THE ELDORET NATIONAL POLYTECHNIC

14TH ANNUAL INTERNATIONAL RESEARCH CONFERENCE

THEME:

COMPETENCIES IN APPLIED RESEARCH, SCIENCE AND INNOVATION FOR SUSTAINABLE DEVELOPMENT

(CIRIS 2025)

DATES: 15TH -16TH OCTOBER 2025

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Overview

The Eldoret National Polytechnic (TENP) 14th International Conference and Inaugural Research Expo stands as a landmark initiative reaffirming the institution's commitment to advancing research, science, and innovation for national transformation. **Research lies at the heart of progress;** it drives innovation, shapes technology, and delivers evidence-based solutions to society's most pressing challenges. Guided by this belief, TENP established the Expo as its **flagship platform to ignite dialogue, inspire collaboration, and strengthen partnerships**.

The event intends to provide a vibrant stage where ideas meet solutions, where researchers, innovators, entrepreneurs, and policymakers converge to exchange knowledge, showcase innovations, and cultivate a culture that fuels sustainable development. The event embodies TENP's leadership in translating training into tangible skills that improve livelihoods and strengthen industry linkages.

Anchored on the theme "*Competencies in Applied Research, Science, and Innovation for Sustainable Development,*" the 2025 edition aligns seamlessly with global, continental, and national development frameworks such as the Sustainable Development Goals (SDGs), with particular focus on SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals), as well as Africa's Agenda 2063, Kenya's Vision 2030, and the Bottom-Up Economic Transformation Agenda (BETA).

This year's event convenes a diverse community of **thought leaders, researchers, innovators, industry players, entrepreneurs, and institutional partners** drawn from sectors such as agriculture, trade, environment, technology, and skills development. Participants include representatives from **TVET institutions, universities, research organizations, government ministries, the Uasin Gishu County Government, the private sector, development agencies, and civil society.**

It further welcomes **professionals, policymakers, trainees, media representatives, and funding partners**, all united by a shared vision, to **advance research, innovation, and skills agenda under the leadership of TENP.** Through this collective effort, the Conference and Expo reaffirm TENP's role as a **catalyst for** driving the country closer to a skill-based, inclusive, and sustainable future.

Conference Themes and Strategic Focus Areas

The focus areas are strategically aligned with Kenya's national development priorities, emphasizing **agricultural productivity**, **climate resilience**, **economic inclusion**, and **food security**. The key thematic areas include:

1. Digital Transformation for Inclusive Growth and Innovation
2. Smart and Sustainable Agriculture, Food Security, and Nutrition
3. Health Innovations for Resilient Communities
4. Rethinking Education and Skills for the 21st Century
5. Sustainable Engineering, Green Technologies, and the Built Environment
6. Culture, Gender, Tourism, and Hospitality in Sustainable Development

Through these thematic areas, the event seeks to catalyze transformative action that advances sustainable livelihoods, nurtures inclusive growth, and drives long-term national prosperity and resilience.

Event Duration and Structure

Duration

The 14th Annual International Conference and Expo will be held from October 15th to 16th, 2025, at The Eldoret National Polytechnic, Main Campus.

Structure of the Event

The event will take the following format.

i. Keynote addresses
ii. Exhibitions
iii. Skills Competition
iv. Showcasing Innovations
v. Panel Discussions
vi. Paper and Poster Presentations
vii. Pitching by Companies
viii. Networking activities
ix. Awards

OUR PARTNERS

KEYNOTE SPEAKERS

Senior Lecturer, Department of Pharmacology & Therapeutics, Makerere University College of Health Sciences

Chair, Makerere University School of Biomedical Science Research Ethics Committee

Chair, National Taskforce for Drafting Guidelines on Gene Therapy Research and Development

Member Novartis and DNDi Visceral Leishmaniasis Africa Advisory Board

President Uganda Pharmacological Society (UpharS)

Member Africa Bioethics Network

Moses Ocan (BS, MSc, PGD, P.h.D; Postdoc)

Dr. Moses Ocan has a wide range of experience in research covering both conduct and research ethics. He has developed skills in the design and conduct of both intervention and non-intervention studies. Moses has experience in monitoring adherence to ethical standards among researchers in the conduct of research. Initially, he graduated as a biological scientist in 2006 and later in 2011 as a Pharmacologist at Makerere University, where he took on a faculty position at the Makerere University Department of Pharmacology & Therapeutics. Moses enrolled in a doctoral program, graduating with a PhD in pharmacology in Makerere University in February 2017 and later completed his Postdoctoral fellowship in 2018 at the University of California, Berkeley.

He has conducted clinical trials and has experience as a Data Safety and Monitoring Board (DSMB) member. Moses has published over 60 articles in peer-reviewed journals and is a member of the editorial board and reviewer in several peer-reviewed journals. He has supervised to completion 20 graduate (MSc) and 2 doctoral (PhD) students. He is currently supervising 4 MSc and 6 PhD students at Makerere University. Moses has won both international and local research grants.

ORCID iD: http://orcid.org/0000-0002-8852-820X

Senior Lecturer, Head of the Department of Medical Laboratory Sciences-Kabarak University
Coordinator-Research Grants and Resource Mobilization.
Member Board of Management- National Quality Control Laboratory Kenya
DR. MICHAEL N. WALEKHWA, PHD, MBA, PGD

Dr. Michael N. Walekhwa is a distinguished biomedical scientist, researcher, and academic leader whose work bridges the disciplines of medical immunology, infectious disease epidemiology, and healthcare quality systems. He holds a PhD and MSc in Medical Immunology, a BSc (Hons) in Medical Laboratory Sciences, and an MBA in Strategic Management. He also holds advanced certifications in Epidemiology for Global Health and Leadership and Management in Health, and is a certified consultant in ISO 9001:2015 and ISO 15189:2022 Quality Management Systems.

At Kabarak University, Dr. Walekhwa serves as Senior Lecturer, Head of the Department of Medical Laboratory Sciences, and Coordinator of Research Grants and Resource Mobilization. He has previously served as the Coordinator of Research Ethics and Secretary of the Kabarak University Research Ethics Committee (KUREC), His scholarly work focuses on immunology, vaccine immunogenicity, antimicrobial resistance, and the epidemiology of infectious diseases in low-resource settings.
He has over 50 publications in reputable peer-reviewed journals and has authored several academic books among them - *Research Methods: Essential Tools and Techniques*, *Instructional Immunology: A Textbook for Beginners*, and *Guidelines for Writing Scientifically and Ethically Sound Proposals*, which have become reference resources for students and researchers across Africa.
Beyond academia, Dr. Walekhwa is a governance and quality systems expert actively engaged in Kenya's health and research regulatory ecosystem. He serves on the Board of Management of the National Quality Control Laboratory (NQCL), and also as a member of the Operational Research Committee of the Pharmacy and Poisons Board (PPB).

ORGANIZING COMMITTEE

Secretariat

Chairperson: Dr. Charles Koech

Co-chairperson: Dr. Fred Ageng'o

Technical Committee

Dr. Fred Ageng'o

Jacinta Muthuri

Danol Rotich

Emmanuel Kipruto

Finance committee

Dr. Charles Koech

Richard Sang

Logistics Committee

Dr. Charles Koech

Paul Seurey

Peninnah Ogutu

Dr. Fred Ageng'o

Charles Ruto

Research Committee

Dr. Charles Koech

Dr. Fred Ageng'o

Jacinta Muthuri

Danol Rotich

Emmauel Kipruto

Dr. Virate Kiprop

Benedict Otieno

Betty Chemutai

Kevin O. Otieno

Carolyn Bii

Raphael Murei

Luyali Irene

Hyline Mokano

Joan Kitur

Daniel Nyandema

Ronald Yego

Celestine Jepchumba

Wilmin Atieno

Laurence Koskei

Regina Nyongesa

Dorcas Sambu

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THEME:

COMPETENCIES IN APPLIED RESEARCH, SCIENCE, AND INNOVATION FOR SUSTAINABLE DEVELOPMENT

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DATES: 15TH -16TH OCTOBER 2025

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
TIME	**ITEM**
0800 - 0830	♦ Registration of participants at the reception Desk **Chief Guests and other Invited Guests** ♦ Arrival and Signing of visitors' Book
0830 - 0900	♦ Tour of the exhibition, skills, and innovation show tents. ♦ Tour of TENP and Planting of trees by the chief guest.
0900- 1300	**OFFICIAL OPENING CEREMONY AND KEYNOTE PRESENTATION**
1100 - 1300	**Venue:** The Plenary Hall **Director of program:** Paul Seurey & Peninnah Ogutu **Session Chair:** Dr. Paul Murgor **Rapporteur:** Dorice Koech Angela Vwamula Musiega **Keynote presentation** "Bridging the Gap: Transforming Innovations into real-world Solutions" By **Dr. Moses Ocan,** *Senior Lecturer of pharmacology, college of Health sciences, Makerere university* **Official opening ceremony by the chief guest**
1300 - 1400	**HEALTH BREAK**
	Innovation pitching, Exhibitors and Partners marketing session
1400 - 1700	Breakout to Parallel Sessions (A-I)
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (A)	
SUB-THEME I: SMART AND SUSTAINABLE AGRICULTURE, FOOD SECURITY, AND NUTRITION **Venue: JL 03** **Chair:** ***Dr. Susan Keino*** **Rapporteur:** *Getrude Onsando*	
TIME	**TITLE**
1400 - 1420	Development of a Fortified Uji Mix to Combat Malnutrition and Strengthen Food Security in Arid Regions of Kenya *Aaron Chigumba*
1420 - 1440	Production of Cookies Made from Blends of Cassava Flour and Amaranth Flour *Abigael Chepkoech*
1440 - 1500	Leveraging TVET for Smart Agricultural Practices and Sustainable Livelihoods in Kenya *Adams Yakini & Nathaniel Karanja*
1500 – 1520	Computational and Experimental Evaluation of CO_2 Retention in Polymer-Stabilized Beverages *Anthony B. Mathenge*
1520 - 1540	The Role of Food System Policies in Addressing Food and Nutrition Security in Vihiga County, Kenya *Aron, L, G. Nguka, & S. Konyole*
1540 – 1600	Predictors of Malnutrition Among Children with Disabilities Aged 6–59 Months at Mbagathi County Referral Hospital, Nairobi, Kenya *Eddah Chepkoton Kolgat*
1600 – 1620	Food System Transformation through Integrated Community Development: A Case Study of Nandi County *Esther Omayio*
1620 - 1640	Dimensions of Food Security in Uasin Gishu County: Availability, Accessibility, Utilization, and Stability *Joan Jerop*
1640 - 1700	Harnessing Agricultural Biotechnology for Climate Change Mitigation and Sustainable Environmental Stewardship *Lyna Nkatha Muthomi*
	Assessing the Relationship Between Sleep and Weight Control: Emerging Trend *Juliet Wafula*
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (B)	
SUB-THEME I: SMART AND SUSTAINABLE AGRICULTURE, FOOD SECURITY, AND NUTRITION **Venue: JL 04** **Chair:** *Syvester Jaika* **Rapporteur:** *Lydia Boit*	
TIME	**TITLE**
1400 - 1420	Assessment of Energy and Food Security for Rural Development in Keiyo South, Elgeyo Marakwet County *Evans Ondati*
1420 - 1440	Formulation of Finger Millet and Termite Powder Composite Thin Porridge Flour *Tracy Musimbi Amdara*
1440 - 1500	Leveraging Climate-Smart Biomedical Technologies to Strengthen Health System Resilience in Kenya *John Gichuru*
1500 – 1520	Optimization of Azolla and Black Soldier Fly Larvae Formulation as Affordable Fish Feeds: A Case Study on Essunza Tilapia Fish Ponds *Charles E. Butiko*
1520 - 1540	Optimizing Nutritional Quality through Fortification of Common Household Foods with Lemongrass (*Cymbopogon citratus*): A Review of its Functional and Therapeutic Potential *Gertrude Onsando*
1540 – 1600	Determinants of Infant and Young Child Feeding Practices among Children Aged 0–23 Months in a Pastoralist Community: A Case of Baringo South, Kenya *Joyline Rotich*
1600 – 1620	Exploring Dung Beetle (*Scarabaeus viettei*) Larvae as a Sustainable Source of Edible Oil and Food Fortification *Kelvin O. Otieno*
1620 - 1640	Dietary Diversity and Nutrition Status Among Young Adults Aged 18–24 Years at Eldoret National Polytechnic *Chepkwony Peter*
1640 - 1700	Nutrition Knowledge, Dietary Practices, and Nutrition Status Among Pregnant Women Attending Kapsabet County Referral Hospital *Peter Chege, Wesley Bor & Olympia Jeruto*
	Dietary Practices and Risk of Hypertension among Adults Attending Nakuru Level 5 Hospital, Kenya: A Cross-Sectional Study *Winnie Moimet*
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (C)	
SUB-THEMEII: CULTURE, GENDER, TOURISM AND HOSPITALITY IN SUSTAINABLE DEVELOPMENT **Venue: JL 05** **Chair:** ***Dr. Zipporah Berut*** **Rapporteur: A*lbert Odula***	
TIME	**TITLE**
1400 - 1420	Roles of Community-Based Cultural Initiatives in Promoting Sustainable Tourism and Hospitality Development in Western Kenya *Anna Awuor Adera*
1420 - 1440	Bridging the Gender Gap in Technical and Vocational Education: Enrollment and Retention of Female Students in Technical Courses in Kenya *Evasheila Wawira Njeru*
1440 - 1500	Femicide in Kenya: Trends, Contributing Factors, and Strategies to Address Gender-Based Violence and Societal Vulnerabilities *Gladys Maritim*
1500 – 1520	Culinary Tourism and Its Influence on Restaurant Sustainability in Kisumu County, Kenya *Pedo Ruth Awuor*
1520 - 1540	Effects of Seasonal Domestic Tourism Boom on Environmental Pollution in Kitale National Park, Trans Nzoia County, Kenya *Benson Murrey & Raphael Murei*
1540 – 1600	Effects of Online Food Delivery Platforms on the Performance of Traditional Restaurants *Cecilia Maina*
1600 – 1620	Community-Based Tourism and Sustainable Development in Rural Kenya: The Case of the Rimoi Region *Christabel H. Sheri*
1620 - 1640	Household Use of Earthenware and Aluminum Cookware in Racecourse Ward in Uasin Gishu: Implications for Health, Flavour, and Cultural Practices *Nancy Jemutai Sei & Raphael Murei*
1640 - 1700	Influence of Community Participation in Tourism on Socio-Economic Growth of The Abagusii Otenyo Cultural Group in Kisii, Kenya *Hyline Mokano*
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (D)	
SUB-THEME III: DIGITAL TRANSFORMATION FOR INCLUSIVE GROWTH AND INNOVATION **Venue: JL 10** **Chair:** ***Dr. Robert Odhiambo Onyango*** **Rapporteur:** ***Rutto Jeniffer***	
TIME	**TITLE**
1400 - 1420	Development of an Artificial Intelligence-Based System for Automated Detection of Plant Diseases Using Thermal Imaging and Image Processing to Enhance Food Security *David Ochieng Oduor*
1420 - 1440	Leveraging Digital Innovation and Science, Technology, and Innovation (STI) to Enhance Agricultural Productivity under Kenya's Bottom-Up Economic Transformation Agenda *Harrison Wairegi*
1440 - 1500	Evaluation of Kenya TVET Trainers' Use of Artificial Intelligence in Instructional Design and Delivery *Maina Cyrus King`ori*
1500 – 1520	Incorporating Automation and Human-Centered AI in TVET Programs: Equipping Kenyan Technicians for the Fifth Industrial Revolution *Milton Olala & Isaac Gitonga*
1520 - 1540	Effectiveness of Social Media on Information Retrieval and Learning among University and College Students in North Rift, Kenya *Moturi, M. Alvin & Samikwo C. Dinah*
1540 – 1600	An Assessment of Integration of Emerging Technologies in Technical Training: A Case Study of Kitale National Polytechnic *Stephen Musilang'ombe Wafula*
1600 – 1620	Predictive Maintenance of Solar Panels Using IoT and Machine Learning *Felix Langat*
1620 - 1640	Evaluating the Influence of Cybersecurity Policies and Cybersecurity Behaviour on Institutional Security Performance in Remote Learning: The Moderating Role of Technological Readiness *Chrispus Zacharia Oroni*
1640 - 1700	Gamification Strategies for Enhancing Engagement in Online Courses: A Case Study of Rift Valley Technical Training Institute, Eldoret *Graham Kituzi & James Kosgey*
	Intelligent Student Recruitment and Career Guidance: Leveraging Artificial Intelligence to Revolutionize TVET Entry Pathways in Kenya *Justus Musasia*
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (E)	
SUB-THEME IV: SUSTAINABLE ENGINEERING, GREEN TECHNOLOGIES AND THE BUILT ENVIRONMENT **Venue: JL 11** **Chair:** ***Prof. Peter Okemwa*** **Rapporteur:** ***Nancy Sei***	
TIME	**TITLE**
1400 - 1420	Evaluating Environmental Sustainability through Greening Initiatives: A Case Study of Green Innovation and Industrial Transformation in Kenya *Linda Chepkoech*
1420 - 1440	Durable and Reusable Antimicrobial Textiles Functionalized with *Erythrina Abyssinica* Extracts and Bio-Mordants *Odero P. Mark, Fred Agengo, & Graham Kituzi*
1440 - 1500	Integrating Green Hydrogen and Power-to-X Technologies into Kenyan TVET Curricula: A Feasibility and Implementation Study *Ronald Kibet Yego*
1500 – 1520	Assessing the Effects of Renewable and Non-Renewable Energy Consumption on Economic Growth in Kenya *Chepkirui Jeniffer*
1520 - 1540	Interrelations Between Built Environment, Health, and Well-Being: Empirical Insights and Policy Implications from Global and Kenyan Perspectives *Simon Wafula Nyongesa & Charles Koech*
1540 – 1600	A Sustainable Engineering Solution through Decentralized Renewable Microgrids for Rural Kenya *Nathan Karanja & Adams Yakini*
1600 – 1620	
1620 - 1640	
1640 - 1700	
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (F)	
SUB-THEME V: HEALTH INNOVATIONS FOR RESILIENT COMMUNITIES **Venue: JL 12** **Chair:** ***Dr. Peter Mark Odero*** **Rapporteur:** ***Charles E. Butiko***	
TIME	**TITLE**
1400 - 1420	Phylogenetic Analysis of the Subgenus Anopheles: Unraveling Evolutionary Relationships Between the Angusticorn and Laticorn Sections *Adam Ford Wanyonyi*
1420 - 1440	Evaluating Innovative, Community-Embedded Approaches to Mental Health Support for Building Resilience in Junior Secondary Schools in Uasin Gishu County, Kenya *Chemutai Irene Sang & Samikwo Dinah*
1440 - 1500	Design and Implementation of a Blended Learning Framework for Competency-Based Education in Vocational Training *Elizabeth Mutunge Mukeu*
1500 – 1520	Evaluating the Association Between Sleep and Weight Control: Emerging Trends *Juliet Wafula*
1520 - 1540	Comparison of Traditional Fat Sources and Thermal Processing Methods as Contributing Factors to Kenya's Pandemic of Non-Communicable Diseases *Cheruiyot Sambu & Julius Koske*
1540 – 1600	Leveraging Climate-Smart Biomedical Technologies to Strengthen Health System Resilience in Kenya *John Gichuru*
1600 – 1620	Microplastics in Aquatic Ecosystems: Pathways, Persistence, and Implications for Environmental and Human Health *Phanice Jelimo*
1620 - 1640	
1640 - 1700	
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (G)	
SUB-THEME VI: RETHINKING EDUCATION SKILLS FOR THE 21ST CENTURY **Venue: JL 13** **Chair:** ***Dr. Keter Philemon Kibet*** **Rapporteur:** ***Cynthia Koech***	
TIME	**TITLE**
1400 - 1420	Sustainability Awareness and Practices in Technical and Vocational Education: Preparing a Green Workforce for Tourism and Hospitality in Kenya *Gloria Aketch & Adams Yakini*
1420 - 1440	Influence of the Mechanical Engineering Technician Curriculum on the Implementation Effectiveness of Outcome-Based Education in Public TVET Institutions in Mount Kenya Region *Apollo M. Maingi*
1440 - 1500	Evaluating the Impact of Virtual Laboratory Instruction on Students' Conceptual Mastery of Key Biology Topics in Secondary Schools in Likuyani, Kakamega County, Kenya *Jacob W. Kachi, Samikwo Dinah, Jeruto Pascaline*
1500 – 1520	Equipping Pre-Service Teachers with Practical and Digital Competencies for Effective Implementation of Competency-Based Mathematics Instruction in Teacher Training Colleges, Kenya *Jepkosgei Purity & Tololwo Kiptoo Dennis*
1520 - 1540	Reimagining Training of Trainers for the 21st Century: Skills, Strategies, and Institutional Responsibilities *Joseph Muchiri & Apollo Maingi*
1540 – 1600	Modular Syllabus Implementation and Performance of Technical Courses: Does Modular Digitalization Strategy Matter? Evidence from Technical and Vocational Education and Training in Nairobi County, Kenya *Joseph Irungu Kimemia*
1600 – 1620	Effect of Inquiry-Based Learning Approach and Traditional Learning Approaches on Retention of Physics Concepts *Kinyanjui Godfrey Kimiru, Dinah C. Samikwo & Dismas Choge*
1620 - 1640	Effectiveness of Field Courses on Technology Education Students' Learning *Lorna Wafula, Damaris Naliaka Simiyu & Stanley Simiyu Sitati*
1640 - 1700	TVET Trainees' Perspective on Dual Training: A Case Study of Michuki, Nyeri & Kiambu National Polytechnics and Thika Technical Training Institute *Olwese Felix & Wangila David*
1700 - 1730	**HEALTH BREAK**

