TABLE OF CONTENTS

THEME: AGRICULTURE

HEALTH AND NUTRITION

NATURAL RESOURCES

ICT

CONFERENCE PROGRAMME

ABOUT THE CONFERENCE

The 3rd EAC Regional STI Conference is convened under the overarching theme of *"Accelerating development and diffusion of Science, Technology and Innovation solutions for a green, inclusive and resilient East Africa"*. This biennial Conference builds on the deliberations and success of the 1st and 2nd conferences, which were respectively held in Kampala, Uganda in 2019 and Bujumbura, Burundi in 2021. The Conference will bring together diverse actors in the STI system, including policy makers, industry players, academicians, researchers, innovators, students and development partners.

The Conference aims to be a multifaceted platform for the STI players in the EAC region and beyond to share their experiences, best practices and results within the knowledge and technology generation, translation and transfer chain. The Conference shall consist of keynote presentations, paper presentations, panel discussions, exhibitions and high-level policy makers interaction session.

Under the overarching theme, the conference engagement sessions will be structured into four thematic areas, namely:
(i)   Agricultural Productivity, Resilience and Food Security;
(ii)   Health and Nutrition;
(iii) Natural Resources Management; and
(iv) Information Communication Technology and Digital Economy.

All full paper submissions in the conference will be peer-reviewed and evaluated based on originality, technical and/or research depth, accuracy and relevance to conference theme and topics. The accepted peer-reviewed papers will be published in the East African Journal of Science, Technology and Innovation (EAJSTI) to boost the dissemination of research findings within the region and improve regional visibility and competitiveness.

SPEAKERS

Hon. Dr. Peter Muthuki
Secretary General, East African Community

Hon. Ezekiel Machogu, CBS
Cabinet Secretary, Ministry of Education, Kenya

Dr. Sylvance Okoth
Executive Secretary, EASTECO

Prof. Gaspard Banyankimbona
Executive Secretary, IUCEA

Mr. Fortunate Muyambi
Deputy Executive Secretary, EASTECO

Prof. Idris Rai
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SPEAKERS

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AGRICULTURE

Factors Influencing Farmers' Choice of Agrometeorological Information Pathways

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Abstract

Development of agriculture sub-sector in Kenya is adversely affected by climate change and variability due to overdependence on rain-fed agriculture and use of outdated farming technologies. Agrometeorological information dissemination likely boosts farmers' production, planning, and adaptation strategies. The effectiveness of agro-information among farmers depends on packaging of the information and the dissemination pathway used. Despite their transformative potential, factors influencing the choice of information dissemination pathways among small-scale sorghum farmers remain unclear, while their adaptive capacity to the threats of climate variability remains weak.

This study intends to address the aforementioned gap by identifying information pathways used by sorghum farmers and evaluating socio-economic, institutional, and land-related characteristics influencing access to such pathways. Primary data were collected using a pretested semi-structured questionnaire from 423 randomly selected small-scale sorghum farmers in Busia sub-county, Kenya. A multivariate Probit model was used to analyse factors influencing farmers' choice of agrometeorological information pathways. Education, gender, proportion of income allocated to farming, access to credit facilities, frequency of extension visits, training counts, access to internet services, radio ownership, and use of comprehensible language influenced choice of agrometeorological information dissemination pathways.

In this regard, pathways found to be complementary or substitutes give new knowledge on channels to adopt in information dissemination. Policy formulations should enhance the use of these pathways to improve farmers' adaptation to climate change strategies.

Keywords: *Agrometeorological information, climate variability, dissemination pathway, Multivariate Probit model, small-scale farmers*

Effect of Pollinator Visitation Frequency to Flowers On Fruit Development and Yield of Butternut *(Cucurbit moschata).*

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Abstract

Butternut (Cucurbit moschata) is one of the crops that are gaining commercial importance in Kenya after its introduction to smallholder farmers in the year 2000. The fruits are a rich source of vitamins, energy and minerals. They also contain proteins, carbohydrates and fats. In crop production, the process of fertilization takes place in the flowers through pollination. Most plants rely on either animals or the wind for their pollination requirements, usually referred to as pollinators.

The butternuts usually have a bisexual flower system, hence pollen grains from the male flowers have to be moved to the female flowers in order for fertilization to take place. A study was carried out at Matuga in Kwale County to determine the minimum number of times a pollinator requires to visit the female flower of butternut in order to facilitate proper fruit production and seed development. Butternut plants were established in plots of 9 x 10 m and replicated three times. At flowering, the flowers in some plots were bagged throughout to prevent pollination while those in other plots were bagged after a certain number of pollinator visitations.

In some of the plots, the flowers were left open for unlimited number of pollinator visitations. At maturity, the fruits were harvested in each of the plot and data collected on various parameters was analyzed using SPSS. The results showed that honey bees were major pollinators for butternuts. No fruit development occurred in those plots whose flowers were bagged throughout. Fruit formation was realized with a minimum number of 6 bee visits to a flower. However, proper fruit development was attained after an optimum number of 14 bee visits. The study recommends that butternuts farmers should complement the bee activity in their farms by installing some bee hives (298 words).

Key Words: *Butternut, fertilization, pollinators, visitations, yield.*

Development and evaluation of a reverse transcription loop-mediated isothermal amplification (RT-LAMP) for rapid typing of serotype 'O' foot-and-mouth disease virus in endemic regions of Tanzania

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Abstract

Foot-and-mouth disease (FMD) is an economically viral disease of all cloven-hoofed animals. Caused by FMD virus (FMDV), the disease threatens sustainable food production which is geared towards solving food security problems and poverty. In Tanzania, four serotypes are in circulation but serotype 'O' has the widest distribution. The disease is endemic in Tanzania with outbreaks occurring annually, with losses evidenced in production, death in young stock, and trade sanctions on livestock and livestock products, hence timely diagnosis is vital to inform on control measures. A reverse transcription loop-mediated isothermal amplification (RT-LAMP) assay that can rapidly and accurately diagnose serotype 'O' FMDV under laboratory settings was developed for appropriate management of the disease. A total of 44 archived FMDV epithelial tissues from cattle collected from different regions in Tanzania were purposively employed and LAMP primers were designed using Primer Explorer V5 software. The virus was screened using RT-LAMP from extracted total RNAs, while t he detection of serotype 'O' VP1 gene was carried out using the designed LAMP primers.

To determine specificity, cross-reactivity was evaluated using serotype 'O' primers against other FMDV serotypes while sensitivity was inferred as a detection limit by conducting an RT-LAMP assay on a serial ten-fold dilution of one viral sample. The RT-LAMP assay successfully amplified the 3D *polymerase* gene of FMDV. The VP1 gene of serotype 'O' FMDV was detected within 13—26 min, with annealing derivatives in the range of 70.0—89.0°C. The assay was highly specific as no cross-reactivity occurred and recorded a detection limit of 3.78×10^{-2} ng/µl at 10^{-2} dilution. This assay is rapid, accurate, and cost-effective. Furthermore, it enhances FMDV surveillance, provides baseline information for managing outbreaks, and supports the development of serotype-specific vaccines, ultimately addressing concerns related to food security and agriculture.

Keywords: *LAMP, FMDV, VP1* gene, diagnosis

Assessing the Impacts of Invasive Weed *Parthenium hysterophorus* (Ragweed) to Plant Diversity in Baringo Lowlands Kenya

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Abstract

Parthenium hysterophorus is recognized as a substantial threat to biodiversity, agriculture, and public health. Despite well-documented impacts, a knowledge gap persists concerning the mechanisms through which *Parthenium hysterophorus* influences the diversity of native plant species and soil attributes across diverse land-use contexts. A comprehensive assessment of the impacts of *Parthenium hysterophorus* on native plant communities' populations within invaded landscapes in Baringo rangelands, Kenya was conducted during the dry and wets seasons of 2023. The study was aimed at evaluating Parthenium weed effects on the diversity and population dynamics of native plant communities and soil seed bank within the rangelands under diverse land uses. Vegetation sampling was carried out during the dry and wet seasons to account for temporal variability.

For each land use type (grazed fields under natural pasture, seasonal cropping, seeded pasture), 1 x 1m quadrats were placed at a 10m interval along a 200m transect and plant species diversity, population, dominance and percentage cover assessed. Significant Parthenium weed densities were observed between the land uses whereby seeded pasture had lower Parthenium invasion densities compared to seasonal cropping and grazed rangelands. A higher plant species diversity was observed in seasonal cropped land, while grazing field showed loss of native plants due to competition and browsing by animals. This study has shed light on Parthenium weed's ecological effects on native plant communities which is vital for devising effective control measures and management strategies.

Keywords: *Biodiversity, Land-use Impacts, Soil Seed Bank, Plant Community Diversity*

Climate Smart Agricultural Technologies (TIMPS) as a Resilience Strategy for Semi-Arid Agroecosystems production in Kenya

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Abstract

Improving soil moisture levels is a fundamental strategy to enhance crop productivity and t he resilience of semi-arid agroecosystems. Zai pits and semicircular bund technologies coupled with the right climate smart crops offer great agro ecological potential as such practices conserve soil moisture, improves the soil ecology, stabilizes and enhances crop yield and water conservation. These technologies have been tested in several regions in African but side- by- side evaluations on same farm have not been validated. Thus, this study evaluated and validated performance of selected land, soil and water management strategies in conserving soil moisture and improvement of crop production. The study adopted an integrated land and water management approach which incorporated validation of existing climate smart natural resource management practices when applied together with climate smart crops. A Side-by-side comparison of crops and soil water management measurements was implemented for Zai pits and semicircular bunds for soil moisture conservation in green grams and pigeon pea cropping in Machakos and Tharaka Nithi counties of Kenya. Biometric data collection, yield and yield components and monitoring of soil moisture was carried out in the long rains and short rains of 2021 and 2022. Our findings showed significant improvement in the yield of climate smart crops planted in Zai pits and semicircular bunds. Water and soil management practices had significant effect on soil moisture retention during the study period at 0-15 cm soil depth at various growth stages. Zai pit had the highest soil moisture levels which corresponded to a significantly improvement in yield by 43 and 30% in green grams and pigeon pea respectively compared to a control across the seasons and crop growth stages. The studied technologies emphasize the importance of diversifying climate smart strategies in farming systems to enhance resilience of agricultural systems and reduce vulnerability to extreme climatic events.

Keywords: *Climate Smart Agricultural Technologies, Green grams, Soil moisture, Crop Yield, Zai pits*

The effect of different growing media on seed germination and seedling growth of *Telfairia pedata*

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Abstract

Telfairia pedata (Smiths ex Sim) Hook commonly known as Oyster nut, a herbaceous vine belonging to Cucurbitaceae family, regularly grown as a food crop in Tanzania, the coast of Kenya, Uganda, Mozambique and Angola, essential to the livelihood of small-scale farmers in East Africa. Despite the species' importance in enhancing agro-biodiversity, it's nutritional, and economic value to the community, little is known about its seedling growth performance in different growing media. A field experiment was conducted at the Forestry Training Institute, Olmotonyi nursery in 2021 to assess the growth performance of *T. pedata.* Replicated three times, a Randomized Complete Block Design (RCBD) was applied.

The experiment involved pretreated seeds of *T. pedata* in hot water (100oC) and four types of growing media (forest top soil, sand soil, clay soil with NPK and silt soil as a control) were used. Height of the seedlings (cm), number of leaves, average height (cm), root collar diameter (cm) and germination percentage were determined. The chemical properties of each growing media including nitrogen, pH, potassium and phosphorus were also determined. The findings of this study after 12 weeks indicated that the germination of *T. pedata* had early sprouting (83%), seedling height (65 cm), root collar diameter (2.84 cm) and average number of leaves (3.0) recorded significantly higher performance in seeds raised in soil with NPK while the seeds raised in silt soil had the lowest performance. The findings of this study showed that the growth media containing fertilizer is recommended as appropriate growth media to improve soil fertility to raise and produce vigour *T. pedata* seedlings.

