

**Multisectoral  
Conference and  
Exhibitions**  
on Research, Science, Technology and Innovation




# PROGRAMME AND BOOK OF ABSTRACTS

**Research, Science, Technology and Innovation Impacts,  
Intellectual Property Protection and Monetization**



NACOSTI PLAZA

**9<sup>TH</sup> - 12<sup>TH</sup>  
JUNE  
2025**

 **Conference Venue**  
Lake Naivasha  
Resort, Naivasha,  
Kenya

## Chief Guests



Hon. Julius Migos Ogamba,  
Cabinet Secretary,  
Ministry of Education



Prof. Shaukat Abdulrazak  
PS, State Department for Science,  
Research and Innovation



Dr. Beatrice Inyangala  
PS, State Department for Higher  
Education and Research

## Convener(s)



Dr. David Ngigi  
Ag. Director General,  
NACOSTI (Convener)



Prof. Dickson Andala  
CEO,  
NRF



Dr. Tonny Omwansa  
CEO,  
KENIA



Prof. J.W. Khamasi  
Ag. Principal,  
Kenya-AIST



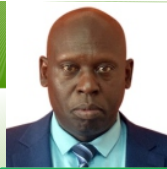
Eng. Margaret Ogai  
CEO, Engineers  
Board of Kenya



Mr. John Paul Okwiri  
CEO,  
Konza Technopolis



Mr. John Onyango  
Managing Director,  
KIPi



Mr. Evans Bosire  
Sigalagala National  
Polytechnic

Dr. Tonny Omwansa  
CEO,  
KENIA



## 2025 NACOSTI AWARDS STIR OLYMPIAD AWARDS FOR TOP NOTCH TEAMS IN HIGH SCHOOLS

Sharpening the Next Generation Global Leaders  
in Science, Technology, Innovation  
and Research (STIR)



## THEME

RESEARCH, SCIENCE, TECHNOLOGY AND INNOVATION  
IMPACTS, INTELLECTUAL PROPERTY PROTECTION  
AND MONETIZATION



Conference Venue  
Lake Naivasha  
Resort, Naivasha,  
Kenya

## Call for Abstracts

### Sub-Themes

- Impacts of Research, Science, Technology and innovation on the Bottom-up Economic Transformation Agenda.
- Whole of government approach, and Mainstreaming of research, science, technology and innovation in programmes MDAs and Private Sector Institutions-
- Intellectual Property, Technology transfer, collaboration and commercialization Systems
- Sustainable Funding Models for Research and Innovation
- Digital Transformation and Emerging Frontier Technologies
- Regulatory and Policy Frameworks for Research, Science, Technology and Innovation
- Entrepreneurship and Startups in Science and Technology
- STEM Education and Talent Development
- Research and Technology Security, Integrity and Ethics for prosperity

### +Registration Fees

- Kenya citizen - Kshs 40,000
- Non-citizen - USD 500
- Students - 25,000

### +Exhibition Fees

- 3 X 3 m –  
Kshs 130,000  
(4 days)

### +To advertise in the Book of Abstracts

- Full page-Kshs  
50,000
- Half page-Kshs  
30,000



National Commission for Science,  
Technology and Innovation



TIME	SESSION	MODERATOR / CHAIR
DAY ONE: 9TH JUNE 2025		
8:00 am – 8:30 am	Registration of delegates	NACOSTI Secretariat
8:30 am – 9:30 am	Starter-ups panel Session	Stephen Situma, Principal Scientist, NACOSTI
	Remarks by Mr. Gideon Kirui, Director Corporate Services, NACOSTI	
	Sigalagala National Polytechnic Innovators	
	KENIA Innovators	Francis - KENIA
9.30 am – 11:00 am	<b>OFFICIAL OPENING</b> <ul style="list-style-type: none"> <li>◦ Welcome Remarks/recognition of dignitaries by Dr. David Ngigi, Ag. Director General, NACOSTI</li> <li>◦ Remarks on behalf of Co-Conveners by Mr. John P. Okwiri CEO, Konza Technopolis Development Authority</li> <li>◦ Remarks by Dr. Beatrice Inyangala, PhD, CBS, PS Higher Education</li> <li>◦ Remarks by Prof. Shaukat Abdulrazak, PhD, EBS, PS Science, Research and Innovation</li> <li>◦ <b>Official Opening by Chief Guest Julius Migos Ogamba, EBS, Cabinet Secretary Education</b></li> </ul>	Prof. Vasey Mwaja – Chief Editor, Kenya National Academy of Sciences
	Photo Session	
11:00 am – 11:30 am	HEALTH BREAK	
11:30 am – 1:00 pm	Distinguished Public Lecture by H.E. Dr. Mathew Ochieng Owili Deputy Governor Kisumu County Mainstreaming Research, Science, Technology and Innovation, in County Governments (DPL 1)	Prof Mabel Imbuga Former VC, JKUAT

TIME	SESSION	MODERATOR / CHAIR
1:00 pm – 2:00 pm	LUNCH BREAK	
2:00 pm – 3:00 pm	<p>Inter-Ministerial High Level Dialogue Research, Technology and Innovation, Impacts Intellectual Property Protection and Monetization: The case of Digital Super-Highway and the fifth revolution</p> <ul style="list-style-type: none"> <li>◦ Prof. Raphael Munavu, <i>Chair Konza Technopolis Development Authority</i></li> <li>◦ Maj. General Benard Waliaula, <i>Director General National Defense Industries</i></li> <li>◦ Dr. Kevit Desai, <i>CEO Centurion Systems Limited</i></li> </ul>	Prof. David Some Former VC Moi University
3:00 pm – 4:00 pm	HALL A	Prof. Vasey Mwaja, Chief Editor, KNAS
	<p>Lead Thematic Discussions - Impact of RSTI on Bottom –Up –Economic Agenda</p> <ul style="list-style-type: none"> <li>◦ Prof. Ratemo Michieka, <i>Chancellor; Tharaka University: Intellectual Property and Job Creation for Youth</i></li> <li>◦ Prof. Fred Baraza, <i>VC Taita Taveta University: Leveraging on natural resources, resource rights to uplift Kenyan Industries</i></li> <li>◦ Dr. Zipporah Bukania, <i>Kenya Medical Research Institute (KEMRI): Revamping Kenya's Health Systems</i></li> </ul>	
	<p>HALL B</p> <p>STEM Mentorship Session</p> <p>Mentors</p> <ul style="list-style-type: none"> <li>• Dr. Purity Ngina, <i>CEO National Gender and Equality Commission (NGEC)</i></li> <li>• Ms. Everline Kimanthi, <i>Chairperson, SCOKA</i></li> </ul>	Ms. Christine Apakoreng, NACOSTI

TIME	SESSION	MODERATOR / CHAIR
4:00 pm – 4:30 pm	Mr. Stephen Situma, Ag. Deputy Director, Physical, Infrastructure, Computing and Engineering, NACOSTI: Peaceful use of Nuclear Science and Technology in Kenya.	Prof. Vasey Mwaja
8:30 am – 5:00 pm	Exhibitions/Display of technologies and innovation to enhance service delivery to citizenry	NACOSTI Secretariat
4:30 pm – 5:00 pm	Health Break, Exhibition Market Place and Departure	
DAY TWO: 10TH JUNE 2025		
8:30 am – 9:00 am	Registration of delegates	NACOSTI Secretariat
9:00 am – 10:00 am	<p>Inter-ministerial High-Level Dialogue  “Research Technology and Innovation: Impacts, Intellectual Property Protection and Monetization: The case of Affordable Housing, and Universal Healthcare”</p> <ul style="list-style-type: none"> <li>◦ Prof. Emmanuel Mutisya, <i>Chair, Kenya - AIST</i></li> <li>◦ Dr. Mercy Mwangangi, <i>CEO SOcial Health Authority (SHA)</i></li> <li>◦ Prof. Tom Migun Ogada, <i>Chair KENIA</i></li> <li>◦ Eng. Margaret Ogai, <i>CEO Engineers Board of Kenya</i></li> </ul>	Prof. Mabel Imbuga Former VC, JKUAT
10:00 – 11:00 am	Distinguished Public Lecture by Professor Raphael Munavu, Chair KOTDA and Chair Presidential Task Force on Education Reconfiguring Higher Education for Transformative Societal Impact through Cutting edge Research, Innovation and Commercialisation (DPL 2)	Prof. Vasey Mwaja KNAS