1730	END OF DAY ONE

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025	
PARALLEL SESSION (H)	
SUB-THEME VI: RETHINKING EDUCATION SKILLS FOR THE 21ST CENTURY **Venue: JL 18** **Chair:** *Dr. Michael Walekwa* **Rapporteur:** *Simon Wafula Nyongesa*	
TIME	**TITLE**
1400 - 1420	Industry-Based Linkages as a Driver of Effectiveness in Competence-Based Evaluation and Training: A Literature Review *Bochaberi Dorcas Ondicho*
1420 - 1440	Determinants of Academic Performance of Students with Special Needs in Public Colleges in Mombasa County *Carolyn Kogo*
1440 - 1500	Integration of Climate Change Education in TVET Training Institutions in Kenya: A Comprehensive Review *Koech D. C*
1500 – 1520	Walking the RPL Journey: Candidate Perspectives on Skills Recognition and Certification in Kenya *Joseph Okwaro Athenus*
1520 - 1540	Effect of Debt Financing on Financial Sustainability of Private Secondary Schools: Evidence from Uasin Gishu County, Kenya *Neusta Chepleting Metto*
1540 – 1600	A Green, Tailored Skills Curriculum for People with Disabilities and Limited Mobility *Onyait Immaculate*
1600 – 1620	Influence of Internal Control Systems and Organizational Culture on the Performance of Public TVET Institutions in Kenya *Regina Nyongesa Ojwangi*
1620 - 1640	Common Mistakes in Spoken English and their Effect on Learning among Trainees at The Eldoret National Polytechnic *Judith Nyamwaya & Robert Masinde*
1640 - 1700	Identification of Knowledge and Skill Gaps among Eldoret National Polytechnic Food Technology Graduates *Kiprop, J. V, Samikwo, D & Wafula, N. W*

	Competency-Based Curriculum in Kenya: The Missing Link Between Junior School and Senior School. A Desktop Study *Kennedy W. Nyongesa*
1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY ONE: WEDNESDAY, 15TH OCTOBER, 2025

PARALLEL SESSION (I)

SUB-THEME VII: CROSS-CUTTING ISSUES

Venue: JL 20

Chair: ***Dr. George Ariya***

Rapporteur: ***Felix Langat***

TIME	TITLE
1400 - 1420	The Implications of Small Arms and Light Weapons Proliferation on Human Security among the Rendille Community in Marsabit County-Kenya *Isaac Meme Mwenda & Towett Geofrey*
1420 - 1440	Supply Chain Strategic Capabilities and Quality of Health Care Services among Private Hospitals in Western Kenya *Joan Bii & Walumbe Titus*
1440 - 1500	Data Protection Awareness and Compliance in Kenyan TVET Institutions: A Case of The Eldoret National Polytechnic *Cynthia Koech*
1500 – 1520	Effects of Employee Participation in Decision Making on Organizational Performance: A Case Study of Huduma Centre Eldoret Branch *Luyali M. Irene*
1520 - 1540	Effect of operational costs on quality service delivery: A survey of commercial bank branches in Kenya *Lydia Boit, Rhoda Chumba & Kennedy Otiso*
1540 – 1600	Effect of Electronic Banking on the Financial Performance of Commercial Banks in Kenya *Christine Iminza*
1600 – 1620	Role of Forensic Accounting Services in Fraud Mitigation Among Kenyan Public Institutions: A Case of Parastatals in Kenya *Luka Kibiwott*
1620 - 1640	Effect of Mobile Banking on Savings Mobilization by Cooperative Societies: A Case of Boresha Sacco, Eldoret *Makori Sammy Job*
1640 - 1700	

1700 - 1730	**HEALTH BREAK**
1730	**END OF DAY ONE**

DAY TWO: THURSDAY, 16TH OCTOBER, 2025		
PLENARY SESSION		
TIME	**ITEM**	
0800- 0930	♦ Registration of participants at the reception Desk ♦ Tour of exhibition, skills and innovation show tents	**Invited Guests** ♦ Arrival and Signing of visitors' Book
0930- 1100	**PLENARY PRESENTATIONS**	
	Keynote Presentation and Panel Discussion **Venue:** The Plenary Hall **Director of program:** Paul Seurey & Peninnah Ogutu **Session Chair:** Dr. Peter Mark Odero **Rapporteur:** Dorice Koech **<u>Keynote presentation</u>** "Unlocking Opportunities: Strategies for Securing Research and Innovation Funding" By **Dr. Michael Walekwa** *Senior Lecturer- Immunology and Hematology, Department of Biomedical Sciences, Kabarak University.* **<u>Panel Discussion</u>** "The role of Dual TVET and modularized programs in shaping a market-ready workforce". **Panel Chair:** Peninnah Ogutu- *Deputy Principal Academics* **Moderator:** Angela Vwamula Musiega- *Journalist TENP.* 1. Stanely Maindi - Director RPL Delivery Unit, State department for TVET. 2. Magdaline Chepkemoi- Chief executive officer, EldoHub 3. Albert Kipchirchir- Principal, Tech academy 4. Gideon Murenga - Senior TVET and Labour Markets Advisor, *GIZ*, Kenya. 5. Theresa Wasike- Ag. Director General, National Industrial Training Authority (NITA)	

1100-1130	**HEALTH BREAK**
1130-1200	Exhibitors and Partners Marketing session
1200-1300	**Official closing Ceremony**
1300-1400	**HEALTH BREAK**
1400-1700	Tour of exhibitions, Business & Partner Networking session

SUB-THEME:

SMART AND SUSTAINABLE AGRICULTURE, FOOD SECURITY AND NUTRITION

Development of a Fortified Uji Mix to Combat Malnutrition and Strengthen Food Security in Arid Regions of Kenya

Aaron Chigumba[1]*
[1]Taita Taveta National Polytechnic

Abstract

Malnutrition remains a pressing public health challenge in Kenya, particularly in arid and semi-arid regions where persistent food insecurity has left vulnerable populations, especially children, at heightened risk. The discontinuation of food assistance programs such as those supported by USAID has further intensified this crisis, underscoring the urgent need for sustainable, locally driven nutritional interventions. This study explored the development of a fortified *uji* mix as an affordable and scalable solution to combat malnutrition and enhance food security in these regions. Using locally available grains, including maize, millet, sorghum, and nutrient-dense legumes such as amaranth, the study formulates a fortified *uji* mix enriched with essential vitamins and minerals, such as iron, zinc, vitamin A, and calcium. A mixed-methods research design was employed, incorporating laboratory analyses to determine optimal nutritional composition, interviews to assess community acceptability, and cost-effectiveness analyses to evaluate affordability for low-income households. The findings indicate that the fortified *uji* mix met the World Health Organization's recommended daily nutrient requirements and offers a culturally acceptable, cost-effective alternative to imported nutritional supplements. Its production and distribution potential make it a viable tool for improving child nutrition and reducing micronutrient deficiencies in resource-constrained settings. The study concludes that promoting fortified *uji* development through partnerships among government agencies, TVET institutions, food scientists, the private sector, and local communities can significantly advance food security and health outcomes. This research highlights the transformative potential of food science innovations in addressing malnutrition and fostering sustainable development in Kenya's arid regions.

Keywords: Malnutrition, Food Security, Fortified *Uji Mix*, Child Nutrition, Low-income Households

Production of Cookies Made from Blends of Cassava Flour and Amaranth Flour

Abigael Chepkoech[1*]
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Abstract

Food insecurity and malnutrition remain pressing challenges in developing countries, largely due to dependence on cereal-based diets and rising prices of staple foods. Cassava and amaranth, both underutilized indigenous crops, offer promising alternatives for enhancing food and nutrition security. Cassava is a drought-tolerant root crop rich in carbohydrates, while amaranth is a nutrient-dense pseudocereal with high-quality protein, iron, and vitamins. This study aimed to produce and evaluate cookies made from blends of cassava and amaranth flours as a strategy for developing affordable, nutrient-rich, and locally sourced food products. Dried cassava tubers and amaranth grains were processed into fine flours and combined at varying substitution levels (100:0, 80:20, 60:40, 40:60, and 20:80). Standard cookie recipes were used to prepare samples, which were then evaluated for proximate composition, mineral content, sensory attributes, and physical characteristics. Data were analyzed to determine the optimal flour ratio that balanced nutritional enhancement with consumer acceptability. Results indicated that increasing the proportion of amaranth flour significantly improved protein, iron, and fiber content while reducing carbohydrate levels. However, higher amaranth substitution beyond 40% slightly reduced cookie spread and sensory acceptability due to changes in texture and flavor. The 60:40 cassava-to-amaranth blend produced cookies with desirable taste, texture, and nutritional balance, meeting acceptable consumer standards. The study concludes that blending cassava and amaranth flours can yield affordable, nutritious cookies suitable for improving dietary diversity and reducing reliance on imported wheat flour. Adoption of such composite flour products can enhance food security, generate rural employment, and promote the utilization of indigenous crops in Kenya and beyond.

Keywords: Cassava flour, Amaranth flour, Composite flour, Cookies, Nutritional value, Food security, Value addition

Computational and Experimental Evaluation of CO_2 Retention in Polymer-Stabilized Beverages

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Abstract

Loss of carbonation significantly reduces the sensory appeal, texture, and shelf life of carbonated beverages, making it a persistent challenge in product formulation. This study investigates the potential of two food-grade polymers, methylcellulose (MC) and gellan gum (GG), to enhance CO_2 retention and overall beverage stability. A dual methodological approach combining *in-silico* molecular modeling and *in-vitro* laboratory experimentation was applied. Computational simulations were conducted using Density Functional Theory (DFT) at the B3LYP/6-31G(d,p) level in Gaussian software to estimate interaction energies and visualize molecular electrostatic potential (MEP) maps for CO_2–polymer complexes. Experimental validation involved titrimetric CO_2 quantification, headspace pressure analysis, UV–Vis absorbance studies, and sensory evaluation. Computational results revealed binding energies of −8 kcal ·mol^{-1} for CO_2–MC and −10.5kcal ·mol^{-1} for CO_2–GG, consistent with stronger non-covalent attraction in GG. After 24 hours, polymer-treated beverages retained 31% (MC) and 33% (GG) of initial CO_2, compared to 24% in untreated controls, representing a 28–38% improvement in carbonation stability. Sensory panel results (n = 15) confirmed a notable increase in perceived fizziness and freshness in polymer-fortified samples. The integrated findings demonstrate that MC and GG are promising natural additives for extending the shelf life and quality of carbonated beverages.

Keywords: Carbonation, methylcellulose, DFT, Gaussian, CO_2 retention,

The Role of Food System Policies in Addressing Food and Nutrition Security in Vihiga County, Kenya

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Abstract

Access to a safe and healthy variety of food, as a fundamental human right, has long been a subject of global debate. The Kenyan government is committed to achieving food security for all citizens, as reflected in the Big Four Agenda and the Sustainable Development Goals (SDGs), particularly Goals 2, 3, and 4. Policies and goals related to food and nutrition security require regular review to assess their effectiveness. However, despite the critical importance of monitoring and evaluation, information on the role and influence of stakeholders in shaping these policies remains limited. This study examines the role of food system policies and the actors influencing them in relation to food and nutrition security in Vihiga County, Kenya. The specific objectives are to assess the food and nutrition security status of households relying on small-scale farming, investigate food system policies influencing Vihiga County, and map stakeholders affecting these policies among small-scale farmers. A cross-sectional analytical approach was adopted. Two sub-counties were randomly sampled, and purposive sampling was used to select households. Data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25, applying both descriptive and inferential statistics. Results showed that most households were severely food insecure, with a Household Food Insecurity Access Scale of 63 percent. Thirteen food system policies and regulations affecting Vihiga County were identified. The national government formulates overarching policies that guide agricultural production, while the county government, through the County Assembly, develops complementary frameworks to support implementation. According to Community Health Volunteers (CHVs), the major challenge lies not in the absence of policy documents but in inadequate sensitization and implementation. Addressing severe food insecurity requires greater awareness among farmers, stronger policy execution by the Directorate of Agriculture, expert engagement in policymaking, and improved resource allocation at both national and county levels.

Keywords: Food Security, Policies, Nutrition Security, Food System

Food System Transformation through Integrated Community Development: A Case Study of Nandi County

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Abstract
Transforming food systems to deliver improved outcomes for health, livelihoods, and the environment remains one of the most critical global challenges of the 21st Century. In Kenya, food systems are struggling to provide nutritious and affordable diets while also facing issues of sustainability, resilience, and inclusivity. The agricultural sector, central to the nation's economy, continues to be vulnerable to climate shocks that affect productivity and livelihoods. Moreover, systemic challenges such as inadequate infrastructure, limited access to markets for smallholder farmers, and poor access to credit further undermine the sector's performance. This study examined the key food system challenges and outcomes in Nandi County using participatory and food systems mapping frameworks. Data were collected through desk reviews, key informant interviews, and focus group discussions. Primary tools included community and natural resource maps, transect walks, seasonal and agronomic calendars, gender daily calendars, and stakeholder mapping and analysis. Problem ranking and analysis were conducted using pairwise matrix ranking, problem tree, and objective/solution tree analyses. Community action plans were developed and validated during ward-level community meetings. The analysis revealed that low farm production and productivity driven by land degradation, declining soil fertility, market inefficiencies, limited credit access, and weak extension services constituted the core problem. The findings provide a foundation for identifying priority challenges to be addressed through ward action plans and will guide policy formulation by the County Government of Nandi and practice among other stakeholders.

Keywords: Policy integration; Food systems transformation; Participatory research; Community development; Agricultural productivity

Harnessing Agricultural Biotechnology for Climate Change Mitigation and Sustainable Environmental Stewardship

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Abstract

Climate change continues to pose a significant threat to human livelihoods and environmental stability, largely driven by greenhouse gas emissions resulting from fossil fuel combustion, deforestation, and unsustainable agricultural practices. Rising global temperatures and unpredictable weather patterns have disrupted food production systems, degraded ecosystems, and undermined sustainable development efforts. In response, agricultural biotechnology has emerged as a transformative tool for climate change mitigation and adaptation, offering innovative solutions to enhance productivity, conserve resources, and promote environmental stewardship. This study explored how biotechnological innovations, specifically genetic improvement, microbial and soil biotechnology, bio-based inputs, and precision farming technologies, contribute to reducing greenhouse gas emissions, improving soil carbon sequestration, and strengthening resilience in agricultural systems. A qualitative review approach was employed, drawing insights from scientific literature, policy reports, and regional case studies. Findings indicate that biotechnology improves crop resistance to drought and pests, increases soil fertility through microbial activity, and minimizes emissions through efficient input utilization. Moreover, precision agriculture enables optimized resource management, reducing waste and enhancing sustainability. However, the study also identified persistent challenges, including biosafety concerns, unequal access to biotechnology tools, and limited institutional capacity, particularly in developing economies. The findings emphasize that for biotechnology to effectively drive a low-carbon, climate-resilient agricultural transformation, it must be supported by strong regulatory frameworks, ethical oversight, and inclusive access. When responsibly adopted, agricultural biotechnology becomes a powerful catalyst for mitigating climate change, conserving biodiversity, and achieving global sustainability and food security goals.

Keywords: Agricultural biotechnology, Climate change mitigation, Crop resilience, Sustainable environment, Carbon sequestration

Nutrition Knowledge, Dietary Practices, and Nutrition Status Among Pregnant Women Attending Kapsabet County Referral Hospital

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Abstract

Good nutrition during pregnancy is essential for both maternal health and fetal development. Optimizing maternal nutritional status helps prevent complications, reduce mortality, and promote positive birth outcomes. Dietary intake among pregnant women is a key determinant of their nutritional status, while nutrition knowledge significantly influences dietary practices. However, in many cases, the nutritional status of pregnant mothers remains inadequately addressed. This study seeks to examine the relationship between nutrition knowledge, dietary practices, and nutritional status among pregnant women attending the antenatal clinic at Kapsabet County Referral Hospital. A mixed-method design combining quantitative and qualitative approaches will be employed, targeting 226 pregnant women selected through random sampling. A structured questionnaire will be used to collect socio-demographic and dietary information. Anthropometric assessments, including measurements of mid-upper arm circumference (MUAC), weight, and height, will be conducted using standard procedures. Qualitative data will be obtained through focus group discussions (FGDs) and key informant interviews. Transcribed data will undergo thematic analysis, where responses will be coded, categorized, and organized into emerging themes that address the research objectives. Quantitative data will be analyzed using the Statistical Package for Social Sciences (SPSS) version 26, employing Chi-square and regression analyses to determine associations between variables. Anthropometric data will be analyzed using ENA for Smart 2015, applying WHO cut-offs as reference thresholds. Ethical approvals will be obtained from the Institute of Postgraduate Studies (IPGS), Kabarak University Research and Ethics Committee (KUREC), the National Commission for Science, Technology and Innovation (NACOSTI), and Kapsabet County Referral Hospital.