Keywords: *Germination, Soil mixture, Initial growth, Pre-treatments, Seedling, Telfairia pedata*

The determinants and impacts of agriculture loans on maize yield among members of maize producer organizations in Tanzania

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Abstract

Access to agriculture loans remains a challenge among smallholder farmers in East Africa. Various development partners, including governmental and non-governmental stakeholders in Tanzania, have made efforts to increase access to agricultural loans. One of the strategies to improve farmers' access to loans has been the creation of producer organizations. There is limited information on how farmers among producer organizations access agricultural loans and their impact on crop productivity. In 2022, we sampled 1140 maize farmers among producers' organizations in Rukwa and Ruvuma, Tanzania, to assess factors influencing the acquisition of agriculture loans and their impacts on maize yield. Analysis was conducted using the endogenous switching regression (ESR) model, a two-stage model that estimates factors in the first stage and impact estimations in the second stage. Results show that 25.53% of the surveyed households acquired agriculture loans in the 2021/2022 crop season. Of these, only 21.77% acquired the loan from the producer organization; the rest obtained loans from other sources such as commercial/development banks, microfinance institutions, fellow farmers, and credit groups. Despite their memberships in producer organizations, very few borrowers obtained loans directly from these organizations. In addition, membership in saving and credit groups, training, and herbicide usage influence agriculture loan acquisition. Results also revealed that agriculture loan users achieved a maize yield of 1359.73 kg, compared to the potential of 1262.96kg without the loan, indicating a boost of 106.77 kg. Non-users had a yield of 1245.82kg, but with the loan, their average yield would have been 2536.98kg, signifying a potential gain of 1291.16 kg for those not utilizing agriculture loans. Analyzing the impacts by gender of household heads showed that female-headed households had higher maize yield than male-headed households. These findings call for targeted efforts based on gender to increase access to agriculture finance.

Keywords: *Producer organizations; maize productivity; impact estimations; gender disparities*

Scaling hermetic storage bags through access to finance: lessons from Tanzania

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Abstract

Grain storage is a serious challenge among farmers in East Africa, primarily due to insect pests. Hermetic storage technologies, including the Purdue Improved Crop Storage (PICS), have gained traction among farmers, driven by investments from governments, donors, and the private sector. While the use of PICS bags to store grain for home consumption has increased, efforts to scale this technology for income generation have been lacking. Most farmers sell their maize at harvest and miss the opportunity to tap into price arbitrage during the lean season. In 2022, building on an existing input loan partnership, a Collateral Management Agreement (CMA) was established between banks and producers' organizations (POs) in the Rukwa and Ruvuma regions. The purpose was to ease the liquidity constraints that force farmers to sell their grain at harvest when maize prices are the lowest. The CMA was expected to unlock the stored maize grain's collateral value, thereby facilitating access to loans to meet household needs at harvest. Despite 33 POs applying for loans and over 50% being approved, the key players (banks and POs) did not actively participate in the CMA. An exploratory evaluation (EE) was conducted in 2023 to understand the dynamics behind this non-participation, involving 601 farmers (POs and non-POs members), 30 PO leaders, 30 village leaders, banks, and grain buyers. The EE revealed that several market and non-market factors influenced the non-participation in the CMA. These include: (i) low maize yields in both regions in 2022, (ii) historically high maize prices and uncertainty about future prices, (iii) banks' reluctance to add output loans to yet unpaid input loans; (iv) elevated warehouse management costs; and (v) high logistic costs (e.g., transport, cleaning, and packing the maize in PICS bag at harvest, and repacking in woven bags at the time of sale with no price premium guaranteed). These findings provide crucial lessons for shaping future interventions to understand further how to improve credit access and boost the adoption of hermetic bags.

Keywords: *Output loan, grain aggregation, credit access, farmers groups*

Impact of physical infrastructures on agricultural production in Burundi

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Abstract

In developing countries like Burundi, physical infrastructures are essential for the development of agriculture, the pillar of its economy. Our work considers four components of physical infrastructure: electricity, transport, ICT and water and sanitation. The Objective of this study is to evaluate the impact of physical infrastructures on agricultural production in Burundi. We use the Engle-Granger method to estimate quarterly data from 2005q1 to 2020q 4. First, the results revealed that all series under study are integrated of order one (ADF unit root test) and cointegrated (Engle-Granger cointegration test). Secondly, the OLS results show that in the long term, electricity, water and sanitation infrastructures considerably contribute to agricultural production, while ICTs influence agricultural production less. Furthermore, transport infrastructure has not immediate effect on agricultural production. Thirdly, the results of the ECM reveal that in the short term, ICTs play an important role in improving agricultural production, water and sanitation infrastructures have not impact and transport infrastructures have a negative and significant impact on agricultural production. These results have policy implications that would enable Burundian government decision-makers to adopt strategies aimed at increasing the resources allocated to basic physical infrastructures, in particular the electricity, water and sanitation, ICTs sectors, as well as to improve their offer.

Keywords: *Impact, physical infrastructures, agricultural production, Engle-Granger method, Burundi.*

Data-Driven Decision Making: A Case Study of Tertiary Institutions in Uganda.

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Abstract

Burundi, a small landlocked country in East Africa, faces a major challenge: feeding its growing population with limited arable land and often fragile soils. The majority of farmers cultivate without first analyzing the state of their soil, which leads to low yields, excessive use of inputs, and soil erosion. In order to increase agricultural productivity and quality, we propose an innovative solution: the use of the Internet of Things (IoT) and drones to transform Burundian agriculture. Drones are used to analyze soil conditions before cultivation. Equipped with sensors, they allow for the mapping of different soil types and the analysis of their nutrient content. This valuable information allows farmers to choose the best suited crops and optimize the use of fertilizers and pesticides. The IoT allows for real-time monitoring of crops and irrigation management. Smart sensors installed in the fields collect data on soil moisture, temperature, light intensity, and crop health status. This data allows farmers to closely monitor the development of their crops and make more informed decisions to optimize their production. Intelligent irrigation systems connected to the IoT can automate crop watering according to real needs, thus reducing water and energy waste. The use of these intelligent technologies optimizes the use of natural resources, reduces losses, and improves yields. Smart agriculture allows for the automation of certain tasks and the optimization of the use of agricultural inputs, which can reduce production costs for farmers. Smart agriculture helps reduce the use of pesticides and fertilizers, which contributes to protecting the environment and preserving natural resources. The development of smart agriculture can create new jobs in the agricultural sector, particularly in the areas of technology, maintenance, and training. In conclusion, the use of IoT and drones in Burundian agriculture is a major asset in meeting the challenges of agricultural development and improving food security and economic development in the country. By adopting these technologies and investing in farmer training, Burundi can ensure a prosperous future for its agricultural sector and its population.

Keywords: Challenges of agriculture in Burundi, Solutions provided by smart agriculture, Advantages of smart agriculture for Burundi

Super ovulatory response and embryo yield in pure Friesian, Inyambo, and crossbreed cows under field conditions in Rwanda

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Abstract

The study investigated the super ovulatory response and embryo yield in pure Friesian, Inyambo, and crossbreed cows under field conditions in Rwanda. Conducted between 2018 and 2019, 38 breeding donor cows and heifers from six different breeds were monitored across three cattle research farms. Variables included age, parity, body weight, body condition score, duration after last calving, and milk yield in peak lactation. Data encompassed the type of hormone used in donor superovulation, ovarian cyclicity, estrus signs, and the number of developed corpora lutea on the ovaries during embryo collection. Results revealed a total of 183 collected oocytes, yielding 107 transferable embryos, with an embryo recovery rate of 58.5% across all donor cows. The study investigated the influence of donor cow breed, age, parity, body weight, body condition score, duration after last calving, milk yield, type of hormone used, ovarian cyclicity, and estrus signs on the number of transferable embryos. Except the type of hormone used that significantly affected the number of morulae collected embryos, none of the other factors significantly affected the bovine embryo yield and recovery rate in this study. In conclusion, the bovine embryo recovery rate was deemed moderately good, suggesting potential application in Rwanda's dairy genetic improvement and Inyambo local breed genetic conservation through embryo cryopreservation. The study recommends further research to explore major factors influencing bovine embryo recovery rates for sustainable application in the mentioned contexts. (231 words).

Keywords: *Bovine embryo; inyambo breed; embryo recovery rate; superovulation protocol*

Business sustainability status measurements: A case of owners of agro-processing Micro Small Medium Enterprises in Morogoro municipality, Tanzania.

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Abstract

Purpose of this study is to evaluate business sustainability status of agro-processing MSMEs in Morogoro Municipality. The study employed a cross-sectional study design where data were collected in eight wards found in Morogoro Urban. Collection of data was done through questionnaires given to 183 MSMEs owners as a sample of the study. This study used factor analysis technique to explore business sustainability status. Social factors, economic factors and environmental factors emerged to be strong for business sustainability status. This generally implies that for agro-processing MSMEs to remain sustainable, the aforementioned three major factors must all be considered in combination and not in isolation of any.

Keywords: *Sustainability, MSMEs Morogoro Municipality, indicator and factor analysis*

Title Revolutionizing Agricultural Efficiency-Integrating NFC Technology in Precision Agriculture and Data Science Innovations

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Abstract

The agricultural landscape in East Africa is undergoing a transformative shift, propelled by the convergence of precision agriculture, data science and the integration of Near Field Communication (NFC) technology. This paper explores the symbiotic relationship between NFC technology and cutting-edge methodologies, aiming to elevate agricultural productivity, resilience and food security. Traditional agricultural practices face limitations in efficiency and resource management. However, the integration of NFC technology with precision agriculture offers a new frontier. NFC-enabled devices facilitate real-time data collection, enabling seamless communication between farm equipment, databases, and stakeholders. This integration optimizes decision-making processes, inventory management and product traceability.

The synergy between data science and NFC-generated analytics amplifies the potential for predictive modeling, disease monitoring, and precise resource allocation. NFC-generated data fuels analytics and decision support systems, enabling proactive measures to mitigate risks and enhance agricultural outcomes. Case studies within the East African context highlight the tangible advantages of NFC integration in precision agriculture. These instances showcase notable improvements in crop yield, resource optimization and streamlined supply chains. Such success stories underscore the transformative impact of NFC technology on agricultural sustainability and economic growth.

This paper emphasizes the necessity for ongoing innovation and collaboration to maximize the potential of NFC technology in tandem with precision agriculture and data science. By harnessing these integrated technologies, East Africa can fortify its agricultural sector, ensuring sustained productivity, resilience and food security in the face of evolving challenges.

Keywords: *NFC Technology, Precision Agriculture, Data Science, Agricultural Efficiency, East Africa*

Production, Utilisation and Indigenous Knowledge of Spider plant among Smallholder Farmers in Nyaribari Chache Sub County, Kisii County

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Abstract

Spider plant (Cleome gynandra) exists as cultivated or semi-cultivated crop with ecological, social and cultural values. It plays a significant role in the nutrition and food security of people in Kenya. This study sought to better establish the production, utilization and indigenous knowledge of spider plant among smallholder farmers in Nyaribari Chache sub county, Kisii County. A household survey was carried out for collection of primary data. Ten administrative sub-locations were randomly sampled for the study. Twenty households were randomly sampled from each sub-location to make a sample size of 200 households. Questionnaires and interviews were administered to collect data on production, utilization and indigenous knowledge of spider plant among smallholder farmers in Nyaribari Chache Sub County, Kisii County. Both descriptive and inferential analysis (t-test) were utilized to analyze data gathered. The analyzed data was presented using tables. The study established that there were relatively a small number of indigenous vegetables cultivated in Nyaribari Chache Sub County, Kisii County. Spider plant utilization among smallholder farmers was due to various factors such being tasty and nutritious, rich in iron, its medicinal value, has fast growth rate and suitable for recovering patients among others. Some farmers had some indigenous knowledge on spider plant utilization in terms of its value as an indigenous vegetable crop particularly on human nutrition and health such as being suitable for recovering patients. There was a statistical significance ($p<005$) among variables on production, utilization and indigenous knowledge of spider plant. These findings will be of significance to stakeholders especially Ministry of Agriculture and relevant NGOs to formulate policies to govern production of spider plant among small scale farmers in the study area and beyond. (276 words).