TIME	SESSION	MODERATOR / CHAIR
11:00 am – 11:30 am	HEALTH BREAK	
11:30 am – 12:15 pm	<p>Lead Thematic Panel Discussion: Digital Transformation and emerging Frontier Technologies</p> <ul style="list-style-type: none"> <li>Mr. John P. Okwiri, <i>CEO Konza Technopolis: Data Governance in the wake of the Fifth Industrial revolution</i></li> <li>Prof. David Some, <i>Former VC, Moi University: Sharing research infrastructures to stimulate advancement of Frontier Technologies</i></li> <li>Prof. Daniel Mugendi, <i>Vice Chancellor University of Embu: Universities at cross-roads-charting the next discourse for Higher Education</i></li> <li>Prof. J.W. Khamasi, <i>Acting Principal Kenya AIST: Digital transformation and Frontier Technologies in Education and specialized skills development</i></li> </ul>	Dr. Kevit Desai
12:15 pm – 1:00 pm	<p>Key Note Presentation: The Role of Scientists in Navigating the Fast Changing Scientific World</p> <ul style="list-style-type: none"> <li>Dr. Nkem Khumbah, <i>Head, Policy Systems, Governance and Partnerships, Africa Academy of Sciences</i></li> </ul>	Ruth Muriithi – Manager Knowledge Economy, KONZA
1:00 pm – 2:00 pm	LUNCH BREAK	
2:00 pm – 3:00 pm	<p>Inter-Ministerial High-Level Dialogue "Research, Science, Technology and Innovation: Impacts, Intellectual Property Protection and Monetization: The Case of Climate-Smart Agricultural Transformation, and MSME Economy" (HLD 3)</p> <ul style="list-style-type: none"> <li>Prof. Ratemo Michieka, <i>Chair, NRF Board and Chancellor, Tharaka University</i></li> </ul>	Prof. Rose Mwonya Former VC, Egerton University

TIME	SESSION	MODERATOR / CHAIR
2:00 pm – 3:00 pm	Contd' <ul style="list-style-type: none"> <li>◦ Dr. Vimal Shah, Industrialist and Chancellor Maasai Mara University</li> <li>◦ Eng. Benson Kariuki, <i>Jomo Kenyatta University of Agriculture and Technology</i></li> <li>◦ <i>Dr. Martin Oduor, Chancellor KCA University</i></li> </ul>	Prof. Rose Mwonya Former VC, Egerton University
3:00 pm – 4:00 pm	Lead Thematic Discussions: Regulatory and Policy Frameworks for RSTI <ul style="list-style-type: none"> <li>◦ Prof. Rosebella Maranga, VC. <i>Multi-Media University – A framework for classifying Kenyan Universities</i></li> <li>◦ Prof. Vasey Mwaja, <i>Chief Editor, Kenya National Academy of Sciences</i></li> <li>◦ Prof. Victoria Ngumi, <i>Vice Chancellor, JKUAT: Novel Strategies for securing IP Rights in institutions of Higher Learning and their monetization</i></li> </ul>	Prof. Ratemo Micheka, NRF Board and Chancellor, Tharaka University
8:30 am – 5:00 pm	HALL B – Scholarly Papers Attached Abstracts Schedule	Dr. Rael Adhiambo, NACOSTI
8:30 am – 5:00 pm	Exhibitions/Display of technologies and innovation to enhance service delivery to the citizenry	NACOSTI Secretariat
4:00 pm	Health Break, Exhibition Market Place, Networking and Departure	
	DAY THREE: 11TH JUNE 2025	
8:30 am – 9:00 am	Registration of delegates	NACOSTI Secretariat

TIME	SESSION	MODERATOR / CHAIR
9:00 am – 10:00 am	<p>Lead Thematic Panel Discussion: STEM Education and Next-Generation RSTI Workforce</p> <ul style="list-style-type: none"> <li>• Prof. Mike Kuria, <i>CEO Commission for University Education: Talent Development in Higher Education and harnessing for transformational leadership of the RSTI Sector</i></li> <li>• Prof. Henry Kiplangat, <i>Vice Chancellor, Kabarak University: Revolutionizing STEM Education in Universities to respond to society's issues</i></li> <li>• Dr. Purity Ngina, <i>CEO NGEC: Leaving no one behind; inclusive STEM Education</i></li> <li>• Mrs. Jacinta Akatsa, <i>CEO CEMASTEA: STEM Boot camps and their impacts on the youth</i></li> <li>• Mr. Evans Bosire, <i>Principal, Sigalagala National Polytechnic: Fostering and Skilling up the next generation workforce for Science, Technology, Engineering, Mathematics and Innovation</i></li> </ul>	Prof. Rose Mwonya, Former VC, Egerton University
10:00 am – 10:45 am	Distinguished Public Lecture by Dr. Martin Oduor-Otieno, Chancellor, KCA University Inspiring Quintuple Helix coalition between the industry, academia, government, civil society and communities for National Prosperity (DPL 3)	Prof. Rose Mwonya, Former VC, Egerton University
10:45 am – 11:15 am	HEALTH BREAK	
11:15 am – 12:15 pm	<p>Lead Thematic Panel Presentations - Sustainable Research Funding Options for Global Competitiveness</p> <ul style="list-style-type: none"> <li>◦ Prof. Dickson Andala, CEO NRF: Aligning research funding and financing to national priorities</li> </ul>	Mr. Stephen Situma, NACOSTI

TIME	SESSION	MODERATOR / CHAIR
11:15 am – 12:15 pm	<p>Contd'</p> <ul style="list-style-type: none"> <li>◦ Dr. Kevit Desai, <i>CEO Centurion Systems: Inspiring Private Sector Involvement in Research Funding and IP Monetization</i></li> <li>◦ Prof. Tatien Masharabu, <i>Principal Officer, Innovation Technology Acquisition and Development, EASTECO.</i></li> <li>◦ Dr. Margaret Karembu: <i>Director, ISAAA-Afri-Centre: Managing Intellectual Property rights in Joint Grant Proposals</i></li> </ul>	Mr. Stephen Situma, NACOSTI
12:15 pm – 1:15 pm	<p>National Research Fund Dissemination Seminar Session</p> <ul style="list-style-type: none"> <li>◦ Prof. Mary Abukutsa, JKUAT: <i>Upscaling African Indigenous Vegetables, Climate Smart Tech for Food and Nutrition Security in Kenya</i></li> <li>◦ Dr. Paul Tanui, <i>Dedan Kimathi University of Technology: Capacity Building for the job creation and growth of leather goods and leather footwear Manufacturing Enterprises in Kenya</i></li> <li>◦ Dr. Faith Mueni, University of Embu: <i>A digital intervention for the prevention and early detection of depression and suicide among the youth in Kenya</i></li> <li>◦ Prof. George Kamucha, UON: <i>Improving Neonatal Care through Affordable Phototherapy and CPAP solutions in Kenya</i></li> </ul>	Mr. Jacob Njagi, National Research Fund
1:15 pm – 2:00 pm	LUNCH BREAK	

TIME	SESSION	MODERATOR / CHAIR
	BREAKOUT SESSIONS	
	HALL A: Lead Thematic Presentations	
2:00 pm – 3:00 pm	<p>Thematic Panel: Research and Technology Security, Integrity and Ethics for prosperity</p> <ul style="list-style-type: none"> <li>◦ Maj. General Benard Waliaulula, <i>Director General, National Defense Industries (KDF): Protecting National Research, Technology and Innovation Assets for Posterity</i></li> <li>◦ Prof. Rose Mwonya, <i>Former VC Egerton University. Emerging Research Security issues in universities and research institutions</i></li> <li>◦ National Intelligence Service, <i>Protective Actions to Counter Extremists and terrorists from using emerging technological advances to destabilize national security and public safety</i></li> <li>◦ Ms. Josephine Ndambuki, <i>Chief Manager Business Development and Innovation, KONZA Technopolis: Securing research/Technology systems for prosperity</i></li> </ul>	<p>Prof Mabel Imbuga Former VC, JKUAT</p>
3:00 pm – 4:00 pm	<p>Private Sector Panel discussion - Enhancing RSTI security and Risk Taking in Investments</p> <ul style="list-style-type: none"> <li>◦ Ms. Joyce Njogu, <i>Kenya Association of Manufacturers</i></li> <li>◦ Dr. Benson Okita, <i>Director Eastern Africa Hub, Wyss Academy for Nature at the University of Bern.</i></li> <li>◦ Dr. Kevit Desai, <i>CEO Centurion Systems Limited</i></li> </ul>	<p>Prof. Vasey Mwaja, Chief Editor, KNAS</p>

TIME	SESSION	MODERATOR / CHAIR
4:00 pm – 5:00 pm	<p>Thematic Panel: Intellectual Property, Technology Transfer, Collaboration and Commercialization Systems</p> <ul style="list-style-type: none"> <li>◦ Prof. Tatien Masharabu, <i>Principal Officer, Innovation, Technology Acquisition and Development, EASTECO</i></li> <li>◦ Ms. Janet Kisio, <i>Deputy Director KIPI: Demystifying IP Acquisition Mechanisms and Protocols</i></li> <li>◦ Mr. Godfrey P. Kalerwa, <i>Deputy Director, Standards and Licensing. NACOSTI. The unexploited commercial potential of IP in Kenya</i></li> <li>◦ Eng. Benson Kariuki, <i>Jomo Kenyatta University of Agriculture and Technology: Reversing the African Paradox of low IP registration despite vast resource</i></li> </ul>	Prof. David Some Former VC, Moi University
	HALL B	
2:00 pm – 5:00 pm	Scholarly Papers Session	Dr. Rael Adhiambo
9.00 am – 5.00 pm	Exhibition/Display of technologies and innovations to enhance service delivery to citizenry	NACOSTI Secretariat
5.00 pm	Tea Break, Networking and Departure	

