacy** - Keeping an individual data secret.
- **Eligibility** - allowing only registered voters to vote only once.
- **Receipt-freeness** - Voters should not prove to a third party who they voted for.
- **Convenience** – Voters must be able to vote easily, and every student who is eligible should be able to vote.

Current Voting System

There are many different ways to vote today. We will therefore discuss some of the drawbacks to traditional voting and discuss how these may or may not appear in our system.

Paper Ballots

Paper ballots are used for voting. Paper ballots are usually marked and the tallied by human or a machine. Paper ballots come at a much cheaper cost than electronic systems. They also reduce the attack surface on an election by removing the possibility of a software/hardware attack. Paper ballots rely on physical security and trust in the polling stations to not manipulate them and to properly handle them.

Our Solution

The system will be using a database server to store every candidate's details and every user's details and will be running online. Every student's vote shall be tallied automatically after when the user finishes voting for the last candidate. The results can then be viewed by anyone who wants to know the winner or loser. The system shows the total number of votes that the user has scored by the end of the day. It allows voters to check to see how their vote is being tallied while still providing receipt-freeness to the contents of their vote. The good thing with this system is that many people can be voting using the same system at the same time and therefore reducing time that could be wasted while standing waiting for other voters to vote. The other advantage of the system is that it increases trust to the user. The system is also very much reliable.

Conclusion and Future Work

Our proposal satisfies privacy and the ability to check votes, reducing paper works, voting for a short while, and having a better guide to assist the user throughout the whole process. We use the database as a ledger to record that a vote has been cast. We also use cryptographic primitives to ensure the votes remain private and are tallied correctly.

Budget

A Laptop (2 gb ram)/mobile phone. Mysql server database (Downloadable). Internet connection.

COMMENTS:

How original is the method. Not able to express ideas clearly.

Design of Automated Street Lights

By Morris Mukiri Gitari and Charles Kinyua Gitonga, Department of Computer Science, Chuka University, P. O. Box 109-Chuka

Summary

Automated Street Light Management System (ASLMS) is an embedded application that enables an individual to switch lights on and off with the use of short messages (sms) from a mobile phone. Over the years, counties and local councils have been installing street lights in various towns and streets. This lighting system is supposed to enhance security and promote business and economic growth of such towns. Nevertheless, most council leaves the lights permanently on during daytime. This leads to huge consummation of power straining the national grid, which in turn leads to high bills to be paid from council taxes. This is a waste of resources and against prudent utilization of resources. ASLMS enables one to switch on/off lighting system through sms at low cost. This can be applied to a homestead security lights enabling one to control lights from his/her phone. The project was developed in line with the country goal of proper utilization of resources.

Introduction

The automated street light system uses light sensors to turn on and off street lights without human intervention. We introduced a GSM module to read SMS into a microcontroller which in turn on or off the lights on demand.

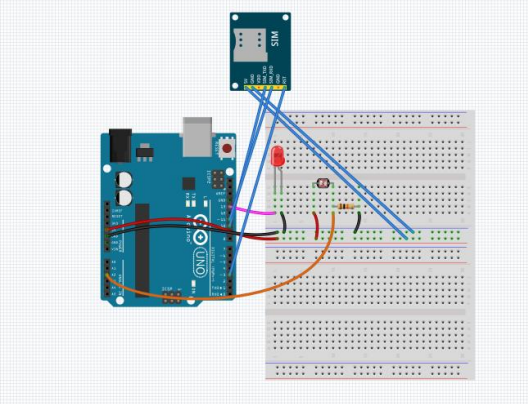
Statement of the Problem

- Need for physical presence to turn on or off security lights
- High electricity bills from always on lights
- Insecurity if no one available to switch on the light

Solution

- Light controlled light switch to turn on the lights when there is darkness and off when there is light.
- SMS controlled backup switch for remotely controlling the lights

Implementation



- Arduino Microcontroller
- SIM800l GSM Module
- Photocel
- 1kOhm Resistor

Deployment of Clays and Other Technologies in Purification of River Water for Bottling and Commercialisation

by Dr. Ochieng Ombaka and Samwel Muraya, Department of Physical sciences, Chuka University, P. O. Box 109-60400, Chuka

CLAY WORKS AND WATER PURIFICATION

Introduction

A majority of Kenyan population who live below poverty line still lack access to clean water which has a negative impact on health as well as infant mortality. Safe drinking water is one of the most basic human needs. Access to water and sanitation plays a crucial role in the overall social and economic development of a community. Approximately 3100 children in Kenya die every year from preventable diarrhea and diseases caused by unsafe water (WHO 2012). Water treatment systems for community involves one of the following methods; storage and sedimentation, up-flow roughing filter before pumping for water bottling, this increases the cost the bottled water making it unaffordable to disadvantage the community. Hence without simpler, affordable and cheaper methods, water quality control is almost non-existent in developing countries like Kenya and indeed a challenge to professionals in the community.

Statement of the Problem

In Kenya due to rapid population growth, unsanitary disposal of wastes and other human activities, most of the water sources are becoming polluted. The prevailing practices of unscientific disposal of human wastes and agricultural practices in most of the rural Kenya have increased the level of microbiological and chemical contamination in water from streams, springs and ground sources. Water quality from physical and chemical parameters from different sources has huge impact on public health when the concentrations are high. Due to lack of simpler and cheaper methods the use of bottled water by people below poverty line and rural areas in Kenya is a luxury they cannot afford and instead contaminated water from different sources are used. To give guarantee of clean, cheap drinking water quality, the present pretreatment section will be replaced by beneficiated clay bricks water filters which in part consist of beneficiated clay, sand, rice husks and activated charcoal. Chuka University water bottling project intents to collaborate with KIRDI and other esteemed water and civil engineers to develop an efficient system to provide cheap and clean bottled water.

Objectives

- To make use of beneficiated clay in making of ceramic water filters
- To bottle cheap and safe drinking water for commercialization
- To test the drinking water samples from the plant in collaboration with KEBS so as to maintain all parameters expected of drinking water
- To increase the life span of the proposed plant

Methodology

Making of ceramic bricks water filters

Materials

- Clay: must be completely dry, plasticized, and free of chemical contaminants.
- Combustible material: rice husks, sawdust, or coffee grounds depending on what is locally available.
- Sand and activated charcoal
- Kiln fuel: can be wood, compressed rice husks, motor or palm oil.
- Clay mixer: only if there is electricity in the area. If not, mixing by hand is done.
- Kiln: constructed from brick and mortar.

- Filter press: either hand or electricity operated.

Step 1: Producing the clay mixture

A hammer mill is used to grind dry clay into smaller particles, which are then screened through fine mesh to filter out particles that are too large. Sawdust (or other combustible material) is dried and then subjected to the same screening process.

Step 2: Shaping the filter bricks

Molds are lined with plastic so that the clay does not stick and the filter can be easily removed.

Step 3: Firing

Filters can be dried for 4 – 21 days, depending on local weather conditions. After drying, they are fired in the kiln for 12 hours, at a temperature of 890℃. Temperature can be controlled using pyrometric cones – ceramic objects that bend differentially in response to different levels of heat. Fired filters are cooled down to room temperature, then submerged in water overnight to permeate the newly formed pores.

Step 4: Testing

Every filter must be tested before being put on the market or distributed within a community. Flow rates are measured, and must be within 7-10 liters per hour.

Water Bottling Process

The Following steps shall be involved in the bottling process:

Raw Water →Pre-treated water by use of clay → Pre-treated Water Feed Pump dosing system 1 & 2→Pressure Sand Filter →Activated Carbon Filter→ Micron Cartridge Filter High Pressure Pump→Reverse Osmosis Ozone generator and re circulation→ Finished Water Storage →U.V System→Filling and Packing →Visual Examination →Storage for testing →Forwarding

1) DOSING SYSTEM 1 & 2

The water is drawn from the source line. The water is then collected to storage tank. It then goes to dosing system through raw water feed pump. In the dosing system, antiscalent is used for the softening of the water

2) PRESSURE SAND FILTER

Water goes to pressure sand filter, where the impurities of pre-treated water are removed.

3) ACTIVATED CARBON FILTER

From pressure sand filter water goes to activated carbon filter to remove organic impurities.

4) MICRON CARTRIDGE FILTER (MCF)

Water is passed through micron filter. This filter removes the micron particles from the water.

5) DEMINERALISATION BY REVERSE OSMOSIS SYSTEM (R.O.)

Water from MCF goes to R.O. System through High Pressure Pump. R.O. removes 90-95% of dissolved solids. The finished water is passed into Storage Tank.

6) OZONE GENERATOR WITH RE-CIRCUALTION

Finished water from R.O. system is stored in S.S made storage tank. The tank is provided with the Man Hole so that the tank can be cleaned. This tank is used as ozone circulation tank. The ozone is passed to this tank for disinfections.

7) U.V. SYSTEM

Water from S.S. tank is passed through MCF to U.V. disinfection system to inactivate bacteria.

8) FILLING AND PACKING

Water is then filled in cleaned and rinsed containers.

9) VISUAL EXAMINATION

Containers are visually inspected for leakage and suspended matter against illuminated screen.

10) TESTING

The raw water is tested two times in a month and finished water as per scheme of testing prescribed by KEBS.

Marketability

This profile envisages the establishment of a plant for the production of Mineral Water with a capacity of 200,000 liters per annum. The present demand for the proposed product is estimated at 250,000 liters per annum. The demand is expected to reach at 300,000 liters in three years.

Projected Demand

The annual average growth rate in the past 10 years of local mineral water production was about 11% (WARMA 2014). The future demand is a function of income, urban population growth and growth of catering and recreational establishments. After considering all the above factors, the demand for mineral water is forecasted to grow at a rate higher than the growth of the urban population in order to take account of effects of growth in income and other demand determining variables. Consumers of the product shall initially be the Chuka University community-consisting of the local community as well as students-and thereafter in the entire region.

Cost Effectiveness: The major plant machinery and equipment

	Description	Quantity
A	**Water pre-treatment unit**	1
B	**Water Treatment Unit**	1
1	Feed tank	1
2	Feed pump	1
3	Multi-media filter	1
4	Cartridge filter	1
5	Fine filter	1
6	Micron filter	1
7	Final tank	1
8	Ozone system	1
9	Pipes, valves and accessories	1
10	Control equipment	1
C	**Filling, Capping and Packing** Unit	
1	Rinser, filler and capper	1
2	Caps sterilizing cabinet	1
3	Conveyor with drive motor	1
4	Extension for conveyor	1
5	Label inserting table	1
	With other inclusion of other utilities such as electricity, buildings and civil works, the initial cost is proposed to be at Kshs	**KES 8,000,000**

Production Programme

The annual production programme is formulated based on the proposed plant capacity. At the initial stage of production period, the plant will require some years for a considerable penetration into the market and to capture the proposed market share of the product. Thus, it is planned that the plant will start production with 80% of its rated capacity in the first year and will produce 90% of same in the second year. Full production (100%) capacity will be attained in the third year and onwards.

Production Programme (Liters) and Projected Sales

Production	Year 1	Year 2	Year 3	**Projected sales**	Year 1	Year 2	Year 3
In 0.5 litre bottle	100,000	200,000	200,000	0.5 litre @15/=	3,000,000	3,000,000	3,000,000
In 1 litre bottle	100,000	150,000	250,000	1 litre @30/=	3,000,000	4,500,000	7,500,000
Total	**200,000**	**250,000**	**450,00,00**	**Total**	**6,000,000**	**7,500,000**	**10,500,000**
Use rated %	80	90	100				

Starting Capital

SN	**Description**	**Amount (KSh.)**	**Annual Working capital**	**Amount (KSh.)**	**Cost of production**	**Amount (KSh.)**
1	Land	1,500,000	Electricity	200,000	Working Capital	2,010,000
2	Building	500,000	Fuel & Others	50,000	Deprec. Building @ 5%	75,000
3	Plant & Machinery	3,500,000	Maintenance & Repairs	20,000	Deprec. machinery 10%	350,000

4	Furniture	50,000	Advertisement	10,000	**Total**	**2,435,000**
5	Total	5,550,000	Miscellaneous Expenses	80,000		
6			Beneficiation of clay	50,000		
7			Raw Material for ceramic water filters	1,600,000		
			Total	**2,010,,000**		

Projected Profit and Loss/ Income statement

Particulars	**Amount (KShs.**	**Year I**	**Year II**	**Year III**
Income				
Revenue				
For 1 liter Bottle	3,000,000		4,500,000	7,500,000
For 0.5 liter bottle	1,500,000		3,000,000	3,000,000
Total		**4,500,000**	**7,500,000**	**10,500,000**
Expenditure				
Cost of goods sold				
For 1 liter bottle	250,000		350,000	
For .05 liter bottle	100,500		200,500	
Operating Expenses				
Fixed Cost	550,000		445,500	425,000
Variable Cost	110,000	1,010,500	220,000	330,000
Net Profit		3,489,500	6,284,000	8,994,500
Total		**4,500,000**	**7,500,000**	**10,500,000**
Payback period: 2 Years & 4 months			**Profitability period: 3 years after inception**	

Staffing

The project proposes to involve qualified staff from various sections/departments of the university at its formative stages. The areas include construction of the plant, business model approach of the project, procurement of various equipment and materials intended for the project, quality control as well as marketing and distribution of the product. The project is expected to be on profitability path by the third year of its establishment.

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SETTING UP THE WATER BOTTLING PLANT

Summary

This profile envisages the establishment of a plant for the production of Mineral Water with a capacity of 2 million liters per annum. The present demand for the proposed product is estimated at 2.5 million liters per annum. The demand is expected to reach at 3 million liters by the year 2018. A ceramic water filter is a large vessel that is made from a mixture of clay and combustible material, such as sawdust or rice husks. These materials are usually locally sourced, so that communities are able to produce the filters independently. A simple manual or electric press can be used to shape the filters into a mold. These microscopic pores are small enough to remove most bacteria, protozoa, sediments and organic matter from impure water. To enhance filtration, each filter is usually coated with a solution of silver, a natural biocide that inactivates bacteria and viruses on contact. The filter can be placed inside a plastic bucket or receptacle, which collects the purified water after it passes through the filter. Flow rate of water through the filter is between 5 – 7 liters per hour – anything faster would signify an issue with the filter. Ceramic water filters can be used to treat rainwater, water from rivers, streams, or ponds, and groundwater. Ceramic water filter technology is an attractive choice for developing countries throughout the world, in many cases reducing diarrhoeal disease and viral contamination of water sources by up to 99%. Ceramic pot filters do two things: they filter out the sediment, and they kill microbes using a coating of silver nanoparticles. The filters sieve about 10 liters of water per hour through their clay, removing 99.7% of bacteria and 92% of the turbidity, or muddiness. The quality of filtered water ought to be acceptable in terms of turbidity, coliform bacteria level, and Escherichia coli, according to WHO drinking-water quality guidelines. Bacteriological quality is the most important factor in assessing the relationship between the safety of drinking water and diseases transferred by water. If coliform bacteria are found in water, they may cause diseases, so-called waterborne diseases. A clay water filter has many advantages of being lightweight, portable, low-cost, requires no chemicals, and is simple to use; it can be produced locally, using naturally available clay and other materials. The pore size and surface charge of a clay-pot water filter determine its ability to remove particles and pathogens from water

Making of ceramic water filters; a step by step: **Materials**

- Clay: must be completely dry, plasticized, and free of chemical contaminants. A convenient clay source is unfired bricks from brick factories.
- Combustible material: rice husks, sawdust, or coffee grounds depending on what is locally available.
- Kiln fuel: can be wood, compressed rice husks, motor or palm oil.
- Clay mixer: an option only if there is electricity in the area. If not, mixing by hand is possible.
- Kiln: constructed from brick and mortar.
- Filter press: either hand or electricity operated.

Step 1: Producing the clay mixture

A hammer mill is used to grind dry clay into smaller particles, which are then screened through fine mesh to filter out particles that are too large. Sawdust (or other combustible material) is dried and then subjected to the same screening process.

Step 2: Shaping the filter

Molds are lined with plastic so that the clay does not stick and the filter can be easily removed.

Step 3: Firing

Filters can be dried for 4 – 21 days, depending on local weather conditions. After drying, they are fired in the kiln for 12 hours, at a temperature of 890℃. Temperature can be controlled using pyrometric cones – ceramic objects that bend differentially in response to different levels of heat.

Fired filters are cooled down to room temperature, then submerged in water overnight to permeate the newly formed pores.

Step 4: Testing

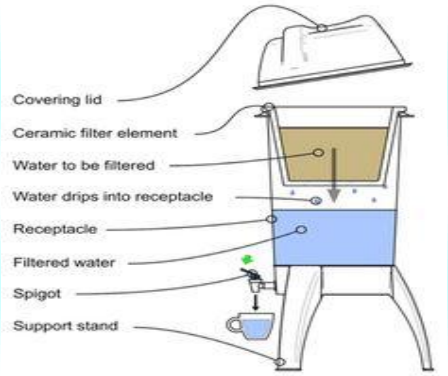
Every filter must be tested before being put on the market or distributed within a community. Flow rates are measured, and must be within 5–7 liters per hour.

Step 5: Silver coating

Two milliliters of colloidal silver at 3.2% are added to 250 milliliters of water. When the filter is completely dry it is dipped into the solution. The solution can also be applied using a brush.

Product Description and Application

The simple definition of water is that it is the liquid that descents from the cloud as rain, forms streams, lakes and seas, issues from the ground in form of springs and is a major constituent of all living matter and that when pure consists of an oxide of hydrogen H_2O or $(H2O)x$ in the proportion of 2 atoms of hydrogen to one atom of oxygen and is an odorless, tasteless, very slightly compressible liquid. Water freezes at 0oC and boils at 100oC, has a maximum density at 4^oC and a high specific heat. The present proposal considers bottling, packing and distribution of mineral water.



Projected Demand

The annual average growth rate in the past 10 years of local mineral water production was about 11%. The future demand for mineral water is a function of income, urban population and growth of catering and recreational establishments. After considering the above factors, the demand for mineral water is forecasted to grow at a rate higher than the growth of the urban population to take account of effects of growth in income and other demand determining variables.

Plant Capacity and Production Programme

1. Plant Capacity

Considering projected unsatisfied demand the annual production capacity of the envisaged plant is proposed to be 3,000,000 litres of mineral water on a basis of eight hours each, per day and 210 days per annum.

2. Production Programme

The annual production programme is formulated based on the proposed plant capacity. At the initial stage of production period, the plant will require some years for a considerable penetration into the market and to capture the proposed market share of the product. Thus, it is planned that the plant will start production with 80% of its rated capacity in the first year and will produce 90% of same in the second year. Full production (100%) capacity will be attained in the third year and onwards.

Production Programme	Year 1	Year 2	Year 3
In 0.5 litre bottle	1,200,000	1,350,000	1,500,000
In 1 litre bottle	400,000	450,000	500,000
Total	**1,600,000**	**1,800,000**	**2,000,00**
Utilization of rated capacity %	80	90	100

Materials and Inputs

A. Raw Materials

The direct raw material required by the plant is raw water from spring or other sources. The annual requirement for raw water at 100% capacity utilization rate of the envisaged plant is 3,600,000 litres. It is assumed that the raw water from the source will be acquired free of charge. The major auxiliary materials required by the plant basically constitute the filling and packing materials. Some of these auxiliary materials, to name a few, are polyethylene terephtalate (PET) bottles with pilfer proof caps, labels, polypropylene rolls for wrapping of filled bottles. Labels of desired size, number and colour can be locally sourced from the public or private suppliers.

Utilities

The utilities required by the envisaged plant will be electricity, water for general purpose, fuel gas (petrol) for vehicles.

Land, Buildings and Civil Works

The total land area of the plant including both open and built-up area is about 10,000 m2. Total built-up area including factory building, office, storage for raw materials and finished products is estimated to be 1,200 m^2.

Technology and Engineering

A. Technology

Production Process

The manufacturing of the processed water mainly involves the following process;

a) Collection of Raw Water

b) Removal of suspended and colloidal impurities by filtration such as sand, carbon, micron filter

c) Removal of dissolved solids by Reverse Osmosis, Ion Exchange etc

d) Disinfection by different means such as ozonization, U.V., Silver Ionization etc

e) Filling and Packing

The production and bottling of mineral water in PET bottles involves processes like raw water storage and treatment, filling and capping, labeling, wrapping and dispatching. The major operations in water storage and treatment unit include water colour removal, raw water pumping and storage, chemicals dosage, filtration using different types of filters, ultraviolet water disinfection or ozone generation with recirculation system. The chemically dosed water is fed to the cartridge filter for removal of suspended particles upto 5 microns. The output from the cartridge filter is pumped to the reverse osmosis module where the salts get rejected partially by means of high pressure pump. The permeate water is blended with filtered water if required to maintain the desired total dissolved solids level of 100 to 150 ppm. The water before stored in the tank is disinfected by means of ozonator. Suspended solids are removed from the raw water by using a sand filter which thereby reduces the turbidity of water and helps in obtaining clean and clear filtered water. Iron staining is eliminated by changing the ferrous iron to ferric iron by the ozone oxidizing effect on the ferrous iron.

After proper water treatment, the PET bottles are automatically conveyed and transferred onto the rinsing rotor where they are subject to rinsing jets. Then the bottles are automatically transferred onto the filling rotor where they are filled with the product. On the capping rotor, the bottle by itself picks up a cap from the chute of the vibratory bowl feeder which ensures a continuous supply of properly oriented caps. The caps are sterilized from inside prior to capping with the help of direct exposure of UV lamps. Sealing of the heat sealable labels of the PET bottles is done on labeling and shrink wrapping machine. Finally, the labeled and sealed bottles are transferred to the discharge conveyor and then packed and dispatched. Machinery and equipment required by the envisaged plant will be for the main production line and for the supporting units like PET stretch blowing and plastic injection unit for PET performs and caps.

The major plant machinery and equipment

	Description	Quantity
A	**Water Treatment Unit**	1
1	Feed tank	1
2	Feed pump	1
3	Multi-media filter	1
4	Cartridge filter	1
5	Fine filter	1
6	Micron filter	1
7	Final tank	1
8	Ozone system	1
9	Pipes, valves and accessories	1
10	Control equipment	1
B	**Filling, Capping and Packing Unit**	
1	Rinser, filler and capper	1
2	Caps sterilizing cabinet	1
3	Conveyor with drive motor	1
4	Extension for conveyor	1
5	Label inserting table	1

Selecting and Purchasing Water Treatment Equipment

This project will commission a full microbiological and chemical analysis of their intended source water. The selection of the water treatment systems shall be based on two key factors:

1. The types of contaminants found in the source water (what problems are there with the quality of the water?)
2. The water treatment capacity required to meet the projected sales volumes (How much clean water do you need to produce in order to meet your sales goals?)