Key words: *Spider plant, Production, Utilization, Indigenous, Kisii*

Ambient air pollution exposure and child birthweight in East African Countries

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Abstract

Exposure to air pollution during pregnancy has been associated with adverse impacts on fetal development including reduced birth weights. However, the extent of these effects is poorly documented in developing countries. Using the latest published Demographic and Health Surveys and a unique MERRA-2 air pollution datasets, we developed the multilinear and logistic regression models to assess the effects of prenatal exposure to fine particulate matter (PM2.5), Carbon monoxide (CO), and Ground-level Ozone (O3) on the children's birth weight in East African Countries. Our estimates revealed that prenatal exposure to 1 ppb of O3 concentrations above the mean value reduced the birthweight by 0.0079 kg (standard deviation (SD): 0.0013; $p<0.01$). After adjusting the model for weather variables and household socioeconomic factors, the effect of O3 on birthweight was found to be moderate with a reduction of 0.0051 kg (SD: 0.0014 kg; $p<0.01$) on each increase of 1 ppb in prenatal O3 exposure above the mean value, and with adjusted odd ratio of 1.0063 (95% Confidence interval: 0.9741–1.0122; $p<0.05$) on the underweight birth occurrence. PM2.5 and CO did not demonstrate significant impacts on the birthweight ($p>0.05$), although CO seemed to act in the negative direction. Furthermore, the child birthweight was found to be much influenced by socioeconomic factors with children born in richer families or with higher maternal education levels recording higher birthweights than their counterparts. The findings from this study should be good informative for policies aimed at protecting child health by incorporating maternal health as an integral part of the air pollution control systems and increasing air pollution public awareness in local communities. However, the current study also suggests several areas for further research with one of the important questions being the identification of the susceptible exposure periods. (291 words).

Keywords: *Air pollution; birthweight; underweight birth; children growth; maternal health; East Africa*

Co-administration of Artesunate and Coenzyme Q10 enhanced treatment outcomes during experimental cerebral malaria by ameliorating lethal inflammatory and oxidative mediators

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Abstract

Cerebral Malaria (CM) is a form of malaria that is associated with high morbidity and mortality rates. The efficacy of the current antimalarial regimens has demonstrated poor treatment outcomes, thus the development of new approaches for the treatment of CM is urgently needed. This study aimed to evaluate the efficacy of co-administration of artesunate and Coenzyme-Q10 (Co-Q10) as adjunctive therapy for the treatment of cerebral malaria. Experimental cerebral malaria (ECM) was simulated in female C57BL/6 mice by infection with *Plasmodium berghe*i ANKA (PbA). Adjunctive therapy combined with 6 mg/kg body weight artesunate and 200mg/kg was administered and mice were sacrificed at the onset of ECM phase. Body and relative organ weights, survival analysis, parasitemia levels, and clinical scores were evaluated during the study period. At day 9 post-infection, mice were euthanized blood and various organs were processed for the analysis of oxidative and inflammatory mediators, blood–brain barrier (BBB) integrity, biochemical changes and edema. Co-administration of artesunate and Co-Q10 improved the survival rate, protected the integrity of the BBB, edema and improved neurological function in infected mice. Furthermore, the co-administration significantly decreased PbA-induced elevation of inflammatory cytokines (TNF- , IFN- , IL-1 , 1L-12 and IL-6) gene expression. The amplified levels of brain chemokines (CCR5, CXXR3, CXCL9, CXCL10), and adhesion molecules (ICAM-1 and VCAM1) caused by PbA were also annulled by co-administration. Notably, exposure to both artesunate and Co-Q10 promoted a reduction in serum levels of ALT, AST, urea, uric acid, albumin and creatinine, peroxidation and oxidant damage by ameliorating PbA-driven elevation of malondialdehyde (MDA) in the brain, liver, spleen and serum. Co-exposure to artesunate and Co-Q10 attenuated PbA-driven depletion of nitric oxide (NO) and reduced glutathione (GSH). In conclusion, this study demonstrated that artesunate combined with Co-Q10 could be useful in protecting against lethal inflammatory and oxidative mediators associated with pathophysiology observed during the ECM.

Keywords: *Artesunate, Coenzyme Q10, Experimental cerebral malaria, Inflammation, oxidation stress*

Factors associated with Menstrual Hygiene Management among adolescent girls in primary schools in Northern Division, Mbale city

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Abstract

The study sought to assess girls' knowledge, attitude and practices regarding menstrual hygiene management in Northern Division, Mbale City, Uganda. Active participation of the girl child in development is hampered by MHM challenges. MHM is an important gender issue and a critical component in holistic human development. It affects about 25% of the global population aged between 15 and 49 years. MHM amongst girls in rural government-run primary schools in Uganda is an under-examined area of research. The study aimed at assessing girls' Knowledge, Attitudes and Practices regarding MHM in Mbale City to generate data that would be used to plan for a program to create awareness about MH which will improve education and improve quality of life. A cross sectional study that involved collection of quantitative data. Data was collected using pre-tested semi structured questionnaires developed from reviewed literature. Data entry and cleaning was performed using EpiData version while analysis done using Stata version12. Proportions, measures of central tendency and measures of variation were used to describe the study subjects, the results were summarized into graphs, tables, and pie chart. A total of 408 primary school pupils were interviewed

The study respondents were randomly selected from 10 primary schools using simple random sampling technique. Overall 237/408 (58.2%) not knowledgeable about menstrual hygiene. Majority 213/408 (52.4 %) good attitude towards menstrual hygiene. 310/408(76.2) believed that menstruation was not a burden to women. More than half of the respondents 223/408 (54.55%) good menstrual hygiene practices. 208/408 (51%) used good absorbent materials and 245/408 (60.1%) changed pads twice a day. Fathers' occupation, mother's occupation and source of information were found to be significantly associated with knowledge of children regarding MHM. Age, parent's education level, parents' occupation and source of information were significantly associated with practice of children regarding MHM

Keywords: *menstrual hygiene management; knowledge, attitudes, Practices, global population, holistic human development*

iMake Food Dryer to Nourished Zero Food Waste in Northern Uganda.

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Abstract

Agriculture is the main source of livelihood in Uganda and across Africa yet 45% of harvested produce (mainly fruits and vegetables) are lost before consumption, according to FAO (2013). The post-harvest losses are due to the use of inappropriate post-harvest handling technologies to improve poor handling and preservation practices among farmers. The common methods used by 90% of the Ugandan farmers are open sun drying and solar dryers which are limited to drying high sugar and acid content fruits and not recommended for drying vegetables as they take 3-8 days to dehydrate, unhygienic and highly dependent on the weather which is very unpredictable in today's climate change. iMake Food Dryer is a high commercial temperature oven machine suitable for drying a very large variety of fruits and vegetables that prolong the shelve-life from 3 days to at least 1 year, increasing farmer's income by 100% and reducing food insecurity as it avails food in period of scarcity and climate unpredictability. It is powered by biogas made from kitchen and animal remains as clean biofuel and solar energy to dehydrate food clean while maintaining all the nutrients in typically 5 hours. It dehydrates 5 times faster than solar dryers and 10 times faster than the open sun drying method while maintaining all the nutrients in the food. With iMake, a farmer can dry up to 200kg of products within a day with only 5kg of biofuel through a gasification process with zero CO_2 emission despite whether it is raining or shining. This makes iMake not only reliable but also very convenient for use and environmentally friendly. The losses dose not only mean less food available for consumption, but also less profitability for the farmers, reducing their earnings and keeping them in the cycle of poverty. This challenge is affecting over 15 million smallholder farmers in Uganda, according to the Uganda bureau of statistics (2015).

Keywords: Turning post-harvest losses into profit, improving nutrition, and providing clean renewable energy to Africa.

A GIS-Based Method for Analyzing the Impact of Physical Planning in the Spread of COVID-19 in Kampala City

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Abstract

This study focused on analyzing the impact of Physical planning on the spread of COVID-19 in Kampala City, Uganda. This assessment was done based on the confirmed COVID-19 cases registered between 21st March 2020 and 27th March 2021 and the Kampala Physical Development Plan of 2012 as a standard to determine the level of conformance to Physical planning in Kampala City. The GIS-based methods that were used were the global Moran's Index, Anselin's Local Indicator of Spatial Association (LISA), Post-Classification Change detection, and the Geographically Weighted Regression (GWR) model. The Global Moran's I was used to determine global spatial autocorrelation whereas Anselin's LISA was used to determine the local spatial autocorrelation. The post-classification change detection was used to determine the level of conformance to spatial planning between the Kampala physical development plan and the existing land uses. The GWR was used to model the relationship between conformance to Physical planning and the spatial distribution of COVID cases.

Spatial distribution results show that the distribution characteristics of COVID-19 across Kampala are distinct with instances of clustering. Parishes located in the Central Business District were identified as the major disease risk whereas those located in the suburb Divisions of Kawempe, Makindye, Nakawa, and Rubaga were identified as cold spots of COVID-19. The trend of Physical planning in Kampala shows that the city is moving towards mixed-use developments with a positive non-conformity of 25.11%. Analysis through the GWR revealed a negative relationship between Physical planning and spatial distribution of COVID-19. Also, relationship results further specified that Physical planning could explain 51% of the variations in the spatial distribution of COVID-19 cases within Kampala City. Therefore, to transform Kampala into a pandemic-resilient city, there is a need to develop appropriate compact Physical planning designs. (291 words).

Keywords: *Physical Planning, COVID-19, Kampala City*

Sterilized malaria vector, Anopheles *funestus* can autodisseminate sufficient pyriproxyfen to the breeding habitat under semi-field settings

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Abstract

An. funestus, the dominant malaria vector, prefers to oviposit in permanent and/ or semi-permanent breeding habitats located far from human dwellings. Difficulties in identifying and accessing these habitats jeopardize the feasibility of conventional larviciding. Therefore, a semi-field study was conducted to assess the potential of autodissemination of pyriproxyfen (PPF) by An. *funestus* for its control. This study was conducted inside a semi-field system. Therein, two identical separate chambers, the treatment chamber with a PPF-treated clay pot (0.25g Al), and the control chamber with an untreated clay pot. In both chambers, one artificial breeding habitat made of a plastic basin with one liter of water was provided. Three hundred blood-fed female An. *funestus* aged 5-9 days were held inside a clay pot for 30 minutes and 48 hours before being released for oviposition. The impact of PPF on adult emergence, fecundity, and fertility through autodissemination and sterilization effects were assessed by comparing the treatment with its appropriate control group. Mean (95% CI) percentage of adult emerged was 15.5% (14.9 – 16.1%) and 70.3% (69 – 71%) in the PPF and control chamber for females exposed for 30 minutes ($p < 0.0001$) whereas, was 19% (12 – 28%) and 95.0 (88 – 98%) in the PPF and control chamber for female exposed for 48 hours ($p < 0.0001$) respectively. Eggs laid by exposed mosquitoes and its hatch rate were significantly reduced compared to unexposed females ($p < 0.0001$). Approximately, 90% of females exposed for 48 hours retained abnormal ovarian follicles and only 42% in females exposed for 30 minutes. The study demonstrated sterilization and adult emergence inhibition via autodissemination of pyriproxyfen by Anopheles *funestus*. Additionally, it offers proof that sterilized An. *funestus* can transfer pyriproxyfen to prevent adult emergence at breeding habitats. These findings warrant further assessment of the autodissemination of pyriproxyfen in controlling wild population of *Anopheles funestus,* and highlights its potential for complementing LLINs.

Keywords: *Anopheles funestus,* Autodissemination, Pyriproxyfen, Sterilization, Semi-field settings.