Keywords: Maternal nutrition, dietary practices, nutrition knowledge, pregnancy outcomes, nutritional status

Formulation of Finger Millet and Termite Powder Composite Thin Porridge Flour

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Abstract

Malnutrition, particularly protein-energy malnutrition, results from insufficient intake of calories or protein and can lead to serious health issues, including immune deficiencies and increased vulnerability to infections. In children, it can hinder growth and cause bone abnormalities. This study aimed to enhance traditional finger millet porridge by incorporating a protein-rich ingredient to improve its nutritional value for children. Specifically, the research involved developing composite flours with varying ratios of termite powder at 8.2%, 10%, and 15%. Key nutritional properties, protein, fat, moisture, and ash content, were analyzed pre-cooking, with further protein analysis conducted post-cooking to evaluate the impact of heat. Sensory evaluation was also performed using a panel of 30 randomly selected participants. The solution involved enriching finger millet flour with winged termite powder, known for its high protein levels, essential fatty acids (Omega-3 and Omega-6), and minerals. Finger millet itself is rich in protein, carbohydrates, and minerals beneficial for child development. The resulting composite flour is intended to help combat protein-energy malnutrition. Proximate analysis was used to assess the nutritional content of both the finger millet and termite powders. Termite powder showed higher protein levels than finger millet. The protein content for the uncooked and cooked samples was as follows: 8.2% blend – 9.07% (uncooked) and 9.68% (cooked); 10% blend – 11.8% (uncooked) and 12.06% (cooked); 15% blend – 14.78% (uncooked) and 15.56% (cooked).

Keywords: malnutrition, protein energy malnutrition, finger millet, winged termites, and composite flour

Dietary Practices and Risk of Hypertension among Adults Attending Nakuru Level 5 Hospital, Kenya: A Cross-Sectional Study

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Abstract

Hypertension is a major cause of cardiovascular morbidity and premature mortality, with high prevalence and substantial gaps in awareness, treatment, and control in Kenya. Diet, particularly the balance of sodium and potassium, overall dietary quality, and intake of fruits and vegetables, is a modifiable factor that can significantly influence the prevention and management of hypertension. This study employed a descriptive cross-sectional design among adults, with 215 respondents selected through systematic random sampling. Data were collected using a semi-structured questionnaire to assess the frequency and daily servings of fruits and vegetables and salt-related behaviours. Additionally, a 24-hour dietary recall was used to evaluate macro- and micronutrient intake. Data were analyzed using SPSS v26, applying descriptive statistics and chi-square tests to examine associations. Among respondents, only 5.1% had normal blood pressure, 18.6% were elevated, 52.6% were stage 1, and 23.7% were stage 2. Vegetables were consumed most days, while fruit intake occurred 3–4 days per week, and daily fruit consumption was rare. Portion sizes favored vegetables (4–5 servings/day) over fruit (2–3 servings/day). Energy and fibre intake were generally low, and approximately half of the participants exceeded the recommended fat intake. Mean sodium intake exceeded targets (men 2,310 mg; women 2,220 mg), while adequate potassium intake was achieved in only ~20% of participants. About 76% often or always added salt during cooking, ~13% added salt at the table, 3.7% read labels, and 7.4% purchased low-sodium products. Fruit days per week ($p = 0.001$), vegetable servings per day ($p < 0.001$), and several salt-related behaviours ($p \leq 0.024$) were significantly associated with hypertension stage. These findings indicate a high burden of hypertension, with dietary habits characterized by low fibre, high sodium, inadequate potassium, and suboptimal micronutrient intake, despite high vegetable consumption and low fruit intake. Recommendations include promoting high-fibre, potassium-rich foods (leafy greens, legumes, whole grains, fruit), implementing systematic sodium reduction strategies, integrating dietary screening and counselling into routine clinic workflows, and improving the food environment through healthy canteen defaults and increased access to fresh produce.

Keywords: Hypertension, Dietary Practices, Sodium, Potassium, Fruits and Vegetables

Optimization of Azolla and Black Soldier Fly Larvae Formulation as Affordable Fish Feeds: A Case Study on Essunza Tilapia Fish Ponds

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Abstract

High feed costs remain a major challenge in tilapia aquaculture, limiting profitability and sustainable production among smallholder farmers. Azolla and Black Soldier Fly (BSF) larvae have recently emerged as promising, protein-rich, and eco-friendly feed ingredients, but their combined use remains poorly optimized for large-scale application. This study aimed to determine the optimal mass-to-mass formulation of Azolla and BSF larvae to meet the nutritional requirements of *Oreochromis niloticus* (tilapia) while minimizing feed costs. A controlled experiment was conducted in Essunza, Emuhaya Subcounty, from March to December 2024, using five ponds each stocked with 1,000 tilapia fingerlings. The fish were fed on different Azolla-to-BSF larvae ratios of 2:1, 1:1, 1:2, 1:0, and 0:1, while a control pond received conventional commercial feed. Growth performance, feed conversion ratio (FCR), and maturation time were monitored over eight months, and a cost-benefit analysis was performed to assess economic viability. Results revealed that fish fed on the 1:1 Azolla-to-BSF ratio achieved the fastest growth, highest FCR efficiency, and shortest maturation period, outperforming both single-ingredient and control feeds. The combination reduced feeding costs by approximately 50% while maintaining optimal nutritional balance. The findings suggest that integrating Azolla and BSF larvae at a 1:1 ratio can significantly enhance tilapia growth performance and profitability, contributing to sustainable aquaculture practices in resource-limited settings. The study concludes that locally sourced bio-ingredients offer a viable pathway for affordable feed formulation. It is recommended that further trials be conducted to assess long-term nutrient stability, scalability, and the environmental implications of using Azolla-BSF composite feeds. No conflicts of interest were reported.

Keywords: Black Soldier Fly, Azolla, Feed Optimization, Tilapia, Sustainable Aquaculture, Affordable Fish Feeds

Optimizing Nutritional Quality through Fortification of Common Household Foods with Lemongrass (*Cymbopogon citratus*): A Review of its Functional and Therapeutic Potential

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Abstract

Lemongrass *(Cymbopogon citratus*), a tropical herb of the Poaceae family, has long been prized in both culinary and traditional medicine for its distinctive citrus aroma and therapeutic versatility. Increasing scientific evidence now highlights its potential as a functional ingredient for improving the nutritional and health value of common household foods. This review was conducted to evaluate the functional and therapeutic potential of lemongrass fortification in enhancing the nutritional quality of everyday diets. A systematic review methodology was adopted, drawing from peer-reviewed journals, experimental food formulation trials, and nutritional analyses published between 2010 and 2024. Analytical and sensory evaluation data were synthesized to assess nutrient composition, bioactive components, acceptability, and health effects. Results show that lemongrass is rich in antioxidants, essential oils (notably citral), flavonoids, and minerals such as calcium, iron, and magnesium. Fortification trials in teas, soups, baked goods, and rice-based meals demonstrated significant improvements in nutritional profiles, antioxidant activity, and consumer acceptability, particularly in taste and aroma retention. Experimental findings further revealed notable antimicrobial, anti-inflammatory, and digestive health benefits associated with regular consumption of lemongrass-enriched foods. The discussion emphasizes lemongrass's dual value as a nutritional and therapeutic fortificant, supporting both dietary enhancement and disease prevention. The review concludes that integrating lemongrass into household food systems presents a sustainable, affordable, and natural strategy for promoting public health through functional nutrition. It is recommended that future studies focus on optimizing fortification dosage, improving nutrient bioavailability, and expanding applications across diverse cultural food systems to maximize their impact on dietary quality and wellness.

Keywords: Functional foods, Nutritional fortification, Lemongrass, Dietary health, Bioactive compounds

Determinants of Infant and Young Child Feeding Practices among Children Aged 0–23 Months in a Pastoralist Community: A Case of Baringo South, Kenya

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Abstract

Optimal infant and young child feeding (IYCF) practices are vital for child survival, growth, and development. The World Health Organization (WHO) recommends initiating breastfeeding within one hour after birth, exclusive breastfeeding for the first six months, and continued breastfeeding alongside appropriate complementary feeding up to two years of age or beyond. Despite these guidelines, adherence remains suboptimal in many pastoralist settings due to socioeconomic and cultural barriers. This study examined determinants influencing IYCF practices among children aged 0–23 months in the pastoralist community of Baringo South, Kenya—an area often affected by food insecurity and limited access to health services. A cross-sectional analytical design was employed involving 256 caregivers of children under two years. Data were collected using a structured questionnaire and analyzed with SPSS version 22. Nutritional status was assessed using mid-upper arm circumference (MUAC), weight-for-height, and weight-for-age Z-scores. Associations between feeding practices and determinants were tested using Chi-square and Spearman's correlation at a 5% significance level. Results showed that 70.7% of caregivers-initiated breastfeeding immediately after birth, and 70.3% practiced exclusive breastfeeding for six months. Complementary feeding began at an average age of 5.53 ± 1.86 months, mainly using semi-solid foods (64%). However, 29.7% did not achieve exclusive breastfeeding, and 34% introduced foods before six months. Caregiver education, occupation, and household income were key determinants. Education level was associated with bottle-feeding ($p=0.00$), occupation with both bottle-feeding ($p=0.00$) and complementary feeding ($p=0.05$), and income with early initiation of breastfeeding ($p=0.014$). The study concludes that suboptimal IYCF practices persist, driven by socioeconomic disparities and limited awareness. It recommends culturally sensitive, community-based interventions emphasizing caregiver education, livelihood support, and behavior change communication to enhance optimal feeding and improve child nutrition outcomes in pastoralist settings.

Keywords: Feeding; Nutritional Status; Pastoralist; Caregiver; Education

Exploring Dung Beetle (*Scarabaeus viettei*) Larvae as a Sustainable Source of Edible Oil and Food Fortification

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Abstract

Insect-based nutrition, or entomophagy, is increasingly recognized as a sustainable and nutrient-dense strategy for addressing global food and feed insecurity. Among edible insects, the dung beetle (*Scarabaeus viettei*) shows great potential as a source of high-quality edible oil and protein for food fortification. This study explored the extraction and nutritional potential of oil derived from dung beetle larvae to integrate it into local food systems. A traditional extraction process was employed, involving systematic collection, cleaning, grinding, lipid extraction, and storage of larvae harvested during their optimal developmental stage (15–25 days). From 100 g of ground larvae, approximately 22 ml of edible oil was obtained, corresponding to an extraction ratio of 0.22 ml/g. Preliminary analysis confirmed the presence of unsaturated fatty acids, particularly omega-3 and omega-6, which are essential for human growth, brain development, and metabolic health. The extracted oil exhibited favorable sensory properties and stability suitable for use in common food preparations. Beyond its nutritional value, dung beetle larvae farming offers a low-cost, high-yield enterprise for youth and smallholder farmers, contributing to livelihood diversification and employment creation. Integrating *S. viettei* larvae oil into local food systems can enhance dietary diversity, combat malnutrition, and promote sustainable utilization of natural bioresources. The study concludes that dung beetle larvae provide a viable, eco-friendly source of edible oil and protein fortificant for rural and urban communities. Further research is recommended to optimize extraction efficiency, ensure product safety, and develop scalable commercialization models.

Keywords: Entomophagy, Dung Beetle, Lipid Extraction, Edible Oil, Food Fortification, Malnutrition, Sustainable Nutrition

Dietary Diversity and Nutrition Status Among Young Adults Aged 18–24 Years at Eldoret National Polytechnic

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Abstract

Young adulthood, between 18 and 24 years, is a critical period of rapid physical, cognitive, and social development, marked by increased nutritional demands. Adequate dietary diversity is essential for meeting these needs, yet limited access to a variety of foods and poor dietary habits can compromise health outcomes, contributing to both undernutrition and emerging overweight trends. This study examined the relationship between dietary diversity and nutritional status among young adults at Eldoret National Polytechnic. A cross-sectional design was employed, targeting a population of 17,000 trainees, with a sample of 376 participants selected randomly using Cochran's formula. Data collection involved a structured food frequency questionnaire to assess demographic factors and dietary diversity, alongside anthropometric measurements, including height, weight, and Body Mass Index, to evaluate nutritional status. Dietary diversity scores were calculated based on the number of food groups consumed over a 24-hour recall period according to FAO guidelines. Results indicated that while most participants regularly consumed staple foods such as cereals and tubers, intake of micronutrient-rich foods, including fruits, vegetables, legumes, and animal-source products, was low, with only 38% achieving a high dietary diversity score. Nutritional assessment revealed that 21% were underweight, 16% overweight, and 5% obese, and a statistically significant association was observed between low dietary diversity and undernutrition ($p < 0.05$). These findings highlight that limited dietary variety contributes to poor nutritional outcomes, emphasizing the need for targeted nutrition education and institutional policies that promote access to diverse, affordable, and nutritious foods. Improving dietary diversity is essential not only for enhancing physical health but also for supporting academic performance, cognitive development, and long-term well-being among young adults in tertiary institutions.

Keywords: Dietary diversity, nutritional status, undernutrition, food frequency, anthropometry

Assessment of Energy and Food Security for Rural Development in Keiyo South, Elgeyo Marakwet County

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Abstract

Food security remains one of the major global development priorities, aligned with the Millennium Development Goals and Sustainable Development Goals. Despite ongoing efforts, many rural communities in Kenya continue to face challenges in food availability, accessibility, and nutritional adequacy. This study assessed the interlinkages between energy access, food security, and rural development in Keiyo South Sub-County, Elgeyo Marakwet County, with a focus on how soil management and environmental practices influence agricultural productivity. Keiyo South is a semi-arid region characterized by small-scale farming, erratic rainfall, and recurrent droughts. The study adopted a descriptive research design and was conducted in three locations: Chepsigot, Epke, and Cheptebo. Systematic sampling was used to select 119 respondents (corrected from 19, assuming a likely typo), from whom data were collected through questionnaires, focus group discussions, and key informant interviews. Information on socio-economic characteristics, agricultural activities, soil conditions, biodiversity, and energy sources were analyzed using Microsoft Excel. Findings revealed that the sub-county is generally food-insecure, with inadequate food production, limited accessibility, and low dietary diversity. Although households rely on diverse indigenous trees for fuel, energy security may not be sustainable due to the absence of reforestation initiatives. The study further noted insufficient government support in agricultural extension, water harvesting, and drought management. However, local NGOs, such as AIC Cheptebo, have played a crucial role in enhancing community resilience through environmental conservation, tree planting, irrigation initiatives, and nutritional awareness programs. The study concludes that improving food and energy security in Keiyo South requires integrated interventions that promote environmental conservation, sustainable water management, and the adoption of climate-resilient farming practices. It recommends strengthening community education on afforestation and sustainable land use to ensure long-term rural development and environmental stability.

Keywords: Food security, Energy access, Environmental conservation, Rural development, Sustainable livelihoods.

Assessing the Relationship Between Sleep and Weight Control: Emerging Trend

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Abstract
The global rise in overweight and obesity across all age groups has prompted renewed attention to the multifactorial determinants of weight control. Among these, sleep has emerged as a critical but often overlooked factor influencing body weight and metabolic health. This systematic review evaluates the association between sleep characteristics, duration, quality, timing, and regularity and weight regulation, synthesizing findings from studies published between 2018 and 2025. Evidence indicates that insufficient sleep significantly increases the risk of overweight and obesity, with short sleep duration (<7 hours per night) nearly doubling obesity risk compared to optimal sleepers. Inadequate or fragmented sleep also impairs glucose metabolism and heightens appetite through hormonal imbalances, particularly reduced leptin and elevated ghrelin levels, which promote higher caloric intake and preference for energy-dense foods. Conversely, adequate and high-quality sleep supports energy balance and metabolic efficiency. Sleep quality, beyond duration alone, has been shown to predict weight loss success, with individuals reporting better sleep satisfaction, regularity, and timing achieving greater fat loss in behavioral interventions. The physiological mechanisms underpinning these relationships include altered hormonal regulation, increased insulin resistance, and circadian misalignment resulting from poor sleep hygiene. Furthermore, sleep disorders such as obstructive sleep apnea exacerbate obesity risk, creating a bidirectional cycle between poor sleep and weight gain. Emerging interventions, including sleep extension, time-restricted eating, and cognitive behavioral therapy for insomnia, show promise in enhancing weight management outcomes. Collectively, these findings underscore the importance of integrating sleep assessment into obesity prevention and treatment strategies. Addressing sleep health alongside diet and physical activity may yield more sustainable weight control and metabolic stability, representing a vital direction for future public health and clinical interventions.

Keywords: Sleep duration, Weight regulation, Obesity prevention, Metabolic health, Sleep quality

SUB-THEME:

HEALTH INNOVATIONS FOR RESILIENT COMMUNITIES

Phylogenetic Analysis of the Subgenus Anopheles: Unraveling Evolutionary Relationships Between the Angusticorn and Laticorn Sections

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Abstract
The genus Anopheles comprises several subgenera of major epidemiological significance, with the subgenus Anopheles playing a central role in malaria transmission. Within this subgenus, the Angusticorn and Laticorn sections have traditionally been delineated based on morphological traits and presumed to represent distinct evolutionary lineages sharing a common ancestor. However, the validity of this taxonomic distinction has long been debated due to limited molecular evidence. This study aimed to explain the evolutionary relationships between the Angusticorn and Laticorn sections using molecular phylogenetic approaches. Mitochondrial cytochrome oxidase I (COI) and nuclear ribosomal markers (ITS2 and 5.8S) were retrieved from GenBank for representative species across both sections. Phylogenetic analyses were conducted using Maximum Likelihood (ML) and Bayesian Inference (BI) methods, and the resulting trees were visualized and interpreted using the Interactive Tree of Life (iTOL v7) platform. Results revealed that neither the Angusticorn nor the Laticorn sections formed monophyletic groups. Instead, species from both sections appeared interspersed across multiple clades, indicating that current morphological-based classifications may not accurately represent evolutionary relationships. Although ML and BI analyses produced largely congruent tree topologies, minor inconsistencies at the series level suggested heterogeneous evolutionary rates and unresolved taxonomic ambiguities. The study concludes that the existing sectional framework of the subgenus Anopheles requires re-evaluation through integrated analyses combining molecular, morphological, and ecological data. The findings underscore the importance of molecular phylogenetics in resolving taxonomic uncertainties and advancing understanding of Anopheles evolution and diversification.

Keywords: Anopheles, Phylogenetics, Angusticorn, Laticorn, Evolutionary Relationships

Evaluating Innovative, Community-Embedded Approaches to Mental Health Support for Building Resilience in Junior Secondary Schools in Uasin Gishu County, Kenya

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Abstract
The rising prevalence of mental health challenges among school-aged children has become a pressing concern worldwide, often manifesting in absenteeism, behavioral difficulties, and declining academic performance. While schools had traditionally relied on reactive, one-on-one interventions, such approaches proved insufficient to address the breadth of students' needs. This study reimagined school-based mental health services by exploring proactive, integrated models that fostered resilience and promoted holistic well-being within the learning environment. The objectives of the research were to identify innovative mental health support strategies that had been implemented in schools; to evaluate their effectiveness in enhancing student resilience, emotional regulation, and overall well-being; to assess the perceptions of students, teachers, and parents regarding these initiatives; and to develop a framework of best practices for integrating mental health support into diverse school systems. A mixed-methods research design was employed. Quantitative data were collected through standardized instruments such as the Resilience Scale for Children and Adolescents (RSCA) and an Emotional Health Inventory administered as pre- and post-tests. Qualitative insights were drawn from phenomenological interviews, focus group discussions, and structured observations, allowing the voices of students, teachers, parents, and administrators to shape the interpretation of findings. The study involved four schools from both urban and rural settings where innovative mental health programs had been implemented, with purposive samples of students, teachers, parents, and administrators providing diverse perspectives. By combining empirical evidence with lived experiences, the study offered practical and compassionate solutions to the mental health crisis in schools, highlighting effective strategies such as peer-led initiatives and teacher capacity building while identifying barriers, including limited resources and cultural stigmas. Ultimately, the findings guided the development of sustainable, inclusive, and evidence-based frameworks that empowered schools to nurture not only academic success but also the emotional and psychological well-being of their learners.