Types of Water Contaminants

Microbes. Waterborne microbes are small organisms that can be harmful to human health. They are divided among three main classes: bacteria (for example, those causing typhoid, cholera, and dysentery), protozoan parasites (such as Giardia and Cryptosporidium), and viruses.

Suspended solids. These are earth or dirt in the water. Suspended solids affect how the water looks, giving it a cloudy or muddy appearance (known formally as "turbidity"). In addition, other contaminants may be attached to the suspended sediment particles, including both microbes and chemical contaminants such as the agricultural and industrial pollutants described below. Suspended solids are mainly a problem in surface waters such as rivers, earth pans, and springs.

Salinity. This refers to how salty the water is by measuring the amount of major salts such as sodium, potassium, calcium, magnesium, chloride, sulfate, and carbonate. Salinity is also known as TDS (for "total dissolved solids"). Water with high salinity is not suitable for drinking. Salinity is usually low in surface waters but higher in groundwater, particularly along the coast.

Naturally occurring trace contaminants. These include chemicals such as arsenic and fluoride that are harmful for human health when consumed over long periods.

Industrial contaminants. These include both heavy metals such as mercury, lead, and cadmium as well as many of the chemicals used in fuels, manufacturing, and processing. They also include lightweight organic compounds often used as solvents (known collectively as volatile organic compounds (VOCs), petroleum hydrocarbons, benzene and related compounds (known as BTEX, for "Benzene, Toluene, Ethylbenzene, and Xylene"), and heavier compounds such as PCBs (polychlorinated biphenyls), which tend to be found in sediment. Industrial chemicals are more likely to be found in groundwater but also may be found in rivers adjacent to or downstream of zones of heavy industry.

Agricultural contaminants. The agricultural materials of concern for human health are pesticides, herbicides, and fungicides. These contaminants generally are not immediately dangerous, but if people drink them in high concentrations over long periods of time, they may increase the likelihood of some diseases, including cancers. Agricultural contaminants are primarily found in groundwater from intensively farmed regions and in rivers that are downstream of these areas.

Water Treatment Technologies

The type of water treatment system needed depends on the types of contaminants found in our source water. To remove or kill the different classes of contaminants, the project proposes to rely on three levels of water treatment:

1. Physical Filtration.
2. Ultraviolet (UV) Irradiation.
3. Reverse Osmosis (RO) Membrane Filtration

Physical Filtration

This removes suspended solids and sediment (sand and dirt).
Ultraviolet (UV) irradiation, which exposes source water to ultraviolet light, shall kill pathogenic microbes.

Reverse Osmosis Membrane Filtration

Reverse Osmosis (RO) membrane filtration uses pressure to 'push' water through filters with extremely small pores. These filters trap a large number of all classes of water contaminants, including microbes, naturally occurring trace contaminants, industrial contaminants and agriculture contaminants. These contaminants are discarded in 'reject water', which is the water that does not pass through the RO membrane.

Staffing

The project proposes to involve qualified staff from various sections/departments of the university at its formative stages. The areas include construction of the plant, procurement of various equipment and materials intended for the project, quality control as well as marketing and distribution of the product.

Branding
Signs and exterior branding are the first things many customers see identifying a product. It is important that a sign show the product and the service the business provides.

To teach projected customers about the quality and safety of the water, its proposed that
1. Display a copy of the KEBS standardization mark certificate and/or water quality tests results in an area where they are easily seen by customers in the shop.
2. Put up diagrams explaining the treatment process and showing that the way the water is treated and packed.

By explaining that the water produced by the project meets the same quality guidelines and is treated in the same way as other bottled water, we shall address most of the quality concerns customers may have.

Labels
Labels are required for all new bottle sales and they should:-
1. Physical location and contact information of the business.
2. Specify that the water is "Bottled in Kenya".
3. Specify the instruction that "Store in a cool, dry place away from direct sunlight".
4. Treatment process used (for instance, RO purified, UV treated).
5. Specify the volume of the product in metric units.
6. Space for the KEBS standardization mark to be applied.
7. Space for the batch number or lot number.
8. Space for the manufacturing/production date
9. Space for expiration date (one year from the date of production) to be marked.

***Note**: KEBS guidelines (KEBS, 2007) place limits on what can appear on labels, specifically:*
• The use of the term "Natural Drinking Water" is prohibited for water that has been treated.
• No claim can be made concerning medical (preventative, alleviative, or curative) or other beneficial effects relating to the health of the consumer.
• Labels may not use any statement or pictorial device which may create confusion in the mind of the public about the nature, origin, or properties of the drinking water.

Obtaining Necessary Licenses and Permits
In order to comply with regulatory and taxation requirements, the project will have to obtain licenses and/or permits from a number of government agencies.

Kenyan Bureau of Standards
The project will obtain a permit to use the standardization mark from KEBS. The law says you need to have the mark, but it also helps customers trust the quality of the product if they can see it on the water bottles. KEBS will only give the standardization mark after the water treatment equipment has been installed at the intended location and test the system's product, water:

Water Resources Management Authority
The project will need an abstraction permit (official permission) from WRMA for the use of either ground or surface water (any natural water resource).

Maintaining Water Quality
To maintain quality of the product then, it is proposed that microbiological testing at least once a month and chemical composition testing once every three months

ANNEX 1

A Typical Manufacturing Process

Following treatment steps are involved in the manufacturing process: Raw Water →Raw Water Storage Tank → Raw Water Feed Pump dosing system 1 & 2 → Pressure Sand Filter →Activated Carbon Filter → Micron Cartridge Filter High Pressure Pump → Reverse Osmosis Ozone generator and re circulation → Finished Water Storage →U.V System →Filling and Packing → Visual Examination → Storage for testing → Forwarding

Steps/Processes

1) DOSING SYSTEM 1 & 2: The water is drawn from the source line. The water is then collected to storage tank. It then goes to dosing system through raw water feed pump. In the dosing system, anti-scalent is used for the softening of the water

2) PRESSURE SAND FILTER: From dosing system water goes to pressure sand filter, where the impurities of raw water are removed

3) ACTIVATED CARBON FILTER: From pressure sand filter water goes to activated carbon filter where organic impurities are removed.

4) MICRON CARTRIDGE FILTER (MCF): Water is then passed through micron filter. This filter removes the micron particles from the water.

5) DEMINERALISATION BY REVERSE OSMOSIS SYSTEM (R.O.): Water from MCF goes to R.O. System through High Pressure Pump. R.O. removes 90-95% of dissolved solids. The finished water is passed into Storage Tank.

6) OZONE GENERATOR WITH RE-CIRCUALTION: Finished water from R.O. system is stored in S.S made storage tank. The tank is provided with the Man Hole so that the tank can be cleaned. This tank is used as ozone circulation tank. The ozone is passed to this tank for disinfections.

7) U.V. SYSTEM: Water from S.S. tank is passed through MCF to U.V. disinfection system, where the bacteria are inactivated.

8) FILLING AND PACKING: Water is then filled in cleaned and rinsed containers.

9) VISUAL EXAMINATION: Containers are visually inspected for any leakage and suspended matter against illuminated screen.

10) TESTING: The raw water is tested two times in a month. Finished water is tested as per scheme of testing prescribed by KEBS.

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Sui X, Huang X. The characterization and water purification behavior of gradient ceramic membranes. Separation and Purification Technology 2003; 32(1-3): 73-79

COMMENTS:

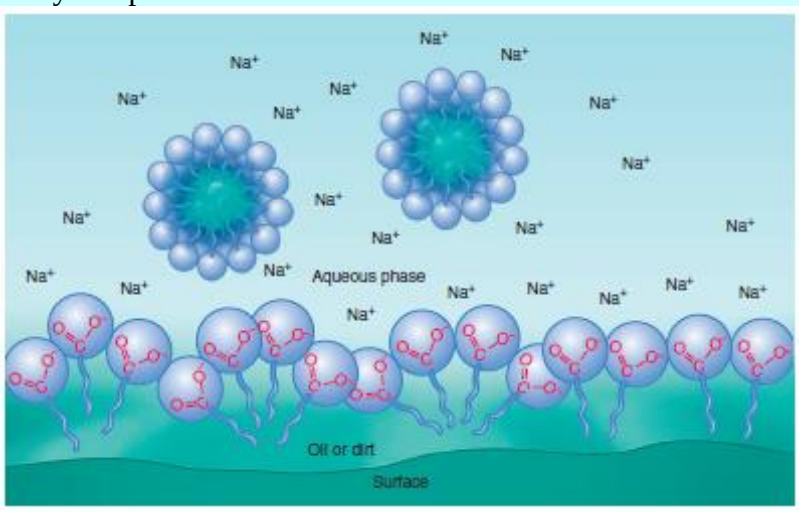
A good suggestion would be to pilot the project first. The cost of the final plant is looking to be too high. Clay may not filter all the impurities in water. Has to spell out how he will ensure that the clay is free from chemicals. Branding to make the water competitive. Methodology: use flow diagram and model to illustrate purification process. Not cost effective.

Formulation of Soaps and Detergents

by Mr. Joram Bulemi & Dr. Eric Chomba Njagi, Department of Physical sciences, P. O. Box 109-60400, Chuka

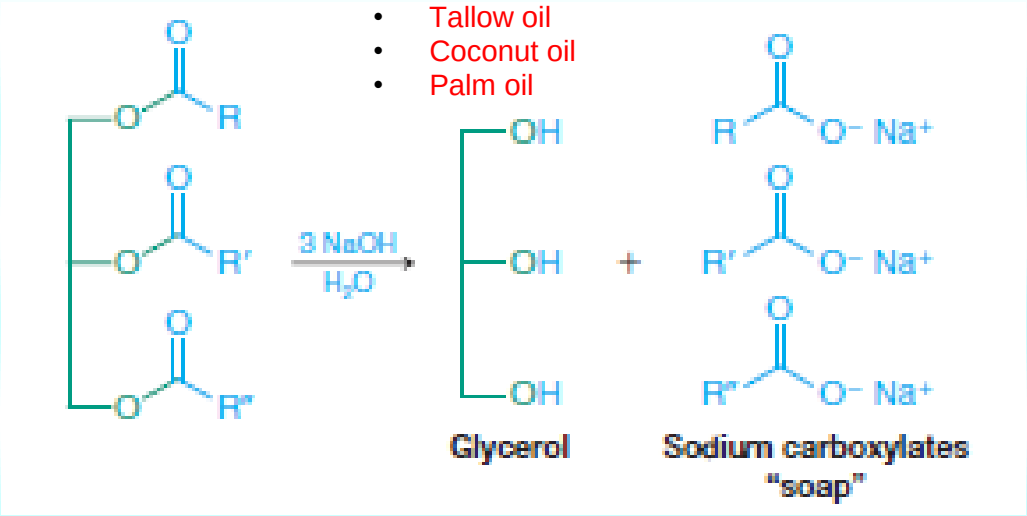
Introduction

- Contains a surfactant as their active ingredient
- Surfactants
- Cpds with a long, linear, non-polar, hydrophobic 'tail' and a polar hydrophilic 'head'
- Lowers the surface tension of water; water penetrates the fabric more
- Allows the oily dirt particles to form an emulsion with water



Batch Process for Manufacture of Soap

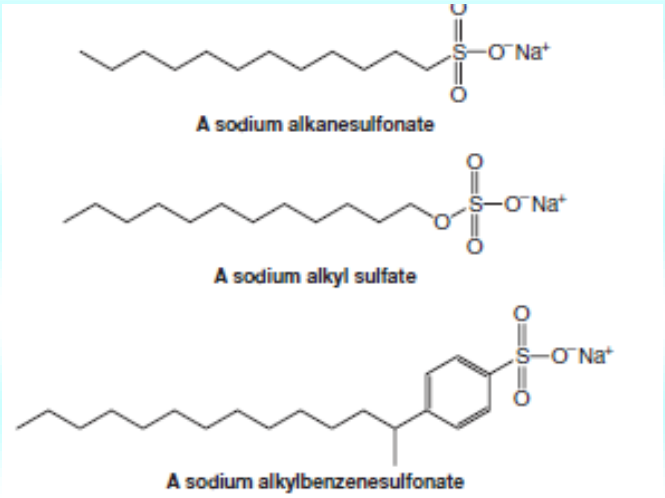
Saponification- alkaline hydrolysis of triacylglycerols



- Preparation of the oils
  - Blending
  - Vacuum drying
  - Bleaching
- Saponification
- Separation of soap & glycerine
- Purification of crude soap
- Drying – conversion of soap into solid form

- Finishing
  - Addition of perfume, color, preservative, glycerine, disinfectant, etc.
  - Homogenization, extrusion, sizing and stamping

Formulation of Detergents



Active ingredient

- Alkanesulfonates
- Alkyl sulfates
- Alkylbenzenesulfonates

Synthetic detergents do not form scum with hard water

- Primary surfactant- provide detergency and foam
- Secondary surfactant – Improve detergency and foam
- Viscosity modifiers
  - Electrolytes e.g. NH4Cl, NaCl
  - Natural gums –Gum Karaya, tragacanth, alginates
  - Cellulose derivatives –Hydroxyethyl cellulose, methyl cellulose
  - Carboxyvinyl polymers –Carbopol934
  - Others – e.g. phosphate esters.,
  - Perfumes, preservatives, color

Formulations

Component	Amount in general purpose detergent %	Amount in dish washing liquid %
Sulphonic acid	3.75	10
Caustic (50% solution)	1	2.4
SLES	5	3
CDE	0.5	1
Preservative	0.2	0.2
Colour (1% solution)	qs	qs
Perfume	qs	qs
Salt (20% solution)	qs	qs
Water	89.75	83.5

Evaluation of Detergents

- Foam and foam stability - Ross-Miles foam column test
- Detergency and cleaning action – The method of Barnet and Powers
- Wetting action
- Microbial Assay
- Viscosity- Brookefield viscometer
- Color and fragrance consistency

Formulation of Assorted Soaps, Detergents and Cosmetics

1. HAIR SHAMPOO (25 L)

A shampoo is a preparation of a surfactant in a suitable form for removal of surface grease, dirt, and skin debris from the hair shaft and scalp. Shampoos are largely composed of a principal surfactant that provide detergency and foam and a secondary surfactant that improve detergency, foam and hair condition. Conditioning agents (e.g. lanolin, mineral oil, herbal extracts), foam builders (e.g. lauroyl monoethanolamide, sarcosinates), viscosity modifiers (e.g. electrolytes, natural gums, cellulose derivatives), sequestering agents (e.g. EDTA), preservatives, coloring agents and fragrances are added to enhance the performance and aesthetic appeal of the shampoo. A high quality shampoo should effectively and completely remove dirt, excessive sebum and other fatty substances and dead cells from the hair. In addition, the shampoo should produce enough foam to satisfy the psychological requirements of the user and be easily removed on rinsing with water. Further, the shampoo should leave the hair with a pleasant fragrance, soft, lustrous, and manageable. Moreover, the shampoo should be non-toxic, non-irritant and gentle on hands. We propose to formulate 25 L of high quality apple hair shampoo and package it in well labelled plastic containers for exhibition during Chuka University Open Week. The shampoo will be packaged in 5 L, 1 L and 500 mL containers to mimic actual packaging in the Kenyan market. Chemicals and packaging materials that are required for formulation and packaging of the shampoo are given in **Table 1**.

Table 1: Chemicals required for formulation of 25 L of Apple Shampoo

Chemical	Quantity	Packaging container (Size)	Quantity
Texapon N70	5 L	5L	2
Coco Diethyl Ether (CDE)	1.5Kg	1L	10
Sodium Chloride(Industrial Grade)	50Kg	500mL	10
Glycerine BP	1.5Kg	Labels	22
Methyl Paraben	250g		
Propyl Paraben	250g		
Dye (Apple Green)	250g		
Perfume (1:1 Blend)	250g		

2. HAIR CONDITIONER (25 L)

Conditioners are hair products designed to improve the look and feel of hair. The most common conditioners are rinse-out conditioners that are applied to the hair after shampooing, allowed to stay in the hair for a short time and then rinsed. Conditioners make hair soft, easier to comb and shiny. They also protect hair from future damage. Conditioners contain a variety of conditioning and moisturizing ingredients that are left behind on the hair after rinsing and affect the hair characteristics. Conditioning agents include cationic surfactants, cationic polymers and silicones. Moisturizers are organic solvent concentrated with humectants (compounds that able to attract and hold moisture into the hair). Hair conditioners also contain reconstructors (e.g. proteins), detanglers, preservatives, colorants and fragrances. We propose to formulate 25 L of high quality white hair conditioner and package it in well labelled plastic containers for presentation during Chuka University Open Week. The conditioner will be packaged in 5 L, 1 L and 500 mL containers to mimic actual packaging in the Kenyan market. Chemicals and packaging materials that are required for formulation and packaging of the shampoo are given in **Table 2.**

Table 2: Chemicals required for formulation of 25 L of white hair conditioner

Chemical	Quantity	Packaging container (Size)	Quantity
Cetostearyl Alcohol (CSA)	5kg	5L	2
Lanette Wax	1.5kg	1L	10

Cetrimide	250g	500mL	10
White Oil	2.5Kg	Labels	22
Methyl Paraben	250g		
Propyl Paraben	250g		
Glycerine BP	5Kg		
Perfume	250g		

3. MEDICAL GRADE DISINFECTANT & BLEACHING AGENTS (25 L)

Sodium hypochlorite (NaOCl) is a broad-spectrum effective disinfectant for enveloped viruses (e.g. HIV, HBV and HSV) and non-enveloped viruses (e.g. *Adenovirus* and *Parvovirus*), vegetative bacteria (e.g. *Pseudomonas, Staphylococcus, and Salmonella*), fungi (e.g. *Candida*) and mycobacterium (e.g. *M. tuberculosis and M. bovis*). Sodium hypochlorite (Ca. 225ppm) is widely recommended for use on hard non-porous environmental surfaces in health care facilities, institutions, schools and the hospitality industries. It is also widely used as a household bleaching agent, stain remover and deodorizer. We propose to produce 25 L of concentrated sodium hypochlorite solution for bleaching and medical uses and package it in well labelled plastic containers for presentation during Chuka University Open Week. Chemicals and packaging materials that are required for production are given in **Table 3**.

Table 3: Materials for manufacture and packaging of concentrated sodium hypochlorite

Chemical	Quantity
Sodium Carbonate (Industrial Grade)	12.5Kg
Calcium hypochlorite (Industrial Grade)	12.5Kg
Sodium thiosulphate (AR Grade)	125g
White Jelly Cans	22
Labels	22

4. HAND SANITIZER (25 L)

Alcohol-based hand sanitizers are available as liquids, gels and foams. Sanitizers that contain 60 to 95% alcohol are most effective against a variety of microorganisms. Humectants (e.g. glycerin, tocopherol and propylene glycol) are added to hand sanitizers to prevent the skin from drying with frequent usage. Emollients (e.g. isopropyl myristate) are added to hand sanitizers to seal the skin surface and make it smoother. Fragrances and colorants are also added to enhance the aesthetic appeal of hand sanitizers. We propose to formulate 25 L of an alcohol-bases hand sanitizer and package it in plastic bottles with pumps for presentation and demonstration during Chuka University Open Week. Chemicals and packaging materials that are required for formulation are given in **Table 4**.

Table 4: Chemicals and packaging materials for formulation of hand sanitizer

Chemical	Quantity
IPA	5Kg
TEA	0.15Kg
Carbopol	75g
Glycerine	0.25Kg
DDW	15L
Lemon Perfume	25g
Blue Dye	50g
0.5L PET bottles (with pump)	50
Labels	50

5. DISH WASHING LIQUID (25 L)

Optimum liquid dishwashers with high grease cutting ability can be formulated using anionic surfactants, foam boosters, viscosity builders, emulsifiers and builders (e.g. EDTA). Caustic soda is used to neutralize the surfactants and form soap. Aloe vera, vitamin E, panthenol, glycerin and

other herbal extracts are added to the formulation for skin care benefits. Essential oils (e.g. lavender and rosemary) are used for aromatherapy benefits. Antibacterial agents (e.g. triclosan), colorants, fragrances and preservatives are also added to the formulation. We propose to formulate 25 L of a high quality dish washing liquid and package it in plastic containers for presentation and demonstration during Chuka University Open Week. Chemicals and packaging materials that are required for formulation are given in **Table 5**.

Table 5: Chemicals and packaging materials for formulation of dish washing liquid

Item	Quantity
Sulphonic acid	5 Kg
Caustic soda	1.5 Kg
SLES	5 Kg
CDE	1.5 Kg
Preservative	50 g
Colour (% soln)	qs
Perfume	qs
Salt (20% soln)	qs
Packaging (1 L x 10pcs; 500 mL x 30pcs)	40
Labeling	40

6. HAIR FOOD (20 Kg)

Hair Food is a formulation that keeps the hair healthy by providing vital nutrients to the hair. These nutrients include essential oils that keep the hair healthy, shiny, soft and conditioned. We propose to formulate 20 Kg of hair food for exhibition during Chuka University Open Week. Chemicals and packaging materials required for formulation are listed in **Table 6**.

Table 8: Chemicals and packaging materials for formulation of hair food

Component	Quantity
Micro crystalline wax	4 Kg
Paraffin wax	2 Kg
White oil	14 Kg
Isopropyl myristate	0.2 Kg
Propyl paraben	0.2 Kg
Methyl paraben	0.2 Kg
Lanolin	0.4 Kg
Castor oil	0.3 Kg
Coconut oil	0.04 Kg
Dye yellow {oil soluble}	20 g
Perfume	0.08 Kg
PET Containers (250 mL, 100 mL, 50 mL, 25 mL)	
Labelling	

7. GENERAL PURPOSE LIQUID DETERGENT (25 L)

Liquid detergents are mainly composed of sodium or potassium salts of long chain ionic surfactants (alkylbenzenesulfonates, alkyl sulfates), foam stabilizers (*N*-(2-Hydroxyethyl)dodecanamide), viscosity builders (e.g. electrolytes), preservatives, colorants and fragrances. We propose to formulate 25 L of liquid detergent and package it in plastic containers for presentation and demonstration during Chuka University Open Week. Chemicals and packaging materials that are required for formulation are given in **Table 7**.