Stretching limits of ecosystem service provision by black soldier fly *(Hermetia illucens)* larvae beyond the horizons of food, feed and fertilizer for cleaner cities

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Abstract

Due to higher rates of urbanization, municipal waste generation in our cities is anticipated to grow at a rate higher than 40% by 2050. Here, we evaluated emerging black soldier fly larvae (BSFL) as a bio-waste management technology for efficient municipal trash conversion to high-value industrial raw materials beyond food, feed and fertilizers. Effect of graded levels of maize bran inclusion to shredded municipal waste on larval growth, substrate and larval proximate composition, metabolizable energy (ME), fatty acid proofile, saponification value and substrate physical characteristics was assessed. Substrate moisture reduced from 80% to 60% due to increasing dietary maize bran while ME increased from 10.9 to 12 MJ/kg DM. Maize bran inclusion decreased larval mortality at a decreasing rate ($P<0.05$) from 5% to 3% but with an optimal level of 20% eliciting the lowest larval mortality. Conversely, substrate pH and temperature increased following quadratic trends ($P<0.05$) with highest values observed at intermediate levels. Lipid production per unit larval weight increased at a decreasing rate ($P<0.05$) but closely followed similar trends of individual larval length, girth and weight. Saponification value (208 mg KOH/g of larval lipids) at intermediate levels of maize bran inclusion suggests that more short chain fatty acid suitable for soap salt formation are synthesized. Total saturated fatty acids (SFA) ranged from 53.5 to 63.2% but increased at a decreasing rate ($P<0.05$). Total SFA lipids were at least 3 times the total polyunsaturated fatty acids (PUFA) and omega (n-6) while only minute quantities of the essential n-3 lipids were observed. Therefore, BSFL can be useful in an industrial symbiosis model for cleaner cities to support a circular bio-economy where larval lipids can be used as industrial raw material for soap manufacturing while defatted larval residue may be fed to livestock and frass used as fertilizer for food production.

Key words: *Circular bio economy; Essential fatty acids; Industrial raw material; Municipal waste management; Saponification value; clean cities*

Development of a Pneumonia Computer Aided Diagnosis System by using AI to interpret Chest X-Rays in Low Resource Settings of East Africa.

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Abstract

Pneumonia remains a significant public health concern, particularly in developing countries. Accurate and timely diagnosis is crucial for effective treatment and improved patient outcomes. However, traditional diagnostic methods of interpreting chest X-rays are often subjective and time-consuming, requiring expert radiologist interpretation. From this problem, this abstract describes the development and evaluation of our deep learning AI-based computer-aided diagnosis system, PneumoNet, to reduce misdiagnosis and wrong interpretation of chest X-rays in resource-constrained settings. PneumoNet is a deep learning algorithm trained on a large dataset of chest x-ray images representing low resource populations. It was designed to accurately classify chest X-ray images as pneumonia-positive or pneumonia-negative, providing a rapid and reliable diagnostic tool for healthcare practitioners in resource-limited settings. PneumoNet was evaluated on two publicly available pneumonia X-ray datasets, provided by Kermany et al. and the Radiological Society of North America (RSNA), respectively, using a five-fold cross-validation scheme. The proposed method achieved accuracy rates of 98.81% and 86.85% and sensitivity rates of 98.80% and 87.02% on the Kermany and RSNA datasets, respectively. The results were superior to those of state-of-the-art methods and our method performed better than the widely used ensemble techniques. Statistical analyses on the datasets using McNemar's and ANOVA tests showed the robustness of the approach. The successful implementation of PneumoNet software with the AI algorithm has the potential to revolutionize pneumonia diagnosis in resource-constrained settings, improving patient outcomes and reducing the burden of this deadly disease in our region.(240 words)

Keywords: Chest X-rays; AI algorithm; disease burden; misdiagnosis; accuracy; cross-validation; five-fold cross-validation scheme; low-resource populations

Treatinet teleMEDICINE – Bridging Uganda's rural Healthcare Gap, Bundibugyo district, Uganda.

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Abstract

Majority, 76% of 49.4 million Ugandans LIVE in rural areas. Hospitals, doctors and specialists are more in urban. Healthcare access in rural areas is very challenging. 1 in 4 adults (>30years) suffer Non-Communicable Diseases (NCDs). 1 in 5 women (15-49years) is pregnant. 200,000 children (0-5 years) die annually of preventable childhood illnesses. Treatinet is pioneering telemedicine solutions aligned with Universal Health Coverage (UHC), SDG 3, SDG 13 and SDG 17. For example, consider Anna, 87-year-old female, rural peasant farmer in remote Ntotoro, Bundibugyo district of Western Uganda, diagnosed with a chronic illness. She needs constant medical attention. Our initiative facilitates remote consultations, medication orders, and lab sample collections, ensuring accessibility, privacy, flexible payment options, personalized passwords, secure data transmission with End-to-End encryption. The platform maintains detailed digital records to assist in auditing patient interactions, promoting accountability. Freemium teleMEDICINE account sign-up option, allowing users to upgrade to Premium for a nominal fee. Prescribed medicine ordered via the Treatinet app with a 50% deposit, with the remaining amount settled upon delivery. Similarly, lab samples are collected at rural teleMEDICINE kiosks/outlets with a 50% deposit, and the lab results are accessible via the app upon full payment. Monthly subscriptions enable access to health checkups at rural telemedicine kiosks/outlets, thereby improving healthcare accessibility. Treatinet teleMEDICINE App will iterate language translation algorithms and AI voice models to cater for linguistic diversities of Ugandan users. To access Treatinet teleMEDICINE system, visit: https://treatinet.org/telemedicine/ User email: gift@treatinet.org Password: gift@01 Reduce carbon emissions, minimize carbon footprint from rural-urban healthcare travel (SDG 13). Download and install the Treatinet teleMEDICINE App or use SMARTDoctor card for non-smartphone users. (319 words).

Keywords: *SMARTDoctor card; Rural Kiosk/outlet; language translation algorithms, AI voice models*

Gesture-Controlled Speech Assistant for stroke patients.

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Abstract

Stroke is a significant healthcare challenge, leading to communication impairments in affected individuals. In response to this critical issue, we have developed a groundbreaking Gesture-Controlled Speech Assistant (GCSA) tailored specifically for stroke patients. This innovation utilizes state-of-the-art technology in the domains of Artificial Intelligence and the Internet of Things to create a revolutionary solution that accelerates the rehabilitation and communication process for stroke survivors.The GCSA system harnesses the power of AI and IoT to interpret and respond to the gestures and movements of stroke patients, allowing them to communicate effectively and independently. By recognizing and translating subtle hand and facial gestures into clear and intelligible speech, GCSA empowers stroke survivors to express their thoughts and needs with ease.Key features of our GCSA include; real-time gesture recognition, adaptive learning algorithms, and a user-friendly interface. These attributes enable customized communication solutions, making it suitable for a wide range of stroke patients, irrespective of their level of impairment. This presentation will focus on the development, implementation, and clinical outcomes of the Gesture-Controlled Speech Assistant. By providing a platform for stroke survivors to regain their voice and communicate effectively, GCSA contributes to the resilience of East Africa by addressing a critical aspect of stroke rehabilitation, exemplifying the power of collaboration between technology and healthcare to improve the lives of those affected by stroke.The GCSA project embodies the overarching theme of the 3rd EAC Regional STI Conference: "Accelerating development and diffusion of Science, technology and Innovation solutions for a resilient East Africa." By presenting this breakthrough innovation, we aim to contribute to the shared goal of fostering sustainable development in the region and strengthening the collaboration between STI stakeholders in East Africa and beyond. (282 words)

Keywords: *Stroke Rehabilitation; Artificial Intelligence; Healthcare; Internet of Things; Communication Impairments.*

NATURAL RESOURCES

Determination of Liming Material Requirements to Correct Soil Acidity and Improve Soil Chemical Properties in Ngoma District, Rwanda 2023-2024

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Abstract

Soil acidity is the main constraint to agricultural development in many parts of sub-Sahara Africa. In Rwanda, it is estimated that more than 45% of arable land is acidic. In agriculture, limes play great importance in correcting soil acidity, reducing Aluminum saturation, and hence favoring plant nutrition. The aim of this study was to estimate the amount of limes needed for rectifying soil acidity up to and improving soil chemical properties. The composite soil samples were collected from Ngoma District and various parameters were analyzed in the laboratory using various following methods. Total nitrogen by the Kjeldahl method, available phosphorous by the Bray II method, Potassium and Exchangeable acidity by titration method, Calcium content in lime, and Exchangeable base (K^+, Ca^{2+}, Mg^{2+}) by EDTA method.

The results obtained showed that the soil in the study area has a pH is 4.9, and a total nitrogen of 0.03%. They also revealed that site 1 has 85.6% of calcium carbonate content (burned lime), site 2 has 67% of calcium carbonate content(agro-lime), and site 3 has 57.6% of calcium carbonate content (travertine). Thus, liming materials can correct acidity levels differently, the lime requirement to correct soil acidity up to the pH-range for plant growth was found between 0.115 t/ha and 0.245 t/ha or between 115.5kg/ha and 245 kg/ha of Mg $CaCO_3$ (dolomitic limestone) of Musanze mining sites. Based on these results, the farmers are recommended to use the liming material as suggested by this research for correcting the soil acidity thus improving the productivity and soil stability.

Keywords: Soil PH, exchangeable Acidity, lime recommendation

Performance evaluation of a bioethanol stove in domestic setting: implications on cost, time and user perception.

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Abstract

Most households in Uganda use wood fuel for cooking and heating which pose numerous environmental and health hazards, hence leading to the desire for transition to alternative clean cooking solutions. Uganda Industrial Research Institute and Raising Gabdho Foundation developed a bioethanol stove prototype for a typical household. Given the need for information on user perception and its comparison with other cooking alternatives for further improvement, this study presents a controlled cooking test which was conducted for performance evaluation of the prototype in terms of user perception, cost of cooking, and cooking time in comparison to Liquified Petroleum Gas (LPG), Electric Pressure Cooker (EPC), briquettes, and charcoal while cooking beans and posho for a family of four people by four cooks in triplicates. Controlled Cooking Test protocol from the Clean Cooking Alliance was adapted for the study, implemented, data collected and then analyzed using One-way ANOVA and Tukey HSD test in ASTATSA software. The cost of cooking using ethanol & pressure cooker with the flame regulated was not significantly different from that of charcoal, EPC, and briquettes using pressure cooker, but less than LPG which shows the possibility of households shifting from the use of charcoal to cleaner cooking solutions without significant cost implications on cooking fuel expenditure. The speed of cooking using ethanol & pressure cooker with the flame regulated was significantly higher than that of charcoal with aluminium saucepan, but not different from that of EPC, LPG, and charcoal with pressure cooker. The bioethanol stove was easy to ignite, burnt with blue flame after regulation, cooked fast, convenient for indoor cooking, and stable when mingling. However, it needed complete combustion at maximum stove power, elimination of sharp edges, and design modifications for grilling and to accommodate other saucepan sizes. (290 words).

Keywords: *Cooking cost; cooking time; clean cooking; electric pressure cooker; controlled cooking test; bioethanol fuel.*

Evolution of physicochemical parameters in the pelagic zone of the northern Lake Tanganyika basin

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Abstract

The northern of Lake Tanganyika in vicinity of Bujumbura City is more exposed to anthropogenic impact than the rest of the aquatic ecosystem. The aim of this study was to assess changes in the physico-chemical quality of the water column on two sites of the pelagic zone of the northern basin of Lake Tanganyika, one offshore Nyamugari beach and the other offshore Bujumbura port, near the REGIDESO raw water catchment site. To perform the study, a three-month sampling campaign was carried out. The water column at different depths between 0 and 100m offshore Nyamugari beach and between 0 and 35m offshore Bujumbura port was sampled. Twelve physico-chemical parameters were investigated, some of them were measured directly in situ, other samples were taken for laboratory analysis at the Faculty of Sciences of the University of Burundi. Parameters such as COD, BOD5 and nutrients concentrations were analyzed. The results showed a vertical thermal stratification, varying in intensity and unstable in July for the site offshore Nyamugari beach. For the site offshore Bujumbura port, the water column remained homogeneous throughout the sampling period, with high turbidity consistent with low water transparency.   Temperature, dissolved oxygen, pH, conductivity and TDS showed values and profiles similar to those obtained in the previous researches. Similarly, higher nutrient concentrations were observed in hypolminion than in the epilimnion and this corroborates the results of previous researches. However, the values of COD and BOD5 concentrations found at the site offshore Bujumbura port, ranging from 4 to 330mgO2/l and from 0 to 20 mgO2/l respectively, indicate a major organic pollution especially concerning as it is near the REGIDESO raw water catchment site.