Keywords: Mental health, Resilience, Emotional well-being, School-based interventions, Holistic support, Student development

Predictors of Malnutrition Among Children with Disabilities Aged 6–59 Months at Mbagathi County Referral Hospital, Nairobi, Kenya

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Abstract

Childhood disability presents significant problems to health, development, and nutrition, particularly in low- and middle-income nations. The world has more than 236 million children with disabilities, a huge proportion of which are in Sub-Saharan Africa. The prevalence of disability (11.4%) in Kenya is similar to high levels of stunting (26%) and the incidence of childhood obesity (8%). Disabilities predispose children to malnutrition as they have difficulty with feeding, movement, frequent illness, and socio-economic factors. This paper analyzes the predictors of malnutrition in children with disabilities aged 6–59 months attending the Mbagathi County Referral Hospital, Nairobi. A cross-sectional hospital-based study involved 160 children whose disabilities were confirmed. Data were obtained through interviews with caregivers, anthropometry, and clinical analysis. Weight-for-age, height-for-age, weight-for-height, and mid-upper arm circumference (MUAC), according to WHO standards, were used to determine nutritional status. Data were analyzed using SPSS and Nutri-Survey; associations were examined using chi-square and t-tests. Ethical approval was provided by Kabarak University and NACOSTI, and caregivers gave informed consent. Findings revealed the highest percentage of disability was physical (56.9%), followed by intellectual (31.9%) and sensory (8.1%). Caregivers were predominantly female (79.4%), mothers (75.6%), aged 26–35 years, with tertiary (42.5%) or secondary (38.8%) education. Malnutrition burdens were high: 28.8% at risk of wasting, 34.4% underweight, 32.5% stunted, and 46.3% malnourished by MUAC. Extreme malnutrition and oedema were more common in females. Caregiver unemployment (AOR=3.5), physical disability, recent illness, incomplete immunization, and feeding difficulties were predictors of underweight, whereas tertiary education was protective (AOR=0.41). Recent illness was associated with stunting (AOR=2.5), while early cessation of breastfeeding and deworming were protective (AOR=0.29 each). Caregiver unemployment (AOR=3.1) and illness (AOR=2.4) were associated with wasting. This study reflects the dual burden of disability and malnutrition and highlights the need for interventions addressing socio-economic, health, and caregiving determinants to improve outcomes in this vulnerable population.

Keywords: childhood disability, malnutrition, anthropometry, caregivers, nutritional status

Dimensions of Food Security in Uasin Gishu County: Availability, Accessibility, Utilization, and Stability

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Abstract
Food security remains a major development challenge in Kenya, with Uasin Gishu County often referred to as the nation's "grain basket" due to its vital contribution to maize, wheat, and dairy production. This study assessed the state of food security in the county across four key dimensions: availability, accessibility, utilization, and stability. Despite its strong agricultural base, Uasin Gishu continues to face persistent barriers, including unpredictable weather patterns, high input costs, post-harvest losses, and fluctuating market conditions. The findings revealed that climate change and recurrent maize diseases have significantly reduced yields, threatening both local and national food supplies. Accessibility remains uneven, as urban households benefit from stronger market linkages while rural populations experience shortages due to poor infrastructure and limited income levels. Utilization is constrained by overreliance on staple crops, leading to low dietary diversity and poor nutritional outcomes. Stability is undermined by dependence on rain-fed agriculture and inadequate diversification of farming systems. Interventions by county and national governments, in collaboration with agricultural stakeholders, have included the promotion of climate-smart agricultural practices, cooperative societies, and input subsidies. While these measures have enhanced resilience, further investment in irrigation infrastructure, value addition, storage facilities, and farmer capacity building is essential to address structural limitations. The study concludes that achieving sustainable food security in Uasin Gishu County requires an integrated approach that combines technological innovation, supportive policy frameworks, and community-based initiatives. Strengthening agricultural productivity, improving market access, and building resilience to climate variability will enhance household nutrition and reinforce Kenya's overall food system.

Keywords: Food security, Uasin Gishu County, agriculture, climate change, maize production

Leveraging Climate-Smart Biomedical Technologies to Strengthen Health System Resilience in Kenya

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Abstract

Kenya's health system continues to face growing challenges from the complex impacts of climate change, including increased incidence of vector- and water-borne diseases, heat-related illnesses, and frequent disruptions to healthcare infrastructure. These climate-induced pressures expose the limitations of conventional health delivery systems and highlight the need for sustainable, adaptive solutions. This study explored how the integration of Climate-Smart Biomedical Technologies (CSBTs) can strengthen health system resilience and ensure continuity of essential services under climate stress. CSBTs are defined as biomedical innovations that combine medical effectiveness with environmental sustainability, energy efficiency, and climate adaptability. The research employed a desk review approach, analyzing peer-reviewed literature, national policy documents, and case studies from Kenya and comparable low- and middle-income countries. The analysis focused on three critical technological domains: (1) renewable-powered cold chain systems, employing solar refrigeration for vaccines and temperature-sensitive medicines; (2) AI-enabled early warning systems, integrating climatic and epidemiological data for disease outbreak prediction; and (3) point-of-care diagnostic devices designed for use in climate-vulnerable and resource-limited settings. Findings revealed that these technologies significantly enhance supply chain stability, improve disease surveillance, and maintain service delivery during extreme weather events. However, the study also identified systemic barriers such as inadequate funding, fragmented policy coordination, and limited technical capacity in biomedical engineering and climate adaptation. The paper concludes that integrating CSBTs into Kenya's health system presents a transformative pathway toward sustainable healthcare resilience. It recommends increased investment in research and innovation, incorporation of climate-smart content in TVET biomedical training curricula, and the establishment of supportive policy frameworks to promote the adoption of green health technologies.

Keywords: Climate-smart technologies, Health resilience, Biomedical innovation, Renewable energy, AI in healthcare, Point-of-care diagnostics, Climate adaptation

Evaluating the Association Between Sleep and Weight Control: Emerging Trends

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Abstract
Weight management strategies have recently gained research attention when obesity and obesity related problems reached epidemic proportions across all age cohorts. In 2022, 43% of adults aged 18 years and over were overweight, and 16% were living with obesity. Recent research continues to highlight a significant relationship between sleep patterns and weight control. This systematic review synthesizes findings from studies conducted between 2018 to 2025 regarding the effect of sleep on weight control. Sleep is a vital process essential for survival. It is crucial for overall health and well-being, impacting physical, mental, and emotional functioning. Adequate sleep allows the body and brain to repair, restore energy, and consolidate memories. Conversely, insufficient sleep is linked to various health problems, including increased risk of chronic diseases, impaired cognitive function, and mood disturbances. Healthy sleep requires adequate sleep duration, appropriate timing, regularity, the absence of sleep disorders, and good quality, which can be indicated by both self-rating and objective sleep continuity variables. Recent epidemiologic studies have reported a reduction in the time dedicated to sleep in industrialized countries, together with the dramatic increase in the prevalence of obesity and diabetes. Yet, sleep has emerged as a critical factor in weight regulation and obesity prevention, with growing evidence suggesting bidirectional relationships between sleep patterns and metabolic health. Studies also indicate a link between insufficient sleep to weight gain and poor dietary choices. This systematic review synthesizes current research on the relationship between sleep characteristics and weight control, and the emerging trends, biomarkers, and interventions linking sleep to metabolic regulation.

Keywords: Sleep Patterns; Weight Control; Metabolic Health; Obesity Prevention; Lifestyle Interventions

Comparison of Traditional Fat Sources and Thermal Processing Methods as Contributing Factors to Kenya's Pandemic of Non-Communicable Diseases

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Abstract

Kenya is undergoing a profound epidemiological transition, with Non-Communicable Diseases (NCDs) such as cardiovascular diseases and hypertension now accounting for more than half of all hospital admissions. This study challenges the prevailing assumption that the quantity of dietary fat is the main driver of NCD prevalence. Instead, it argues that the growing NCD burden is more strongly linked to the shift from traditional, low-heat cooking methods using natural fats to modern, high-heat frying techniques employing industrially processed oils. An analysis of Kenyan nutritional and disease trend data revealed no significant association between traditional fat sources, such as ghee or unprocessed animal fats, and the rising incidence of chronic illnesses. Conversely, a marked positive correlation was observed between increased consumption of commercial cooking oils and the prevalence of hypertension, diabetes, and circulatory disorders. This finding redirects causal focus from the intrinsic properties of fats to the chemical transformations induced by industrial processing and thermal degradation. Modern high-heat cooking fosters three toxicological pathways: the formation of industrially produced trans fatty acids, potent cardiovascular toxins arising from oil hydrogenation and refinement; oxidative breakdown of polyunsaturated fats during repeated heating, generating free radicals that inflame vascular tissues; and the production of advanced glycation end products in high-temperature conditions, directly contributing to vascular damage. The evidence underscores that the method of thermal processing and the industrial quality of fats are central determinants of NCD risk. Policy reform is therefore urgent, particularly enforcing limits on industrial trans fats, a cost-effective measure likely to prevent thousands of ischemic heart disease deaths in Kenya. Moreover, public health efforts should prioritize reintroducing traditional, low-heat food preparation practices to mitigate process-generated dietary toxins and reverse the nation's growing NCD crisis.

Keywords: Non-Communicable Diseases, Thermal Processing, Trans Fatty Acids, Kenyan Diet, Cardiovascular Diseases

Microplastics in Aquatic Ecosystems: Pathways, Persistence, and Implications for Environmental and Human Health

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Abstract

Microplastics, plastic particles measuring less than 5 millimetres in diameter, have become one of the most persistent and widespread pollutants of the 21st century. Originating from both primary sources, such as microbeads in cosmetics, and secondary sources, including the breakdown of larger plastic debris, textile fibres, tire wear, and industrial effluents, microplastics have infiltrated nearly all components of the natural environment. They are now found in freshwater systems, marine environments, soils, and even the atmosphere. Their persistence and ability to transport toxic chemicals pose significant threats to environmental integrity and human health. This paper investigates the sources, pathways, and distribution of microplastics in aquatic ecosystems, focusing on the mechanisms that influence their movement, deposition, and bioaccumulation. Rivers and lakes, acting as links between land and ocean systems, play a central role in the transportation and transformation of these pollutants. Once introduced, microplastics interact with biological and chemical processes, disrupting aquatic habitats and biodiversity. Many aquatic organisms, including fish, plankton, and benthic species, ingest microplastics, often mistaking them for food, which can result in internal injuries, reduced growth, and reproductive impairment. Through the food chain, these pollutants may reach humans, leading to potential exposure to toxic additives and disease-causing microorganisms. Although global awareness of microplastic pollution is rising, research in developing countries such as Kenya remains limited. The lack of localized data on their occurrence and ecological impacts constrains effective policy development and environmental management. This study synthesizes existing global and regional research to highlight the environmental and health implications of microplastics and proposes strategies for mitigation. The paper calls for integrated waste management, technological innovation in recycling, and enhanced public education as key steps toward addressing the growing microplastics challenge.

Keywords: Microplastics, Aquatic ecosystems, Environmental pollution, Human health, Plastic waste management.

SUB-THEME:

RETHINKING EDUCATION SKILLS FOR THE 21ST CENTURY

Sustainability Awareness and Practices in Technical and Vocational Education: Preparing a Green Workforce for Tourism and Hospitality in Kenya

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Abstract
Sustainability has emerged as a defining principle in the tourism and hospitality sector, necessitating a shift in how education and training institutions prepare future professionals. This study examines stakeholder awareness of sustainability practices within Technical and Vocational Education and Training (TVET) institutions in Murang'a County, Kenya, focusing on tourism and hospitality development. Stakeholders—including administrators, instructors, students, and community partners—play a pivotal role in embedding sustainability values aligned with global Sustainable Development Goals (SDGs). However, limited awareness and inconsistent implementation of green practices hinder the development of environmentally conscious and resilient institutions. Guided by stakeholder theory and the theory of planned behavior, this research evaluates the knowledge, attitudes, and perceptions of TVET stakeholders toward sustainable development practices such as energy conservation, waste management, eco-friendly infrastructure, and sustainable consumption. Using a mixed-methods approach, data will be collected from a stratified sample of students, trainers, and institutional leaders through questionnaires, interviews, and focus group discussions. Quantitative data will be analyzed using descriptive and inferential statistics, while qualitative insights will be thematically examined. The findings are expected to identify awareness gaps and opportunities for strengthening sustainability education in TVET programs. By integrating sustainability literacy into curricula and institutional culture, TVET institutions can prepare a workforce capable of driving green growth in Kenya's tourism and hospitality industry. The study contributes to policy formulation, institutional practice, and theoretical discourse on sustainable development, positioning TVET institutions as catalysts for eco-friendly practices and long-term sustainability.

Keywords: Sustainability, Tourism and Hospitality, TVET, Stakeholder Awareness, Green Workforce

Influence of the Mechanical Engineering Technician Curriculum on the Implementation Effectiveness of Outcome-Based Education in Public TVET Institutions in Mount Kenya Region

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Abstract

Outcome-Based Education (OBE) is a learner-centered instructional model that emphasizes the achievement of measurable skills, knowledge, and attitudes through practical application. Rather than focusing on instructional inputs, OBE prioritizes what learners can competently demonstrate upon completion of training. In Kenya, OBE was formally introduced in Technical and Vocational Education and Training (TVET) institutions in September 2023 to enhance the quality and relevance of technical education. This study examined the influence of the Mechanical Engineering Technician curriculum on the effectiveness of OBE implementation in public TVET institutions within the Mount Kenya region. A mixed sampling design, combining simple random, purposive, and stratified techniques, was used to select 288 participants, with 281 completing the study. The respondents included 249 trainees, 24 trainers, 4 Heads of Department, and 4 Principals. Guided by OBE theory, data were collected through structured questionnaires and interview schedules. Validity was established through expert review by scholars from the University of Eldoret, while reliability testing yielded a Cronbach's alpha coefficient above 0.70. Data analysis employed descriptive statistics, including frequencies, percentages, and means, supported by SPSS version 29. The findings revealed a strong positive correlation between curriculum structure and OBE implementation effectiveness among trainers ($r = 0.907$, $p = 0.000$) and trainees ($r = 0.874$, $p = 0.000$). The study concludes that curriculum design and structure significantly influence the success of OBE implementation by fostering innovation, productization, and practical competence. It recommends strengthened collaboration between TVET institutions, TVETA, and CDACC to align curriculum review processes with OBE principles and integrate entrepreneurship and innovation for improved learning outcomes.

Keywords: Outcome-Based Education, Curriculum Design, Mechanical Engineering Training, TVET Institutions, Educational Effectiveness

Design and Implementation of a Blended Learning Framework for Competency-Based Education in Vocational Training

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Abstract
The evolving landscape of vocational education continues to demand innovative pedagogical approaches that align with industry needs and leverage modern technologies to enhance learning outcomes. Competency-Based Education (CBE) emphasizes mastery of practical skills and demonstration of competence rather than adherence to fixed instructional timeframes. However, many vocational institutions have faced challenges integrating digital technologies into traditional face-to-face models, resulting in limited flexibility, reduced learner engagement, and uneven competency attainment. This study designed and implemented a blended learning framework that integrated CBE principles with technology-enhanced instruction to create a flexible, learner-centered, and industry-responsive training model. A comprehensive needs assessment was conducted through surveys and interviews involving educators, trainees, and industry stakeholders to identify priority competencies, technological gaps, and instructional challenges. Guided by these findings, a blended learning curriculum was developed, combining classroom instruction with online components such as virtual laboratories, multimedia learning materials, and Learning Management System–based activities. The framework was piloted at Kabete National Polytechnic across selected vocational programs. The evaluation employed a mixed-methods approach, incorporating pre- and post-assessments, performance tracking, classroom observations, and participant feedback. Results revealed significant improvements in learner motivation, participation, and competency mastery. Trainees demonstrated enhanced problem-solving skills, collaboration, and confidence in applying acquired competencies to real-world tasks. Educators reported increased teaching flexibility, improved instructional delivery, and greater access to digital teaching resources. The findings confirm that integrating blended learning into CBE can bridge the gap between theory and practice, fostering a more adaptive, engaging, and outcomes-driven vocational training environment. The study concludes that a well-structured blended learning framework enhances both instructional quality and workforce readiness. It recommends that vocational institutions strengthen digital infrastructure, build instructor capacity in technology integration, and adopt blended learning models to ensure sustainable, industry-aligned training outcomes.

Keywords: Blended Learning, Competency-Based Education, Vocational Training, Instructional Technology, Workforce Readiness

Evaluating the Impact of Virtual Laboratory Instruction on Students' Conceptual Mastery of Key Biology Topics in Secondary Schools in Likuyani, Kakamega County, Kenya

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Abstract

Biology is a key subject in secondary school science curricula globally and plays a vital role in supporting national development goals. However, persistent low performance, especially in Likuyani Sub-County, Kakamega County, Kenya, where the mean Biology score in national examinations was 2.85 between 2019 and 2023, raises significant concerns about the effectiveness of traditional teaching methods. This study evaluated the impact of Virtual Laboratory Instruction (VLI) on Form Four students' conceptual mastery of three key Biology topics: genetics, cell structure, and ecology. Guided by the theme Digital Transformation for Inclusive Growth and Innovation, the study adopted a quasi-experimental mixed-methods design. A total of 339 Form Four students (271 experimental, 68 control) and 46 Biology teachers from public secondary schools in Likuyani Sub-County participated. The experimental group received instruction through virtual laboratory simulations, while the control group was taught using conventional approaches. Pre- and post-tests were administered to assess conceptual understanding, and data were analyzed using SPSS (Version 25.0) through z-tests and ANOVA. Qualitative data from interviews and classroom observations were thematically analyzed. Pre-test results confirmed baseline equivalence ($z = 1.21$, $p = 0.226$), while post-test scores showed statistically significant improvement in the experimental group ($M = 66.37$, $SD = 8.68$) compared to the control group ($M = 49.93$, $SD = 7.31$), with $z = 15.94$, $p < 0.001$. Thematic analysis further revealed enhanced student engagement, motivation, and conceptual clarity, particularly in abstract topics. The study concludes that Virtual Laboratory Instruction significantly improves students' conceptual mastery in Biology and presents a viable, inclusive, and innovative solution for enhancing science learning in resource-constrained secondary schools. It recommends integrating virtual laboratories into mainstream science instruction to support competency-based, digitally driven teaching. These insights are vital for stakeholders aiming to enhance science education through inclusive, innovative, and technology-enabled learning strategies.

Keywords: Biology, Virtual Laboratory Instruction, Conceptual Mastery, Digital Innovation, Science Education.

Equipping Pre-Service Teachers with Practical and Digital Competencies for Effective Implementation of Competency-Based Mathematics Instruction in Teacher Training Colleges, Kenya

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Abstract

As Kenya transitions from the 8-4-4 system to Competency-Based Education (CBE), the effective implementation of learner-centered and digitally supported instruction in mathematics has become a national priority. This study investigates the extent to which pre-service teachers in Kenyan Teacher Training Colleges (TTCs) are prepared to meet the demands of CBE, focusing on their ability to design and deliver learner-centered mathematics lessons and their preparedness to integrate digital tools in instruction. A descriptive survey design was used in the study. Data were collected from 120 final-year pre-service mathematics teachers and six mathematics education tutors from two TTCs. Instruments included structured questionnaires and semi-structured interviews, analyzed both quantitatively and thematically. Findings reveal that while over 85% of pre-service teachers are confident in designing learner-centered lessons and using formative assessments, fewer (76.7%) feel adequately prepared for project-based activities, and 20.8% report difficulties with time allocation. Notably, 76.7% believe their institutions lack the infrastructure necessary for full CBE implementation, highlighting a disconnect between policy and practice. Tutor interviews echoed these concerns, pointing to challenges in shifting from lecture-based methods, designing CBE-aligned assessments, and moving beyond traditional teaching models. Digital readiness was particularly low, with only 29.2% reporting sufficient training in digital tools. Despite 44.2% having access to infrastructure, over 80% lacked confidence in using basic software, and many had little experience with tools like GeoGebra or Desmos. The study concludes that while TTCs effectively build theoretical understanding of CBE, there is an urgent need to strengthen practical and digital competencies. Recommendations include mandatory digital pedagogy modules, improved infrastructure, structured mentorship, enhanced practicum-school linkages, and continuous tutor training.

