DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

PROCEEDINGS OF THE 5TH DeKUT INTERNATIONAL CONFERENCE ON SCIENCE, TECHNOLOGY, INNOVATION & ENTREPRENEURSHIP

THEME:

'Leveraging Science, Technology, Innovation and Entrepreneurship for Sustainable Development'

November 2019

PROCEEDINGS OF THE 5TH DeKUT INTERNATIONAL CONFERENCE ON SCIENCE, TECHNOLOGY, INNOVATION & ENTREPRENEURSHIP

Dedan Kimathi University of Technology

Published by 5th DeKUT International Conference on STI&E Committee

P.O. Box Private Bag – 10143,

Dedan Kimathi NYERI, KENYA

Disclaimer

Views and opinions expressed herein do not represent those of the publisher, Dedan Kimathi University of Technology. These views and opinions are those of the contributing authors.

TABLE OF CONTENTS

DEKUT'S VISION AND MISSION STATEMENTS

VISION

"To be the Premier Technological University, Excelling in Quality Education, Research, and Technology Transfer for National Development"

MISSION

"To provide academically stimulating, culturally diverse and quality learning environment that engenders research, innovation and technology development for the attainment of national development goals."

CORE VALUES

- Innovation
- Scholarship
- Diversity
- Integrity
- Teamwork

PREFACE

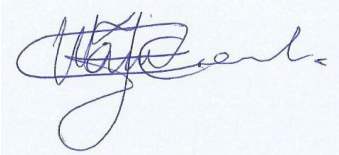
The 5th DeKUT International Conference on Science, Technology Innovation and Entrepreneurship (STI&E) was held on 13th – 15th November, 2019 at Dedan Kimathi University of Technology (DeKUT) Main Campus in Nyeri. The theme of the conference was '*Leveraging Science, Technology, Innovation and Entrepreneurship for Sustainable Development'*. Conference sub themes were;

1. Engineering Technologies and Innovations for Industrialization.
2. Business Management and Entrepreneurship for Sustainable Development.
3. Basic and Applied Sciences for Advancement of Research and Innovations.
4. Innovative Agricultural Sciences and Technologies for Sustainable Food and Nutrition Security.
5. Water, Energy, GIS and Remote Sensing, Environment, and Climate Change.
6. Health Sciences and Community Development.
7. Information and Communication Technology for Development.
8. Tourism, Wildlife and Hospitality Management.
9. Policy, Culture and Governance for Sustainable Development
10. Security Trends and Innovations.
11. Trends in Technical Education and Training.
12. African Development and Harnessing Traditional Knowledge
13. Data Science

The conference provided researchers from local and international institutions, a forum to discuss and share ideas on latest innovations and research outputs that address local and global challenges and those that improve the quality of life for the people and inform the decision-making process in matters of development by government and businesses. International delegates came from countries such as Germany, Japan, and Uganda.

Selected papers will be published in the Journal of Applied Science, Engineering and Technology for Development. This journal has a reputation of high international standards and a reference in engineering, applied sciences and development. We continue to seek collaboration with the largest number of authors and institutions, to assist us in maintaining our reputation.

The conference organizing committee would like to thank all the key note speakers, authors and exhibitors for their great effort to make this outstanding conference come true. We are hopeful that you enjoyed the conference. We look forward to seeing you again during the 6th DeKUT International Conference on STI&E to be held on 11th – 13th November, 2020.



Prof. F. K. Waweru

ACKNOWLEDGEMENT

We acknowledge with appreciation the Chief Guest, the Managing Director, Kenya Industrial Property Institute, KIPI Mr. Sylvance A. Sange and. for officially opening of the conference; Dr. Salome Guchu, CEO Kenya National Innovation Agency, KENIA for delivering an opening address; the University Management Board led by the Vice Chancellor, Prof. P. Ndirangu Kioni for financial support given towards organizing the conference and publication of the conference proceedings; Director RIMCL, Dr. Moses. A. Ollengo, Prof. F. K. Waweru, Chairperson for the Organizing Committee for their tireless efforts in making the conference and publication of conference proceedings a reality; conference delegates, DeKUT staff and students for attending and presenting papers during the conference.

CONFERENCE ORGANIZING COMMITTEE

1. Prof. F. K.Waweru - Quality Assurance, Chairperson
2. Dr Moses A Ollengo -Director Research Innovation Management and Linkages
3. Dr. Paul Wanyeki - Department of Education Technology
4. Prof. Nicholas Marita - Institute of Geothermal Energy Training and Research Institute
5. Prof. Nancy Karuri - Department of Mechanical Engineering
6. Dr. Anthony Ngunyi - Department of Actuarial Science
7. Dr. Daniel Njoroge - Institute of Food Bio Resource Technology (IFBT)
8. Dr. Anne Sang - School of Business Management and Economics (SMBE)
9. Dr. Esther Nthiga - Department of Chemistry
10. Dr. Kennedy Malanga - School of Computer sciences and Information Technology
11. Dr. Juma Misiko - Institute of Tourism &Hospitality Management
12. Dr. Joyce Kaguta - Institute of Criminology Forensics and Security Studies
13. Dr. Lucas Mugaka - Department of Electrical &Electronics Engineering
14. Mr. Moses Gitonga - Department of Nursing
15. Ms. Faith Mutheu - Public Relations Officer
16. Ms. Carol Githinji - Finance Department
17. Ms. Hadija Dahal - SAA, RIMCL
18. Mr. Peter Mbichu - RIMCL (Secretariat)

OPENING REMARKS

The conference started with a word of prayers. The Chair of session welcomed all the participants and then welcomed the Deputy Vice Chancellor (DVC Academics & Research) to invite the Vice Chancellor.

The DVC (AA&R) emphasized that the conference was very important for sharing, learning and networking. She invited the Vice Chancellor to make his remarks.

REMARKS FROM THE VICE CHANCELLOR

The Vice Chancellor thanked the two key note speakers, Professors from partnering Universities, international and local delegates, Dedan Kimathi staff and students for attending the important conference.

He remarked that this was the fifth international conference in Technology, Innovation and Entrepreneurship to be held in the University.

The University was becoming stronger in participation and stringy of papers published which had a positive impact on the academic programmes offered to students. This year, ninety-three papers were expected to be presented and later published. The University had developed a better publication platform where participants could track the progress of publication including the reviews.

He remarked that research is extremely important in guaranteeing the quality of programmes in the University. The University aimed at equipping the students with skills to solve problems in the society.

He emphasized that the University was privileged to host the Science and Technology Park and was in the process of developing an eco-system that will support the STP. That a study done in Thailand on STPs indicated that for every successful company there were eight to ten patents. In a successful STP there was one successful company, 250 PhD graduates and 40 patents each year. To create the ecosystem to support the STP, the University had established a network with the neighbouring Universities through signing an MOU, as well as Nyeri and Laikipia counties. The University had also raised the ratio of Undergraduate and Masters programmes to 1:1.

To encourage student involvement in research, the University had established graduate assistantship programmes and engaged many students on internship programmes from the University, EBK and also from the Public Service Commission.

The University had also established relationships with international Universities and programmes to support research i.e University of Gifu, Saarland, Erasmus and DAAD Programmes.

The University increasingly wants early preparation of undergraduate students for research through establishment of data science programmes, economic policy, green institute, DeHUB and other initiatives to support research.

The Vice Chancellor welcomed the first key note speaker, the CEO Kenya National Innovation Agency (KENIA), Dr. Salome Guchu to make her remarks

REMARKS FROM CEO KENIA DR. SALOME GUCHU

Dr. Guchu thanked the Vice Chancellor, delegates, staff, students and all participants for finding time to take part in the conference.

She started by informing the conference that one of the institutions major role is harnessing research for sustainable development and making opportunities available to support research. She defined research as transformation of money into knowledge while innovation is the transformation of knowledge into money. She also informed participants that Kenya was ranked position 78 out of 127 in the global innovation index.

Reasons for Research and Innovation

a) Increasing demand for goods and services
b) Growing global population
c) Diminishing resources
d) Emerging sustainability and security concerns
e) Opportunities of advancing science and technology

She stated that KENIA was established by Science, Technology and Innovation Act, 2013 and its role is as follows;

a) Support development and commerce of innovation
b) Recognition and motivation

c) Increase awareness of Intellectual property
d) Scout for and nurture innovation
e) Establish and maintain database on innovation
f) Contribute to institutionalization

She highlighted that KENIA had developed various programmes and initiatives to support research like;

- Motivation and recognition of innovators
- Capacity development programmes through workshops
- Innovation commercial programmes for seed grants

The following are the success stories born out of these initiatives: maziwa plus, Ecodudu, pediatric hip spica table, Upesy, Ecotilis, Sign 10, etc.

To enhance innovation, there needs to be established a link between research efforts and actions which can be realized through creating an institutional culture that supports research and building human resource capacity. Innovation can also be enhanced through creation of IP awareness, commercialization of innovations support of IP registering, partnering and sale of IP.

By supporting research and innovation we will to have increased inter-relationship and growth of research through to production, new technology and new markets. We also aim to be contributors to knowledge generation, distribution and generation of solutions. Research and innovation also create a well-developed interface between knowledge generation and its utilization.

Dr. Guchu thanked the participants once again and paved way for the second key note speaker, Managing Director, Kenya Industrial Property Institute (KIPI), Mr. Sylvane A. Sange.

REMARKS FROM MANAGING DIRECTOR KIPI MR. SYLVANCE A. SANGE

Mr. Sange thanked the Vice Chancellor for the invitation as a key note speaker. He started by informing the participants that KIPI was established by Industrial Property Act, 2001 to promote inventive innovative activities and facilitate acquisition of technology through registering and licensing Intellectual Properties.

Functions of KIPI

a) Assist public in registration of Intellectual properties

b) Provide information on IPs
c) Promote inventiveness and innovation
d) Sensitize public on invention, innovation, intellectual property, industrial property and copyrights

When eye glasses solves the eyesight problem, this is an innovation. Problems affecting the society need solutions and solutions to problems of a technical nature are derived from science and technology which are therefore technological outputs which are made into innovations.

Innovation provides a solution to a specific problem affecting society while an invention is a technological solution to a specific problem. He emphasized that intellectual property can be created without money resources.

Mr. Sange concluded by stressing that universities need to be the main producers of intellectual capital.

BASIC AND APPLIED SCIENCES FOR ADVANCEMENT OF RESEARCH & INNOVATIONS (BAS)

The Analysis of Foreign Exchange Markets in Kenya Using the Markov Chain Analysis

Ngunyi Antony [1], Omari Cyprian, Mundia Simon

Dedan Kimathi University of Technology, Private Bag-10143, Nyeri

ABSTRACT

The implications of real exchange rate changes for economic growth have become a growing focus of attention in the recent policy implementation debate**.** Existing empirical evidence reveals that fluctuations in exchange rates can potentially generate distortions in the economy. An understanding of the foreign exchange market trend in-terms of predicting price movement is important for economic decisions. However insufficient empirical evidence on the long –run scenarios of these movements in the Kenyan economy is the empirical contribution this paper wishes to highlight. Markov chain models have been widely applied in predicting group stock markets. In this study Markov chain model was applied on the time series data from the Central Bank of Kenya (CBK).

Change Point Estimation in Volatility of a Time series

Josephine Njeri Ngure*[a], Anthony Gichuhi Waititu[b] and Simon Maina Mundia [c]

[a]School of Science, Dedan Kimathi University of Technology, Private Bag, Nyeri, Kenya,

*Corresponding Author E-mail: ngurejosephine@gmail.com,

ABSTRACT

A major problem that is likely to be encountered by a scientist when analysing data is lack of homogeneity in the stochastic structure of the data. Meaning, there may be non-stationarity in the conditional variance function as it is the case in this paper. Undetected discontinuities within the structure of the data can easily make the results of any analyses to be invalidated. Detection of structural change in volatility of a time series is very important for understanding volatility dynamics and the stylized facts observed in financial time series. Using the Nadaraya-Watson kernel estimator of the mean function, the conditional mean function is obtained and residuals extracted. The conditional variance function is also obtained using a kernel estimator of the conditional variance. A Kolmogorov-Smirnov type estimator for change point estimation in volatility of a time series is developed and its consistency shown through simulations. This change point estimator is then used to detect the point of change in the squared residuals. The developed estimator is then applied to KES/USD exchange rate data set to estimate a single change point.

Keywords: *Change point Kernel, Nonparametric, ICSS, GARCH.*

Rapporteurs Report

Presenter's name:
Josphine Njeri Ngure
Title/Topic of presentation:
Change Point Estimation in Volatility of a Time series.
Institutional affiliation:

Dedan Kimathi University of Technology

Highlights/key points from presentation:

a) A major problem that is likely to confront a scientist who seeks toanalyze data is that the structure of the data may not be homogeneous e.g changing mean, variances e.t.c
b) Undetected discontinuities or breaks within the data structure can easily lead to invalidation of any results of analysis.
c) Volatility of _nancial data behaves like a jump process uctuating around some value for a long period of time before an abrupt change and then after it uctuates around another new value (volatility clustering).
d) The standard GARCH model fails to contain possibility of these sudden jumps leading to volatility persistence [Tsay and Ruey, 2005].
e) Change point estimation focuses on describing the nature and degree of the known change.
f) The presentation was related to time series.
g) The Non Parametric Arc Model was explained- the presenter derived 20 equations that tried to explain the Change Point Estimation of Volatility in time series.
h) Throughout her presentation, she discussed; Kernel estimation of volatility, formulation of hypothesis, change point detection and estimation, change point estimator, estimation of change point under simulation, change point statistics and the application of the change point estimator.
i) The results and discussions were also presented.- the researcher presented the results that showed that there was consistency of the change point estimator.

Questions /key points discussed:

a) Why did you use P/D= 1 instead of any other number?
   Any number can be used but the researcher chose 1 for consistency purposes.

b) Does the magnitude of the change matter?
   Yes it does, the more the magnitude the chain is the better.

c) What is chain point analysis in simple terms?
   It is the differences one experiences in the day to day live. An abnormality from the norm.

d) What are the applications of your study?

Answer: 1. Estimation of weather changes. 2. Treatment of students in medicine. 3. Growth between boys/girls. 4. Comparison of different currencies.	
Responses/general recommendations: Improve on the organization of your work.	
Name of session chair: Dr. Emma Marigi	**Name of session rapporteur:** Mr. David M. Gitau

Computational Investigation of Threshold Moisture Content for Slope Stability using BP-FF Artificial Neural Networks: A Case of Sergoit Swamp Soils based on Laboratory Flume Tests

Kanule Jason[1], Ng'etich Wilson[2], Rotich Samuel[3], Tonui Joel[1] and Kosgei Richard[4]

[1]Department of Physics, University of Eldoret, P.O. Box 1125-30100, Eldoret,

[2]Department of Soil Science, University of Eldoret, P.O. Box 1125-30100, Eldoret,

[3]School of Physical and Biological Sciences, Moi University, P.O. Box 3900-30100, Eldoret.

[4]School of Science, University of Kabianga, P.O. Box 2030, Kericho.

*Corresponding author - Email: jaskanule@gmail.com, jaskanule@uoeld.ac.ke, ORCID: 0000-0003-3424-6204

ABSTRACT

Slope stability problems have become rampant in Kenya in the past few decades. The effects of slope failures and other unexpected mass movements have impacted negatively on both human life and infrastructure. Majority of the failures are triggered by increased water levels originating from intense rainfall storms or irrigation events. Entry of water into a soil mass serves to increase the groundwater level and induce a decrease in matric suction (negative pore water pressure) that may cause slope failure. However, the minimum soil moisture content capable of triggering slope failure

is unknown. In this study we propose a constitutive model linking the threshold soil moisture content to other slope parameters. A solar-powered monitoring (SPM) system comprising of moisture sensors and optical strain/displacement transducers in combination with a rainfall simulator has been fabricated to aid in data collection. The collected data is then used to train, test and validate a back-propagation feed-forward (BP-FF) artificial neural network model. Three trial tests were carried out for each of the eight slope angles (30 – 65^{o}) investigated. The threshold moisture content was established when displacement of the soil mass was detected. Comparison of computational and experimental results shows excellent agreement. Conclusions from the results indicate that instead of complex state-of-the-art monitoring systems on slopes involving measuring several physical factors requiring enormous technological know-how in programming and installation, a set of soil moisture probes only would be relatively cheaper, but yielding satisfactory results, as long soil lithological parameters are known. Secondly, feeding the data in a neural network model for purposes of forecasting can aid in the design of inexpensive early warning system for disasters associated with slope instabilities.

Keywords: *Soil stability, Solar-Powered Monitoring (SPM) system, soil moisture content, artificial neural network*

Rapporteurs Report

Presenter's name: Kanule Jason
Title/Topic of presentation: Computational investigation ofthreshold moisture content for slope stability using BP-artificial neural networks: A case of Sergoit swamp soils based on laboratory flume tests
Institutional affiliation: University of Eldoret
Highlights/key points from presentation: a) There are rampant soil mass movements due to Climate change and Human activities. b) The researcher used the historical rainfall data and real-time displacement data to study the triggers of unstoppable slopes. They include- hydrological factor, earthquake events c) The research concentrated on Volumetric Water Content (VWC). d) Slope parameters such as cohesion, pore-water pressure (PWC), internal friction angle depend on VWC e) The researcher tried to determine the minimum VWC that causes slope failure.

f) He used mathematical Formulation to do this. The formulation was explained.

g) He came up with an experimental setup.

h) His results showed that the causes for the land- slides followed this order; - Water content= 54.84%, Slope angle = 27.98%, Pore-water pressure= 14.56%, Internal Friction angle= 2.26%, cohesion=0.35%. The results were explained.

Questions /key points discussed:

a) Land slide is a common occurrence in Murang'a. How can the model be used to help Murang'a people in Muranga?

The design is just an early warning system. Multidisciplinary task force is needed to assist the system to help people before the occurrence of the land slide.

b) Poor land practices like division of land into small portions lead to less trees being planted. What can you do to help the farmers in such cases?

Authorities should ensure that laws governing environmental management are adhered to. Buildings should also be guided by the rules that govern construction.

c) Can the slope be used to mark where people should not go beyond for the sake of safety?

Geophysical analysis must be used in setting and marking the boundaries in addition to being involved in any construction or building.

d) What is the duration between the early warning signal and the actual occurrence of the land slide?
the system detects the small cracks before the actual slide happens.

The researcher is still working on the projects and will look into that.

e) Can your model be used to detect the time the dam is about to break?

The breaking of the dam is majorly due to pressure of water and not the soil structure.

f) Does the type of soil determine the kind of the buildings constructed?

Yes. It also determines the height of the building.

Responses/general recommendations:

The presentation was very educative and informative to the audience.

Name of session chair:	**Name of session rapporteur:**
Dr. Emma Marigi	Mr. David M. Gitau

Regulation and Control of Temperature using a Microcontroller

Njuguna A. N.* and Juma S. A.

School of Engineering, Dedan Kimathi University of Technology, Nyeri, Kenya

*Corresponding Author Email: *alex.njuguna4@hotmail.com*, *0710193832*

ABSTRACT

Climatic conditions and weather have been drastically changing in the past years due to global warming. Some areas now experience extreme cold temperature while other areas experience the extreme opposite and these conditions are detrimental to the human body. This can make people feel uncomfortable or cause illness if not prepared for such kind of conditions. It is essential to come up with solutions of convection to regulate room temperatures to normal ranges of about 20 to 25 degrees Celsius. The smart coat will enable regulation and control of temperature within it to suit the user's needs. Regulation and control of temperature using a microcontroller system, especially during winter is going to be studied.

Keywords — *Convection, Microcontroller, Regulation, Smart coat, Temperature*

Recovery of Collagen Hydrolysate from Chrome Leather Shaving Tannery Waste through Two-Step Hydrolysis using Magnesium Oxide and Bating Enzyme

Alvin Asava Sasia[1, 2*], Paul Sang[1], Arthur Onyuka[2]

[1]Department of Chemistry, Dedan Kimathi University of Technology

[2]Kenya Industrial Research and Development Institute (KIRDI)

ABSTRACT

Chrome-tanned solid waste emanating from leather industry is usually disposed of to the environment through landfill which not only pollutes the environment but also wastes the protein resource contained in it. Protein recovery for use in secondary industry presents the best strategy for

its re-utilization. Dechroming by hydrolysis is the most practiced method of recovery of collagen and chromium from tanned solid waste. The alkali-enzyme two step hydrolysis methods are commonly utilized for improved recovery efficiency. However, enzyme cost and temperature dependence of the heat stable alkali enzyme has made the process economics difficult and therefore unattractive. The objective of the present work is to recover collagen hydrolysate through a two-step hydrolysis. The method of treatment involved a first-step denaturation and degradation with alkali followed by inoculation with bating enzyme. The ash content, total kjeldahl nitrogen, dry matter and chromium content of the collagen hydrolysates obtained are reported. 58.20% and 50.76% protein recovery efficiency were obtained for the separate alkali and enzyme hydrolysis respectively. A combined protein recovery rate of 79.45% was obtained for the two-step process. Hydrolysis dechroming employing the use of bating enzyme could offer a low-cost alternative for the effective treatment of tanned solid waste.

***Key words**: Dechroming, chrome shavings, bate enzyme, collagen hydrolysate, protein recovery efficiency*

Rapporteurs Report

Presenter's name: Alvin Asava Sasia
Title/Topic of presentation: Recovery of Collagen Hydrolysate from Chrome Leather Shaving Tannery Waste through Two-step Hydrolysis using Magnesium Oxide and Bating Enzyme.
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: a) The study aimed at recovering collagen hydrolysate from chrome leather shaving tannery waste through two-step hydrolysis using magnesium oxide and bating enzyme b) The presenter pointed out that leather manufacture involves a number of process steps; categorized as either chemical or mechanical. c) The downside of mechanical operations was noted to be generation of high volumes of solid waste e.g. chrome shavings and chemically depicted as collagen-chromium complex and finds little use because of their shapes and cross-linked features. d) It was highlighted that in Kenya, close to 13,000 tons were being generated weekly. e) The background information showed that disposal was done by open dumping and on site burning which

had demerits such as; Landfill being expensive, leaching of Cr^{3+} to environment, oxidation of Cr^{3+} to more harmful Cr^{6+} and Loss of valuable protein resource.

f) The study concluded that hydrolysis using alkali and incorporating the use of conventional bating enzyme was effective in deproteination of chrome shavings and that protein recovery rates at 58.20% and 50.76% efficiency were obtained for the separate alkali and enzyme hydrolysis while the combined rate was at 79.45%.

g) The study also recommended investigation into potential application of the collagen hydrolysate for use as auxiliary chemical in leather processing or soil amendment and folia spray in agriculture, pilot and (or) industrial scale use of bating enzyme in the management of tanned solid tannery waste and a study on bate enzyme kinetics aimed at reducing inoculation time.

Questions /key points discussed:

The presenter was asked to name the bating enzyme.

Responses/general recommendations:

In response to the question, the presenter clarified that the bating enzymes included trypsin and chymotrypsin.

Name of Session Chair:	**Name of Session Rapporteur:**
Dr. Paul Tanui	Ms. Nancy Koigi

The Freeze-Dried Extracts of Rotheca Myricoides (Hochst.) Steane & Mabb Possess Hypoglycemic, Hypolipidemic and Hypoinsulinemic On Type 2 Diabetes Rat Model

Boniface Mwangi Chege[1], Peter Waweru Mwangi [2], Frederick Bukachi [2]

[1]School of Science, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya.

[2]Department of Medical Physiology, School of Medicine, College of Health Sciences, University of Nairobi. P.O. Box 30197–00100, Nairobi, Kenya.

bmchege87@gmail.com

ABSTRACT

Ethnopharmacological relevance: *Rotheca myricoides (Hochst.) Steane & Mabb* is a plant species used in traditional Medicine for the management of diabetes in the lower eastern part of Kenya (Kitui, Machakos and Makueni Counties, Kenya) that is mainly inhabited by the Kamba community.

Aim: This study investigated the antihyperglycaemic, antidyslipidemic and antihyperinsulinemic activity of the freeze-dried extracts of *Rotheca myricoides (Hochst.) Steane& Mabb (RME)* in an animal model of type2 diabetes mellitus.

Methods: Type 2 diabetes was induced by dietary manipulation for 56 days via (high fat- high fructose diet) and intraperitoneal administration of streptozocin (30mg/kg).Forty freshly-weaned Sprague Dawley rats were randomly assigned into the negative control (high fat/high fructose diet), low dose test (50mg/kg RME, high dose test (100mg/kg RME and positive control (Pioglitazone, 20mg/kg) groups. Fasting blood glucose and body weight were measured at weekly intervals. Oral glucose tolerance tests were performed on days 28 and 56. Lipid profile, hepatic triglycerides, fasting serum insulin levels and serum uric acid were determined on day 56.

Results: The RME possessed significant antihyperglycemic [FBG: 6.5 ±0.11mmol/l (negative control) vs. 4.62 ± 0.13mmol/l (low dose test) vs. 5.25 ± 0.15mmol/l in (high dose test) vs. 4.33 ± 0.09mmol/l (positive control):$p < 0.0001$]and antihyperinsulinemic effects [1.84 ± 0.19(negative control)vs.(0.69 ± 0.13 (low dose test) vs. (0.83 ± 0.17 (high dose test) vs. (0.69 ± 0.10 (positive control): $F(3, 36)=0.6421$: $p < 0.0001$. The extracts also possessed significant antidyslipidemic effects [LDL levels: 3.52 ± 0.19mmol/l (negative control) vs. 0.33 ± 0.14mmol/l (low dose test) vs. 0.34 ± 0.20 mmol/l (high dose test) vs. 0.33 ± 0.01mmol/l (positive control): $p < 0.0001$].RME significantly lowered plasma uric acid levels, as well as hepatic triglycerides and hepatic weights.

Conclusions: The freeze-dried extracts of *Rotheca myricoides* possessed significant antihyperglycemic and antidyslidemic effects. In addition, it lowered serum uric levels, as well as hepatic triglycerides and hepatic weight. These results appear to validate the traditional use of this plant species in the management of diabetes mellitus.

Keywords: *Type 2 diabetes, Antihyperglycemic, Antihyperinsulinemic, Streptozocin*

Rapporteurs Report

Presenter's name: Boniface Mwangi Chege

Title/Topic of presentation: The freeze-dried extracts of *Rotheca myricoides* possess hypoglycemic, hypolipidemic and hypoinsulinemic on type 2 diabetes rat model.

Institutional affiliation: Dedan Kimathi University of Technology

Highlights/ key points from presentation:

a) The study aimed at evaluating the antidiabetogenic effects of freeze dried extracts of *Rotheca myricoides* in a diet and low dose streptozocin type 2 diabetes animal model**.**

b) The presenter introduced type 2 diabetes as a complex metabolic disorder characterized by alterations in lipid metabolism, insulin resistance and pancreatic β-cell dysfunction.

c) It was also justified that Current treatment modalities do not cure or reverse the progression of the disease, antidiabetic drugs have toxic adverse effects, and that approximately 80% of the population in some countries in Africa and Asia use herbal medicine in management of diabetes.

d) It was also pointed out that *Rotheca myricoides* was used in lower Eastern part of Kenya in management of diabetes

e) The study took duration of 16 weeks and took place at the department of Medical Physiology, University of Nairobi.

f) Since the study was carried out on rats, an ethical approval for the study was sought from Biosafety, Animal Care and Use Committee, Faculty of Veterinary Physiology, University of Nairobi.

g) The study recommended further elucidates other mechanisms of action of freeze-dried extracts of *Rotheca myricoides* (Hochst.)

h) Sodium-glucose cotransporter (SGLT 2) which is up regulated in type 2 diabetes mellitus.

i) Inflammatory markers such as interleukin-1 (IL-1), interleukin-6 (IL-6) and tissue necrosis factor-alpha (TNF-α) which are associated with chronic inflammation observed in type 2 diabetes mellitus.

j) Levels of adipocytokines e.g. resistin, adiponectin and leptin which are often deranged in type 2 diabetes mellitus.

k) The study concluded that results of the study validated the traditional use of the plant species in the management of Diabetes mellitus and indicated that the main mechanism of action of the antidiabetic effects was via the modulation of GLUT-4 and that future studies to focus on trying to isolate the chemical moiety (ies) responsible for mediating these beneficial pharmacological effects and determine the safety and efficacy in humans.

Questions /key points discussed: a) A question was raised on whether the traditional use of the plant had the same results as dried freeze. b) A question was also raised on whether the presenter did the experiment himself. c) A concern was raised on whether the sex of rats mattered in the study and whether the same study can be done on human beings.	
Responses/general recommendations: a) In response to whether the traditional use of the plant had the same results, the presenter explained that the community used to boil the leaves and extracted the water. b) The presenter confirmed that the experiment was done in support of Chemistry Department University of Nairobi. c) It was also confirmed that the sex of the rats was of great concern and that the study only used male sex because of the normal changes that occur to female sex that could have affected the results. d) The presenter pointed out that the process could not be tested on human beings until it proven safe by the required authority.	
Name of Session Chair: Dr. Paul Tanui	**Name of Session Rapporteur:** Ms. Nancy Koigi

Assessment of The Quality of Leather Shoes: A Case Study of Children's Shoes Produced by SMES in Kariokor Market, Nairobi, Kenya

Janet Mesa[a], Douglas Onyancha[a] and Paul Sang[a]

[a]School of Science, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

E-mail: mesahj5@gmail.com

ABSTRACT

Kenya in its long-term vision of becoming an industrialized middle-income country by 2030, has identified the leather and leather products sector as one of the key pillars.

As a result, there is a growing number of SMEs engaged in leather goods and footwear manufacturing around the country. This has been encouraged by local demand for affordable footwear. Even though production of leather footwear in the informal subsector has increased over

the years, the country's local footwear has low market share locally and internationally. The market share of the SME produced footwear has been attributed to the low quality of the products.

In this study, a survey was carried out on the quality of leather shoe for school going children produced by SMEs in Kariokor market, Nairobi. Data was collected from 20 respondents who constituted owners and managers of footwear workshops to ascertain if they have adopted the use of quality standards in their shoe fabrication and if their products conform to laid down quality standards. The data was collected using simple random sampling method and analysed using Microsoft excel. Additionally, shoe samples were collected from the artisans for laboratory analysis to ascertain if they meet the quality requirements as recommended by KEBS. Samples were analysed using IUC/IUP methods.

From the findings, none of the SMEs had adopted the use of quality standards and none of them had adopted Kenya Bureau of Standards (KEBS) standards. As a consequence, there was no mechanism of ensuring and maintaining conformity to footwear quality. Findings from the laboratory revealed that shoes sampled failed KEBS test parameters. Even though some of the shoe uppers passed the recommended values, all the soles failed to meet KEBS requirement in terms of hardness and abrasion resistance properties. The overall quality of the shoe was affected as each shoe component plays a vital role in the overall performance and hence quality of the shoe. Therefore, the whole products failed KEBS recommended standards.

Owing to the failure of the shoe to pass the KEBS requirement, and the findings that SMES have not adopted quality standards, there is need for the SMEs to be sensitized on the need of quality checks and quality assurance mechanism on footwear manufacture. Also, a corrective measure and strategy to be instituted to help SMEs in producing quality products

Keywords: *footwear, SMEs, KEBS, quality, standards*

Rapporteurs Report

Presenter's name: Janet Mesa
Title/Topic of presentation: Assessment of the Quality of Leather Footwear for School Children made by SMEs in Kariokor Kenya.
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation:

a) The study aimed at determining the quality of school children's shoes produced by SMEs in Kariokor market, physical properties of school children's shoes made by SMEs and the chemical properties of school children's shoes made by SMEs. b) The study concluded that the sampled footwear failed KEBS standards and recommended that, sensitization on the need of quality checks and quality assurance mechanism in footwear manufacture be done, corrective measure and strategy to be instituted to help SMEs in producing quality products and finally a study on consumers be conducted.
Questions /key points discussed: a) A question was raised on whether the test and time was enough for the study. b) A concern was raised on effect to the children if the shoe does not meet the required standards and if so, what could be done to eliminate the problem. c) A concern was also raised on the conclusion of the study which stated that shoes did not meet the KEBS standard and how the owners of the business will react to that conclusion.
Responses/general recommendations: a) In regard to the test and time for the study, the presenter confirmed that more time was required to test other aspects and that the study checked whether the people in business had background knowledge on shoe making. b) The presenter pointed out that lack of technical knowledge may have an effect because chromium may react to the children skin. c) The presenter confirmed that the study also recommended sensitization of the people involved in the business on the right leather, procedures, training and the effect of chromium.