Keywords: *Lake Tanganyika, northern basin, pelagic zone, physicochemistry, stratification*

Wood diversity, carbon stocks and land use dynamics of the Lwampango relict forest in the Kaziba chiefdom, eastern DR Congo

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Abstract

The mountain forests are diversified and store large quantities of carbon, despite facing threats. This study aims to assess the floristic diversity, carbon stock, evaluate threats, and quantify land use changes of the Lwampango mountain relict forest from 1990 to 2021. The woody species inventory was conducted in 24 plots of 20x20m each, and the above-ground biomass was estimated using the equation of Chave et al. (2014). The land cover of Lwampango forest was quantified using a mapping approach coupled with remote sensing. A total of 1032 individuals from 22 woody species, 21 genera and 17 families were inventoried. Macaranga kilimandscharica, Maesa lanceolata, Hagenia abyssinica and Polyscias fulva belong to the group of ecologically important species. The forest is estimated to store 136.3 tonnes/ha of carbon. Over its entire surface area, the Lwampango forest has an estimated stock potential of 25317.4 tonnes of carbon and 92915.07 tonnes of sequestered carbon dioxide. Our study indicates that the dense vegetation of the Lwampango forest has undergone a regression in the period from 1990 to 2011 due to anthropogenic activities, compared to the period from 2011 to 2021 where dense vegetation is beginning to progress. Conserving this relict forest would further increase carbon storage and reduce the current global warming problem.

Keywords: *Relict forests conservation; Wood diversity; carbon stocks; land use dynamics; global warming*

The Impact of High Turbidity Feed Water on the Performance of Gravity Driven Membrane Modules

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Abstract

Majority of the low-income households in Uganda who use surface water, collect it from ponds, rivers and lakes at turbidity in the range of 60 – 160 NTU. Evident increase in this turbidity is observed mainly after rainfall events. The Gravity Driven Membrane (GDM) system is a low-cost water treatment method fully driven by gravity thereby requiring no electricity for operation. The filters also do not require regular back flushing for sustainable operation. This makes the system low-cost. This study evaluated the performance of the GDM filters with raw water of high turbidity. Flux values, turbidity, pH, electrical conductivity, temperature and E. coli were monitored both in the raw water and filtered water. The flux values were observed to be in the range of 5-22L/h/m2. The data collected indicated a 99% removal of turbidity. A decrease in E. coli from too numerous to count to an average of 7 CFU/100 mL with log removal value of 2-3 was obtained. There was no significant difference between the pH and electrical conductivity of the raw water and filtered water indicating that GDM is not suited for treatment of water with high dissolved solids content. The GDM if used with other treatment methods like chlorination has the potential to be applied for the provision of affordable safe water to rural Ugandans. (217 words).

Keywords: Gravity-driven membrane (GDM); flux stabilization; ultrafiltration; high turbidity; water treatment

Knowledge, Attitude, And Practices of Insect-Based Organic Waste Management and Willingness to Add Value Organic Waste to Insect Products in Nairobi County, Kenya

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Abstract

Organic waste management remains a great challenge, particularly in the rapidly growing urban areas. This study surveyed 485 organic waste producers and collectors to assess factors influencing their knowledge, attitudes, and practices (KAPs) and willingness to use insect-based technologies to recycle organic waste into value-added products. Logistic regression, multinomial logit, and Tobit model were used for analysis. Most respondents (98.6%) knew about insect-based waste management, with 80% of them expressing a positive attitude towards the practice, while only 57.4% were practicing it. Black soldier flies (33.8%), crickets (10.2%), mealworms (5.3%), and cockroaches (3.9%) were the most known insect species. Pig and poultry farmers were the most willing to add value (89%), while 75% of respondents were willing to sell the waste if not able to add value. The amount of waste the respondents were willing to recycle was highly influenced by market availability and cost-effectiveness. Despite most respondents possessing good knowledge, positive attitude, and willingness to add value, only a few of them recycled organic waste using insects with the majority citing inaccessibility to training. Subsequently, effective training is therefore crucial (181 words).

Keywords: *Waste management, Organic waste recycling, insect farming, KAP, circular economy*

Implications of adopting insects for recycling organic waste on household recycling income

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Abstract

Managing organic waste, especially in urban and peri-urban areas, is a significant challenge that calls for local and efficient waste management solutions. The use of insects such as black soldier fly (BSF) is emerging as one of the local solutions that bio-convert organic waste into larval biomass and the residual is a nutrient-rich organic fertilizer. However, the adoption levels of BSF are low. Understanding the implication of using the insects on household waste recycling income is vital in promoting their use in organic waste management. Primary data was collected from a sample of 222 households, 105 using BSF and 117 using conventional composting in Kiambu County. STATA software was used in running the Endogenous switching regression model. Our findings revealed that factors such as the size of land for recycling organic waste, access to information on efficient organic waste management, access to segregated waste, distance to the source of waste, and value addition/amendment of organic fertilizer significantly influenced the selection of BSF as an approach for recycling organic waste. The average treatment effect (ATT) among households using BSF was 2.224 (18.7%) indicating that the adoption of BSF positively affected household recycling income. Moreover, the average treatment effect on the untreated households (those not using BSF) indicated that the households would increase their recycling income by 18.8% if they adopted BSF in recycling organic waste. Our findings reveal the potential of BSF in producing frass fertilizer as an additional household income, and alternative to inorganic fertilizer for agricultural production. Policy development on efficient waste management should be aimed at increasing awareness on the economic, environmental and circular economy benefits of using BSF for organic waste recycling. Moreover, households should be encouraged to adopt BSF so that they benefit from recycling organic waste into fertilizer and animal feed protein. (297 words).

**Keywords:** *Black soldier fly, conventional composting, recycling, organic waste management*

Evaluating Effectiveness of the Blend of *Moringa oleifera* Lam and Synthetic Coagulants in Coagulation/Flocculation of Wastewater from Wastepaper Recycling Mill

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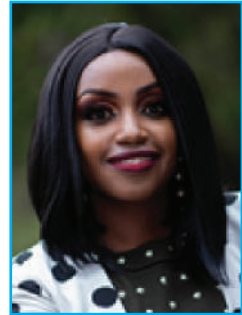
Abstract

Wastepaper recycling is a growing global industry addressing the high pollution and toxic components from defibering, deinking and papermaking processes. Nonetheless, inefficient treatment of wastepaper mills effluent negatively impacts water ecosystems and users' health. This study evaluated the efficiency of using *Moringa oleifera* Lam plant parts, alum and polyaluminium chloride coagulants. The study established effective doses for individual and blended coagulants and determined their efficacy in treating wastewater from wastepaper recycling. Wastewater samples were obtained from Maz International Paper Mill using grab sampling method. A randomized design was applied, using standard jar test procedures to assess the effective doses of defatted *Moringa oleifera* seeds (DMos), fatted Moringa oleifera (FMos), *Moringa oleifera* bark (BMo), Alum and Polyaluminium chloride (PAC). Analysis of Variance (Anova) on the data acquired were conducted and the means obtained separated using Fisher's least significant difference. The study revealed that effective doses were DMos; 16g/ml (144.0NTU), FMos; 18g/ml (250.2NTU), BMo; 80g/ml (881.0NTU), alum; 0.75g/ml (24.1NTU), PAC; 3.6g/ml (162.2NTU), DMos/Alum; 20/80% (17.1NTU), FMos/Alum; 30/70% (25.2NTU), DMos/PAC; 70/30% (93.6NTU), and FMos/PAC; 70/30% (110.4NTU). However, there was no synergy assessed for the blends of BMo/Alum and BMo/PAC. The results established that turbidity of the wastewater from wastepaper recycling mill was reduced using various effective doses. Alum was the most efficient individual coagulant, while DMos/Alum was the most efficient blended coagulant. In conclusion, the turbidity of the wastewater from wastepaper recycling mill was effectively reduced using the blend of DMos and alum. The study recommends using a DMos-alum blend for effective wastewater treatment in wastepaper recycling mills. (255 words).

Key words: *Wastepaper, Wastewater, Moringa oleifera, Synthetic Coagulants*

EcoDetect: A Portable and Novel Solution for Detection of Arsenic Contamination in Food and Water.

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Abstract

Heavy metal contamination in food and water poses a significant global health threat, affecting millions of people worldwide. The World Health Organization (WHO) estimates that over two billion people globally consume drinking water with heavy metal concentrations exceeding recommended safety limits. A study by the United Nations Environment Programme (UNEP) found that heavy metal contamination is widespread in the region, with particularly high levels found in water, soil, and food this is attributed to a variety of factors, including mining activities, industrial waste disposal, and agricultural practices. Exposure to heavy metals can have a range of detrimental health consequences including cancer, nervous system damage, kidney damage, reproductive problems, and developmental delays in children. Current detection methods often remain bulky, expensive, or limited to qualitative analysis. EcoDetect, which utilizes a novel electrochemical approach through a user-friendly biosensor strip and meter combination, not only identifies harmful metals but also measures their exact concentration, offering invaluable insights for informed decision-making. It is safer, more accessible than existing methods, and used for samples in both laboratory and field settings. It is also a portable, easy-to-use device capable of detecting and quantifying Arsenic in various samples, including rice and water. It can potentially revolutionize food safety practices and safeguard public health from heavy metal contamination. While currently under development, this abstract displays the concept and its potential impact while acknowledging ongoing research and product refinement. We actively seek funding and collaborators to finalize development, conduct field trials, and commercialize EcoDetect, empowering individuals and communities to safeguard their food and health.In conclusion, this innovative device empowers individuals and communities to take control of their food and water quality, promoting overall health and well-being. (298 words).

Keywords: *Food safety, heavy metal detection, arsenic, portable device, EcoDetect.*

Unveiling Innovative Solutions to Unlock Underutilized Groundwater and Rainwater Potential in Tanzania

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Abstract

Groundwater access, reliable rainfall, rainwater harvesting, and climate-smart technologies are essential for food production and promoting water access and resilience. Harnessing these resources requires more cross-sectoral collaboration, innovative approaches, and fragmented operations to ensure the implementation of holistic solutions in water access and food production for resilient livelihood. This study explores the underutilized potential of groundwater and rainwater access to sustain agricultural production in Tanzania's southern and northwest highlands. The study employs an integrated approach, including qualitative and quantitative data collection techniques, in four agriculturally productive districts of Tanzania. The qualitative and quantitative data collection techniques used key informant interviews, household questionnaires, focus group discussions, direct field observations, the WEF-Nexus index, Interpolation of climate data, and a comprehensive literature review. The data analysis used SPSS 20 and Microsoft Excel for quantitative data and employed content and trend analysis for qualitative data. Key findings highlight the significant impact of climate variability, anthropogenic activities, knowledge gaps, and policy frameworks on groundwater and rainwater management. Challenges encompass financial constraints, technological limitations, siltation, declining water tables, and governance inadequacies, hindering optimal resource management. A notable impediment emerges from a need for knowledge and innovative solutions, posing a critical obstacle in effective rainwater harvesting and groundwater management. Despite these challenges, the study emphasizes the substantial irrigation and water resilience potential inherent in rainwater and groundwater resources, advocating for robust management systems, ecosystem sustainability, informed decision-making through innovative solutions, and concerted efforts toward addressing climate change and improving rainwater harvesting technology and storage facilities. The study recommends the urgency of striving for sustainability to fully leverage these resources, advocating for comprehensive management systems to enhance water access, bolster local communities, and fortify livelihood resilience.

Keywords: *Water resilience, Food production, Rainwater harvesting, Water access, Groundwater utilization, Innovative solutions.*

Bio fertilizers for environmentally sustainable soil health management

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Abstract

There is current interest in agrarian sustainability with soil microorganisms instead of agro-chemicals. Bio fertilizers are known to be eco friendly but their use has been constrained by inadequate knowledge about bio inoculants and lack of promotion network and publicity among the end users. This paper is a review of the current technical information as a way of creating awareness for the promotion of the use of bio fertilizers. Publon, Google Scholar, Science Direct and Microsoft Academic data bases were used for the review in 2022. Research and review articles published from 2020 onwards were considered as current information for the review. The findings of the review were that; both primary and secondary macronutrients can be provided by bio fertilizers. Potential microbes for bio fertilizer formulation that the review found were; free-living nitrogen fixing bacteria and cyanobacteria, symbiotic nitrogen-fixing bacteria and fungi such as mycorrhiza. Important functions of bacteria noted were; conferring to plants the ability for salt tolerance, lignin degradation and remediation of heavy metals from the soil. Bio Compost, vermicompost and termite soil with their rich microorganism content were found suitable for use as eco friendly bio fertilizers. In order to reap maximum benefit from bio fertilizers the need for their formulation in appropriate materials was highlighted. Apart from addition of nutrients to the soil, bio fertilizers were found to play an important role in plant health. This paper attempted to provide adequate knowledge about bio inoculants as well as promoting and publicizing them among the end users. The conclusion of the review is that bio fertilizers are suitable for environmentally sustainable soil health management.