TIME	SESSION	MODERATOR / CHAIR
	DAY FOUR: 12TH JUNE 2025	
8.30 am – 9.00 am	Registration	NACOSTI Secretariat
9:00 am – 10:00 am	<p>Lead Thematic Presentations: Entrepreneurship and Start-ups in Science and Technology</p> <ul style="list-style-type: none"> <li>Prof. Isaiah I.C. Wakindiki, <i>Vice Chancellor, KCA University: Tenets and Characteristics of modern entrepreneurial universities in Africa</i></li> <li>Dr. Tonny Omwansa, <i>CEO KENIA: Entrepreneurship and Start-ups for job Creation and Product Development</i></li> <li>Mr. John Paul Okwiri, <i>CEO, KoTDA: Establishing Smart Science and Technology parks/Cities to spur Kenya as the Lead Technology and Innovation hub</i></li> <li>Dr. Ing. Calvince Onyango, <i>CEO KIRDI: The role of Incubation centres in promoting commercialization for start-ups</i></li> </ul>	Prof. Mabel Imbuga, former Vice Chancellor, JKUAT
10.00 am – 10.30 am	HEALTH BREAK	
10.30 am – 11.30 am	<b>OLYMPIAD AWARDS</b>	
11.30 am – 1.00 pm	<p><b>CLOSING CEREMONY</b></p> <ul style="list-style-type: none"> <li>Remarks by Mr. Kibiego Kigen, Director, National Counter Terrorism Centre</li> <li>Remarks by Prof. Dickson Andala, CEO, NRF on behalf of Consortium members</li> <li>Conference Resolutions by Dr. David Ngigi Ag. Director General NACOSTI</li> <li><b>Official Closing by Chief Guest - Prof. Shaukat Abdulrazak PhD, EBS PS Science Research and Innovation</b></li> </ul>	Prof. Vasey Mwaja – Chief Editor, Kenya National Academy of Sciences
1:00 pm	Lunch, Networking and Departure of Participants	





REPUBLIC OF KENYA



**National Commission for Science,  
Technology and Innovation**

## **CONTACT US**

**National Commission for Science, Technology  
and Innovation (NACOSTI),**

Upper Kabete, Off Waiyaki Way

P.O. Box 30623 – 00100, Nairobi, Kenya

TEL: 020 400 7000, 0713 788787, 0735 404245

Email: [info@nacosti.go.ke](mailto:info@nacosti.go.ke)

Website: [www.nacosti.go.ke](http://www.nacosti.go.ke)



**Multisectoral  
Conference and  
Exhibitions**  
*on Research, Science, Technology and Innovation*



# BOOK OF ABSTRACTS

Lake Naivasha Resort, 9<sup>TH</sup> – 12<sup>TH</sup> June 2025



## **The Multisectoral Conference and Exhibition on Research, Science, Technology and Innovation (MS-CEORSTI)-2025**

Theme: Research, Technology and Innovation: Impacts, Intellectual property Protection and Monetization

The Multisectoral Conference and Exhibition on Research, Science, Technology and Innovation (MS-CEORSTI) is a yearly conference which aims to facilitate a multifaceted forum of national and international discourse to deliberate, network, partner, share experiences and resolve on how best to infuse or deploy Science, Technology and Innovation for prosperity of humanity as well as for public good, safety and security. The Conference accentuate on a technology-driven and innovation-led inclusive sustainable development agenda.

### **MS-CEORSTI-2025 Planning Committee**

1. Dr. David Ngigi
2. Mr. Gideon Kirui
3. Ms. Harriet Kinya
4. Ms. Christine Apokoreng
5. Dr. Mary Onsarigo
6. Ms. Carolyne Nekesa
7. Mr. Dennis Yegon
8. Ms. Eunita Ogindo
9. Ms. Yasmin Hussein

### **Abstract Review Committee**

1. Dr. Mary Onsarigo
2. Dr. Benson Mburu
3. Dr. Rael Adhiambo
4. Ms. Margaret Muthee
5. Ms. Teresia Nyawira
6. Ms. Charity Musembi
7. Ms. Olive Munavu
8. Ms. Brenda Wangui





**PAPER PRESENTATION SCHEDULE**  
**TUESDAY, 10<sup>TH</sup> JUNE 2025**

TIME	THEME	PRESENTER	TITLE	SESSION MODERATOR	RAPPORTEUR
<b>7:30-8:30</b>	<b>Registration</b>				
8:30 - 9:30 am	Impacts of Research, Science, Technology and innovation on the Bottom-up Economic Transformation Agenda	Oganda Bartholomew Mogoi	Exploring the Impact of Adoption of E-Learning at Kisii University, Kenya	Mr. Godfrey Kalerwa	Mr. Steve Indimuli and Ms. Olive Munavu
		Dr. Denis Ouma	Research, Technology, Innovation and BETA: Normative to Positive Statements in Kenya		
		Prof. Rewe Thomas	From NRF Seed to Impact Stream – Catalyzing Continental Bioeconomy through Strategic Research Investment		
		Argwings Omondi	The Role of the Government and TVETs in Enhancing Blue Economy, and Kenya's Economic Growth through Fostered Research and Sustainable Agricultural Development		
9:30 – 10:30 am	Intellectual Property, Technology transfer, collaboration and commercialization Systems	Nelly Chesang	Bridging The Gap: Strengthening Intellectual Property Frameworks in Kenya's Water		
		Dr. Berut Zipporah and Dr. Mulati Tom	Assessing Intellectual Property Awareness and Implementation Among TVET Trainees and Trainers: Case Study of TVET Institutions in Kenya		
		Christine Omina Mutayi	Mechanical Properties Structural suitability of Guava Timber: Comparative Analysis with Eucalyptus and Cypress		
		Cecilia Wanjala, Abook Brian, Joab	Assessing Kenya's Readiness for Vaccine and Biotherapeutics Manufacturing by Biovax:		

		Odhiambo, and Serah Muteru	Challenges, Strategies, and Stakeholder Insights		
10:30 - 11:00 am	Health Break				
11: 00 -12:00 noon	Digital Transformation and Emerging Frontier Technologies	Lilian W. Muthoni	The Application of AI in Improving the Quality of Education in Higher Learning Institutions in Kenya: A Systematic Review	Dr. Benson Mburu	Ms. Joan Chepleting and Ms. Brenda Wangui
		Jack Abibo Adem	Android Nurse		
		Eng. Erastus Waweru and Francis Kiura	Application of Drone-Based LiDAR Technology for Topographical Surveys		
		Salome Wabuye	Kenya Road Network Knowledge Hub: Transforming Spatial Data Infrastructure into A Digital Public Good for Intelligent Planning		
12.00 noon – 1.00 pm	Regulatory and Policy Frameworks for Research, Science, Technology and Innovation	Susan Musembi, Prof. Richard Oduor, Prof. Judith Kimiywe	Strengthening Research Ethics and Security Towards Managing Intellectual Property and Technology Transfer in Universities in Kenya		
		Dr. Rael Adhiambo, Dr. Blessing Charuka, Dr. Donatus Angnuureng	Adaptation at the Margins: Reframing Policy Priorities for Africa’s Coastal Communities through Scientific Evidence		
		Dr. John Ayisi	An analysis of Innovation policy framework for Kenya’s transformative change		
		Prof. Kelvin K. Omieno	Technology Innovation Hubs: Interlink between Universities and County Governments		
1:00 – 2:00 pm	Lunch Break				
2:00 – 3:00 pm	STEM Education and Talent Development/ Whole of Government Approach, and Mainstreaming of Research,	Apollo M. Maingi	Effect of Curriculum on Mechanical Engineering Technician Training on the Effectiveness of OBE Implementation and Monetization in Public TVET Institutions, Mount Kenya Region	Dr. Rael Adhiambo	Mr. Evans Njuguna and Mr. Robert Mobisa