Table 7: Chemicals and packaging materials for liquid detergent

Component	Quantity
Sulphonic acid	1.5 Kg
Caustic soda	500 g
SLES	1.5 Kg
CDE	250 g
Preservative	Qs
Colour (% solution)	Qs
Perfume	Qs
Salt (20% solution)	Qs
Packaging (5L,1L and 500mL)	22
Labeling	22

8. PETROLEUM JELLY (10 Kg)

Petroleum Jelly (white / yellow soft paraffin) is an ointment-like homogenous, highly refined semi solid with a delicate balance between liquid and solid hydrocarbons. Petroleum Jelly is used in pharmaceutical formulations, cosmetic and personal care formulations. In personal care formulations, Petroleum Jelly works by creating a sealing barrier between cells in dry or damaged skin which locks in moisture and speeds up the skin's natural recovery process. Its occlusive function allows it to protect dry skin, cracked skin, minor cuts, scraps, and burns. It also helps to reduce the appearance of fine, dry lines. We propose to formulate 10 Kg of Petroleum Jelly and package it in PET containers for presentation and demonstration during Chuka University Open Week. Chemicals and packaging materials that are required for formulation are given in **Table 8**.

Table 8: Chemicals and packaging materials for formulation of petroleum jelly

Component	Quantity
Technical White Oil	7.5 Kg
Microcrystalline Waxes	2.5 Kg
Paraffin Waxes	1.5 Kg
PET Containers (250 mL, 100 mL, 50 mL, 25 mL)	
Labelling	

9. ACCESSORIES

The following items will be used to formulate proposed products:

Item	Quantity
200L Plastic tank	1
100l Plastic tank	2
Big *mwiko* for stirring	1
Industrial gloves	5
Weighing containers	5
Industrial funnels	2

COMMENTS:

Mostly the presentation was informing. The project that can be commercialized is lacking. How is it different from what is being prepared by anybody. How will you brand to make it competitive? How do you ensure that the machine is not dangerous to the people. No originality. Be innovative doing a formulation that can selectively kill microbiocells leaving out the host cells. Originality of work is vague.

Preparation and Antibacterial Activities of Bar Soap from *Moringa oliefera* and *Croton megalocarpus* Seeds

By Dr. Gichumbi, J.M.; Dr. Ombaka, O.; Muraya, S; Ogolla, F., Department of Physical Sciences, Chuka University, P. O. Box 109-60400, Chuka

Abstract

Moringa oleifera and *Croton megalocarpus* seed oil was extracted using the soxhlet extraction method and the oil was used to make soap by reacting with caustic soda. The soaps were then added a disinfectant and *Aloe vera* extract to make medicated soaps. The activity of these soaps were investigated against the common bacterial organism by the disk diffusion method and compared against the commercial medicated soaps.

Introduction

Moringa oleifera is a tropical multipurpose tree that naturally grows in India, South-Saharan Africa and South-America [1]. Almost every part of the plant (leaves, flowers, seeds, roots and bark) can be used as food or with medicinal and therapeutic purposes [2], especially in developing countries. *Moringa oleifera* seeds also contain between 30-35 *% (w/w)* of vegetable oil [2], known as "Behen" or "Ben" oil. *Moringa oleifera* seeds are also used as a primary coagulant in drinking water clarification and wastewater treatment due to the presence of a water-soluble cationic coagulant protein able to reduce turbidity of the water treated.

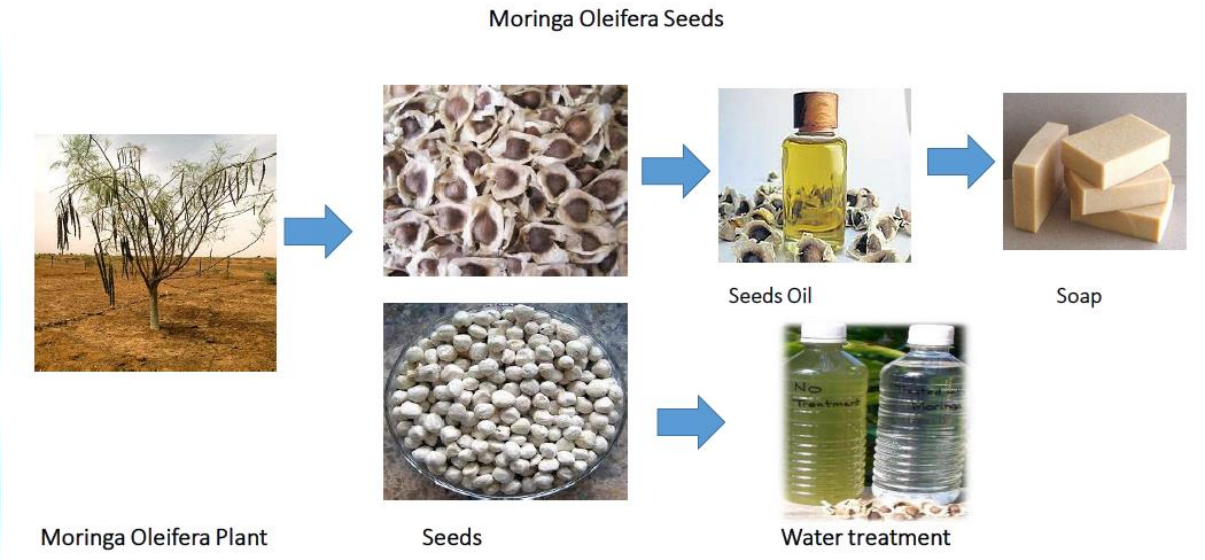
Moringa oleifera ranges in height from 5 to 12m with an open, umbrella-shaped crown, straight trunk and corky, whitish bark, the tree produces a tuberous tap root. The evergreen or deciduous foliage (depending on climate) has leaflets 1 to 2 cm in diameter; the flowers are white or cream coloured. The fruits (pods) are initially light green, slim and tender, eventually becoming dark green, firm and up to 120cm long, depending on the variety. Fully mature, dried seeds are round or triangular, the kernel being surrounded by a lightly wooded shell with three papery wings [3].

In the tropics, it is used as forage for livestock; in many countries, Moringa is used as a micronutrient powder to treat diseases. The green pods, fresh and dried leaves are used as vegetable. The seeds contain up to 40% of oil by weight which is used for cooking, cosmetic base and in lamps. All parts of the plant are used in a variety of traditional medicines. The press cake, obtained following oil extraction, is useful as a soil conditioner; the plants are grown as live fences and windbreaks. It is also used as fuel wood source after coppicing (cutting back the main stem to encourage side shoots); as an intercrop with other crops and the wood pulp may be used for paper-making. In the tropics, it is used as forage for livestock; in many countries, Moringa is used as a micronutrient powder to treat diseases. The green pods, fresh and dried leaves are used as vegetable [4, 5].

Moringa trees have been used to combat malnutrition, especially among infants and nursing mothers. The leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. Moringa is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce [6, 7]. It is commonly said that Moringa leaves contain more Vitamin A than carrots, more calcium than milk, more iron than spinach, more Vitamin C than oranges, and more potassium than bananas," and that the protein quality of Moringa leaves rivals that of milk and eggs. However, the leaves and stem of *M. oleifera* are known to have large amounts of their calcium bound in calcium oxalate crystals. The tree's bark, roots, fruit, flowers, leaves, seeds, and gum are also used medicinally. The uses include as an antiseptic and in treating rheumatism, venomous bites, and other conditions. The flowers, leaves

and roots are widely used as remedies for several ailments. The bark of the moringa root should be scraped off because of its toxicity and the flesh of the root should be eaten sparingly [8]. Moringa seeds are effective against skin-infecting bacteria Staphylococcus aureus and Pseudomonas aeruginosa [8]. They contain the potent antibiotic and fungicide terygospemin. Moringa seem to have most of the food nutrients required by the body to replenish its defensive mechanisms. The Tonga people of Binga District in Zimbabwe use the root powder as an aphrodisiac and when it is mixed with milk, it is considered useful against asthma, gout, rheumatism and enlarged spleen or liver. It also helps in the removal of wind from the stomach and as a snuff and can be used to alleviate ear and toothache [8,9]. The leaf juice has a stabilizing effect on blood pressure. The leaf juice controls glucose levels in diabetic patients. Fresh leaves and leaf powder are recommended for tuberculosis patients because of the availability of vitamin A that boosts the immune system. If leaf juice is used as diuretic, it increases urine flow and cures gonorrhoea. Leaf juice mixed with honey treats diarrhoea, dysentery and colitis (colon inflammation). Fresh leaves are good for pregnant and lactating mothers; they improve milk production and are prescribed for anaemia. Paste made from bark treats boils. Paste from ground bark can be applied to relieve pain caused by snake, scorpion and insect bites. Oil is sometimes applied externally for skin diseases [9-11].

Fully mature, dried seeds are round or triangular in shape, where the kernel is surrounded by light wooded shell with three papery wings. When mature, the seeds from the pods can be extracted and treated like green peas and can be fried or roasted and eaten like peanuts. It also contains oleic acid-type oil. The seeds contain up to 40% of oil by weight which is used for cooking, soap manufacture, cosmetic base and in lamps. All parts of the plant are used in a variety of traditional medicines. The press cake, obtained following oil extraction, is useful as a soil conditioner; the plants are grown as live fences and windbreaks. It is also used as fuelwood source after coppicing (cutting back the main stem to encourage side shoots); as an intercrop with other crops and the wood pulp may be used for paper-making.



Scheme 1: Utilization of *Moringa oleifera* seeds

1.1 Croton megalocarpus

C. megalocarpus is a large forest tree (15-36 m height) of Euphorbiaceae family. In Kikuyu it is called *Mukinduri* and *Musine* in Luhya. *Croton* is indigenous to East Africa and has been widely grown in its mountainous regions as an ornamental for generations. It is therefore inconceivable that an ecological catastrophe can be triggered by large scale cultivation of *Croton* [12]. When

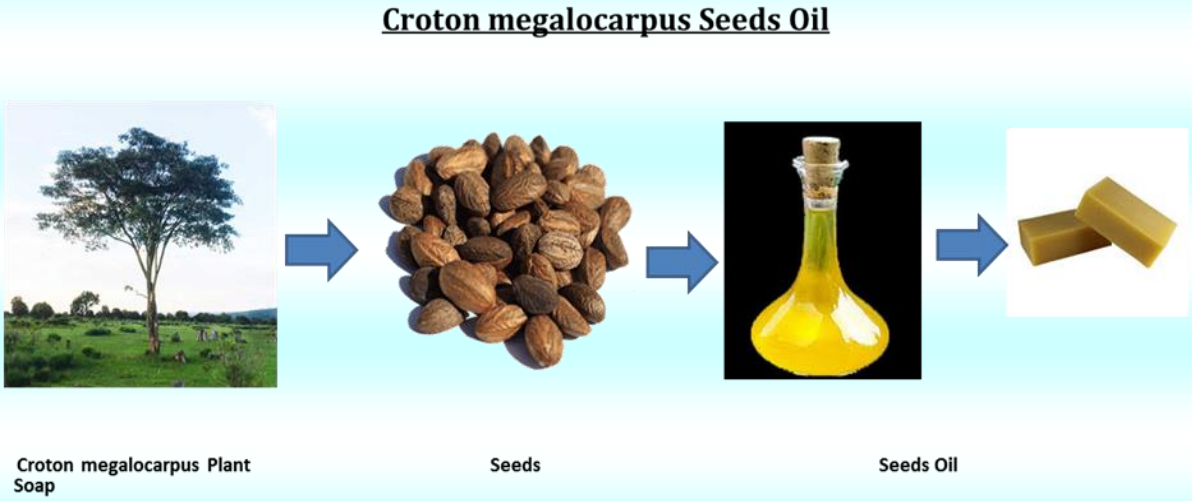
mature the tree has a relatively open architecture, allowing a significant amount of sunlight to penetrate the canopy and reach the ground. Other crops can therefore in principle be grown under the trees in a two-tiered agro-forestry system.

Maize, a crop which requires relatively high solar intensities, grows effectively beneath croton [13]. *Croton* grows and produces well at rainfall accumulations of 800mm/year without the need for irrigation. Because of its tap roots, it can access sufficient soil nutrients so that fertilization is not required. The root exudates enrich the soil with minerals and the leaf litter with organic carbon [13].

Fig. 1: *Moringa Oleifera* seeds.

Figure 2: Croton megalocarpus tree.

Figure 3: *Croton megalocarpus* seeds



Materials and Methods

Plant material

Moringa oleifera and *Croton megalocarpus* seeds were collected from Tharaka-Nithi and Embu counties districts. Pods shells were removed manually and kernels were grounded in a domestic blender and sieved through 600llm stainless steel sieve. Oil extraction was performed to meet the objectives.

Oil extraction

In crushed shelled seeds were extracted using a mechanical soxhlet extractor.

Procedure for soap making

The caustic soda and the seed oil, was carefully measured in a ratio of 2: 1 respectively. And mixed in a heavy, heat-proof glass container and using a wooden spoon, the mixture was gently stirred and the reaction was observed to be exothermic. The mixture was allowed to come to room temperature with stirring and the stirring is continued until the mixture takes on a consistency of a loose pudding. The disinfectant or Aloe vera was added and the mixture blended once more, then the soap was carefully poured into the mold, smoothing out the top. The soap was set aside in a clean, safe place until completely solid. The soap was left into the container until the process with the caustic soda and oil was complete.

Antibacterial studies

The antimicrobial activities of the soaps were determined using the disk diffusion method.

Results

Preliminary data is showing promising results and the research is on going

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Expenditure Budget

ITEM	AMOUNT	PRICE
1. Moringa Oleifera Seeds	6 kgs	9,000
2. Croton Mukinduri seeds	6kgs	9,000
3. Aloe vera extract	100ml	2,000
4. Antiseptic	100ml	200
Total		39,000

Expenditure Budget for Efficacy Test

	Media	**Code/Brand**	**Cost (Ksh)**	
1	Baird-Parker Agar Base	CM0275-OXOID	*9000/=*	
2	Maximum Recovery Diluent	CM1049-OXOID	*3200/=*	
3	TBX	CM0945-OXOID	13,000/=	
4	Listeria supplement	CM0897-OXOID	*5300/=*	
5	Listeria Selective Agar Base	CM0856- OXOID	*10,000/=*	
6	Nutrient Agar	CM0003-OXOID	*5000/=*	
7	Orange Serum Agar	CM0657-OXOID	*13,000/=*	
8	Tryptone Soya Broth	CM0129	*4500/=*	
9	Xylose-Lysine Deoxycholate Agar	CM0469-OXOID	*5300/=*	
10	Egg york		*1800/=*	
	Lactose casein hydrolysate agar (LCHA)	oxoid	*5000/=*	
11	T.C.B.S	CM0333-OXOID	*7000/=*	
	Total		*82, 100/=*	*82,100*

Test organisms, Code and cost

	Media	**Code**	**Cost (Ksh)**	
1	*Escherichia coli,*	NCTC 9001	*550/=*	*4850/=*
2	*Staphylococcus aureus*	NCTC 657	*500/=*	
3	*Salmonella nottingham,*	NCTC 7832	800/=	
4	*Listeria monocytogenes*	NCTC 11994	*600/=*	
5	*Candida alblicans*	*NCPF 3255*	*550/=*	
6	*P. aeruginosa*	NCTC 10662	*500/=*	
7	*V. furnissii*	NCTC 11218	750/=	
8	*A. niger*	NCPF 2275	600/=	
	Total		4850/=	
	Grand total			**86,950**

ANTIBACTERIAL, ANTIFUNGAL AND ANTITUBECULAR ACTIVITIES OF NOVEL HYDROXYTRIAZENES by Ombaka and Gichumbi

ITEM	AMOUNT	Cost
p-Methyl-Nitro benzene Anal. grade	500 g	4,000
o- Methyl-Nitro benzene Anal. grade	500 g	4,000
2,4,6-tribromo amino benzene Anal. grade	500g	4,000
p-hydroxy-nitro benzene Anal. grade	500g	5,000
o-hydroxy-nitro benzene Anal. grade	500g	5,000
p-amino benzoic acid Anal. grade	500g	5,000
o-amino benzoic acid Anal. grade	500g	5,000
Jaggery	2kgs	800
Maize flour	2kgs	200
Muslin cloth	1 M^2	1000
Ethanol	10 Lts	8,000
Activated charcoal	2kg	5,000
Total		47,000

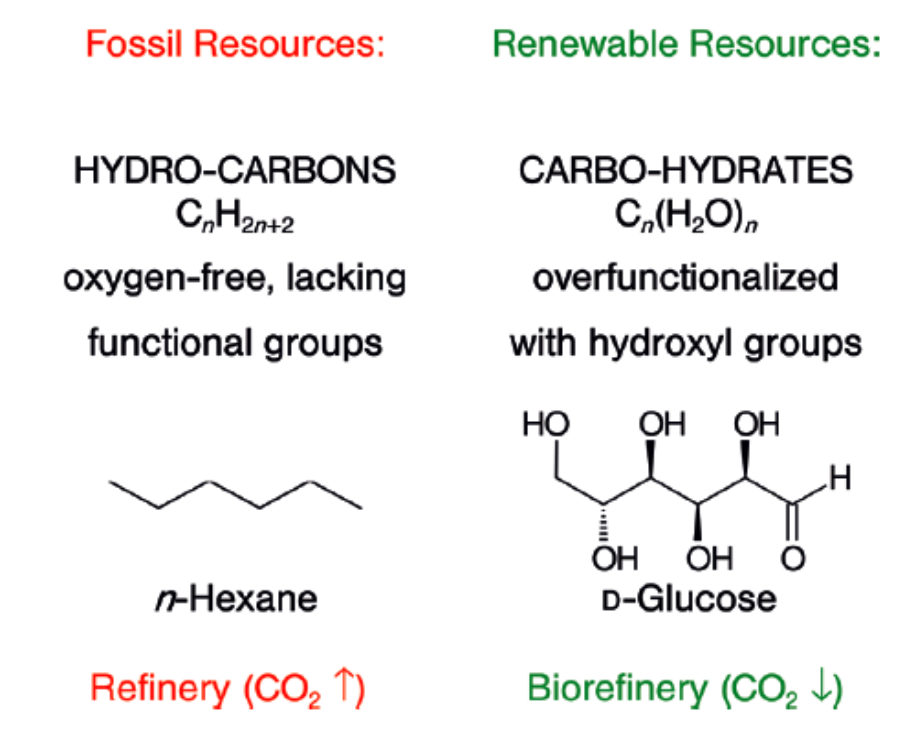
COMMENTS:

He should find what gap exists because others are using it to make soap.

Conversion of Biomass Residues to Levulinate Esters Using Solid Acid Catalysts

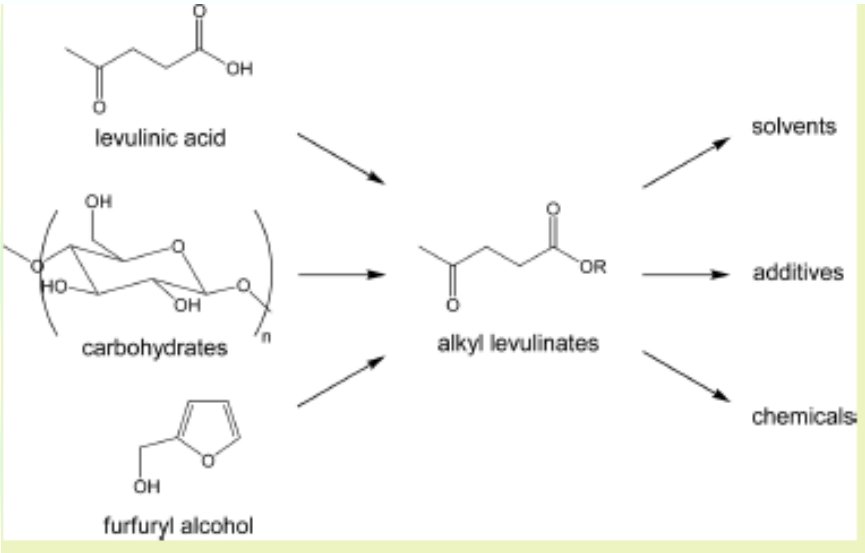
by Dr. Eric Chomba Njagi, Department of Physical Sciences, P. O. Box 109-60400, Chuka

Carbohydrates as Organic Raw Materials



Lichtenthaler. F. W. *Acc. Chem. Res*. 35 (**2002)** 728-737

Levulinate Esters



- fuel oxygenates; flavors; fragrances

Catalysts for Conversion of Biomass

- **Mineral acids** e.g. H_2SO_4, H_3PO_4, HCl
- **Organic acids** e.g. PTSA, Levulinic acid
- **Lewis acids** e.g. $ZnCl_2$, $AlCl_3$, BF_3

- **Metal oxides** e.g. ZrO_2, TiO_2
- **Metal phosphates** e.g. Vanadyl phosphate
- **Ion-exchange resins, zeolites**

Challenges

- Corrosion of equipments, disposal of used catalyst e.g. liquid waste
- Low activity and selectivity- polymeric products
- Rehydration of HMF to form levulinic and formic acids
- Separation of products and reactants
- Metal oxides- deactivation by water, control of acidity

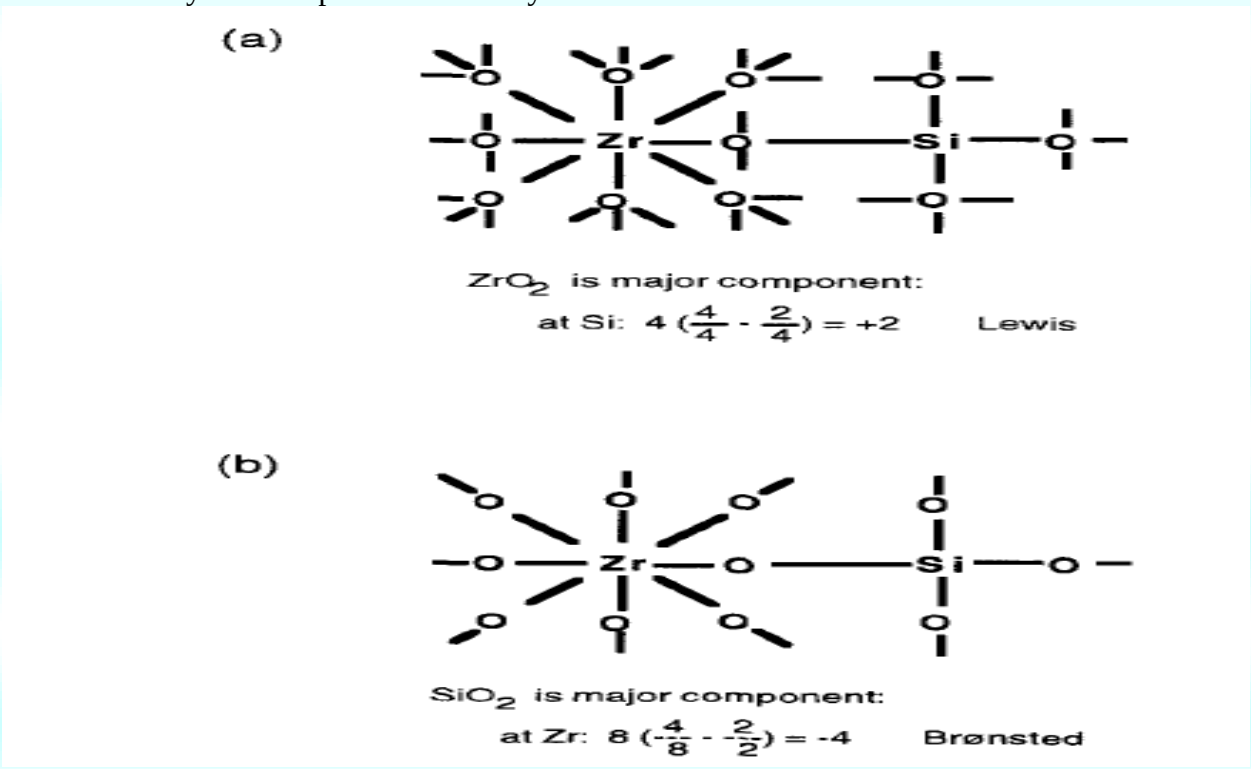
Wanatabe et al. *Applied Catalysis A* 295 **(2005)** 150-156
Vigier and Jerome. *Top Curr Chem* 295 **(2010)** 63-92