Name of Session Chair:	**Name of Session Rapporteur:**
Dr. Paul Tanui	Ms. Nancy Koigi

Physical Properties of Chrome-Tanned Nile Perch (Lates niloticus) Fish Leather

Peter Maina Wairimu*, Moses A. Ollengo And Esther W. Nthiga

Department of Chemistry, Dedan Kimathi University of Technology,

Private Bag, Dedan Kimathi-Nyeri, Kenya

*Corresponding author: Tel. +254 718 835737, Email petermaina63@gmail.com

ABSTRACT

The aim of this study was to utilise the Nile perch fish skins which are usually a waste from fish filleting companies to make leather and then to determine its physical properties. The skins were processed into leather using chromium (III) sulphate. The physical properties of leathers were determined using standard IUP methods which include: Tensile strength, Tear strength, Flexing endurance, Shrinkage temperature, Grain crack and Grain burst tests.

The results demonstrated that the tensile, tear strength and elongation of the leather varied depending on the direction and location of the collagen fibres. The properties of the Nile perch leather were satisfying enough for the material to be used in the manufacture of high-grade leather products.

The study showed that the fish skins can supplement sources of raw materials in the leather industry and reduce the environmental pollution caused by disposing of the skins to the environment.

Key words*: Fish leather, Shrinkage, Collagen, Properties*

Rapporteurs Report

Presenter's name: Peter Maina Wairimu
Title/Topic of presentation: Physical Properties of Chrome-Tanned Nile Perch (Lates niloticus) Fish Leather
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: a) The study aimed at determining physical properties of chrome tanned Nile perch fish leather, to stabilize Nile perch fish skin by chrome tanning and to determine the tensile strength, tear strength, ball burst extension, flexing endurance and shrinkage temperature of Nile perch fish leather. b) The study concluded that Nile perch fish skins can be made to leather to supplement available raw materials, Nile perch fish leather is an anisotropic material displaying different strength in different parts and that the Nile perch leather showed adequate strength to be used in the manufacture of high grade leather products. c) The study recommended that Nile perch fish processing should be done with moderate drum speed to prevent damage to the leather.

d) Based on the results of all the tests, the Nile perch fish leather was found suitable for making leather goods that do not require any physical properties such as wallets, ladies purse, passport case, coin wallet, key holder, earrings. e) It also recommended that for organizations that deals with leather testing and standardization of the leather materials, to come up with the standards for the fish leather.
Questions /key points discussed: a) A question was raised on the future of fish leather processing in leather industry. b) A concern was raised on whether Nile perch qualifies to be exotic leather and whether cost would increase by tanning the leather.
Responses/general recommendations: a) The presenter stated that there existed no known tannery industry for commercial business hence a venture opportunity to explore. b) The presenter clarified that Nile perch qualified to be exotic leather and that cost would increase by tanning leather hence increase in price to the consumers.

Name of Session Chair:	**Name of Session Rapporteur:**
Dr. Paul Tanui	Ms. Nancy Koigi

Manufacturing of Novelty Leather from Ovine Stomach using Oil Tannage

Peris N. Wainaina, Benson Ongarora and Paul Tanui

School of Science, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya, Corresponding Author E-mail: periswayne@gmail.com

ABSTRACT

Leathers made from exotic skins or rare parts of animal have very good market value. The exotic leathers are usually preferred because of their patterns, natural occurring marks and their unique structures. Processing of these materials require a non-conventional approach in order to preserve the natural characteristics of the skin after converting into leather. The present work exploits a new raw material source for its utilization as exotic leather. The ovine stomach was converted into finished leather by using suitable tanning methodology and the resultant leather produced quality

exotic leather with a grain, which has a different variety from the ordinary leather. The stomachs were taken through pre-tanning, tanning and post-tanning operation. Then mechanical operations like drying, toggling and staking were done. Physical properties of the rumen and the reticulum leathers were analysed by determining their thickness, tensile strength, elongation at break, tear strength, flex endurance and ball burst extension test. The grain structure of the leathers was analysed using a Light Microscope. The results of physical tests were poor compared to the grain leather as the composition of raw outer coverings of animals and the stomachs are different. The leathers were used for making leather product such as *coin purse, key holders, purses and wallets.*

Key words: *Exotic leather, Ovine stomach, Tanning*

An Investigation on the Properties of Rabbit Leather from Different Tannages

Wandia Dennis Kanuri [a], Arthur Onyuka [b], Rose Tanui [a]

[a]Chemistry Department, Dedan Kimathi University of Technology

[b]Kenya Industrial Research and Development Institute

Corresponding Author Email: kanuridennis@gmail.com

ABSTRACT

The non-conventional sources of raw materials, i.e. exotic skins are skins obtained from animals such as crocodiles, alligators, snakes and rabbits. Rabbit farming in Kenya has emerged as a good source of supply of raw materials to the exotic leather industry. However, there lacks detailed knowledge on the structural and physical properties of rabbit leather and specifically from different tannages. The knowledge would be of benefit to tanners in designing their processes as well as leather goods designers in designing products to meet the desired end-use. For this reason, a study was undertaken to analyse the structural and physical properties of the rabbit leather tanned using chrome and mimosa. The skins were collected from a local slaughterhouse and subjected to standard pre-tanning beam house processes followed by the respective different tanning processes. Physical properties of the crust leathers from the two tannages were analysed by determining the thickness, shrinkage temperature, tensile strength, tear strength; balls burst and flex endurance in accordance with IUP official methods. The statistical results for the two tannages were analysed using excel. From the study, the average shrinkage temperature of mimosa tanned leather was 83°C and chrome

was 100°C. Notably, chrome tanned leather recorded higher tear strength value (37.4 N) than that of mimosa tanned leather (28 N). The other physical parameters were comparable for both tannages. Based on the results both tannages produced leather with physical properties that can be used in production of lining as well as fancy products such as watch strap

Keywords: *Exotic skins, rabbit skin, tannages.*

Rapporteurs Report

Presenter's name: Wandia Dennis Kanuri	
Title/Topic of presentation: An Investigation on the Properties of Rabbit Leather from Different Tannages	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/ key points from presentation: a) The study aimed at investigating the properties of rabbit leather from different tannages, carry out chrome and vegetable tannages of rabbit skins and to determine the physical properties of the tanned leathers. b) The study concluded that rabbit leather was anisotropic material, that chrome tanned rabbit leather offered good physical properties compared to mimosa tanned leather, rabbit leather can be produced by either tannage with good physical properties and finally butt region for all leathers provided the best physical properties compared to the belly. c) The study recommended further studies to be done on the structural properties.	
Questions /key points discussed: a) A question was raised on the products that can be made from rabbit skin b) A question was also raised on whether the study checked on the thickness of the skin.	
Responses/general recommendations: a) The presenter pointed out that rabbit skin can be used to make several products including wrist bands, wallet and belts. b) The presenter confirmed that the study aimed at carrying out chrome and vegetable tannages of rabbit skins and also to determine the physical properties of the tanned leathers where thickness was inclusive.	
Name of Session Chair:	**Name of Session Rapporteur:**

Dr. Paul Tanui	Ms. Nancy Koigi

Helminthiasis, Pneumonia and Enteritis Prevalence and Livestock Production Constraints In Manyatta Sub-County, Embu

Auma E.O[a], Muriithi F. M[b] and Gichohi Mrs[a]

[a]Department of Biological Sciences, University of Embu, P. O. Box 6, Embu, 6100, Kenya,

Corresponding Author E-mail: aumaliz98@gmail.com

ABSTRACT

Livestock production of cattle, goats, sheep and pigs is the most common agricultural practice of small-scale farmers in Embu county. It is however hampered by common livestock diseases. Herein we set out to investigate common livestock diseases production constraints. To understand health constrains of animals reared by small scale farmers, we used administrative data collected in the past five years. Data was collated from both zero grazed animals and free range animals in Manyatta subcounty. Helminthiasis, pneumonia and enteritis are the most common livestock diseases in Manyatta subcounty and Helminthiasis cases were the most prevalent in cattle and peaked in 2014 attributed to drought and water scarcity. The data implies lack of portable drinking water for the livestock and absence or infectiveness of Anti-helminthiasis drugs being administered in the sub county. Most farmers do not vaccinate their livestock and only seek treatment drugs when the animals become sick. The data proposes the need for alternative prescription drugs for treatment of helminthiasis. We also propose the need for regular sensitization strategies informing livestock farmers of the need to regularly deworm and vaccinate their animals.

Keywords: *livestock, production, constraints, helminthiasis, pneumonia, enteritis.*

Determination of Effect of Land Use on Distribution and Abundance of Ground Dwelling Macroinvertebrates in Kirimiri Forest in Embu County, Kenya

***Clifton Omondi[1], Fredrick O. Ogolla[2], Christopher Odhiambo[3]**

[1]Kenyatta University, Department of Microbiology

P.O. Box 43844-00100, Nairobi – Kenya

omondiclifton@gmail.com

[2]Chuka University, Department of Biological Sciences

P.O. Box 109-60400, Chuka, Kenya,

ogolla.fredy@gmail.com

[3]Technical University of Kenya, Department of Ecology and Conservation Biology

P.O. Box 52428-00200, Nairobi, Kenya

chrsodhiambo@gmail.com

ABSTRACT

Ground dwelling macro invertebrates are essential for soil functions and other significance ecological process such as nutrient cycling. The distribution and ecological role of crawling macro invertebrates may be influenced by anthropogenic factors. Human factors such as deforestation and agricultural activities that destroy the habitat pose great threat for the survival of macro invertebrates. Most of the natural ecosystems including forests in Kenya have been encroached, segmented and reduced in size by the rapidly growing population. However, studies on the impact of such destructive activities on the abundance and distribution of ground dwelling macro invertebrates are limited. Thus, there exist information gap on macro invertebrate composition and their distribution in different ecosystem and habitat segments in Kenya. Such studies are necessary in generating knowledge and creating wholesome understanding to facilitate policymaking, habitat management and conservation of crawling macro invertebrates. Based on the above highlights, this study was conducted to determine the effect of land use on the distribution and abundance of ground dwelling macro invertebrate in Kirimiri forest in Embu County, Kenya between January and April 2016. The Napier grass plantation, Tea plantation and indigenous intact forest were evaluated

for their macro invertebrates. In every habitat of studied, crawling macro invertebrates were caught using the pit fall traps set in 50 m by 50 m grid subdivided into six rows at equidistance gap of 8 m. The pit holes comprised of 100 (250 ml capacity) clear plastic containers filled with 50 ml mixture of ethanol and liquid soap. Macro invertebrates were identified using their morphometric features and then stored in 70 % Ethanol for further laboratory identification at the National museums of Kenya headquarter in Nairobi, Kenya. The data collected was subjected to the analysis of variance using Scientific Analysis System (SAS) version 9.4 and significance means separated using Least Significance Difference (SLD). The indigenous intact forest habitat recorded the highest mean of macroinvertebrates with family of *Polydesmidae* being the most abundant (mean=17.33). Tea plantation had the second largest mean (4.59) of macro invertebrates, and the family *Gryllidae* was the most abundant group with mean of 12.667. Napier grass plantation had a mean of 3.94 and the family *Platydesmidae* was the most abundant group (mean=12.833). The disparity in abundance and distribution of terrestrial macro invertebrate observed in this study may have resulted from micro and microenvironment shift influenced by human activity along and within the forest.

Keywords: Macro invertebrates, Habitat effect, Kirimiri forest, Embu, Kenya

Rapporteurs Report

Presenter's name: Clifton Omondi
Title/Topic of presentation: Determination of Effect of Land Use on Distribution and Abundance of Ground Dwelling Macro-invertebrates in Kirimiri Forest In Embu County, Kenya
Institutional affiliation: University of Embu
Highlights/ key points from presentation: a) The study aimed at determining the effect of land use on the distribution and abundance of ground dwelling macro invertebrate in Kirimiri forest in Embu County, Kenya b) The study aimed at bridging the knowledge gap on macro invertebrate composition and their distribution in Kenya as other studies had focussed on aquatic macro-invertebrates with little attention to terrestrial environments. c) The study concluded that macroinvertebrate population and types varied in the three habitats namely; forest, tea plantation and Napier plantation. d) The study found out that there was lower abundance of some macroinvertebrates in some habitats points to the possible extinction facing some important species.

e) It also established that continuous loss of the macroinvertebrate may negatively impact soil ecological systems and its' function as well. f) The study recommended that continued or regular study be done and use of environmentally friendly alternatives.	
Questions /key points discussed: A question was raised on whether the climate could affect the micro invertebrate.	
Responses/general recommendations: a) The presenter pointed out that the study was carried out and cut across rainy season and dry season but comparison of both seasons was not done since it was not within the scope of the study. b) The presenter was asked to add a recommendation of a study on comparison between rainy and dry season.	
Name of Session Chair: Dr. Paul Tanui	**Name of Session Rapporteur:** Ms. Nancy Koigi

Assessment of Wild Rodents Endoparasites in Kirimiri Forest in Embu County, Kenya

Fredrick O. Ogolla *[1], Clifton Omondi [2], Christopher Odhiambo [3]

[1] Chuka University, Department of Biological Sciences

P.O. Box 109-60400, Chuka, Kenya,

ogolla.fredy@gmail.com

[2] Kenyatta University, Department of Microbiology

P.O. Box 43844-00100, Nairobi – Kenya

omondiclifton@gmail.com

[3]Technical University of Kenya, Department of Ecology and Conservation Biology

P.O. Box 52428-00200, Nairobi, Kenya

chrsodhiambo@gmail.com

ABSTRACT

Rodents are reservoirs and hosts of zoonotic diseases. Rodents' pathogenic parasites can be introduced onto soils, water supplies, vegetables and fruits thus playing significant role in human infection. Though studies on rodents and their parasites are necessary to understand and managing zoonotic disease cycle, knowledge gap of endoparasite composition of wild rodents that interact with domestic animals and human still exists in Kenya. This study was carried out to determine the prevalence of rodents' endoparasites in Kirimiri forest, Embu County in Kenya between January and May 2016. Wild rats were caught by laying traps in 100 m x 100 m grid of 50 Sherman and 50 victor traps. Rodents' morphometric data was used for their identification. Necropsy was performed for gastrointestinal tract (GIT) and endoparasites extracted, counted and prevalence determined. Three species of rats totalling to 355 rats comprising of 199 males and 156 females were captured and identified. A total of 533 endoparasites extracted. Rate of endoparasite prevalence was significantly higher in *Rattus spp* a peri-domestic rodent than forest rodents' species (χ= 57.791, P = < 0.05). *Asyphalia obvelata* (44.79 %) had higher prevalence while the *H. dinimuta* had lowest prevalence (6.20 %). Prevalence based on forest patches, GIT and was different. The current study highlights the importance of rodents as potential vectors for intestinal parasitic infections.

Keywords: Rodents, Endoparasites, Kirimiri Forest, Kenya

Rapporteurs Report

Presenter's name: Clifton Omondi
Title/Topic of presentation: Assessment of Wild Rodents Endoparasites in Kirimiri Forest in Embu County Kenya
Institutional affiliation: University of Embu
Highlights/ key points from presentation: a) The study aimed at assessing the effect of forest type, rodent species, rodent gender on the prevalence of wild rodents endoparasites in Kirimiri forest, in Embu, Kenya. b) The study found out that endoparasites that were shared between peridomestic rodents and wilt rodent in Kirimiri forest are zoonotic. c) It was also established that occurrence of zoonotic endoparasites in wild rats elucidated the public health implication of interaction between the wild rats, peri-domestic rats and human habitat. d) The study concluded that build-up of the parasites might negatively impact ecological systems, wildlife, domestic species and have implications to human health.

e) The study recommended regular scouting.
Questions /key points discussed: a) A question was raised on whether there was a secondary study to human being that can be pointed back. b) A concern was raised on whether the parasites were transmitted through saliva and or whether the people around the forest could be the ones mostly affected. c) A question was raised on the coverage area of the study. d) A concern was raised on whether there was a chemical used in the study and if it had any effect to the stomach.
Responses/general recommendations: a) The presenter confirmed that there was no earlier or secondary human being study on parasites. b) The presenter clarified that the study did not study the parameters on human beings. c) In regard to area covered by the study, presenter pointed out that the area was segmented and graded by the type of the forest. d) The presenter confirmed that chloroform was used in the study and that it had no effect to the stomach.

Name of Session Chair:	**Name of Session Rapporteur:**
Dr. Paul Tanui	Ms. Nancy Koigi

BUSINESS MANAGEMENT AND ENTREPRENEURSHIP FOR SUSTAINABLE DEVELOPMENT (BME)

Effects of earnings announcements on share prices at Nairobi Securities Exchange

Elijah Kihooto Maringa*[a], Dr. David Kiarie[b] and Dr. Riro G.K.[a]

[a]School of Business, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

[b]School of Business, University of Kigali, Rwanda.

*Corresponding Author E-mail: elijahkihooto@yahoo.com

ABSTRACT

The study comprised of earnings announcements and how they influence share prices at NSE. Event study methodology was followed over a five-year period from 2012 to 2016. A census was carried out where 57 companies qualified to examination over the period through positivism approach. Average abnormal returns were tested for significance at 95% confidence level. The results indicated that NSE was efficient in semi-strong form for year 2012, 2013, 2014 and 2016 except for year 2015 where the market was found to be inefficient with regard to earnings announcements.

Keywords: *earnings, semi strong form, efficient market hypothesis.*

From Ivory Tower to Entrepreneurial University: A Transformation Agenda for Sustainable Job Creation and Development Among University Graduates in Uganda.

Jacob L. Oyugi

School of Management and Entrepreneurship Kyambogo University, Kampala

jacoyugi@yahoo.com/ joyugil@gmail.com Mob. No.0772639120

ABSTRACT

This paper stresses the importance of entrepreneurial university towards enhancing sustainable job creation and development among university students. The problems facing the country ranging from high rate of poverty, youth and graduate unemployment; overdependence on foreign goods and technology; as well as low economic growth and development are partly caused by the education system especially at the university level. Currently many people believe that university education in Uganda is primarily for its own sake – to impart knowledge and a love of learning with higher paper qualifications. University education is for academic superiority disconnected from day-to-day realities, a closed environment in which knowledge and intellect is the preserve of the self-selecting, privileged few – no understanding of what is important for ordinary people. Yet, the reality of university education is about helping people make progress in their lives in the more specific sense of helping them to get better job and position in life.

This paper therefore argues that transformation of universities in Uganda, from ivory tower to entrepreneurial universities, will equip the students with the behaviour, attitudes and skills with

which to be self-reliant and contribute to sustainable job creation and development. The paper begins by highlighting the concept of university as an ivory tower. The objectives and framework for designing entrepreneurial university are also presented. The paper recommends that educational programmes at all levels of university education should be made relevant to the community so as to provide the youth with the needed entrepreneurial and employable skills.

***Key words**: ivory tower, transformation, entrepreneurial university, sustainable development, Uganda.*

Stakeholder Management Strategies and Deposit Taking SACCOs' Bottom Line in Kenya

Jesse Maina Kinyua[1], Dr. Mike Iravo Amuhayo [2] & Prof. Gregory. S. Namusonge[3]

School of Business & Economics, University of Embu

*Corresponding author email: kinyua.jesse@embuni.ac.ke; jessekinyua71@gmail.com

ABSTRACT

For firm to succeed in a dynamic competitive market place, it has to understand the concerns of its key stakeholders and address them to their satisfaction. This study sought to establish the relationship between stakeholder management strategies and the financial performance of deposit taking Savings and Credit Co-operatives societies in Kenya. The SACCO subsector is part of the Kenyan Co-operative sector comprising of both financial and non-financial cooperatives. Saving and credit co-operative (SACCO) are the financial cooperatives. They are an important part of the financial sector in Kenya, providing savings, credit and insurance services to a large portion of the population. Stakeholder management is paramount in creating trust and confidence to key stakeholder especially in deposit taking SACCOs, and in keeping them satisfied. It has been argued that stakeholder management is decisive in determining whether or not a company is or remain successful and that it has direct environment and bottom line result of an organization. Systematic attention to all parties who affect or may be affected by the organization's behaviour is critical to that organization's success. Stakeholder management studies have mostly concentrated on normative branch of stakeholder management theory. It is however important to extend the study to member - based co-operatives. Descriptive research method was employed in this study. Questionnaires ware

used to collect primary data. To ensure that the research instrument yields valid data, the researcher engaged expert in the relevant field in scrutinizing it. Pilot study was carried out to check on the reliability and validity of the instrument and a Cronbach's Alpha of 0.915 was obtained. Data was collected from a sample of 64 Deposit taking SACCOs out of a population of 180 licensed DTS. This made a sample of 130 individual respondents. Research findings were that all the five strategies individually and when combined have positive relationship with the performance of deposit taking SAACOs. Data analysis gives a p value of 0.000 for the overall model. The level of significance (α) is 5% = 0.05. This shows that there is a fit in the overall model. The research contributes to stakeholder management theory by supporting previous studies that stakeholder management strategies have positive relationship with SACCO societies' performance. Managers should be proactive in managing their stakeholders and to enhance their relationships and financial performance of their SACCOs.

Key words: *Deposit Taking SACCOs, Financial Performance, Stakeholder Management strategies*

Rapporteurs Report

Presenter's name: Jesse Maina Kinyua	
Title/Topic of presentation: Stakeholder Management Strategies and Deposit Taking Saccos Bottom Line in Kenya	
Institutional affiliation: University of Embu, Kenya	
Highlights/ key points from presentation: a) The study sought to establish which management strategies had the greatest influence on deposit taking Saccos performance.	
Questions /key points discussed: a) The study quoted old citations of year 2010, why was that the case? b) How did you measure the management strategies?	
Responses/general recommendations: a) The study obtained the latest SASRA Report which collected data of year 2010 and earlier but was released later. Hence no other formal data was available for the study. b) The study measured management strategies using financial analysis tools such as profitability, number of customers and rate of growth of shares.	
Name of session chair:	**Name of session Rapporteur:**

Dr. Ann Sang	Peter Mbichu

Banks' Portfolio Diversification and Financial Performance of Commercial Banks in Kenya

Stephen Githaiga Ngware[1] Tobias Olweny[1] Willy Muturi[1]

[1] Jomo Kenyatta University of Agriculture and Technology

Corresponding author: sngithaiga@gmail.com

ABSTRACT

It is complicated to efficiently manage bank's portfolio, simultaneously maximize returns and minimize risks while being subject to managerial and regulatory constraints. This paper has discussed pertinent issues in bank portfolio diversification in the banking industry while focusing on the elimination of the existing classes of risk. The banks' portfolio diversification as a strategy in the context of a country like Kenya is assessed on the fundamentals of available theoretical supported by empirical literature with a bias to all commercial banks in Kenya. The 43 commercial banking institutions having official license from CBK by December 2017 were the target population of this study. The study analysed Time Series Cross Sectional unbalanced secondary panel data obtained from KNBS, World Bank website, CBK, published financial accounts statements of all the 43 commercial banking institutions in Kenya, and the Banking survey publications for fifteen years ranging from 2003 to 2017. Four hypotheses were estimated using Panel data techniques of fixed effects and random effects. Generalized Method of Moments (GMM) was used to estimate short run model and to purge unobserved firm specific time–invariant effects and also to help to mitigating presence of endogeneity problems. GMM revealed short run significant effect of ROE and ROA on financial performance of commercial banks. Sectoral credit diversification, income services diversification, deposits portfolio diversification and investment portfolio diversification had significant positive effect on financial performance respectively.

Key words: Portfolio Diversification; Sectoral credit; income streams; deposits portfolio; investment portfolio; Dynamic Panel Model; Fixed Effects

Rapporteurs Report

Presenter's name: Stephen Githaiga Ngware.

Title/Topic of presentation: Banks Portfolio Diversification & Financial Performance of Commercial Banks in Kenya
Institutional affiliation: JKUT, Kenya
Highlights/ key points from presentation: a) It is complicated to efficiently manage bank's portfolio, simultaneously maximize returns and minimize risks while being subject to managerial and regulatory constraints. b) This paper has discussed pertinent issues in bank portfolio diversification in the banking industry while focusing on the elimination of the existing classes of risk c) The 43 commercial banks licensed by CBK by December 2017 were the target population of this study. d) The study will analyze Time Series Cross Sectional unbalanced secondary panel data obtained from Kenya National Bureau of Statistics, World Bank website, Central Bank of Kenya, published financial accounts statements of all the 43 commercial banks in Kenya.
Questions /key points discussed: a) Why did you carry out the research only from year 2003 to 2015? b) How did you pick the most influential factor in your study?
Responses/general recommendations: a) The study focused on the period from year 2003 to 2015 because that was when all the banks and economies experienced economic recession. b) The study found that all the four variables were significant and hence influenced the performance of the commercial banks.

Name of session chair:	**Name of session Rapporteur:**
Dr. Ann Sang	Peter Mbichu

Analysis of Strategies for Successful Integrated System Implementation: A case Study of UNIPLUS Implementation at the Co-operative University of Kenya

Orucho Michael Ngala[1]

[1]School of Business and Economics, Co-operative University of Kenya, Nairobi, Kenya

Correspondence: E-mail: oruchomiko@gmail.com

ABSTRACT

An integrated system is essential for automation of manual routine tedious organizational processes. It is meant to improve efficiency and effectiveness at work. However, implementation of such systems, if not properly organized and appropriate strategies put in place to ensure its success, may take unnecessarily longer time than anticipated, ot the whole system abandoned all together. This study sought to establish the most effective strategies that ensure successful and timely integrated system implementation. Systems theory approach and Resource Based View were used to anchor the study. Case study was adopted as the research design. The population of the study comprised twelve (12) departments within Co-operative University of Kenya where different system modules were rolled out for implementation. Primary data was collected using semi-structured questionnaires. Since data collected was largely categorical in nature, Chi-square was used to analyze relationship between variables. It was established that personal interest and optimism is the most influential strategy in determining success and pace in integrated system implementation. The key recommendation that the study offers as insight to policy makers, body of theory and practitioners is the need to deliberately concentrate on strategies that induce personal interest and optimism among employees so as to ensure success during implementation of a new system or change.

Keywords: *Customer Focus, Customer Retention, Employee Focus, Strategies, Small and Medium Enterprise*

Rapporteurs Report

Presenter's name: Michael Ngala Orucho
Title/Topic of presentation: Analysis of strategies for successful integrated system implementation: A study of UNIPLUS at Cooperative University.
Institutional affiliation: Cooperative University, Kenya
Highlights/ key points from presentation: a) The Co-operative University of Kenya began ERP system implementation in the year 2014. b) While nonacademic modules have been implemented with a lot of expediency, academic modules are at different levels of success. c) There are some departments at a relatively higher level of success compared to others. d) Having been the academic modules implementation champion at the Co-operative University of Kenya, I noted that the end users would attribute implementation status to different factors. e) Most commonly cited factors include management support, training, personal interest, system related

functionalities.

f) Farzandipur, et. al (2016) noted that human factors have the most influence on successful implementation of ERP systems followed by technological factors.

g) This study sought to establish the most effective human factor strategies that ensure successful and expedited integrated system implementation.

Questions /key points discussed:

a) The study appears not to come out clearly on the different factors influencing implementation of the ERP system between academic and non-academic division.

Responses/general recommendations:

a) The study sought to establish the most effective human factor strategies which influenced successful implementation of ERP system at the University. The study concentrated on the human factors and not technical factors for any of the division.

b) This study has established that personal interest is the most significant and strategic factor that would expedite success in ERP system implementation.

c) The implication of the finding, is that project leaders charged with the responsibility of overseeing ERP system implementation, must endeavor to elicit reasonable level of user interest so us to expedite the entire process.

Name of session chair:	**Name of session Rapporteur:**
Dr. Ann Sang	Peter Mbichu

Who Really is the King between Customer and Employee? Comparative Effect of Customer Versus Employee Focus Strategies on Customer Retention by Small and Medium Enterprises in Nakuru town, Kenya

Orucho Michael Ngala

School of Business and Economics, The Co-operative University of Kenya, Nairobi, Kenya

Correspondence E-mail: oruchomiko@gmail.com

ABSTRACT

Customer retention is paramount for a business to guarantee continuous and stable revenue flow. Both customer and employee focus strategies are critical impetus in attracting and retaining loyal

customers. There is really no point in over emphasising one side at the expense of the other. Although most studies have analysed separate influence of customer and employee focus on customer retention, this study sought to establish the deference in the degree of influence when customer and employee focus strategies are compared. Competing Values model of organizational effectiveness was used as the main theory anchoring the study. Cross-Sectional survey was adopted as the research design. The population of the study comprised fifty-seven (57) SMEs in within Nakuru town Kenya. Primary data was collected using structured questionnaires. Correlation and regression analyses were carried out to analyse data and to test hypotheses. Customer Retention Rate (CRR) was used as dependent variable. It was established that although both employee and customer focus strategies significantly predict CRR, employee focus strategies are comparatively greater predictors of CRR than customer focus strategies. However, the combined effect of both employee and customer focus strategies manifested greatest effect on CRR. The significance of employee focus when it comes to customer retention cannot be overlooked. The key recommendation that the study offers as insight to policy makers, body of theory and practitioners is the need to deliberately consider strategies that focus on employee empowerment and not over emphasize the global buzz phrase the customer is the king. A non-skewed and fair balance between customer and employee focus strategies is critical for customer retention.

Keywords: *Customer Focus, Customer Retention, Employee Focus, Strategies, Small and Medium Enterprise*

Rapporteurs Report

Presenter's name: Orucho Michael Ngala
Title/Topic of presentation: Who Really is the King? Customer or Employee? Comparative Effect of Customer Versus Employee Focus Strategies on Customer Retention by Small and Medium Enterprises in Nakuru Town, Kenya.
Institutional affiliation: Cooperative University, Kenya
Highlights/ key points from presentation: a) Customer retention is paramount for a business, to guarantee continuous and stable revenue flow. b) Both customer and employee focus strategies are critical impetus in attracting and retaining loyal customers. c) Although most studies have analysed separate influence of customer and employee focus on customer

retention.

d) This study sought to bridge this gap by establishing the deference in the degree of influence when customer and employee focus strategies are compared.

e) Globally, researchers have determined an increasing interest in the role of Small and Medium Enterprises (SMEs) in creating jobs as well as developing economy.

Questions /key points discussed:

a) Did the study findings agree with the hypothesis?

Responses/general recommendations:

a) The study failed to accept the null hypothesis. Although many researchers and industry practitioners have been over emphasizing the fact that customer is the king, findings of this study reaffirm assertions by Van Doorn, (2011) who established that paying attention and focusing on motivating employees is directly correlated to how delighted customers would be about their experience with such employees hence return to you or go to a competitor.

b) Although the findings of this study show that customer focus is equally significant in predicting customer retention rate, the debate which seems unconcluded is whether organizations should incline their focus towards customer at the expense of employees.

Name of session chair:	**Name of session Rapporteur:**
Dr. Ann Sang	Peter Mbichu

Effects of Integrated Infrastructure on Sustainable Mobility of Matatu Sacco's in Public Transport in Nairobi County

Priscilla Wambui Muhoro[a], Anita Wachira[b] and David Kiarie[c]

[a]School of Business Management and Economics, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

Corresponding Author E-mail: muhoromrs@yahoo.com

ABSTRACT

Road transport is the most widely used means of transportation in Africa. Maintenance of physical infrastructure is the key to rapid economic growth and poverty reduction. Road network infrastructure connectivity plays a significant role in allowing for a mobile town in which passengers can fluidly move on time with a reduction on fare and also enhancing decongestion in towns. As a result of the increasing movement trends passengers are demanding for more integrated infrastructure in transport sector specifically in the Matatu Sacco. In response to these demands, this study guided by positivism theory and employing the mixed research design set out to evaluate the effects of integrated infrastructure on sustainable mobility of Matatu Sacco's public transport sector in Nairobi County. The population of the study was all 177 Matatu Sacco's registered by NTSA in 2015 located in Nairobi County. The respondents were the Sacco Managers of the 177 Matatu Sacco's. Census design was employed since all the registered Sacco were used in the study. A semi-structured questionnaire was used to collect both quantitative and qualitative data from the 177 Sacco managers, while an interview schedule was used to collect data from the representatives from both the ministry of transport and vehicle owner association respectively. Quantitative data was analysed using SPPS. Pearson's correlation indicated that integrated infrastructure had a positive effect on sustainable mobility of Matatu Sacco's in public transport sector ($rHo = 0.808$, $p<0.05$ with beta coefficients; $\beta = 1.095$ $t=15.796$, $p<0.05$). The study recommends that integrated infrastructure is instrumental for the effective functioning of Matatu Sacco's in the transport sector and that the Ministry of Transport and all other stakeholders should adopt an integrated infrastructure, one which is accessible to transfer points, route planning, clean and secure. The Ministry should also develop and mainstream policies on strategic transport integration that would influence sustainable mobility of Matatu Saccos in public sector. Similar studies are recommended in other Counties since public transport is experienced in all Counties. The study further proposes that if the government structures and reorganizes the Matatu Sector and embrace integrated infrastructure accordingly, it can provide the much needed employment to the youth and also enhance other modes of transport for low income households.