	Science, Technology and Innovation in Programmes MDAs And Private Sector Institutions	Dr. Victor O. Shikuku	ChemEzzy: A digital chemistry education platform for enhancing the teaching and learning of chemistry		
		Dr. Beatrice K.C Obwoye	Literacy, Technology and Innovation for Monetization of the Kenyan Youth		
		Antony Musabi	Attitude Change & Perception of Care Givers at Maternal Health Child Clinic of Jaramogi Oginga Odinga Teaching and Referral Hospital		
3:00 – 4:30 pm	Impacts of Research, Science, Technology and innovation on the Bottom-up Economic Transformation Agenda	Alexander Muvea	Plant regulatory research: A critical tool to support phytosanitary decision-making on enhanced food security		
		Kathleen Asena	Creative Thinking and Intellectual Property Protection in the Age of Artificial Intelligence in Kenya		
		Tabitha Kibuthu	Menace to Magic: Transforming Plastic Waste into Sustainable Solutions		
		Charles Waweru, Peris Wambui and Julius Ogato	Advancing Research and Innovation Capacity: The Strategic Growth of Mathari National Teaching and Referral Hospital		
		Fred Sifuna Wanyonyi, Francis Orat, Gershom Kyalo Mutua, Adedapo Adeyinka, Mbah Bake Maraf and Anthony Pembere	Removal of Selected pesticides from Wastewater on zeolite; Molecular Simulation and Experimental Study		
		Jones Fairfax Agwata	Opportunities and Challenges for Universities in Promoting Research, Science, Technology and Innovation in the Realization of Kenya’s Bottom-Up Economic Transformation Agenda		
4:30 – 5:30 pm	Health Break/ Poster Presentation Session/ Networking				
END OF DAY PRESENTATIONS					

**WEDNESDAY, 11<sup>TH</sup> JUNE 2025**

TIME	THEME	PRESENTER	TITLE	SESSION MODERATOR	RAPPORTEUR
2:00 – 3:00 pm	Impacts of Research, Science, Technology and innovation on the Bottom-up Economic Transformation Agenda	Khanani Sarah Risper, Odipo Felix, Mwangi Kennedy, Ouma George, and Agar Joshua	Improved Access to Potable Water Using Clean Energy for Rural Communities within Lake Victoria Basin	Ms. Margaret Muthee	Ms. Brenda Wangui and Ms. Olive Munavu
		Lyna Muthomi	Role of Agricultural Biotechnology in Climate Change Mitigation		
		Harrison Wairegi	Enhancing Agricultural Productivity in Kenya through Digital Solutions: A Study on the Integration of Science Technology and Innovation under the Bottom-Up Economic Transformation Agenda		
		Alex Muthengi	Phytochemical Screening and Repellence Potencies of Bioactive Molecules of Plant Extracts Derived from Ocimum suave, Ocimum americanum and Eucalyptus citriodora against Anopheles gambiae		
3:00 – 4:00 pm	Crosscutting	Jiveri Bonface and Dr. Remmy Shiundu	Delivering bio-alkanol gel fuel as a renewable energy source to rural households in the lake basin region (Patent Number, KE/P/2019/3341)		
		Elly Ochere	Role of Intellectual Property in Fostering Innovation in Kenya's Water Sector		
		Stephen Musilngómbé, Wafula and Dr Berut Zipporah	Enhancing Innovation Capacity through Managing Plagiarism and Academic Dishonesty in TVET Institutions in Kenya.		
		Dr. Richard Dimba Kiaka, Joy Oakes and Jennifer Wanyingi	“Hanging by a thread”: an analysis of vulnerabilities facing Maasai group conservancies in Amboseli Ecosystem, Kenya		
4.00 – 5.00 pm		Winrose K. Burale	Bridging The Ethical Gap in Research and Innovation in Technical and Vocational Education and Training in		

			Kenya for Public Good, Safety and Security		
		Anthony B. Mathenge	Molecular Modelling of Toxic Indole Derivatives from High-Temperature Cooking		
		Tracy Musimbi Amdara	Formulation of Finger Millet and Termite Powder Composite Thin Porridge Flour		
		David Ochieng Oduor	An Artificial Intelligence- Based System for Automated Detection of Plant Diseases using Thermal Imaging and Image Processing as a Tool for Enhancing Food Security		
<b>5:00 – 5: 30 pm</b>	<b>Health Break</b>				
<b>END OF DAY 2 PRESENTATIONS</b>					

### POSTER PRESENTATION SUMMARY

Theme	Presenter Name	Title	Institution
Impacts of Research, Science, Technology and Innovation on the Bottom-Up Economic Transformation Agenda	Clement Wanjage	Digital Transformation and Emerging Frontier Technologies: A Case Study of the Teachers Service Commission (TSC), Kenya	Teachers Service Commission
	Kiambi, M.M.	Evaluation of Production and Performance of Different Varieties of Potatoes under Conventional Farming Methods at ADC Sirikwa, Kuresoi North	Agricultural Development Corporation, Molo, Kenya
	Kiambi, M.M.	In Vitro Evaluation of Salinity Tolerance in Kenyan Potato ( <i>Solanum tuberosum</i> ) Varieties under NaCl Stress	Agricultural Development Corporation, Molo, Kenya
	Kiambi, M.M.	Production and Performance of Different Grades of Shangi Potato Variety under Uniform Environmental and Management Conditions at ADC Sirikwa Farm, Kuresoi North	Agricultural Development Corporation, Molo, Kenya
	Joan Jerop	Impact of Research, Science, Technology, and Innovation on the Bottom-Up Economic Transformation Agenda in Nyeri Region	Mathenge Technical Training Institute
Intellectual Property, Technology Transfer, Collaboration and Commercialization Systems	Jiveri Bonface	Screening of <i>Carica papaya</i> Seed and Flower Oil for Phytochemical Constituents, Antioxidants, Antibacterial and Anthelmintic Activities	Kaimosi Friends University
Digital Transformation and Emerging Frontier Technologies	Ishmael Papa and Anthony Luvanda	Evaluating Challenges in Utilizing Intelligence, Surveillance, and Reconnaissance Systems for Effective Force Protection in Military Operations	National Defense University
	Cyrus King'ori Maina	Impact Of Artificial Intelligence on Technical and Vocational Education and Training	Mukiria Technical Training Institute, Kenya
Regulatory and Policy Frameworks for Research, Science, Technology and Innovation	Dr. Richard Kiaka	From Conflict to Coexistence? Evaluating the Promise and Pitfalls of the Mbirikani Predator Consolation Fund in Kenya	Academy for Nature at the University of Bern
	Dr. Dickens Odeny	Leveraging Indicator Species and Citizen Science for Cost-Effective Biodiversity Monitoring of Restoration in Naibunga-Mukogodo Landscape in Laikipia	Wyss Academy for Nature at the University of Bern
Entrepreneurship and Startups in Science and Technology	Peter M. Musyoka1 Email:	Perceived Bias and Learner Attitudes in the Implementation of Outcome Based Education Assessments in Kenyan TVET National Polytechnics	Mathenge Technical Institute

## **ABSTRACTS**

# **THE MULTISECTORAL CONFERENCE AND EXHIBITION ON RESEARCH, SCIENCE, TECHNOLOGY AND INNOVATION (MS- CEORSTI)**

**LAKE NAIVASHA RESORT, NAIVASHA**

**9-12<sup>TH</sup> JUNE 2025**

# **IMPACTS OF RESEARCH, SCIENCE, TECHNOLOGY AND INNOVATION ON THE BOTTOM-UP ECONOMIC TRANSFORMATION AGENDA**



## Exploring the Impact of Adoption of E-Learning at Kisii University, Kenya

Oganda Bartholomew Mogoi<sup>1</sup>

<sup>1</sup>Kisii University

Email: bartmogoi@kisiiversity.ac.ke

E-learning refers to the leveraging of digital platforms, tools, and technologies in the educational process. The adoption of e-learning involves using computer technologies, internet connectivity, and various digital platforms to enhance educational delivery and learning outcomes. While e-learning is embraced globally as a means of improving educational accessibility and flexibility, its adoption in sub-Saharan Africa, particularly in Kenya, faces unique challenges. These include inadequate technological infrastructure, limited internet connectivity, varying levels of digital literacy, the need for pedagogical shifts and institutional support. Despite these challenges, e-learning presents a significant potential in providing flexible learning opportunities, improving academic performance, enhancing learner retention, and increasing educational access. This research endeavoured to explore the impact of adoption of e-learning at Kisii University, Kenya, focusing on how the integration of digital learning platforms affects students' academic performance, faculty engagement and institutional growth. Beyond educational impacts, the study also addressed two increasingly critical dimensions of e-learning, intellectual property rights and monetization. As digital learning materials become central in e-Learning, questions around ownership, the protection of intellectual property and monetization of these content have become more pronounced. A descriptive research design was employed, with data collected through questionnaires administered to students, faculty members, and administrative staff. The study used purposive and stratified random sampling techniques to select participants. The study findings were used to draw recommendations and conclusions and offered a comprehensive view of how e-learning adoption at Kisii University influences educational access, academic performance, learner retention, flexibility, and institutional development, while also highlighting the importance of formalized intellectual property frameworks and monetization strategies. The insights gained from this research also provided valuable guidance and recommendations on enhancing the effectiveness of e-learning initiatives and bridging the digital divide in Kenyan higher education, while also protecting content creators' rights and fostering viable economic models for long-term success.

**Keywords:** e-learning, adoption, academic performance, learner retention, Intellectual Property, Monetization, faculty engagement, technology, infrastructure.