Objectives

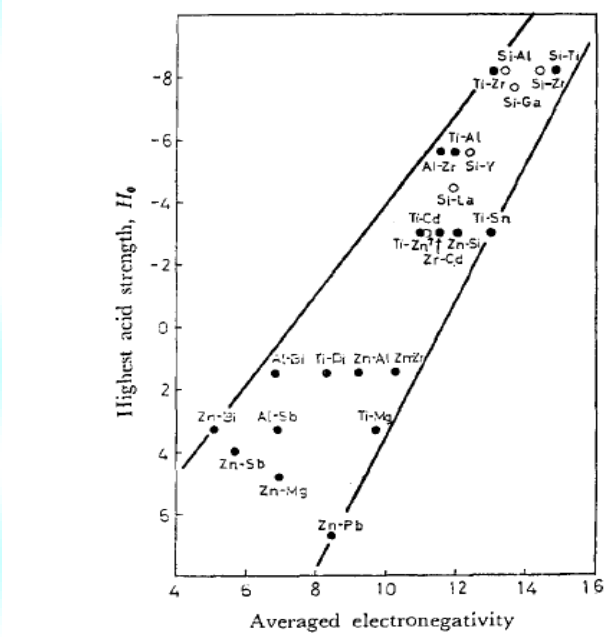
- Tunable Bronsted & Lewis acidity
- High catalytic activity and selectivity
- Chemically stable
- Thermally stable
- Cost-effective

Mixed-Metal Oxides

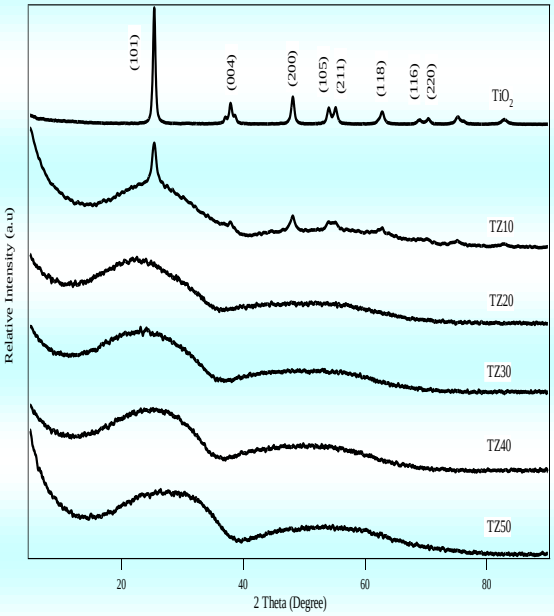
- Acidity caused by generation of excess charge
- Composition determine Bronsted or Lewis acidity
- Acidity depend on ρ of M-O-M' bonds
- Acidity of MMO > Σ individual MO
- Acidity > Amorphous chemically mixed oxides

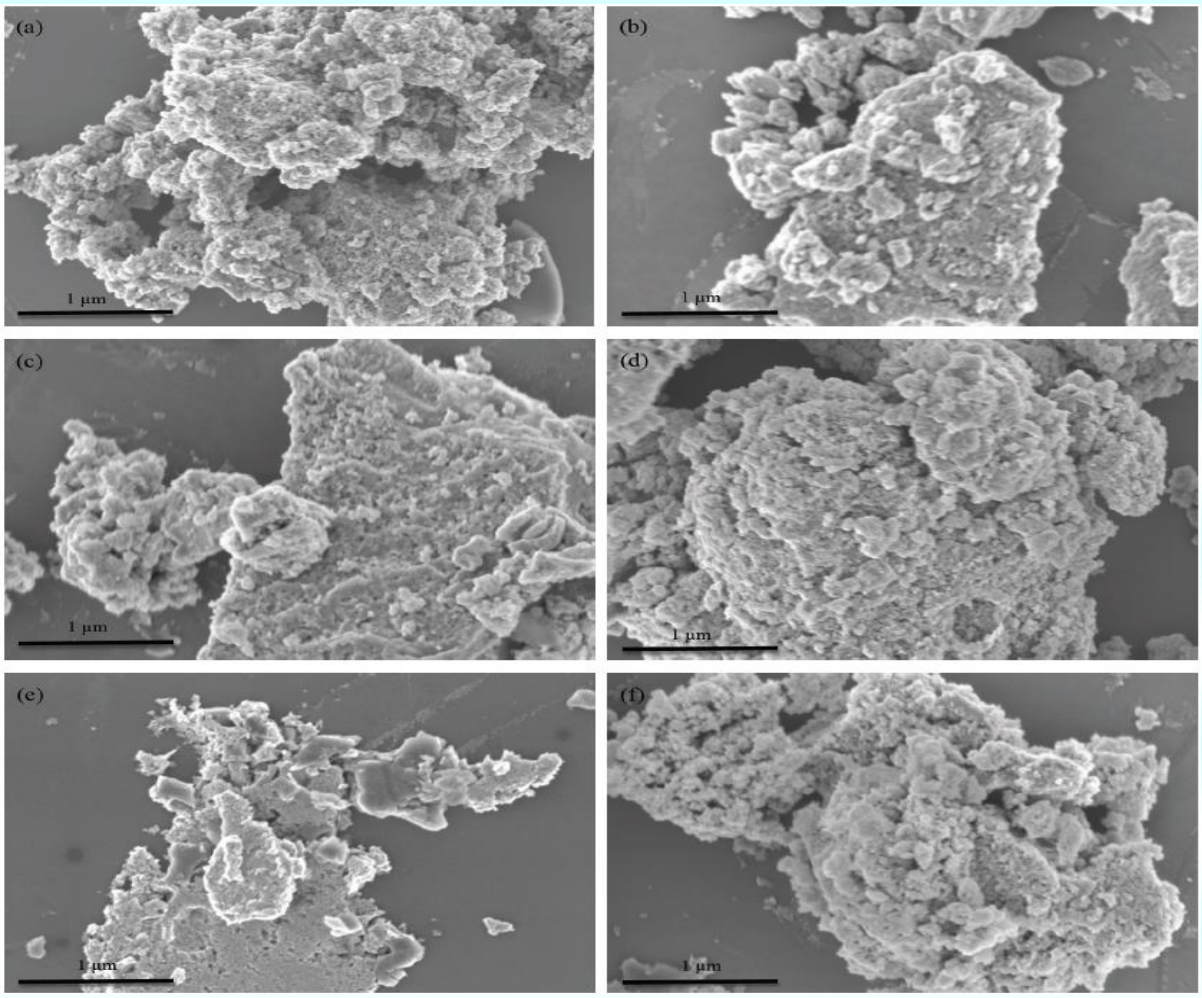


Miller and Ko. *Catal. Today* 35 **(1997)** 269-292
Tanabe et al. *Bull. Chem. Soc. Jpn.* 4 **(1974)** 1064



Highest acid strength increases with algebraically averaged electro-negativities
Tanabe et al. *Bull. Chem. Soc. Jpn.* 4 **(1974)** 1064



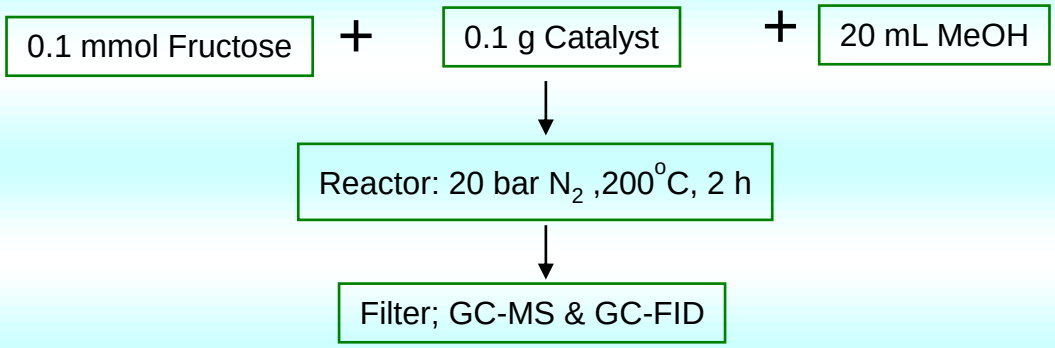


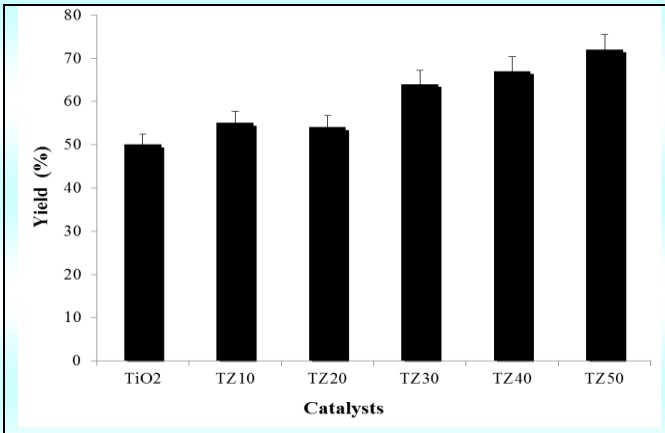
FESEM images of (a) TiO_2, (b) TZ10, (c) TZ20, (d) TZ30, (e) TZ40, (f) TZ50

Textural Properties

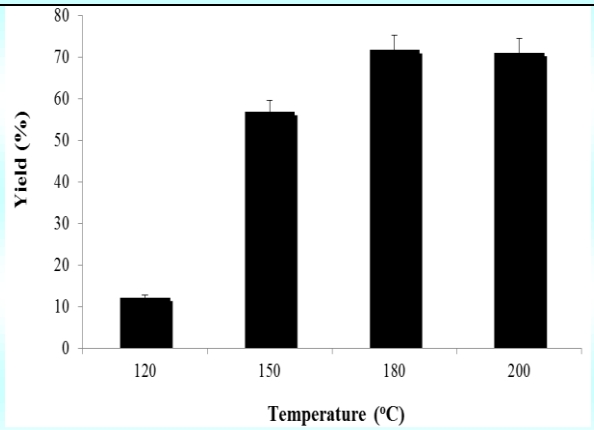
Samples	BET surface area (m^2/g)	Pore diameter (nm)	Pore volume (cm^3/g)[a]
TiO_2	41	3.8	0.054
TZ10	62	3.8	0.113
TZ20	82	3.8	0.145
TZ30	131	3.8	0.188
TZ40	119	3.4	0.238
TZ50	106	3.4	0.257

Conversion of Fructose

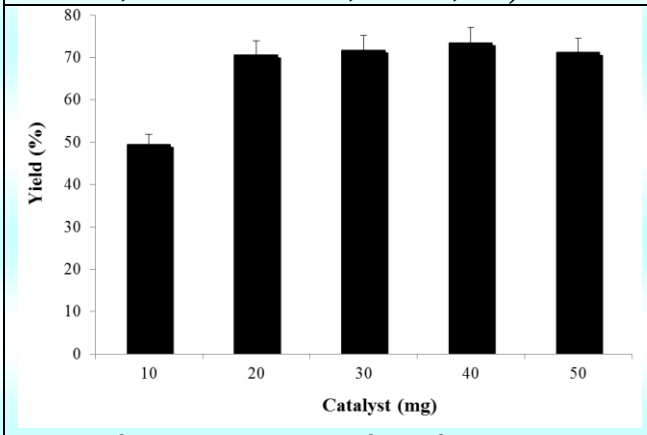




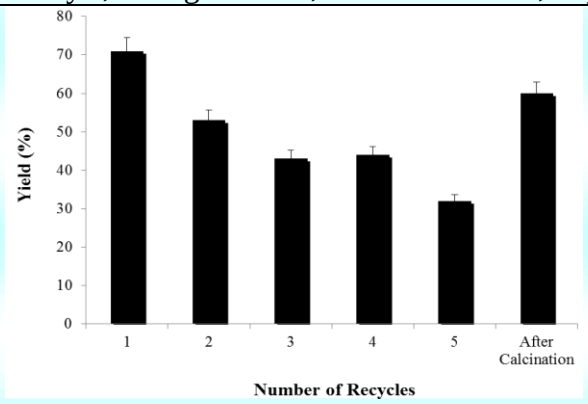
Yields of methyl levulinate from fructose using the synthesized materials. (50 mg catalyst, 90 mg fructose, 10 mL methanol, 200 °C, 1 h)



Yield of methyl levulinate from fructose at various reaction temperatures (50 mg TZ50 catalyst, 90 mg fructose, 10 mL methanol, 1h)



Yield of methyl levulinate from fructose with different amounts of TZ50 catalyst. (90 mg fructose, 10 mL methanol, 200 °C, 1 h)



Synthesis, Characterization, and Cytotoxic and Antimicrobial Activities of Ruthenium (II) Arene Complexes with *N,N*-bidentate Ligands

By Dr. Joel M. Gichumbi, Department of Physical Sciences, Chuka University, P. O. Box 109-60400, Chuka

Abstract

Three new complexes, $[(\eta^6\text{-}C_6H_6)RuCl(C_5H_4N\text{-}2\text{-}CH{=}N\text{-}Ar)]PF_6$ (Ar = phenylmethylene (**1**), (4-methoxyphenyl)methylene (**2**), and phenylhydrazone (**3**)), were prepared by reacting $[(\eta6\text{-}C_6H_6)Ru(\mu\text{-}Cl)Cl]_2$ with N,N′-bidentate ligands in a 1 : 2 ratio. Full characterization of the complexes was accomplished using 1H and 13C NMR, elemental and thermal analyses, UV–vis and IR spectroscopy and single crystal X-ray structures. Single crystal structures confirmed a pseudo-octahedral three-legged, piano-stool geometry around Ru(II), with the ligand coordinated to the ruthenium(II) through two N atoms. The cytotoxicity of the mononuclear complexes was established against three human cancer cell lines and selectivity was also tested against non-cancerous human epithelial kidney (HEK 293) cells. The compounds were selective toward the tumor cells in contrast to the known anti-cancer drug 5-fluoro uracil which was not selective between the tumor cells and non-tumor cells. All the compounds showed moderate activity against MCF7 (human breast adenocarcinoma), but showed low anti-proliferative activity against Caco-2 and HepG2. Also, antimicrobial activities of the complexes were tested against a panel of anti-microbial-susceptible and -resistant Gram-negative and Gram-positive bacteria. Of special interest is the anti-mycobacterial activity of all three synthesized complexes against *Mycobacterium smegmatis*, and bactericidal activity against resistant *Enterococcus faecalis* and methicillin resistant *Staphylococcus aureus* ATCC 43300.

Introduction

Cancer is used to describe over 200 diseases which have the common characteristic of uncontrolled cell division and the ability of these cells to invade healthy tissues [1]. It is one of the most challenging diseases to cure and is a major cause of death worldwide. There are many approaches to the treatment of cancer, and chemotherapy has been the most effective method since the discovery of cisplatin [2, 3]. However, cisplatin has the disadvantage of being ineffective against many common types of cancer, drug resistance is common and it has bad side effects which can include nerve damage, hair loss, and nausea [4, 5]. Therefore, alternative metal compounds are presently being evaluated for anticancer applications to overcome these limitations. Among these metal complexes, ruthenium-based compounds are regarded as the most promising alternatives to platinum complexes [6]. These compounds tend to cause fewer and less severe side effects as compared to platinum drugs. Ruthenium's properties are well suited toward pharmacological applications. It can access a range of oxidation states (II, III, and IV) under physiologically relevant conditions and in general the rates of ligand exchange processes in ruthenium complexes are much faster than in square planar Pt(II) complexes. It has lower toxicity, which is thought to be due to its ability to mimic iron and therefore bind to biomolecules such as serum albumin and transferrin [7]. Transferrin normally transports Fe(III) in the blood but is only about one-third occupied by Fe(III) and so there are vacant sites available for Ru(III) binding [8].

Ruthenium (II) arene compounds have also shown antiproliferative activity *in vitro* and *in vivo* [9–13]. The promising anticancer properties of ruthenium have prompted other researchers to synthesize a series of organometallic ruthenium (II) complexes. The Sadler group have synthesized complexes of the general formula $[(\eta^6\text{-arene})Ru(en)Cl]PF_6$, where en is ethylenediamine and arene represents benzene, *p*-cymene, tetrahydroanthracene, dihydroanthracene, and biphenyl, which were found to exhibit anticancer activity both *in vivo* and *in vitro* [8, 14]. The Dyson group have synthesized ruthenium-arene complexes bearing the

1,3,5-triaza-7-phosphatricyclo-[3.3.1.1]decane ligand [PTA] [5, 15] and polypyridine complexes have been synthesized by the Sheldrick group [16]. All these researchers synthesized half-sandwich organometallic Ru(II) complexes which were designed to allow fine tuning of physical and chemical properties which could result in optimized biological activity [17–19].

These three-legged, piano-stool complexes have a pseudo-octahedral geometry around the ruthenium(II), the arene ligand occupying three coordinating sites (the seat) with three other ligands (the legs) [20]. Arene ligands stabilize Ru(II) and also provide a hydrophobic face for the complex, which might enhance biomolecular recognition processes and transport of ruthenium. In addition, the arene identity appears to affect cell uptake and interactions with potential intracellular targets [21]. A monodentate ligand, usually chloride, as leaving group facilitates the binding of the biomolecules to the metal center. Finally, bidentate ligands affect the kinetics of the complexes. Research has shown that the nature of the monodentate and bidentate ligands influence the pharmacological properties of these complexes [22].

Ruthenium complexes have also attracted interest as antimicrobial agents [23–26]. This is because multidrug resistance is a major problem and there is a clear need for the development of new types of antimicrobial agents, which can overcome the bacterial mechanisms of resistance developed against the current range of drugs [23, 27]. Resistance against antimicrobial agents develops quickly, even against synthetic compounds that bacteria have never encountered previously [28]. This has triggered interest in new classes of antimicrobial agents and several avenues are being pursued to find new compounds that inhibit the growth or virulence of pathogenic bacteria [28]. Transition metal compounds have attracted interest due to the success of platinum anticancer agents [28] and in particular ruthenium complexes are of great interest due to the ability of ruthenium to mimic iron when bound to biological molecules [27].

This study was motivated by the increasing interest in the application of half-sandwich ruthenium complexes in therapeutic applications [29]. Thus three new complexes, $[(\eta^6\text{-}C_6H_6)RuCl(C_5H_4N\text{-}2\text{-}CH{=}N\text{-}Ar)]PF_6$ (with Ar = phenyl methylene (**1**), (4-methoxy phenyl) methylene (**2**), phenyl hydrazone (**3**)), were synthesized and characterized by NMR, UV–vis, thermal analyses, IR, HRMS, and elemental analyses. In addition, the molecular structures of **1**, **2,** and **3** have been determined by single crystal XRD. The cytotoxicity of the mononuclear complexes was established against the human cancer cell lines Caco-2 (human epithelial colorectal adenocarcinoma), MCF7 (human breast adenocarcinoma) and HepG2 (human hepatocellular carcinoma). Additionally, antimicrobial susceptibility tests were done against antimicrobial-resistant and antimicrobial susceptible Gram-positive and Gram-negative bacteria to determine their antibacterial potential.

2. Experimental

All manipulations were carried out under an inert atmosphere (UHP nitrogen) using Schlenk techniques. Solvents were dried using reported techniques [30]. Chemical reagents were purchased from Sigma–Aldrich and utilized as received. Melting points were measured on an Ernest Leitz Wetzlar hot stage microscope. Elemental analyses were performed on a Thermal-Scientific Flash 2000 CHNS/O analyzer. Infrared spectra were recorded using an ATR Perkin Elmer Spectrum 100 spectrophotometer between 4000 and 400 cm−1 in the solid state. Mass spectra were recorded via a Waters Micromass LCT Premier TOF-MS with ESI in the positive mode. Acetonitrile (100%) was used as a mobile phase and 10 μL of the sample injected at 0.3 mL min−1 flow rate. Electronic spectra were recorded in acetonitrile with a Perkin-Elmer Lamba 35 UV–visible spectrophotometer. 1H and 13C NMR spectra were recorded on a Bruker Top Spin 400 and 600 MHz spectrometers using deuterated DMSO-d_6 from Sigma–Aldrich. Thermogravimetric analyses (TGA) were performed on a SDTQ600 TGA-DSC in a nitrogen

atmosphere. The precursor $[(\eta^6\text{-}C_6H_6)Ru(\mu\text{-}Cl)]_2Cl_2$ was prepared following a reported method [31]. The pyridyl-imine ligands were synthesized according to reported procedures [32–35].

2.1. In vitro *anticancer activity*

2.1.1. Chemicals

Eagle's Minimum Essential Medium (EMEM) with l-glutamine (4.5 g L−1), trypsin-versene mixture, and antibiotic were purchased from Lonza BioWhittaker (Verviers, Liege, Belgium). MTT reagent [3-(4,5-dimethyl- 2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide], phosphate buffered saline (PBS) tablets, and DMSO were purchased from Merck (Darmstadt, Hesse, Germany). Fetal calf serum (FCS) was purchased from Highveld Biological (Pty) Ltd. (Lyndhurst, Gauteng, RSA). All tissue culture consumables were obtained from Corning Incorporated (New York City, NY, USA). All other chemicals and reagents were of analytical grade. Ultrapure deionized 18 MΩ water (Milli-Q50) was used throughout.