Keywords: *Integrated Infrastructure, Sustainable Mobility, Matatu Sacco's, Public Transport Sector*

Rapporteurs Report

Presenter's name: Priscilla Wambui Muhoro.
Title/Topic of presentation: Effect of Integrated Infrastructure and Sustainable Mobility of Matatu

Sacco's in Public Transport sector in Nairobi County Kenya.
Institutional affiliation: DeKUT, Kenya
Highlights/ key points from presentation: a) Rising traffic congestion in Nairobi Metropolitan area has made Nairobi to be marked as the second most congested city in the world UN Habitat. It is also reported to have one of the longest average journeys. b) **Causes of congestion**: the widespread movement of people to pursue certain goals such as obligatory movement, professional movement, personal, touristic and distributional movements. This movements put pressure on the transport infrastructure c) **Effects of congestion**: road accidents, air pollution problems noise, longest average journeys, high fare, high cost of fuel, frustrated drivers and loss of productivity. d) **Interventions carried out**: Intelligent transport system, expansion roads, construction of bypass and underpass, creation of bus lanes painted with different colours, free car plans. e) **Reason for carrying out this study**: Documented studies have not addressed the issue of integrated infrastructure and sustainability of mobility. This is what motivated the researcher to carry out this study on the effect of integrated infrastructure and sustainable mobility of Matatu Sacco's in public transport in Nairobi County Kenya.
Questions /key points discussed: a) Did the study propose any tangible solutions to the problem of matatu overcrowding in Nairobi city? b) What percentage reduction of traffic jam occurred after applying the integrated infrastructure program?
Responses/general recommendations: a) The integrated infrastructure project has worked in countries like South Africa and Australia and hence it will work in Kenya b) The Study established that 67% of the traffic jam problem was addressed by applying the system.

Name of session chair:	**Name of session Rapporteur:**
Dr. Ann Sang	Peter Mbichu

Effects of Horizontal Public Procurement Practices on Supply Chain Performance in Kenya Owned State Corporations

Matayo Ratemo

Dedan Kimathi University of Technology

ABSTRACT

Public Procurement, which accounts for 15-18 % of the country's GDP, is a major policy tool which the Kenyan government is using to pursue "horizontal" objectives- of social transformational and development in addition to the "functional" objectives - of obtaining goods, works and services in the best terms. Despite the widespread utilization of public procurement's "buying power" to realize horizontal outcomes, pertinent literature on supply chain performance has paid much attention to functional aspects of supply chain performance, to the exclusion of horizontal issues. This study sought to determine the relationship between horizontal public procurement practices and supply chain performance in Kenya owned State Corporations using public value theory as analytical framework. Specifically, the study examined the effect of Socially Responsible Procurement, Environmentally Responsible Procurement and Protectionist Public Procurement on Supply Chain Performance of Kenya owned State Corporations. The study employed a positivist research paradigm and a cross-sectional census survey design and targeted the 187 Kenya owned State Corporations. Closed and open-ended questionnaires were distributed to procurement practitioners and interview guides were conducted with accounting officers to gather primary data, whereas secondary data was retrieved from existing reports of the public procurement Regulatory Authority website. Descriptive statistics, correlation and multiple regression analysis were used to analyze the data. The results indicated that Socially Responsible Procurement, Environmentally Responsible Procurement, Protectionist public Procurement, and Public Procurement of Innovation had positive and statistically significant effect on supply chain performance. The study had two major implications for theory, and for practice. First, the study revealed the robustness of public value theory as an analytical framework for horizontal public procurement hence further extending the theoretical discourse of the theory. Second, the study showed that pursuit of functional and horizontal objectives in public procurement is critical to supply chain management practice.

Effect of Holistic Marketing on Performance of Dairy Processors in Kenya

John M.Wanyoike*, Anita Wachira, Lilian Mwenda and Eddy Owaga

School of Business,Dedan Kimathi University of Technology

*Corresponding Author Email: Johnmwanyoike@gmail.com

ABSTRACT

The purpose of the study was to evaluate the effect of holistic marketing on performance of dairy processors in Kenya. Studies have been conducted but none has, on effect of holistic marketing in dairy business. Kenya dairy processors have been experiencing several challenges in their operation, among them, low quality and quantity of milk, high cost and waste along the production value chain, Poor access to both domestic and export market and unfair competition amongst processors. The study objective was to evaluate the effect of holistic marketing on performance of dairy processors in Kenya. The study was anchored on Partial theory of holistic firm. Descriptive research design was adopted for the study. Purposive sampling technique was used as it allows picking most appropriate cases providing the required information for the study. The study targeted a census of 14 managers of dairy processing firms in Rift valley and Central region of Kenya. Self-administered questionnaire of 14 general managers of the processing firms was used to collect data. Correlation of variables; multiple linear regression and overall analysis of variance were computed. Pearson's correlation index showed that dairy processor's holistic marketing variables contributed to performance of each other and that all holistic marketing variables were correlated with performance variable (dependent variable). Social responsibility and discretionary effort for processors had a negative correlation coefficient of – 0.63 and -0.93 respectively while all the other independent variables had positive coefficient values. The processor's independent variables were significant apart from relationship marketing which had a p value of 0.055, slightly higher than α=0.05. The ANOVA computed F for dairy processors was 0.03. Thus, there was an overall significant relationship between the processors explanatory variables and performance of the dairy industry. In conclusion, the study showed that, the dairy processors were aware and implemented holistic marketing management practices fairly. However, the dairy processors considered social responsibility as an expense and addition to cost hence avoiding it resulting to the negative coefficient value. Dairy processing managers require training and development in implementing holistic marketing as an approach to performance of the dairy industry as the study found it rewarding.

Keywords: *Holistic marketing, Relationship marketing, Internal marketing, integrated marketing, Social responsibility, Discretionary effort, Performance*

Rapporteurs Report

Presenter's name: John Maina Wanyoike

Title/Topic of presentation: Comparative Study on Effect of Holistic Marketing on Performance of Dairy Industry in Central and Rift Valley Regions of Kenya

Institutional affiliation: DeKUT, Kenya

Highlights/ key points from presentation:

a) The trend of market fragmentation and dynamism in the environment in this era of globalization has introduced a couple of challenges in Kenya Dairy industry.

b) Among the challenges are**:** low quality of milk, high cost of production and waste along the production value chain, high cost of farm inputs, Poor access to domestic and foreign market and low returns on investment.

c) Competition in the dairy industry has gradually set in a new trend in the market such as consolidation buy-outs, led by the increasing need for processors to own the process of milk sourcing.

d) Holistic marketing originated as a response to fundamental changes in the marketing environment, namely: demographic, globalization, hyper-competition, internet development and corporate social

Questions /key points discussed:

a) Some of the respondents in the rural setting could have been illiterate, how were they consulted?

b) The specific objectives of the study were not adequately covered in the conclusions of the study.

Responses/general recommendations:

a) The questionnaires were customised to accommodate the charateristices of the respondents in the rural areas.

b) The dairy farmers showed little participation in implementing holistic marketing with intent of promoting performance of the dairy. Unlike the dairy processors.

c) Processor's relationship marketing and social responsibilities were considered as expenses and hence avoided.

d) The farmer's and the processor's explanatory variables were all correlated with the response variable (performance of the dairy).

Name of session chair:	**Name of session Rapporteur:**
Dr. Ann Sang	Peter Mbichu

Business Incubation Imperatives in Technology Based New venture creation: An evaluation of Business Support Value Proposition in Kenyan Business Incubators

James Mwangi Njau*[a], Anita Wachira[b] and Lilian Mwenda[c]

School of Business Management and Economics, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

*Corresponding Author E-mail: mwanginjau@gmail.com

ABSTRACT

Globally, business incubation has emerged as a popular mechanism for supporting new venture creation. Given this backdrop, the objective of this research was to assess the effect of business Support on technology based new venture creation in Kenya. This study was based on Co-production Theory and Smilor's Incubation Model. The study used descriptive research design. The population of study was 9 business incubator managers and 364 incubates located in Nairobi Metropolitan. Stratified sampling was undertaken to obtain strata based on each business incubator involved in the study. For the incubates, simple random sampling was then applied to obtain a sample size of 186 incubate. A Semi-structured questionnaire was used to collect both quantitative and qualitative data from the incubates. An interview schedule was used to collect data from incubator managers. Quantitative data was analysed using SPSS that generated both descriptive and inferential statistics. Pearson's correlation coefficients indicated a positive correlation between business incubation components and technology based new venture creation with correlation coefficient for business support (0.390, $p<0.05$. Bivariate analysis indicated business support had a significant effect on technology based new venture creation, with the beta coefficients; $\beta = 0.348$, $p<0.05$). Data obtained from incubator managers was analysed through a qualitative analysis process. The study recommends integration of incubation theories and incubation models in the configuration of an effective business support services configuration in Kenya Business incubators. This Study recommends that business incubators need to model business support services that encompass the four elements of business support; business coaching, training, business plan support and provision of subsidies. Business incubation managers and practitioners need to improve these elements to increase new venture creation success. The incubation service provider should also be

customer-centric, implying that it should be tailored to meet the specific needs of the incubates that most of the times depend on the stage of development of the new venture.

Keywords: *Business Incubation, Technology-Based New Venture Creation, Business Support and Value Proposition.*

Rapporteurs Report

Presenter's name: James Mwangi Njau
Title/Topic of presentation: Business incubation Imperatives in Technology Based New venture creation: An evaluation of Business Support Value Proposition in Kenyan Business Incubators.
Institutional affiliation: DeKUT, Kenya
Highlights/ key points from presentation: a) The impact of the small enterprises on economic growth in many countries has led to increased support for new venture creation and innovative entrepreneurship. Innovative entrepreneurship plays an important role in creation of wealth, jobs and products and services that meet consumer needs. Globally, business incubation has emerged as a popular mechanism for supporting new venture creation. b) Despite the important role that the Micro Small and Medium Enterprises play in the Kenyan economy, a number of challenges affecting the sector have been identified. These include; limited linkages with large enterprises, inadequate access to skills and access to markets. The overall effect of these challenges is business failure and stagnation among many business start- ups. c) Incubation of start-ups will enable the Kenyan government to promote industrialization and technological innovations in the region. There is a need evaluate the business support value proposition in Kenyan business incubators.
Questions /key points discussed: a) How did the study consider helping the Kenyan innovators under the incubation centers? b) Are there specific recommendations advanced for the Counties to promote incubation centers?
Responses/general recommendations: a) The study established that challenges exist of assisting innovators although both the National and County Governments are up to the task. b) The Counties developed and are implementing Integrated Development plans to address the incubation centers in the country. c) The study recommended that business incubators should model business support services that encompass

the four elements of business support; business coaching, training, business plan support and provision of subsidies. d) That incubation service provider should also be customer-centric, implying that incubation should be tailored to meet the specific needs of the incubatees. e) Business incubation policy be developed to help in mainstreaming business incubation in Kenya	
Name of session chair: Dr. Ann Sang	**Name of session Rapporteur:** Peter Mbichu

Effect of Heuristic Factors and Real Estate Investment in Embu County, Kenya

Geoffrey Gikonyo Gitau, David N. Kiragu, Riro Kamau

Dedan Kimathi University of Technology

ABSTRACT

Investment decisions are deemed as a deliberate and rational process based on availability of information. Though at times people are usually found to hold little information but yet end up making general decisions. Heuristics factors are simple rules of the thumb which explain how people make decisions, arrive at judgments and solve problems when faced with complex situations or in cases where the available information is incomplete. This study sought at assessing the influence of the heuristic factors on real estate investment in Embu County. The study was guided by Heuristic Theory. A census of 126 registered real estate investors from Embu town, Runyenjes and Siakago Urban centres was undertaken. Primary data was collected through a self-administered questionnaire composed of closed ended questions. Cronbach alpha coefficient of 0.7 was used to ascertain test of the reliability of the data collection instrument. Descriptive and regression analysis were used to analyse data with the help of statistical package. Inferential statistics was also carried out to establish the nature of the relationship that exists between heuristic factors and real estate investment. Data was interpreted with the help of 0.05 significance P-values. Model fitness R^2, ANOVA statistics and regression coefficient were generated. Prior to running a regression model, normality test was conducted. The study findings indicated heuristics factors have a positive and statistically significant relationship with real estate investment in Embu County. This study concludes that real estate

investors in Embu County sometimes do not make investment decisions rationally but are influenced by heuristic biased decisions. The study recommends that Embu County Government should establish a mechanism to ensure that the prices of real estate in specific regions are availed to enable investors evaluate price changes as it may influence their decision to buy or sell the investment.

Effects of Financing Structure on Financial Performance of Saccos in Kikuyu Sub-County, Kiambu County, Kenya

Zachariah Mburu*[a], George Gongera[b], James Ndegwa[c]

[a]The Co-operative University of Kenya, School of Cooperatives and Community Development. P.O. Box 24814-00502 Karen Nairobi, Kenya,

[b,c] The Co-operative University of Kenya, School of Business and Entrepreneurship, Karen Nairobi

*Corresponding Author Email: mburuz@cuk.ac.ke Phone: 0721 917 439

ABSTRACT

No one forgets the tremendous responsibilities that SACCOs convey by providing financial services. They appeal funds inside and outwardly enabling continuous lending services. Nevertheless, due to extraordinary cost of capital, SACCOs experience financial anguish restraining their financial performance. This research study aimed at analysing the effects of financing structure on the financial performance of SACCO's registered in Kikuyu Sub-county Kiambu, Kenya. This descriptive quantitative study, an earthed the financing structure pattern and the effects it has on financial performance of SACCOs. The dependent variable was measured by dividing surplus with equity while the independent variable was attained by dividing debt with equity. The explanatory research design was adopted to establish contributory properties of an independent variable while a census survey was adopted. Data collection was effected using a data sheet distributed to all the SACCOs. The research was pegged on trade-off, pecking order and market timing theory. Data obtained was an extract from audited published business reports of all registered SACCOs by end of the year 2017 in Kikuyu Sub-county's Co-operatives Office. It was put in SPSS and analysed quantitatively using correlation, analysis of variance and regression analysis. Results acquired displayed that SACCOs financing structure had a moderate correlation significantly explaining the variance in financial

performance. This research finding applauds an implementation of more combined financing options leading to better-quality financial performance. Research findings called for government becoming more influential in contributing financial assistance to support SACCO's managing intensified rebate charges charged by commercial banks. This attention might heighten SACCOs' entrepreneurial performance principally leading to supporters' wealth enlargement.

Key words: *financing structure, Debt, equity, financial performance*

Rapporteurs Report

Presenter's name: Zacharia Mburu
Title/Topic of presentation: Effects of Financing Structure on Financial Performance of Saccos in Kikuyu Sub-County, Kiambu County, Kenya
Institutional affiliation: Cooperative University, Kenya
Highlights/ key points from presentation: a) The study was on the effects of financing structure on financial performance of SACCOs. It was carried out in Kikuyu Sub-county, Kiambu County. Co-operative Societies Act, (2008) defines how Co-operative Societies as institutions which finance their operations either be through; equity capital & Debt Capital Financing. b) SACCOs are unable to acquire the necessary capital enough for their operations. They experience difficulties in selecting the financing structure (Mix) to apply at any given time. This leads to inclined activities, less returns. Notably, debt or external funding exhibit unbearable interest spread.
Questions /key points discussed: a) What was the researcher establishing from the Saccos? b) What was the focus of your study? c) Are Saccos studied still enrolling new members? d) What were the key recommendations of the study?
Responses/general recommendations: a) The study was establishing the influence of financing structure on the performance of Saccos. b) The focus of the study was measuring performance of the Saccos in terms of financial analysis such as dividend ratios and debt ratios. c) The studied Saccos were not enrolling new members. They have locked in the existing members.

d) Among the recommendations made were the need for stricter Government regulations and interventions on activities of Saccos. Another recommendation was removal of board members who had overstayed in management position – some for over 15 years.
Name of session chair: Dr. Ann Sang | **Name of session Rapporteur:** Peter Mbichu

Board Gender Diversity and Financial Performance of Commercial Banks Evidence from Kenya

Caleb BwÁuma Manyaga, Willy Muturi, Oluoch Oluoch

Jomo Kenyatta University of Agriculture and Technology

cmanyaga@yahoo.com Cellphone 0721489589

ABSTRACT

This paper examines the influence of board gender diversity on return on equity on the 34 commercial banks in Kenya during the years 2008-2017. The results found board gender diversity had a negative but significant influence on return on equity across peer and across banks. However, in regard to time, board gender diversity had insignificant influence on return on equity across time. In regard to individual years, board gender diversity had a positive and significant variability on return on equity across time, across peer and across banks. This imply that board gender diversity had generally a negative influence on return on equity across time, across peer and across banks. Whereas, in regard to individual years, peer and bank, board gender diversity had a positive and significant variability on return on equity across time, across peer and across banks.

Key words: *Board gender diversity, return on equity, Kenya*

Rapporteurs Report

Presenter's name: Orucho Michael Ngala
Title/Topic of presentation: Board Gender Diversity and Financial Performance of Commercial Banks in Kenya.
Institutional affiliation: Cooperative University, Kenya
Highlights/ key points from presentation: a) Institutions are managed by board of directors who have delegated authority from the owners of the firm

to enhance corporate governance and increase the wealth of the owners of the firm.

b) Board of directors manage the firms on behalf of the owners and prepares the strategic plan.

c) Based on the analysis the study concluded that board gender diversity had a negative but significant influence on return on equity on commercial banks in Kenya. This result support Akpan and Amran (2014) who found board gender diversity had negative but significant influence on performance of listed Nigerian firms.

d) The study recommends varied board membership in the form of gender which is likely to enhance good understanding of markets that are differentiated in terms of growing creativity and innovativeness, improved decision-making provided evaluation of other available alternatives.

e) Government should take steps to enact mandatory laws to increase female membership in the board. This action will be in line with that taken in Spain where enactment raised women board membership by 98 percent between the years 2005 and 2009 after enactment (Reguera-Alvarado, De Fuentes & Laffarga 2017).

Questions /key points discussed:

a) How did the study differ or agree with others?

b) With the removal of interest capping by the Goverment, what will be the fate of the consumers?

Responses/general recommendations:

a) The study revealed similar findings which were arrived at by other several studies, even in Kenya. In addition, the study indicated that presence of many women directors positively influenced the performance of many commercial banks.

b) The removal of interest capping would enable more investors to access loans. Indeed, the study found that 800 customers would qualify for loans unlike in the past regime.

Name of session chair: Dr. Ann Sang	**Name of session Rapporteur:** Peter Mbichu

Inflation Rate and Performance of the Residential Property Market in Kenya

Charles Njoroge*, Willy M. Muturi, and Oluoch Oluoch

School of Business, Jomo Kenyatta University of Agriculture and Technology, PO Box 62000 – 00200 Nairobi, Kenya.

**Corresponding Author Email: gitiyas@gmail.com, Tel: +254723719796.*

ABSTRACT

The purpose of the study was to establish the effect of inflation rate on the performance of the residential property market in Kenya. Swelling of the residential property prices in Kenya vis a vis the inflation rate has ignited concerns about the sustainability of residential property market in Kenya. This study adopted a positivist philosophical attitude using causal research design. The study used secondary data from first quarter of 2005 to fourth quarter of 2018. The study conducted several test statistics and diagnostic tests in order to achieve the most optimal solution. Vector error correction model and auto-regressive distributed lag model were employed to test the hypothesis in the short run and long run respectively. Interestingly, the study results found that inflation rate had a negative effect on performance of residential properties in Kenya in the short run while a positive effect was observed in long run. The study has narrowed down the research gap brought about by the conflicting empirical, theoretical and conceptual literature with regard to the effect of inflation rate on performance of residential property market in Kenya. To investor, the study recommends the need to have varying strategies on the inflation effect on residential property market investments as it has diverse effect depending on whether the relationship is short run on long run.

Keywords: *Inflation Rate, Performance, Residential Property*

Human Capital Development and Economic Growth in Kenya: Best Practices from South Korea and Singapore (2002-2014)

Gabriel Juma Okumu[1], Mwita S. Marwa[2], Dr. Anne Sang[2]

[1]Public Service Commission, P.O. Box 30095-00100 Nairobi.

[2]School of Business, Management & Economics Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

*Corresponding Author E-mail: gjokumu@gmail.com

ABSTRACT

Numerous studies have attributed the differences in the level of socio-economic development across countries to the quantity and quality of human capital. These studies further singled out growth of human capital as the principal source of economic growth for both the developed and some South East Asian countries. Kenya, Singapore and South Korea exhibited similar income levels in the 1960s. However, the gap between Kenya's economic growth and those of South Korea and Singapore has widened tremendously since independence in 1963 with Kenya recording low Gross Domestic Product (GDP) compared to the two Asian countries. The study examined the role played by HCD in the economic development of Kenya between 2002 and 2014 by interrogating the development models adopted by South Korea and Singapore as a benchmark to determine the gaps in the model adopted by Kenya. Secondary data was collected through a designed recording form. The model variables included GDP as the response variable explained by six predictor variables; government expenditure on education, human development index, average years of schooling as a proxy for percentage of population that has attained education, patents filed by the countries, government effectiveness and government expenditure on research and development. Secondary data was analyzed using hypotheses tests, stationarity tests, granger causality tests, correlation analysis and regression modelling and interpreted in line with the study objectives. Findings revealed that whereas human development index was found to be positively correlated to economic growth in South Korea and Singapore, it was negatively (inversely) correlated to economic growth in Kenya; an indication that the country is not doing very well in terms of developing and deploying her human capital in the three critical areas of education, health and standard of living. Findings further revealed that whereas investment in education, competitive Human Development Index and Average Years of Schooling positively influenced economic growth in South Korea and Singapore, Government investment in Research and Development had a negative influence. The study recommends that the TVET sector be revamped and prioritized as a response to youth unemployment challenge; the government, strengthens linkage between policy makers, universities, research institutions and industry; lays more emphasis on applied R&D; and invests heavily in science, engineering, ICT and mathematics for human capital accumulation in order to realized

sustained economic growth. Based on the best practices from South Korea and Singapore a framework for HCD is developed.

Keywords: *Human Capital, Human Capital Development, Education, Economic Growth.*

Rapporteurs Report

Presenter's name: Gabriel Juma.
Title/Topic of presentation: Human Capital Development and Economic Growth in Kenya: Best Practices from South Korea and Singapore (2002-2014)
Institutional affiliation: JKUAT
Highlights/ key points from presentation: a) Gap between Kenya's economy and those of South Korea and Singapore has widened since independence b) Currently South Korea and Singapore are way above Kenya in terms of economic development c) Its not clear why Kenya has lagged behind South Korea and Singapore d) Most studies are cross sectional - present one is country specific using different variables e) Limited research conducted in Kenya f) Most studies examined causes of economic growth in the period after independence. Present study focused on the period 2002-2014 g) Lack of consensus on causes of economic growth and Development - research is far from over (Barro).
Questions /key points discussed: a) When did the Kenyan Goverment started losing out on economic development? b) What is there to gain from this study? c) Do the variable of Governance capabilities in the right place in the conceptual framework? d) How did you measure the factor of adaptation in the study? e) Did the study recommended changes in Legislation or in development of Policies?
Responses/general recommendations: a) Little emphasis was made in Kenya on development of technical institutions after independence. In addition, the factor of governance impacted negatively on the rate of economic growth. b) The study will fill in a gap in this area and planners can develop a roadmap of economic growth based on the lessons learnt. c) It was agreed that some variables be revised such as inserting bilateral policies instead of foreign relations policy. In addition, use policies instead of legislation. d) Study revealed that the rapid economic development of South Korea and Singapore has been largely due to their deliberate policy on capacity building through investment in human capital and institutional building. e) It is therefore concluded that investment in education leads to economic growth and that the rate of economic growth is associated with accumulation of the human capital. • Need for both the National and County Governments to continually support HCD • Government to embrace the PPP model towards financing of education. • The Government to establish closer collaboration and partnership between educators and employers

in order to narrow the gap between the skill supply and demand. • TVET should be prioritized TVET sector to aid in job creation and economic development. • Universities, TVETs, research institutions and other government training institutes be supported to nurture culture of innovation & R&D. • Relevant policies be reviewed to support the informal sector for its ingenuity and originality.	
Name of session chair: Dr. Ann Sang	**Name of session Rapporteur:** Peter Mbichu

The Influence of Capabilities on Adoption of Internationalization Strategies in Chartered Universities in Kenya

Kirugumi Ann Thogori *[a], David M. Magu[a] and Theuri M Matthew[b]

[a]School of Business Management and Economics, Dedan Kimathi University of Technology, Private Bag-10143, Nyeri, Kenya

[b]Institute of Criminology, Forensics and Security Studies, Dedan Kimathi University of Technology, Private Bag-10143, Nyeri, Kenya

*Corresponding author, E-mail: annkirugumi@gmail.com

ABSTRACT

Internationalization has grown to be an important force in shaping the higher education sector. It is the intentional process of integrating an international, intercultural or global dimension into the purpose, functions and delivery of post-secondary education in order to enhance quality of education and research for all students and staff, and to make a meaningful contribution to society. Thus, the study seeks to examine the influence of capabilities on the adoption of internationalization strategies in chartered universities in Kenya. Specifically, the study seeks to establish the influence of managerial, governance, technological capabilities and financial capabilities on the adoption of internationalization strategies in universities in Kenya. In addition, the study seeks to establish the moderating effect of government legislation on the influence of capabilities on the adoption of internationalization strategies in universities in Kenya. The study is thus hinged on the Deming's Theory of Quality Management, Resource Based View theory, Dynamic Capability Theory and the

Technology Acceptance Model. The study will be conducted in private and public universities in Kenya and will employ the mixed methods research design by integrating both qualitative and quantitative research. A cross-sectional survey that will involve both analytical and descriptive methods to address the objectives of the study will be used. The respondents in each institution will comprise of the Registrar in charge of Academic Affairs, Registrar in charge of Research, the Director of International Programmes and Linkages/International Office and the Dean of Students. The study will conduct a census survey by covering all the units in the population. The study will use both primary and secondary data. Primarily sourced data will be collected by administering semi-structured questionnaires that will be 196 in total. In order to ascertain how valid and reliable the questionnaires are, a pilot study will be conducted. Quantitative design will involve descriptive and inferential statistics. Qualitative data collected from the open-ended part of the questionnaire will be analysed using content analysis and the results will be presented in prose form. Results will then be presented in tables, diagrams and charts. The study is beneficial to policy makers, academicians and scholars and managers of higher education institutions as it will contribute to knowledge by broadening the literature available. The study will also develop a clear and succinct road map guiding internationalization to other universities in Kenya.

Keywords: *Internationalization, Internationalization Strategies, capabilities, adoption, chartered universities.*

ENGINEERING TECHNOLOGIES AND INNOVATIONS FOR INDUSTRIALIZATION (ETI)

Effective Biosensors based on Whispering Gallery Modes

Antony Ndolo[1,2,*]

[1]*Machakos University, Dept. of Electrical and Electronics Engineering, 136-90200, Machakos/Kenya*

[2]*Karadeniz Teknik Üniversitesi, Dept. of Electronics & Communication Engineering, 61080, Trabzon/Türkiye*

**Corresponding author: antony.ndolo@mksu.ac.ke*

ABSTRACT

Whispering gallery modes are specific resonances of a wave field confined inside a given cavity with smooth edges based total internal reflection phenomenon. Practical electromagnetic whispering gallery modes posses many unique properties, for example, ultra-high Q-factors, low mode volumes, small sizes of resonators supporting them and its operation at optical and telecommunication frequencies of light, it is easy to fabricate and intergrate on-chip of devices using them, make them ideally suited for a vast array of applications, such as biosensors. In this poster we will look at some of the main factors regarding whispering gallery modes and resonators. These include its wave theory, resonator performance parameters, resonator geometries, coupling of whispering gallery modes to and from resonators and at some practical applications of whispering gallery modes with emphasis on biosensors.

Keywords : Resonators, Whispering gallery modes, Biosensors, Optical metrology/telemetry

Maintenance Data Analytics Architecture for Decision Support Considering Heterogeneous Data

Wakiru, J.M[1,2,*], Pintelon, L[1] , Muchiri, P.N[2] , Chemweno, P[3], and Elgin, C[1]

[1]*Centre for Industrial Management/Traffic and Infrastructure, Leuven, Belgium*

[2]*Dedan Kimathi University of Technology, School of Engineering, Kenya.*

[3]*University of Twente, Department of Production and Design, Endeschede, Netherlands.*

ABSTRACT

The advent of Industry 4.0, has promoted significant evolution of maintenance decision support systems (MDSS) and is expected to shape how maintenance strategies are developed and implemented, with an emphasis on decision support models and methods leveraging on integrated data analytics. Many industrial installations generate different historical and real-time data from operational and maintenance activities, envisaged to retain vital information that may enhance maintenance, ultimately improving the uptime of the assets. However, the data sets are not readily analyzable due to several characteristics among others; heterogeneity due to industries integrating electromechanical systems, different domain origins hence, lack standardized formats to enable amalgamation for comprehensive analysis and finally, embeds different structure and formats

(structured and unstructured). This study sets out to address the aforementioned challenges, by developing a model for aggregating, integrating and deriving optimal decision support from such data (knowledge discovery), which includes data analysis and evaluation (knowledge extraction) to generate an applicable and comprehensible output (knowledge application).

This study firstly, advances a methodology that develops an architecture for integrating, structuring, exploration and standardizing the heterogeneous (different) data sets, making the data analysis-ready for statistical analysis and ultimately, derive decision support solutions from the integrated analysis-ready data. The methodology is validated by an application scenario, by developing a data-driven decision support model that integrates different types of maintenance data like condition monitoring (e.g. vibration analysis), production and failure data, where information embedded in the data (through knowledge discovery models) is derived and used for decision support. This study aims to contribute to this growing area of research, provide input for maintenance optimization and serve as a reference for reliability and maintenance managers, not only deriving predictive MDSS, but also developing maintenance data management architecture that reduce time and effort spent on preprocessing.

Keywords: *Maintenance decision support, data exploration, data mining, data integration, big data analytics*

Rapporteurs Report

Presenter's name: ***Mr. James Wakiru***
Title/Topic of presentation: Maintenance data analytics architecture for decision support considering heterogeneous data
Institutional affiliation: Leuven, Belgium
Highlights/ key points from presentation: a) Challenges faced due to poor data management systems; Operational disconnect (disintegrated), Disjointed decision support, Conflicting departmental objectives, Significant non-maintenance stoppages, no standardized framework, no standardized methods of data collection, storage, or analysis further prevent successful usage for decision support b) On conclusion the presenter emphasized on the Importance of integration of heterogeneous data, Information sharing for operational and performance optimization, Maintenance, operational and production information. c) Improvements suggestions for case company included; Consistency in data collection (daily production +

condition monitoring-vibration), Document failure modes and mechanism real time, Seize external maintenance opportunities and Compatibility between different data➔ standardization d) He suggested the following Future areas of study; Simulation-based optimization based heterogeneous data, Reliability/Survival analysis (non-parametric and fully parametric), Consideration of Internal and external maintenance opportunities and other maintenance strategies: Lubricant Condition monitoring.
Questions /key points discussed: There were no questions or reactions from the audience
Responses/general recommendations: Integration of heterogeneous data, Information sharing for operational and performance optimization, Maintenance, operational and production information will generally assist in decision making process in an organization and also improve communication.

Name of session chair:	**Name of session rapporteur:**
Prof. Peter Muchiri	Monicah Njeri Kibui

Simulation of Feedforward and feedback controller for Cone Dielectric Elastomer Actuators

Minoru Sasaki[*], Titus Mulembo[b], Waweru Njeri[c], Joseph Muguro[c], Gakuji Nagai[a], Hirohisa Tamagawa, Takahiro Nitta[d] Keishi Naito[a] and Harrison Ngetha[c]

[a] Department of Mechanical Engineering, Faculty of Engineering, Gifu University, 1-1 Yanagido, Gifu, 501-1193, Japan.

[b] Department of Mechatronic Engineering, Faculty of Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri

[c] Department of Electrical & Electronic Engineering, Faculty of Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri

[d] Department of electrical & Electronic Engineering, Applied Physics Course, Gifu University, 1-1 Yanagido, Gifu, 501-1193, Japan.