## Research, Technology, Innovation and BETA: Normative to Positive Statements in Kenya

Denis Ouma<sup>1</sup>

<sup>1</sup>School of Business and Economics, Kaimosi Friends University

Email: [ouma\\_denis@yahoo.com](mailto:ouma_denis@yahoo.com)

Presentation Type  
Oral

The support of research, technology and innovation to a country's economic agenda and vice versa is not well defined in most developing economies. However, some empirical findings suggest that with commercially viable avenues and practical economic models, sector-led economic and social development could be stimulated. This study identifies the impact of Research, Technology, Innovation under the bottom-up economic transformation agenda (BETA) model. The five pillar industries: agriculture, industry, housing, healthcare and MSME are used as variables of results. Using the distributed and open value creation theory, 97 main actors within service within the period (2017-2025) responded to a survey questionnaire. They represented a response rate of 81% out of the targeted 120 actors from the five pillar industries selected purposively. The results show that although resources distributed through BETA model were stimulants to Research, Technology and Innovation (RTI), the three stimulants accelerated the attainment of BETA objectives in return. The study shows that resource and policy support to the stimulants of BETA agenda were weak. It recommends that significant support to energy, communication technology, R/D, high tech imports and research institution linkages could promote the attainment and long run sustenance of the objectives of BETA.

**Keywords:** Research: Technology: Innovation: bottom-up economic transformation agenda: distributed and open value creation

## **From NRF Seed to Impact Stream – Catalyzing Continental Bioeconomy through Strategic Research Investment**

Rewe Thomas

Email: [t.rewe@pu.ac.ke](mailto:t.rewe@pu.ac.ke)

In 2017, Kenya's National Research Fund (NRF) awarded a seed grant of KSh 9.5 million to a multidisciplinary project integrating coffee, dairy, and biogas systems in Kiambu and Kilifi counties. This pilot initiative, led by Pwani University in collaboration with Hivos Kenya and KALRO, demonstrated the viability of circular bioeconomy models in improving rural livelihoods, environmental sustainability, and energy access. The project's success catalyzed a cascade of international funding and partnerships, including: the DANIDA-funded Agroval project (DKK 11.9M) in Kenya, Tanzania, Ethiopia, and Denmark; the SNV-supported REALMS regenerative agriculture initiative in Kenya and Rwanda; the EU Erasmus+- backed AQUADEVBUS project in aquaculture education across Kenya, Finland, and Norway; and the UNEP-CCAC WASTE to WEALTH program (\$1M) targeting methane reduction in Kenya and Uganda. Additional technical engagement included FAO consultancy in Liberia and a transcontinental DFG German-Africa bioeconomy research network. These projects collectively advanced climate-smart agriculture, waste valorization, food system resilience, and human capital development. This trajectory culminates in the formation of the Africa Bioeconomy University (ABU)—a pan-African initiative developed with support from the Bioeconomy Coalition of Africa, the European Bioeconomy University, and the World Bioeconomy Association, in response to the strategic priorities of the International Advisory Council for Global Bioeconomy (IACGB). This case study illustrates how targeted national research investment can scale into global partnerships and policy influence, creating sustainable, locally grounded, and internationally connected bioeconomy ecosystems.

**Keywords:** bioeconomy, circular economy, international cooperation, higher education, sustainable agriculture, Africa, public investment, climate resilience

## **The Role of the Government and TVETs in Enhancing Blue Economy, and Kenya's Economic Growth through Fostered Research and Sustainable Agricultural Development**

Argwings Omondi<sup>1</sup>

<sup>1</sup>Department of Agriculture and Environmental Studies, Sigalagala National Polytechnic, P.O Box 2966, Kakamega

Email: owinoargwings@gmail.com

Presentation Type  
Oral

Blue economy has diverse components, including established traditional ocean industries such as fisheries, tourism, and maritime transport, but also new and emerging activities, such as offshore renewable energy, aquaculture, seabed extractive activities, marine biotechnology and bioprospecting. The aim of this paper was to undertake a comprehensive analysis of the role of the government and TVETs in enhancing blue economy, and Kenya's economic growth through fostered research and sustainable agriculture development. This paper used published, unpublished and analyzed data as the key methodological design. The blue economy concept seeks to promote economic growth, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of the aquatic spaces by supporting various SDGs. It drives Kenya's economic growth, and development, with an estimate of 13,000 metric tons (Ksh. 30 billion) of freshwater fisheries production and 18,000-23,000 metric tons (Ksh. 5 billion) of aquaculture production annually. But we have some challenges to the perspective of blue economy such as frequent floods, marine pollution including ocean acidification and blue carbon, lack of trained personnel, harmonizing sectoral policies, plans and laws, poor ocean governance and political support. Thus, in order to harness blue economy in Kenya, the government and TVETs have played a key role in fostering research and sustainable agriculture development. This has been achieved through ecosystem restoration/carbon trading, training of personnel, aquaculture production, green jobs, blue jobs, and government partnerships. Also, through Kenya Marine and Fisheries Research Institute, the government has invested in aquaculture production, infrastructural development, stock assessment, training of deep-sea personnel, focus on the big four agenda, funding, and legal framework improvement.

**Keywords:** TVETs, Blue Economy, Sustainable Agriculture Development, Economic Growth

## **Plant regulatory research: A critical tool to support phytosanitary decision-making on enhanced food security**

Alexander Muvea<sup>1</sup>

<sup>1</sup>Kenya Plant Health Inspectorate Service (KEPHIS)

Email: amuvea@kephis.org

Kenya Plant Health Inspectorate Service (KEPHIS), is a regulatory body focused on assuring the quality of agricultural inputs and produce, preventing adverse impacts on the plants, environment, and human health through science-based regulatory services. As a result of increased global trade, transport and climate change, the likelihood of pest introductions has increased. Despite these challenges KEPHIS envisions a robust, practical management system to produce healthy plants and aims to strengthen national plant health systems and ensure food and nutrition security and improved safe trade through research. KEPHIS undertakes regulatory research in various fields including Plant health, national performance trials, establishment and recognition of pest free areas and areas of low pest prevalence, pesticides residue analysis, soil and inputs analysis. Growers and exporters often deploy various measures and technologies to manage pests of national and international importance. As the NPPO, we are obliged to provide proof of processes and efficacy of systems before our export produce is allowed in other territories. This research primarily permits the institution to prepare studies to justify the inclusion, exemption from or reduction of regulatory control of products and services, which might have this prerogative. A case in example is post-harvest treatment measures for various commodities which demands research to show proof of effectiveness. The country uses large number of technological products that are in common use but whose possible effects on plant health are still not completely understood. With new products regularly entering the market, new certifications will be required, and the need for these raises a number of questions. What are these new products likely to be, and will they have an effect on pest management? It is therefore essential that research is performed in a regulatory environment to assist the institution to clarify its stated function in an optimal and proactive manner.

**Keywords:** Pests, regulatory research, treatments, Inputs

## **Creative Thinking and Intellectual Property Protection in the Age of Artificial Intelligence in Kenya**

Kathleen Asena<sup>1</sup>

<sup>1</sup>National Oil Corporation of Kenya

Email: kasena@nockenya.co.ke

Presentation Type  
Oral

Artificial Intelligence (AI) is transforming research and development by fostering creative thinking through tools like generative AI, which supports brainstorming, problem-solving, and interdisciplinary collaboration. For research institutions, leveraging this potential is essential, as AI-driven platforms can advance both research methodologies and educational practices. This paper explores how AI platforms can enhance research methodologies and educational approaches in Kenyan universities and research institutions, enabling researchers and students to develop innovative solutions aligned with national priorities. Yet, the rise of AI-generated content raises complex intellectual property (IP) questions, such as ownership of created works and the protection of research innovations. By examining global best practices and Kenya's IP framework, this paper proposes strategies for integrating AI into research and development curricula while ensuring robust IP protection to safeguard innovations from universities, research institutions, and individual researchers, ultimately contributing to Kenya's economy.

**Keywords:** Artificial Intelligence, Research and Development, Intellectual Property, Creative Thinking, Kenya, Innovation, Generative AI

## Menace to Magic: Transforming Plastic Waste into Sustainable Solutions

Tabitha Kibuthu<sup>1</sup>

<sup>1</sup>Nyeri National polytechnic

Email: [tabwamboi@gmail.com](mailto:tabwamboi@gmail.com)

Presentation Type  
Oral

Heavy plastic waste pollution presents a significant environmental challenge in urban areas, contributing to clogged drainage systems, habitat destruction, and climate change. This project aims to repurpose discarded plastics into functional and aesthetically appealing products, such as vertical gardens, decorative flower vases, and door ornaments, offering innovative solutions to reduce waste accumulation. Additionally, the initiative introduces biodegradable seedling pods made from citrus fruit peels and mud mixtures, addressing key agricultural challenges such as land limitations and excessive chemical usage. By integrating waste transformation with sustainable agriculture, the project seeks to promote environmental conservation, food security, and ecofriendly entrepreneurship among students and young innovators. The methodology involves systematic collection of discarded plastic materials and organic components, followed by product design, refinement, and testing to ensure usability and durability. The recycled plastic-based products contribute to urban beautification and resource optimization, while the biodegradable seedling pods offer farmers a sustainable alternative to conventional trays. Marketability and awareness efforts include showcasing these solutions in innovation competitions and engaging local communities. This initiative not only mitigates plastic pollution but also empowers youth with practical skills to drive sustainability-oriented entrepreneurship. By fostering innovation, reducing environmental harm, and supporting agricultural resilience, the project aligns with global sustainability goals and advocates for a circular economy model that transforms waste into value.