2.1.2. Cell culture

HEK 293 (human embryonic kidney), Caco-2 (human epithelial colorectal adenocarcinoma), MCF7 (human breast adenocarcinoma), and HepG2 (human hepatocellular carcinoma) cell lines were maintained at 37 °C under 5% CO2 in culture flasks containing 5 mL of complete medium [EMEM supplemented with 10% (v/v) gamma-irradiated FCS and antibiotic (100 μg mL−1 penicillin, 100 μg mL−1 streptomycin, 0.25 μg mL−1 amphotericin B)].

2.2. Cytotoxicity tests

2.2.1. MTT assay

Human embryonic kidney (HEK293) cells were obtained from the Anti-viral Gene Therapy Unit, Medical School, University of the Witwatersrand, SA, human breast adenocarcinoma (MCF7) cells were purchased from the ATCC, Manassas, VA, USA, and the human hepatocellular carcinoma (HepG2) and human colorectal adenocarcinoma cells (Caco-2) were purchased from Highveld Biologicals (Pty) Ltd., Kelvin, SA. The cells were grown to semi-confluency in 25 cm2 tissue culture flasks in EMEM supplemented with 10% fetal bovine serum and antibiotics (100 μg mL−1 penicillin, 100 μg mL−1 streptomycin). Cells were seeded at a density of 1.8 × 103 cells per well in a 96 well plate containing 100 μL of medium. The cells were then incubated for 24 h at 37 °C in 5% CO_2, after which the medium was removed and 100 μL fresh medium was added. Compounds **1**, **2,** and **3** at concentrations of 20, 40, 60, and 80 μg mL−1 were then added in triplicate to the cells and incubated for 48 h at 37 °C. Cells receiving no test compounds were used as positive controls (100% viability).

The MTT assay was adapted from that of Mosmann [36] and measures the metabolic activity of cells by the reduction of MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) to formazan using the succinate-tetrazolium reductase system. After 48 h of incubation, the spent medium was replaced with 100 μL fresh medium and 100 μL of MTT (5 mg mL−1 in PBS), and cells were incubated for 4 h at 37 °C. Thereafter, the medium and MTT were removed, and 200 μL of DMSO was added to each well to dissolve the formazan salt. The absorbance of resulting purple solution was read in a Mindray 96A microplate reader (Vacutec, Hamburg, Germany) at 570 nm (detection λ) and 630 nm (reference λ for nonspecific signals) wavelengths. Cell viability (%) was directly correlated to absorbance and calculated in comparison to the untreated control as follows: Tests were conducted in triplicate and calculation of the concentration at which 50% cell death was achieved (IC50) was done using Microsoft Excel 2010™.

2.3. Evaluation of antimicrobial activity by disk diffusion assay

The antimicrobial activities of the three synthesized complexes and ligand were determined using the disk diffusion method [37].

2.4. Synthesis and characterization of cationic Ru(II) iminopyridyl complexes **1–3**

2.4.1. General synthetic procedures

Compounds **1–3** were prepared using the same procedure. For **1**, to a suspension of [(η6-C_6H_6)Ru(μ-Cl) Cl]$_2$ (0.20 mmol, 100 mg) in CH_2Cl_2 (20 ml) was added the ligand (56 mg, 0.41 mmol) in DCM (10 mL) dropwise with stirring. The mixture was stirred at room temperature for 2 h. The mixture was filtered to remove any undissolved solids, evaporated to dryness and the solid treated with ethanol (10 mL) and ammonium hexafluorophosphate (100 mg, 0.41 mmol) dissolved in ethanol and the mixture stirred for another hour. The compound was precipitated by addition of diethyl ether (20 mL). The microcrystalline solid was filtered and washed with diethyl ether.

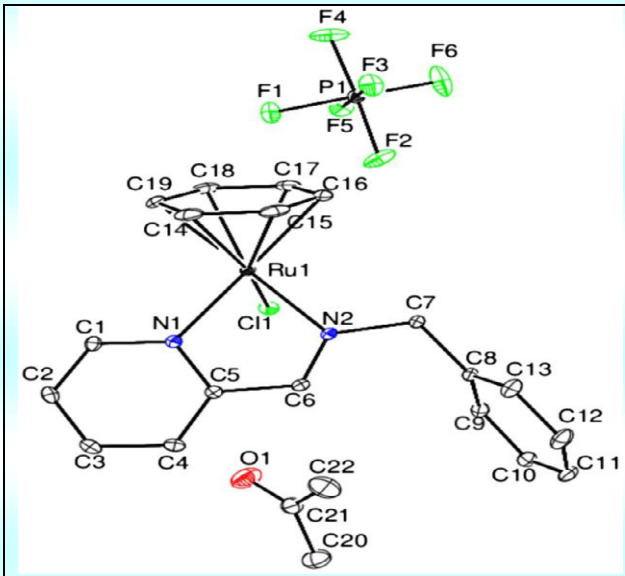


Figure 1. ORTEP view of **1**; displacement ellipsoids are drawn at the 50% probability level; hydrogens are omitted for clarity.

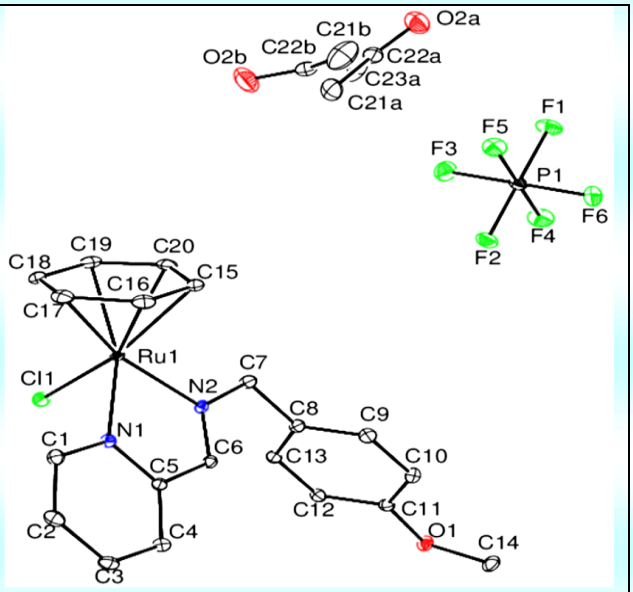


Figure 2. ORTEP view of **1**; displacement ellipsoids are drawn at the 50% probability level; hydrogens are omitted for clarity.

RESULTS

Table 2. *In vitro* cytotoxic effect of newly synthesized ruthenium compounds **1–3**.

Compound	IC_{50} (μM)[a]			
	HEK293	Caco-2	MCF7	HepG2
1	218.7 ± 5.9	130.6 ± 8.5	46.6 ± 6.1	119.6 ± 3.4
2	188.6 ± 4.9	100.5 ± 0.3	61.6 ± 3.1	105.9 ± 9.6
3	251.8 ± 3.2	144.2 ± 9.2	58.7 ± 0.9	168.3 ± 8.6
5-Fu	47.4 ± 0.8	73.9 ± 4.5	30.5 ± 2.9	50.2 ± 1.2

[a]IC_{50} value corresponds to the concentration of the respective compound required to effect 50% mortality in net cells. 5-Fu or 5-Fluoro uracil was used as a reference drug.

Table 3. Antimicrobial susceptibility test results of **1–3** with zones of inhibition given to the nearest mm.

	Gram-positive bacteria																	
	B. subtilis ATCC 6653			*E. faecalis* ATCC 51299			*S. aureus* ATCC29213			*S. aureus* ATCC 43300			*S. saprophyticus* ATCC 35552			*M. smegmatis* mc^2155		
Compound (20 mg mL^{-1})	10	20	40	10	20	40	10	20	40	10	20	40	10	20	40	10	20	40
Ligand	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	na	na	na
1	0 (R)	7 (R)	17 (S)	17 (S)	25 (S)	30 (S)	10 (R)	18 (S)	24 (S)	15 (S)	20 (R)	30 (S)	0 (R)	0 (R)	14 (I)	14 (I)	17 (S)	24 (S)
2	0 (R)	7 (R)	24 (S)	0 (R)	9 (R)	15 (S)	8 (R)	12 (I)	22 (S)	6 (R)	10 (R)	20 (S)	0 (R)	0 (R)	15 (S)	14 (I)	16 (S)	26 (S)
3	15 (S)	17 (S)	22 (S)	17 (S)	20 (S)	25 (S)	15 (S)	18 (S)	21 (S)	15 (S)	18 (S)	25 (S)	0 (R)	0 (R)	12 (I)	19 (S)	20 (S)	22 (S)
DMSO	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)
Tetracycline (TE30) – 30 µg		36 (S)						28 (S)			36 (S)			26 (S)			na	
Ampicillin (AMP10) – 10 µg		40 (S)						25 (S)			20 (S)			11 (R)			na	

	Gram-negative bacteria											
	E. coli ATCC 25922			*E. coli* ATCC 35218			*K. pneumoniae* ATCC 700603			*P. aeruginosa* ATCC 27853		
Compound	10	20	40	10	20	40	10	20	40	10	20	40
Ligand	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)
1	15 (S)	20 (S)	26 (S)	0 (R)	7 (R)	7 (R)	0 (R)	0 (R)	12 (I)	7 (R)	12 (I)	21 (S)
2	0 (R)	0 (R)	18 (S)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	12 (I)	0 (R)	7 (R)	13 (I)
3	0 (R)	0 (R)	18 (S)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	12 (I)	0 (R)	10 (R)	19 (S)
DMSO	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)	0 (R)
Tetracycline (TE30) – 30 µg		27 (S)			23 (S)			12 (R)			15 (I)	
Ampicillin (AMP10) – 10 µg		20 (S)			0 (R)			0 (R)			0 (R)	

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COMMENTS:
Methods for determination of cytotoxicity and antimicrobial activity is not clear.

Modeling the Role of Treatment and Counseling in the Management of HIV/AIDS and Tuberculosis Co-Infections

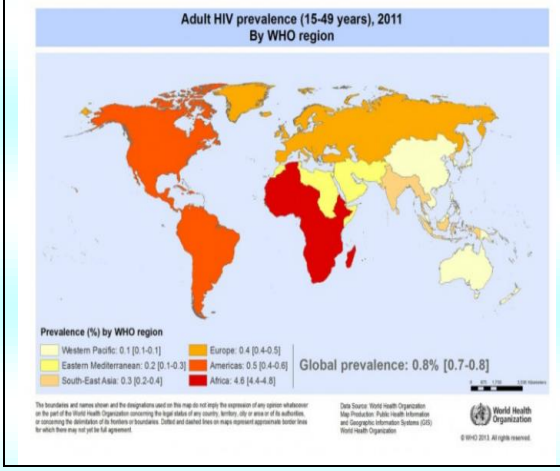
by Dr. Mark Okong'o, Department of Physical Sciences, P. O. Box 109-60400, Chuka

Introduction

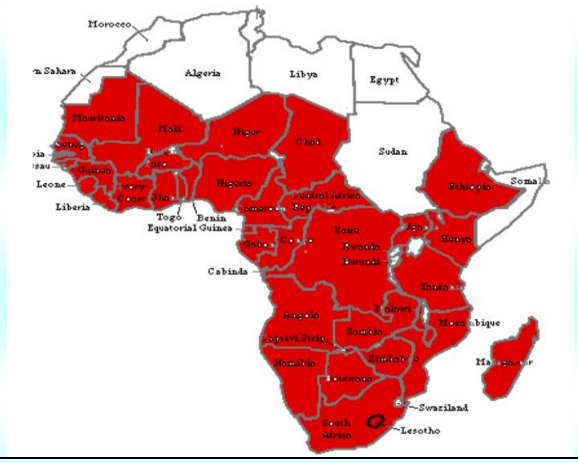
Globally HIV/AIDS has killed > 35 million since 1981. Main factor that fuels the high incidence of HIV/AIDS in Sub-Saharan Africa is dual infection with malaria and TB.

A comparison of the geogical distributions of HIV/AIDS and TB in Africa shows that the 2 diseases have similar geogical distributions

HIV/AIDS (AFRICA)



TUBERCULOSIS (AFRICA)



An investigation of the co-infections on the *CD*4+ cell counts:

- Healthy control group - median *CD*4+ cell counts of 789 cells/μl.
- HIV/AIDS only - 386 cells/μl.
- HIV/AIDS and TB - of 268 cells/μl.

Model Formulation/Methods

To study the dynamics of HIV/AIDS and TB co infection, a deterministic model is formulated by a system of O.D.Es under reasonable assumptions and parameters.

Analysis and Results

- LOCAL STABILITY OF THE D.F.E.
- The reproduction numbers of TB and HIV/AIDS are given by:

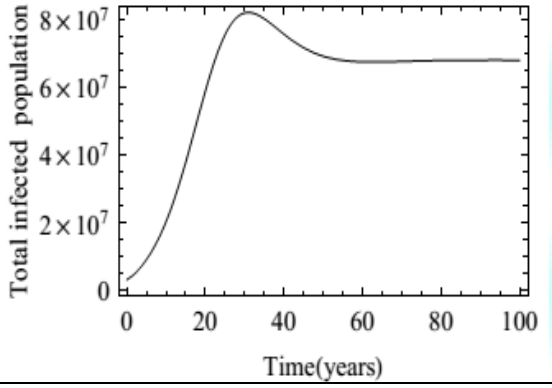
$$R_T = \frac{\beta_t c_2}{d_n + d_t + r_t}$$

$$R_H = \frac{c_1(1-\delta)(\alpha + d_a + d_n)\beta_a}{(\alpha d_n + d_a d_n + d_n^2 + d_a p - \alpha d_a p + d_n p - \alpha d_n p)}$$

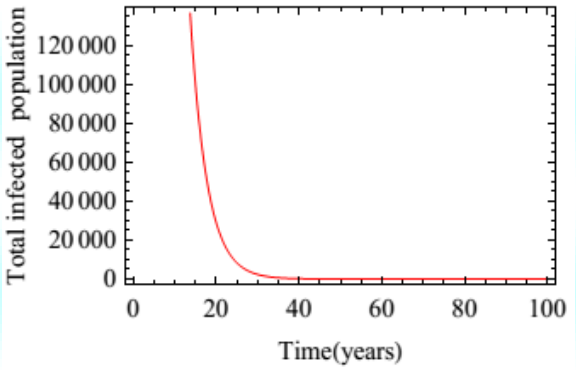
The DFE of the HIV/AIDS, TB model is LAS when $R_{HT} < 1$ *and unstable when* $R_{HT} > 1$

The Role o Treatment and Counseling

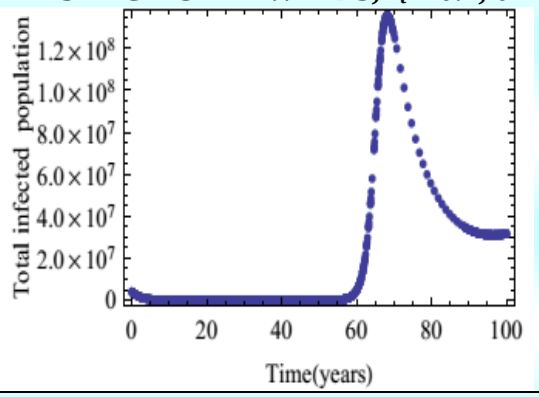
ABSENCE OF HIV/AIDS, $r_t = 0$



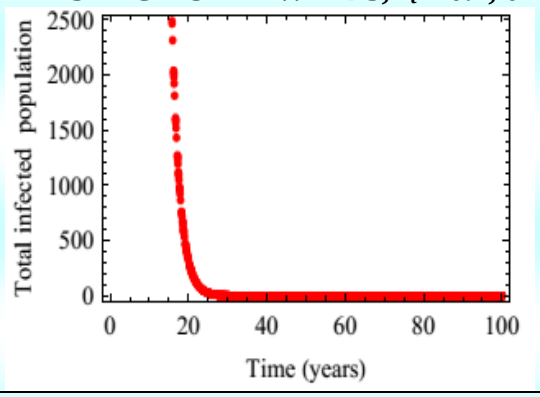
ABSENCE OF HIV/AIDS, $r_t = 0.7$



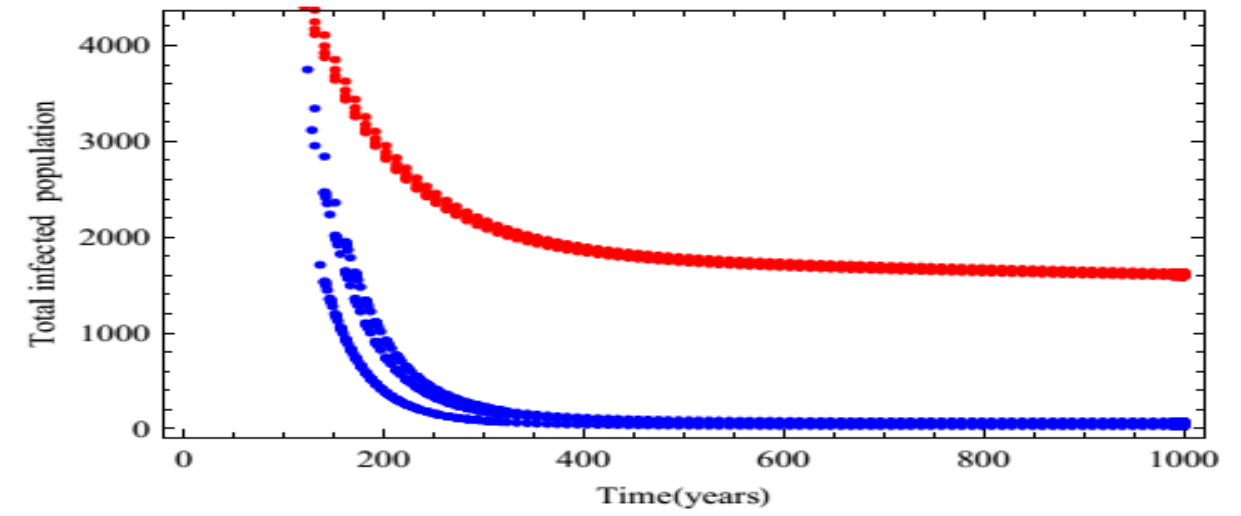
PRESENCE OF HIV/AIDS, $r_t = 0.7$, $\delta = 0.0$



PRESENCE OF HIV/AIDS, $r_t = 0.7$, $\delta = 0.7$



Global Stability of DFE



Backward birfucation

Conclusion

In the absence of HIV/AIDS, TB would not establish itself in the population if there is effective TB treatment

COMMENTS:

It is good to define terms used in a formula so that it makes sense to the audience. Jude had no knowledge on the subject matter.

Analytical Approach to Semi-Open/Semi-Closed Sets

by Dr. S. W. Musundi, Kinyili Musyoka, Priscah M. Ohuru, Department of Physical Sciences, Chuka University, P. O. Box 109-60400, Chuka, and Department of Computer Science and Technology, University of Embu

Introduction

Concept of open and closed sets in metric and topological spaces:

Definition 1: Open ball/sphere and closed ball/sphere

B(x_0,r) = { $x \in X : d(x, x_0) < r$ } is referred to as an open ball while

B(x_0,r) = { $x \in X : d(x, x_0) \leq r$ } is a closed ball.

Definition2: open set/ closed set

A subset *U* of a metric space *X* is said to be open if for any point $x \in U, \exists\, r > 0$:

$B(x, r) \subset U$

A subset *U* of *X* is said to be closed if its complement is open. Equivalently *U* is said to be closed if it contains a closed ball.

Properties of open set/ closed set in metric spaces

a. Any open ball is an open set
b. Both *X* and $\emptyset$ are open sets
c. The intersection of a finite number of open sets is open
d. The union of an arbitrary number of open sets is open

properties of closed sets

a. Any closed ball is a closed set
b. Both *X* and $\emptyset$ are closed sets
c. The intersection of an arbitrary number of closed sets is closed
d. The union of a finite number of closed sets is closed

Gap

There is scanty literature available about semi-open/semi-closed sets on these spaces. Little effort has been made in introducing these sets as clopen sets (representing a closed-open set) in topological spaces as a set which is both open and closed. However, no literature exists of the same under metric spaces.

Statement of the Problem

To give the analytical definitions of semi-open/ semi-closed sets in metric spaces and presentation of their properties.

Main Results

Analytical definitions of semi-open/ semi-closed sets in metric spaces.

Definition: A subset S of a metric space M is said to be semi-open/ semi-closed if it contains some of its limit points. Alternatively, a subset S of a metric space M is said to be semi-open/ semi-closed if the neighborhood of some elements is contained in S.

EXAMPLE

S = { $\frac{1}{n}$: n = 1, 2, 3, . . .} i.e. S = [1, $\frac{1}{2}$, $\frac{1}{3}$, . . . 0)

Remark 3.1.1: Semi-open/semi-closed sets can be categorized into two main categories on the basis of the position of openness and closedness. The categories are:

(i) Lower open-upper closed set denoted by $S\,(a,\ b]$ where $S \in M\ \forall\ a,\ b \in S.$

(ii) Lower closed-upper open set denoted by $S\,[a,\ b)$ where $S \in M\ \forall\ a,\ b \in S.$

Definition: semi-open/ semi-closed balls (spheres)

The set **S (a, r] = {**x ∈ M: ׀x – a ׀< r**}** is called lower open- upper closed ball/ sphere whereas the set **S [a, r) = {**x ∈ M: ׀x – a ׀≤ r**}** is called lower closed- upper open ball/ sphere.

Both lower open-upper closed sphere and the lower closed- upper open sphere are called semi-open/ semi-closed sphere

Alternative definition of semi-open set/ semi-closed set

We say that a subset $g \in M$ is a semi-open set if $\forall\ x \in g,\ \exists\ r > 0:$ $S\,[x,\ r) \subset g$ while a subset $\mathfrak{H} \subset M$ is a semi-closed set if $\forall x \in \mathfrak{H},\ \exists\ r > 0:\ S\,(x,\ r] \subset \mathfrak{H}$.

Example.

Show that $[-1,0)$ is semi-open

Analytical Properties of semi-open/semi-closed set in metric spaces

(a) An arbitrary union of semi-open (resp. semi-closed) sets is semi-open (resp. semi-closed).

(b) Finite intersection of semi-open (resp. semi-closed) sets is semi-open (resp. semi-closed).

Significance and Suggestions

The study of open and closed sets and their somewhat intuitive terms semi-open and semi-closed sets is of importance in design of structures. The study of semi-open/ semi-closed sets and their properties can be extended to topological spaces.

References

Alternative Method for the Geometric Construction of Angles

by Dr. Musundi Sammy W., Wanjohi Elijah, Department of Physical Sciences, Chuka University, P. O. Box 109-60400, Chuka,

Introduction

Geometry is concerned with the properties and relations of points, lines, surfaces, solids and higher dimensional analogs. In geometry, there are those common angles which can comfortably be constructed using a pair of compass and a rule. Such angles are like $60^o, 30^o, 90^o$. As well as their multiples such as $135^o, 45^o, 15^o, 7.5^o$ and so on. However, no literature exist for the construction of angles not related to the above geometrically.