*Corresponding authors. Email: sasaki@gifu-u.ac.jp, Tel: +81582932551, +81582932541

ABSTRACT

Conventional actuators based on metal and ceramics are limited in applications where service and welfare robots must work in collaboration with human workers. Dielectric Elastomer Actuators (DEAs) are a promising alternative to the conventional hard actuators because they can realize motions which more resemble those of human muscles. Innovating practical fabrication techniques and conducting and compliant materials can enable the realization of DEAs of different sizes and force requirements, with reproducible behaviour and fast responses. Large scale and modular production of low voltage driven practical DEAs by low-cost methods and materials is still a challenge. Furthermore, the dynamic characteristics and controllability of DEAs need to be well understood. In this paper, experimental data for the input voltage and the resulting displacement of the cone DEAs were subjected to system identification and a transfer function was determined. The identified model was validated against the voltage input and it well reproduced the output of the cone DEA. The DEAs was found to be stable in terms of the location of the pole. Four kinds of controllers were designed for the model DEA; linear quadratic regulator (LQR), the linear-quadratic integral (LQI), inverse controller and PID controller. The LQR, LQI, and inverse controllers managed to eliminate the overshoots. Overall, the inverse controller tracked well the desired trajectory. On the closed-loop simulation of the DEA, the LQR controller having a Luenberger observer well reproduced the results of its simulation and the overshoot was eliminated.

Key Words: *Dielectric Elastomer Actuators (DEAs), linear quadratic regulator (LQR), the linear-quadratic integral (LQI), inverse controller, PID controller*

Rapporteurs Report

Presenter's name: ***Prof. Minoru Sasaki***
Title/Topic of presentation: Simulation of Feedforward and feedback controller for Cone Dielectric Elastomer Actuators (DEA)
Institutional affiliation: GIFU
Highlights/ key points from presentation: **Objectives of the study** The study's main objective was; to identify and validate a Model of an existing DEA from input/output data and to design, simulate and compare linear controllers for the control of DEA **Merits of DEA**

Lightweight and soft like human muscle, Noiseless, can attain fast response speeds <1Hz and DEA has promising applications for soft robotics and medical field

Challenges associated with DEA

There are modelling issues in that DEA behaves linearly in some regions while deviating from this behaviour in other frequencies, Excitation is normally followed by overshoot and delayed settling and These factors justifies both studying DEA and the need for controller design

Conclusion

Model identification was carried out and validated. The performance of the resulting model was like the experimental model, Four kinds of controllers were designed and simulated i.e. LQR, LQI, Inverse Controller and PID, LQR could eliminate overshoot and reduce settling time but was limited in that it could track a trajectory and LQI and PID preformed very good but were limited in the high frequency regions of the trajectory.

Inverse controller was found to track the output best.

Questions /key points discussed:

a) What is the industrial application for this study?

b) Material used?

Responses/general recommendations:

a) Potential application by NASA – solar cells for space exploration though it still has some challenges such as high voltage and multiple thick actuators

b) PDMs polymer

Name of session chair:	**Name of session rapporteur:**
Prof. Peter Muchiri	Monicah Njeri Kibui

Robust Posture Tracking Control of Stable Coaxial Two-Wheeled AGV Using an Approximate Inverse System And LMI

Minoru Sasaki[a*], Hideaki Tochigi[a], Waweru Njeri[b],Hiroyuki Hayashi[a],

JosephMuguro[b], Kojiro Matsushita[a] and Harrison Ngetha[b]

[a] Department of Mechanical Engineering, Faculty of Engineering,

Gifu University, 1-1 Yanagido, Gifu, 501-1193, Japan

[b] Department of Electrical & Electronic Engineering, School of Engineering,

Dedan Kimathi University of Technology, P.O Box 657-10100, Nyeri, Kenya

*Corresponding Author Email: sasaki@gifu-u.ac.jp

ABSTRACT

This report describes the design of the posture controller for two-wheeled AGV. The objective is to improve the posture stability when running on ramps by balancing between vehicle body attitude angle and wheel angular velocity target value. We confirmed the effectiveness of the controller by simulation and experiment.

Key Words: *coaxial two-wheeled AGV, LMI, inverse system, robust control.*

Rapporteurs Report

Presenter's name: **Prof. *Minoru Sasaki***
Title/Topic of presentation: Robust posture tracking control of stable coaxial two-wheeled AGV using an approximate inverse system and LMI.
Institutional affiliation: Gifu University
a) The research established Model Based Development (MBD) environment platform for stable coaxial two-wheel AGV. b) It confirmed the effectiveness of the proposed posture controller (Hybrid model) through simulation (improving posture stability and eliminating the trade-off between velocity target value tracking). c) There was also confirmation of trade-off cancellation with the proposed controller in the implementation experiment. d) One of the problems of the conventional methods is the risk of falling due to power loss and the other concern was about deviations during static balancing on slope and Stability of dynamic characteristics such as running on Rough ground (slope) as well as the acceleration/deceleration, and stopping. e) Proposed approach emphasized on Physical resilience and Mechanism with one additional control degree of freedom
Questions /key points discussed: a) Application; can the model be used in industries or can only be used for sporting and human transportation? b) Can it be used in a rough grounds e.g. on a road with pot holes?

c) What does the government want to achieve with the research now that it is the sponsor?	
Responses/general recommendations: a) It was tested in a Museum for transporting human and for information transportation as it is installed with cameras. b) The model was basically designed for in-house. But can be improved to accommodate un- even surfaces in future. c) It is a government support for automation in industries.	
Name of session chair: Prof. Peter Muchiri	**Name of session rapporteur:** Monicah Njeri Kibui

Facility Redesign and Optimization of Printing Press Operations

Moses B. Kataka[a], Jean B. Byiringiro[b] and Peter N. Muchiri[a]

[a]Department of Mechanical Engineering, Dedan Kimathi University of Technology P.O Box 657-10100, Nyeri-Kenya, Email: mbkatsus@gmail.com

[b]Department of Mechatronic Engineering , Dedan Kimathi University of Technology P.O Box 657-10100, Nyeri-Kenya

ABSTRACT

Printing industry has benefitted from technological advances in the field of automation coupled with advances in storage and retrieval of raw materials, work in progress and finished work. These advances combined with a good printing factory layout maximizes production with minimum investment in new equipment. However, a good factory layout alone cannot achieve the intended objectives unless tightly coupled with production process monitoring and improvement, which entails monitoring of Overall Equipment Effectiveness (OEE) to pinpoint areas of production losses and identify areas of performance improvement. This research focused on carrying out a process and facility layout analysis with the aim of identifying gaps, bottlenecks and challenges in productivity that contributed to poor production throughput and to redesign the layout and optimize the production capacity.

Input variables considered were: number of departments, flow matrix, floor area for each machine, design speed, actual speed, losses and rate of failure. Output variables were: dual graph and layout proposition, availability, performance, Quality, OEE. The facility layout add-in that implements the Computerized Relative Allocation of Resources (CRAFT) was used for layout redesign. ARENA was used, for the design of experiment (DoE), simulation, analysis, and optimization. Pareto chart was developed using Minitab statistical software. The Pareto analysis established that 69.6% of the distance covered was taken up by movement between machine and store and 78.2 % of the print volume was taken up by three printing machines, (Web, Print master and Speed master). Failures, breakdowns and setup times were found to have a less significant effect on the performance and hence OEE of the factory. The quality of paper affected breakdowns for the web whereas run speed significantly influenced the overall performance and OEE. The optimal conditions obtained at about 80% of design speed of each machine that gave OEE of 79% for 3 critical machines and 68% for all five printing machines (only three machines were considered for optimization). Experimental output values obtained during validation were Web printer at 130,000 runs per day (without auto- splicing), Printer master (PM) and Speed master (SM) printers at 70,000 each at runs per day. These results were closer to the software results since some changes in storage location and automation were not yet put in place. The contribution of this research emphasizes the need for government institutions to run production facilities like businesses and to operate basing on industry best standards. In practice the contribution to knowledge is the application of engineering knowledge to solve industrial problems in a fast and cheap way by use of modern computer-based tools.

Keywords: *ARENA, CRAFT, Optimization, OEE, Printing, Simulation*

Rapporteurs Report

Presenter's name: ***Moses Busolo Kataka***
Title/Topic of presentation: Facility Redesign and Optimization of Printing Press Operations, A Case Study of a Printing Factory.
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: **Objectives of the study** The study purposed to: carry out a process analysis of the current printing process, perform a gap analysis of the factory and to redesign and optimize the production facility

Methodology

Determining OEE, Pareto analysis. The data was then used for layout redesign and process improvement ARENA for simulating the process improvements during optimization.

Conclusion

a) The research investigated the gaps existing in the printing factory that contributed to poor production throughput.
b) ARENA and CRAFT software were used for the simulation of production improvement.
c) Operating printing machines at 80% of their design speed optimizes production
d) A trial run for validation was done using the 3 critical machines. Improved output of 130,000 runs per day for the web were realized though below the simulated values. This was attributed to low quality paper used for the trials.
e) It's very important for production planning to put into consideration manufactures specifications.

Questions /key points discussed:

a) How did you account for the vibration from the machines? Did you have vibration sensors
b) Did you validate the values you were getting with empirical data?
c) How did the facility layout improve the performance?
d) Did you moderate the data so that you can be able to analyse it? You cannot compare a new machine and old machine.

Responses/general recommendations:

a) Some of the machines already had been installed vibration sensors by the manufacturer.
b) It was possible to fast track the Arena from the highest zooming down to lowest
c) Design was affecting the distances. Reducing the distances meant changing the layout and time taken. Leading to improved processing/output
d) The study eliminated the use of the old machines because failures increased on efforts to bring them to the near manufacturers' design.

Name of session chair:	**Name of session rapporteur:**
Prof. Peter Muchiri	Monicah Njeri Kibui

Plastic Shape the Future

Herzog, T. M., Dimitrov V. K.

Institute iMEP, Technical University of Applied Sciences Wildau, 15745 Wildau, Germany

Corresponding Author Email: michael.herzog@th-wildau.de

ABSTRACT

Plastic production is growing and is an important economic factor in many countries. Plastics used in industrial and consumer goods have a broad spectrum of optimized properties and in many cases are difficult to replace. Their low weight means they are irreplaceable when it comes to resource-efficient products. However, too much plastic waste ends up in the environment at the end of its life cycle. However, the raw material base only slowly opens up for biogenic sources. The aim of contemporary research is to develop new competencies, methods and products for the circular plastics industry. The basic idea is simple: to minimize the extraction of fossil resources, minimize end-of-life losses, and at the same time enable real recycling. But the change from today's largely linear global system to an efficient recycling economy requires systemic, technical and social innovations. The diverse range of plastics must be optimized in terms of recyclability without sacrificing functionality. Plastic products must be designed to enable repairability and long lifetimes. At the same time, the cultural practices and value that we place on plastics must be actively reinvented.

Smart collection systems for plastic waste must be in place on a global scale and they must become significantly more efficient and better accepted. Collection, separation and recycling technologies need to be enhanced to avoid downcycling. Where the release of microplastics is unavoidable, for example due to weathering and abrasion, or not feasible for reasons of resource efficiency, it must be ensured that they can rapidly degrade in the environment. Recycling losses should be replaced exclusively by renewable – not fossil – sources. This vision requires a »plastics revolution along the entire value chain«, which can only succeed with a multi-stakeholder approach. From the beginning scientists work together with marketing experts and business development managers.

Keywords: *Circular Economy, Recycling, Sustainability*

Rapporteurs Report

Presenter's name: Prof. Herzog, M. T.
Title/Topic of presentation: Microplastic in the environment – sources and recycling technologies. Plastic shape the future.

Institutional affiliation: Technical University of Applied Sciences (TUAS). Germany	
Highlights/key points from presentation: a) Different types of Microsplastics were listed and countries which pollute oceans most. Different types of plastics included ordered and unordered plastics. b) Various sources of Microplastics included: Automotives, textile processing etc c) A number of environment related articles have been done. Research activities included green economy, consumption, recycling limnic systems, sea and ocean (sink and sources). d) Limnic include; waste water treatment, rain relief systems, balancing, sewerage sludge and there are strategies to deal with plastic, either by ban, waste management or change of product properties (bloplastic).	
Questions /key points discussed: a) Among the three strategies to deal with plastic which is the best/more effective. b) How is plastic waste managed?	
Responses/general recommendations: a) It was noted that plastic itself is not harmful to human and can be managed. b) It was noted that limited waste collection and recycling rates increase the likelihood that potential countries adopt stringent plastic ban legislation. c) The industries can sort and process to have better products.	
Name of session chair: Dr. Harrison Ngetha	**Name of session rapporteur:** Naomi Nkirote

Elevator System Modelling Focusing on Security Using Digital Twin Approach for Real-Time Monitoring and Control

Michael M. Gichane[a], Jean B. Byiringiro[b] , Peterson M. Nyagab and Consolata W. Kiiru[b]

[a]Department of Mechatronic Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya

[b]Siemens Training Centre, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya

**corresponding author, E-mail: michael.gichane@dkut.ac.ke, Tel: +254-713-933-535*

ABSTRACT

Real time monitoring and control of non-direct observable systems such as transportation used in buildings and mining operations pose a unique challenge especially during emergency situations, specifically security breaches or natural disasters. During such periods, lack of adequate information concerning the actual state of the system hinders quick rescue of passengers involved. This is evident from the 489 fatalities experienced globally due to mining accidents since the year 2000. Kenya has also seen a rise in terrorism attacks since the year 2011 with 88 recorded death where terrorism occurred in business and shopping complexes. The ability to observe the real-time location and to remotely control the operations of such system can mitigate such risks, save lives, and improve system efficient. This paper presents the design and implementation of a digital twin model of a 3 floor elevator system. The system was modelled in Siemens NX and programmed via Total Integrated Automation (TIA) portal software. Programmable logic controller (PLC) S7 1200 was used as the hardware to interface Siemens NX and TIA portal. The digital model was programmed to match the normal operations of a typical elevator system used in a commercial or residential building setting. This was done using the OPC (open platform communications) protocol. The resulting digital twin was tested and performed in a manner similar to Mixed Reality (MR) systems, where the virtual system, duplicated actual operations of the physical counterpart through the use of sensor data as opposed to cameras or virtual head-sets are in the cause of Virtual and Augmented Reality systems. The system was taken through performance tests where the time delay between virtual and physical systems operation was observed and found to be less than one second. This result can be improved through the use of operation computers with higher processing power and implementing faster communication channels between the physical system and digital twin.

Keywords: *digital twin, elevator system, real-time monitoring and control, Siemens NX, open platform communication (OPC)*

Rapporteurs Report

Presenter's name: Mr. Michael M. Gichane
Title/Topic of presentation: Elevator System Modelling focusing on Security using Digital Twin approach for Real-Time Monitoring and Control.
Institutional affiliation: Dedan Kimathi University of Technology.

Highlights/key points from presentation: The following was discussed. a) Unique challenges: Natural disasters/security b) Digital Twin Concept c) Research Objectives d) Elevator system digital twin implementation e) Results and System Operation and Conclusion
Questions /key points discussed: a) For the OPC server did you compare with another one to ensure that you are using the correct one? b) Implementation Steps: Creation of virtual model, Fabrication of model elevator system, Signal connection between physical and virtual model via OPC server, Web access interface and System testing.
Responses/general recommendations: The research intends to implement elevator digital twin model using OPC-UA protocol instead of a combination of TIA portal and KEP server, A real time monitoring and control has been achieved, Web based monitoring and control has been achieved and for future work: -Analysis of the mechanism and failure modes – for virtual commissioning application and -Integrate artificial intelligence and data mining.

Name of session chair: Dr. Harrison Ngetha	**Name of session rapporteur:** Naomi Nkirote

Thermal Energy Balance of a Black CTC Tea Factory

Kimari M Patrick[a], J B Byiringiro[a], Evan Murimi[b] and Magdalene Muigai[a]

[a]School of Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri, Kenya, E-mail:

[b]College of Engineering and Technology, Jomo Kenyatta University of Technology, P.O. Box 62000-00200, Nairobi

*Corresponding Author Email: patrick.kimari@dkut.ac.ke

ABSTRACT

Tea processing is an energy intensive process. Approximately 85% of energy input into a kilogram of made tea is thermal energy. Electric energy comes second at about 14% while manpower accounts for 1%. A typical tea factory thermal energy system comprises of steam generator (boilers),

steam transmission, distribution and recovery system (pipeline and fittings), and heat exchangers (steam radiators). The primary energy source for steam generation in tea factories in Kenya is biomass in the form of firewood. Briquettes and furnace oil are also significant source of primary energy sources for steam generation. Steam is mainly used to provide process heat in tea withering and drying processes. About 2,400,000 trees are cut down per year to meet the factories thermal energy needs. Considering there are 125 tea processing factories in Kenya, approximately 4.1 million trees are felled every year to meet their thermal energy demand. Firewood consumption by the tea factories is a significant contributor to deforestation and environmental degradation in tea growing regions of Kenya. Wood plantations plays an important role in sequestration/storage of carbon dioxide by removing it from the atmosphere through photosynthesis process. When trees are felled, the stored carbon in them and in the soil is released into the atmosphere. The increased carbon in the atmosphere contributes to global warming which in turn leads to climate change. It is therefore important to have a fundamental understanding of thermal energy flow of a tea factory. This understanding will reveal opportunities that exist for tea factories to improve their thermal energy efficiency and by extension reduce their consumption of firewood and other primary energy sources such as briquettes and furnace oil. The approach involved defining a tea factory thermal energy system. The factory thermal energy consumption is determined and quantified using energy flow analysis (EFA) method. Environmental inputs such as temperature and humidity associated with tea processing are also evaluated. The tea factory thermal energy system considered is defined with regard to system properties such as mass flow rate, pressure and temperature. Data analysis includes determination of energy inputs and outputs at each stage of energy flow. The empirical data for this study is from a Kenyan tea factory. Finally, thermal energy balances for a tea factory is established using mathematical modelling.

Keywords: *Thermal, Energy, Steam, Firewood, Tea factory, Carbon dioxide*

Rapporteurs Report

Presenter's name: Mr. Patrick Kimari
Title/Topic of presentation: Thermal Energy Balance of a Black CTC Tea Factory
Institutional affiliation: Dedan Kimathi University of Technology.
Highlights/key points from presentation: a) The use of solar energy to process tea which is an energy intensity method.

b) Wood fuel is the major source of energy for a significant proportion of the tea factories.
Questions /key points discussed: a) To explain what the study was the study recommending? b) What are the reasons for the differences in energy intensity of thermal energy? c) How does the cost of wood treatment influence the end price of the product?
Responses/general recommendations: a) The study was recommending the use of thermal/solar energy to replace wood as a source of energy in processing of tea in the plantations. b) The differences in energy intensity between the tea factories was due to the treatment of the wood. was noted that the Model used was rough because its only few reactions are captured. c) The presentation should include a column to show the cost of firewood vis a vis the cost of solar energy. d) The tea factories should adapt better performing boilers and wood with lower moisture content.

Name of session chair:	**Name of session rapporteur:**
Prof. Henry Nyongesa	Hadija Dahal

A Numerical study of Volatile Matter Generation from Wood Combustion in a Fixed Bed under O_2/CO_2 Environment

J. K. Tanui[a], P. N. Kioni[a], T. Mirre[b], M. Nowitzki[b] and N. W. Karuri[a]

[a]Department of Mechanical Engineering, Dedan Kimathi University of Technology Private Bag 10143, Nyeri, Kenya.

[b]Fachbereich Ingenieur- und Naturwissenschaften, Technische Hochschule Wildau, Hochschulring 1, 15745 Wildau, Germany.

ABSTRACT

In this study, the influence of bed porosity on volatile matter generation was investigated in a fixed bed under O_2/CO_2 environment. Wood particles of various sizes were arranged in a fixed bed to form different bed porosities that ranged between 0.51 and 0.74. Numerical simulations of combustion of wood in fixed bed were carried out using a commercial software CD-Adapco (STAR

CCM+ version 11.04). Wood burning in a fixed bed was simulated using Lagrange-Euler method, where gas-phase was calculated using Computational Fluid Dynamics (CFD) while solid-phase was tracked in Lagrange phase (Discrete Element Method - DEM). Species generation and depletion in the fuel bed were analyzed along the axial length of the fixed bed for different bed porosity. It was established that the amount of CH_4, H_2, CO and tar at any height of the bed decrease as porosity is increased. Furthermore, for all conditions tested, unburnt volatiles exited the top of the fuel bed. Therefore, under such conditions, a well-designed combustion chamber with a secondary air supply is required in order to complete the oxidation of unburnt hydrocarbon.

***Keywords**:* CFD-DEM; Wood combustion; Volatiles; Fixed bed; Oxy-fuel

Rapporteurs Report

Presenter's name: Mr. Josephat K. Tanui
Title/Topic of presentation: A Numerical Study of Volatile Matter Generation from Wood Combustion in a fixed Bed under O_2/CO_2 Environment.
Institutional affiliation: Dedan Kimathi University of Technology.
Highlights/key points from presentation: a) Biomass fuel is the major source of energy for a significant proportion of the world population. b) The need for efficiency and reduction of NO_x emissions has led to development of clean combustion technologies such as **oxy-fuel combustion**. c) The fuel particles were grouped into three categories according to their sizes: Sawdust 1 (SD1), Sawdust 2 (SD2) and wood chips (WC).
Questions /key points discussed: a) To explain the equation used. If it's either detailed/rough model. b) Why use a certain type of wood as a source of energy?
Responses/general recommendations: a) 0.0It was noted that the Model used was rough because its only few reactions are captured. b) The type of wood used matures faster and commonly found in Kenya. c) The number of combustible volatiles – tar, CO, CH_4 and H_2 – along axial length of the fixed bed is inversely proportional to the bed porosity. d) As porosity is increased, the fixed bed combustion of wood operates on fuel-lean conditions. e) For all bed porosity studied, a substantial amount of tar, CO, CH_4 and H_2 exited the top of the fuel bed as

unburnt hydrocarbon.	
Name of session chair: Dr. Harrison Ngetha	**Name of session rapporteur:** Naomi Nkirote

A Study on the Performance of LoRa: Connectivity and Range Evaluation

Nahshon Mokua[a] and Ciira Maina

School of Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri, Kenya.

[a]nahshonmokua@gmail.com

ABSTRACT

Low-power wide-area networks (LPWANs) are gaining the attention of industry due to their potential applications in automotive and intelligent transportation systems, various metering and smart home systems among others. Recently, there are several competing technologies in the market including Sigfox, LoRa and Weightless.

The main features of LPWANs technologies are low consumption of power, low transceiver chip cost and broad coverage. Out of these goals, the two former ones are much easier to attain. Having a base station makes it efficient to move all network complexities to its side. This way, the nodes are made simple and sufficiently affordable for mass production. Reaching the ten years lifetime can be made possible by limiting the number of messages sent each day by every node, even if the range of applications becomes naturally limited.

Despite the traditional wireless sensor networks (WSNs) and LPWANs having much in common, mainly in terms of networks requirements and devices, their approaches have significant critical differences. Firstly, while the traditional WSN employs mesh or ad-hoc topology, the current LPWAN technologies require setting up the base stations (concentrator/gateway) to serve the end-devices. The latter communicates to the base stations only by forming around them a star network. Depending on the technology, the area of coverage of a base station may cover several kilometres, which is never a predetermined parameter.

Consequently, this study focuses on the third problem, connectivity and range evaluation. LoRa technology shall be used, and a set of real-life experiments will be conducted using commercially available hardware. A battery-powered mobile node located on the ground (attached on a 3m tall

stand) reporting their data to a base station, will be the main execution of measurements. The main parameter of consideration will be the Received Signal Strength (RSSI). Then, there will also be a presentation of a channel attenuation model derived from the measurement data obtained. In an area similar to the chosen station of study, the model can be used for estimation of the connectivity and range of operation (path loss) in 868 MHz ISM band.

Keywords: *LPWANs, WSNs, LoRa, connectivity, range, RSSI, path loss model*

Rapporteurs Report

Presenter's name: Mr. Nahashon Mokua
Title/Topic of presentation: The Performance of LoRa in a Rural Environment: Connectivity and Range Evaluation.
Institutional affiliation: Dedan Kimathi University of Technology.
Highlights/key points from presentation: a) There has been an increasing interest in the industry towards the low power wide area networks (LPWANs). Competing technologies: Sigfox, **Long-Range** (LoRa) and Weightless b) Traditional wireless sensor networks (WSNs) and LPWANs have much in common but their approaches have significant critical differences. Having a base station makes it efficient for network configurations, for LPWANs. c) The main features of LPWAN Technologies are low consumption of power, low transceiver chip cost, and broad coverage. d) Depending on the technology, the area of coverage of a base station may cover several kilometres. This is never a predetermined parameter.
Questions /key points discussed: a) To consider other options during the work in progress and improve on quality of the research. b) To work and improve on the objectives i.e. reasons for doing the work, coming up with it, environmental factors- if it affects the results etc.
Responses/general recommendations: a) The reported results of the measurements show that on the ground distance up to 1 km, the amount of successfully attained RSSI within a 1km range ensures favourable connectivity. b) The results obtained will be used to develop a model that can be used by the Dedan Kimathi University of Technology fraternity to design LoRa-based application systems, and similar places as well.

c) In the future, we plan to carry out more experiments in regards to distance and non-line of sight (NLoS) and obtain much data for a comprehensive channel attenuation model. d) We will also do a comparison of various LPWAN Technologies.	
Name of session chair: Dr. Harrison Ngetha	**Name of session rapporteur:** Naomi Nkirote

Use of Doppler Radar Interfaced with ATMEGA16 for Accident Detection and Collision Avoidance in Dedan Kimathi University, Nyeri, Kenya

Kamathi Joseph[a]

[a]School of Engineering, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

E-mail: kamathijoseph10@gmail.com

ABSTRACT

The research paper will outline how Doppler radar sensors can be implemented in Dedan Kimathi University to detect accidents and hence avoid collisions. Information regarding speeds, movements of people and distance from other objects shall be availed in the research. The sensors are placed on the neck, back, arms, and chest of the users for the provision of information regarding objects relative to the Doppler radar sensors. If movement is noted within 8m of the user, the vibration motors send information regarding the object relative to the user of the Doppler Radar. In case the object is moving at a high velocity towards the user, all the motors are activated at a high intensity and a corresponding emergency notification is sent to the user. The primary objective of the research is to reduce the amount of collisions experienced and hence avoid the possibility of accidents occurring. The research hence aims at improving the safety of the users in cases as when a person is walking in a dark alley with minimal to no lighting, they can be notified of moving objects. When walking along a road, the users are notified of bicycles or objects that may be approaching from behind [1]. The exploratory research methodology shall be used for data collection and analysis. It is recommended that the development and implementation of the Doppler Radar Sensors interfaced with the ATMEGA16 shall facilitate safety improvement through accident avoidance.

Keywords: Doppler Radar, ATMEGA16, Accident Detection, Collision Avoidance.

Evaluation of The Surface Finish of Titanium Alloy, Ti-6Al-4V During Surface Grinding under Different Cooling Techniques Using Vegetable oil-based and Water based Cutting Fluids

K.N. Ronoh[1*], F.M. Mwema[1, 2], N.W. Karuri[1], and H.T. Ngetha[1]

[1]*Department of Mechanical Engineering, Dedan Kimathi University of Technology, Nyeri, Kenya*

[2]*Department of Mechanical Engineering Science, University of Johannesburg, Johannesburg, South Africa*

*Corresponding email: kipkurui.ronoh@dkut.ac.ke

ABSTRACT

Ti-6Al-4V alloy is used widely in biomedical industries and its surface finish is critical in medical components. In this research, the surface finish of medical grade Ti-6Al-4V alloy was evaluated to understand the effects of cutting fluids, cooling techniques, and grinding depth after surface grinding with alumina wheel. Three cutting fluids were applied to the grinding zone using two cooling techniques: minimum quantity lubrication and wet cooling techniques. They were sunflower oil, sunflower oil-based cutting fluid, and conventional cutting oil. The grinding was undertaken at three different grinding depths of 0.005, 0.010, and 0.015 mm to determine the surface roughness of the ground surfaces. The design of the experiment was done using Taguchi L_9 orthogonal array using Minitab 17 software. The surface roughness of the ground surfaces was determined using a surface profiler. The results showed that the lowest surface roughness was obtained in minimum quantity lubrication systems. In terms of cutting fluid type, sunflower oil-based cutting fluid generated the lowest surface roughness. The analysis of the signal-to-noise ratio showed that grinding depth was the most influential input factor on the surface roughness of ground Ti-6Al-4V. The analysis of variance show that the three input parameters individually have no significance statistically on the surface roughness. But through interactions with other input parameters, they influence surface roughness. From the study, it is possible to obtain the good surface finish of Ti-6Al-4V under favourable grinding conditions.

Keywords: *Ti-6Al-4V; Cutting fluids; MQL; Taguchi; Signal-to-noise; ANOVA; surface roughness*

Rapporteurs Report

Presenter's name: Mr. Kipkurui Nickson Ronoh
Title/Topic of presentation: Evaluation of the Surface Roughness of Ti-6Al-4V for Surface Grinding

under Different Cooling Methods Using Conventional and Vegetable Oil-based Cutting Fluids
Institutional affiliation: Dedan Kimathi University of Technology.
Highlights/key points from presentation: a) Biomaterials are used for making medical implants b) They should have good mechanical and chemical properties c) Cp Ti and its alloys are widely used in many biomedical applications. d) Properties of the Ti-6Al-4V: ➢ Superior biocompatibility ➢ Excellent bio-corrosion resistance ➢ Relatively low Young's modulus ➢ High tensile strength and fatigue strength
Questions /key points discussed: a) What are the effects of higher roughness? Why use certain specifications for the implants which are not very thin or thick. To add more explanation. b) When using the ANOVA tables to reserve it for inferential statistics. c) Can the used coolants be used for another process?
Responses/general recommendations: a) Coolants get degraded after a single process due to environmental effects. b) The SOBCFs have acceptable pH with good stability c) The optimal parametric setting for minimizing the Ra: SOBCFs, MQL_2 and 0.005 mm d) The most influential input parameter on Ra: cutting fluid types. e) This research contributes to the green and simple grinding technology. Find applications in titanium machining industries. f) Future work for development and application of environmentally friendly cutting fluids g) Further research can be undertaken to develop numerical models and standards showing the correlation between grinding parameters and surface integrity of the ground Ti-6Al-4V
Name of session chair: Dr. Harrison Ngetha | **Name of session rapporteur:** Naomi Nkirote

HEALTH SCIENCES AND COMMUNITY DEVELOPMENT (HSC)

Medical Device Integration with Electronic Health Records: A Case Study of University of Nairobi Health Services

Benard Mutisya Nzyoka[a], **David Muchangi Mugo**[b], **Stephen Mburu Ng'ang'a**[a]

[a]School of Computing and Informatics, University of Nairobi, P.o Box 30197-00100, Nairobi, Kenya

[b]School of Pure and Applied Sciences, University of Embu, P.o Box 6-060100, Embu, Kenya, E-mail: david.mugo@embuni.ac.ke

ABSTRACT

Medical devices provide invaluable information to clinicians on a patient's illness, making them a crucial component in the provision of safe, effective and efficient patient care. Traditionally, in most medical devices data has been secluded in silos, with every device having incompatible data formats, unique physical connections and dedicated communication protocols. Largely most of these devices are not integrated with hospital electronic medical record systems with output information stored in the device or presented and kept in the form of paper reports. In this study, we describe a demonstration in which available Electronic Medical Records system (EMR) was successfully integrated with a wireless Blood Pressure Monitor (BPM). This was implemented by adopting the use of RESTful Application Programming Interface (API) technologies and commonly established standards designed for medical devices interoperability. Before deploying the prototype, we conducted pilot tests at the University of Nairobi, nursing station to get feedback on the time spent using the conventional blood pressure data capture methods and the newly integrated application. Clinical data from the device was exchanged adhering to the HL7/XML standard communication protocol. There was a measurement differential in time for conventional system used and the integrated medical device solution. The duration the blood pressure cuff was on the patient was an average of 123 seconds before the integration and 83 seconds after integration. Additionally, there was an observable substantial reduction in the average time that the medical assistant spent at the intake section from 370 seconds before the medical device was integrated and an average of 240 seconds after the integration. The findings indicate a positive outcome was availed on the time taken for the blood pressure readings, time spent by the patient at the nursing station, doctor's time to search the patients' blood pressure readings as well as the data accuracy fed in the EMR system.

Keywords: *EMR, BPM, Interoperability, RESTful, HL7/XML*

Performance of a Fused Machine Learning Model for Smart Health Care in MANETS.