**Keywords:** Plastic waste recycling, biodegradable seedling pods, sustainable agriculture, entrepreneurship, environmental conservation,

## **Advancing Research and Innovation Capacity: The Strategic Growth of Mathari National Teaching and Referral Hospital**

Charles Waweru<sup>1</sup>, Peris Wambui<sup>1</sup>, Julius Ogato<sup>1</sup>

<sup>1</sup>Mathari National Teaching and Referral Hospital

Email: cmukabi@aol.com

Mathari National Teaching and Referral Hospital (MNTRH), Kenya's foremost mental health facility, has embarked on a strategic transformation anchored in Science, Technology, and Innovation (STI). From its beginnings in 1904 as a smallpox isolation centre to becoming a State Corporation in 2020, MNTRH is institutionalizing research and innovation to enhance mental healthcare. This abstract outline the hospital STI strategic growth, focusing on fostering a research and innovation culture; strengthening STI capacity among staff; promoting ethical research practices; and leveraging technology for better mental health service access. A mixed-methods institutional review (2022–2024) assessed internal documents, interviewed key stakeholders, and analyzed institutional metrics—research protocols, publications, grants, training sessions, and intellectual property filings. MNTRH established a multi-disciplinary STI Committee and integrated research roles into HR structures. The hospital reviews over 10 research protocols monthly and is ODPC-accredited under the Data Protection Act (2019). Skill gaps in proposal writing and data analysis led to targeted training. Staff were mentored and involved in four grant applications through international collaborations. A NACOSTI-accredited Institutional Scientific and Ethical Review Committee (ISERC) was formed to ensure research compliance and feedback mechanisms. MNTRH also launched telepsychiatry services, addressing major access barriers among youth, and implemented a hospital management system that supports real-time clinical and administrative decision-making. MNTRH has seen increased research productivity, stronger academic ties, improved patient access, and real-time data use in management. Its SAGA status enhances reform implementation and resource mobilization. Challenges include limited funding, high workloads, and a need to build grant networks. MNTRH's STI-driven reforms exemplify how targeted innovation investments can transform healthcare delivery and institutional resilience in mental health systems.

## Removal of Selected pesticides from Wastewater on zeolite; Molecular Simulation and Experimental Study

Fred Sifuna Wanyonyi<sup>1</sup>, Francis Orat<sup>2</sup>, Gershom Kyalo Mutua<sup>2</sup>, Adedapo S. Adeyinka<sup>4</sup>, Mbah Bake Maraf<sup>5</sup>, Anthony M.S Pembere<sup>3</sup>

<sup>1</sup>Department of Pure and Applied Chemistry, Bungoma National Polytechnic, P.O Box 185 Bungoma, 50200, Kenya

<sup>2</sup>Department of Pure and Applied Chemistry, Masinde Muliro University of Science and Technology, P.O Box 190 Kakamega 50100, Kenya

<sup>3</sup>Department of Physical Sciences, Jaramogi Oginga Odinga University of Science and Technology, P.O Box 210 Bondo 40601, Kenya

<sup>4</sup>Research Centre for Synthesis and Catalysis, Department of Chemical Sciences, University of Johannesburg, P.O Box 524 Auckland Park, Johannesburg 2006

<sup>5</sup>Computational Chemistry Laboratory, Department of Chemistry, Higher Teacher Training College, University of Yaoundé I, P. O. Box 47 Yaoundé, Cameroon

Email: sifunafredie@yahoo.com

The prevalence of emerging micropollutants in the environment, which include pesticides, is of great concern because they are persistent and toxic to humans. The adsorption of hazardous pesticides on 45 zeolites was examined in this study utilizing molecular simulations for pesticide sorption was investigated using Grand canonical Monte Carlo (GCMC) simulation. Batch mode was used to study the adsorption of aqueous solution imidacloprid and chlorpyrifos onto the heulandite surface. Diuron had the highest stability, with an energy gap of 5.30 eV, followed by imidacloprid (4.83 eV) and chlorpyrifos (4.19 eV). The adsorption process was discovered to follow the pseudo-first-order kinetic model, while the intraparticle diffusion model revealed that the adsorption process was multi-mechanistic and that pore diffusion was not the only rate-controlling phase. Experiments revealed that imidacloprid and chlorpyrifos adsorption capacity are 0.0201 and 0.0194 mg/g onto natural heulandite zeolite which gave the percentage removal of 50.25 and 48.43%. The calculated thermodynamic parameters of imidacloprid and chlorpyrifos on natural zeolite showed that Gibbs free energy ( $\Delta G$ ) was less than zero. While Enthalpy ( $\Delta H$ ) was negative and  $\Delta S$  was positive hence the adsorption reaction suggest that the adsorption process was spontaneous and exothermic. Based on the two isotherm models (Langmuir and Freundlich) with constant values ( $K_L = 0.677$  and  $0.625$ ,  $n = 0.6199$  and  $0.4476$ ) and the correlation coefficients for ( $R^2 = 0.9496$ ,  $R^2 = 0.9616$ ), we concluded that the for imidacloprid and chlorpyrifos adsorption onto the heulandite zeolite could be followed by the Freundlich isotherm model rather than the Langmuir isotherm model. The Langmuir, Freundlich, adsorption isotherm models were used to describe the adsorption process. Thermodynamic parameters were also determined using experimental data. The thermodynamic study indicates that during pesticide adsorption is, chemisorption and physisorption are present at the same.

**Keywords:** adsorption, pesticides, zeolites and molecular simulation

## **Opportunities and Challenges for Universities in Promoting Research, Science, Technology and Innovation in the Realization of Kenya's Bottom-Up Economic Transformation Agenda**

Jones Fairfax Agwata<sup>1</sup>

<sup>1</sup>Directorate of Research, Innovation and Technology Transfer, Machakos University, PO Box 136-90100, Machakos

Email: [agwatas@maksu.ac.ke](mailto:agwatas@maksu.ac.ke)

Kenya's Bottom-Up Economic Transformation Agenda (BeTA) is the government's blueprint and framework which emphasizes and prioritizes research, science, technology, and innovation (RSTI) as key enabling drivers for socio-economic growth and development in the country. The aim of BeTA is to anchor and leverage RSTI so as to achieve enhanced and expanded socio-economic development and growth with the objective of benefiting the poor and vulnerable through increased food production, job creation and poverty reduction. For this to be realized, RSTI should be at the very center and core of various universities and other institutions of higher learning where creation of new products, cutting-edge innovations and inventions, and improved processes occur. This is because the institutions are established to provide a conducive environment and opportunities to spearhead cutting edge RSTI besides teaching and instruction, and community service. However, the institutions face critical challenges which hinder and prevent progressive RSTI activities and processes in the institutions. In this paper, some of the opportunities available in the universities to drive and spearhead RSTI activities to achieve the country's BeTA are discussed and the associated challenges faced elucidated. Possible interventions to the challenges are recommended at the end of the paper.

## Improved Access to Potable Water Using Clean Energy for Rural Communities within Lake Victoria Basin

Khanani sarah Risper<sup>1</sup>, Odipo Felix<sup>1</sup>, Mwangi Kennedy<sup>1</sup>, Ouma George<sup>1</sup>, and Agar Joshua<sup>1</sup>

<sup>1</sup> Science, Technology and Innovation Committee, Lake Basin Development Authority, P.o  
Box 1516-40100 Kisumu

Email: [info@lbda.go.ke](mailto:info@lbda.go.ke), [Khanani.risper@lbda.go.ke](mailto:Khanani.risper@lbda.go.ke)

Presentation Type  
Oral

Access to sustainable, safe, and reliable potable water remains a persistent challenge in the rural regions of the Lake Victoria Basin. This challenge disproportionately affects women and girls, who bear the burden of water collection, limiting their opportunities for education and economic participation. To address this, Lake Basin Development Authority has in its area of jurisdiction, implemented 34 community-based solar powered water projects that integrate Science, Technology, and Innovation (STI) with a focus on use of clean energy. These interventions have significantly improved water availability to over 100,000 beneficiaries. The time spent on water collection by women has reduced by 60%, allowing them to focus more on unlocking their potentials on education and other economic activities. The adoption of clean energy to pump water into elevated tanks, enhances resilience in off-grid areas, while reducing operational costs and greenhouse gas emissions. The critical aspect of sustainability of the infrastructure, is enhanced through capacity-building of local community management committees in maintaining the water systems. When combined with clean energy and STI-driven design, these initiatives not only improve water security, but also advance climate resilience and gender equity. This, therefore, underscores the urgent need for integrated, community-led approaches that leverage STI to drive sustainable development in underserved rural areas.