Keywords: *Bio fertilizer, Microorganism consortia, Nitrogen-fixation, Rhizosphere management*

Organic Matter Sources and Sewage Pollution in Human-Impacted River Estuaries-Wami and Pangani: Multidimensional Approach of Fatty Acids and Stable Isotopes

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Abstract

The study used a complementary strategy incorporating stable isotopes and fatty acids aiming at identification of various organic matter sources and allochthonous inputs linked to sewage pollution in Wami and Pangani River estuaries. Permutational multivariate analysis of variance (PERMANOVA) revealed variations in fatty acid indicators of terrestrial-based organic matter and sewage pollution between *Pomadasys argenteus* and *Sillago sihama* (Pseudo-F 0.97, $p < 0.05$), with high amounts in *Pomadasys argenteus* collected from Wami. Also, high values of these markers were noted in polychaetes with large concentrations in Wami estuary. Bacterial fatty acid indicators showed considerable variations between *Epinephelus coioides* in the two estuaries with high concentrations in Pangani. Results also revealed significant variations in carbon and nitrogen isotope ratios (PERMANOVA, pseudo-F $\geq$ 18.5, $p = 0.001$) among the fish species. Sewage contamination was found in Wami and Pangani estuaries, as evidenced by significant concentrations of nitrogen isotope ratios, bacterial fatty acids and indicators for sewage pollution in estuarine fish. Also, findings indicated that estuarine fish relies on different organic matters sources including both autochthonous and allochthonous. These suggest an urgent need for regular monitoring by Wami and Pangani River authorities for sustainable use of these ecologically vital and economically significant ecosystems.

Keywords: *Organic matter sources, Allochthonous, Human activities, fatty acid biomarkers, sewage pollution, stable isotopes, Pangani and Wami River estuaries.*

A Smart IoT and Machine Learning-based Irrigation System

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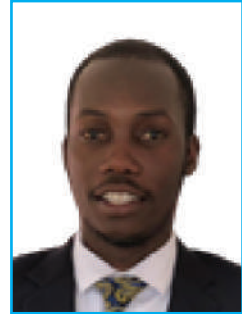
Abstract

Agriculture is a vital sector, providing food to the global population and raw materials to various industries. Although it is a major source of income for many people, it is severely affected by water scarcity which consequently impacts crop yields. Effective water management is therefore essential for ensuring stable and sustainable farming practices. Irrigation systems play a great role in mitigating water scarcity and enhancing crop productivity by enabling agriculture to be carried during any season. Traditional irrigation systems rely on manual labor, constant vigilance and rudimentary tools while modern irrigation systems like drip irrigation, sprinkler systems offer a better control. However, they still face challenges of adaptability and resource optimization. This paper describes a smart irrigation system that utilizes Internet of Things (IoT) and machine learning to optimize water usage thereby reducing operational costs and enhancing crop yields. The system integrates an ESP32 microcontroller board, low-cost sensors i.e., resistive soil moisture sensors, submersible digital temperature sensors, light-dependent resistors, a water pump, machine learning models and a web application. The sensor readings are continuously logged to the Firebase real-time database and a web application was developed to provide real-time visualizations of the system performance, enabling remote monitoring and control. Machine learning models were trained to predict optimal irrigation timings based on incoming sensor data. Four (4) classification algorithms were employed i.e., random forest, XGBoost, Support Vector Machine (SVM) and logistic regression, with random forest performing best, achieving an accuracy of 90.67%. The random forest model was deployed on the ESP32 microcontroller board and autonomously controls the water pump according to the changing environment conditions. In addition, the developed system allows selection of a specific crop for irrigation based on its respective water requirements.

Keywords: *Agriculture; water scarcity; irrigation system; IoT; machine learning*

Social Media and Stakeholder Engagement in Public Chartered Universities in Kenya

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Abstract

In the ever-evolving global higher education landscape, public universities play a crucial role in shaping both academic and social dimensions. However, there exists a persistent reliance on traditional communication methods, such as circulars and memos, for stakeholder engagement in public universities worldwide, reflecting challenges in adapting to contemporary communication tools. This research specifically focuses on the unexplored relationship between Social Media and Stakeholder Engagement in Public Chartered Universities in Kenya. While existing studies suggest the potential of social media in enhancing stakeholder engagement, its specific impact in the context of public chartered universities remains verbally acknowledged rather than quantified. The research aims to address this gap by thoroughly examining the adoption and efficacy of social media channels, content optimization, and targeted audience strategies in public chartered universities. The study's significance lies in its imperative to clarify uncertainties surrounding the effectiveness of implementing social media in these institutions and its influence on stakeholder engagement. The potential impact of the findings is substantial, as they have the capacity to inform the development of more dynamic and responsive practices, contributing to the ongoing improvement of the higher education sector in Kenya. The study, employing a mixed-method research design integrating Gratification Theory and Diffusion of Innovations (DoI) Theory, centers on the research topic "Social Media and Stakeholder Engagement in Public Chartered Universities in Kenya." The comprehensive approach involves data collection from 38 public chartered universities, targeting faculty, students, guardians, and the Head of Communications through convenient sampling. Methodologies include documentary review, qualitative methods (content analysis), and quantitative methods (SPSS, Stata, frequency analysis) to offer a holistic understanding of the dynamic relationship between social media and stakeholder engagement. Key findings indicate that leveraging Social Media Channels, optimizing content, and targeting specific audiences significantly enhances Stakeholder Engagement in Public Chartered Universities in Kenya. Qualitative data, obtained through content analysis, enriches the findings, demonstrating a clear correlation between effective social media utilization and heightened stakeholder engagement. While the study emphasizes the positive impact, limitations include its regional focus and potential biases from convenient sampling. Future research endeavors could enhance generalizability by conducting similar studies across diverse geographical regions and employing more rigorous sampling methods.
Keywords: Social Media, Stakeholder engagement, Public Universities, Gratification Theory, Diffusion of Innovations Theory,

Data-Driven Decision Making: A Case Study of Tertiary Institutions in Uganda.

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Abstract

The aim of this study is to assess the degree of adoption of data-driven decision-making (DDDM) in Ugandan tertiary institutions. The objective of this study is to provide insight into the present condition of DDDM, evaluate its efficacy, identify the obstacles encountered when utilizing data for decision-making, and suggest a structure for enhanced DDDM utilization. Existing frameworks, methodologies, and best practices in DDDM as they pertain to higher education are examined in the literature review. In an academic context, comprehension of the ways in which data science and analytics, business intelligence, and digital infrastructures facilitate well-informed decision-making is of paramount importance. The research methodology utilizes a mixed-methods structure, which integrates interviews, surveys, data mining, and predictive analytics. The acquisition of quantitative data regarding the degree of data integration in decision-making processes is facilitated by surveys, data mining, and predictive analytics. Conversely, qualitative insights into the challenges and successes encountered by various institutions are obtained through interviews. In institutions surveyed, preliminary results indicate varying degrees of DDDM implementation. Obstacles consist of restricted data literacy, inadequate data quality, and accessibility, resource limitations, and institutional opposition to transformation. On the contrary, success tales underscore enhanced student outcomes, resource allocation, and strategic planning. The results emphasize the criticality of cultivating a culture that is focused on data in higher education establishments. Generally, institutions that have a clearly defined DDDM strategy and a dedication to enhancing data literacy among stakeholders achieve more favorable results. This study provides valuable insights that can inform policies, practices, and reporting in academic settings, thereby contributing to the wider discourse on data utilization in academia. Such contributions can enhance decision-making processes. (298 words).

Keywords: *Data-Driven Decision Making, Tertiary Institutions, Data Science and Analytics, Decision-making Process*

Exploring the Integration of Emerging Technologies in Agriculture 4.0 to Enhance Food Security in Sub-Saharan Africa: A Comprehensive Review

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Abstract

The purpose of this study was to examine the state of research into the integration of emerging technologies in Agriculture 4.0 (A4.0), to identify the key determinants influencing the assimilation of these technologies in A4.0 while also identifying challenges and unexplored avenues for exploration in the specific unique context of Sub-Saharan Africa. A structured literature review methodology was used in this study. The authors reviewed research literature published between the years 2012 and 2022 which yielded insights from 55 articles. Our scrutiny revealed a notable dearth of studies concerning A4.0 technologies in the Sub-Saharan context. Despite this gap, our analysis of the key technologies in terms of A4.0 underscores that the majority of literature concerning these technologies is still in its early stages. In certain instances, the literature is conspicuously absent. About sub-Saharan Africa, certain A4.0 technologies, such as digital twins, lack established use cases. We observed that a few authors are continually engaged in this field, with their contribution often having limited visibility in mainstream databases and publications.

This study further illuminated a scarcity of diversity and rigor in the methodological approaches adopted by authors, coupled with restricted usage of theoretical models or frameworks despite the few that were used. This study was able to aggregate the primary determinants influencing the adoption of A4.0 technologies and use cases with evidence in the Sub-Saharan context. In terms of originality and value, this study provides a comprehensive systematic literature review of research published on Agriculture 4.0 within the context of Sub-Saharan Africa.

Keywords: *Agriculture 4.0, A4.0 adoption frameworks, Food Security, Smart Agriculture*

Responsible Mentorship : Bridging The Gap Between Research And Practice : A Case Study of KALRO – CRI, Kenya: Literature Review Report

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Abstract

This paper titled "Research and Practice: Bridging the Gap through Responsible Mentorship" presents a systematic literature review aimed at facilitating responsible mentoring to bridge the divide between research and practice within KALRO-CRI, Kenya. The study draws on sources from Google Scholar.The systematic review delves into professional development and mentorship across diverse fields, spotlighting the significance of networks and mentoring in aiding transitions. The review suggests enhancements in postgraduate mentorship satisfaction and introduces the TAD Framework, a proposed mechanism to augment compatibility between mentors and mentees. It advocates for formal mentoring initiatives catering to Early Career Academics, highlighting the synergy between scientific pursuits and practical application. Notably, the review underlines the criticality of interpersonal skills for graduate triumph and suggests collaboration between academia and industry to combat graduate unemployment challenges. Emphasizing the imperative of collaboration for building trust and achieving successful outcomes, the review concludes by advocating the establishment of structured mentoring programs and the cultivation of interdependence in professional milieus. Additionally, it explores the significance of interpersonal aptitudes and the seamless integration of fresh graduates into the workforce through academia-industry collaboration.The study asserts that mentorship should be viewed as an ongoing process rather than a singular event. It advocates for a structured program tailored to workplace dynamics and overseen by mentors, positing that such an approach can effectively narrow the gap between research and practice. The review also underscores the significance of an optimally oriented mentorship period to equip graduates, postgraduates, and working professionals with the tools to function as autonomous practitioners. Notably, mentorship contributes to bolstering the confidence of both mentors and mentees, facilitating an environment where mentor-leadership is revered.