Kirori Mindo[a], **Simon Karume**[b] **and Moses Thiga**[a]

[a]School of Science, Engineering and Technology, P.O. Private Bag 20157 Kabarak, Kenya,
kirori@kabarak.ac.ke

[b]School of Science and Applied Technology, P.O. Box 1100 – 20300. Nyahururu, Kenya,
skarume@laikipia.ac.ke

ABSTRACT

Mobile Ad-Hoc Networks (MANETs) are prevalent in provision of smart healthcare. The smart devices in MANETS aid in monitoring health like high blood pressure, high cholesterol levels and various heart conditions and cardiac misnomers like syncope, third murmurs and atrial fibrillation. These irregularities that cause mysterious fainting, unexplained stroke, heart palpitations and atrial fibrillation need to be monitored remotely, accurately and effortlessly. However, the growth and provision of MANET based smart healthcare monitoring has faced various security obstacles, primarily security. The characteristic mobility of these health monitoring devices as well as their inherently dynamic network topology, causes the connectivity structure to change frequently and unpredictably. The available security approaches and techniques however fail to capture and take account the physiognomies of MANETs; mainly low processing power, miniature memory and inadequate processor. In the intervening time, usage of MANETs in the provision of smart healthcare is expanding and the inherent risks snowballing. Attacks aimed at MANETs are increasing to an alarming extent. This study employed a fusion of machine learning techniques through both simulation and a running prototype to achieve a more resilient intrusion detection system. The study was implemented and evaluated on a MANET environment on both Linux NS 2 and further implemented on a network of Smart wearable devices and Raspberry Pi. Traffic generated within the network was imported for supervised learning, and thereafter tested for purposes of evaluating the ability to identify similar anomalous activity. The results showed that it is possible to improve intrusion detection for such networks by fusing machine learning algorithms and identifying anomalous activity within a MANET ubiquitously.

Keywords: *MANET, Smart Healthcare, Intrusion Detection Systems, Machine Learning, Fused.*

Rapporteurs Report

Presenter's name: Mr. Kirori Mindo	
Title/Topic of presentation: Performance of a Fused Machine Learning Model for Smart Health Care in MANETS.	
Institutional affiliation: Kabarak University	
Highlights/key points from presentation: Medical devices have a higher rate of cyber attacks than other smart devices. The study is to help reduce stigma, cost and increase speed and use of the devices.	
Questions /key points discussed: a) Is cloud computing viable?	
Responses/general recommendations: a) The medical devices are to be used to detect and medical changes in the body that will enable one seek medical attention. b) Cloud computing is viable but medical data is very expensive	
Name of session chair: Ms. Esther Opisa	**Name of session rapporteur:** Hadija Dahal

AGRICULTURAL SCIENCIES AND TECHNOLOGIES FOR SUSTAINABLE FOOD AND NUTRITION SECURITY (IAS)

Challenges and potential opportunities for mitigation of food fraud in Kenya

Eddy Owaga[a]

[a]Institute of Food Bioresources Technology, Dedan Kimathi University of Technology, Private Bag, Nyeri-10143, Kenya, E-mail: eddy.owaga@dkut.ac.ke

ABSTRACT

Food fraud refers to deliberate and intentional substitution, addition, tampering or misrepresentation of food, food ingredients or food packaging, labelling, product information or false or misleading statements made about a product for economic gain that could impact consumer health. Most consumers in Kenya are vulnerable to risks of food fraud due to lack of knowledge of their existence and how to use simple techniques of detection. The most commonly adulterated

foods include milk, sugar, honey, cereal grains and flour, cooking oil tea leaves, salt, ice cream, coconut oil spices, meat and meat products, wine, jam, pulses, cloves, tomato sauce, ghee, coffee, and vegetables. Kenya's Anti-counterfeit Agency (ACA) estimates that at least 20% products sold in major Kenya towns are counterfeit thus counterfeits are a major impediment to growth of the manufacturing sector which is key to attainment of targets in employment creation, and food security. The Standards and Regulatory committee of Kenya Association of Manufacturers (KAM) estimates counterfeit and substandard products cost East Africa over $500 million in tax revenue annually. Other impacts of food fraud include loss of brand value which encompasses quality, efficiency, health and safety concerns in the food supply value chain. In this paper we discuss the challenges and potential opportunities for mitigation of fraud in Kenya as a strategy towards attainment of key components of the 'Big 4 agenda' on promotion of manufacturing and food and nutrition security in Kenya.

Keywords: *food fraud, adulteration, counterfeit, Big 4 agenda*

Rapporteurs Report

Presenter's name: Dr. Eddy Owaga
Title/Topic of presentation: Challenges and Potential Opportunities for Mitigation of Food Fraud in Kenya, DeKUT
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: a) Food fraud is deliberate and intentional substitution, tampering or Mis representation of food, food ingredient, packaging or labelling b) Commonly adulterated foods: liquid milk, sugar, cereals, cooking oil, tea leaves, wine, ice cream, salt and beef c) To mitigate food fraud is done by blocking opportunities and motivations to fraud and having proper control measures through awareness campaigns, capacity building and efficient detection systems d) Food fraud is a main concern to public health and being addressed through the 'Big Four Agenda'
Questions /key points discussed: a) Is food fraud as a result of lack of integrity, control measures or lack of sensitization? b) What are we doing as professionals to protect Kenyans?

c) What should we do about the afro toxins reported in maize flour and peanuts? d) Is there a gadget that can be used to detect food fraud?	
Responses/general recommendations: a) Integrity and ethics need to be embedded at an early age to curb the menace b) Use of block chain as an innovative detection technique that enables tracing of food chains as a way of curbing food fraud c) Food needs to be protected all the way from production to consumption d) Sale of peanuts and ground nuts is not regulated and hence the government needs to create awareness on food safety to informal groups handling food	
Name of session chair: Dr. Daniel Njoroge	**Name of session rapporteur:** Catherine Nyawira

Relative Contribution of Farm Inputs and Activities to the Productivity of Coffee

Irungu Maina

Institute of Food Science and Bio resource Technology, Dedan Kimathi University, Private Bag 10143, Nyeri, Kenya.

Email: Irungu_maina@yahoo.com, Telephone; 0722 765 804

ABSTRACT

A cooperative society is an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through jointly owned and democratically run enterprises. Cooperatives are formed by members when the market place fails to provide the needed goods and services of acceptable quality at affordable prices. Many of cooperatives in Africa have faced decline in performance since 1980s as a result of the structural Adjustment programmes championed by the World Bank and the International Monetary Fund. In Kenya the programmes saw the government withdraw its influence and controls of the cooperatives. In Kenya the coffee cooperatives suffered a double tragedy; besides the ill-timed liberalization, the International Quota System that ensured stable coffee prices collapsed leading to very low prices. This led to decline in coffee production from 138000 tonnes in 1987 to 38000 tonnes in 2009. The entrepreneurs and innovators need to come up with a way of helping bring

the cooperatives sector to its past glory. To help recover from the decline the cooperative management need an environment that is conducive - management of cooperatives is one area that needs improvement. Studies carried out in the cooperatives show a lot of management incompetence and general lack of suitability. This article highlights how weighted voting could be used to improve the management commitment to the cooperatives. It has two objectives; to assess the importance of management in cooperative societies and to evaluate the applicability of weighted voting to improve the quality of management of coffee cooperative societies. The study was conducted in Muthithi Coffee Farmers' cooperative society in Murang'a County, Kenya. It was concluded that weighted voting would improve the management commitment in the coffee cooperatives.

Keywords*: Weighted voting, cooperative, dictator, dummy, Banzhaf index*

Rapporteurs Report

Presenter's name: Dr. Irungu Maina
Title/Topic of presentation: Relative Contribution of Farm Inputs and activities to the Productivity of Coffee
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: a) In Kenya, the acreage of coffee has reduced with 32% from 1988 to 2018 and production has reduced by 68% for the same period b) The study is carried out in Murang'a county at Kenyatta Farmers c) Inputs to the coffee farms include farm yard manure, NPK, CAN, Urea, Pestcides, pruning and weeding d) The study established that for optimal coffee production, of most to least important input is pest management, CAN fertilizer, NPK fertilizer, pruning and finally farm yard manure
Questions /key points discussed: a) What was the reason for reduced coffee production? b) That the government through Ministry of Agriculture and coffee cooperatives should sensitize farmers on coffee management
Responses/general recommendations: a) That most farmers would spend money on one input in one season e.g CAN while neglecting the others

hoping to input them at a different season. This was not beneficial to the plants since each of the input was required at any given time b) That the farmers needed sensitization on importance of each input required for optimal coffee production	
Name of session chair: Dr. Daniel Njoroge	**Name of session rapporteur:** Catherine Nyawira

Differential Response of Nerica Yield to Irrigation regimes in Mwea irrigation scheme, Kenya

Mathew Etabo [a], Thomas Akuja[a]

[a]School of Science, Turkana University College, P.O Box 69, Lodwar, 30500, Kenya, E-mail: mathewetabo@gmail.com

ABSTRACT

Mwea is water-stressed due to the drying effect of global warming, thereby limiting rice production. An experiment was therefore carried out in two cropping seasons between 2016 and 2017 to determine the yielding of two Nerica cultivars under the effect four irrigation regimes. The design adopted was RCBD on split plot arrangement replicated thrice, where variety was the main plot and the irrigation regime was the sub-plot. Results depicted significant effect ($P \leq 0.05$) on 1000-grain weight and unproductive tillers in season 1 and 2 respectively. The 1000-grains were weightier at every three days' regime (55.92 g per hill), with Nerica 4 and less weighty at weekly regime (41.0 g per hill). Similar findings were reported by Ishmael *et al.* [1] who saw a correlation of 1000-grain weight in rice and soil-moisture conditions. Increased unproductive tillers was produced in Nerica 11 (2 tillers per plant), therefore showing an inverse correlation with grain yield, signifying superiority of Nerica 4 (1.0 tiller per plant) over Nerica 11 [2]; [3].

It was further observed that the irrigation regimes did not significantly affect shoot biomass, root biomass, panicles, filled grains, productive tillers, net plot grain weight, and grain yield. However varietal differences revealed that Nerica 11 produced higher shoot biomass, root biomass, panicles, filled grains and productive tillers, whereas Nerica 4 recorded higher net plot grain weight and grain yield. Further, weekly irrigation regime positively influenced grain yield as was reported by Grigg *et al.*, [4] that, there was no reduction in yield under water-saving moisture stressed soil conditions. This is a confirmation of the research reports by IRRI [2]; Africa Rice Center [3]; Atera *et al.*, [5], that

water-deficit conditions in this research yielded optimally beyond the expected. It was therefore inferable that, Nerica 4 optimized yield on weekly irrigation regime (8.42 tons/ha), and so recommended to farmers in Mwea irrigation scheme for adoption for optimum yields.

Keywords: *Mwea, irrigation regime, rice, Nerica, variety, yield*

Rapporteurs Report

Presenter's name: Mr. Matthew Etabo	
Title/Topic of presentation: Differential Response of Nerica Yield to Irrigation regimes in Mwea irrigation scheme, Kenya	
Institutional affiliation: Turkana University College	
Highlights/ key points from presentation: a) Mwea is in the lowlands where rice is produced mainly by irrigation where Nerica varieties are well adapted to Mwea agro ecology, though production is faced with erratic rainfall, scarcity of water and poor irrigation-water management b) The objective of the study was therefore to determine the effects of irrigation regimens on yield component and grain yield of two Nerica rice cultivars. c) The study established that weekly irrigation regimen on yield component and grain yield of Nerica 4 proved best for water use efficiency by the crop at the same time water that would have gone to waste would be saved for more crop production in the expanded land in Mwea d) It is therefore recommended to farmers in Mwea to adopt a weekly irrigation regimen with Nerica 4 for water use efficiency and saving of water from wastage	
Questions /key points discussed: a) Was the rice yield affected by increased irrigation?	
Responses/general recommendations: a) The rice yield reduced with increased irrigation as a result of water logging which affected production negatively	
Name of session chair: Dr. Daniel Njoroge	**Name of session rapporteur:** Catherine Nyawira

Effect of Harvesting Stages and Nitrogen Fertilizer on Seed Quality and Yield of Jute Mallow in Kenya

Rutto K. D.[1*], Omami N. E.[1], Ochuodho O. J.[1] and Ngode L.[1]

[1]Department of Seed, Crop and Horticultural Sciences, School of Agriculture and Biotechnology, University of Eldoret, P.O. Box 1125 Eldoret, Kenya

**Correspondence author: ruttodkl@gmail.com*

ABSTRACT

Production of high-quality seeds in African Leafy vegetables has not been practiced due to varying reasons including incorrect harvesting stages and poor agronomic practices like incorrect fertilizer rates. Jute mallow pods do not ripen simultaneously and appropriate time of seed harvest ensures maximum seed quality attributes of purity, germination and vigour. Farmers in Kenya plant seed from Jute mallow whose quality potential is not ascertained. The study sought to investigate effect of harvesting stages and nitrogen fertilizer on seed quality and yield of Jute mallow morphotypes. Four Jute mallow morphotypes (GEMS, GLMT, BEMS, BLMT) were planted at two sites of University of Eldoret and Kenya Agriculture and Livestock Research Organization, Kitale using Randomly Complete Block Design with three replicates and three nitrogen fertilizer levels (0, 60, and 120kg/ha). Five plants were randomly tagged per plot and seed harvested at three maturity stages of green, tan and black and seed quality test of purity, germination and vigour done and analyzed as per International Seed Testing Association, (2004) and means separation done by DMRT at $p \leq 0.05$. Results showed harvesting stage maximizing on seed quality attributes of analytical purity was highest at tan stage (99.9%) on 120kg/ha N fertilizer by BLMT Morphotype and lowest at black stage (99.4%) on none fertilized GEMS and BEMS morphotypes. Germination was highest (92.9%) at tan stage from morphotypes GEMS and BEMS on 120kg/ha N fertilizer and lowest was at black stage (59.5%) by BEMS Morphotype on 0kg/ha N fertilizer. Highest seed vigour (93%) was at tan stage by GEMS and BEMS on 120kg/ha N fertilizer and lowest was black stage 59% by BEMS Morphotype on 0kg/ha N fertilizer. The lowest E.C. (0.04 $\mu Scm^{-1}g^{-1}$) was by Tan stage seed by GEMS and BEMS morphotypes on 120kg/ha N fertilizer and highest E.C being at black stage of 2.7 $\mu Scm^{-1}g^{-1}$ by GLMT Morphotype on 0kg/ha fertilizer. It is concluded that best agronomic practices of Jute mallow seed be harvested at tan stage coupled with N fertilizer use for high quality seed and yield.

***Key words**: Harvesting, Jute mallow, seed quality*

Rapporteurs Report

Presenter's name: Mr. Ruto. K. D
Title/Topic of presentation: Effect of harvesting stages and nitrogen fertilizer on seed quality and yield of jute mallow in Kenya
Institutional affiliation: University of Eldoret
Highlights/ key points from presentation: a) Jute mallow is a source of food through its leaves, tubers, fruits and seeds and its known to have medicinal and culinary properties b) Farmers have been using cultural practices in growing this crop yet effective crop management using correct fertilizers and using good quality seeds would influence growth and yield c) Currently there is no good quality seeds of the vegetable from breeders to the farmers thus farmers are forced to re-cycle planting seeds from their own collections d) The study established that tan seed harvesting stage gives highest seed quality attributes of purity, germination e) It also established that increasing nitrogen fertilizer also increased the plant vigor significantly
Questions /key points discussed: a) Did other factors other than nitrogen fertilizer and harvesting staff affect the seed quality?
Responses/general recommendations: a) Further studies were recommended to establish if other factors like altitude and soil affects jute mallow seed quality

Name of session chair:	**Name of session rapporteur:**
Dr. Daniel Njoroge	Catherine Nyawira

Evaluation of Suitability Human Solid Waste from Green Toilet System as Fertilizers for Agricultural Use.

Ouma Shellemiah Otieno[a], Mabel Imbuga[a], Esther Magiri[b], Hamadi Boga[c],

[a]Department of Biochemistry, Jomo Kenyatta University of Agriculture and Technology, P.O Box 62000-00200, Nairobi, Kenya.

[b]Dedan Kimathi University of Technology

[c]Ministry of Agriculture

Corresponding Author Email: hemshell3@gmail.com

ABSTRACT

Unabating exponential rise in world human population, Kenya not spared, has posed a major challenge in waste generation and its subsequent accumulation. The problem is far reaching in poor and developing nations in South East Asia and Africa that have no proper systems for recycling and safe use of the high volume of human waste filling open landfills. This has led poor farmers to use raw sewage to irrigate their farms, exposing both the human and animal population to harmful pathogens in the raw waste water. The use of human fertilizer for agricultural production has been safely and successfully applied in organic farms in developed nations like England and Japan in a bid to reduce dependence on synthetic fertilizers that are harmful to the environment. Green Toilet System was developed and used to destine solid and liquid human wastes to different collection points with negligible or zero contact. This study took advantage of the high volume of human waste being generated and use it to prospect for fertilizer safe for agricultural production. The study therefore identified, isolated and characterized microorganism and parasites colonizing the human solid waste, followed by determining the presence of heavy metals in the human solid waste. This study used biochemical techniques for isolation, biochemical and molecular characterization of the microbial community in the waste. Formal ether sedimentation technique was used to identify parasites. Mineral nutrients in the compost and raw waste was analyzed using atomic absorption spectrophotometer (AAS) and atomization for the case of mercury for comparison with the inorganic fertilizers. The physiochemical characteristics were determined using glass electrode pH meter and conductivity meter for the pH and conductivity respectively. The compost temperature, colour, structure, and odour were determined at the decomposition site. Heavy metal and minerals data was analyzed using SPSS. Molecular characterization results were analyzed using bioinformatics tool for multiple sequence alignment tool and CHROMAS pro to draw the phylogenetic tree. The findings of this work are expected to guide research in determining the safety of human waste compost as fertilizer for agricultural and the efficacy of using biotechnology to enhance the decomposition of human waste into fertilizer.

Keywords: *population explosion, human solid waste, diseases, Green Toilet System, microbial progression, molecular characterization, heavy metals, micro and macro nutrients.*

Effects of Integrated Application of Rhizobium and Phosphatic Fertilizer on Growth, Nodulation and Yields of Soybean in Meru South Kenya

Mulambula[a] Sioma, Gathungu[a], K. Geoffry., Ndukhu[a] O. Haggai. and Ogolla[b], O Fredrick

[a]*Department of Plant Sciences, Chuka University, Box 109, Chuka, Kenya*

[b]*Department of Biological Sciences, Chuka University, Box 109, Chuka, Kenya*

Email: siomulambula@yahoo.com

ABSTRACT

The cultivation of soybean is increasing in Kenya due to its widespread use in the food and feed industry. Production is, however, constrained by low soil nitrogen (N) and phosphorus (P) levels. A field trial was conducted at Chuka University Research farm to determine effects of integrated application of rhizobium and phosphatic fertilizer on growth, nodulation and yields of soybean. Treatments included three rates of Triple superphosphate fertilizer (0, 20 and 30 kg^{-} ha^{-1}), and three rates of rhizobia (0, 100 and 200 g ha^{-1}) using two soybean varieties (SB19 and SB24). Each treatment combination was replicated three times in a randomized complete block design in a split plot arrangement and the experiment was repeated once. Data collected included the plant height, number of branches, number and weight of nodules, number of pods, fresh and dry shoot weight and grain yield. The data was subjected to analysis of variance using SAS statistical programme and significantly different means were separated using Tukey's studentized range test. It was observed that rhizobia and phosphatic fertilizer had significant effect ($p=0.05$) on the plant height, number of nodules, fresh and dry weight of nodules and mean number of branches and pods, fresh and dry weight of shoots and weight of seed $plant^{1}$. The overall means for plant heights, nodule number, fresh and dry nodule weights, number of branches and pods, fresh and dry weight of shoots and weight of seeds $plant^{1}$ were 29.35 cm and 26.79 cm, 38.71 and 35.14, 0.51 and 0.38, 5.5 g and 12.54g, 49.13 and 59.18, 77.65 and 90.91, 56.99 and 69.33g, 168.9g and 148.13g for SB19 and SB24 respectively. The SB24 genotype remained significantly superior to SB19, with same treatment levels employed. From the results, it can be concluded that integrated application of rhizobia and phosphatic fertilizer (TSP) has significant effect on growth, nodulation and yield of soybean.

Keywords: Rhizobia, Triple Super Phosphate, Nodulation, Growth, Yields

Effect of Different Stabilizers and Emulsifiers on Functional, Rheological and Sensory Properties of Macadamia Nut Spread

Ayub Mungai Kamau[1]; Monica Mburu[1]

[1]Institute of Food Bioresources Technology, Dedan Kimathi University of Technology. Nyeri, Kenya

ABSTRACT

Macadamia nuts are known for their nutritional composition that makes the edible kernel beneficial to human health. In additional to nutritional value, it has high economic potential leads to the country foreign exchange through exportation, job creation for both the farmers, intermediary agents and the processors. However, the macadamia nuts production is seasonal with short storage in raw form due to microbial growth and chemical composition instability. This may be mainly contributed by amount of free water and unsaturated fatty acids in the kernel. The nuts therefore need to be dried immediately after harvesting to lower the water activity and prevent rancidity through vacuum packaging of clean kernel. Various products may be made such as macadamia nut spread to ensure continuous supply to consumers. Processed nut spread is an alternative to spread made from animal products and is known for its good flavor and smooth spreadability. Attempts by various processing companies to produce macadamia nut spread has been failing due to chemically and physically instability during storage, thus, need for use of favourable and permitted emulsifiers and stabilizers. Change in rheological behavior of macadamia nut spread during storage, leads to oil solid phase separation that is not acceptable to consumers. Incorporation of chia seed mucilage and palm stearin will be evaluated to improve the functional, rheological and sensory properties. Different proportions of the selected stabilizers are used to formulate macadamia nut spread while considering process modification and optimization. The products are evaluated for chemical composition, sensory, functional and rheological properties.

Rapporteurs Report

Presenter's name: Ayub Mungai Kamau
Title/Topic of presentation: Effect of Chia Mucilage on Stability, Rheological and Sensory Properties of Macadamia Nut Butter
Institutional affiliation:

Dedan Kimathi University of Technology

Highlights/key points from presentation:

a) Macadamia is a plant cultivated for its edible kernel and its products.

b) Originated from Australia which were then distributed to other continents for its commercial purposes.

c) Benefits of Macadamia nut presented.

d) The presenter presented on how macadamia nuts are processed at the factory.

e) He presented on the factors that affect the storage of Macadamia which include:-Changes during storage.

f) Chia is used as a stabilizer because; is an edible, in addition to its nutritional and health benefits chia seed contains mucilage which can be used as a natural stabilizer preventing physical separation.

g) **Chia mucilage as a stabilizer:-**Chia mucilage is made up of fiber, protein and fat.
-Chia seed, chia mucilage and chia powder have high WHC (5.25, 5, 5.5 g water/ g sample, respectively).
-On the other hand, chia mucilage has high OHC (5.85 g oil/ g sample) than both whole seeds and powder (3.5, 2.5 g oil/ g sample)
-These properties could be connected to the relatively high fiber and protein content of chia mucilage (12.47 and 10.68% respectively)
-The fibrous structure in the microstructure of chia seeds and its mucilage is expected to increase WHC

h) **Why use chia as a stabilizer:-**Encourage chia farming creating employment.
-additional nutritional value, increase fiber, protein and oil content into the butter, thus, more health benefits.
-Increase export, thus, earn the country foreign exchange.

Questions /key points discussed:

There was no question to the presenter.

Responses/general recommendations:

The presenter was hailed for a good and informative presentation.

Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Technological Quality Characterization of Bakery Products supplemented with Raw Chia Seeds (*Salvia hispanica* L.)

Monica Mburu*, Viktoria Zettel & Bernd Hitzmann****

*Institute of Food Bioresources Technology. Dedan Kimathi University of Technology. Private Bag. Dedan Kimathi. Nyeri. Kenya

**Process Analytics and Cereal Science, Institute of Food Science and Biotechnology, University of Hohenheim, Garbenstr. 23, Stuttgart 70599, Germany

ABSTRACT

The viability of production of good quality and acceptable baked products with chia seeds substitution for wheat flour was evaluated. Chia seeds were added to standard bread, muffins and cookies recipes at 5 % and 10 % substitution levels for flour on a weight for weight basis for comparison with standard products. The bakery products were assessed for their baking loss, specific volume, moisture content, textural properties and porosity. The addition of chia seeds at 5 % and 10 % chia seeds showed similar quality to standard bread in terms of baking loss, cohesiveness, porosity and moisture after 24 hours of storage, with the three formulations remaining stable for the 48 hours shelf life. A lower moisture content and higher hardness and gumminess were observed with chia seeds fortified breads, which was more evident with 10 % supplementation. The textural quality of the three bread and muffins formulations showed significant increase in hardness, gumminess and chewiness, while cohesiveness and resilience significantly decreased during storage. However, springiness remained stable for the standard and chia enriched breads and muffins. Baking loss and specific volumes in muffin and cookies were not significantly affected by chia supplementation. The porosity percentage of the three formulations for bread and muffins were not significantly different. However, hardness of cookies increased significantly for all the cookies formulations during storage. Change in fracturability during storage of the three cookie formulations were not significantly different with stabilization at the end of the storage. The study confirmed that bakery products formulation with chia seeds affect the technological qualities of the final products caused by natural processes during product staling which a complex process. Wheat flour supplementation with chia seeds for bread making can lead to acceptable quality products that can help to extend the baked products choices in the African market.

Key words: *Chia seeds, wheat flour, texture, bread, muffins, cookies*

Rapporteurs Report

Presenter's name: Dr. Monica Mburu

Title/Topic of presentation: Technological Quality Characterization of Bakery Products supplemented with raw Chia Seeds (*Salvia hispanica* L.).

Institutional affiliation: Dedan Kimathi University of Technology

Highlights/key points from presentation:

a) The researcher introduced by describing the Bakery Products –that include **bread**, rolls, **cookies**, pies, pastries, and **muffins**, are usually prepared from flour or meal derived from some form of grain and cooked by dry heat process, especially in some kind of oven.

b) Fortification of bakery products is one of the components of nutrition strategies for *correction of micro-nutrient deficiencies*

c) Products which are consumed by the majority in a given population - *Bread, muffins and cookies.*

d) Why fortification with chia seeds? - Chia has various health benefits especially in maintaining healthy serum lipid level, contributed by phenolic acid, omega-3- and omega-6-oil present in the chia seed, Protein-rich with good balance of essential amino acids and rich in total of dietary fibre

e) Objectives of the Study**-** Determine the effect of chia seeds supplementation in bakery products: bread, muffins and cookies; to evaluate the stability of these products on their technological quality.

f) Materials and Method- Breads, muffins and cookies were prepared using standard recipes, 5% chia seeds and 10% chia seeds.

g) Results were presented and discussed.

h) Chia seeds led to more compact texture, which imparts to the increment of the bread hardness during storage

i) Conclusion;

-Whole chia seeds (up to 10%) can be used as a raw material to improve the overall quality of bakery products by replacing the amount of flour on weight to weight basis.

-These findings may help in the development of enhanced functional chia supplemented bakery products for commercialization in Africa, where chia farming is at its infancy.

Questions /key points discussed:

There was no question or reaction from the audience.

Responses/general recommendations:

The presentation was very educative and informative to the audience.

Name of session chair:	**Name of session rapporteur:**

Dr. Eddy Owaga	Mr. Simon Mwaura

Mould Characterization and Mycotoxin Quantification of Chia Seeds (*Salvia hispanica L.*) Grown in Kenya

Veronicah Njeri[1], Monica Mburu[1], & Kipkorir Koskei[1]

[1]Institute of Food Bioresources Technology, Dedan Kimathi University of Technology. Nyeri, Kenya

Correspondence: Veronicah Njeri, Dedan Kimathi University of Technology, P.O Box Private bag, Nyeri, Kenya. Tel: 254-718-458-186. E-mail: njeri.veroh87@gmail.com

ABSTRACT

Chia seeds are functional food that have been considered highly nutritious. They have high levels of polyunsaturated fatty acid content therefore counteract lifestyle disorder such as cardiovascular diseases. This study sought to determine the level of mould contamination in chia seeds; enumeration and characterization of the types of molds and quantification of mycotoxin level, for chia seeds grown and sold in Kenya. A complete randomized block design with triplicates was used in the study. Samples were collected at random from farmers and distributors in Nyeri, Nakuru, Busia and Trans Nzoia counties. Moulds species were isolated from PDA and MEA Medias and morphological characteristics was determined under X 40 magnification power. Mould counts were found to be between 1.33 X 10^3cfu/ml to 2.67 X 10^3cfu/ml. Mould characterization done by microscopic and macroscopic technique showed evidence of *Rhizopus spp*, *Trichoderma* spp and *Fusarium* spp. Amongst the three genera found, *Rhizopus spp* was the predominantly occurring mould. The percentage moisture content of chia seeds samples ranged from 6.49±1.26 and 9.16±0.43. Significant variations on moisture content ($p< 0.05$) were observed among chia samples from different farmers. Aflatoxin was not detected in all chia samples. It can therefore be concluded that the chia samples were not contaminated with aflatoxin although different species of mold were present. Farmers need to be trained on proper postharvest handling methods of chia seeds, as well as proper storage and an objective method of analyzing the moisture content of the chia seeds need to be developed.

Keywords: *chia seeds, mould characterization, mycotoxins*

Rapporteurs Report

Presenter's name: Veronica Njeri
Title/Topic of presentation: Mould Characterization and Mycotoxin Quantification of Chia Seeds (*SalviahispanicaL.*) Grown in Kenya, DeKUT
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/key points from presentation: a) The researcher presented on the benefits of Chia. b) In Kenya, Chia growing has gained momentum because of its nutrition benefits thus it is grown in most counties such as Busia, Nakuru, Trans Nzoia, Machakos and Nyeri counties. c) Chia crop matures within four months where they are harvested, dried and packaged for various uses as food components. d) During harvesting, contamination may occur due to poor post-harvest handling techniques enhanced by high moisture content or relative humidity during storage. e) At this stage, mould contamination may occur leading to production of mycotoxins therefore need for monitoring and control. f) The justification to her study is that she wanted to find out the reason as to why moulds and mycotoxins form in chia grown in the above areas and do the comparison. g) She explained the materials and the methods she applied in her research. h) She explained the results of the research in form of a discussion. Problem Statement: - • Chia seeds are at the initial stages of growth trial in Kenya yet there is limited information on possible mycotoxins contamination. • Chia seeds can be contaminated with moulds if good handling and storage conditions are not observed when growing at the farm, between harvesting and drying, and in storage. Mould infestation is catalysed by high temperature and relative humidity where good handling practices is not observed. • This research project seeks to determine the level of mould growth and mycotoxin contamination in chia seeds produced in Kenya, contributed by different types of post-harvest handling techniques. Main objective: - • To characterize the occurrence of moulds and mycotoxin contamination levels in chia seeds grown in

Kenya

Conclusion: -

- There is no standardized method for determining moisture content or dryness of the seed by different farmers.
- Chia seeds from different farmers had different moisture content levels.

Sampled chia seeds from different farmers did not have aflatoxin contamination but mould contamination was present.

Questions /key points discussed:

a) What is the main cause of aflatoxin in chia?

The research found out that the main cause of aflatoxin in chia was how the farmers handled chia after harvesting.The source of aflatoxin is from the soil itself.

b) Why did you only concentrate on aflatoxin on while there could be other micro-toxins affecting chia?

The researcher agrees that there are many other toxins that affect chia but she chose to focus on aflatoxin only because she believed that the main risk for chia was aflatoxin.

c) Why did you categorize one source of chia for research as –Naivas Chia?

It is because I bought it from Naivas.

Responses/general recommendations:

a) The presenter was advised to know the source of Chia from Naivas because it must have originated for a certain farm somewhere in Kenya.

b) The researcher should also consider studying other toxins apart from aflatoxins alone.

c) The presentation was educative.

Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Effect of Soaking and Thermal Soaking Coffee (*Coffea Arabica* L.) Cherries Negatively affects the Biochemical Composition and Cup Quality of Coffee Brew

Pauline Wairimu Ikumi* [a], Daniel Mwangi Njoroge [b], Richard Kipkorir Koskei [c], Cecilia Wagikondi Kathurima [d]

[a] Institute of Food and Bioresources, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

*Corresponding Author E-mail: pauline.wairimu61@gmail.com

ABSTRACT

During the peak harvest season, most coffee processing factories may lack sufficient capacity to process coffee cherries. Such processing delays lead to undesirable fermentation affecting the quality of the coffee. Soaking of coffee cherries may be adopted in an attempt to preserve the cherries but information on the effects of this practice on chemical composition and sensory quality of coffee is limited. This study aimed at determining the biochemical composition and cup quality of soaked coffee cherries, for a period of seven and ten days with daily change of soaking water and without change of soaking water with the control being freshly processed coffee cherries. The levels of caffeine, chlorogenic acids, sugars and trigonelline were determined by HPLC methods. The cup quality was determined by the use of 3 trained coffee cuppers. The results of this study showed that soaking of coffee cherries did not have significant variations in the level of trigonelline, chlorogenic acids, caffeine and sucrose. The levels of trigonelline ranged between 0.88-1.15 %, chlorogenic acid 6.71-8.13%, caffeine 1.04-1.13% and finally sucrose 5.67-6.60%. The results of sensory analysis revealed significant variations ($p \leq 0.05$) in terms of raw bean color, flavor and class of the coffee brew. In terms of quality, coffee samples obtained from freshly processed coffee cherries scored the highest at 4.78 (fair to good quality). Discrimination function analysis placed the freshly processed coffee cherries further distinctively from other treatments thus yielding the best quality.