**Key words:** Potable water, clean energy, Community-led approaches

## Role Of Agricultural Biotechnology in Climate Change Mitigation

Lyna Muthomi<sup>1</sup>

<sup>1</sup>Applied Science Department, Kabete National Polytechnic

Email: lynnmmthomiedu@gmail.com

Presentation Type  
Oral

Climate change is a one of the major challenges that is already affecting people and the environment worldwide. Average global temperatures of earth have been rising day by day over the last century. The problem is not just changing temperatures; it is a changing climate—or a change in the weather patterns that people and ecosystems have become accustomed to over time. Emissions of carbon (IV) oxide and other greenhouse gases from human activities, primarily burning of fossil fuels such as coal and oil are the major culprits for climate change. Climate change is therefore the most serious issue on earth which needs to be focused for a better and sustainable development. Biotechnology in this context could contribute to the adaptation and mitigation of climate change impacts. Greenhouse gas emission can be reduced using modern biotechnology which ultimately leads to increase food security. The present paper discusses about the conventional and modern biotechnological approaches to address climate change adaptation and mitigation for improved crop productivity and food security. Therefore, Biotechnology can positively contribute towards climate change mitigation through reduction of greenhouse gases, carbon sequestration, use of biofuels, reduced use of fertilizer, and adaptation for biotic and abiotic stresses. This can ultimately play an important role in improving agricultural productivity and food security and at the same time protecting our environment from adverse effects of climate change.

**Keywords:** Climate change, mitigation, carbon sequestration, agricultural biotechnology

## **Enhancing Agricultural Productivity in Kenya through Digital Solutions: A Study on the Integration of Science Technology and Innovation under the Bottom-Up Economic Transformation Agenda**

Harrison Wairegi<sup>1</sup>

<sup>1</sup>Kabete National Polytechnic

Email: Muthuiharryson302@gmail.com

Presentation Type  
Oral

Practically, globally almost 828 million people live in undernourishment and hunger, and food insecurity is compounded by climate shocks, pandemics, and geopolitical disruptions. 80 percent of food is produced by smallholder farmers across Africa, but they are the most insecure of all, because smallholder farmers are typically the most food insecure for one simple reason: any given smallholder farmer is remarkably far away from food production, and his variety of food production inputs — land, labour, and technology — are poor, suboptimal, and underleveraged. Currently, the opportunity to transform food systems is finally here in sub-Saharan Africa, and clearance of digital infrastructure is a major contributor to that, if it achieves success. In Kenya, where agriculture accounts for the order of 33% of GDP and contributes to more than 60% of humanity in the rural population, food and nutrition insecurity is a key part of the Bottom-Up Economic Transformation Agenda (BETA). Science, technology, and innovation (STI), especially in digital agriculture, can help to transform diverse forms of knowledge, innovations, practices, and forms of organizing for inclusive economic growth at the grassroots level. This paper analyses the processes through which STI can contribute to grassroots inclusion in economic growth. The paper draws on field data and recent reports from the Kenya Postharvest Management Strategy, Kenya Youth Agribusiness Strategy, and field reports of Nakuru, Bungoma, and Makueni towns to explore digital innovations, including AI-powered advisory platforms (PlantVillage), IoT-enabled irrigation, and mobile-based input and market platforms. As a result of these technologies, yield increased by as much as 35%, post-harvest losses reduced, and youth participation in agri-tech entrepreneurship and localized innovation hubs increased by as much as 35%. The research finishes by suggesting a viable digital agriculture model for counties grounded on public sector policies, academic research, and private sector innovation to sustain productivity and resilience conducted in the context of inclusive growth. The paper succeeds at linking STI to the goals of BETA as a case for funding grassroots innovation ecosystems as a route to national food security, economic empowerment, and sustainable transformation.

**Phytochemical Screening and Repellence Potencies of Bioactive Molecules of Plant Extracts Derived from *Ocimum suave*, *Ocimum americanum* and *Eucalyptus citriodora* against *Anopheles gambiae***

Alex Muthengi<sup>1</sup>

<sup>1</sup>Department of Basic Sciences, Tharaka University, P.O. Box 193 - 60215, Marimanti, Kenya

Email: alex.mugwiria@tharaka.ac.ke or muthengialex@gmail.com

Presentation Type  
Oral

Malaria is a vector-borne disease of public health concern and affects the socio-economic status of people in developing countries. Malaria management faces many challenges namely, affordability, availability, and quality of drugs. Conventional drugs are expensive and not readily available. Repellents have been in use for the prevention of *Anopheles* bites, but all these have a myriad of negative effects to the user, such as allergy and dermatitis. This study sought to develop a plant-based *Anopheles gambiae* repellent for control of malaria, because it is eco-friendly and non-toxic. The plant leaf samples: *Ocimum americanum* and *Eucalyptus citriodora* were collected from Mugui village in Tharaka Nithi County, Kenya, while *Ocimum suave* was harvested at Gacuru village in Meru County, Kenya. The chemical analysis of the essential oils was done using a Gas Chromatography-Mass Selective detector instrument (GC-MSD). The human-bait method was used to assess the repellency efficacy of the essential oils and their blends against *An. gambiae*. The GC-MSD results revealed that the plants are endowed with terpenoids, such as 1,8-Cineole,  $\beta$ -Bisabolene,  $\beta$ -Pinene,  $\alpha$ -Terpineol, and Geranial as the most abundant compounds in the samples. The blend of *O. suave* and *O. americanum* in the ratio of 1:1 was the most potent ( $100.00 \pm 0.00$ ) and compared well with the positive control Ballet<sup>TM</sup> ( $100.00 \pm 0.00$ ). The observation that the blend of *O. suave* and *O. americanum* was comparable to Ballet<sup>TM</sup>, suggests that this may be due to additive or synergistic effects of individual constituents. This study revealed that these plants are endowed with bioactive compounds such as terpenoids and flavonoids that possess potent repellency against *An. gambiae* mosquitoes.

**Keywords:** Repellent activities, *Ocimum suave*, *Ocimum americanum*, *Eucalyptus citriodora*, essential oils, *Anopheles gambiae*

## Formulation of Finger Millet and Termite Powder Composite Thin Porridge Flour

Tracy Musimbi Amdara<sup>1</sup>

<sup>1</sup>Institution: The Kabete National Polytechnic

Email: tracymusimbi@gmail.com

Presentation Type  
Oral

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 were 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

## **Digital Transformation and Emerging Frontier Technologies: A Case Study of the Teachers Service Commission (TSC), Kenya**

Clement Wanjage Kabuti<sup>1</sup>

<sup>1</sup>Teachers Service Commission

Email: clementkabuti@tsc.go.ke

Presentation Type  
Poster

The Teachers Service Commission (TSC) of Kenya, managing over 400,000 employees nationwide, has undertaken a comprehensive digital transformation to address inefficiencies inherent in manual processes. This study explores the automation and digitization of core human resource functions at TSC, aligning with the Bottom-up Economic Transformation Agenda (BETA) through enhanced public service delivery. Anchored on the Commission's Strategic Goal of Service Delivery Re-engineering and Innovation, several key systems were developed, including Online Entry/Exit, TPAY, Teachers Online, TPAD, and the Electronic Document Management System (EDMS). The implementation of these platforms has yielded significant results: reduction in teacher onboarding time from six months to under 30 days; cost savings of over Ksh 170,000 monthly on pay slip printing and dispatch; a 60% drop in third-party service traffic; and an increase in commission revenue from third-party payroll services from Ksh 250M to Ksh 650M. Moreover, digital innovations have improved transparency and allowed teachers to access services remotely. Despite the successes, challenges persist including low e-literacy among some staff, lack of system integration, and infrastructure disparities across counties. The paper recommends full integration of databases, continuous capacity building, and increased investment in ICT infrastructure countrywide to allow for faster growth in the ICT industry. This case illustrates how mainstreaming digital transformation in a public sector institution can significantly enhance efficiency, accountability, and service delivery.