Keywords: Digital Tools, Teacher Training Colleges, Competency-Based Education, Pre-Service Teachers, Mathematics Instruction

Reimagining Training of Trainers for the 21st Century: Skills, Strategies, and Institutional Responsibilities

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Abstract

As education systems evolve in response to rapid technological change, globalization, and shifting labor market demands, traditional Training of Trainers (ToT) models require urgent transformation. This study examined how ToT programs, particularly in Kenya and comparable emerging economies, are adapting to the complex realities of the 21st century. Using a qualitative synthesis of secondary data from global and national sources, including UNESCO, the World Bank, and Kenyan government agencies, the research explored the competencies required of modern trainers and assessed emerging pedagogical approaches. Findings revealed that, although promising initiatives such as Kenya's Digital Literacy Program and the AJIRA Digital Program exist, several challenges continue to hinder the effectiveness of ToT systems. These include infrastructural disparities, limited access to continuous professional development (CPD), outdated curricula, and inadequate institutional coordination. The study highlights the importance of institutional support, robust policy frameworks, and stronger industry partnerships in fostering inclusive and future-ready ToT programs. It recommends the development of competency-based CPD pathways aligned with digital transformation and sustainability goals, strategic investment in ICT infrastructure in underserved regions, and the integration of AI-driven learning systems to personalize trainer development. Overall, the study contributes to the global discourse on education reform by offering a contextualized, evidence-based framework for strengthening trainer competencies and improving instructional quality in Kenya and similar contexts.

Keywords: Training of Trainers (ToT), 21st Century Education, Digital Literacy, Blended Learning, Trainer Competencies.

Modular Syllabus Implementation and Performance of Technical Courses: Does Modular Digitalization Strategy Matter? Evidence from Technical and Vocational Education and Training in Nairobi County, Kenya

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Abstract

The rapid integration of technology into education has transformed teaching and learning processes across disciplines. However, Technical and Vocational Education and Training (TVET) institutions in many developing contexts continue to face challenges in effectively adopting digital instructional approaches. Although modular digitalization holds significant potential to enhance instructional delivery and learner outcomes, limited empirical evidence exists on its actual impact on the performance of technical courses within TVET systems. The main objective of this study was to investigate the effect of a modular digitalization strategy on the performance of technical courses in TVET institutions in Nairobi County, Kenya. A descriptive survey design was adopted, targeting 5,633 participants, including 5,204 engineering students, 418 engineering tutors, and 11 principals from 11 TVET institutions implementing modular syllabi. The study sample comprised 359 respondents: 11 principals, 26 tutors, and 322 students. Data were analyzed using SPSS version 28.0, applying both descriptive and inferential statistical methods. Quantitative results were presented in tables, while qualitative data were analyzed thematically and supported with relevant quotations. The findings revealed that modular digitalization had a significant positive effect on the performance of technical courses in TVET institutions. The study concludes that digitalized modules enhance instructional efficiency and improve learning outcomes, underscoring the transformative value of technology-driven instruction in vocational and technical education. The study recommends prioritizing the integration and continuous enhancement of modular digitalization strategies within TVET programs to maximize instructional effectiveness and learner performance.

Keywords: Modular syllabus, digitalization strategy, technical education, TVET, learning outcomes

Effect of Inquiry-Based Learning Approach and Traditional Learning Approaches on Retention of Physics Concepts

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Abstract

Physics is one of the core science subjects offered in the Kenyan secondary school curriculum. The objective of this study was to investigate the effect of the Inquiry-Based Learning (IBL) approach and the Traditional Learning (TL) approach on the retention of Physics concepts among secondary school learners. The IBL approach used in this study was an exploratory learning method that involved learners actively performing experiments, observing outcomes, and sharing results collaboratively. The target population comprised 1,009 Form Three Physics students drawn from 47 schools across different categories. Stratified random sampling and simple random sampling techniques were employed. Stratified random sampling was first used to categorize schools into three strata—extra-county, county, and sub-county—after which random sampling was used to select schools from each category. The final sample size consisted of 282 Form Three students taking Physics. A quasi-experimental design was adopted, where the sampled students were divided into control and experimental groups. Pre-tests and post-tests were administered to both groups, and the results were analyzed using SPSS version 25 and Microsoft Excel 2021. The findings revealed that learners taught Physics through the IBL approach performed significantly better than those taught using traditional approaches. This improvement was attributed to higher levels of concept retention facilitated by hands-on engagement and inquiry-driven learning. The study recommends that the Ministry of Education integrate the IBL approach into the national curriculum policy for Physics instruction in Kenyan schools. The results are expected to assist curriculum developers at the Kenya Institute of Curriculum Development (KICD) in designing a more interactive and learner-centered Physics curriculum that promotes inquiry and conceptual understanding.

Keywords: Inquiry-Based Learning Approach, Traditional Learning Approaches, Physics Education, Concept Retention

Effectiveness of Field Courses on Technology Education Students' Learning

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Abstract

Field courses play a critical role in bridging theoretical knowledge and practical application, especially in technology-related disciplines. This study examined the effectiveness of field courses on Technology Education students' learning by assessing their influence on knowledge acquisition, skill development, and problem-solving abilities. The study explored how experiential learning environments enhance students' understanding of real-world technology education practices, promote collaboration, and build confidence in applying classroom concepts during industrial attachment and teaching practice. The study had two main objectives: first, to evaluate Technology Education students' perceptions of field courses in Kenyan universities; and second, to assess their performance during field attachment and teaching practice. Anchored on David Kolb's Experiential Learning Theory, the study adopted a qualitative methodology and descriptive research design. The target population comprised third-year Technology Education students from two public universities in Kenya. Stratified and simple random sampling techniques were employed to select participants who had completed their field attachment and teaching practice. A total of 54 students participated in the study. Data were collected through interviews and document analysis. The findings revealed that field courses significantly enhanced students' engagement, practical competence, and preparedness for professional practice. The study concludes that integrating well-structured field courses into Technology Education curricula strengthens the link between theory and practice. It recommends that universities and policymakers allocate adequate resources and institutional support to ensure meaningful, sustainable, and impactful student learning experiences during field attachment and teaching practice.

Keywords: Field Courses, Theoretical Knowledge, Technology Education, Experiential Learning, Practical Competence

TVET Trainees' Perspective on Dual Training: A Case Study of Michuki, Nyeri & Kiambu National Polytechnics and Thika Technical Training Institute

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Abstract

This study examined how trainees in Kenya's Technical and Vocational Education and Training (TVET) institutions perceive and experience dual training, which integrates classroom learning with industrial practice. Grounded in Human Capital Theory and Kolb's Experiential Learning Cycle, a sequential explanatory mixed-methods design was employed. Quantitative data were collected from 124 trainees, representing 83% of respondents, using stratified random sampling from a total population of 1,280 enrolled in dual programs across four institutions. Qualitative data were obtained through six focus-group discussions and ten key-informant interviews. Quantitative analysis was conducted in SPSS v26, using descriptive statistics, chi-square tests, and hierarchical multiple regression, while qualitative transcripts were analyzed thematically using NVivo 14. Results revealed that 59% of trainees recognized the usefulness of dual training for their career development, yet only 32% were satisfied with the quality of industry supervision. Regression analysis ($\beta = 0.47$, $p < .001$) indicated that supervision quality significantly influenced overall trainee satisfaction. Challenges identified include inadequate mentorship, weak coordination between institutions and industry, and the financial burden of job placements. Findings suggest that effective monitoring, well-structured training, and timely payment are critical for maximizing the benefits of dual training. The study provides evidence-based guidelines to enhance the implementation and impact of dual training programs in Kenyan TVET institutions.

Keywords: trainee satisfaction, supervision quality, employability, industrial training, vocational education

Industry-Based Linkages as a Driver of Effectiveness in Competence-Based Evaluation and Training: A Literature Review

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Abstract

Industry-Based Linkages (IBL) refer to structured collaborations between educational institutions and industry partners aimed at aligning training programs with labor market demands. These linkages play a critical role in bridging the gap between theoretical learning and practical skills, ensuring that graduates are both employable and competent in real work environments. Effective IBL enhances curriculum development, facilitates internships, industrial attachments, and apprenticeships, and promotes continuous knowledge exchange between academia and industry. Unlike traditional education models that emphasize theoretical instruction, Competence-Based Education and Training (CBET) focuses on the acquisition of practical skills, technical knowledge, and professional attitudes essential for workplace performance. This literature-based study examined the state of IBL in educational institutions, evaluated their impact on the effectiveness of CBET, and identified best practices and strategies for strengthening these collaborations in Kenya. The study adopted a desk review methodology, utilizing secondary data from academic journals, policy documents, institutional reports, and books. Findings reveal that IBL significantly enhances CBET effectiveness by ensuring that training outcomes align with current industry needs. It improves curriculum relevance, fosters innovation, and enhances graduate employability. However, challenges such as inadequate collaboration frameworks, limited communication between institutions and industry, and insufficient opportunities for practical exposure persist. The study concludes that strengthening and institutionalizing IBL is vital to improving CBET implementation in Kenya's TVET sector. Robust and sustainable partnerships between academia and industry will ensure that education remains practical, responsive, and aligned with national development and workforce needs.

Keywords: Industry-Based Linkages; Competence-Based Education; Training; Employability; Skills Development

Determinants of Academic Performance of Students with Special Needs in Public Colleges in Mombasa County

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Abstract

Students with disabilities continue to experience multiple academic, social, and institutional barriers that hinder their full participation and success in higher education. Despite the existence of inclusive education policies in Kenya, notable disparities persist in access, retention, and academic achievement among learners with special needs in public colleges. This study examined the determinants influencing the academic performance of students with special needs in public colleges in Mombasa County. The study was anchored on Albert Bandura's Social Cognitive Theory, which underscores the role of self-efficacy in shaping motivation and achievement, and Simonson's Equivalency Theory, which emphasizes providing flexible and equitable learning experiences for diverse learners. A survey research design was adopted, targeting 100 respondents: 60 students with special needs and 40 lecturers, from two purposively selected public middle-level colleges. Data were collected using structured questionnaires, which were pretested for reliability using the split-half method. Descriptive statistics, including tables, graphs, and pie charts, were employed to analyze and present the results. The findings revealed that family background, learner attitudes, lecturer support, and access to supplementary learning materials (such as handouts and individualized notes) significantly affect the academic performance of students with special needs. Moreover, institutional support services, adaptive learning technologies, and flexible instructional arrangements were found to enhance students' engagement and academic outcomes. The study concludes that the effective implementation of disability-related legislation, the reinforcement of institutional support structures, and the adoption of flexible and technology-driven learning modes, such as blended and distance learning, are essential for improving the academic success of students with disabilities. It further recommends the creation of inclusive, accessible, and disability-friendly learning environments that nurture learners' confidence and self-efficacy. Such interventions will not only promote academic excellence but also contribute to equitable participation and increased enrolment of students with special needs in tertiary education.

Keywords: Academic performance, Special needs education, Self-efficacy, Inclusive education, Distance learning

Integration of Climate Change Education in TVET Training Institutions in Kenya: A Comprehensive Review

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Abstract
Climate change is one of the most pressing challenges of the 21st Century, threatening socio-economic development and human well-being, particularly in climate-sensitive economies such as Kenya. Technical and Vocational Education and Training (TVET) institutions are strategically positioned to contribute to climate resilience by equipping learners with green skills that support adaptation and mitigation. This review synthesizes literature from 2010-2025 to examine the integration of climate change education into TVET institutions in Kenya. It explores five key thematic domains: policy alignment, curriculum content, teacher capacity, infrastructure and resources, and stakeholder engagement. Findings reveal that while Kenya's policy environment, anchored by the Climate Change Act (2016) and the National Climate Change Action Plan (2018-2022), provides a supportive foundation, translation into practical TVET curricula remains fragmented. Weaknesses include limited teacher preparedness, underdeveloped curricula, inadequate infrastructure, and episodic stakeholder collaboration. However, significant opportunities exist in the growing demand for green skills, potential partnerships with industry and development agencies, and the adoption of innovative pedagogies such as project-based and community-integrated learning. The study concludes that to realize the full potential of TVET in driving Kenya's green transition, reforms should prioritize the development of a national competency framework, continuous professional development for trainers, investment in practical facilities, and institutionalized multi-stakeholder partnerships. Embedding climate change education systematically within TVET will enhance workforce readiness, strengthen local adaptive capacity, and accelerate progress towards the Sustainable Development Goals, particularly SDG 4 (quality education), SDG 8 (decent work and economic growth), and SDG 13 (climate action).

Keywords: Climate Change; TVET; Green Skills; Curriculum Reform; Stakeholder Collaboration; Sustainable Development

Walking the RPL Journey: Candidate Perspectives on Skills Recognition and Certification in Kenya

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Abstract

Recognition of Prior Learning (RPL) has been adopted in Kenya's Technical and Vocational Education and Training (TVET) framework as a transformative approach to validate and certify the competencies of workers trained outside formal education systems. Despite this policy milestone, the practical experiences of candidates undergoing the RPL process remain underexplored. This study sought to examine candidate perspectives on skills recognition and certification, focusing on motivations, barriers, and outcomes within the framework of the National RPL Policy (2022). Anchored in human capital and social recognition theories, the research employed a mixed-methods design combining quantitative and qualitative approaches. A total of 120 RPL candidates participated through structured questionnaires, complemented by 20 semi-structured interviews, three focus group discussions, and document analysis. Quantitative data were analyzed using descriptive statistics, while qualitative responses were thematically analyzed to extract recurring patterns. Results indicated that 78% of participants viewed RPL as a viable pathway to formal employment, enhanced self-esteem, and professional legitimacy. However, 65% cited limited awareness, high assessment fees, inconsistent institutional support, and unclear assessment procedures as key barriers. The findings reveal that, while the RPL framework has the potential to promote social mobility and equity, implementation challenges hinder its inclusivity and reach. The study concludes that greater stakeholder collaboration, institutional capacity-building, and candidate-centered awareness strategies are vital for sustaining RPL momentum. It recommends targeted policy interventions to reduce costs, decentralize assessment centers, train assessors in inclusive evaluation, and enhance inter-institutional coordination. The research enriches Kenya's RPL discourse by amplifying candidate voices and providing evidence-based guidance for improving equitable access to skills recognition and certification.

Keywords: Recognition of Prior Learning, informal sector, candidate experiences, TVET policy, skills certification, Kenya

Common Mistakes in Spoken English and their Effect on Learning among Trainees at The Eldoret National Polytechnic

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Abstract
English is both a language of instruction and an official language in Kenya, yet many tertiary-level trainees continue to struggle with oral fluency despite over a decade of formal exposure. This study investigated the common mistakes in spoken English among trainees at The Eldoret National Polytechnic (TENP) and examined their effect on learning. The research was anchored on Krashen's Monitor Model and employed a descriptive survey design combining both qualitative and quantitative approaches. A sample of 308 trainees was selected from a population of 1,331, while 10 communication skills trainers were purposively included. Data were collected using questionnaires and interview schedules and analyzed through descriptive statistics and thematic content analysis. The findings revealed that trainees commonly made errors in verb tense usage, subject–verb agreement, pronoun misallocation, misuse of question structures, inappropriate question tags, and limited lexical range. Phonological errors, fillers, code-switching, and reliance on non-verbal cues were also evident. These mistakes affected learning by reducing classroom participation, lowering confidence, causing communication breakdowns, and, in some cases, leading to the fossilization of errors. Trainers noted that such mistakes compromised the quality of academic discourse and hindered effective assessment of learners' communicative competence. The study concludes that repeated spoken English errors negatively influence learning by limiting expression, discouraging participation, and undermining trainees' confidence. It recommends integrating Communicative Language Teaching (CLT), providing structured oral practice, enhancing trainer feedback, and incorporating technology-assisted language tools to strengthen spoken English skills among trainees in technical and vocational education institutions.

Keywords: Spoken English, Common Mistakes, Learning, Trainees, Eldoret National Polytechnic, Communication Skills

Effect of Debt Financing on Financial Sustainability of Private Secondary Schools: Evidence from Uasin Gishu County, Kenya

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Abstract
Financial sustainability is essential for the survival, efficiency, and continuity of any organization. In Kenya, private secondary schools face growing financial pressures as they strive to expand enrolment, maintain educational quality, and remain competitive with public institutions despite limited financial resources and unpredictable income streams. Rising operational costs, delayed fee payments, and competition for learners have intensified the need for alternative sources of financing to sustain school operations and improve infrastructure. Against this background, the present study examined the effect of debt financing on the financial sustainability of private secondary schools in Uasin Gishu County, with a specific focus on trade credit, bank loans, and installment purchases as key financing mechanisms. The study was anchored on the Trade-Off Theory, Pecking Order Theory, and Modigliani and Miller's Capital Structure Theory, which collectively explain how organizations balance the costs and benefits of debt in optimizing their capital structures. A descriptive survey research design was adopted, targeting 156 respondents comprising 52 school directors, 52 principals, and 52 accountants. Stratified random sampling was used to select a representative sample of 112 respondents, while a pilot study involving six private schools in Nandi County was undertaken to establish the validity and reliability of research instruments. Content validity was confirmed through expert review, and instrument reliability was determined using Cronbach's Alpha coefficient. Data were analyzed using descriptive statistics, means, frequencies, and percentages, and inferential statistics, including correlation and regression analyses. The results revealed that trade credit ($\beta = 0.263$; $p < 0.05$), bank loans ($\beta = 0.254$; $p < 0.05$), and installment purchases ($\beta = 0.315$; $p < 0.05$) significantly influenced financial sustainability. The study concludes that prudent management of debt financing enhances financial performance, liquidity, and long-term stability. It recommends that school managers adopt optimal debt levels, minimize administrative costs, diversify income sources, and strengthen internal financial controls to promote long-term sustainability within Kenya's private education sector.

Keywords: Debt Financing, Financial Sustainability, Trade Credit, Bank Loans, Installment Purchase

A Green, Tailored Skills Curriculum for People with Disabilities and Limited Mobility

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Abstract
The pursuit of sustainability and inclusivity in education underscores the urgent need for innovative approaches to curriculum development within Technical and Vocational Education and Training (TVET). People with disabilities and those with limited mobility continue to face barriers in accessing skill-based training, restricting their employment opportunities, independence, and participation in the green economy. This study aimed to design and evaluate a green, tailored skills curriculum that integrates sustainability principles with adaptive instructional methods to promote inclusive participation among learners with disabilities and limited mobility. A qualitative, participatory approach was adopted, involving consultations with TVET instructors, disability inclusion specialists, and learners with mobility challenges. Data were collected through focus group discussions and document reviews of existing TVET curricula. The information guided the development of a pilot curriculum emphasizing eco-friendly practices such as the use of sustainable materials, recycling, upcycling, and energy-efficient production methods. Accessibility adaptations were made to ensure that all practical training activities could be effectively undertaken by wheelchair users and individuals with mobility limitations. The pilot curriculum demonstrated that integrating green concepts with adaptive learning methods significantly enhanced learner participation, confidence, and skill acquisition. Instructors reported improved engagement, while learners expressed increased motivation and a sense of inclusion. The findings also indicated potential for scalability within other TVET institutions to promote equitable access to sustainable livelihoods. A green, tailored skills curriculum offers dual benefits, advancing environmental sustainability and fostering inclusivity in vocational education. It aligns with the United Nations Sustainable Development Goals (SDG 4: Quality Education, SDG 8: Decent Work and Economic Growth, and SDG 10: Reduced Inequalities). The study recommends the establishment of a national framework for inclusive green TVET to guide policymakers, educators, and training institutions in implementing adaptive, sustainability-driven programs.