Statement of the Problem

Precise geometrical construction of an arbitrary angle.

Methodology

(i) Draw the baseline; say AB(X cm) on which the angle of interest say α^o (being an acute angle) lies.

(ii) Drop a perpendicular bisector of the baseline at point D.

(iii) Using the length of Y=X/2 * tan α^o mark an arc on the perpendicular bisector at point E.(algorithmically)

(iv) With the use of a ruler join point E to B.

(v) Measure angle DBE with a protractor. Angle DBE=α^o, which is the required angle.

Exercise

Construct angle ABC=54^o where AB=6 cm

Significance of the Study

Its application in construction industry will help have stable structures which will reduce cases of collapsing. It will help in realization of beautiful structures of queer angles and improvement of structures like the D-TOWER in Dubai, and design and construction of specific structures for special disabilities and sickness in medical industry.

References

Groundwater Aquifer Trait Investigation Using Vertical Electrical Soundings

by Anthony Odek, Department of Physical sciences, P. O. Box 109-60400, Chuka

Introduction

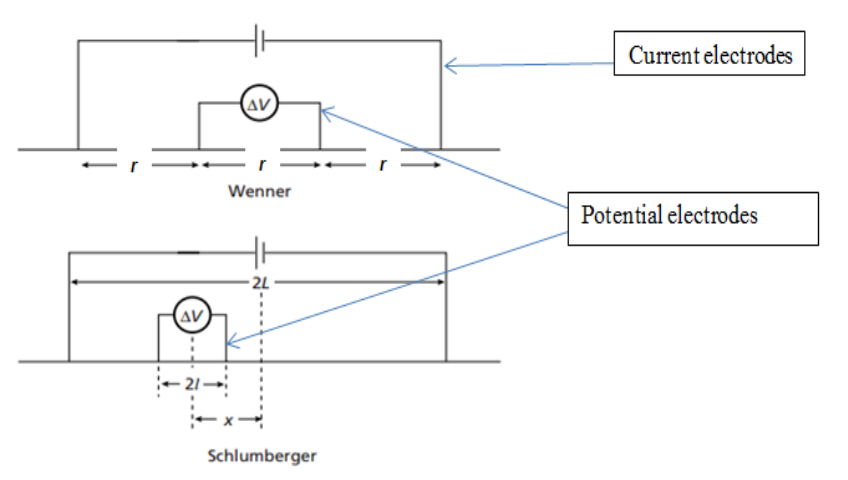
Climate change and global warming are the main causes of unreliable rainfall. Groundwater has successfully been used as alternative means of water supply where rainfall is scarce. Groundwater potential-ability of subsurface at a given geographical area to hold underground water resource; - pore spaces between mineral grains or in fractures in a rock mass. Losses associated to borehole failure have been incurred in an attempt to site ground water resources

Objectives

- To identify ground water primers
- To establish aquifer geometry.

Materials and Methods

- Resistivity Method-Inject current into the ground
- Schlumberger configuration has inner potential electrodes with spacing which is smaller relative to the outer current electrodes separated by



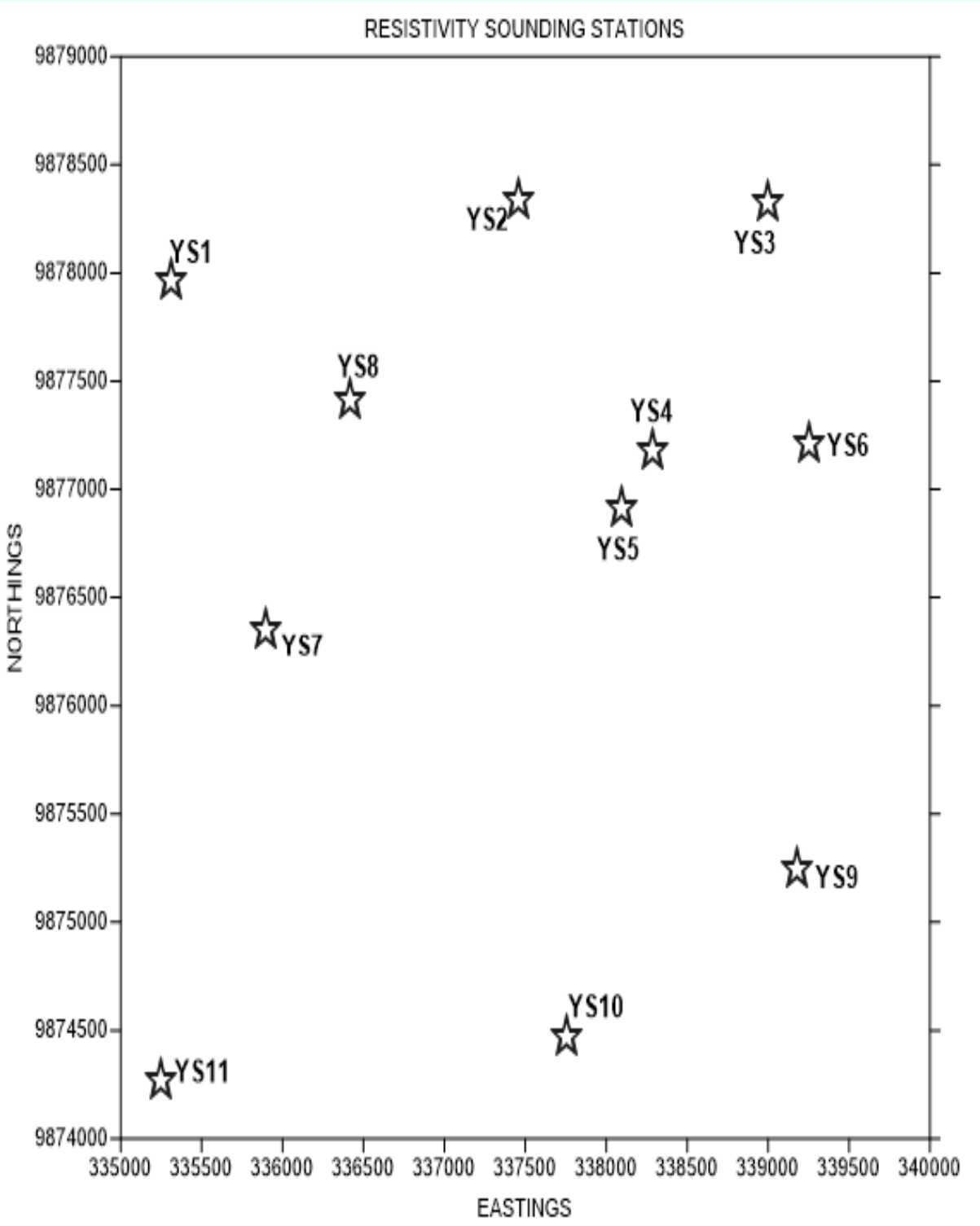
- For VES surveys the potential electrodes remain fixed as the current electrodes get expanded.

$$\rho_a = \frac{\pi L^2 \Delta V}{2lI}$$

ρa= apparent resistivity,
l=potential electrode separation,
L=current electrode separation, I=injected current
V=potential difference.

- SARIS resistivity meter was used to obtain resistivity measurements for this survey
- Station coordinates were taken using handheld GPS
- Grids- 11 measurement stations -25 Km^2 area
- VES by Schlumberger array method with half the spacing between current electrodes and potential electrode ranging from 1.5 m to about 200 m and 0.5 m to about 20 m respectively was then conducted within the same grids for vertical investigations.

Station Co-ordinates

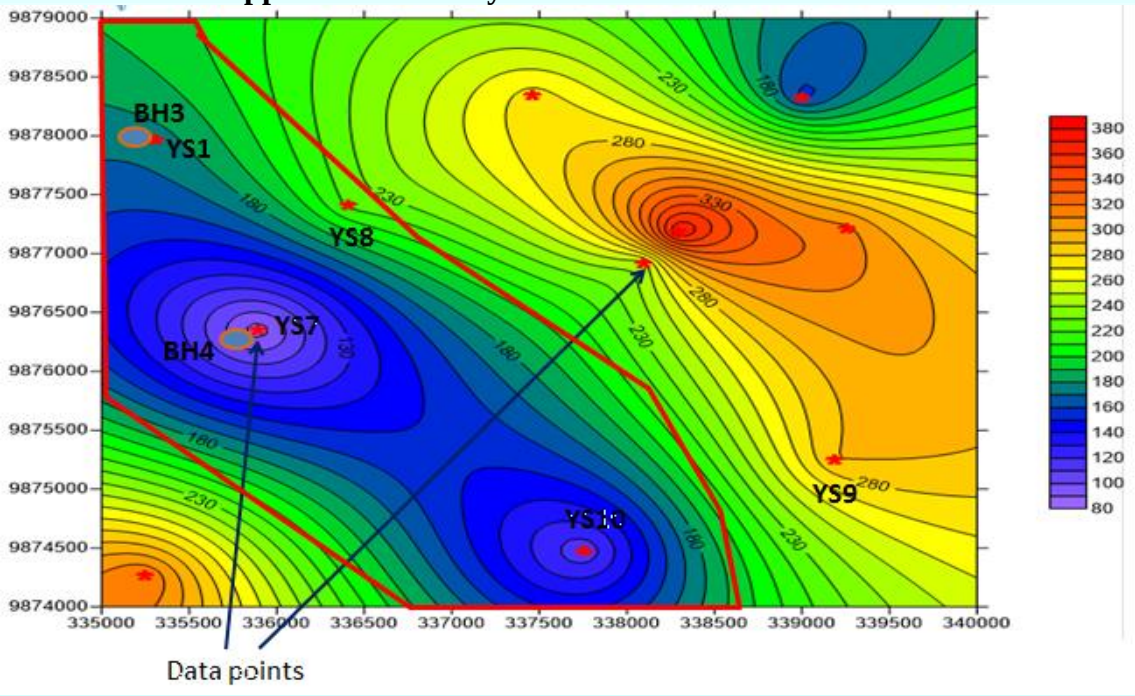


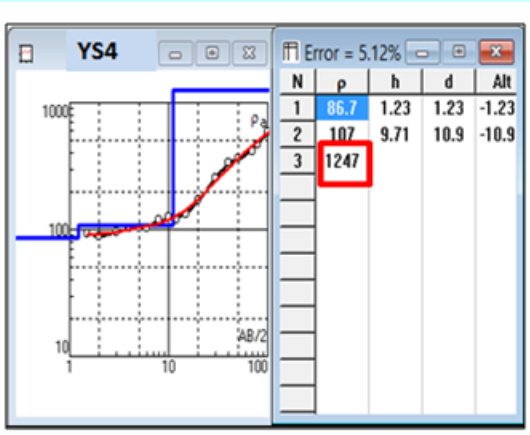
Data Processing

Apparent resistivity data obtained from Schlumberger measurements were subjected to contour plotting using Surfer 10 software with contour interval of 10Ωm. Free air correction

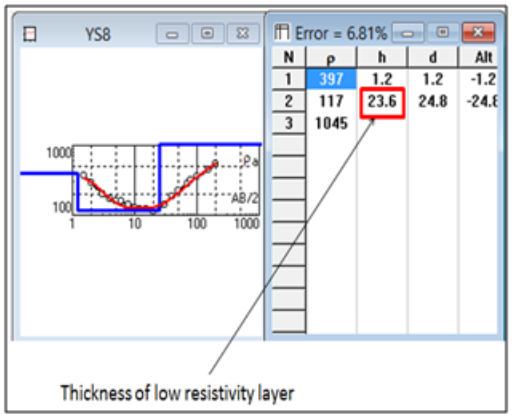
VES data from the 11 stations- subjected to digital inversion using IPI2Win software station by station and subsurface formations were mapped together with their corresponding resistivity and thicknesses

Contour Plot of Apparent Resistivity





(a) *Inversion result for YS4 sounding, located at the Eastern side of the study area*



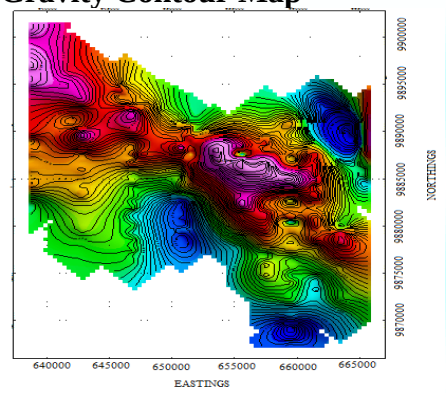
(b) *Inversion result for YS8 sounding,(west of Matuu)*

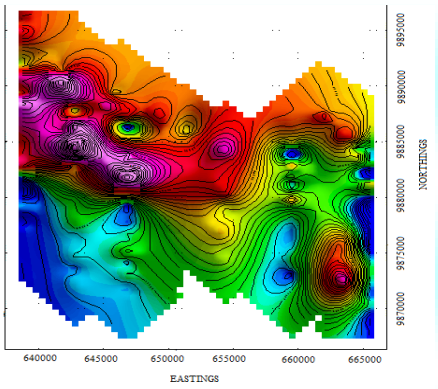
VES Station Code	Parameters	
	Transverse Resistance (Ωm^2)	Longitudinal Conductance (mS)
YS1	11523.12	0.306062
YS2	3275.93	0.088506
YS3	23908.67	0.555043
YS4	1145.611	0.104935
YS5	4023.946	0.097382
YS6	2867.9	0.150078
YS7	880.02	0.434947
YS8	3224.7	0.203885
YS9	2935.598	0.071684
YS10	653.5612	0.586065
YS11	4405.328	0.225382

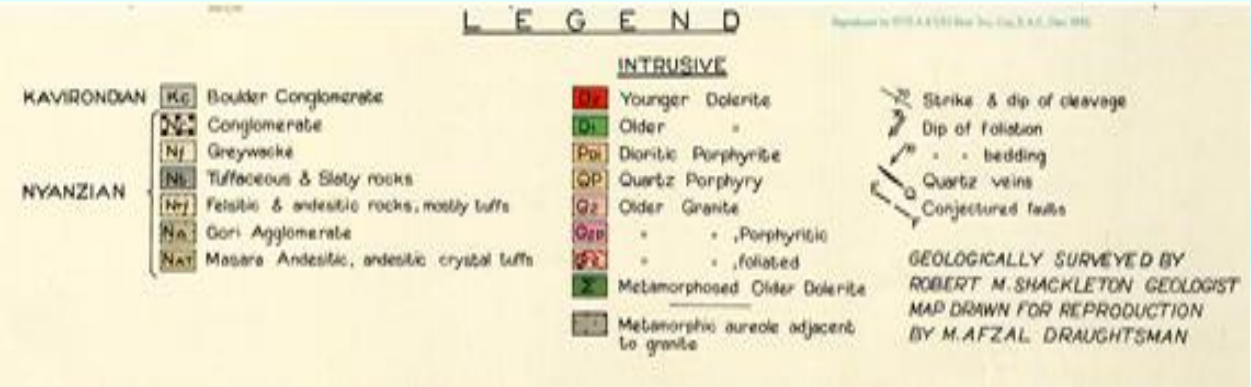
Discussion

- Aquifer characteristics and geo-electric parameters, transverse resistance (R) and longitudinal conductance (S) calculated from the inversion result
- Relatively high values dominating the western zone soundings.
- This can be attributed to the potential for groundwater being greater at the western part of the study area than it is to the East.

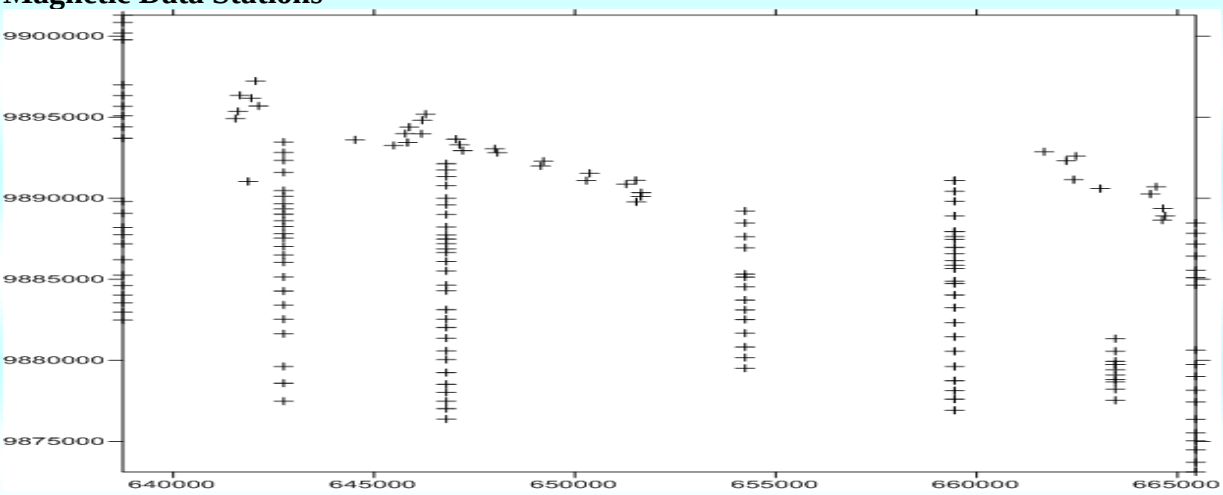
Gravity Contour Map







Magnetic Data Stations



Comments

This is not original. It is done by only borehole digger. It application is questionable.

Short Course: Contemporary Life and First Aid Skills for Managers of Learning Institutions: *Empowering Young People for Sustainable Development*

by Mr. Willy Rankesh, Department of Nursing, Chuka University, P. O. Box 109-60400, Chuka

Introduction

Kenya has a youthful population with 25.5% of the population aged between 15-29years (KDHS 2014). Following implementation of the free primary education program, the enrollment surged tremendously (UNES 2004). Although retention and progression rates from primary to tertiary education where low, the overall net effect was a general increase in the population of those in secondary and other tertiary institutions of learning. This therefore means majority of these young people are either in secondary school or at an institution of learning (Mumiukha et al 2015). The demand and expansion secondary and tertiary education has brought a fair share of the challenges of the growing youth into the learning environment, hitherto which the teacher was not traditionally prepared to deal with. It is common knowledge that the growing youth will bring into the learning environment the challenges they face in the community, which may negatively impact on performance and the general education outcome. It is therefore instructive that means and ways should be put into place to mitigate for such challenges. Moreover in such settings accidents are rife. It is against this background that life and first aid skills for managers of learning institutions were conceived.

The Problem

There are myriad of socio-economic challenges with which the Kenyan youth are faced with. These are well summarized in the Kenya youth policy document (Ministry of home affairs, heritage & Sports 2002).The key ones include unemployment and underemployment with over 75% being unemployed and having significant health related problems with the HIV/AIDS pandemic prevalence being above 30% in people aged below 30 years. Other challenges include increasing school and college dropout rates, drug and substance use, crime and deviant behavior, limited participation and lack of opportunities as well as abuse and exploitation among others. These multi-pronged problems facing the young people would require multi-faceted approach to reliably address. One such approach is by building capacity within the individuals to be resilient and to be able to make sound judgments and choices. The world health organization (WHO) together with other socio-economic sector actors has demonstrated that capacity to deal with life challenges can be inculcated in people at an early age by enabling them to acquire the necessary skills and competencies at an early age (WHO 1994). Over the years life skills have been incorporated into primary education as a core component of empowering the young. In 1986 (WHO), during the first international conference on health promotion, it was generally agreed (The Ottawa Declaration) that one of the five action strategies for achieving healthy life-styles is by developing personal skills which could be realized by enabling people to learn, throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This learning has to be facilitated in school, home, work and community settings. Action is required through educational, professional, commercial and voluntary bodies, and within the institutions themselves. In subsequent years, other UN organs propagated and or refined the concept of life skills in various conventions and charter documents. For instance, in 1989, the UN's convention on the rights of the child stipulates that education is a right to the child and should be used to facilitate their fullest potential whereas the Jomtein Declaration (1990) clearly stipulates that education as a right for all should not only be used for full potential but also included life-skills among essential learning tools for survival, capacity development and quality of life (UNESCO 1990). WHO (1994) defines life skills as abilities for adaptive and positive behavior that enable individuals to deal effectively with demands and challenges of every day. UNICEF (https://www.unicef.org/lifeskills/index_7308.html) further elaborate life

skills as behavior change or behavior development approach designed to address balance of three areas: knowledge, attitude and skills. These skills are summarized under ten core life-skills: Self-Awareness; Problem-Solving; Decision-Making; Critical-Thinking; Creative-Thinking; Interpersonal-Relationships; Effective-Communication; Empathy; Managing feelings/ emotions; and Coping with Stress. Life-skills training can be used to enable young people acquire skills for promotion of mental well-being, healthy interaction and behavior. It also forms the basis for internalizing concepts of dealing with more specific problems like peer pressure, drug use, unsafe sex, and being involved in vandalism. Life-skill is an effective approach for primary prevention. Moreover it enables individuals to translate knowledge, attitudes into actual abilities and can influence the way we feel about ourselves and others. Furthermore, life-skill training is now recognized as a methodology of addressing variety of issues e.g. 51st Commission on the Status of Women (UN 2007) and World Development Report (2007).

Objectives

The goal of this short course is therefore to enable managers of learning institutions to acquire, knowledge, skills and attitudes to enable them inculcate life-skills in learners in their care. The objectives include developing concept of life-skills with respect to everyday life, creating awareness about the ten core life-skills and their interrelatedness, gaining knowledge on psycho-social theories related to learning and developing life-skills, acquire skills in appraising the need for life-skills training in different settings. Those who will enroll for this course will also acquire knowledge on common medical emergencies as well as first-aid skills to use in such cases.

Methodology

The course is will be delivered in experiential settings and is compressed and designed to be delivered over a period of five days. The course will be delivered by mentors who are knowledgeable in youth, education and health matters. Participatory learning methods will be used and learners will be required to conceptualize a project for implementation in their own work settings. This is to maximize on knowledge retention and quick conversion of acquired skills to tangible societal benefits. Upon successful completion, the successful candidates will be awarded certificates.

Target Market

The course is designed to suit leaner needs with the great flexibility. The course targets teachers and education managers and administrators in both primary and post-primary learning institutions. Those pursuing a career in the education sector are also eligible. The initial trainings will be class-based and shall be held during school holidays and thereafter more customer-oriented approaches to delivery of content will be explored.