Keywords: *Chemical composition, coffee cherries, cup quality, soaking.*

Rapporteurs Report

Presenter's name: Pauline Ikumi
Title/Topic of presentation: Soaking coffee (*Coffeaarabica*L.) cherries negatively affects biochemical and cup quality of coffee
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/key points from presentation: a) Introduction:-Coffee belongs to the genus ***Coffea*** *and* ***Rubiaceae***family, Two species mainly

cultivated:*Coffeaarabica*L (70%) and *Coffeacanephora*L (30%)

b) Varieties : SL 28, SL 34, K7,Ruiru 11, Batian.

c) Processing of coffee is in the form of; Sun dried (Natural), Wet processed (Washed) and Semi-processed/ pulped natural.

d) Soaking of coffee cherries is practiced to slow on set of fermentation when there are processing delays.

Why this study?--

- Lack of adequate capacity to process within reasonable time (peak season)-pulping capacity, fermentation facilities & drying beds.
- Above is compounded by frequent mechanical breakdowns.
- Processing delays
- Onset of undesirable fermentation hence quality is affected
- Poor quality coffee = Poor prices at the market
- Soaking practiced with limited information

- To determine the effect of soaking coffee cherries on green coffee chemical composition and the cup quality.
- Materials and methods were explained.
- Processing after soaking entails: - pulping, Natural fermentation, washing and grading, sun drying, hulling and storage at (-18C).
- Data was analysed by Statistical software- SPSS V20 and Variability determined using ANOVA.
- Results and discussions were presented.

Conclusions: -

- Soaking showed significant effects on the sensory attributes of the raw coffee beans e.g. color and flavor and class of the coffee brew.
- Soaked samples were more discriminated from the fresh and the fresh samples gave better quality than the soaked samples.

Questions /key points discussed:

a) From your results, it showed that phosphorous was found in coffee. Is it desirable in coffee?

No it is not desirable.

Responses/general recommendations:	
The presentation was good.	
Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Perception and Adoption Level of Urban Horticulture Technologies, Nairobi County, Kenya

Oyaro, E.N.[1] and Mukundi, J.B.[2]

Jomo Kenyatta University of Agriculture and Technology, Department of Horticulture,

P. O. Box 62000 -00200, Nairobi, Kenya

ABSTRACT

Urban and peri urban areas face numerous challenges such as food insecurity, inadequate basic services, air pollution, insufficient water supply, waste-disposal problems and high population. An investigation was done to evaluate the main socioeconomic factors significantly determine the farmers' decision for adoption of horticultural practices and how knowledge transfer influence urban horticulture. A sample of 580 respondents was used, 138 in Kasarani, 195 in Mathare and 247 in Kibera. Data was collected by use of Questionnaires and observations. Social and economic characteristics such as accesses to space, access to information, business management and governance data was collected. Frequencies and percentages were used to analyze the data using Statistical Package for Social Sciences (SPSS). The chi –square was used to differentiate different groups and conclusions. The most common vegetables among urban respondents in order of prevalence were kales, Spinach, Onions and Amaranth while pepper was the least common. About 70% of surveyed farmers mentioned the source of food as the main reason for adoption of urban horticultural technologies. With respect to space identified for farming, over 20% of the farmers mentioned along the road strips. More than 65% of the respondents were female. About six different modes of Technology transfer were identified and the most common was authority. The study also shows that there is positive relationship between age in peri-urban respondents and technology transfer while there was a negative relationship between education level and technology transfer at 95% level of confidence, statistical test.

Keywords: *urban and peri urban farmer, horticultural technologies, food insecurity*

Rapporteurs Report

Presenter's name: Oyaro. E.N

Title/Topic of presentation: Perception And Adoption Level Of Urban Horticulture Technologies, Nairobi County, Kenya

Institutional affiliation: Dedan Kimathi University of Technology

Highlights/key points from presentation:

a) **Introduction**:-

- Food shortage has become the main challenge in urban areas due to increased population.
- Urban and peri-urban horticulture plays an important role in terms of economic, social, and food security for the urban residents.
- A wide range of crops are cultivated which takes short time to mature
- Urban horticulture also creates safe spaces for recreation, improves the physical space of the neighborhood, beautifies the neighborhoods.
- Materials and Methods:-
- This study was conducted in Nairobi County, this is because urban horticulture has been ongoing many years.
- The target population for this study was the visible /active urban and peri-urban farmers in Nairobi County.
- The research study was carried out in the following areas: Mathare and Kibera(Urban areas) and Kasarani (Peri-urban area).
- Data was collected by the use of a structured questionnaires which were administered through face-to-face interviews, complimented with field observations and informal discussions.

b) Results and discussions;

- The number female farmers were more than male in urban and peri-urban areas at 69%, 70% and 75% for Mathare, kibera and Kasarani respectively (Figure 1)
- The majority of the female farmers in Kasarani (26%) did farming on the vacant spaces, while those from Mathare (21%) and Kibera (24%) did farming along the sewage line/river banks.
- The preference of vacant space was more prevalent in peri-urban areas than the urban areas.
- Majority of the urban farmers have had previous experience with mixed farming in rural areas.

• Indigenous vegetables have been replaced by kale, swiss chard, and cabbage.
Questions /key points discussed: a) You have indicated that some of the places that horticulture is along the sewer line. What is your perception about it knowing that the practice isn't good? I know it is not health but the people in Nairobi slums find one of the vacant places along the sewage line and they do farming there due to lack of options. b) Why the study area? The places are urban areas and are a good sample representation for Nairobi county. a) What were the methods used in the farming of horticulture The researcher was not interested on the methods of farming.
Responses/general recommendations: The presentation was very educative and well presented.

Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Integrated Effect of Rhizobium Inoculation and Phosphorus Application on Tissue Content, Symbiotic and Phosphorus Use Efficiency in Soybean Production

Mulambula Sioma*[a], Gathungu[a] K. Geoffry, Ndukhu [a], Haggai, Ogolla O. Fredrick [b]

[a]Department of Plant Sciences Chuka University, Kenya

[b]Department of Biological Sciences, Chuka University, Kenya

**Corresponding author Email:siomulambula@yahoo.com*

ABSTRACT

Soybean *(Glycine max)* is an important legume crop that is cultivated all over the world as livestock feed, food for human consumption, soil fertility improvement and industrial products such as candles and paints. However, Nitrogen (N) and phosphorus (P) nutrient have been

attributed to the decline in soybean yields. Furthermore, scanty information is documented on P-efficient soybean genotypes, which are a sustainable P management strategy for enhancing symbiotic efficiency (SEF) and phosphorus use efficiency (PUE). As a solution, field experiment was conducted at Chuka University farm to evaluate the integration effect of rhizobium inoculation (R) and P on tissue nutrient content, SEF and PUE in soybean production in Meru South Sub County. Two cultivations (Trial I and II) were done in 2018. Treatments included; three rates of R (0, 100 and 200 g ha^{-1}), three rates of P (0, 20 and 30 kg ha^{-1}), either applied alone or integrated and soybean genotypes (SB19 and SB24). Both Trials were laid out in a randomized complete block design in split-split plot arrangement with each treatment replicated thrice. Genotypes were assigned main plot, R subplots and P in sub-subplots. Data collected was subjected to analysis of variance using the Scientific Analysis System SAS and significantly different means separated using Tukey test at ($p \leq 0.05$). The results showed significant difference in N and P tissue content, SEF and PUE for SB19 and SB24 genotypes in both Trials at ($p \leq 0.05$). The highest N tissue content of between 1.73% and 9.10% was observed when integration of R and P were applied at the rate of 200 g and 30 kg for SB19 and SB24 in both Trials. While R and P at the rate of 200 g and 30 kg per ha showed the highest P content of between 849.6 ppm and 955.0 ppm in both Trials. The highest SEF recorded was 207% and 261%, and 201% and 227% in Trials I and II, respectively. The PUE was highest when R and P was applied at the rate of 200 g and 30 kg per ha for SB19 and SB24 soybean in both Trials. Integration of R and P at the rate of 200 g and 30 kg ha^{-1} and adoption of either SB19 or SB24 showed a potential in enhancing soybean cultivation.

Keywords: *Genotypes, phosphorus use efficiency, symbiotic, Tissue content.*

Effect of Soaking and Thermal Treatment on Common Beans Pectic Polysaccharides in relation to the Hard-To-Cook Defect

Daniel Mwangi Njoroge

Institute of Food Bioresources Technology, Dedan Kimathi University of Technology, Private Bag-10143, Dedan Kimathi, Nyeri, Kenya, E-mail: daniel.njoroge@dkut.ac.ke

ABSTRACT

The importance of common beans (*Phaseolus vulgaris*) in addressing food insecurity and protein energy malnutrition cannot be underestimated. However, their utilization is hampered by

development of the hard-to-cook (HTC) that is accelerated by elevated storage conditions of temperature (>25°C) and relative humidity (>65%). Although the HTC defect has been studied, detailed molecular insight is incomplete. Therefore, the aim of this research was to gain detailed mechanistic insights into changes occurring during storage and soaking, whether or not followed by a thermal treatment, on common bean pectic polysaccharides in relation to the development and manifestation of the HTC defect. Both fresh or easy-to-cook (ETC) and stored (HTC) bean samples were either soaked or soaked and thermally treated in demineralized water, solutions of Na_2CO_3 and $CaCl_2$ salts followed by extraction of cell wall materials. The Pectic polysaccharide properties determined included solubility in different solvents, galacturonic acid content, neutral sugars content, degree of methylesterification (DM) and molar mass (MM) distribution. Specifically, the polysaccharides were fractionated into water extractable pectin, chelator extractable pectin, Na_2CO_3 extractable pectin and a hemicellulose fraction. Spectrophotometric methods were used for determination of galacturonic acid content and the DM, while high-performance anion exchange chromatography and high performance size exclusion chromatography coupled with multi angle light scattering and refractive index detection were used for determination of neutral sugars content and MM distribution respectively. The DM of pectin from ETC and HTC beans was similar but low (<50%). Fresh Canadian Wonder beans in general had a good cooking quality; however, soaking and thermal treatment in a Na_2CO_3 solution further improved the quality while treatment in a $CaCl_2$ solution decreased the quality. The poor cooking quality exhibited by stored beans was improved by soaking and thermal treatment in a Na_2CO_3 solution, while treatment in a $CaCl_2$ solution hindered softening. With regard to molecular changes, soaking followed by thermal treatment in different brine solutions revealed that thermally induced solubilization of pectic polysaccharides is a key factor in influencing the cooking quality of beans. Treatment in a Na_2CO_3 solution increased the amount of loosely bound pectin (WEP) while on the other hand, it decreased the amounts of strongly bound pectins (CEP and NEP) for both fresh (ETC) and stored (HTC) beans. Therefore, it can be inferred that development of the hard-to-cook defect in Canadian wonder beans during storage and its manifestation during soaking and subsequent thermal treatment is largely reflected by the pectic polysaccharide properties in line with the pectin hypothesis. The results points at the release of Ca^{++} leading to pectin cross-linking and the increase or decrease of β-elimination depolymerization. However, the relatively high amounts of neutral sugars and strongly bound NEP in HTC seeds do not allow to rule out the possible existence of non-Ca^{++} based pectin cross-linking.

Keywords: *Beans; Hard-to-cook; Storage; Soaking; Thermal treatment; Pectic polysaccharides.*

Rapporteurs Report

Presenter's name: Dr. Daniel Njoroge
Title/Topic of presentation: Effect of soaking and thermal treatment on common beans pectic polysaccharides in relation to the hard-to-cook defect.
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/key points from presentation: a) Importance of Legumes were presented; - Good source of nutrients; Relatively cheap source of protein; Important for addresing food insecurity and protein-energy malnutrition. b) Drawbacks: - Flatulence factors; Antinutritional factors; Hard-to-cook phenomenon. c) Hard-to-cook phenomenon explained: - Failure of seeds to sufficiently imbibe water during soaking; Seeds do not become tender/soften to desired texture after a reasonable cooking time. d) Hard-to-cook defect economic importance: - Hard to cook seeds → Prolonged cooking time → High energy consumption → Increased cost of processing. e) Proposed mechanisms: - Involvement of pectin; Lignification; Involvement of protein and starch; Lipid oxidation. f) Aim of the study: - To gain mechanistic insight into changes occurring during storage and soaking, whether or not followed by thermal treatment, on common bean pectic polysaccharides in relation to the development and manifestation of the HTC defect. g) Specific objective: - To determine the effect of (pre)treatments (i) soaking and (ii) soaking and thermal treatment on common bean pectic polysaccharides. h) Conclusion: - • DM of ETC beans was similar to that of HTC beans; however, on average it was rather low. • Seemingly, no demethoxylation took place during storage indicating the absence of PME activity. • Pectin properties reveals involvement of Ca++ cross-links and either hindrance or enhancement of β-eliminative depolymerisation. • Possible existence of covalent cross-linking.
Questions /key points discussed: a) What is the effect of panadol and magadi soda to the softening of beans?

There are chemicals in panadol and magadi soda that softens the beans. Though the use of panadol is dangerous. b) Does sodium biocarbonate have any health issues? Yes, it is not advisable to use. c) Why do some beans don't cook even when the are subjected to high temperatures? They are defective beans. d) Why do some people have stomach aches after taking beans? Beans has some elements that are not good for health. That is why we are advised not to take the water that remains in cooking pots after the beans are fully cooked.
Responses/general recommendations: The presentation was very educative.

Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Assessment of Rhizobia Strains Isolates of Soils around Lake Victoria Basin for their Effectiveness in Nodulation and Symbiotic Efficiency on Soybeans and Bambara Groundnuts

Onyango O. Benson [a] and Ogolla O. Fredrick [b]

[a] Jaramogi Odinga University of Science and Technology, Department of Biological Sciences, P.O. Box 210-40601, Bondo, Phone: 0724694613, Email: benboyih@gmail.com

[b] Chuka University, Department of Biological Sciences, P.O. Box 109-60400, Chuka, Kenya, P.O. Box 210-40601, Bondo, Phone: 0724694613, Email: ogolla.fredy@gmail.com

ABSTRACT

The symbiotic Biological nitrogen fixation (SBNF) is a sustainable and low-cost alternative to expensive and inaccessible inorganic fertilizers. However, SBNF is underutilized in soils of Lake Victoria basin due to insufficient information on local rhizobial strains diversity and their N-fixation efficiency. This study was carried out to assess the effectiveness of rhizobium strains isolates of Kisumu, Port Victoria, Kendu bay and Karungu soils within Lake Victoria basin in

nodulation and symbiotic efficiency on soybeans and bambara groundnuts. Two bambara seeds of groundnut landraces; Kakamega Cream (KAKC) and Busia Brown (BUSB) used in this study were collected from farmers in Kakamega and Busia counties respectively. Screen house experiment was performed at Kenya Forestry Research (KEFRI) in plastic pots with four seeds of each cultivar which was later thinned to two plants. Randomized Complete Block Design (RCBD) was used. Experiments data were subjected to analysis of variance (ANOVA) using Genstat 16th Edition and significant means separated using Least Significant Difference at [LSD5%] and Dancun Multiple Range Test (DMRT). Result indicated highly significant ($p<0.05$) effect of isolate inoculation on number of nodules per plant. Soybean Variety SB19 formed effective nodules with rhizobia in the genera Bradyrhizobium, Rhizobium and Agrobacterium. On the other hand, 'Safari' was quite selective and formed very few nodules with isolates identified as Bradyrhizobium. However, both varieties SB19 and 'Safari' had better growth under glasshouse inoculation with Bradyrhizobium spp., rhizobia isolates although one Rhizobium isolate (SoyKis1) resulted in good nodulation of both varieties. Seed treatment of the two legumes with some isolates resulted in improved nodulation and better plant growth; in some instances, outperforming the commercial strain *Bradyrhizobium japonicum* USDA110. In conclusion, Isolates BAMKis12, BAMKis8, BAMKis4, BAMKbay8 and SoyKar2 were found to be potential elite strains and are recommended for more host range tests as viable inoculants sources.

Keywords: *Rhizobium, Nodulation Effectiveness, Soybeans, Bambara Groundnut*

Rapporteurs Report

Presenter's name: Ogola O. Fredrick
Title/Topic of presentation: Assessment of Rhizobia Strains Isolates of Soils around Lake Victoria Basin for their Effectiveness in Nodulation and Symbiotic Efficiency on Soybeans and Bambara Groundnuts.
Institutional affiliation: Chuka University
Highlights/key points from presentation: a) The researcher introduced the topic of study and the study area. b) Air is comprised of different elements that are useful to either plants/and animals depending with the elements. c) One of the elements that is in abundance in air is Nitrogen. d) Atmospheric Nitrogen is not available for plants in its natural form, thus there is need for nitrogen

fixation.

e) The symbiotic Biological nitrogen fixation (SBNF) is sustainable and less expensive. It is also inaccessible in inorganic fertilisers.

f) SBNF is underutilized in soils of Lake Victoria basin due to insufficient information on local rhizobial strains diversity and their N-fixation efficiency.

g) This study was carried out to assess the effectiveness of rhizobium strains isolates of Kisumu, Port Victoria, Kendu bay and Karungu soils within Lake Victoria basin in nodulation and symbiotic efficiency on soybeans and bambara groundnuts.

h) Two bambara seeds of groundnut landraces; Kakamega Cream (KAKC) and Busia Brown (BUSB) used in this study were collected from farmers in Kakamega and Busia counties respectively.

i) Screen house experiment was performed at Kenya Forestry Research (KEFRI) in plastic pots with four seeds of each cultivar which was later thinned to two plants. Randomized Complete Block Design (RCBD) was used.

j) Experiments data were subjected to analysis of variance (ANOVA) using Genstat 16th Edition and significant means separated using Least Significant Difference at [LSD5%] and Dancun Multiple Range Test (DMRT).

k) Result indicated highly significant ($p<0.05$) effect of isolate inoculation on number of nodules per plant.

l) Soybean Variety SB19 formed effective nodules with rhizobia in the genera Bradyrhizobium, Rhizobium and Agrobacterium. On the other hand, 'Safari' was quite selective and formed very few nodules with isolates identified as Bradyrhizobium.

m) Both varieties SB19 and 'Safari' had better growth under glasshouse inoculation with Bradyrhizobium spp., rhizobia isolates although one Rhizobium isolate (SoyKis1) resulted in good nodulation of both varieties.

n) Seed treatment of the two legumes with some isolates resulted in improved nodulation and better plant growth; in some instances, outperforming the commercial strain Bradyrhizobium japonicum USDA110.

o) In conclusion; Isolates BAMKis12, BAMKis8, BAMKis4, BAMKbay8 and SoyKar2 were found to be potential elite strains and are recommended for more host range tests as viable inoculants sources.

Questions /key points discussed:

a) Have you communicated the results and findings to the farmers so that they can benefit from your

research findings? Yes. The results have been shared with farmers and agricultural around the lake basin to encourage good farming practices.	
Responses/general recommendations: The presentation was very educative.	
Name of session chair: Dr. Eddy Owaga	**Name of session rapporteur:** Mr. Simon Mwaura

Variation in Temperature And Nutrient Source Influence the growth of *Exserohilum Turcicum* Mycelia Isolated From Sorghum

Fredrick O. Ogolla [a], Moses M. Muraya [b], Benson O. Onyango [c]

[a] Chuka University, Department of Biological Sciences, P.O. Box 109-60400, Chuka, Kenya, Telephone: 0708576198, Email: *ogolla.fredy@gmail.com*

[b] Chuka University, Department of Plant Sciences, P.O. Box 109-60400, Chuka, Kenya, Email: *moses.muraya@gmail.com*

[c] Jaramogi Oginga Odinga University of Science and Technology, Department of Biological Sciences, P.O. Box 210-40601, Bondo, Kenya, Email: *benboyih@gmail.com*

ABSTRACT

Turcicum leaf blight (TLB) caused by the fungus *Exserohilum turcicum* is a serious threat to production of maize and sorghum, since it damages photosynthetic leaves. Growth and development of *E. turcicum* pathogen is influenced by factors such as light, temperature, dew period, plant age and inoculums concentration. Tharaka Nithi County in Eastern Kenya where sorghum is actively grown has heterogenous climatic and edaphic conditions. It is currently unclear if variations in temperature and media type may influence growth, development and virulence of *Exserohilum turcicum*. Thus, this study was carried out to investigate the effect of media type and different temperature variations on the growth and development of mycelia of *E. turcicum* isolates from Tharaka Nithi County in Kenya. Results showed that the effect of temperature was significantly differences for development of *E.*

turcicum (Pr < 05) mycelia. Media type had significant effect on growth of *E. turcicum* isolates ($p<0.05$). Corn meal agar with mean of 4.233 cm was the best growth media followed by Malt extract agar at 3.3200 cm, while the most preferential ($p<0.05$) temperature for mycelia growth was 30 °C. The study recommends in-cooperation of wider environmental factors in future studies involving TLB pathogen from Tharaka Nithi County.

Keywords: Incidence, Severity, TLB, Sorghum, Tharaka-Nithi, Kenya

Incidence and Severity of Turcicum Leaf Blight Caused by *Exserohilum turcicum* (pass.) Leonard and Suggs) on Sorghum Populations in Different Regions of Tharaka Nithi County, Kenya

Fredrick O. Ogolla [a], Moses M. Muraya [b], Benson O. Onyango [c]

[a] Chuka University, Department of Biological Sciences, P.O. Box 109-60400, Chuka, Kenya, Telephone: 0708576198, Email: *ogolla.fredy@gmail.com*

[b] Chuka University, Department of Plant Sciences, P.O. Box 109-60400, Chuka, Kenya, Email: *moses.muraya@gmail.com*

[c] Jaramogi Oginga Odinga University of Science and Technology, Department of Biological Sciences, P.O. Box 210-40601, Bondo, Kenya, Email: *benboyih@gmail.com*

ABSTRACT

Sorghum [*Sorghum bicolor* (L.) Moench] is a drought tolerant food crop preferred by subsistence farmers in dry areas which experience low annual rainfall. However, Turcicum Leaf Blight (TLB) caused by *Exserohilum turcicum* has threatened sorghum production in the world. New sorghum varieties have been introduced into the Kenyan production systems, including the drier parts of Tharaka Nithi County to boost yield and thus meet the increased demands for food and as a raw material by brewing industries. Nonetheless, challenges due to infection by TLB have negatively impacted on sorghum production resulting from damaged photosynthetic leaves. This study was conducted to determine the incidence and severity of TLB on sorghum populations in different regions of Tharaka Nithi County. Sorghum farms in eleven villages for the study were selected by multistage random sampling. The study was conducted between the month of January and June

2018. Data analysis was done by SAS software version 9.4 and significantly different means separated using LSD test at 5% probability level. There was statistically significant difference in the severity and incidence of *E. Turcicum* leaf blight on sorghum population from different regions in Tharaka Nithi County ($P<0.05$). Disease TLB occurred in all the villages surveyed though at different frequencies. The disease incidence was higher at Kithaga, and Nkairini recording 74.45% and 55.93% and lowest at Gatuntu and Gituntu both recorded the disease incidences 12.22%. Thus, farmers should be educated on sorghum TLB management for increased sorghum production and higher income to farmers.

Keywords: Incidence, Severity, TLB, Sorghum, Tharaka-Nithi, Kenya

Rapporteurs Report

Presenter's name: Ogola O. Fredrick
Title/Topic of presentation: Incidence and Severity of Turcicum Leaf Blight Caused by *Exserohilum turcicum* (pass.) Leonard and Suggs) on Sorghum Populations in Different Regions of Tharaka Nithi County, Kenya.
Institutional affiliation: Chuka University
Highlights/key points from presentation: a) The researcher introduced the types of sorghum grown in Tharaka Nithi county. b) He explained the types of diseases that affect the crop in Tharaka Nithi county. c) He aimed at determining the effects of a specific desease- Turcicum Leaf Blight Caused by *Exserohilum turcicum,* Its severity and incidences. d) He explained the materials and methods used in the research. e) He carried out sample collection and pathogen isolation. f) Results and observations were well explained using graphs and tables. g) Discussions and conclusions were presented.
Questions /key points discussed: There was no question to the presenter.
Responses/general recommendations: The presentation was good.

Name of session chair: Dr. Eddy Owaga	**Name of session rapporteur:** Mr. Simon Mwaura

Characterization, Incidence and Severity of *Solanum lycopersicum* Bacterial leaf spot Caused by Xanthomonad species in Farms in Wanguru, Mwea, Kirinyaga County, Kenya

Ogolla O. Fredrick [a] **and Neema B. Daisy** [b]

[a] Chuka University, Department of Biological Sciences, P.O. Box 109-60400, Chuka, Kenya, P.O. Box 210-40601, Bondo, Phone: 0724694613, Email: ogolla.fredy@gmail.com

[b]Chuka University, Department of Biological Sciences, P.O. Box 109-60400, Chuka, Kenya, *daisyneema5@gmail.com*

ABSTRACT

Demand for tomato has increased tremendously but its production has been bedeviled by phytopathogens such as bacteria leaf spot. Studies have reported cases of bacteria leaf spot associated with tomato losses in many tomato production regions globally. However, despite persistent of tomato diseases in different agroecological regions in Kenya, there is scanty information on incidences and severity of individual diseases. This study was done to determine the incidence and severity of bacteria leaf spot of tomato in Wanguru in Mwea, Kirinyaga county in Kenya between February and April 2019. A total of ten tomato farms were selected randomly for the surveyed of incidence and severity bacteria leaf spot. From these ten farms, a total of 3000 tomato leaves in 100 tomato plants were assessed. Severity was scored by rating on a scale of 0 – 5. Data collected was subjected to analysis of variance using SAS software version 9.3 and significant means separated using least significance difference (LSD). Results showed that bacterial leaf spot incidence and severity was significant ($p<0.05$). Bacteria leaf blight was observed in all farms but at lower rates. However, the incidence was below 15% with farm 7 recording mean of 13%. The lowest incidence was observed in farm 3 and 5 recording 8.33%. Severity observed in all the farms was below 35% with farm 7 recording severity mean of 33.33% while farm 5 recorded lowest severity mean of 16.00%. The colonies isolated from the infected leaves were generally yellow on the surface of nutrient agar. Results of differential staining showed gram negative rods while

biochemical tests slightly varied. Based on totality of cultural, morphological and biochemical tests results, we concluded that *Xanthomonas campestris pv vesicatoria* is responsible for leaf spot tomato disease in Wanguru. However, we recommend the inclusion of molecular tool for proper identification. This study therefore reports the incidences and severity of bacteria leaf spot caused by Xanthomonads species complex though at lower rates. The study should be extended to other tomato production areas in Mwea.

Keywords: incidence, Severity, Tomato_Leaf_spot, Wanguru, Mwea, Kenya

Rapporteurs Report

Presenter's name: Ogola O. Fredrick
Title/Topic of presentation: Characterization, Incidence and Severity of *Solanum lycopersicum* Bacterial leaf spot Caused by Xanthomonad species in Farms in Wanguru, Mwea, Kirinyaga County, Kenya.
Institutional affiliation: Chuka University
Highlights/key points from presentation: a) The demand for tomato has increased tremendously but its production has been bedeviled by phytopathogens such as bacteria leaf spot. b) Studies have reported cases of bacteria leaf spot associated with tomato losses in many tomat production regions globally. c) Despite persistent of tomato diseases in different agroecological regions in Kenya, there is scanty information on incidences and severity of individual diseases. d) Study was done to determine the incidence and severity of bacteria leaf spot of tomato in Wanguru in Mwea, Kirinyaga county in Kenya between February and April 2019. e) Data collected was subjected to analysis of variance using SAS software version 9.3 and significant means separated using least significance difference (LSD). f) Results showed that bacterial leaf spot incidence and severity was significant ($p<0.05$). Bacteria leaf blight was observed in all farms but at lower rates. g) The study reports the incidences and severity of bacteria leaf spot caused by Xanthomonads species complex though at lower rates.

Questions /key points discussed: b) Have you communicated the results and findings to the farmers so that they can benefit from your research findings? Yes. The results have been shared with farmers and agricultural around the lake basin to encourage good farming practices. I have even presented at Kirinyaga University when among the stakeholders to that conference were county officials and farmers.	
Responses/general recommendations: a) The presentation was very educative. b) The study should be extended to other tomato production areas in Mwea.	
Name of session chair: Dr. Eddy Owaga	**Name of session rapporteur:** Mr. Simon Mwaura

Effect of Maize-Cowpea Cropping patterns on Soil Moisture Conservation in Meru and Tharaka Nithi Counties

Kirimi, I. Mwenda[1], Munyiri, S. W[2], Ndukhu H. O[3]

[1]Department of Plant Sciences, Chuka University, P. O. Box 109-60400, Chuka Kenya

*Corresponding author; Kirimi Ian Mwenda: Email: ianmwenda89@gmail.com, Mobile: 0715800941

Munyiri, S .W: Email: munyirishelmith@gmail.com, Mobile: 0722269532

Ndukhu H. O: Email: hndukhu@gmail.com, Mobile: 0727485052

ABSTRACT

Given the frequent drought pressure caused by the unpredictable and limited precipitation concurrent with global climate change, highly efficient cultivation technologies have been increasingly recognized by various levels of scientific communities. Maize (*Zea mays* L.) based intercropping systems are widely practiced in Kenya, but only a few studies have focused on cowpea

(*Vigna unguiculata* L.) as the companion intercrop. This two site study was conducted during the 2018 long rains of March-April at the Kenya Agricultural and Livestock Research Organization (KALRO) Igoji research station and Magutuni in Meru and Tharaka-Nithi Counties Respectively. The objective of the study was to assess the effect of incorporating cowpea into the maize production pattern on crop cover and soil moisture content (SMC). Randomized complete block design was used in the experiment with three replications in 3 x 4 m plots. The treatments comprised of pure maize stand (T1), maize intercropped with inoculated cowpea (T2), maize intercropped with non-inoculated cowpea (T3) and pure non-inoculated cowpea (T4). A generalized linear model (GLM) was used to determine the effects of cropping patterns on ground cover, leaf area index and soil moisture content, using Genstat 19th edition. Means were separated using Fischer's protected least significant difference (LSD) test, with differences considered significant at $P \leq 0.05$. Significantly higher (82%) crop cover was exhibited at kernel development stage in T2 compared to 78, 64 and 53% in T3, T4 and T1 respectively. Similarly, the highest SMC was recorded at kernel development stage: 210.3, 209.3, 200.2 and 196.4 mm in T2, T3, T4 and T1 respectively. Relative to (T1 and T4), (T2) recorded the peak LAI of 3.75 at 70 DAP at Igoji and 3.16 at 63 DAP in Magutuni. The study showed that cowpea is a promising legume crop that could be integrated into maize cropping patterns to improve moisture conservation.

Keywords: *maize-cowpea intercropping, soil moisture content, maize development stages, Canopy cover, Cropping Patterns.*

Optimization of Garlic (*Allium sativum* L.) though Application of Goat Manure-Based Vermicompost in Eastern Kenya

Gichaba, V. M[a], Muraya, M[a], Ndukhu, H. O[a] and Odilla, G. A[b]

[a]Department of Plant Sciences, Chuka University, P.O. Box 109-60400, Chuka-Kenya,

vincent.gichaba@gmail.com

[b]Department of Agricultural Education, Agricultural Economics and Agribusiness Management, P.O. Box 109-60400, Chuka-Kenya.

ABSTRACT

Garlic, a bulb vegetable used as food and for medicinal purposes, has gained prominence among farmers in Eastern Kenya. The number of consumers preferring organic agricultural products has

increased. But, the farmers are still over utilising chemical fertilizers, which cause adverse effects on the environment and human health. The objective of this study was to evaluate the effects of goat manure-based vermicompost on growth and yield of garlic. The study was conducted at PCEA Nkio secondary school farm and KALRO Embu horticultural field in 2018 to 2019. The experiments were laid out in a Randomized Complete Block Design and replicated three times. The treatments consisted of goat manure-based vermicompost at five levels (0, 5, 10, 20 and 30 t ha^{-1}), inorganic fertilizer (NPK 17-17-17) at the rate of 200 Kg ha^{-1} and goat manure (30 t ha^{-1}). Data were collected on plant height, number of leaves, stem diameter, leaf length, leaf width, bulb fresh weight, bulb diameter, bulb length, number of cloves per bulb, bulb dry weight and bulb yield. The data obtained were subjected to ANOVA and significantly different means were separated using least significance difference at $\alpha = 0.05$. The results showed that application of goat manure-based vermicompost had statistically significant difference ($p < 0.05$) on growth and yield of garlic. Application of 30 t ha^{-1} goat manure-based vermicompost showed significantly ($p < 0.05$) higher plant height, number of leaves, stem diameter, leaf length and leaf width. Application of 30 t ha^{-1} goat manure-based vermicompost showed significantly ($p < 0.05$) higher bulb fresh weight, bulb diameter, bulb length, number of cloves per bulb, bulb dry weight and bulb yield. The study recommended use of goat manure-based vermicompost at rate of 30 t ha^{-1} in the organic production of garlic in the study area.