Keywords: Inclusive education, Green skills, Adaptive TVET curriculum, Disability empowerment, Sustainable development

Influence of Internal Control Systems and Organizational Culture on the Performance of Public TVET Institutions in Kenya

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Abstract

Despite substantial public investment in the Technical and Vocational Education and Training (TVET) sector, the performance of public TVET institutions in Kenya remains suboptimal. Repeated audit reports by the Office of the Auditor General (OAG) have consistently revealed systemic weaknesses in internal control systems (ICS), including poor financial accountability, non-compliance with procurement regulations, and inadequate oversight mechanisms. This study investigated the influence of internal control systems on the performance of public TVET institutions in Kenya, with a specific focus on the moderating role of organizational culture. The study was guided by the Agency Theory and the Resource-Based View, which emphasize accountability, governance, and the strategic value of internal capabilities. A descriptive survey research design was adopted, targeting 720 respondents from 180 accredited public TVET institutions across Kenya. Using stratified random sampling, a representative sample of 257 respondents was selected. Data were collected through structured questionnaires and analyzed using descriptive statistics, Pearson's correlation, and hierarchical regression analysis. The findings revealed that organizational culture significantly moderates the relationship between internal control systems and institutional performance. Specifically, cultures that uphold integrity, transparency, and accountability were found to strengthen the effectiveness of internal controls, whereas weak or compliance-averse cultures diminished their impact, regardless of formal structures. The study concludes that effective internal control systems are indispensable to improving operational efficiency and institutional performance, but their success depends greatly on a supportive organizational culture. The study recommends promoting ethical, transparent, and accountability-driven cultures to enhance governance and service delivery in TVET institutions. Future research may explore the role of leadership styles and governance frameworks in strengthening internal controls within the education sector.

Keywords: Internal Control Systems, Organizational Culture, Institutional Performance, Governance, TVET Institutions

Competency-Based Curriculum in Kenya: The Missing Link Between Junior School and Senior School. A Desktop Study

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Abstract
In June 2024, the High Court of Kenya upheld the implementation of the Competency-Based Curriculum (CBC), dismissing a petition seeking its abolition. The court ruled that reversing the system was impractical due to the extensive investment and progressive implementation already undertaken. Consequently, the Ministry of Education was directed to amend the Basic Education Act within 120 days to align it with the CBC framework. In a subsequent ruling in August 2025, another High Court ordered the establishment of an Education Standards and Quality Assurance Council (ESQAC) within 14 days to oversee CBC implementation, emphasizing that the absence of such a body could compromise the credibility and objectives of the curriculum. The CBC replaced Kenya's long-standing 8-4-4 system, which had been criticized for its excessive focus on examinations at the expense of skill development and talent nurturing. While CBC seeks to cultivate competencies such as critical thinking, problem solving, creativity, communication, collaboration, and self-efficacy, its implementation has faced significant challenges. Many stakeholders have argued that the rollout was rushed, inadequately planned, and lacked professional guidance, resulting in numerous court petitions and public controversies. This desktop study critically examines the Competency-Based Curriculum in Kenya through the lenses of curriculum integration and knowledge management, highlighting the transitional gap between Junior School and Senior School. The paper identifies structural, pedagogical, and policy inconsistencies that threaten the continuity and integrity of learning outcomes across the two levels. It concludes by proposing strategies to strengthen curriculum alignment, institutional readiness, and stakeholder collaboration for the sustainable realization of CBC goals.

Keywords: Competency-Based Curriculum, Curriculum Integration, Knowledge Management, Educational Reform, Learning Continuity

SUB-THEME:

CULTURE, GENDER, TOURISM, AND HOSPITALITY IN SUSTAINABLE DEVELOPMENT

Roles of Community-Based Cultural Initiatives in Promoting Sustainable Tourism and Hospitality Development in Western Kenya

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Abstract
This study explored the role of community-based cultural initiatives in promoting sustainable tourism and hospitality development in Western Kenya. These initiatives, owned and managed by local communities, extend beyond economic objectives to foster cultural preservation, environmental stewardship, and social equity. Actively involving residents in tourism and hospitality ventures promotes equitable benefit-sharing through job creation, income generation, and poverty reduction, empowering communities and strengthening local resilience. The research further examined how these initiatives act as catalysts for sustainable development by safeguarding tangible and intangible cultural heritage, including traditional arts, rituals, and historical sites, while enhancing local capacity through training in hospitality management, tour guiding, and craft production. They also foster a sense of ownership and cultural pride among community members and offer authentic, experience-based tourism alternatives to conventional mass tourism. A mixed-methods research design, integrating quantitative and qualitative approaches, was employed to provide a comprehensive understanding of the relationships between cultural initiatives, community well-being, and tourism sustainability. The methodology involved sampling community projects, conducting structured interviews, and analyzing data under ethical research guidelines. The study identified best practices and strategies to strengthen community-based cultural tourism and offers recommendations for policymakers, development partners, and tourism stakeholders on supporting and scaling up such initiatives. Overall, the findings underscore the transformative potential of community-based cultural approaches as vital instruments for advancing responsible, inclusive, and sustainable tourism that benefits both visitors and host communities.

Keywords: Communities, Cultural Initiatives, Sustainable Tourism, Cultural Preservation, Hospitality Development

Bridging the Gender Gap in Technical and Vocational Education: Enrollment and Retention of Female Students in Technical Courses in Kenya

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Abstract

Technical and vocational education has become a cornerstone of Kenya's human capital development strategy, supporting industrialization, job creation, and inclusive growth under Vision 2030 and the Bottom-Up Economic Transformation Agenda (BETA). Despite progress in expanding access, gender disparities persist in traditionally male-dominated technical disciplines. This study analyzed enrollment and retention patterns of female students in technical courses, identified factors contributing to gender imbalances, and proposed strategies for promoting equity. A quantitative research design was employed, utilizing data from the Technical and Vocational Education and Training Authority (TVETA), the Ministry of Education, and institutional reports from 2019 to 2024. Descriptive statistics and trend analysis examined gender distribution across fields, complemented by literature-based contextual insights. Findings revealed that overall enrollment increased from 239,900 in 2019 to 406,649 in 2023/24, with female participation rising from 39.3% to 45.4%. However, disparities remained pronounced in technical areas; female enrollment stood at 11.8% in mechanical engineering, 15.8% in electrical engineering, and 22.7% in building and civil engineering, while women dominated health sciences (57%) and applied sciences (69.5%). Retention rates were lower among women (82.3%) than men (88.5%), due to financial barriers, socio-cultural expectations, and gender-based discrimination. The study concludes that while access has improved, systemic gender biases and limited institutional support continue to constrain women's progress in technical education. It recommends targeted scholarships, mentorship, gender-responsive infrastructure, industry partnerships, and enforcement of anti-discrimination policies. Bridging this gender gap is crucial for achieving educational inclusion, gender equity, and sustainable economic transformation aligned with Sustainable Development Goals (SDGs) 4, 5, and 8.

Keywords: Gender equity, technical education, female participation, skills development, educational inclusion

Femicide in Kenya: Trends, Contributing Factors, and Strategies to Address Gender-Based Violence and Societal Vulnerabilities

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Abstract

Femicide, the intentional killing of women or girls because of their gender, represents the most extreme manifestation of gender-based violence and reflects entrenched gender inequality. This phenomenon includes domestic homicides, ritual killings, and other targeted acts of violence specifically against women. Globally, approximately one in three women experiences physical or sexual violence in their lifetime, with underreporting particularly pronounced in Africa due to limited data collection systems. In Kenya, femicide remains a pressing concern, frequently associated with domestic violence, economic hardship, social norms, and cultural practices. Data from the Kenyan National Crime and Safety Survey (2021), UN Women, and local NGOs indicate an upward trend in femicide cases, although precise statistics are difficult to determine due to widespread underreporting. High-profile incidents highlighted by media and advocacy groups further underscore the urgent need for effective interventions. Key contributing factors to femicide in Kenya include gender inequality, weak legal enforcement, domestic violence, socioeconomic vulnerabilities, entrenched cultural norms, social stigma, and jealousy-driven violence. Addressing this complex issue requires multi-dimensional strategies, including strengthening legal frameworks, promoting gender equality, implementing education and awareness initiatives, providing comprehensive victim support services, enhancing law enforcement capacity, engaging communities and religious leaders, fostering economic empowerment, improving data collection, and controlling access to weapons. Coordinated social, legal, and policy actions are essential to reduce women's vulnerability, protect potential victims, and shift societal attitudes toward gender-based violence. Only through sustained and integrated interventions can Kenya effectively combat femicide and move toward safer, more equitable communities for women and girls.

Keywords: Femicide, gender-based violence, Kenya, preventive strategies, domestic violence

Culinary Tourism and Its Influence on Restaurant Sustainability in Kisumu County, Kenya

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Abstract

Culinary tourism involves travelling to experience different types of food that represent a region's culture, history, and way of life. This study explored how culinary tourism influences the sustainability of restaurants in Kisumu County, Kenya. The main objectives were to identify both the positive and negative effects of culinary tourism on restaurant sustainability. The study used a descriptive research design and was carried out in Kisumu town and its outskirts, focusing on restaurants around Lwang'ni and the Kisumu Bus Park. From a target population of 600 people, 60 respondents were selected using random sampling. The respondents included restaurant owners, guests, waiters, and cooks. Data were collected through questionnaires and interviews and analyzed using simple descriptive statistics such as frequencies, means, and percentages. Results showed that culinary tourism helps improve community livelihoods, creates job opportunities, and attracts both local and outside visitors. Many restaurant workers gained skills through on-the-job training, traditional cooking practices, and training in TVET institutions. The study also found that culinary tourism promotes cultural heritage by encouraging the preparation of local dishes. However, rising costs of local ingredients and limited support for farmers remain major challenges. The study concludes that culinary tourism supports restaurant growth and strengthens the local economy. It recommends including indigenous dishes in culinary training, training and supporting farmers, and promoting local food to attract more tourists.

Keywords: Culinary Tourism, Restaurant Sustainability, Cultural Heritage, Local Cuisine, Community Livelihoods

Effects of Seasonal Domestic Tourism Boom on Environmental Pollution in Kitale National Park, Trans Nzoia County, Kenya

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Abstract

Seasonal domestic tourism significantly contributes to local economic growth and cultural exchange; however, it also presents notable environmental challenges when not properly managed. This study investigated the effects of seasonal domestic tourism booms on environmental pollution in Kitale National Park, Trans Nzoia County, Kenya. The study was influenced by the recurrent environmental degradation observed during school holidays and festive seasons, when increased tourist inflows exert considerable pressure on the park's natural resources. These pressures manifest through solid waste generation, vehicular emissions, and improper waste disposal practices. Despite domestic tourism's recognized economic value, limited empirical research has focused on its environmental implications in smaller protected areas such as Kitale National Park. The study was guided by three specific objectives: (i) to assess the extent of solid waste pollution during peak tourism seasons, (ii) to evaluate the contribution of tourist transport to air and noise pollution, and (iii) to examine the effectiveness of environmental management practices employed by park authorities. A descriptive survey research design was adopted, involving 238 respondents, comprising domestic tourists, park staff, and local community members. Data were collected through structured questionnaires, interviews, and field observations. Quantitative data were analyzed using descriptive statistics, while qualitative data were subjected to thematic analysis. The findings revealed that seasonal tourist surges lead to substantial accumulation of solid waste, particularly plastic bottles, polythene bags, and food wrappers. Vehicular congestion during peak periods contributed to localized air and noise pollution. The study established that existing environmental management practices are inadequate due to limited funding, insufficient facilities, and low environmental awareness among tourists. Unregulated seasonal tourism poses serious long-term threats to the ecological sustainability of Kitale National Park. It recommends strengthening waste management infrastructure, enforcing park regulations more rigorously, introducing eco-tourism awareness programs for visitors, and enhancing community partnerships to enforce conservation-oriented tourism practices.

Keywords: Seasonal tourism, Domestic tourists, Environmental pollution, Solid waste management, Eco-tourism

Effects of Online Food Delivery Platforms on the Performance of Traditional Restaurants

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Abstract

The restaurant industry has undergone a rapid digital transformation driven by technological innovation, increased smartphone use, and widespread internet access. This shift, further accelerated by modern lifestyles, urbanization, and the COVID-19 pandemic, has changed customer behavior from dining in to ordering meals online, posing new challenges for traditional restaurants that have long relied on walk-in customers. This study aimed to examine the effects of online food delivery platforms on the performance of traditional restaurants, focusing on the opportunities and constraints they create. A descriptive research design was adopted, using structured questionnaires administered to restaurant managers and owners within Eldoret Town, with data analyzed through descriptive and inferential statistics to determine the relationship between online platform adoption and key performance indicators such as sales, customer reach, and profitability. The findings indicated that restaurants partnering with online delivery platforms experienced revenue growth of between 15% and 25% due to an expanded customer base, yet they faced challenges, including high commission fees ranging from 15% to 30%, reduced profit margins, limited control over customer experience, and increased competition. The discussion revealed that while online platforms enhance visibility and convenience, they also heighten dependency on third-party systems and operational complexities. The study concludes that online delivery platforms have both positive and negative impacts on traditional restaurant performance, and their effective utilization requires strategic adaptation. It recommends that traditional restaurants strengthen digital branding, negotiate fairer commission rates, and adopt hybrid models that integrate both online and in-person service. Furthermore, policymakers should promote digital capacity building and innovation within the hospitality sector to foster competitiveness and sustainable growth.

Keywords: online delivery platforms, traditional restaurants, performance, digital transformation, COVID-19

Community-Based Tourism and Sustainable Development in Rural Kenya: The Case of the Rimoi Region

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Abstract

This study evaluates the role of community-based tourism (CBT) in promoting sustainable development in rural Kenya, with a specific focus on the Rimoi National Reserve. In recent years, CBT has gained recognition as a strategic approach to empowering local communities by combining economic growth, cultural preservation, and environmental conservation. It serves as an inclusive development model that positions communities not merely as beneficiaries but as active participants in the tourism value chain. The research explores how CBT initiatives in Rimoi have contributed to improving livelihoods through job creation, entrepreneurship, and income diversification, while simultaneously promoting the preservation of indigenous cultural heritage, natural landscapes, flora, and fauna. Employing a qualitative case study approach, the study analyzes data collected through interviews, field observations, and document reviews to understand how local communities interact with tourism activities and manage natural resources. The findings reveal that active community participation in tourism planning and decision-making enhances equitable benefit-sharing, fosters social cohesion, and strengthens conservation outcomes. However, the study also identifies key challenges, including limited financial resources, inadequate training, and insufficient institutional support, which constrain the effectiveness of CBT initiatives. The research concludes that sustainable success in community-based tourism depends on capacity building, inclusive planning processes, and strong environmental stewardship. By addressing existing gaps and promoting collaborative management between communities, government agencies, and private stakeholders, CBT can serve as a transformative tool for achieving rural development, environmental sustainability, and long-term resilience. Ultimately, the study underscores the potential of CBT to harmonize conservation with community welfare while safeguarding Kenya's natural heritage for future generations.

Keywords: Community-Based Tourism, Sustainable Development, Inclusive Planning, Capacity Building, Conservation

Household Use of Earthenware and Aluminum Cookware in Racecourse Ward in Uasin Gishu: Implications for Health, Flavour, and Cultural Practices

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Abstract

The type of cookware used in food preparation influences nutritional quality, health safety, and culinary outcomes. In many Kenyan households, aluminum cookware has largely replaced traditional earthenware despite growing health concerns linked to metal leaching. However, limited empirical studies have explored how households perceive and choose between these two cookware types. This study examined household preferences for earthenware and aluminum cookware in Kenya, focusing on perceived health effects, cooking quality, cultural attachment, and usability. A descriptive research design was adopted, and data were collected from 355 households in Racecourse Ward in Uasin Gishu using structured questionnaires and key informant interviews. Quantitative data were analyzed using descriptive statistics, while qualitative responses were thematically analyzed. Findings revealed that 68% of households preferred aluminum cookware due to affordability, durability, and fast cooking, while 32% continued using earthenware for its ability to enhance food flavor and retain heat. However, 54% of aluminum users expressed concern over possible long-term health risks such as metal contamination, especially when cooking acidic foods. Earthenware users cited fragility and limited availability in urban markets as major challenges. The study concludes that cookware choice is shaped by both socioeconomic factors and cultural identity. It recommends consumer education on safe cookware use, promotion of improved earthenware designs, and policy support for small-scale ceramic producers to revitalize traditional, health-friendly cookware options.

Keywords: Cookware preference, earthenware, aluminum cookware, household health, Kenya, traditional cooking.

Influence of Community Participation in Tourism on Socio-Economic Growth of The Abagusii Otenyo Cultural Group in Kisii, Kenya

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Abstract

Tourism development thrives on collaboration among key stakeholders, including local communities, government agencies, and private sector players. In Kenya, however, the potential of tourism as a driver of socio-economic transformation remains underexploited, largely due to weak institutional frameworks, inadequate resource allocation, and limited community awareness of tourism's benefits. These constraints are particularly evident in rural settings, where insufficient engagement and information dissemination have hindered active local participation in tourism development processes. This study assessed the influence of community participation in tourism on the socio-economic growth of the Abagusii Otenyo Cultural Group in Kisii County. Anchored on the Social Exchange Theory, the research employed a descriptive design and targeted 300 registered members of the cultural group. Data were collected through structured questionnaires and analyzed using descriptive statistical methods, with the results presented in tables, pie charts, and bar graphs. Findings revealed that while members of the Abagusii Otenyo Cultural Group participate actively in traditional tourism activities such as cultural exhibitions, performances, and handicraft production, the frequency and intensity of involvement vary considerably among participants. Enhanced participation was found to contribute positively to income generation, cultural preservation, and community cohesion. The study concludes that community participation is a critical catalyst for sustainable tourism and socio-economic advancement. It recommends the implementation of targeted policies and empowerment programs that strengthen local capacities, enhance decision-making roles, and foster inclusivity in tourism planning. Strengthening institutional support and promoting awareness of tourism's economic potential will further ensure that culture-based tourism initiatives contribute meaningfully to rural development and community well-being.