Keywords: *Research, practice, responsible mentorship, KALRO – CRI, (Kenya Agricultural and Livestock Research Organization - Coffee Research Institute), TAD Framework and systematic literature review.*

The Applicability of Social Media Platforms for Academic Purposes: A Case of Selected Higher Learning Institutions in Tanzania

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Abstract

In recent years, the Internet has evolved and become a means of connecting people globally. There is an increasing applications of social media platforms as a result of the growth of the Internet. Social media usage is growing exponentially and becoming more popular among students. There has been an increasing demand to examine the usage of social media among students. While majority of the existing literature concentrates on investigating the general usage of social media among students, scholarly works that access the applicability of social media platforms for academic purposes is still limited. This study seeks to examine the applicability of social media platforms for academic purposes. The study employed a cross-sectional design and quantitative approach to provide more reliable and generalizable results. The study involved 318 higher learning students across six regions in Tanzania. Data were summarized, coded, and analyzed by using SPSS 25. Cronbach's Alpha coefficient was used to determine the reliability and internal consistency of the items. The significance of the difference in parameters in this study was analyzed using Analysis of Variance. A Multiple Linear Regression model was used to assess the applicability of social media platforms for academic purposes in higher learning institutions. Results from this study suggests that WhatsApp is the leaning social media platform to facilitate communications for academic-related matters. Other commonly used platforms include YouTube, Facebook, Twitter, and Instagram. The results from a Multiple Linear Regression model indicate that student's academic matters were explained by social media usage by 57.9%. The predictor variables were found to have a statistically positive significance ($p < 0.005$) on the outcome. Respondents indicated that social media platforms assist in completing tasks and assignments. Taken together, social media platforms can be blended with conventional learning approaches to enhance student participation during their learning trajectory.

Keywords: *Social media platforms; academic purpose; internet applications; higher learning.*

GD Plant Disease Detection: an artificial intelligence tool set to transform disease management and control in plants

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Abstract

Crop losses due plant diseases are estimated at 14.1% worldwide,, 40-100% in maize in East Africa and 20 - 30% generally in Uganda and this effect is aggravated if there is absence of control mechanisms. For appropriate disease control mechanisms to be implemented precise diagnosis is required which is sometimes not possible due to poor technical capacity. The entry of Artificial Intelligence (AI) is set to address this challenge and efforts to initiate this have been deployed by Sow and Grow Foundation (SGF), a company based in Uganda. SGF have developed the first version of an Artificial Intelligence tool called "GD Plant Disease Detection " that enables farmers to assess plant health through leaf analysis. The tool was developed using open access data and has been set up to analyse diseases for maize, tomatoes, beans, soybeans and sunflower and has detected maize northern leaf blight and tomato late blight with confidence of over 0.9 (Confidence scale ranges from the lowest being 0 to 1, the highest). The tool detects the diseases simply from a photograph of the diseased leaf that can be taken using a smart phone. The tool will also display a proportion of confidence. The tool can be downloaded for free from google play store. Sow and Grow Foundation are planning to source resources to develop this tool further to progressively improve diagnosis precision, include more crops as well as add prevention, control and management options for the different diseases. GD Plant Disease Detection has the capacity to prevent excessive plant losses from diseases through precise and early diagnosis and implementation of appropriate prevention, control and management interventions.

Keywords: *Diseases, GD Plant disease detection, control, management*

Development of a web-based system to enhance monitoring and evaluation of Eastern and Southern Africa Higher Education Centers of Excellence

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Abstract

An initiative was launched by World Bank to establish regional education and research centers in Africa to train Africans to advance and use science and technology to solve Africa's most pressing challenges. The Eastern and Southern Africa Higher Education Centers of Excellence Project (ACEII) was rolled out in 2016 with focus on industry, health, agriculture, applied statistics, and education. ACEII seeks to improve the delivery of quality post-graduate education and promote collaborative research capacity at 29 centers of excellence in 8 countries namely Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia. The project study revealed that monitoring and evaluation of ACEII thrives on data for informed decision-making. However, capturing and storing data at the centers of excellence using Excel sheets makes it challenging to analyze due to its disintegration per center and time-consuming. ACEII lacks visual cumulative and informative data to tell its impact and a feedback mechanism for the beneficiaries to share their grievances and concerns, there is no dedicated internal communication channel for stakeholders. The purpose of this paper is to present the developed web-based system "ACE2 Insight Hub" to enhance monitoring and evaluation of ACEII. Qualitative and quantitative research methods were used to collect data from the Inter-University Council for East Africa, the Regional Facilitating Unit (IUCEA-RFU), and the 29 centers of excellence. Google Forms were used to collect and analyze quantitative data and thematic analysis was used to analyze qualitative data collected from the interviews to identify common patterns and themes. The results of data analysis helped to come up with functional and non-functional requirements to develop the ACE2 Insight Hub. The ACE2 Insight Hub can enhance ACEII stakeholder engagement, evidence-based decision-making, project performance, impact assessment, and accountability for the Southern and Eastern Africa Centers of Excellence (292 words).

Keywords: monitoring and evaluation; data input and storage; data analysis; data visualization; stakeholder engagement; feedback mechanism; Centers of Excellence

6th- 8th March 2024
NAIROBI, KENYA

Venue: Sarova Panafric Hotel

The 3rd EAC Regional Science Technology & Innovation Conference

Theme: "Accelerating development and diffusion of STI solutions for a resilient East Africa"

The 3rd EAC Regional STI Conference is organised by East African Science and Technology Commission (EASTECO) and the Inter-University Council for East Africa (IUCEA) in collaboration with various STI stakeholders in the region and globally as an avenue for diffusion of new development in STI and for sharing experiences and results within the knowledge and technology generation, translation and transfer chain, applications of STI outputs, strengthening collaborations, facilitating regional integration and sustainable development.

PROGRAMME
DAY 1: WEDNESDAY, MARCH 6, 2024

09:00 – 11:00 EAT - Opening Session
Session Moderator: Prof. Idris Rai, DES-IUCEA/ Mr. Fortunate Muyambi, DES-EASTECO

Kenya National Anthem
EAC Anthem
Entertainment – Traditional Performance
Mr Björn Richter, EAC GIZ Cluster Coordinator
Hon. Dr. Peter Mathuki, Secretary General, East African Community
Statement by Permanent Secretaries of EAC Affairs: Republic of Burundi, Republic of Rwanda, Republic of Uganda, United Republic of Tanzania, Republic of South Sudan, Democratic Republic of DRC

Prof. Gaspard Banyankimbona, Executive Secretary – IUCEA
Dr Sylvance Okoth, Executive Secretary, EASTECO

Official Opening by Guest of Honour:
Hon. Ezekiel Machogu, CBS
Cabinet Secretary, Ministry of Education, Kenya

• Launch of EAC Regional Policies

11:00 -11:30 EAT - Health Break/Exhibition Tour

11:30 -13:00 EAT - Plenary Session 1: Keynote & Panel Discussion

Theme: *Agricultural productivity, resilience, and food security*

Agriculture is a vital sector in the economies of East Africa Countries. The sector plays a significant role in the livelihoods of citizens in the East Africa Community (EAC). More than 70% of the industries in the EAC region are agro-based and dependent on agriculture as the main source of raw materials. However, the productivity of agriculture in the EAC region is alarmingly decreasing mainly because of the mounting pressures of climate change concerns, diminishing resources, limited application of modern technologies as well as changing demographic trends. The challenge of low agricultural productivity has thus been a major cause of increased hunger, malnutrition and poverty in the EAC countries. It is therefore pertinent for all players to focus and put in place deliberate efforts to enhance agricultural productivity, resilience and food security in East Africa.
Session Moderator: Dr. Joseph Ssemakula, Uganda Martyrs University;
Rapporteur: Milton Melingasuk

Keynote Presentation: (25 minutes)
"Leveraging Science, Technology, and Innovation in the enhancement of agricultural productivity, resilience, and food security in East Africa" by Prof. Richard O. Oduor, Registrar, Research, Innovation and Product Development, Kenyatta University.

Panelists Session (40 Minutes)
• Prof. Joyce Kinabo, Professor of Human Nutrition, Sokoine University, United Republic of Tanzania
• Dr. Roy Mugiira, CEO, National Biosafety Authority, Kenya
• Dr. Richard Edema, Centre Director, Makerere University Regional Centre for Crop Improvement (MaRCCI), Uganda
• Prof George Owuor, Centre Leader, Centre of Excellence in Sustainable Agriculture & Agribusiness Management (CESAAM), Egerton University, Kenya

Discussion/ Q&A (25 minutes)

13:00 - 14:00 EAT - Lunch Break, Exhibition and Poster Session

14:00-17:00 EAT - Plenary Session 2:
Keynote, Panel Discussion & Co-creation Session
Theme: *Stimulating digital entrepreneurship*

The East Africa region has exhibited a strong entrepreneurial mindset with a growing number of digital entrepreneurial intermediaries. However, the existing digital entrepreneurial potential in the region has not translated into a vibrant digital entrepreneurial ecosystem, with commercial digital hubs that can generate talent and ventures to compete at the highest global level. There is a need therefore for the EAC Region to strategically design and implement customized interventions to strengthen the entrepreneurship ecosystem of mutually reinforcing components that include a digital knowledge base and ICT market; a digital business-friendly environment; access to finance; digital skills and e-leadership; and an entrepreneurial culture.

Session Moderator: Mercy Kimalat, CEO, ASSEK;
Rapporteur: Dr. Samuel Obino Mokaya

Keynote Presentation: (25 minutes)
"Building innovation & entrepreneurship ecosystems by nurturing digital skills and talents " *by David Cheboryot - Director, E4Impact Entrepreneurship Centers.*

Panelists Session (40 Minutes)
• Pascal Nyiringango - Head of Business Development and Commercialization, Center of Energy- ACE-ESD, University of Rwanda
• Denis Denaya - Executive Director, Koneta Hub – South Sudan (Virtual)
• Dr. Amos Nungu – Director General-COSTECH, United Republic of Tanzania
• Dr. Joyce Ngure – Assistant Director of Research, State Department for Higher Education and Research, Ministry of Education

Discussion/ Q&A (25 minutes)
Co-creation Session (1hr 15 minutes)
"A deep dive into the strategic pillars to support the regional initiative on IP Policy, Capacity Building of innovators, Early-stage investment and strategic linkage of higher education institutions with entrepreneurship Support Organisations."

17:00- 18:00 Eat – Networking Cocktail & End Of Day One

DAY 2: THURSDAY, MARCH 7, 2024

09:00 – 10:30 EAT - Plenary Session 3:
Keynote & Panel Discussion

Theme: *Open Science and Science Diplomacy: Bridging Borders for Global Impact*

This conference theme aims to explore the dynamic relationship between open science principles and the practice of science diplomacy. Open science emphasizes transparency, accessibility, and collaboration in research, while science diplomacy focuses on building international partnerships to address global challenges. The intersection of these two concepts creates a powerful synergy that can foster innovation, address shared global issues, and promote mutual understanding.