Budget

It is anticipated that the course will attract at least 20 participants for each session on offer. On inception the introductory charges will be Ksh. 15,000 for the five days. Based on this assumption the estimated cost of running the program shall be as tabulated:

	Item description	**Item cost**	**Quantity**	**Total (Kshs)**
1.	Folders	250	20	5,000
2.	Writing Pad	100	20	2,000
3.	Pens	25	20	500
4.	Pencil	20	20	400
5.	Participant Hand out	200	20	4,000
6.	Attendance sheet	5	1	5

7.	Participant Badge/Name tag	200	20	4,000
8.	Conference package (meals)	500	20*5 days	50,000
9.	Facilitation Fee	2500/ hr	8hr* 5 days	100,000
Grand Total Cost of Training				**161,905**
10	Participants' training fee	15,000	20	300,000
11	Surplus			138,095

POWERPOINT CONTENT

Broad Objective

- The equip managers of learning institutions with the competencies necessary to respond to the changing demands of their clientele

Expected Learning Outcomes

- Identify life skill competencies and gaps among students
- Provide necessary knowledge on life skills to students
- Provide mentorship and support to students during critical transition periods
- Gain knowledge on first aid
- Acquire necessary competencies for the formation of emergency response teams in their institutions

Target Audience/Population

- Primary and post-primary teachers
- BEd students
- ECD trainers

LIFE SKILLS

Introduction

- The WHO (1994) defines life skills as abilities for adaptive and positive behavior that enable individuals to deal effectively with demands and challenges of every day
- A behavior change or behavior development approach designed to address balance of three areas: knowledge, attitude and skills (UNICEF)
- Aimed at promoting health and well-being of children, adolescents and young adults
- Popularly used in the context of emerging health issues for young people in different settings and contexts

Origins of Life-Skills Based Education

- **Ottawa Charter** for health promotion (1986)
- **Convention on the Rights of the Child** (CRC) (1989) – education for the development of child's fullest potential
- **Jomtien Declaration** (1990) – (education for all) included life-skills among essential learning tools for survival, capacity development and quality of life
- **Dakar World Education Conference** (2000) – took a position that all young people and adults have the *human right* to benefit from "an education that includes learning to know, to do, to live together and to be"

Why life skills as a generic course?

- ✓ Foundation of life skills education for promotion of mental well-being, healthy interaction and behavior
- ✓ Basis for internalizing concepts of dealing with more specific problems like peer pressure, drug use, unsafe sex, and being involved in vandalism
- ✓ Effective approach for primary prevention

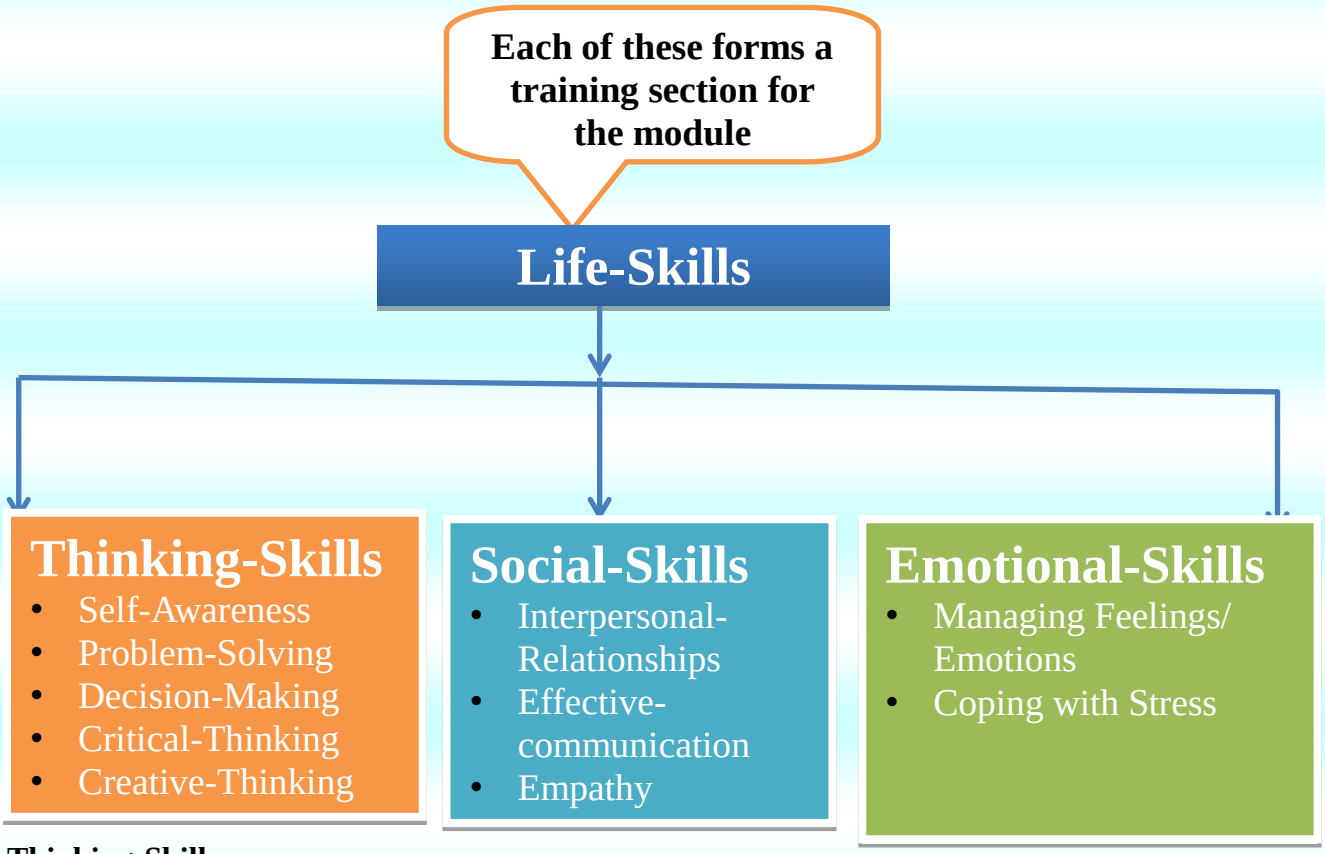
- ✓ Enables individuals to translate knowledge, attitudes into actual abilities
- ✓ Can influence the way we feel about ourselves and others
- ✓ It is now recognized as a methodology of addressing variety of issues e.g. UNGASS on HIV/AIDS (2001), UNGASS on children (2002), World Youth Report (2003), World Program of Human Rights Education (2004), UN Decade on Education for Sustainable development (2005), UN SG's study on Violence Against Children (2006), 51st Commission on the Status of Women (2007) and World Development Report (2007)

Objectives of Life-Skills Programme

- To develop concept of life-skills with respect to everyday life
- To create awareness about the ten core life-skills and their interrelatedness
- To develop life-skills of creative-thinking, critical-thinking, empathy, coping with stress, coping with emotions, inter-personal relationships, communication skills, decision-making skills, self-awareness and problem solving

The Ten Core Life-Skills

- Self-Awareness
- Problem-Solving
- Decision-Making
- Critical-Thinking
- Creative-Thinking
- Interpersonal-Relationships
- Effective-Communication
- Empathy
- Managing feelings/ emotions
- Coping with Stress



Thinking-Skills

- Gaining skills that enable one to evaluate future consequences of their present actions and the actions of others
- Acquire ability to determine alternative solutions
- Analyze the influence of their own values and the values of those around them

Social-Skills

- Verbal and non-verbal communication, active listening, ability to express feelings and give feedback
- negotiation/ refusal-skills assertiveness skills (ability to manage conflicts)
- Ability to listen and understand others' needs
- Teamwork and ability to cooperate and expressing respect for others

Emotional-Skills

- Skills to increase internal locus of control ability to manage self
- Individual belief that they can make a difference and affect change
- Composite of self-esteem, self-awareness, self-evaluation and the ability to set goals
- Ability to deal with anger, grief, loss, trauma and anxiety

Outcomes of Enhanced Life-Skills

- Improved self-esteem
- Self-confidence
- Assertiveness
- Ability to establish relationships
- Ability to plan and set goals
- Acquisition of knowledge related to specific content areas

Theories for Developing Life-Skills

- Child and Adolescent development theory
- Social learning theory
- Problem-solving theory
- Social influence theory
- Cognitive Problem solving
- Multiple intelligences
- Resilience and Risk theory
- Constructivist Psychology theory

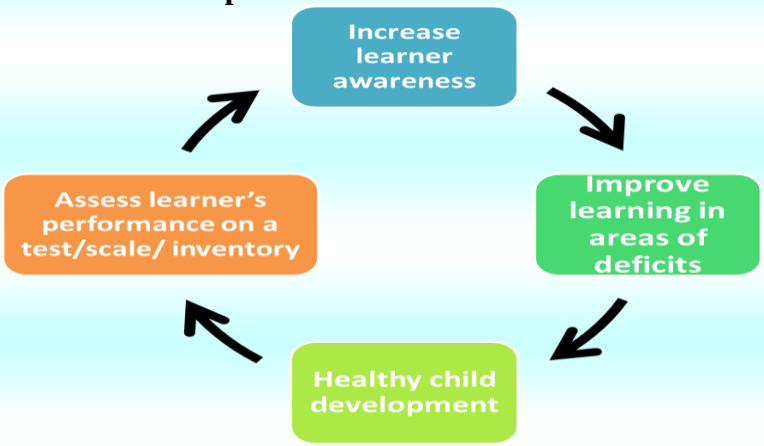
Teaching & Learning Approach

- Define and promote specific skills
- Promote skills acquisition and performance
- Foster skills maintenance and generalization

Teaching and Learning Methods

- Participatory Teaching methods
  - Class discussions
  - Brainstorming
  - Demonstration and guided practice
  - Role play
  - Small groups
  - Educational games and simulations
  - Case studies
  - Story telling
  - Debates
  - Practicing life skills specific to a particular context with others
  - Audio and visual activities
  - Decision mapping or problem trees

Assessment, evaluation and Improvement



FIRST AID

Introduction

- Many accidents are bound to occur
- Not all are life threatening – there those that which can wait but there are those which require immediate action and attention
- Managers of training institutions should have the knowledge and the skills to save lives wherever they are

What will the course entail?

- Step by step guidance on how to identify persons in need of immediate action
- Inculcating the knowledge and skills for rapid and effective action

Why First Aid?

- The initial moments after one stops breathing or the heart fails to pump are critical
- Such a moment can happen anywhere any time – at home, on the roadside, in the class room….
- Everyone should have basic knowledge on how to go about saving life!

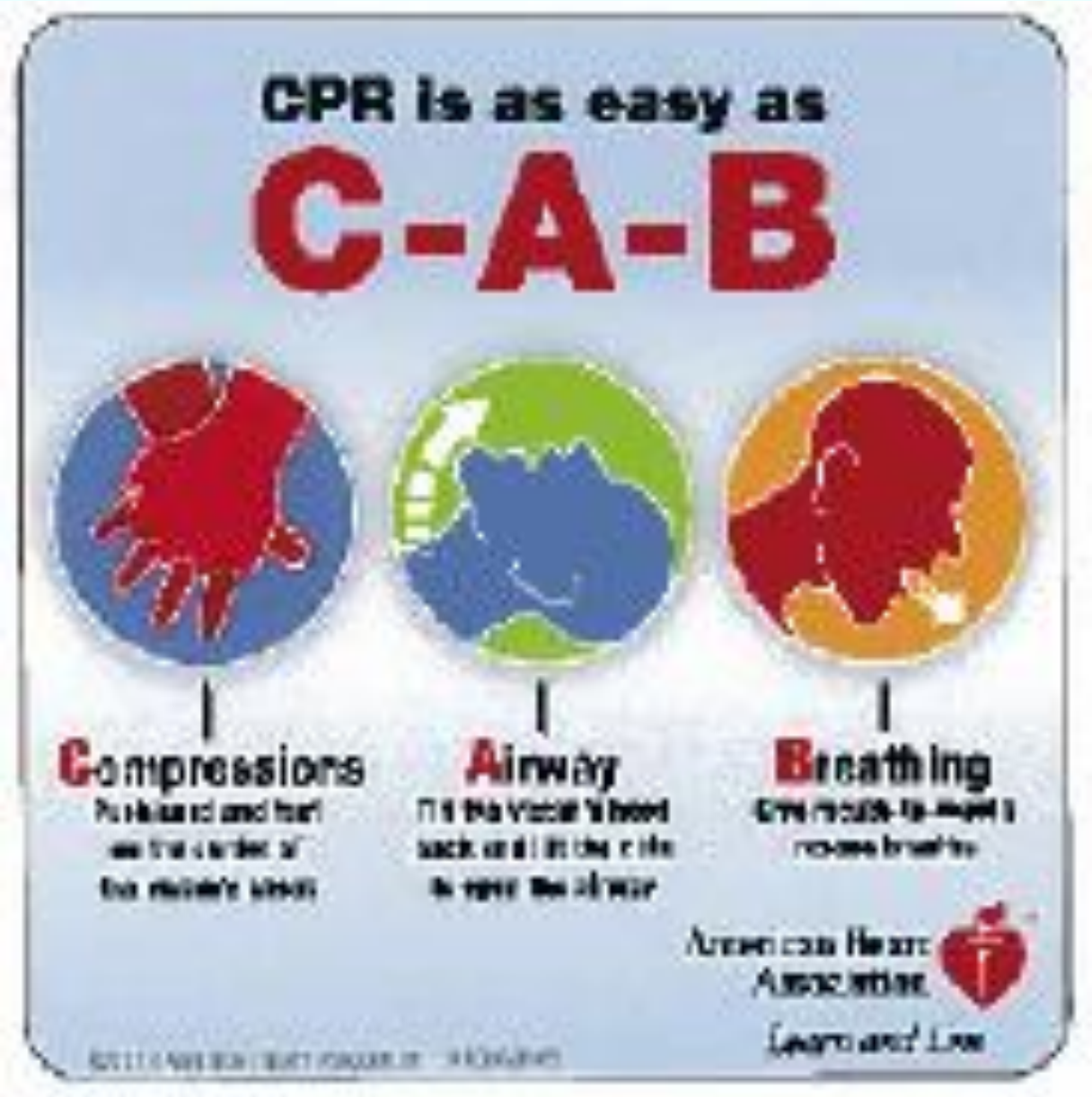
Cardio-Pulmonary Resuscitation

- Why is CPR Important
  - Studies have shown that the general population will start CPR only 1/3 of the time and only 15% of that total is done correctly
  - Chest Compressions can be started within 18 seconds of arriving at the patient, whereas airway first can delay compressions by 1-2 minutes or more

CPR

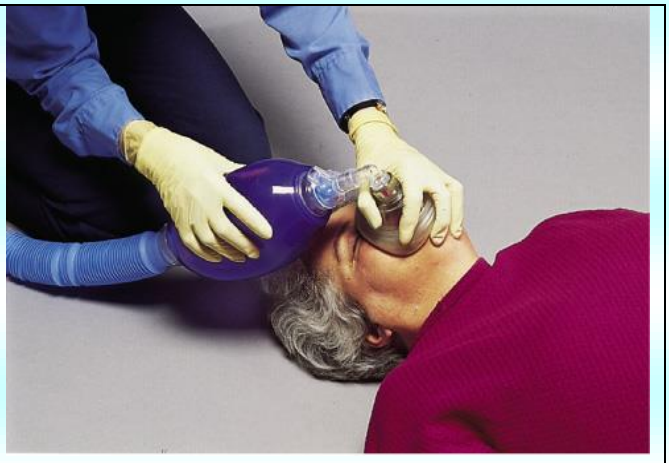
▸ Chest compressions and breaths are the same for adults, child, and infant if you are alone ◦ Adult age starts at the onset of puberty (12-14 years of age) ◦ Child is age 1year to the onset of puberty ◦ Infant is anyone under the age of 1 year	

CPR/AED 2010 Guidelines

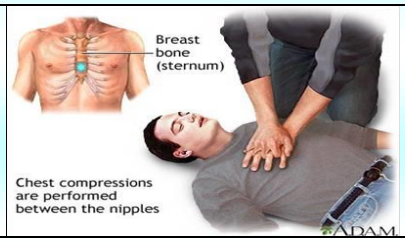


Adult CPR

1. Make sure the scene is SAFE!
2. Check responsiveness and breathing
3. If alone call emergency line and get help
4. Check for a pulse and if no pulse present begin CPR: Always start CPR with Compressions First!
5. Place the casualty on a hard firm surface to lie flat on their back (face up)*
6. Open the airway with head tilt-chin lift
7. Place the mask on the patient's face
8. Use the E-C clamp technique
9. Deliver each breath over 1 second



Compressions

• Push hard and fast • Rate should be at least 100 per minute • Provide 30 compressions then 2 breaths • Make sure you allow the chest to re-expand completely at the end of each compression	

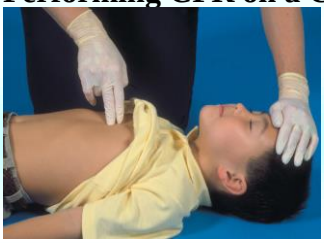
Pediatric CPR

1. Make sure the scene is SAFE!
2. Check responsiveness and breathing
3. If alone call the emergency line and get help
4. Check for a pulse and if no pulse present begin CPR
   - Always start CPR with Compressions first!
   - If despite adequate ventilation and oxygenation, pulse is <60, begin chest compressions

Compressions

- One rescuer: Begin cycles of 30 chest compressions and 2 breaths
- Two rescuers: Begin cycles of 15 chest compressions and 2 breaths
- Rate should be at least 100 per minute

Performing CPR on a Child



Place the heel of one or both hands in the center of the chest, in between the nipples, avoiding the xiphoid process.

Compress the chest one third the anterior-posterior diameter of the chest at a rate of at least 100 times/min. Coordinate compressions with ventilations in a 30:2 ratio (one rescuer) or 15:2 (two rescuers), pausing for ventilations.

Performing Infant Chest Compressions

Position the infant on a firm surface while maintaining the airway. Place two fingers in the middle of the sternum just below a line between the nipples.

Use two fingers to compress the chest one third to one half its depth at a rate of at least 100 per minute. Allow the sternum to return to its normal position between compressions.

Practice good CPR on manikins with your group.

Short Course: Contemporary Oral and Community Health Skills for Social Workers and Other Stakeholders

by Mr. Joshua K. Mwangi and Mrs. Dorothy Mbaya, |Department of Nursing, P. O. Box 109, Chuka

Purpose of the Course
This short course will enable the social workers and other community owned resource persons to apply the basic concepts and skills of community health to provide oral health preventive and promotive care to clients in the community.

Course Duration: 3 days
Target Audience: Community Owned Resource Persons (CORPS)
Course objectives:
To equip CORPS with knowledge on community health and oral health
To equip CORPS with skills necessary to educate the community on good oral hygiene

Proposed Topics
- Introduction to community health and oral health
- Communication and teaching skills
- Basic skills in community health (general-not specific to oral health)
- Common dental conditions in our community
- Causes of these conditions
- Prevention of dental conditions
- Basics on management of simple dental and oral problems
- Health promotion and good practices in oral health.

Learning Outcomes
At the end of the short course the student will be able to:
- Define common terms used in community health and oral health.
- Demonstrate acquisition of teaching skills.
- Explain some basic community health skills applicable in oral health.
- List common oral health problems and outline their causes.
- Explain management of simple dental and oral problems
- Describe the concepts of health promotion in oral health.

Justification of the Course
Oral health is described as the absence of disease and optimal functioning of the mouth and its tissues in such a manner that preserves the highest level of self-esteem. It describes a standard of oral and related tissues, which enable an individual to eat, speak and socialize without active disease, discomfort or discouragement which then contributes to the general well-being. Good oral health is an important and essential component of the general body health and is a birth right of every person in the world (PHC 1978).

According to a Kenya national oral health survey carried out in 2015, dental caries and gum disease were the commonest cause of oral health problems. The survey revealed that the overall prevalence of dental caries among children (5, 12, and 15 year olds) was 23.9%, while among the adult population the prevalence was 34.3%. Three out of every four children had signs of gum disease (gingivitis or periodontitis) with nearly all children aged 5 years being affected. Among adult population, almost all of them (98.1%) had signs of gum disease(s). This implied that there was a very high unmet treatment needs for gum disease(s) (KNOHS 2015). Recent visit to Chuka

hospital records department revealed that in Tharaka-Nithi County found the main oral health problems managed in the Hospital are dental caries followed by gingivitis and periodontitis.

Dental caries, also known as tooth decay, cavities, is a breakdown of teeth due to activities of bacteria (Silk, H. 2014). The cavities may have different colors from yellow to black. Symptoms include pain and difficulty in eating. Complications include inflammation of the tissue around the tooth, tooth loss, and infection or abscess formation (Laudenbach, JM; Simon, Z. 2014).

The cause of caries is bacterial breakdown of the hard tissues of the teeth (enamel, dentin and cementum). This occurs due to acid made from food debris or sugar on the tooth surface. Simple sugars in food are these bacteria's primary energy source and thus a diet high in simple sugar is a risk factor. If mineral breakdown is greater than build up from saliva, caries result. Prevention of dental caries includes regular cleaning of the teeth, a diet low in sugar, and small amounts of fluoride. Brushing the teeth twice per day and flossing between the teeth once a day is recommended by many (Silk, H. 2014).

Gingivitis ("inflammation of the gum tissue") is a non-destructive disease that occurs around the teeth (American Academy of Periodontology 1989). The symptoms of gingivitis are somewhat non-specific and manifest in the gum tissue as the classic signs of inflammation: including Swollen gums, bright red or purple gums, gums that are tender or painful to the touch, bleeding gums or bleeding after brushing and/or flossing, bad breath (halitosis). It can be prevented by regular oral hygiene that includes daily brushing and flossing. *(Sambunjak, D. et al. 2011).*

Periodontitis, also known as gum disease and pyorrhea, is a set of inflammatory diseases affecting the tissues surrounding the teeth. Periodontitis involves progressive loss of the alveolar bone around the teeth, and if left untreated, can lead to the loosening and subsequent loss of teeth. (*Savage, A. et al. 2009).* It is caused by microorganisms that adhere to and grow on the tooth's surfaces, along with an over-aggressive immune response against these microorganisms. In the early stages, periodontitis has very few symptoms, and in many individuals the disease has progressed significantly before they seek treatment. Symptoms may include: Redness or bleeding of gums while brushing teeth, using dental floss or biting into hard food (e.g., apples) (though this may occur even in gingivitis, where there is no attachment loss), gum swelling that recurs, spitting out blood after brushing teeth, halitosis, or bad breath, and a persistent metallic taste in the mouth, gingival recession, resulting in apparent lengthening of teeth, deep pockets between the teeth and the gums and loose teeth, in the later stages (though this may occur for other reasons, as well). It can be prevented through regular oral hygiene that includes daily brushing and flossing.