Keywords: Community Participation, Tourism, Socio-Economic Growth, Culture, Development

SUB-THEME:

DIGITAL TRANSFORMATION FOR INCLUSIVE GROWTH AND INNOVATION

Development of an Artificial Intelligence-Based System for Automated Detection of Plant Diseases Using Thermal Imaging and Image Processing to Enhance Food Security

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Abstract

Plant diseases pose a major threat to global food security by causing severe crop losses and reduced agricultural productivity. In Kenya and other developing nations, most smallholder farmers depend on visual inspection for disease identification, which often results in delayed diagnosis and ineffective interventions. This study sought to develop an Artificial Intelligence (AI)-based system for automated detection of plant diseases using thermal and RGB image data to enhance timely decision-making in agricultural management. Thermal and RGB images of healthy and diseased plants were collected using high-resolution cameras and annotated to indicate disease status. The images underwent preprocessing through noise reduction, illumination correction, and feature enhancement to improve analytical accuracy. Feature extraction techniques, including texture, color, and shape analysis, were used to generate data for training a Convolutional Neural Network (CNN) model. The trained model was validated using unseen test images to evaluate its accuracy and generalization capability. Results showed that the CNN model achieved over 90% accuracy in distinguishing between healthy and diseased plants. The system successfully identified early-stage disease symptoms based on unique thermal patterns and provided real-time diagnostic feedback through an integrated user interface. The integration of AI with thermal imaging substantially enhances the reliability and efficiency of plant disease detection compared to traditional manual methods. The study concludes that the developed system offers a rapid, precise, and scalable solution for early plant disease detection. Its adoption could significantly reduce crop losses, enhance productivity, and strengthen food security. It is recommended that agricultural institutions and policymakers support the deployment of AI-driven diagnostic tools and expand datasets to include diverse crops and disease types. Additionally, mobile-friendly platforms should be developed to increase accessibility among smallholder farmers.

Keywords: Artificial Intelligence, Thermal Imaging, Image Processing, Plant Diseases, Food Security, Disease Management

Leveraging Digital Innovation and Science, Technology, and Innovation (STI) to Enhance Agricultural Productivity under Kenya's Bottom-Up Economic Transformation Agenda

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Abstract

Globally, more than 828 million people continue to face undernourishment and hunger, a crisis deepened by the effects of climate change, pandemics, and geopolitical disruptions. In Africa, smallholder farmers produce nearly 80% of the continent's food, yet they remain among the most food-insecure populations due to limited access to technology, information, and markets. In Kenya, where agriculture contributes about 33% of the national GDP and supports over 60% of the rural population, improving agricultural productivity is a key pillar of the Bottom-Up Economic Transformation Agenda (BETA). This study examined how the integration of Science, Technology, and Innovation (STI), particularly through digital agriculture, can enhance productivity, reduce post-harvest losses, and foster inclusive economic growth among smallholder farmers. The analysis drew upon field data and reports from the Kenya Postharvest Management Strategy, the Kenya Youth Agribusiness Strategy, and case studies conducted in Nakuru, Bungoma, and Makueni counties. The study focused on digital innovations such as AI-powered advisory systems (Plant Village), IoT-enabled irrigation technologies, and mobile-based input and market platforms. Findings revealed that these technologies led to yield improvements of up to 35%, significant reductions in postharvest losses, and increased youth engagement in Agri-tech entrepreneurship and local innovation hubs by approximately 30–35%. The results highlight that integrating STI-driven digital solutions within the BETA framework holds transformative potential for Kenya's agri-food systems. Such integration can drive sustainable agricultural productivity, strengthen food security, and promote inclusive rural employment. To scale these innovations nationally, the study emphasizes the need to reinforce policy support, enhance digital literacy, and deepen public–private partnerships.

Keywords: Digital agriculture, Science and innovation, Food security, Smallholder productivity, Bottom-Up Economic Transformation Agenda

Evaluation of Kenya TVET Trainers' Use of Artificial Intelligence in Instructional Design and Delivery

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Abstract
The integration of Artificial Intelligence (AI) in education is transforming instructional design and delivery by fostering adaptive, data-driven, and personalized learning experiences. This study evaluated the extent to which trainers in Kenya's Technical and Vocational Education and Training (TVET) institutions apply AI tools to enhance instructional processes. Guided by the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework, the study pursued three objectives: to assess trainers' perceptions of the usefulness and ease of use of AI-based tools; to evaluate their technological, pedagogical, and content knowledge in AI integration; and to examine how these factors influence AI adoption in instructional practice. Using a mixed-methods approach that combined surveys and interviews, the study established a growing awareness and interest in AI among TVET trainers. Younger and less-experienced trainers exhibited higher adoption levels, while gender differences were negligible. However, a persistent urban–rural divide was noted, largely attributed to infrastructural limitations and inconsistent institutional support. Trainers identified key benefits of AI, including improved instructional efficiency, enhanced learner engagement, and customized learning experiences. Nonetheless, inadequate training, limited access to AI technologies, and weak policy frameworks hindered full adoption. The study concludes that building AI competencies among trainers through professional development, embedding AI integration in teacher training curricula, and investing in digital infrastructure are critical for sustainable implementation. Strengthened policy frameworks and collaboration among government, academia, and industry are recommended to support AI-driven instructional transformation in Kenya's TVET institutions.

Keywords: Artificial Intelligence, instructional design, instructional delivery, TVET, technology integration

Incorporating Automation and Human-Centered AI in TVET Programs: Equipping Kenyan Technicians for the Fifth Industrial Revolution

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Abstract
The accelerated transition into the Fifth Industrial Revolution (5IR), driven by Artificial Intelligence (AI) and automation, necessitates a paradigm shift in Technical and Vocational Education and Training (TVET) to balance technological innovation with human-centered values. This study evaluated how Kenyan TVET institutions are incorporating automation and human-centered AI to equip technicians with the knowledge, skills, and ethical grounding required for the emerging 5IR workforce. Unlike the Fourth Industrial Revolution, which emphasized automation and digital connectivity, the 5IR focuses on the synergy between humans and machines, ethical AI utilization, and adaptable, empathetic workforces. A mixed-methods approach combining quantitative surveys and qualitative thematic analysis was employed, targeting five training institutions across Kenya. Findings revealed moderate awareness and application of AI tools among trainers and trainees, with mean responses on a five-point scale ranging from 2.6 to 3.0. Approximately 60% of respondents reported no AI integration in curricula, while 40% indicated minimal exposure. Qualitative insights highlighted challenges, including inadequate infrastructure, poor internet connectivity, insufficient staff training, and legacy curricula. The study proposes four key strategies: policy reform, curriculum redesign, infrastructure enhancement, and Training of Trainers (ToT) initiatives. It concludes that fostering collaboration among policymakers, educators, and industry stakeholders is critical to aligning TVET programs with 5IR demands. Embracing human-centered AI principles will enable Kenyan TVET institutions to produce technicians who are both technologically competent and ethically conscious, ready to thrive in a rapidly evolving industrial landscape.

Keywords: Fifth Industrial Revolution, Human-Centered AI, TVET, Automation, Curriculum Innovation

Effectiveness of Social Media on Information Retrieval and Learning among University and College Students in North Rift, Kenya

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Abstract
Social media platforms have profoundly reshaped communication and information exchange, extending their influence into higher education globally and regionally. This study examines the effectiveness of social media on information retrieval and learning among university and college students in the North Rift region of Kenya. It explores how different platforms contribute to students' academic engagement, collaboration, and access to knowledge resources. The study synthesizes existing research and contextual findings to provide practical insights into how social media impacts students' learning processes. Results indicate widespread adoption of social media, with WhatsApp and Facebook emerging as the most dominant platforms among Kenyan university and college students. These platforms enhance information retrieval, promote collaborative learning, strengthen communication between students and educators, and increase access to diverse academic materials. Despite these advantages, significant challenges persist, including distractions, poor time management, information overload, and doubts about content credibility. Case studies from North Rift institutions further reveal infrastructural constraints such as limited internet connectivity and a strong inclination toward recreational rather than academic use. Additionally, a major gap exists in institutional policies guiding the academic use of social media across many higher education institutions. The paper concludes that while social media has immense potential to transform learning, its educational value can only be fully realized through structured integration, robust digital literacy programs, and policy frameworks that support responsible and innovative use for academic purposes.

Keywords: Social Media, Information Retrieval (IR), Collaborative Learning, Digital Literacy (DL), Higher Education Institutions (HEIs)

An Assessment of Integration of Emerging Technologies in Technical Training: A Case Study of Kitale National Polytechnic

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Abstract

The integration of emerging technologies such as Artificial Intelligence (AI), Robotics, and the Internet of Things (IoT) within Technical and Vocational Education and Training (TVET) institutions is essential for trainers and trainees to thrive in a technology-driven economy. This study investigated the extent to which these technologies are incorporated into technical training at Kitale National Polytechnic, with the objective of assessing their level of integration, evaluating trainers' and trainees' readiness for adoption, and recommending capacity-building strategies to enhance digital pedagogy and technological adaptability. A descriptive research design was adopted, targeting both trainers and trainees across selected academic departments. The study involved a sample of 260 students selected through stratified random sampling from various departments, and 40 trainers and administrators chosen using purposive sampling to ensure adequate representation of diverse expertise and experience levels. Data was collected using questionnaires, interviews, and document analysis, and analyzed using descriptive statistics and thematic analysis. Preliminary findings revealed that while there is increasing awareness of digital transformation, the actual integration of emerging technologies into teaching and learning remains limited by infrastructural gaps, inadequate training, and a lack of clear institutional policy frameworks. However, both trainers and students demonstrated a high level of willingness to embrace digital tools when provided with appropriate resources and capacity-building opportunities. The study concludes that successful integration of emerging technologies in TVET requires a holistic institutional approach combining infrastructure investment, staff training, curriculum innovation, and strong policy support. The study recommended strategic partnerships between TVET institutions, industry, and government to accelerate digital adoption and produce graduates who are competent, innovative, and future-ready, in line with Kenya's sustainable development goals.

Keywords: Emerging Technologies, Technical Training, Technology-Driven Economy, Digital Pedagogy, Future-Ready Graduates

Evaluating the Influence of Cybersecurity Policies and Cybersecurity Behaviour on Institutional Security Performance in Remote Learning: The Moderating Role of Technological Readiness

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Abstract

The rapid transition to remote learning has transformed the landscape of higher education, offering flexibility in instructional delivery while amplifying cybersecurity risks. Institutions of higher learning have become increasingly vulnerable to cyber threats due to their reliance on digital platforms, underscoring the need for effective cybersecurity strategies. This study examines the influence of cybersecurity policies and cybersecurity behaviour on institutional security performance within remote learning environments, highlighting the moderating effect of technological readiness. Data were collected from Technical and Vocational Education and Training (TVET) trainers involved in remote teaching programs in Kenya using a structured survey instrument. The proposed research model was empirically tested and validated through Structural Equation Modelling (SEM). The findings reveal that both well-formulated cybersecurity policies and proactive cybersecurity behaviours significantly improve institutional security performance. Additionally, technological readiness positively moderates the relationship between cybersecurity behaviour and security performance, indicating that institutions with advanced technological capacity are better positioned to mitigate cyber risks. These results emphasize the importance of integrating robust policy frameworks with adequate technological infrastructure to strengthen institutional cybersecurity resilience. The study provides valuable insights for educational institutions seeking to enhance their cybersecurity posture, promote safe remote learning practices, and safeguard digital learning ecosystems from evolving cyber threats.

Keywords: Cybersecurity policies, Cybersecurity behavior, Institutional security performance, Remote learning, Technological readiness

Predictive Maintenance of Solar Panels Using IoT and Machine Learning

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Abstract

Solar energy is one of the most sustainable and widely adopted renewable energy sources. Maintaining the long-term efficiency of solar photovoltaic (PV) systems remains a major challenge. Environmental conditions such as dust accumulation, fluctuating temperatures, humidity, and unexpected mechanical faults significantly reduce panel output. Traditional maintenance strategies, including scheduled inspections and reactive repairs, are inefficient, time-consuming, and costly. To address these limitations, this study develops a predictive maintenance framework that integrates Internet of Things (IoT) sensors with Machine Learning (ML) algorithms for improved fault detection, power forecasting, and maintenance optimization. In this study, IoT-based sensors were deployed to continuously monitor solar panel operating parameters, including temperature, voltage, current, dust concentration, humidity, and solar irradiance. The collected real-time data was transmitted to a cloud-based database for secure storage and preprocessing. Plant characteristics data were collected for a period of three weeks at an interval of five minutes. A Random Forest regression model was implemented to analyze the data and test the effectiveness of the model. The model successfully identified and classified faults, detected abnormal operating conditions, and predicted future power output trends based on historical records. The experimental analysis demonstrates that the predictive maintenance model significantly improves fault detection accuracy and enables reliable energy yield forecasting. These outcomes reduce downtime, lower operational and maintenance costs, and provide actionable insights for long-term planning of solar PV plants. Furthermore, by predicting future degradation patterns, the framework helps optimize maintenance schedules and extend the lifespan of solar panels. This research validates the potential of IoT-driven ML solutions in enhancing solar panel performance and ensuring efficient renewable energy management. Future work will focus on improving the model's generalization through hybrid ML techniques, incorporating edge computing to achieve faster real-time decision-making, and developing secure and scalable frameworks for large-scale solar installations.

Keywords: Machine Learning, IoT, Solar Energy, Predictive, Faults

Gamification Strategies for Enhancing Engagement in Online Courses: A Case Study of Rift Valley Technical Training Institute, Eldoret

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Abstract
The expansion of online learning has introduced both opportunities and challenges, particularly regarding student engagement, motivation, and course completion rates. Gamification, the integration of game elements such as points, badges, leaderboards, storytelling, and adaptive challenges into non-game contexts, has emerged as a promising pedagogical approach to enhance learner participation and retention. This study examined the effectiveness of gamification strategies in improving engagement and performance among students enrolled in online courses at Rift Valley Technical Training Institute (RVTTI), Eldoret. A mixed-methods research design was employed, combining quantitative and qualitative data collection. The study targeted 376 students undertaking various online programs, selected through stratified random sampling based on Cochran's formula to ensure statistical significance and diversity. Data were collected using surveys, structured interviews, and learning analytics to monitor course participation and completion rates. The independent variable was the application of gamification strategies, while the dependent variables included learner engagement, motivation, and course completion. Results revealed that gamified learning environments significantly enhanced motivation, participation, and course completion compared to non-gamified settings. Specifically, completion rates among gamified groups were approximately 30% higher, with students demonstrating increased initiative, collaboration, and enthusiasm. However, the study also observed variation in impact across learner cohorts, suggesting that factors such as subject matter, learner demographics, and competition dynamics influence the outcomes of gamification. The study concludes that gamification can be an effective tool for fostering engagement and improving learning outcomes in online education when applied thoughtfully and contextually. It recommends further longitudinal studies to examine the long-term effects of gamified learning and to develop adaptable frameworks suited to different educational environments.

Keywords: Gamification, Online learning, Student engagement, Motivation, Learning performance

Intelligent Student Recruitment and Career Guidance: Leveraging Artificial Intelligence to Revolutionize TVET Entry Pathways in Kenya

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Abstract
The Technical and Vocational Education and Training (TVET) sector in Kenya plays a critical role in advancing national development priorities such as Vision 2030 and the Bottom-Up Economic Transformation Agenda. However, its full potential remains constrained by persistent inefficiencies in student recruitment and career guidance processes. Current practices often result in mismatches between students and programs, where learners enroll in courses that do not align with their abilities or labour market needs. This misalignment contributes to high dropout rates, low completion levels, and the production of graduates whose skills fall short of industry expectations. This desktop-based study explores the transformative potential of Artificial Intelligence (AI) in addressing these challenges. It examines how AI-driven psychometric assessments can identify learners' innate aptitudes, learning styles, and cognitive strengths, providing more accurate placement and career guidance beyond traditional academic metrics. The paper further analyzes the role of intelligent chatbots in delivering personalized, real-time support to prospective students, thereby reducing administrative bottlenecks. Additionally, it underscores the importance of integrating Labour Market Intelligence (LMI) systems, where AI algorithms process real-time industry data to forecast emerging skill demands and provide evidence-based career recommendations. This convergence of personal aptitude analytics and market intelligence ensures that recruitment and guidance are both learner-centered and economically responsive. Despite its promise, AI integration in Kenya's TVET ecosystem faces barriers such as the digital divide, data privacy concerns, and potential algorithmic bias. The study concludes that a phased and ethically grounded implementation is essential. It recommends public-private partnerships to develop localized AI solutions, targeted digital literacy programs, and a robust governance framework aligned with the Data Protection Act. By leveraging AI in recruitment and career guidance, Kenyan TVET institutions can enhance student success, optimize institutional efficiency, and strengthen the alignment between education and industry, laying the foundation for a skilled, future-ready workforce.

Keywords: Artificial Intelligence, Technical and Vocational Education and Training, Career Guidance, Labour Market Intelligence, Digital Transformation

SUB-THEME:

SUSTAINABLE ENGINEERING, GREEN TECHNOLOGIES, AND THE BUILT ENVIRONMENT

Evaluating Environmental Sustainability through Greening Initiatives: A Case Study of Green Innovation and Industrial Transformation in Kenya

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Abstract
Flexible and resilient industrialization lies at the core of Kenya's socio-economic transformation agenda, in alignment with Vision 2030, the Bottom-Up Economic Transformation Agenda (BETA), and the Sustainable Development Goals (SDGs). As Kenya advances along its industrial development pathway, ensuring environmental sustainability and promoting green innovation are essential to prevent ecological degradation, enhance resilience to climate shocks, and promote inclusive growth. This study evaluated the role of greening initiatives in supporting sustainable industrial transformation in Kenya. It adopted a mixed-methods approach combining document analysis, key informant interviews with industry, policy, and training stakeholders, and case studies of three industrial firms: textile, agro-processing, and renewable energy, to examine the adoption and outcomes of green practices. The findings reveal that process, product, and service innovations within the textile and floriculture sectors have achieved 25-40% reductions in waste, energy consumption, and emissions compared to traditional operations. The use of renewable energy sources such as solar and biomass has further reduced dependence on fossil fuels and improved cost efficiency. Despite these gains, major challenges persist, including weak enforcement of environmental regulations, limited expertise in green technologies, high initial investment costs-particularly for SMEs, and low awareness among industry players. Key enablers identified include regulatory reform, public-private partnerships, capacity-building through TVET institutions, green procurement, and integration of green skills into curricula. The study concludes that Kenya can achieve inclusive, low-carbon, and sustainable industrial growth by accelerating green innovation, strengthening institutions, reforming policies, and investing strategically in training and adaptive capacity.

Keywords: Industrialization, Resilience, Greening, Environmental Sustainability, Green Innovation, Kenya

A Sustainable Engineering Solution through Decentralized Renewable Microgrids for Rural Kenya

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Abstract
Social and economic development thrives on access to reliable and affordable energy. Yet, many rural communities in Kenya still lack uninterrupted and cost-effective power. The continued reliance on kerosene and firewood not only strains household finances but also endangers human health and accelerates environmental degradation. Despite ongoing national grid expansion, the pace of electrification in remote areas remains slow, costly, and often unsustainable. This paper examines decentralized renewable microgrids as a practical and sustainable engineering solution to bridge this gap. Findings from existing projects demonstrate that microgrids can transform rural livelihoods by providing dependable electricity that enables schools to extend study hours, health facilities to power medical equipment and vaccine refrigeration, and farmers to irrigate fields and preserve produce. Moreover, renewable microgrids stimulate entrepreneurship, generate green jobs, and reduce dependence on fossil fuels—enhancing community resilience to climate change. However, challenges persist, including limited financing, inadequate technical expertise, and project delays. The paper proposes targeted interventions such as adaptable pay-as-you-go financing models to enhance affordability, stronger public–private partnerships to mobilize investment, and integration of renewable energy training within TVET institutions to ensure long-term maintenance and innovation. Ultimately, the study underscores that decentralized renewable microgrids are not merely technological solutions but catalysts for inclusive and sustainable development. Their adoption can significantly advance Kenya's Vision 2030 and contribute to the achievement of the global Sustainable Development Goals.