Session Moderator: Dr. Shubi Kaijage
Rapporteur: Dr. Lizzy Mwamburi

Keynote Presentation: (20 minutes)
 "Identifying challenges in implementing open science and science diplomacy and exploring opportunities for overcoming barriers to collaboration" by Ms. Joy Owango, Executive Director, Training Centre in Communication

Panelists Session (40 Minutes)
• Panelist 1: Ms. Roheena Anand MChem, Executive Director, Global Publishing Development (PLOS)
• Panelist 2: Dr. Nur Yoslan, Programme Specialist, UNESCO, Nairobi, Kenya
• Panelist 3: Mr. Nicholas Outa, Maseno UNIVERSITY
• Panelist 4: Dr Nokuthula Mchunu/ Dr Tshiamo Motshegwa AOSP
• Panelist 5: Prof Rhoda Wanyenze, Declaration of Open Research Assessment

Discussion/ Q&A (10 minutes)
10:30 -11:00 EAT - Health Break/Exhibition Tour

11:00 - 13:00 EAT - Parallel Sessions 1: Paper Presentations

11:00 - 12:00 EAT	Parallel Session 1A: Precision Agriculture Technologies, and Data Science in Agriculture **Moderator:** Dr. Joshua Ogendo **Rapporteur:** Dr. Charles Masembe	Parallel Session 1B: Water Resources and Waste Management Moderator: Dr. Charles Niwagaba Rapporteur: Dr. Lughano Kusiluka`	Parallel Session 1C: Biomedical Engineering and E-health **Moderator:** Prof Bruno Sunguya **Rapporteur:** Dr. Bunani Samuel
(Each Presenter 10 Minutes then Q&A: 20 Minutes at the end of presentations)	1. Using Normalized Difference Vegetation Index to Predict Potato (Solanum Tuberosum L.) Apical Rooted Cuttings Yields in Njoro, Kenya by Winnie Chebet Wambugu 2. Climate Smart Agricultural Technologies (TIMPS) as a Resilience Strategy for Semi-Arid Agroecosystems Production in Kenya by Hellen W. Kamiri 3. Development and evaluation of Reverse transcription loop-mediated isothermal amplification (RT-LAMP) for rapid typing of serotype 'O' foot-and-mouth disease virus in endemic regions of Tanzania by Sarah M. Njeru 4. Exploring the Integration of Emerging Technologies in Agriculture 4.0 to Enhance Food Security in Sub-Saharan Africa: A Comprehensive Review by Harriet RATEMO	1. The Impact of High Turbidity Feed Water on The Performance of Gravity-Driven Membrane Modules by Mutenyo Mercy 2. Study on the evolution of physicochemical parameters indicators of water quality in the pelagic zone of the northern Lake Tanganyika basin by Stanislas Ndayishimiye 3. Waste Reduction, Biomass Conversion and Growth Performance of Black Soldier Fly Larvae Using Organic Waste by Desta Mulu 4. Implications of adopting insects for recycling organic waste on household recycling income by Perpetual Galena	1. A GIS-Based Method for Analyzing the Impact Of Physical Planning In The Spread Of COVID-19 in Kampala City by Nagula Brendah 2. Sterilized Malaria Vector, Anopheles Funestus Can Autodisseminate Sufficient Pyriproxyfen to The Breeding Habitat Under Semi-Field Settings by HAMISI Kunambi 3. Factors Associated with Menstrual Hygiene Management Among Adolescent Girls in Primary School by Kibingo Pascal 4. Co-Administration of Artesunate and Coenzyme Q10 Enhanced Treatment Outcomes During Experimental Cerebral Malaria By Ameliorating Lethal Inflammatory And Oxidative Mediators by Nyariki James Nyabuga
12:00-13:00 EAT	Parallel Session 1D: Biodiversity and Forestry and agroforestry **Moderator:** Dr. Bernard Barasa **Rapporteur:** Dr. Ndikumana Theophile	Parallel Session 1E: Climate Change Mitigation, Bioeconomy and Environmental Health **Moderator:** Dr. Athanase Nkunzimana **Rapporteur:** Dr. Hamimana Sylvestre	Parallel Session 1F: Nutrition and Environmental Health **Moderator:** Dr. Andrea Pembe **Rapporteur:** Dr. Vivian Levi Enoka
	1. Assessing the Impacts of Invasive Weed Parthenium hysterophorus (Ragweed) to Plant Diversity in Baringo Lowlands Kenya by Sally Patricia Asiyo 2. The effect of different growing media on seed germination and seedling growth of Telfairia pedate by Philipina Shayo 3. Scaling hermetic storage bags through access to finance: lessons from Tanzania by Dieudonne Baributsa 4. Impact of physical infrastructures on agricultural production in Burundi by Bonaventure Minani	1. Factors Influencing Farmers' Choice of Agrometeorological Information Pathways by Godfrey Obwina Atsiaya 2. Wood Diversity, Carbon Stocks and Land-Use Dynamics of the Lwampango Relict Forest in the Kaziba Chiefdom, Eastern Dr Congo by Ndeko Mubembe 3. Performance Evaluation of a Bioethanol Stove in Domestic Setting: Implications on Cost, Time and User Perception by Mambo Wilson 4. Evaluating Effectiveness of the Blend of Moringa oleifera Lam and Synthetic Coagulants in Coagulation/Flocculation of Wastewater from Wastepaper Recycling Mill by Nyambura Janerose Wambui	1. Determination of The Prevalence of Gastrointestinal Parasites In Zanzibar Red Colobus Monkey In Jozan National Park by Dr. James Nyabuga 2. Ambient air pollution exposure and child birthweight in East African countries by Valérien Baharane 3. Imake Food Dryer by Joseph Nyeko Churchill 4. Stretching limits of ecosystem service provision by black soldier fly (Hermetia illucens) larvae beyond the horizons of food, feed, and fertilizer for cleaner cities by Kabi F, Kaweesi G,G and Lutakome P

13:00 - 14:00 EAT - Lunch Break, Exhibition and Poster Session

14:00-15:30 EAT Plenary Session 4:
Keynote & Panel Discussion

Theme: *ICT emerging technologies in driving digital transformation in industrialization in East Africa*

In East Africa, the role of Information and Communication Technology (ICT) emerging technologies has been significant in driving digital transformation across key industries. There is a need to harness digital technologies and innovation to transform East African societies and economies to promote integration, generate inclusive economic growth, stimulate job creation, break the digital divide, and eradicate poverty for the region's socio-economic development and ensure East Africa's ownership of modern tools of digital management.

Session Moderator: Dr Annabella Basaza
Rapporteur: Dr. John Nyiro Mwero

Keynote Presentation: (25 minutes)
"Role of ICT emerging technologies in driving digital transformation in industrialization in East Africa" *by Eng. Murenzi Daniel- PITO East African Community.*

Panelists Session (40 Minutes)
- Panelist 1: Prof Oyawa, Director General, NACOSTI Kenya
- Panelist 2: Dr. Martin Ongol, Executive Secretary, NCST Uganda
- Panelist 3: Dr Eugene Mutimura, Executive Secretary, NCST Rwanda
- Panelist 4: Dr Tony Omwansa - Kenya National Innovation Agency

Discussion/ Q&A (10 minutes)

15:30 – 17:30 EAT - Parallel Sessions 2: Paper Presentations

15:30 - 16:30 EAT	Parallel Session 2A: Soil Sciences **Moderator:** Dr. Niyonzima Francois **Rapporteur:** Prof Kiri Andrew	Parallel Session 2B: Food Systems and Agribusiness Moderator: Dr. Chrispin Kowenje Rapporteur : Dr. Namulawa Victoria	Parallel Session 2C: IOT, Data Analytics & ICT for e-Government Moderator: Dr. Alphose Nkurunziza Rapporteur: Dr. Gabriel Shirima
(Each Presenter 10 Minutes then 20 minutes of Q&A at the end of presentations)	1. Effects of sowing density and different fertilizer sources on maize agronomic performance and soil properties in central Benin by Tobi Moriaque 2. Determination of liming material requirements to correct soil acidity and improve soil chemical properties in Ngoma District, Rwanda by Giramata Joie Claire & Bazimenyera Jean De Dieu 3. Bio Fertilizers for Environmentally Sustainable Soil Health Management by Chrispo Mutebi	1. Scaling hermetic storage bags through access to finance: lessons from Tanzania by Dieudonne Baributsa 2. Characterization of Organic Waste Producers and Collectors and Evaluating their Willingness to Add Value to Segregated Organic Waste for Insect Products by Teresia Wamwondwe 3. The determinants and impacts of agriculture loan on maize yield among maize farmers in Tanzania by Happiness Kilombele	1. Data-Driven Decision Making: A Case Study of Tertiary Institutions in Uganda by Dr. Fredrick Edward Kitoogo 2. Smart IoT and Machine learning Based Irrigation system by Wayne Steven Okello 3. Learner behavior model for a learning management system by Charles Lwande, Lawrence Muchemi, Robert Oboko
17:30 EAT – SNACK & END OF DAY TWO			

DAY 3: FRIDAY, MARCH 8, 2024

09:00-10:30 EAT Plenary Session 5:
Keynote & Panel Discussion

Theme: *Natural Resources Management*

Natural resources are impacted by human exploitation, climate change, and natural disaster risks that require interventions for better management. Harnessing the power of science, technology, and innovation, natural resource management can become more efficient, sustainable, and aligned with conservation goals. These applications contribute to the responsible utilization of resources, biodiversity conservation, and the overall resilience of ecosystems. By leveraging these STI applications, natural resources management can become more efficient, sustainable, and aligned with conservation goals, ultimately contributing to the resilience and health of ecosystems. The integration of these technologies is essential for addressing the complex challenges associated with resource management in a rapidly changing world and helps to monitor, preserve, and sustainably use resources

Session Moderator: Dr. Francis Mugisha
Rapporteur: Dr. John Nduko

Keynote Presentation: (25 minutes)
"Leveraging Science, Technology, and Innovation (STI) advancements in shaping and advancing the bioeconomy" by Dr. Phillip Osano Director, East African Centre SEI, Nairobi, Kenya

Panelists Session (40 Minutes)
• Panelist 1: Dr. Julius Ecuru-icipe/BioInnovate African Programme-Kenya.
• Panelist 2: Prof. Masharabu Tatien, Permanent Executive Secretary NCSTI-Burundi
• Panelist 3: Dr. Rael Adhiambo, NACOSTI, Nairobi, Kenya
• Panelist 4: Ms. Brenda Nakazibwe, Team -Leader-Pathogen Economy, Science, Technology and Innovation, Secretariat, Office of the President-Uganda

Discussion/ Q&A (25 minutes)

10:30-11:00 EAT - Health Break, Exhibition and Poster Session

11:00 -13:00 EAT - Plenary Session 6:
Keynote & Panel Discussion

Theme: *Information Communication Technology and Digital Economy*

Information Communication Technology is the broader framework encompassing various technologies, while the Digital Economy specifically focuses on the economic activities enabled by digital technologies. Together, they shape the way societies, businesses, and individuals interact and conduct transactions in the modern world. Leveraging digital technologies to enhance and streamline Digital Financial Services (DFS) is crucial for improving accessibility, efficiency, and inclusivity in financial systems. By integrating these digital technologies, financial service providers can enhance the efficiency, accessibility, and security of digital financial services, ultimately contributing to financial inclusion and economic development. Additionally, collaboration between industry stakeholders, governments, and regulators is crucial to creating a supportive ecosystem for the adoption of digital financial technologies.
Moderator: Dr. Noel NTAWUHORAKOMEYE
Rapporteur: Prof. Jean Uwamahoro

Keynote Presentation: (25 minutes)
"Leveraging digital technologies to enhance and streamline Digital Financial Services" by Richard Ndahiro, Technical Advisory, United Nations Capital Development Fund, Kampala, Uganda.

Panelists Session (40 Minutes)
- Panelist 1: Dr Dickson Andala CEO - National Research Fund-Kenya
- Panelist 2: Joe Kanyua - Head of Digital Transformation- Safaricom
- Panelist 3: Patrick Mugisha- Innovent Labs Africa- Kampala Uganda
- Panelist 4: Tamara Cook - Chief executive Officer- Financial Sector Deepening Kenya (FSD Kenya)

Discussion/ Q&A (25 minutes)

13:00 - 14:00 EAT - Lunch Break, Exhibition and Poster Session

14:00-16:00 EAT - Ministerial Session (Panel Discussion)
Ministerial dialogue on how to Accelerate development and diffusion of science, technology and innovation solutions for a resilient East Africa

Accelerating the development and diffusion of Science, Technology, and Innovation (STI) solutions for a resilient East Africa involves the intentional efforts and strategies aimed at fostering the rapid growth, application, and widespread adoption of scientific, technological, and innovative solutions in the East African region. It aims at enhancing the region's capacity to respond effectively to challenges and shocks, building resilience across various sectors such as healthcare, agriculture, infrastructure, energy and the environment.
Session Moderator: Muyambi Fortunate DES/EASTECO
Rapporteur: Mr. Moses Ndahiro

Presentation of Ministerial Resolutions Implementation from the 2nd Science, Technology and Innovation Conference
Fortunate Muyambi, Deputy Executive Secretary, EASTECO
Presentation on recommendations from the Plenary Sessions by Rapporteur General
Feedback / Responses from Partner States Ministers
Minister - Republic of Burundi,
Minister - Republic of Rwanda,
Minister - Republic of Uganda,
Minister - United Republic of Tanzania,
Minister - Republic of South Sudan,
Minister - Democratic Republic of DRC

• Launch of EAC Regional Policies and Strategies
16:00-16:30 EAT - Closing Remarks
Executive Secretary, EASTECO
Executive Secretary, IUCEA
Secretary General, EAC

Hon. Ezekiel Machogu, CBS
Cabinet Secretary, Ministry of Education, Kenya

17:00 EAT - END OF THE CONFERENCE