Keywords: *Garlic, goat manure-based vermicompost, growth, bulb yield*

Rapporteurs Report

Presenter's name: Mr. Gichaba V. M
Title/Topic of presentation: Optimization of Garlic (Allium sativum L.) though Application of Goat Manure- Based Vermicompost in Eastern Kenya
Institutional affiliation: Chuka University
Highlights/ key points from presentation: a) Garlic contributes significantly to the nutrition and health status of people in Kenya; however, its production remains low due to negative changes in the soil related factors contributed by dominant use of chemical fertiliaers b) The changes in the soil parameters create unfavourable conditions for garlic development hence it has been difficult to optimize its yields c) The study was conducted in PCEA Nkio secondary school farm and KALRO Embu horticultural field

d) It was established that for optimum garlic productivity, there is need to use 30 t ha of goat manure-based vermicompost in the organic production of garlic
Questions /key points discussed: a) Why recommend goat manure and not any other animal manure? b) Where do you advise farmers to get goat manure from given that goat farming is not very common?
Responses/general recommendations: a) Goat manure retains highest amount of NPK compared to other animals' manure b) Goat manure is odourless and does not attract fries c) The goat manure can be sourced from Manyattas in Meru south where farmers keep goats in large quantities as compared to other animals hence its readily available

Name of session chair:	**Name of session rapporteur:**
Dr. Daniel Njoroge	Catherine Nyawira

Goat Manure-Based Vermicompost Effects on Soil Properties under Garlic Production in Meru South and Manyatta sub-counties, Kenya

Gichaba, V. M[a], Muraya, M[a], Ndukhu, H. O[a], Odilla, G. A[b] and Ogolla, F. O[c]

[a]Department of Plant Sciences, Chuka University, P.O. Box 109-60400, Chuka-Kenya,

vincent.gichaba@gmail.com

[b]Department of Agricultural Education, Agricultural Economics and Agribusiness Management, P.O. Box 109-60400, Chuka-Kenya.

[c]Department of biological sciences, P.O. Box 109-60400, Chuka-Kenya.

ABSTRACT

Majority of farmers in the Eastern region of Kenya mainly apply chemical fertilizers to boost crop yields. Continuous use of chemical fertilizers causes several adverse effects such as P-fixation, volatilization of essential nutrients and leaching that affect safety of groundwater and agricultural environment. Hence, the effects of goat manure-based vermicompost on soil chemical properties under garlic were evaluated in PCEA Nkio secondary school, Meru South sub-county and KALRO

Embu horticultural field, Manyatta sub-county; from 2018 to 2019. The experiment was laid out in a randomized complete block design and replicated thrice. The treatments were; goat manure-based vermicompost applied at five levels (0, 5, 10, 20 and 30 t ha^{-1}), NPK 17-17-17 at 200 Kg ha^{-1} and goat manure (30 t ha^{-1}). Soil sampling and analysis were done on entire sites before planting and after harvesting of garlic on each experimental plot. The results showed that application of goat manure-based vermicompost had statistically significant difference ($p \leq 0.05$) on soil chemical properties. Application of 30 t ha^{-1} goat manure-based vermicompost showed significantly ($p \leq 0.05$) higher soil pH (8.00), total N (0.606%), available P (21.933 ppm) and exchangeable K (0.863 Cmol Kg^{-1}) than control treatment that had pH (6.59), total N (0.043%), available P (4.670 ppm) and exchangeable K (0.456 Cmol Kg^{-1}) at Chuka. A similar trend was observed in Embu where vermicompost gave significantly higher soil pH (7.91), total N (0.563%), available P (21.053 ppm) and exchangeable K (0.710 Cmol Kg^{-1}) compared to control which had pH (6.54), total N (0.030%), available P (4.596 ppm) and exchangeable K (0.343 Cmol Kg^{-1}). Hence, the results of this experiment revealed that addition of goat manure-based vermicompost enhanced soil chemical properties leading to improved garlic productivity.

Keywords: *Garlic, goat manure, vermicompost, soil chemical properties*

Rapporteurs Report

Presenter's name: Gichaba V.M
Title/Topic of presentation: Char Goat Manure-Based Vermicompost Effects on Soil Properties under Garlic Production in Meru South and Manyatta sub-counties, Kenya.
Institutional affiliation: Chuka University
Highlights/key points from presentation: a) The Garlic has a wide area of adaptation & cultivation throughout the world. b) In Kenya, garlic is commonly grown in small-scale farms & the annual production average is about 2,000 metric tons. c) It is cultivated mostly under rain fed conditions in Kenya. Cultivation of this crop greatly relies on many factors such as climate, soil fertility, irrigation, fertilizer management, spacing & growing season. d) Depletion of macro & micro- nutrients from the soil, use of low yielding varieties & poor management practices are major causes of low yields. The growth & yield of garlic crop is greatly influenced by both

inorganic & organic nutrients.

e) Vermicompost can meet the nutrient demand of greenhouse & field crops & significantly reduce the use of fertilizers.

f) Use of organic manures like goat manure-based vermicompost & improved garlic varieties can go a long way towards improving garlic yield, in Meru South & Manyatta sub-counties.

g) Changes in soil parameters create unfavorable conditions for garlic development.

h) Objectives of study: -To determine the effect of goat manure-based vermicompost on garlic growth characteristics; To determine the effect of goat manure-based vermicompost on garlic yield and yield components.

i) Study material, methods and experimental design.

j) Results were presented in tables.

k) Conclusion: - Application of higher rates of goat manure-based vermicompost increased garlic growth characteristics in the study area at the end of the growing season; Application of higher rates of goat manure-based vermicompost increased significantly garlic yield components and yield.

l) Recommendation: - Optimum garlic productivity, there is need to use 30 t ha^{-1} of goat manure-based vemicompost in the organic production of garlic.

Questions /key points discussed:

a) What is the sustainability of use of the earthworms in manure decomposition?

It is very sustainable because the worms multiply very fast. The uric acid from the worms accelerates the growth of the plants.

b) What are the effects of releasing the worms to the farms after complete decomposition?

The worms can be reused, given to chicken or fish instead of releasing them to the farm, although they have no negative effects to the farm.

c) Can the project be commercialised and if yes, how?

Yes, the farmers can do it in large scale and sell manure to other farmers.

d) For how long does the decomposition take?

The decomposition takes up to 120 days.

Responses/general recommendations:

The presentation was very educative.

Name of session chair:	**Name of session rapporteur:**
Dr. Eddy Owaga	Mr. Simon Mwaura

Analysis of Spatial Factors Affecting Rental House Prices: A Case Study of Nyeri Town Constituency, Nyeri County.

Evanson Ndung'u Kimani.

Institute of Geomatics, GIS and Remote Sensing, Dedan Kimathi University of Technology, 657-10100, Nyeri, Kenya.

E-mail: endungukimani@gmail.com

ABSTRACT

Real estate is the backbone of all developments in Kenya as it forms the basis of basic human need, shelter. This sector has attracted many developers constructing commercial and residential houses. Various investors use variety of methods to mark rental prices of their houses. Various factors have been noted to influence rental house prices others having a higher effect than others. This research endeavors to analyze the spatial features that affect rental houses prices and deduce their relationship with rental house prices. This has been achieved by primary data collection from house owners and estate agents in the study area through use of questionnaire, land value data from government valuers, infrastructure, and population data from relevant sources alongside with secondary data which is collected, digitized and prepared then all saved onto a database before analysis. Through use of GIS and remote sensing technologies all the spatial factors identified to affect rental house prices are analyzed and their relationship deduced then through a regression and multicriteria analysis different weights are assigned to the various factors as they are noted to influence the prices differently. The results of the study indicates different indexes as seen from various spatial factors identified. Various maps are generated showing relationship of various spatial factors with rental house prices. With this indexes, investors or agencies can know the percentage influence of the factors and may peg their decisions on the results of this research which can also be used in development of rental house price predictive models which is very crucial for the undeveloped plots. This research is paramount in decision making procedures of investors as they eye on setting up developments within the constituency. The county government may benefit heavily as they may be able to work on certain areas that may increase the revenue in the sector

hence boosting Kenya's overall gross domestic product. This research has proved how GIS and remote sensing technologies can contribute in the real estate sector.

Keywords: real estate, rental houses, GIS, remote sensing.

Rapporteurs Report

Presenter's name: Evanson Ndung'u	
Title/Topic of presentation: Analysis of spatial factors affecting rental house prices; Case study of Nyeri town constituency	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) There's an increasing number of houses being built every day and the challenge is always the setting/determination of rental prices b) Micro and macro factors often affect the pricing of houses, like the slope of the land, nearness to the mail road, proximity to town, population density and security among others c) It was established that the higher the land value, the higher the rent rates	
Questions /key points discussed: a) Have all factors influencing housing prices been incorporated in the study? b) How accurate is the model you have proposed to price rental houses?	
Responses/general recommendations: a) The research presented is part of a larger study where more factors have been studied, so the results aren't conclusive b) The presentation was ok	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Modelling the Influence of Cropping Patterns on Avocado Pests and Pollinators Distribution

Grace Aduvukha[a, b], Godfrey Makokha[b], Arthur Sichangi[b], Elfatih M. Abdel-Rahman[a]

[a]International Center for Insect Physiology and Ecology (*icipe*), P.O. Box 30772, Nairobi 00100, Kenya; Email;gaduvukha@icipe.org

[b]Institute of Geomatics, GIS & Remote Sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya,

ABSTRACT

Pollinators play a pivotal role in agroecosystems and agricultural food production through their pollination services and promoting biodiversity. However, there has been a decline in pollinators due to several factors including the intensive use of agrochemicals in managing crops pests, whose infestation or lack thereof are influenced by cropping patterns (annual sequence and spatial arrangement of crops). On the other hand, crop pests threaten food security by reducing the produce of crops by about 10-16%. The main objective of this study therefore was to evaluate how cropping patterns influence avocado pests and pollinators' distribution, with avocado being an important horticultural crop in export value in Kenya that depends on pollinators.

In specific, classified Sentinel-2 multispectral space-borne image of February 2019 covering three sub counties in Murang'a county together with 'presence only' data of avocado insect pests and pollinators and intervening variables of elevation and bioclimatic variables were used in Maximum Entropy (MaxEnt), an ecological niche model, to provide a spatial understanding of how the cropping patterns influence avocado insect pests and pollinators distribution. The pests in focus were false codling moth (FCM) and fruit fly (FF) whereas the pollinators were honeybees and wasps. Using field data on land use land cover and crop types, the Sentinel-2 image was classified into twelve classes using random forest machine learning classifier. The results showed that cropping patterns could be classified with an overall accuracy of 78% and kappa of 0.76. Seven of the twelve classes extracted comprised of different crop types i.e. avocado, tea, coffee, cabbage, maize and pineapple. The different croptypes were also categorized into various cropping patterns such as monocrop, mixed, perennial and annual to be used in the model.

Prior to modelling in MaxEnt, all variables were subjected to a collinearity test using the variable inflation factor (VIF) approach thus eliminating those with a VIF>10. As a result, seven variables were retained for use in the modelling i.e. cropping patterns, aspect, slope, hillshade, isothermality, temperature seasonality, and rainfall seasonality. To note however is that three additional intervening variables i.e. rainfall wettest month, rainfall wettest quarter for pollinators and minimum temperature of coolest month for pests in this study regarded as important to the specific pests and pollinators according to reviewed literature were also used despite having a VIF>10. Overall, the area under

curve (AUC) of all pollinators and pests were above 0.75 indicating good model performance. It was noted that the cropping patterns contributed the highest (66%) in FF and second highest in FCM, wasps and honeybees distribution models at 41.4%, 39.2% and 11.6% respectively. This results will thus aid in providing advisory tools for making informed decisions by various stakeholders to promote integrated pest and pollinator management for avocado crop production.

Keywords: Sentinel-2, Random forest, Niche modelling, Remote Sensing, Crop health

Rapporteurs Report

Presenter's name: Grace Aduvukha	
Title/Topic of presentation: Modelling the Influence of CroppingPatterns on Avocado Pests and Pollinators Distribution	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Pollinators (bees, birds), which play a key role in biodiversity, have reduced in numbers due to biotic and abiotic factors b) This threatens food security in the long run c) It was noted that cropping patterns were affected by fruit flies as well as with bees and wasps, which if handled will increase avocado production	
Questions /key points discussed: a) At what point do human activities – use of pesticides, fungicides- affect pollinators? Can you include this in your study? b) What does this research mean in terms of agriculture? c) Farmers can be advised to use less pesticides, as they have negative effects on pollinators	
Responses/general recommendations: The study was well presented and is innovative, keep it up	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Application of Geophysical Methods in Foundation Investigation for Construction Purposes at Olkaria (V) Fields, Kenya.

James Omwoyo Obare[1], Njenga Mburu[1]

Dedan Kimathi University

ABSTRACT

Geophysical methods were used in structural foundation investigation at Olkaria (V) field in Kenyan rift valley prior to the construction works. The objective of this investigation was to analyze the foundation conditions without soil disturbance. Geophysical techniques are faster, cost effective and non-destructive compared to conventional way such as borehole investigation, which is expensive and provide information in discrete area, whereas geophysical investigations provide a wider picture of the subsurface. Electrical resistivity, gravity and seismic methods were used in the investigation. Data was collected using electrical resistivity imaging system, gravimeter, geographical positioning system (GPS), receiver and seismograph. The RES2DINV, SURFER and Geometrics SeisImager Software respectively were used to process results obtained from these investigations. The methods used gave results that are significant in the preliminary stages of site assessment for foundation works. The techniques probe the depth to the bedrock and present weak soils zones. Analysis and interpretation of geophysical data aids in understanding the subsurface geology for foundation works.

Compact rock materials were observed from a depth of 14m below ground level extending down to greater depths. Further, the area was characterized by weak Silty material, which has low bearing and consolidation ability. Such materials are prone to frequent washout under conditions of percolating waters hence require utmost care during the placement of engineering structures. Utilization of piles is necessary and should be anchored to a depth greater than 14m below ground level such that they rest directly on the competent bed. In-situ compaction should go before utilization of reinforced concrete amid the development of shallow foundation to achieve the maximum compaction limits due to the anticipated load of the proposed infrastructure. Equally, excavation of the top soil is necessary and thereafter refilling with competent material such as gravel and laterite in order to have a strong basement.

In-season and Inter-season Maize Crop Monitoring with Radar Satellites- case study of Endebess, Kenya

Kuria, T. B.[a]

[a]*IGGReS, Dedan Kimathi University of Technology, Private Bag, Nyeri, Kenya*

ABSTRACT

Continued monitoring of crops in the fields during the entire cropping season, and from one season to another, ensures good cropping seasons, and thus good yields. Remote sensing provides fast, cost effective and timely tools necessary for the effective monitoring of the crops. The acquisition of cloud free optical images in tropical regions however remains a big challenge since the cropping season is characterized by high amounts of rainfall and cloud cover. With the availability of radar images however, it is now possible to acquire cloud free images during the entire cropping season since radar is not influenced by the weather condition. The objectives of the study were two fold. The first objective was to compare the performances of TerraSAR-X (TSX) X-band and Sentinel-1 (S-1) C-band radar images in monitoring the maize growth in Kitale, Kenya. S-1 and TSX image pairs having comparable acquisition times, acquisition modes, and acquisition incidence angles were selected. The second objective was to investigate the transferability of the maize phenological characteristics from one season to the other by comparing the S-1 backscatter values for 2015 and 2016 cropping seasons. 18 ADC Olngatongo Company maize fields were identified for this study, with the principal maize growth and development stages being defined by the universal extended BBCH scale. From the results, the TSX backscatter values were higher than the S-1 backscatter values for the greatest part of the cropping season. The difference between their backscatter values was larger at the beginning of the cropping season, decreasing progressively during the crop growth. This was attributed to reduced influence of soil reflectance after the leaf canopy formation. The maize phenological development stages could however be identified from both the TSX and S-1 images. The field planting orientation influenced the amount of backscatter values observed, with fields oriented in an East-West direction exhibiting higher backscatter values. For the comparison between the 2015 and 2016 cropping seasons, the backscatter values for the S-1 ascending mode performed best in terms of both S-1 2015 and S-1 2016 backscatter curves overlaying. Maize fields planted in similar dates for both the 2015 and 2016 season performed the best. Hence, a S-1 backscatter curve extracted for one cropping season can establish a baseline for the monitoring of

the subsequent cropping seasons. In the event that a deviation from the expected backscatter values is noted, then the necessary action can be taken to mitigate the situation.

Keywords: TerraSAR-X, Sentinel-1, Maize BBCH, Phenology mapping

Rapporteurs Report

Presenter's name: Kuria T. B.	
Title/Topic of presentation: In-season and Inter-season Maize Crop Monitoring with Radar Satellites – Case study of Endebess, Kenya	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Remote sensing has been noted to provide easy monitoring of crop while in the farm compared to other models of monitoring b) This is possible and proves accurate since it gives radar images which are free of clouds, hence enhancing monitoring	
Questions /key points discussed: a) There was no definite conclusion for the study, what can be concluded? b) Have you considered wind direction and sunlight in your study?	
Responses/general recommendations: a) The objective is part of a bigger study, therefore no conclusion can be drawn as of yet b) Radar is independent of climatic conditions because it works in a controlled environment. However, wind as a factor can be included c) The study was ok	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Pond Water Fertilization Effects on the Performance f *Oreochromis Niloticus* in Different Culture Systems in Meru County

Patrick Mbaabu , Ezekiel Ndunda, Esther Kitur

Kenyatta University, School of Environmental Studies, Department of Environmental Sciences,

P.O. Box 43844, 00100, Nairobi, Kenya

ABSTRACT

Information on pond water fertilization is important as it gives among others, productivity of various types of culture systems. Different pond water fertilization rates and physicochemical parameters were investigated in liner, earthen and concrete ponds in Meru County Kenya over a period of 3 months, August to November 2015. The aim of the study was to find out the effects of different rates of pond water fertilization on the production of O. niloticus in different culture systems. Twelve fish ponds of size $2m^2$ were constructed in a randomized design, 4 of each and stocked with 8 niloticus monosex fingerlings each weighing 20gm sourced randomly from a hatchery in the county. Weight gain and total production was measured every 30 days for 90 days. ANOVA was used to analyze the data. Results revealed that, concrete culture system produced the highest mean weight gain of 11.21 ± 3.27 gms, earthen 7.67 ± 1.36 gms and liner 6.41 ± 4.88 gms with 4 gms DAP, showing a significance difference in mean weight gain ($F = 20.07$, $df = 2$, $P = 0.002$). The study concludes that, different pond water fertilization rates strongly influences the growth performance of O.niloticus in different culture systems.

Key words: Fertilization, culture system, weight gain, monosex, *O. niloticus*

Rapporteurs Report

Presenter's name: Patrick Mbaabu	
Title/Topic of presentation: Pond Water Fertilization effects on the performance of Oreochromisniloticus in different Culture Systems in Meru County	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Different pond water fertilization rates strongly influence the growth performance of O. niloticus in different culture systems	
Questions /key points discussed: a) What is the repercussion of using a different amount of fertilizer?	
Responses/general recommendations: Good presentation	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Development of an Integrated Web-based GIS for Revenue Collection, Case Study: Laikipia County, Kenya

Nduati Kariri, David N. Kuria and Moses M. Ngigi

Dedan Kimathi University of Technology

ABSTRACT

Most of the counties in Kenya perform very poorly in revenue collection, most of them failing to meet their projected revenue thereby causing huge local revenue collection gaps. In Laikipia County, property records are maintained in analogue format. Different types of data in stored in different departments. This research study aims to demonstrate how integrated web based GIS can be used in effective revenue collection and monitoring. One of the major limitations to efficient county revenue administration is lack of cadastre and updated land information management system.

Needs analysis was carried out and the majority of the respondents supported the adoption of the system by the county government. Technology decisions are made based on a proper understanding of user requirements, workflow needs and established system performance expectations. Therefore there is a need to come up with a system that will help Laikipia county government to achieve its revenue targets collection through cashless payments.

The system developed, provides an effective platform, for efficient revenue management. Various revenue streams were mapped and their spatial attributes captured. Users can be able to register and make payments from the system. The system has enabled Data accessibility and interoperability between various departments in Laikipia County.

The system has enabled proper management of revenue by the county government since all the revenue streams are properly accounted for and enable sealing of loopholes where revenue is lost or under collected. The system enables users to make payments, and bring all the revenue streams into a spatial web based GIS database.

The system has provided an electronic client and property spatial database, this will enhance revenue processing, credit management and receipt processing on real time basis. All information regarding various revenue streams will be freely available to different users with a controlled level of access.

Once implemented the system will enable increased and streamlined revue collection with executive dashboards, county seals and certification permits with web verifiable QR codes. Also there will be mobile POS payment services with many payment options.

Key words: *Geographic Information System, Quick Response, County, Database, Revenue*

Rapporteurs Report

Presenter's name: Nduati Kariri	
Title/Topic of presentation: Development of an Integrated Web-based GIS for Revenue Collection. Case Study; Laikipia	
Institutional affiliation: Deadan Kimathi University of Technology	
Highlights/key points from presentation: a) Counties aren't collecting enough revenue due to lack of integrated systems. b) In Laikipia, property records are maintained in analogue format, which makes collecting revenue a challenge c) An integrated system will solve this problem because it will be used in mapping and enhancing property rates collection	
Questions /key points discussed: a) How effective are your results, since they are based on dummy data? b) Does your system address the issue of corruption? c) What input did you get from the county government of Laikipia? d) Consider other existing solutions addressing the same issue	
Responses/general recommendations: Good presentation	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Assessing the crop health and growth using multi-temporal vegetation indices derived from sentinel-2 imagery: A case study of wheat production in Narok County

Kirui Benard[a], Kuria Bartholomew[a] and Makokha Godfrey[a]

[a]Institute of Geomatics, GIS and Remote Sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 10143-Dedan Kimathi, Nyeri

E-mail: benard.kirui@dkut.ac.ke

ABSTRACT

Assessment of crop condition at the early stages of growth is essential for monitoring the crop health and yield prediction. The performance and productivity of agricultural crops are however determined by various factors such as soil moisture, fertilizer application, disease, and other farm management practices throughout the crop growing season, which varies across from one farm to the other. So timely repeat information about the crop condition throughout the Phenological stages of crop growth and development is very important in monitoring the conditions of crop.

In this research, a 5-day multi-temporal sentinel-2 data was used to derive various indices that helped in determining the crop conditions throughout the crop Phenological cycle. The normalized difference vegetation index (NDVI), an indicator of the level of photosynthetic activity, was used to determine whether the crop is healthy or not. The plant stress is caused by many issues ranging from shortage of water, attack on crops by pest, presence of weeds and poor crop management practices.

Other indices were used to narrow down to a probable cause of crop stress. Shortage of water was analyzed using the Optimized Soil Adjusted Vegetation Index (OSAVI) which estimates the amount of moisture in the soil. In order to separate between the attack of crops by weeds and pests, the geometric patterns of vegetation were analyzed using canny edge algorithm where low NDVI values and high soil moisture content in a straight rows indicate attack by pests while the randomly allocated low NDVI values and high soil moisture content indicate that there is weeds in the field.

Results indicated that remote sensing data from sentinel-2 provides a very important information for large-scale monitoring and assessment of crop health. The weekly data helps in monitoring the progress of the crops as well as the weeds particularly in the first phase of the Phenological cycle. This then guides in taking measures to counter the threat before it is too late.

Keywords: crop condition, ndvi, crop health, crop phenology, remote sensing.

Rapporteurs Report

Presenter's name: Kirui Benard

Title/Topic of presentation: Assessing the Crop Health and Groeth Using Multi-Temporal Vegetation Indices Derived from Sentinel-2 Imagery: A case study of wheta production in Narok County	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Crop health monitoring using remote sensing data b) Stage of growth that is rampant c) Assessing crop performance using band extraction d) Plant responding to different spectral characteristics e) Integrating remote sensing data and agro-data in modelling health and growth	
Questions /key points discussed: a) The study lacks preliminary conclusion b) To include how to differentiate between wheat and other weeds	
Responses/general recommendations: Good presentation	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Application of Satellite Radar Interferometry (Sbas) in analysis of Land Deformation. A Case of Kerio Valley

Kelvin Mwangi Karanja, Pius Kipngetich Kirui

Department of Geomatic Engineering and Geospatial Information Systems (GEGIS), Jomo Kenyatta University of Agriculture and Technology, P.O Box 62000 – 00200 Nairobi.

Telephone: +254715070948, Email: kelvincaranjah@gmail.com

ABSTRACT

Land deformation is the process of the land changing its original shape which can be induced by naturally occurring phenomena such as volcanic eruptions, landslides, soil erosion, mudslides and earthquakes or by human activities such as extensive groundwater extraction, urbanization and mining. The research has been carried out in Kerio Valley, a region with steep slopes and an increasing rate of soil erosion caused by increased logging due to increased demand of firewood and charcoal. The application of satellite RADAR interferometry techniques overcomes the challenges

of the traditional point based techniques such as levelling by providing more dense information on the deformation rate for large area in an effective and cost efficient way. The objective of this study is to apply DInSAR- SBAS technique to monitor the land deformation rate of the area using a set of 18 Sentinel 1 images from 2017 to 2019. The SBAS technique involves focusing and aligning the SAR data, generating interferograms from images with short baseline and unwrapping the phase using SNAPHU algorithms to obtain the land deformation in the Line of Sight. The deformation rate in the area ranged from 20 mm to – 45 mm per year with regions on the valley floor experiencing an uplift due to deposition while regions on the slopes and on mining sites experiencing subsidence. Using the RUSLE model, the total computed annual soil loss in the region varies from 98 Mg ha^{-1} per year to 419 Mg ha^{-1} per year indicating the high rate of soil erosion in the area. Overlaying the two shows an increase in the rate of deformation with increased rate of soil erosion. This therefore calls for need for continuous monitoring of the area as part of risk assessment so that measures can be taken in time.

Keywords: *SBAS, RUSLE, Soil erosion, interferometry, deformation monitoring*

Strengthening Human Capacity in Support of Enhanced Geothermal Development in the East African Region – a case for Dedan Kimathi University of Technology

MARIITA Nicholas Obuya

Geothermal Energy Training and Research Institute, GeTRI

ABSTRACT

In recent years, greater focus is being put to the development of geothermal energy resources in the Eastern Africa region. Geothermal projects are capital intensive. Like other projects of similar nature, their feasibility in terms of technology, financial and market viability need to be verified prior to their execution. Large investments have been made in training local personnel in geothermal exploration, development and production activities. Unfortunately, the number of geothermal experts trained so far is inadequate to oversee the planned expansion in development of the geothermal resources. This is due to lack of training institutions in the region, necessitating Africans travelling abroad to acquire training in geothermal energy technology. Dedan Kimathi University of Technology has taken the challenge of establishing a Geothermal Training and Research Institute (GeTRI), which is training a new generation of geoscientists, engineers and business leaders in all

aspects of geothermal energy use. GeTRI will contribute, through the education of graduate students, in partnerships with industry and other training universities and in applying an interdisciplinary curriculum encompassing geo-science and engineering. The Institute is becoming both the national and regional centre of excellence in geothermal training and research. We describe the university's contribution in expansion of the energy mix in the region, the successes and challenges in training of experts and research in this renewable energy resource.

Rapporteurs Report

Presenter's name: Prof. Mariita Nicholas	
Title/Topic of presentation: Strengthening Human Capacity in Support of Enhanced Geothermal Development in the East African Region – A case for DeKUT	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Human capacity in support of enhanced geothermal development b) Geothermal is a potential source of energy c) Barriers to geothermal development; pollution, socio-issues, legal framework d) Geothermal industry collaborating with the university	
Questions /key points discussed: a) GIS And remote sensing would address some of the technical issues raised b) Are the industries unwilling for collaboration with the University? c) What is the future of Geothermal field? Does it require diverse field in collaboration?	
Responses/general recommendations: Good Presentation	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Climate Change Vulnerability Assessment using a GIS Modelling Approach in the Upper Ewaso Nyiro Basin

Grace Koech[a], Godfrey O. Makokha[a] and Charles Muindia[a]

Email:gracechero.gc@gmail.com

[a]Institute of Geomatics, GIS and Remote Sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya

ABSTRACT

Investments in climate change adaptation for communities and water resources are increasingly benefiting from vulnerability mapping worldwide. The Upper Ewaso Nyiro basin is a rich, diverse and dynamic ecosystem which is impacted by climate change that in turn is negatively impacting livestock, humans and the entire rangeland system. This research sought to assess the existing vulnerability of the local community to climate change. To achieve this objective, various datasets were identified for analyses including climate data, environmental data and socio-economic data. The community vulnerability assessment model was determined through the process of gathering geo-referenced socio-economic, biophysical data, and climate data. Climate analysis was processed to extract averages and trends. Land use land cover change detection analysis was analyzed using Landsat images, while the vegetation condition index was calculated from Normalized Difference Vegetation Index. Normalized indicator layers were averaged using the equal weighted averaging approach to derive component and vulnerability scores. Through the process of spatial integration of relevant datasets, community vulnerability hotspots maps were developed. Results show that high vulnerability was observed in areas exhibiting similar trend in high exposure and lack of adaptive capacity as well as high sensitivity. The highest vulnerability was observed in Korr/Ngurunit ward in Marsabit County where approximately 45.45% of the population were noted to be highly vulnerable to climate change impacts, while 54.55% of the population were noted to be moderately vulnerable. This study recommends that the county government and national government needs to build targeted resilience efforts within the highly vulnerable communities since this would improve community livelihoods.

Keywords: *climate change, vulnerability, spatial analyses; semi-arid.*

Rapporteurs Report

Presenter's name: Grace Koech
Title/Topic of presentation: Climate Change Vulnerability Assessment Using GIS Modelling Approach in

the Upper Ewaso Nyiro Basin	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Key indicator of community vulnerability to climate change b) Spatial patterns of community vulnerability c) Adaptation measures to climate change	
Questions /key points discussed: a) What would your advice be to policy makers? b) What are the effects of encroachment and deforestation in your study area? c) Consider incorporating a digital elevation model	
Responses/general recommendations: Presentation was ok	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Spatial Modeling of Water Requirement For Paddy Rice Using Evapotranspiration

Francis Ngari Maina[a], Professor Murimi Ngigi[b] and Dr Kuria B

Institute of geomantic, GIS and remote sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya, E-mail: francis.maina2018@dkut.ac.ke

ABSTRACT

Kenya's population has been increasing since independence due to good climate .However, climate has been changing causing draught in many parts of the country .This has affected the irrigation schemes such as Mwea irrigation scheme which is a major producer of rice in Kenya. Water rationing is therefore practiced in Mwea irrigation schemes but there lack a well laid down procedures to decide where water is needed, when it is needed and how much is needed. This will require crop-based, weather-based and soil-based information to assists in estimation of evapotranspiration, a key determinant of water requirement at various stages of rice growth

.However, this information is difficult to get especially when covering a vast area. Over the past years scientists have employed various methods to calculate the rate of evapotranspiration such as Bowen ration; Bowen ration, eddy correlation system and soil water balance but they calculate evapotranspiration at fixed point but do not allow estimations of fluxes at a large area. This has made scientist to turn to remote sensing to obtain the required information over a large area. This study will focuses more on crop based and weather based data collection using remote sensing. Evapotranspiration will be estimated using surface energy balance algorithm for land (SEBAL) model. The models will be prepared to calculate the values of surface radiance, surface reflectance, surface albedo, Normalized Differential Vegetation Index(NDVI), Leave Area Index(LAI), surface emissivity, surface temperature, net radiation, soil heat flux, sensible heat flux, latent heat flux, which will used to calculate the daily evapotranspiration in study area. Landsat 8 images for two images per month of July to December for the years 2016 to 2019 will be used to estimate evapotranspiration.