Oral health care services are capital intensive and the success in the provision of oral health care services is highly dependent on a number of factors such as qualified personnel, appropriate facilities including building, equipment and commodities. Over the years the demand for oral health care services has outstripped the financial provision from the exchequer: preventive and promotive oral health services are being given special attention. (MOH 1994).

Prevention is becoming increasingly important instead of care and treatment which are cost intensive. Dental related diseases are largely preventable. One of the approaches being used in countries including Kenya is dental public health services. Dental public health looks beyond the role of a dental practitioner in treating dental disease, and seeks to reduce demand on health care systems by redirection of resources to priority areas. (Silk, H. 2014). Dental public health is concerned with promoting health of an entire population and focuses on an action at a community level, rather than at an individual clinical approach. Dental public health is a broad

subject that seeks to expand the range of factors that influences people's oral health and the most effective means of preventing and treating these oral health problems. (Silk, H. 2014). To achieve this objective health skills are required.

World Health Organization defines community health as the *health status* of the members of the community, the *problems affecting* their health and to the *totality of health care provided* to the community (WHO 1948). According to CEA Winslow (1920) community (public) health is the science and art of *preventing disease*, *prolonging life* and *promoting health* and *efficiency* through organised efforts for: The sanitation of the environment, the control of communicable diseases, the education of the individual on personal hygiene, the organisation of medical and nursing services for the early diagnosis and preventive treatment of disease and the development of social machinery to enable every citizen to realize his birth right of health and longevity to ensure every individual has high standard of living, adequate for the maintenance of good health. Community health focuses on populations and how specific social determinants of health and disease influence wellbeing. The emphasis is on how well the community can be empowered to improve on the conditions in which they live, their behaviour, socio-cultural interactions, as well as effectiveness in the use of resources to achieve the best possible level of wellness.

Goals of Community Health

1. **Health Promotion**

Health promotion assumes that patients have a higher potential of health than they presently realise. Health promotion is to increase the level of understanding and the expectations of families, groups and communities to cope with health and illness problems. This may include changing or modifying health practices, increasing health knowledge and developing understanding of normal growth and development.

2. **Health Maintenance**

Nurses in the community work with many patients who are well but need to improve to maintain their level of wellness. Maintenance of health involves the thorough and continuous assessment of both individual and community to ensure that they continue to function at the same level. It includes maintaining the family as a group in handling the problem.

3. **Prevention of illness**

This is avoidance of changes in health status that are harmful to the patient. E.g. maintain and increase immunisation in the family to prevent occurrence or recurrence of the disease or illness.

4. **Restoration of Health**

It is to help the patient returning to an optimum state of health and well-being, recovering to as great an extent as possible, whatever health functioning has been lost.

PRINCIPLES OF COMMUNITY HEALTH

- Based on recognized needs of communities, families, groups and individual
- Community health recognizes the family and community as units of service.
- Available to all regardless of sex, status, political beliefs culture and others.
- Health education and counseling for individual, family and community are the primary responsibility of community health care provider.
- Periodic and continuing appraisal and evaluation of the health situation of the patients are basics to Community Health practice.
- Makes use of available community health resources
- Utilizes existing active organized groups
- Does accurate Recording and Reporting.

- The community health care provider does not provide material relief to patients, but directs patient to sound community resources for financial and social assistance.

Conclusion

Good oral health is not only essential to good overall health and freedom from the pain and suffering associated with oral health problems; it also affects self-esteem, quality of life, and performance in school and at work. Oral health problems are preventable using simple measures like proper brushing and flossing daily, dietary modification etc. These are measures that can be taught to the public easily by community owned resource persons after they have gone through the short course training on handling community health issues especially oral health.

Don't "fight tooth decay" Prevent it from happening in the first place.

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BUDGET

Participants paying for themselves or looking for partners who can support participants

Income	**Cost per item**	**Quantity**	**Total**
Charges/person	10,000	20	**200,000**
Expenditure			
Booklets	@50	25	1250
Ballpens	@20	25	500
Handouts	@100	25	2,500
Marker pens	@150	10	1,500
Tea and lunch	@500	23 x 3days	34,500
Honorarium for facilitators	@2000/session	9	18,000
Total expenditure Ksh. **58,250**			
Profit Ksh. 141,750			

Comments:

Change title to be attractive to the market

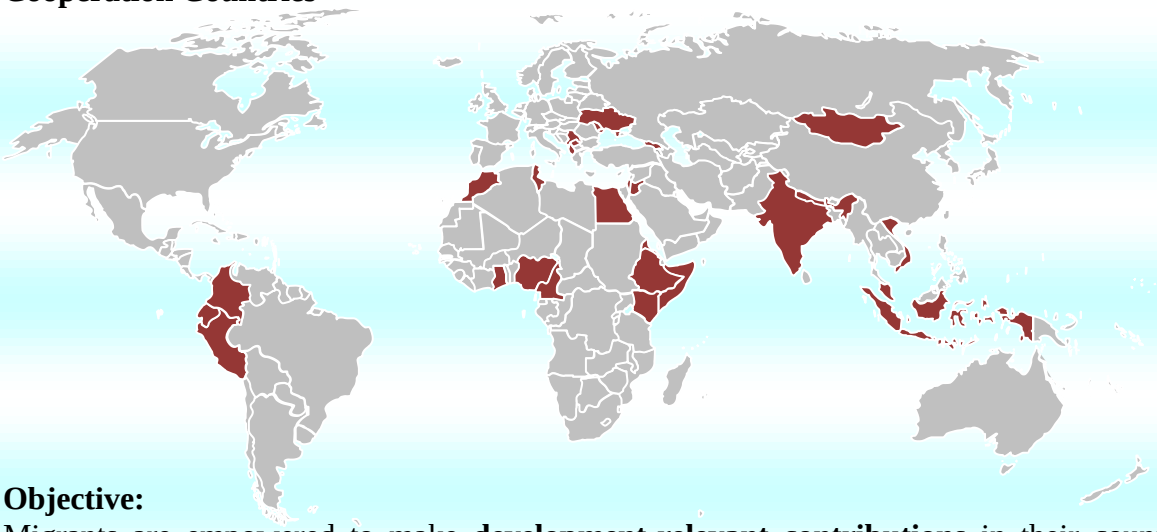
Creating a Culture of Innovation in Youths and Networking for Development: Case of Migration for Development Programme & Alumniportal

Ms. Cynthia Kamau, Coordinator, Migration for Development Programme (PME), Kenya, GIZ Office, P.O. Box 41607 - 00100, Riverside Drive, Nairobi; and Ms. Anne Samba, Alumni Liaison Officer, Kenya/ Somalia, GIZ Office, P. O. Box 41607- 00100, Riverside Drive, Nairobi

PART I: Migration for Development Programme

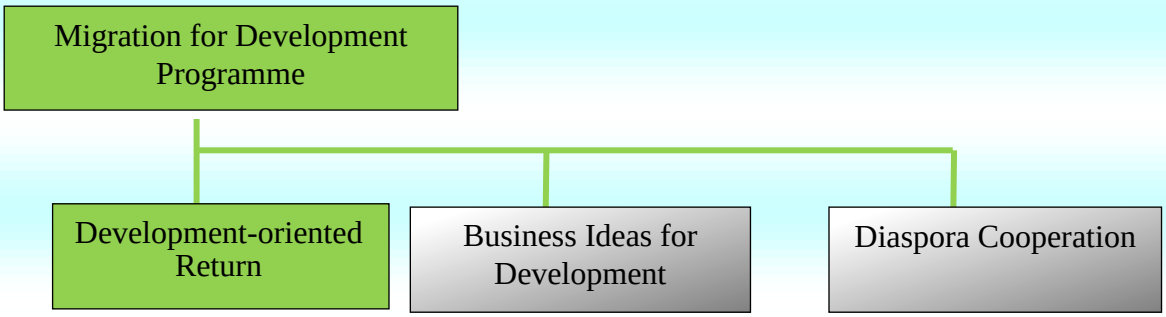
The Center for International Migration and Development is a joint operation of the Deutsche Gesellschaft für Internationale Zusammenarbeit (**GIZ**) GmbH and the German Federal Employment Agency (**BA**).

Cooperation Countries

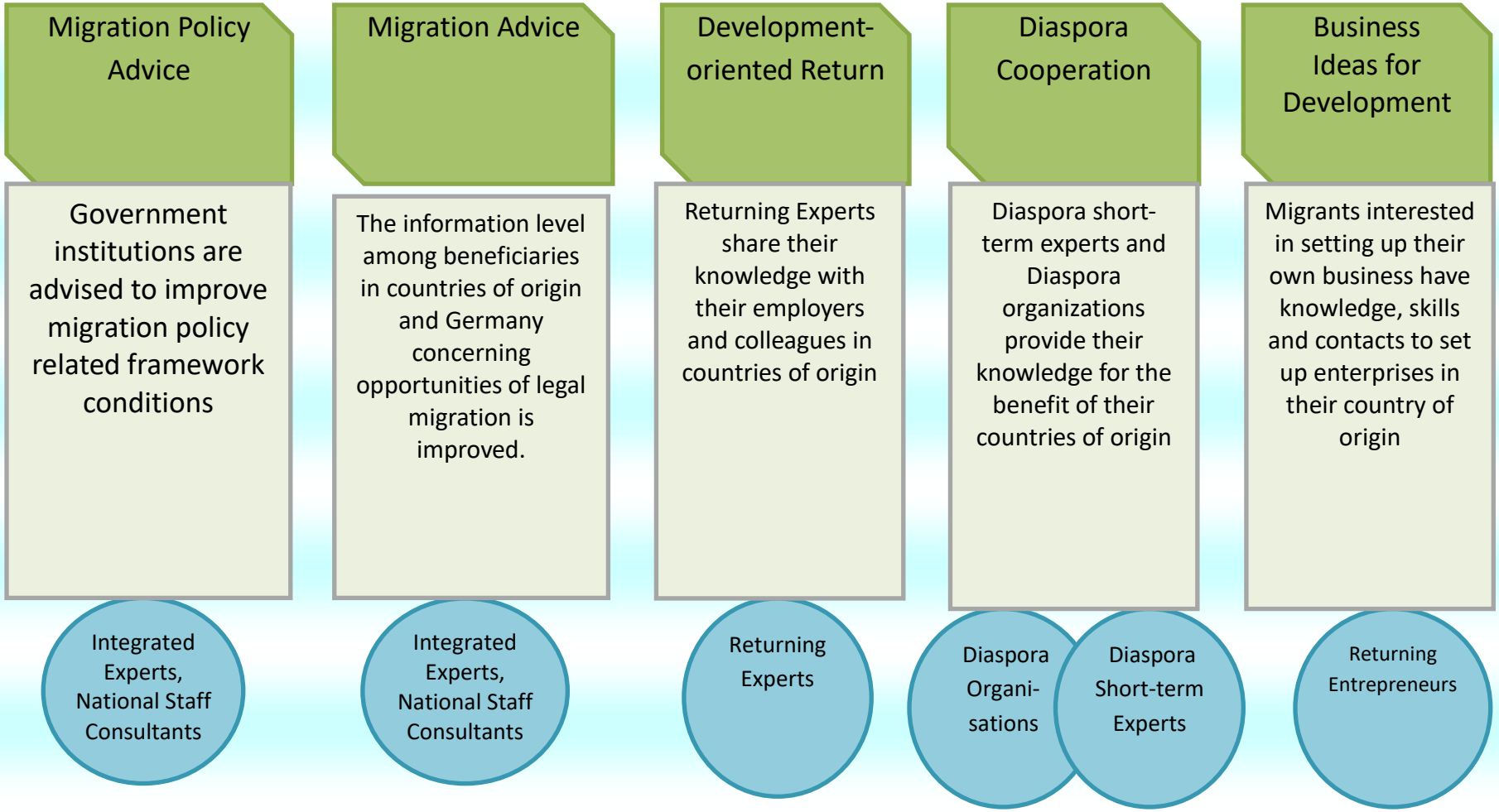


Objective:

Migrants are empowered to make **development-relevant contributions** in their countries of origin and the framework conditions for **legal migration** in selected partner countries are improved.



Government institutions are advised to improve migration policy related framework conditions ex Integrated Experts, National Staff Consultants. The information level among beneficiaries in countries of origin and Germany concerning opportunities of legal migration is improved Integrated Experts, National Staff Consultants. Returning entrepreneurs share their knowledge with their employers and colleagues in countries of origin. Government institutions are advised to improve migration policy related framework conditions. Returning entrepreneurs. Diaspora short-term experts and Diaspora organizations provide their knowledge for the benefit of their countries of origin. Migrants interested in setting up their own business have knowledge, skills and contacts to set up enterprises in their country of origin …Returning entrepreneurs


Migration Policy Advice
Government institutions are advised to improve migration policy related framework conditions
Integrated Experts, National Staff Consultants
Migration Advice
The information level among beneficiaries in countries of origin and Germany concerning opportunities of legal migration is improved.
Integrated Experts, National Staff Consultants
Development-oriented Return
Returning Experts share their knowledge with their employers and colleagues in countries of origin
Returning Experts
Diaspora Cooperation
Diaspora short-term experts and Diaspora organizations provide their knowledge for the benefit of their countries of origin
Diaspora Organi-sations
Diaspora Short-term Experts
Business Ideas for Development
Migrants interested in setting up their own business have knowledge, skills and contacts to set up enterprises in their country of origin
Returning Entrepreneurs

DEVELOPING THE CREATIVE AND INNOVATIVE POTENTIAL OF YOUNG PEOPLE RELEVANT TO EMPLOYMENT

1/6 young Kenyans is unemployed in Kenya

- Significant mismatch in the ambition to the job
- Skills gap in the Kenyan market
- Way Forward
- Formal Training
  - University, College
  - Technical and Vocational Education and Training(TVET)
- Non-Formal Learning

  Often:
  - Outside of formal institutional contexts
  - Unintentional
  - No certificates

ex. Daily activities, Volunteering, Mentoring

Need to recognize and value non-formal learning in a creative and innovative way
*Fostering complementarity between non-formal and formal learning which do not either have the level of curriculum, syllabus, accreditation and certification associated with '**formal***

Being involved in the organisation of the project.
Participating in special exercises and activities during the project.
Reflecting on the learning (in discussions).
Listening to and giving presentations

As a result, the term means different things to different people…For example, when we spoke with managers from a hospitality company regarding their expectations of teamwork, they told us the focus was on whether their employees possessed tolerant attitudes that are important in interacting with a wide range of guests. Asked the same question, an engineering executive singled out the extent to which the employees were able to work and think in cross-functional teams. Same concept - same words - two very different interpretations

Young people have to be set on a long-term, sustainable pathway with quality, stable and sustainable employment. The involvement of a range of stakeholders in the design and delivery of youth employment measures is therefore essential. Youth employment measures should be client-centred, catering for different pathways, for example from mainstream learning to tailored, supported learning. Successful policies are innovative, introducing new ways of reaching out to their target groups.

The EU Youth Strategy promotes youth work, which, along with other forms of participation in society such as volunteering, allows young people to develop self-confidence and to acquire and test specific and soft skills such as leadership, communication, teamwork or taking initiative. This adds to the employability of young people, including those who have already left school.

Youth work can also play an important role in preventing drop-out and in supporting re-integration. Some forms of youth work already deliver individual support on occupational orientation and counselling, tailored to the particular challenges of different young people. Such support should be linked to activities by employment services and other partners involved in supporting young people. An active policy response is required across sectors.

Skills and capabilities needed in the labour market

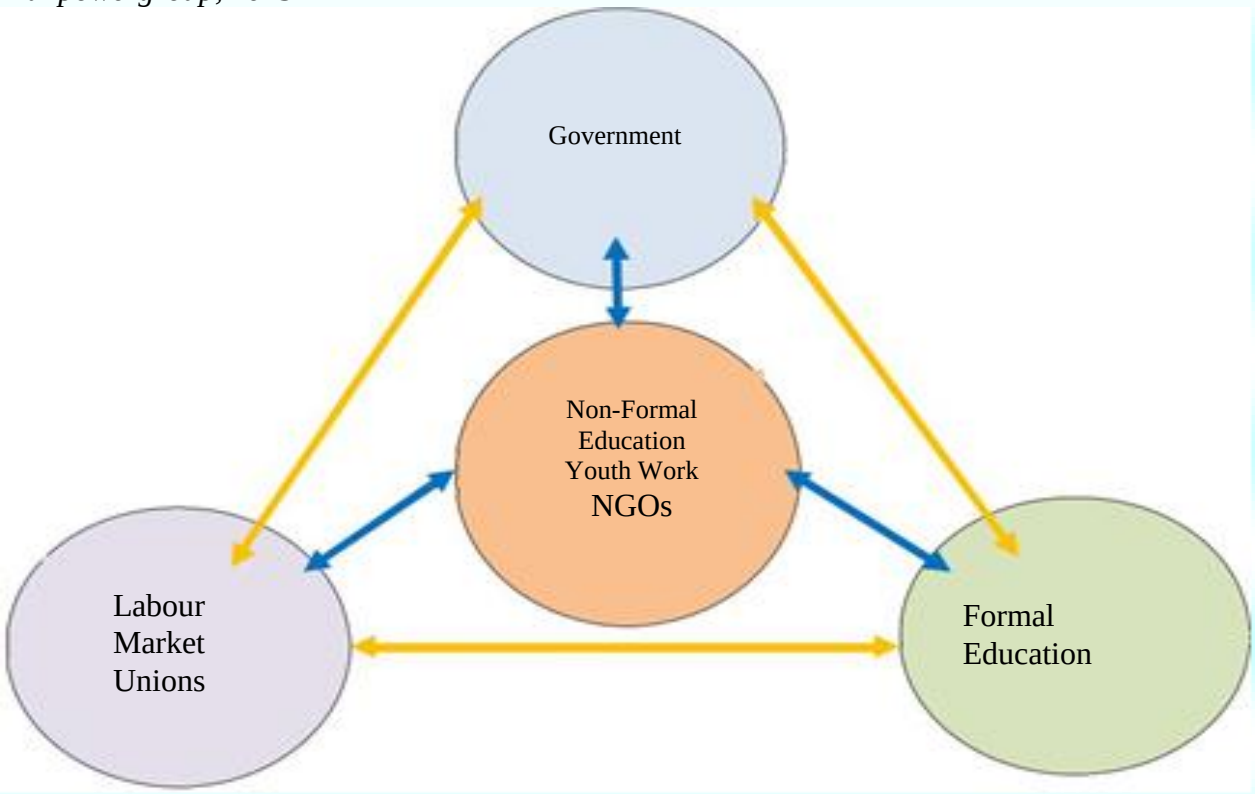
- Personal (for example confidence and self-esteem) - Adaptability and flexibility
- Interpersonal (for example social and communication skills, teamwork, assertiveness)-people management, Leadership, Influencing
- Self-management skills (such as reliability)-Innovation and Entrepreneurship
- Competences in initiative and delivery (for example, planning, problem solving, prioritising).-Change mgt, decision making…

According to the UK Commission for Employment and Skills (2009), these sorts of skills and capabilities are often more highly valued than formal education qualifications

Skills most needed

- Leadership (57%)
- People management and teamwork (51%)
- Innovation and entrepreneurship (50%)
- Communication (39%)
- Adaptability and flexibility (39%)
- Change management (35%)
- Project management (19%)
- Influencing (19%)
- Decision making (17%)
- Time management (14%)
- These skills are a key element for successful job performance, nationally & internationally

Manpowergroup, 2013



One person can make a difference

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PART II: Networking for Success: A Case Study of the Alumniportal Deutschland

What is Networking?

Building stronger relationships in your community. Your network is your net worth

The Power of Alumni Networks	**Alumniportal Deutschland (https://www.alumniportal-deutschland.org/)**
• Alumni generate invaluable word-of-mouth marketing via social and professional networks. • By engaging alumni, an institution can continue to benefit from their skills and experience. • Alumni are great role models for current students and are often well placed to offer practical support to students as they start their careers. • Your alumni are your international ambassadors.	The Alumniportal Deutschland is an information and collaboration platform that is open to Germany alumni, German organisations and international companies.

✓ Networking opportunities ✓ International job board ✓ Learn German ✓ News from Germany ✓ Own blog/external website	✓ Participate in group discussions ✓ Join networks ✓ Personal growth: Webinars, online courses ✓ Info on scholarships and events

Alumni work in Kenya to date

Networking and training activities

For Alumni by Alumni - Ensuring alumni skills are utilized

Thank you.

OPEN WEEK CLOSING REMARKS

Participants' Evaluation Comments

1. Communication reached potential participants rather late. There was need to communicate (explain) in good time about the projects to be exhibited. In future, the exhibitors should be sensitized/notified/mentored well in advance. Publicity and notices this time were done via newspaper advert, University website (www.chuka.ac.ke), Senate, Faculty, Deans' Committee, Departmental, entrants' meetings, written memos, word of mouth etc.
2. The open week was an eye opener but there is need to improve on communication and response to calls so as to involve and get all staff and students to participate.
3. The stands were impressive but require practical solutions to the community.
4. The judges should be experts in areas they are assigned to adjudicate.
5. The University needs more such forums in future to enhance integration and learning from one another.
6. The University should establish an Idea Incubation Centre for students and staff.
7. The open week should identify areas that require further research and commercialisation.
8. In future, the exhibitors should be provided with drinking water and food at a price.
9. The open week should culminate in commercialization of the ideas presented and focus on career guidance for visiting students.
10. The University should extensively publicize the Open Week to all stakeholders.
11. The students' ideas were novel and need to be improved through proper mentorship on how to go about an exhibition, concept development and finally commercialization.
12. The University Open Week should be extended to the University laboratories to enable sensitize the surrounding community members on their usefulness.
13. The University should help publish exhibited works. This can be done in the JESAR.

Closing Remarks

1. Thanks to all participants who submitted their works to make the Open Week a success.
2. The University was grateful to participants and would acknowledge efforts by awarding certificate of merit or participation to them.
3. To facilitate prepare the certificates, participants were to submit to the office write-ups of what they presented, whether in the tent or boardroom.
4. All entries for staff or students, whether finished research or proposed research, short course, etc., were to be submitted, indicating name(s), title of entry, and description as per the evaluation criteria earlier provided and also on the University website.
5. Deadline to submit was **Thursday 15th June, 2017**.
6. All participants were assured that research ethics would be observed, and hence their work would be protected. Likewise, participants were to respect the work of peers by not plagiarizing, copying or turning work that they had not contributed to into their own.
7. The office was going to prepare redacted proceedings; in that all intellectual property that needed to be protected would not be disclosed.
8. With those few remarks, the DVC (ARSA) declared the Open Week officially closed.

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