Keywords: Renewable Energy, Microgrids, Rural Electrification, Sustainable Development, Green Innovation

Durable and Reusable Antimicrobial Textiles Functionalized with *Erythrina Abyssinica* Extracts and Bio-Mordants

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Abstract

Antimicrobial textiles have long been explored for applications in the medical field. Currently, most antimicrobial fabrics in use are disposable and nonwoven, which raises environmental concerns due to both the chemical treatments applied and their limited reusability. To promote more sustainable solutions, there is growing interest in reusable textiles with durable, eco-friendly finishes. This study investigated the effects of bio-mordants on the dyeing performance of *Erythrina abyssinica* natural dye extract and assessed its antioxidant and antimicrobial properties when applied to cotton fabric. Bio-mordants derived from mango bark and rosemary extracts were used. The antioxidant activity of the dyed fabrics was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method, while their antimicrobial activity was tested against *Escherichia coli* and *Staphylococcus aureus* using an absorbance-based assay. The results showed that the use of bio-mordants enhanced color strength, increasing from 0.601 to 0.762 with rosemary and to 0.692 with mango. The dyed cotton exhibited 63.1% antioxidant activity and demonstrated antimicrobial activity, reducing E. coli by 61.26% and S. aureus by 64.3%. These findings indicate that *E. abyssinica* natural dye extract has strong potential for both textile coloration and bio-functionalization as an antimicrobial textile, offering a more sustainable alternative for antimicrobial textiles.

Keywords: Natural dye; Bio-mordants; Antioxidant activity; Antimicrobial activity; Textile colouration

Integrating Green Hydrogen and Power-to-X Technologies into Kenyan TVET Curricula: A Feasibility and Implementation Study

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Abstract

The global transition toward sustainable energy systems, aligned with the United Nations Sustainable Development Goals (SDG 17), underscores the urgent need for a technically skilled workforce capable of implementing emerging clean energy technologies. Among these, Green Hydrogen and Power-to-X (PtX) technologies represent pivotal innovations driving decarbonization and renewable energy integration. This study assessed the feasibility of integrating Green Hydrogen and PtX technologies into Kenya's Technical and Vocational Education and Training (TVET) curricula to equip trainees with industry-relevant competencies. A qualitative research approach was adopted, employing purposive sampling to conduct in-depth interviews with twenty TVET educators and two industry stakeholders engaged in Kenya's renewable energy sector. Data were analyzed thematically, and ethical protocols, including informed consent and confidentiality, were duly observed. The findings revealed that Kenya's existing TVET curricula lack structured content on Green Hydrogen and PtX technologies. Most trainers expressed limited technical capacity, inadequate instructional resources, and the absence of laboratory infrastructure necessary for hands-on learning. Industry participants emphasized the urgent need for alignment between TVET training and the skill demands of Kenya's emerging green hydrogen projects, particularly in areas such as electrolyzer operation, hydrogen storage, and safety management. The study recommends the development of standardized PtX training modules, capacity-building programs for trainers, and the establishment of industry-supported practical workshops and demonstration hubs. Preliminary feasibility analysis indicates that successful integration requires targeted investment in laboratory infrastructure, curriculum revision, and sustained public–private partnerships. In conclusion, while systemic integration of Green Hydrogen and PtX training into Kenya's TVET system presents challenges, it remains both viable and critical. Embedding these technologies within vocational education will enhance employability, strengthen Kenya's human capital base, and position the nation as a regional leader in the green energy transition, thereby advancing sustainable economic development.

Keywords: Green Hydrogen, Power-to-X, Curriculum, Skills Integration, Energy Transition

Assessing the Effects of Renewable and Non-Renewable Energy Consumption on Economic Growth in Kenya

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Abstract

Energy remains a vital driver of economic growth, influencing industrialization, productivity, and overall national development. In Kenya, economic growth has fluctuated over the years, raising concerns about the sustainability of the country's energy mix. This study examined the effects of renewable and non-renewable energy consumption on economic growth in Kenya, while also analyzing the impact of carbon emissions within the context of sustainable development. Using annual time-series data from 1986 to 2022, the study employed an explanatory research design and analyzed the data using the Autoregressive Distributed Lag (ARDL) model. The Environmental Kuznets Curve (EKC) framework guided the analysis to determine both short-run and long-run relationships between energy consumption and economic growth. The results revealed that renewable energy consumption has a positive and statistically significant effect on economic growth, supporting the view that investment in clean energy sources enhances productivity and sustainability. Conversely, non-renewable energy consumption was found to have a negative long-run impact on economic growth due to its associated environmental costs and market volatility. The study also established a positive relationship between carbon emissions and economic growth in the short run, which diminishes over time as environmental degradation offsets the initial economic gains, confirming the EKC hypothesis in the Kenyan context. The study concludes that transitioning toward renewable energy sources is crucial for achieving sustainable and inclusive economic growth in Kenya. It recommends that policymakers strengthen incentives for renewable energy investments, expand green financing mechanisms, and enforce stricter regulations on carbon emissions. Such measures will not only enhance energy efficiency but also align Kenya's growth trajectory with global climate and sustainability goals.

Keywords: Renewable energy, non-renewable energy, carbon emissions, economic growth, Environmental Kuznets Curve, Kenya.

Interrelations Between Built Environment, Health, and Well-Being: Empirical Insights and Policy Implications from Global and Kenyan Perspectives

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Abstract

The built environment, comprising infrastructure, housing, transportation systems, and public spaces, plays a critical role in shaping the health and well-being of urban populations. Globally, studies have established strong links between walkability, access to green spaces, housing quality, and safety with improved mental and physical health outcomes. However, empirical evidence from rapidly urbanizing sub-Saharan African cities remains limited, particularly within the Kenyan context. This lack of localized data continues to hinder evidence-based urban planning and policy formulation. In Nairobi, urban development often overlooks the health and well-being dimensions of spatial planning, leading to widening inequalities and environmental disparities. This study investigates how specific built environment characteristics influence health outcomes among Nairobi residents, and how socio-economic and governance factors mediate these relationships. The study aims to: (1) assess the relationship between key built environment features, walkability, housing quality, green space availability, and safety, and health outcomes including physical activity, mental health, and social well-being; and (2) examine how socio-economic status, neighborhood typology, and governance structures affect the distribution and impact of these environmental features. Using a mixed-methods approach that combined household surveys, GIS-based spatial analysis, and key informant interviews, the research evaluated built environment attributes across diverse Nairobi neighborhoods. Findings indicate that walkability, access to green spaces, housing quality, and perceived safety are positively associated with physical activity and mental well-being. However, these benefits are unevenly distributed, with residents of informal settlements facing greater exposure to environmental and infrastructural health risks. The study concludes that inclusive and health-sensitive urban planning is essential for promoting equitable well-being in Kenya's rapidly urbanizing cities. It recommends stronger regulatory enforcement, expansion of green spaces, and the integration of health and well-being indicators into urban design and policy frameworks to foster sustainable, resilient, and equitable urban environments.

Keywords: Built environment, health and well-being, urban planning, walkability, green space, housing quality, Nairobi, spatial justice, governance, infrastructure inequality.

SUB-THEME:

CROSS-CUTTING ISSUES

The Implications of Small Arms and Light Weapons Proliferation on Human Security among the Rendille Community in Marsabit County-Kenya

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Abstract
Small arms and light weapons are widely manufactured and used by security forces in the maintenance of state security. Studies, however, indicate that millions of illegal small arms and light weapons continue to proliferate despite domestic and international community efforts to contain the spread. This study sought to assess the implications of small arms and light weapons possession on human security among the Rendille community in Marsabit County-Kenya. Open system theory and Relative deprivation theory were adopted to guide the study. A descriptive survey research design was used, and the target population was 477 people drawn from the Rendille Community, Ministry of Interior and National Coordination, and Non-Governmental Organizations. A sample size of 150 respondents participated in the study. Questionnaires, interview schedules, and Focus Group Discussions were used in the collection of primary data, which was corroborated with existing secondary data. A convergent parallel mixed method of data analysis and presentation of the findings was used. Ethical considerations, including confidentiality, anonymity, and informed consent of the respondents, were strictly adhered to. Additionally, prior written permission from the National Commission for Science, Technology, and Innovation was also sought before the beginning of the study. The findings indicated that prevalent crimes such as highway banditry, cattle rustling, inter-community attacks, and electoral violence associated with the use of small arms and light weapons had affected food security, community and personal security, environmental security, health security, and economic security. The study recommended that the government should recruit, equip, and deploy adequate security personnel to Marsabit County to provide requisite security and secure the porous borders from arms traffic flow. The County Government of Marsabit and the national government should identify development projects that provide an alternative source of income to the pastoralist communities. Lastly, further research was recommended on the implications of primordial social linkages among the trans-border communities in the proliferation of small arms and light weapons.

Key Words: Small Arms and Light Weapons, Proliferation, Security, Kenya

Supply Chain Strategic Capabilities and Quality of Health Care Services among Private Hospitals in Western Kenya

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Abstract
Intense competition, increasingly discerning consumers, and strict regulatory oversight have compelled health service organizations to consistently deliver high-quality services that align with the evolving needs of patients, thereby influencing their overall performance. There are well-known gaps in the performance of private health care, which range from medical errors to the soaring cost of health care. Therefore, the general objective of the study was to analyze the effect of supply chain strategic capabilities on the quality of health care services among private hospitals in Western Kenya. The study used an explanatory cross-sectional research design. A target population of 880 employees in private health hospitals in Western Kenya was adopted. The study determined the sample size of 335 respondents by use of Krejcie and Morgan's 1970 formula and considered a non-response rate of 20%. The study used a multistage sampling technique with a questionnaire to collect data. Quantitative data were analyzed using descriptive and inferential statistics through SPSS version 25.0 software. The study found that supply chain strategic capabilities had a significant relationship with the quality of health care services amongst private hospitals in western Kenya. In conclusion, this direct link highlights the importance of efficient, well-managed supply chains laced with strategic capabilities in supporting and enhancing the overall quality of healthcare services. However, the lack of cohesive strategic capabilities and interdepartmental coordination can impede these outcomes. This implies that private hospitals that build sustainable supply chain strategic capabilities, balancing profitability, environmental responsibility, and social well-being, are more likely to achieve and sustain superior quality in healthcare service delivery. The study recommends that Private hospitals aiming to maintain competitiveness and deliver high-quality healthcare services must enhance their supply chain by aligning it with strategic capability-oriented policies. This study provides an evidence-based framework linking supplier chain strategic capabilities in promoting the delivery of quality healthcare services.

Keywords: Strategic Capabilities, Supply Chain, Quality of Health Care Services

Effect of Electronic Banking on the Financial Performance of Commercial Banks in Kenya

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Abstract
This study investigated the impact of electronic banking on the financial performance of commercial banks in Kenya, focusing on three primary e-banking channels: Automated Teller Machine (ATM) banking, internet banking, and mobile banking. Financial performance was measured using Return on Assets (ROA), while the study was anchored on the Technology Acceptance Model (TAM), which explains how technology adoption influences institutional outcomes. A quantitative research design was employed, utilizing secondary data from 25 commercial banks over a five-year period (2018–2022). Data were sourced from the Central Bank of Kenya and the annual financial statements of the selected banks. E-banking indicators were measured by the number and value of transactions conducted through ATMs, online platforms, and mobile banking systems. The results of the correlation analysis indicated a positive relationship between ATM and internet banking with financial performance. However, mobile banking, though positively correlated, exhibited a negative and statistically significant effect on ROA in the regression model. This finding suggests that while mobile banking increases transaction volumes and accessibility, its profitability may be hindered by high operational costs, system maintenance expenses, and security challenges. The study concludes that electronic banking significantly enhances financial service accessibility and operational efficiency, but its effect on profitability depends on strategic cost management and technological optimization. It recommends that banks strengthen ATM and internet banking infrastructure, streamline mobile banking operations, and that the Central Bank of Kenya develop policies to promote secure, efficient, and sustainable electronic banking practices.

Keywords: Electronic banking, Financial performance, Commercial banks, Technology Acceptance Model, Kenya.

Data Protection Awareness and Compliance in Kenyan TVET Institutions: A Case of The Eldoret National Polytechnic

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Abstract
The growing digitization of educational systems has intensified the collection, processing, and storage of personal data within Kenya's Technical and Vocational Education and Training (TVET) institutions, heightening the urgency for robust data protection measures. As institutions increasingly rely on digital platforms for academic management, communication, and service delivery, safeguarding personal information has become both a legal and ethical imperative. Although the Kenya Data Protection Act (2019) provides a comprehensive framework for securing personal data, awareness and practical implementation within the TVET sector remain inadequate. This study examined data protection awareness and compliance at The Eldoret National Polytechnic (TENP), focusing on institutional practices, staff knowledge of legal obligations, and challenges affecting adherence to data protection requirements. A qualitative case study design was adopted, combining document analysis of the Data Protection Act and institutional policy documents with semi-structured interviews involving administrators, ICT staff, and lecturers. The findings revealed low institutional awareness of statutory responsibilities, fragmented compliance mechanisms, and persistent implementation challenges linked to limited financial resources, inadequate technical expertise, and the absence of formalized institutional frameworks. Despite existing guidelines from the Office of the Data Protection Commissioner (ODPC), compliance remains weak due to insufficient training, poor resource allocation, and minimal oversight. The study concludes that achieving sustainable compliance requires structured capacity-building initiatives, institution-specific data protection policies aligned with national legislation, and enhanced collaboration between TVET institutions and the ODPC. Strengthening these mechanisms will promote accountability, improve institutional governance, and foster a culture of privacy-conscious practice essential for Kenya's digital transformation.

Keywords: Data; Protection; Technical Education; Privacy; Policy

Effects of Employee Participation in Decision Making on Organizational Performance: A Case Study of Huduma Centre Eldoret Branch

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Abstract
Employee participation in decision-making is a vital element influencing organizational performance, productivity, and employee satisfaction. This study examined the effect of employee participation in decision-making on organizational performance, focusing on the Huduma Centre Eldoret Branch. Anchored on McGregor's Theory X and Theory Y, the study employed a descriptive survey research design. The target population comprised 85 employees, and a census approach was used to include all participants. Data were collected using structured self-administered questionnaires, with validity confirmed through expert review and reliability established using Cronbach's Alpha coefficient. Data analysis involved descriptive statistics, including frequencies, means, and standard deviations, as well as inferential analysis using linear regression. The results revealed a statistically significant positive relationship between employee consultation, delegation, joint decision-making, and collective bargaining with organizational performance at a 95% confidence level. These findings indicate that higher levels of employee involvement contribute to enhanced organizational efficiency, motivation, and service delivery. The study concludes that participatory decision-making fosters employee commitment, promotes accountability, and improves overall organizational outcomes in public institutions. It recommends that the government review and strengthen policies promoting employee involvement, standardize decision-making frameworks across ministries, and implement effective strategies to enhance employee engagement. Strengthening participatory structures in public organizations can ultimately lead to improved productivity, innovation, and sustainable performance across the public sector.

Keywords: Employee Participation, Decision-Making, Organizational Performance, Delegation, Public Sector Management

Effect of operational costs on quality service delivery: A survey of commercial bank branches in Kenya

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Abstract
Organizations today place great emphasis on the quality of products and services as a key aspect of effective service delivery. In the banking sector, service delivery is influenced by strategic factors that demand sustainable and well-managed solutions. The increasing competition among commercial banks in Kenya has made the pursuit of quality service delivery a complex and continuous challenge. Inefficient management of operational and strategic factors by banking authorities has contributed to declining profitability and customer satisfaction in several institutions. This study sought to assess the effect of operational costs on the quality-of-service delivery among commercial bank branches in Kenya. The research was anchored on the New Public Management Theory and the Total Quality Management (TQM) Model, both of which emphasize efficiency, accountability, and continuous improvement in service delivery. A descriptive research design was adopted, targeting a census of 104 managers from registered commercial banks in Uasin Gishu County. Primary data were collected and analyzed using both descriptive and inferential statistical techniques. The findings revealed that operational costs significantly influence the quality-of-service delivery in commercial banks. Inferential results confirmed a strong and positive relationship between operational costs and the level of service quality offered to customers. The study concludes that managing operational costs effectively enhances service delivery outcomes. It recommends that the financial sector, particularly commercial banks, formulate adaptive policies that address operational cost dynamics to ensure sustainable, high-quality service delivery and improved institutional performance.

Keywords: Banking; Operational Costs; Strategic Factors; Service Delivery; Quality

Role of Forensic Accounting Services in Fraud Mitigation Among Kenyan Public Institutions: A Case of Parastatals in Kenya

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Abstract

Fraud remains a persistent challenge in Kenya's public institutions, undermining accountability and effective resource utilization. This study examined the role of forensic accounting services in mitigating fraud among Kenyan parastatals. Specifically, it investigated how proactive fraud audits, internal controls, litigation support, and compliance mechanisms contribute to fraud prevention and detection. A purposive sampling design was employed, with data collected from 120 respondents using semi-structured questionnaires. The data were analyzed using SPSS, applying descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential analyses, including correlation and regression tests. Results indicated a strong positive relationship between forensic accounting practices and fraud mitigation (R = 0.867), with forensic accounting explaining 70.4% of the variance in fraud mitigation outcomes. These findings suggest that enhanced forensic accounting practices substantially reduce the prevalence of fraud within parastatals. The study also revealed that most parastatals have adopted proactive fraud audits, robust internal controls, compliance policies, and segregation of duties, all of which positively influence fraud detection and prevention. Dispute resolution mechanisms were found to have a moderate but noteworthy effect on fraud mitigation. The study concludes that forensic accounting is a critical tool for promoting transparency and accountability in public institutions. It recommends institutionalizing forensic accounting functions, strengthening internal control systems, and integrating continuous professional training to enhance fraud prevention capacity. The main limitation was limited participation by senior managers due to tight schedules, though a satisfactory response rate of 84.9% was achieved. Future research should compare the effectiveness of forensic accounting in public versus private sector institutions in Kenya.

Keywords: Forensic accounting, fraud mitigation, parastatals, internal controls, compliance, litigation support, Kenya.

Effect of Mobile Banking on Savings Mobilization by Cooperative Societies: A Case of Boresha Sacco, Eldoret

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Abstract

The growth of mobile banking has significantly transformed financial service delivery across Kenya's cooperative sector, enhancing accessibility and efficiency. However, its direct influence on savings mobilization within cooperative societies remains underexplored. This study aimed to assess the effect of mobile banking on savings mobilization at Boresha Sacco, Eldoret. The specific objectives were to determine the impact of mobile banking on savings mobilization, to evaluate the extent to which mobile banking has increased transaction volumes, and to examine the relationship between mobile banking and savings performance among cooperative members. The study adopted a descriptive research design and relied on data collected through structured questionnaires administered to Sacco members. Descriptive and inferential statistical techniques were employed to analyze the data. Findings revealed that mobile banking has a positive and significant effect on savings mobilization within cooperative societies. Increased mobile banking usage was associated with higher transaction volumes, enhanced accessibility, and improved member engagement, which collectively stimulated higher savings levels. Moreover, electronic banking was found to strengthen savings mobilization by reducing transaction costs, improving financial inclusion, fostering trust and security, and offering tailored financial products. The study further established that capital adequacy positively moderates the relationship between mobile banking and savings mobilization, as well as capitalized cooperatives are better positioned to invest in mobile platforms and outreach programs. The study concludes that mobile banking is a strategic enabler of savings mobilization in Kenya's cooperative sector. It recommends that cooperative societies strengthen mobile banking adoption, enhance member digital literacy, and integrate financial technology innovations to promote sustainable savings growth.

Keywords: Mobile banking, savings mobilization, cooperative societies, electronic banking, financial inclusion, capital adequacy, Boresha Sacco.