Keyword: SEBAL, remote sensing and evapotranspiration

Rapporteurs Report

<table>
<tr><td colspan="2">Presenter's name: Maina F. M.</td></tr>
<tr><td colspan="2">Title/Topic of presentation: Spatial Modelling of Water Requirement for Paddy Rice Using Evapotranspiration</td></tr>
<tr><td colspan="2">Institutional affiliation: Dedan Kimathi University of Technology</td></tr>
<tr><td colspan="2">Highlights/key points from presentation:
a) Monitor the rate of evapotranspiration at different stages
b) SEBAL model inputs from satellite images</td></tr>
<tr><td colspan="2">Questions /key points discussed:
a) Rephrase your objectives (make your objectives smart)
b) Validate your model. How do you plan to do this?</td></tr>
<tr><td colspan="2">Responses/general recommendations:
Good Presentation</td></tr>
<tr><td>Name of session chair:
Prof. Charles Mundia</td><td>Name of session rapporteur:
Loice Kemuma</td></tr>
</table>

Assessing Alien Invasive Plants Species Spatial Distribution Under Changing Climatic Conditions

Julius Maina Waititu[a], Charles N. Mundia[a] and Arthur W. Sichangi[a]

[a]Institute of Geomatics, GIS and Remote Sensing, Dedan Kimathi University of Technology, Private Bag - 10143, Nyeri, E-mail: julius.waititu@dkut.ac.ke

ABSTRACT

Alien invasive plant species (AIPS) negatively affect the functions of forests, water, and agricultural ecosystems. AIPS may proliferate as a result of climate change or may act as drivers of climate change. Climate change enhances the invasion process by changing habitats range and hence increasing establishments range of the invasive species. This study assessed potential ecological habitats of five plant species including *Lantana camara L., Opuntia stricta, Solanum campylacanthum Hochst. ex A. Rich., Senna didymobotrya (Fresen.) H.S. Irwin & Barneby, Biancaea decapetala (Mauritius or Mysore thorn))* in areas within and surrounding nyeri forests conservation areas. Species occurrence location data were collected using GPS receivers through roadside surveys. Maximum Entropy (MaxEnt) Algorithm was used to model species distribution with occurence data and explanatory environmental variables for current and year 2050 climate predictions. Future predictions of species habitats based on bcc_csm1_1_m Global climate model and future emission scenarios (Representative Concentration Pathways (RCP) 2.6 and 8.5) for the year 2050 based on IPCC Fifth Assessment Report (AR5) indicated higher suitability index in the current semi-arid parts of study area for all species assessed. Both lantana and senna species will have significant spread to northern semi-arid area and towards mt. kenya to the east and aberdares forest reserves to the west for both climate scenarios as compared to the other species. Although solanum and Mauritius thorn will spread to new habitats, their range shift will be limited to the central and northern parts of study area. Opuntia species suitability will decrease and hence decrease in range within current habitat for both scenarios. This study therefore is important to conservationists and policy makers on invasive species risk assessments in ecosystems threatened by climate change and human disturbances. Additionally, Invasive species which are likely to become invasive due to climate change can be identified through similar assessments and early warning systems developed to reduce biodiversity loss.

Keywords: Alien Invasive Plant Species, Biodiversity loss, Species Distribution Modelling, Climate Change

Rapporteurs Report

Presenter's name: Julius Maina Waititu	
Title/Topic of presentation: Assessing Alien Invasive Plants Species Spatial Distribution Under Changing Climatic Conditions	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Evaluate explanatory variable and species distribution b) Model the distribution of the species for the year 2050	
Questions /key points discussed: a) Include a recommendation on how to manage the invasive species b) Have you come across 'kaskuda' species which is spreading very fast?	
Responses/general recommendations: Good Presentation	
Name of session chair: Prof. Charles Mundia	**Name of session rapporteur:** Loice Kemuma

Experimental Model Investigating Potential of Geothermal Energy in Recycling Polyethylene Terephthalate

Anyona M Kennedy[a], Nicholas Mariita[b] and Benson Ongarora[c]

[a]Emurua Dikirr Technical Training Institute, Box 91 Chebunyo Kenya. Phone +254723-077-477

[b]Geothermal Training and Research Dedan Kimathi University of Technology, Box 657, 10100 – Nyeri Kenya

[c]Dedan Kimathi University of Technology, Box 657, 10100 – Nyeri Kenya

ABSTRACT

Geothermal energy is one of the clean, sustainable and renewable resources, which provide heat energy that is derived from radioactive decay elements within the earth's crust. The non-electric utilization (direct use) of geothermal heat has been reported in various domains that have a need for sustainable supply of heat energy. Adoption and direct use of geothermal energy in Kenya is one

way which can enable waste control to enhance environmental protection and optimize the use of this resource. In this research, heat energy from the geothermal well was simulated using an experimental model in which polyethylene terephthalate (PET) pieces were melted and moulded into usable products under suitable pressure conditions. The objective of this study was using experimental model to investigate the potential of using geothermal heat energy in recycling PET plastics. The ground plastic waste material was exposed to heat and the resulting molten medium was subjected to selected polymer processing techniques to obtain desired products. The suitability of geothermal conditions in recycling PET was investigated through numerical analysis. In the design, the study performed experiments on three controlled factors temperature, velocity and pressure. The data collected was analyzed by use of MATLAB. This study established, through experimental model, that geothermal energy conditions in Olkaria are viable in recycling PET plastics. These findings, will enhance control of environmental pollution and create job opportunities in the recycling process. The study recommends that Kenyan government should explore the utilization of geothermal energy in the recycling of PET plastics.

Keywords: experimental model, geothermal energy, recycling and polyethylene terephthalate

Rapporteurs Report

Presenter's name: Anyona Kennedy	
Title/Topic of presentation: Experimental Model Investigating Potential of Geothermal Energy in Recycling Polythylene Terephthalate	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Plastic is a malice to the environment b) Use of direct geothermal energy can enable waste control	
Questions /key points discussed: a) Why recycle only one type of plastic (PET) when there are so many types that are a menace to the environment? Consider including other types of plastic in the study b) Must the plastic be taken to Olkaria for recycling?	
Responses/general recommendations: Good Presentation	
Name of session chair:	**Name of session rapporteur:**

Dr. Njenga Mburu	Loice Kemuma

Assessing the Impacts of Land Use Land Cover Changes on the Water Levels Using Remote Sensing in Tana River Basin

Arthur W. Sichangi[a]

[a]Institute of Geomatics GIS & Remote Sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya, E-mail: arthursichangi@yahoo.com

ABSTRACT

Linking the river flow regime and the land use land covers changes (LULCC) is crucial in ensuring sustainable use of resources. This study discusses hydrological impacts of the LULCC on the water levels derived in Tana River basin. The changes in water levels were extracted from satellite altimetry observations at a virtual station. LULCC were obtained through the analysis of MCD12Q1 Moderate Resolution Imaging Spectroradiometer (MODIS) product from the year 2009 to 2018. The MCD12Q1 product was reclassified into six classes: forestland, grassland, cropland, wetland, artificial areas and others. The short-term changes in land use were quantified using the normalized difference vegetation index (NDVI) derived from MOD13A3 MODIS product. Preliminary analysis of the trends indicated a 39.47% increase in the cropland and a 46.88% increase in the annual water level changes. A 10-year plot of the monthly water levels revealed an increase in the water level from January to May, followed by an increase at a decreasing rate from May to November, and finally a decrease in December.

Keywords: *Land Use/ Land Cover, Remote Sensing, Satellite Altimetry, Water Levels.*

Rapporteurs Report

Presenter's name: Dr. Arthur Sichangi
Title/Topic of presentation: Assessing the Impacts of Land Use Land Cover Changes on the Water Levels Using Remote Sensing in Tana River Basin
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/key points from presentation: a) Hydrological impacts of the LULCC on the water levels derived in Tana River basin b) Short-term changes in land use

c) Increase in the water level	
Questions /key points discussed: a) Did you consider variation of snow from Mount Kenya? b) Which is the most simple and affordable technology that the government can employ to contain flash floods? c) Study was limited by parameters guided by it and the resolution of the data set	
Responses/general recommendations: Good Presentation	
Name of session chair: Dr. Njenga Mburu	**Name of session rapporteur:** Loice Kemuma

Influence of Agroforestry Age Stand on Physico-Chemical Soil Quality Parameters

[1]Benjamin Mutuku Kinyili, [2]Ezekiel Ndunda, [2]Esther Kitur

[1]Kenya Forest Services, PO Box 2501-30100, Eldoret, Kenya

[2]Department of Environmental Science, Kenyatta University, PO Box 43844–00100, Nairobi, Kenya

Corresponding authors: Email: bmkinyili@yahoo.com

ABSTRACT

The role of agroforestry in improving soil quality is well appreciated. However, there is debate as to how age of agroforestry practice affects soil quality especially in the tropical region of Sub Saharan Africa where adoption of the practice is fairly recent. Therefore this study determined the influence of agroforestry age stand on physico-chemical soil quality parameters. The study was conducted using survey research design from a sample of 73 individual farmers, selected using stratified, random sampling. Soils were sampled from adopters and non adopters using soil auger. At least five sub-samples were collected from each farmer and the soil mixed to get an integrated soil sample for analysis. The soil were packaged in two-kg khaki papers and taken to the laboratory for further physical attributes (sand, clay, silt and bulk density) and chemical analyses (pH, TN, TP, TOC, C/N and C/P). The exchangeable bases (K, Ca, Mg and Na) as well as micronutrients (Mn, Cu, Fe and Zn) were also analyzed. The results indicated that proportion of sand particles was significantly ($P <$

0.05) higher among non adopters as compared to adopters while silt and bulk density was significantly ($P < 0.05$) higher among the adopters. Sand particle decreased with increasing age of agroforestry adoption while proportion of silt and bulk density showed a significant increase in tandem to stand age of agroforestry. The TN, TOC and C/P ratio was significantly ($P < 0.05$) higher among adopters and increased consistently with age of adoption, while C/N was higher among non adopters and decreased with increasing age of tree stand. The trend in exchangeable bases and mineral contents in the soil were similar, where higher concentrations occurred among adopters and displayed an increase with regard to length of adoption of agroforestry. The current study lends support to assertion that length of agroforestry practice positively improves soil quality and therefore urges for up scaling mass adoption of the agroforestry practice.

Keywords: *Agroforestry, Physico-chemical parameters, Age of agroforestry adoption, Soil quality, Machakos*

Rapporteurs Report

Presenter's name: Benjamin Mutuku Kinyili	
Title/Topic of presentation: Influence of Agroforestry Age Stand on Physico-chemical Soil Quality Parameters	
Institutional affiliation: Kenyatta University	
Highlights/key points from presentation: a) No information on the age of agroforestry adoption on soil quality b) Agroforestry resulted in reduced sand and increased silt and bulk density in the soil c) Most physical and chemical properties of soil increased with agroforestry age	
Questions /key points discussed: a) Apart from nitrogen fixation, where do the other nutrients come from? b) What was the control in the study? c) Does productivity increase with agroforestry?	
Responses/general recommendations: Good Presentation	
Name of session chair: Dr. Njenga Mburu	**Name of session rapporteur:** Loice Kemuma

Characterization of Wheat Production Using Earth-Based Observations: A case study of Meru County, Kenya

Edwin Gitobu Mwobobia[a], Arthur W. Sichangi, Kuria B. Thiongo[a]

Institute of Geomatics, GIS and Remote sensing, Dedan Kimathi University of Technology, Nyeri, Kenya.

Email: gitobu87@gmail.com

ABSTRACT

Wheat demand in the world is on rise because of rural urban migration and overreliance on other types of food crops like maize. Earth based observations include use of remote sensing, climatic patterns and the phenomenon being studied. The production of wheat is affected by climatic changes and have better yields in areas with low temperatures and high altitude. The main objective of the research was to evaluate factors affecting wheat production using Earth -based observations. This was achieved through characterization of climatic patterns, correlating the effect of change of Land use to wheat production and correlating wheat growth seasons to wheat production. The analyses include study of drought, change in Land use Land Cover and understanding the wheat growth seasons from 1985 to 2018.Extreme cases of drought was investigated and the most affected years for meteorological drought are 2000,2001,2002 ,2016 whereby it shows monthly SPEI Value of -1.72,-2.3,-2.14 and -2.21 respectively whereas Agricultural drought years are 1991,1992, and 1996 with NDVI monthly anomaly of -81.26,-97.88 and -145.08 respectively .SPEI -6 and SPEI-12 is considered best for Event based and Perennial drought assessment because of the duration and from the analyses they give clear understanding of drought. Strong correlation is in change of Forestland (R=0.75) and Bare land (R=0.66), moderate correlation in Agricultural Land (R=0.42), a weak correlation in vegetation (R=0.32) and a very weak correlation between length of seasons (R=0.16) to wheat production. The year 2000,2008 and 2009 had low whereas 2017 and 2018 had high wheat production (7600,5200,4975,46450 and 27800 tonnes respectively). Both Agricultural and Meteorological drought affects wheat production. SPEI is a good method in the study of meteorological and NDVI anomaly for Agricultural drought. The future analysis should focus on prediction analysis of both drought and Land use Land Cover Changes.

Keywords; *Agricultural drought, Meteorological drought, Growth Seasons and Climate change.*

Rapporteurs Report

Presenter's name: Edwin Gitobu Mwobobia	
Title/Topic of presentation: Characterization of Wheat Production Using Earth-Based Observations: A case study of Meru County, Kenya	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Rural urban migration causes increase in wheat demand b) Wheat farming is affected by climate change c) Both agricultural and meteorological drought affect wheat production	
Questions /key points discussed: a) Consider socio-economic factors' effect on wheat production because they might be stronger than what you covered in your study b) Quantify your study	
Responses/general recommendations: Good Presentation	
Name of session chair: Dr. Njenga Mburu	**Name of session rapporteur:** Loice Kemuma

Modelling Yala Swamp Dry Season Inundation Variation in Response to River Yala Basin Changing Environment

Johanna A. Wanjala, Arthur W. Sichangi and Charles N. Mundia

Institute of Geomatics, GIS and Remote Sensing, Dedan Kimathi University of Technology, Nyeri, Kenya.

ABSTRACT

The sustenance and ecological functioning of wetlands depends on hydrodynamic processes influenced by variation in inundation over time and space. Anthropogenic activities and climate change have been reported to continuously cause a variation in the inundation pattern of wetlands, interfering with their ecosystems and hydrological regime. The effects has called for reclamation and protection of wetlands. Advancement in remote sensing has made it possible to study wetlands

spatiotemporal characteristics aiding in management of degraded wetlands. This study employed the technology to model dry season inundation pattern of Yala Swamp, in relation to the changing environment of River Yala Basin. The swamp's existence is currently being threatened because of unpredictability and the dynamicity of its inundation pattern. Population data from KNBS and Landsat imagery for the years 1986, 2006, 2015 and 2019 were used to estimate population density, inundation pattern, LULC changes and changes in LST. By utilizing historical inputs from TCWI, maximum likelihood classification, land surface temperatures, and population density, the future inundation pattern of Yala Swamp in 2029 was predicted using CA-Markov Chain Analysis Model. Yala Swamp inundation characteristics were classified into dryland, riparian, swamp and water, while LULC was classified into eight classes including swamp, water, bareland, grassland, cropland, plantation, urban and forest. The results established that the swamp has lost approximately 38% of its area in the span of 33 years. It is projected to lose 12% more in the next 10 years. It was also observed that a strong negative correlation exists between inundation and LST with an R^2 value of 0.9.

Keywords: *Yala Swamp, Inundation Pattern, Cellular Automata, Markov Chain Analysis, Change Detection*

Rapporteurs Report

Presenter's name: Johanna Anyesi Wanjala	
Title/Topic of presentation: Modelling Yala Swamp Dry Season Inundation Variation in Response to River Yala Basin Changing Environment	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Anthropogenic activities and climate change cause variations in inundation patterns of wetlands b) Remote sensing aids in reclamation of wetlands c) Yala swamp is under threat because of unpredictable inundation patterns	
Questions /key points discussed: a) Have you considered the ecological activities along Yala Swamp? b) How does the study plan on reclaiming the lost swamp?	
Responses/general recommendations: Good Presentation	
Name of session chair:	**Name of session rapporteur:**

Dr. Njenga Mburu	Loice Kemuma

Potential of Remote Sensing Data in Monitoring Water Quality at Ndakaini Reservoir Dam, Kenya

Kibetu, Dickson Kinoti[1],

1.Department of Social Sciences, Chuka University, Po Box109, Chuka, Kenya, Email dkinoti@chuka.ac.ke.

ABSTRACT

Globally, pollution from anthropogenic inputs and natural processes threaten many fresh water bodies. In Kenya particularly, drought and occasional floods adversely impacted on quality and quantity of open surface waters. It is therefore important to continuously monitor water quality to ensure good health for human beings and proper functioning of natural ecosystems.

Currently, the use of in situ observation methods for assessing water quality in most reservoirs is not available and if then it is inadequate as the measurements are periodically and selectively done. To explore alternative methods, remote sensing based techniques were considered due to their synoptic view and repetitive coverage. The aim of this study was to assess key independent water quality parameters using moderate resolution satellite imageries within Ndakaini dam, a major source of domestic water for the county of Nairobi, Kenya.

Specifically, this study assessed variability in Chlorophyll concentrations (Chl_a), water temperature (SST) and Suspended Sediment Concentrations (SSC) at the reservoir before and after April-May 2018 floods. These parameters determine to a larger extent drinking water quality for open large reservoirs along the tropics. Landsat 8 OLI/TIRS imageries from USGS Earth explorer were analysed with different geospatial soft wares and integrated models for monitoring water quality. Resulting water quality variables were then compared to the Environmental Protection Agency (EPA) surface water standards of 2001 and other locally published drinking water quality benchmarks.

Assessed water quality parameters at the reservoir showed a spatial and temporal variation before and after the floods for the duration considered. Trophic state analysis showed that Ndakaini drinking Water dam is a low level pollution Mesotrophic lake.

Keywords: Ndakaini, Reservoir, Remote sensing, Water Quality, Monitor

Rapporteurs Report

Presenter's name: Kibetu Dickson Kinoti	
Title/Topic of presentation: Potential of Remote Sensing Datain Monitoring Water Quality at Ndakaini Reservoir Dam, Kenya	
Institutional affiliation: Chuka University	
Highlights/key points from presentation: a) Pollution threatens open water sources quality b) Measures to ascertain water quality are inadequate c) Spatial and temporal variation before and after floods considered	
Questions /key points discussed: a) Did you validate your data with remote sensing in comparison to what is on the ground?	
Responses/general recommendations: Good Presentation	
Name of session chair: Dr. Njenga Mburu	**Name of session rapporteur:** Loice Kemuma

Assessing Socio-Economic Drought Spatial Inequalities in Arid and Semi-Arid Basin Ecosystem

Duncan Maina Kimwatu[a], Charles Ndegwa Mundia[a] and Godfrey Ouma Makokha[a]

[a]Institute of Geomatics, GIS and remote Sensing, Dedan Kimathi University of Technology, Private Bag, Nyeri, 7381, Kenya, E-mail: duncan.kimwatu@dkut.ac.ke

ABSTRACT

Socio-economic drought is a situation whereby demand for a certain socio-economic commodity exceeds its supply. In context to pastoralists community's, water and pasture are the most essential

commodities for their livelihood. Acute water shortage and degraded rangelands have negative impacts to the pastoralist's communities. Scarcity and uneven spatial distribution of water and pasture within Upper Ewaso Ngiro River Basin (UENRB) is a nightmare to locals for a long period. This is manifested by frequent famine, rivalries among the neighbouring communities as well as human-wildlife conflicts. This is attributed by low rainfall, high water demand surpassing available water resource, degraded rangelands and uneasy access to available water sources. Assessing socio-economic drought is difficult and complex process in a heterogeneous basin ecosystem. Little attention has been paid to assess socio-economic drought as most researchers assess other environmental droughts such as meteorological, agricultural and hydrological droughts.

This study focused on assessing spatio-temporal inequalities of socio-economic drought in an Arid and Semi-Arid basin ecosystem of the Upper Ewaso Ngiro River Basin in Kenya. Socio-economic drought was assessed based on Domestic Water Deficit Index (DWDI), Dry Bare Soil Index (DBSI) and cumulative travel time to water reach point derived using Tobler's hiking model. Equal weights logical combination amongst normalized DWDI, DBSI and travel cost was performed to generate socio-economic drought index for January 1995. February 2000, January 2005, 2009, 2015 and 2018. DWDI values for 1995, 2000, 2005, 2009, 2015 and 2018 were 0.98, 0.99, 0.98, 0.79, 0.98 and 0.93 respectively which revealed severe socio-economic droughts since they surpassed the equilibrium value of 0.5 which signified the normal condition. The DBSI average values for 1995, 2000, 2005, 2009, 2015 and 2018 were -0.71, 0.19, 0.39, 0.29, 0.08 and 0.07 respectively revealing that January 2005 experienced high depletion of vegetation manifesting high socio-economic drought while January 1995 registered lowest DBSI value revealing less degradation thus low socio-economic drought when compared with others years.

The generated cumulative travel time to water reach points revealed that the minimum travel time was 0 minute while the maximum travel time was 18days, 21hrs and 56 minutes. Derived socio-economic drought index (SEDI) for 1995, 2000, 2005, 2009, 2015 and 2018 had average values of 0.54, 0.56, 0.59, 0.51, 0.57 and 0.52 respectively. This implied that January 2005 registered high socio-economic drought while January 2009 revealed least SEDI value when compared to others. Using SEDI values it is evident that the socio-economic drought for all the months under investigation surpassed the normal condition. The findings in this study provide baseline information and facts for formulating appropriate local socio-economic drought mitigation and water resources planning and management. Further research is recommended to establish how

overstocking, agricultural yields, uncontrolled water abstraction in the upstream as well as existing government policies could improve the findings of this study.

Keywords: *environmental drought; socio-economic drought index; domestic water deficit index; bare soil index; cumulative travel cost; equal weighting.*

Rapporteurs Report

Presenter's name: Duncan Kimwatu	
Title/Topic of presentation: Assessing Socio-economic Drought Spatial Inequalities in Arid and Semi-Arid Basin Ecosystem	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/key points from presentation: a) Socio-economic drought b) Cumulative travel time c) Water deficit index d) Bareness	
Questions /key points discussed: a) Is the model applicable in all areas or restricted to arid areas? b) The research aids the community by highlighting areas in dire need of water sources	
Responses/general recommendations: Good Presentation	
Name of session chair: Dr. Njenga Mburu	**Name of session rapporteur:** Loice Kemuma

TRENDS IN TECHNICAL EDUCATION AND TRAINING (TTE)

Maximizing on Teaching Practicum Exercise in Technical Training Institutions

Paul Wanyeki

Department of Education Technology, Dedan Kimathi University of Technology, Private Bag, Nyeri-10143, Kenya,

ABSTRACT

Teaching practicum requires thorough preparations for one to be successful. Over and above the area of specialty, a teacher trainee requires knowledge of educational psychology, curriculum studies and educational foundations courses. This knowledge will help a teacher trainee to adapt a personal teaching philosophy. The personal philosophy will aid the student teacher to be a reflective and reflexive teacher. This is a teacher who learns through hypothesis testing, context analysis, theorizing, inquiring, experimenting and justifying. If student teachers are well equipped with the stated abilities then they will be able to get maximum benefit of teaching practicum exercise. Such competency has to be built through searching and identification of oneself as a student teacher, based on one's personal philosophy of teaching and learning. For the cooperating teacher and assessors to help the students better their teaching competencies, they ought to have an elaborate assessment guideline. This is a guideline that can measure attitude, skills and knowledge. Teaching practicum (TP) assessment instruments provide insight into the nature of the knowledge that the university expects university-appointed tutors and school-based supervising teachers to have in order to make fair judgments about a student's teaching competence. This paper explores mechanisms that could be employed to maximize student experience during the teaching practicum exercises in technical training institution.

Rapporteurs Report

Presenter's name: Paul Wanyeki
Title/Topic of presentation: Maximizing on Teaching Practicum Exercise in Technical Training Institutions.
Institutional affiliation: Dedan Kimathi University of Technology
Highlights/ key points from presentation: a) The study aimed at maximizing on Teaching Practicum Exercise in Technical Training Institutions. b) The presenter highlighted that, practicum teaching constituted an important part of teacher education and that implementation of teaching practicum was important to bridge the gap between what student teachers had learnt in the program and the reality of teaching practice in schools. c) The presenter pointed out that studies focusing on Kenyan student TP experience had been comparatively limited and that it was the first time DeKUT had conducted TP exercise and data of optimization was important for preparation of subsequent students' teachers. d) The study found out that on the purpose of teaching practicum, it was cited that teaching practicum

provided a platform to practice practically what they had been taught theoretically in lectures and that teaching practicum exposes one to acquire necessary soft skills and experience in teaching like leadership skills, socialization skills, organization skills, problem solving skills and teaching skills .

e) The study concluded that, for maximizing and optimization of the impact of TP a thorough prior preparation should be done. Also, management of the TP exercise before, during and after should be improved as all the objectives are to be met within limited time, 10 weeks.

f) The study recommended that practicum should be done in institutions that are well equipped with educational media resources, emphasis to be put on lesson plan and schemes of work preparation during GTM lessons & MT and seek learners' feedback to improve teaching strategy and TP exercise to be done after fourth year when the students have completed the syllabus and undergone industrial attachment.

g) Also increased cooperation between the university and TTIs in the training of ST as this will make the cooperating teachers take a more active role in ST preparation during TP.

Questions /key points discussed:

A question was raised on whether there was any feedback from respective institutions.

Responses/general recommendations:

a) The presenter confirmed that the feedback information was little from the students' teachers.

b) The presenter was asked include sensitization on bullying of students' teachers by cooperating teachers on study recommendations.

c) To have a recommendation considering having two teaching practicum one at the beginning of the studies and the other at the end of the course.

d) To inter-relate the Technical Training Institutes with the University curriculum and also have the ministry involved.

e) A clarification was made that HELB does not provide funds for teaching practice.

Name of Session Chair:	**Name of Session Rapporteur:**
Prof. Wanjiku Khamasi	Ms. Nancy Koigi

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Cyberspace Situational Awareness: Measure and Manage it

David A. O. Njoga and Samuel Liyala

Corresponding Author Email: david.njoga@cictgov.co.ke

ABSTRACT

The sustainable development goals (SDGs) were designed to serve as a useful guide for focused and coherent action on sustainable development at the global, regional, national and local levels, and also help to mainstream sustainable development into the United Nations system by 2030. Information, a leading factor of production cutting across all sectors lacks the due consideration as a significant enabler of progressive development. SDGs have set up a local, regional and global collaboration arena which inevitably involves among others intensive information sharing, collaboration, distribution and preservation in the cyberspace, powered by assorted information communication technologies (ICT). The cyberspace, however, has been targeted by cybercriminals with the view to compromising the confidentiality, integrity and availability of strategic information systems. With Kenya as a case study, using purposive sampling and qualitative analysis using Cybersecurity Capability Maturity Model (C2M2), this study explores the level of cyberspace situational awareness with a view to leveraging on its maturity level. It is established that cyberspace situation awareness is an obligatory requisite towards cyberspace security management approaches which is predominantly technical solutions oriented. The study further reveals that a thorough and comprehensive cyberspace incidents' intelligence, surveillance reconnaissance are vital, but missing components to achieving a mature, measured and managed cyberspace which may guarantee the achievement of the SDGs. In view of these findings, we demonstrate and create insights into how other non-technical thematic areas are pertinent towards the cyberspace situational awareness. It is recommended that adopting suitable framework encompassing technical, social and political facets would enable a maturity, sustainability and furtherance of cyberspace situational awareness, being core ingredient of information governance, thus the achievement of the SDGs.

Key Words: *Information, Cyberspace, Situation, Awareness, Governance, Surveillance, Intelligence, Maturity*

Towards Human Technology for Kipsigis Language Part of Speech Tagging

Benson Kituku, Cheruiyot Kirui

Department of Computer science, Dedan Kimathi University of Technology, Nyeri Kenya.

Benson.kituku@dkut.ac.ke, amoskirui5@gmail.com

ABSTRACT

This paper describes the development of a data-driven part-of-speech tagger for the resource-scarce Nilotic language of Kipsigis. Fourteen thousand corpora were manually annotated for classification task and a ninth of it was used to train a memory-based tagger while the rest for testing purpose. The results were very encouraging with Overall: Precision of 88.38%, recall of 88.25%, F- score of 88.63% and an average accuracy of 94.49%. This result demonstrates that language technology can be developed using a limited amount of corpus for spoken and under resourced languages.

Keywords: *Part of speech tagging, Data Driven, Tagger, corpus and Annotation*

Rapporteurs Report

Presenter's name: Benson Kituku	
Title/Topic of presentation: Towards Human Technology for Kipsigis Language Part of Speech Tagging	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/ key points from presentation: a) The study aimed at maximizing parts of speech tagging. b) There was need to generate more corpus, improve accuracy and incorporate in other tools.	
Questions /key points discussed: a) What was the size of the corpus? b) How were the different dialects accounted for? c) Where was involvement of linguistics experts and how were they sourced?	
Responses/general recommendations: a) The study had already translated 14,000words. b) The presenter explained how the use of punctuation and context come into play in translation words in different dialects, sentence structure and construction. c) The study used native speaker.	
Name of Session Chair: Prof. Henry Nyongesa	**Name of Session Rapporteur:** Hadija Dahal

The K-9s Dogs in Security Operations: An Assessment of the Their Performance in Detecting and Locating Explosive Materials

Donald W. Theuri

Institute of Criminology, Forensic Science & Security Studies Dedan Kimathi University of Technology

Email : donald.theuri@dkut.ac.ke, Tel: +254722957658

ABSTRACT

Explosive sniffer dogs also known by acronym 'K-9s' are specifically trained to detect and locate explosive substances in a working scenario. This capability has been enhanced acquainting the K-9s by experiences of screening for explosive substances in a working scenario. The concept of screening for was conceptualized as a series of events incorporating four independent variables: the K-9s knowledge; skills for detecting and locating explosive substances; their experiences coupled with time as dependent variable. These variables were studied by observation method in a quasi-experimental settings.

Several studies have depicted that the phenomena of using K-9s lacks adequate empirical studies. This study assessed the performance of the K-9s in a working scenario. This study assumed that the K-9s are enabled to perform in their working scenario by the variables studied. The K-9s knowledge; their skills in detecting for explosive substances; their skills in locating for explosive substances and their experience as independent variables for this study. Time taken in a working scenario was conceptualized as the dependent variables. Five attributes for the K-9s knowledge and five attributes for the K-9s skills in detecting and locating for explosive substances were observed. The K-9s experience was observed as the number of years each K-9 has had in a working scenario. These variable attributes were measured in an interval scale. The data were analysed by descriptive statistics and the relationship for the variables was determined use by of Pearson's correlation. A significant negative correlation was established between the K-9s knowledge and time taken in a working scenario. A significant negative correlation was established between the K-9s skills in detecting for explosive substances and time taken. An insignificant correlation was established between the K-9s experience and skills in a working scenario.

Keywords *: K-9s; explosives; detection and locating.*

Rapporteurs Report

Presenter's name: Theuri D. W (Col Rtd)	
Title/Topic of presentation: The K-9s Dogs in Security Operations: *An Assessment of the Their Performance in Detecting and Locating Explosive Materials*	
Institutional affiliation: Dedan Kimathi University of Technology	
Highlights/ key points from presentation: a) The study main aim was to determine the dependability of the dogs in security through intelligence, skillss in locating, and time taken in locating subs. b) It was mainly determined by cognitive ability and conditional and operant methods of training were used.	
Questions /key points discussed: a) What were the legal provisions for this study? b) What knowledge gap is being addressed?	
Responses/general recommendations: a) No empirical method of testing.	
Name of Session Chair: Dr. Ruth Kaguta	**Name of Session Rapporteur:** Hadija Dahal

Inspiring Research, Innovation and Technology Transfer

DeKUT recognizes that operating a Technology and Innovation Support Centre (TISC) will provide a ready pool of science and technical experts with competence to conduct patent search, patent drafting as well as assist in patent prosecution and benefit from the IP capacity-building interventions of KIPI which will ultimately result in increased IP creation, protection and commercialization in the local community.

KIPI and DeKUT have agreed to undertake the TISC project under the terms and conditions set to achieve the following objectives:-

a. Strengthen the institutional capacity of DeKUT to offer a variety of IP services to its clients including patent searches, patent drafting and assistance in prosecution of IP applications.

b. Increase accessibility by DeKUT to technological information contained in patent literature and other sources.
c. Increase innovative and inventive outputs manifested by increased patent filing by or through DeKUT.

Figure 1: Launching of the TISC centre from L to R; Ms Hadija Dahal (Admin, RIMCL, DeKUT), Dr Moses A Ollengo (Director RIMCL, DeKUT) , Prof Esther N Magiri (DVC A&F, DeKUT), Prof Paul N Kioni (VC, DeKUT), Mr Sylvance A. Sange (MD, KIPI), Dr Salome Guchu (CEO, KENIA), and Mr Peter Chege (KIPI), durirng the sidelines of The 5th DeKUT International Conference on Science, Technology, Innovation and Entrepreneurship.