## **Evaluation of Production and Performance of Different Varieties of Potatoes under Conventional Farming Methods at ADC Sirikwa, Kuresoi North**

Kiambi, M.M., Seneni<sup>1</sup>, M.N., Cherotich<sup>1</sup>, P., and Odhiambo, G.O<sup>1</sup>

<sup>1</sup>Agricultural Development Corporation (ADC), Molo, Kenya

Email: kintuvaity@gmail.com

Potatoes are a vital food and economic crop in Kenya, yet productivity remains suboptimal due to agronomic and environmental challenges. This study evaluated the performance of six seed potato varieties—Dutch Robjin, Shangi, Unica, Kenya Karibu, Sherekea, and Nyota—under conventional rain-fed farming conditions at ADC Sirikwa in Kuresoi North during the 2024/2025 short rainy season. Parameters assessed included average yield per plant, total productivity per acre, and estimated commercial output. Nyota demonstrated the highest yield potential with 2.1 kg per plant and an estimated 751 x50kg bags per acre before by-product losses, outperforming all other varieties. Shangi showed the lowest productivity. Kenya Karibu and Unica also recorded promising yields, while Dutch Robjin and Sherekea delivered moderate performance. The trial highlighted significant variation among cultivars and underscored the need for tailored agronomic practices. These results suggest that strategic variety selection and optimized management could enhance ADC's seed potato output and profitability. Further studies are recommended to investigate environmental and soilspecific factors affecting performance, with a focus on scaling high-yielding varieties like Nyota.

**Keywords:** potato varieties, rain-fed agriculture, yield performance, Nyota, Kenya Karibu, ADC Sirikwa

## **In Vitro Evaluation of Salinity Tolerance in Kenyan Potato (*Solanum tuberosum*) Varieties under NaCl Stress**

Kiambi, M.M., Seneni, M.N.<sup>1</sup>, Cherotich, P.,<sup>1</sup> and Odhiambo, G.O.<sup>1</sup>

<sup>1</sup>Agricultural Development Corporation, Molo, Kenya

Email: kintuvaity@gmail.com

Soil salinity is a growing threat to sustainable potato production in Kenya, especially in arid and semi-arid lands (ASALs). This study aimed to assess the salinity tolerance of key potato varieties—Shangi, Tigoni, Chulu, Dutch Robjin, Lenana, Unica, and Nyota—using in vitro screening under varying concentrations of sodium chloride (NaCl): 0 mM, 10 mM, 60 mM, and 100 mM. Disease-free stem-node explants were cultured on MS media with NaCl treatments and observed for critical growth parameters: plant height, root and leaf development, and internode number over a 49-day period. Results indicated significant varietal differences. Chulu and Dutch Robjin performed best under 10 mM NaCl, with enhanced growth compared to control, suggesting improved osmotic adjustment. Dutch Robjin consistently showed superior tolerance even at 60 mM and maintained growth at 100 mM, outperforming all other varieties in extreme salinity. Conversely, Tigoni and Lenana were severely affected at high salinity levels, exhibiting stunted growth and sparse rooting. A second trial confirmed these observations, reinforcing Dutch Robjin's adaptability to saline conditions. These findings support the use of in vitro screening as an efficient tool for selecting salt-tolerant cultivars and highlight Dutch Robjin and Chulu as promising candidates for cultivation in saline-prone regions. Further in vivo validation is recommended to guide breeding programs and policy decisions for food security in ASALs.

**Keywords:** Salinity stress, *Solanum tuberosum*, NaCl tolerance, in vitro culture, potato breeding, Kenyan ASAL

## **Production and Performance of Different Grades of Shangi Potato Variety under Uniform Environmental and Management Conditions at ADC Sirikwa Farm, Kuresoi North**

Kiambi, M.M.<sup>1</sup>, Seneni, M.N.<sup>1</sup>, Cherotich, P.<sup>1</sup>, and Odhiambo, G.O.<sup>1</sup>

<sup>1</sup>Agricultural Development Corporation, Molo, Kenya

Email: kintuvaity@gmail.com

Presentation Type  
Poster

This study evaluated the productivity of various seed grades of the Shangi potato variety under controlled field conditions at ADC Sirikwa, Kuresoi North. Six grades—Charts, Size 1, Size 2, Ware, Undergrade, and Apical Cuttings—were tested in a Completely Randomized Block Design. Uniform agronomic practices were applied, and performance was assessed by yield per plant and per acre. Ware grade seeds exhibited the highest productivity, averaging 1.0 kg per plant and 358 x50kg bags per acre, due to better nutrient reserves and vigorous sprouting. Charts and Undergrades had significantly lower yields, attributed to poor eye quality and disease susceptibility. Apical Cuttings failed to establish, likely due to climate stress, indicating a need for greenhouse propagation. Size 1 and Size 2 performed comparably, suggesting either can be used interchangeably in seed multiplication. These findings inform optimal seed grade selection and management strategies for enhanced Shangi potato yields. Policy recommendations include certification of Ware grade and guidance for farmers on seed selection.

**Keywords:** Shangi potato, seed grade performance, ware potato, apical cuttings, ADC Sirikwa

## Impact of Research, Science, Technology, and Innovation on the Bottom-Up Economic Transformation Agenda in Nyeri Region

Joan Jerop<sup>1</sup>

<sup>1</sup>Mathenge Technical Training Institute

Email: ropjoan4@gmail.com

Presentation Type  
Poster

In many rural areas across Kenya, including the Nyeri region, economic challenges such as youth unemployment, low farming incomes, and limited business opportunities remain common. The Bottom-Up Economic Transformation Agenda (BETA) aims to address these challenges by focusing on people at the grassroots level and supporting them to build sustainable livelihoods. This study explores how research, science, technology, and innovation (RSTI) are being applied in Nyeri to support local development and create real change in people's lives. In Nyeri, most people depend on farming and small businesses. Some farmers are already using new techniques and technologies like improved seeds, weather apps, and mobile money to grow their income. Young entrepreneurs are creating simple but useful innovations, such as low-cost irrigation systems or online platforms to sell local products. These examples show that when people are supported with the right knowledge and tools, they can find their own solutions to everyday problems. This research will involve talking to local farmers, business owners, and young innovators in Nyeri to understand how they are using RSTI in their work. It will also review available reports, articles, and government policies that promote innovation at the grassroots level. The goal is to find out what is working, what challenges still exist, and what support is needed to help more people benefit from research and technology. The findings will highlight the power of local solutions and show that development does not always have to come from the top. When communities are given the chance to lead and innovate, real transformation becomes possible. This research hopes to encourage more investment in education, innovation hubs, and small business support in regions like Nyeri, where there is great potential for growth from the bottom up.

**Keywords:** Nyeri, Bottom-Up Economy, Innovation, Technology, Local Solutions, Grassroots Development

**WHOLE OF GOVERNMENT APPROACH, AND  
MAINSTREAMING OF RESEARCH, SCIENCE,  
TECHNOLOGY AND INNOVATION IN  
PROGRAMMES MDAS AND PRIVATE SECTOR  
INSTITUTIONS**



## **Attitude Change & Perception of Care Givers at Maternal Health Child Clinic of Jaramogi Oginga Odinga Teaching and Referral Hospital**

Antony Musabi<sup>1</sup>

<sup>1</sup>Sigalagala National Polytechnic P.O Box 2966-50100 Kakamega. Kenya

Email: musabiantony12@gmail.com

Presentation Type  
Oral

There has been rise in death among children below age of 5 due to vaccine preventable diseases. The main objective of this study is to examine the factors affecting utilization of immunization policies on perception of care givers at Maternal Health Child Clinic of Jaramogi Oginga Odinga Teaching and Referral Hospital. The influence of attitude change on perception of care givers at Maternal Health Child Clinic of Jaramogi Oginga Odinga Teaching and Referral Hospital were the specific objectives of this study. Primary data was used. The target population was 200 care givers with children under 5 years and have at least a toddler attending MCH services at the hospital. Descriptive research design was used since it's suitable for description and measurement of phenomena with high level of accuracy. Structured questionnaires were used to collect data. Simple random sampling was employed since it is not a biased method, and each care giver has equal chances of being selected. A sample of 80 care givers with children below five years was used. SPSS was used to analyze data and be presented using tables because this can easily communicate the findings to readers. The study findings showed a positive correlation between Attitude Change and utilization of immunization services ( $R = 0.547$ ). It was evident from results that care givers perception affects utilization of immunization policies and there was variation on utilization of immunization policies due to Attitude change. The study recommends that government to formulate policies and regulations to make utilization of childhood immunization compulsory. Further, increase penalty and stringent measures for those advocating for cultural practices that impede utilization of childhood immunization. It also recommends providing information showing the need for the program interventions which will encourage more women to take their children for immunization for all vaccine preventable diseases thus improving health of children in the area. The study concluded that attitude change influenced Attitude Change to utilization of childhood immunization at Jaramogi Oginga Odinga Teaching and referral Hospital.

# **INTELLECTUAL PROPERTY, TECHNOLOGY TRANSFER, COLLABORATION AND COMMERCIALIZATION SYSTEMS**



## **Bridging The Gap: Strengthening Intellectual Property Frameworks in Kenya's Water Sector**

Nelly Chesang<sup>1</sup>

<sup>1</sup>Lake Victoria South Water Works Development Agency

Email: [nchesang@lvswwda.go.ke](mailto:nchesang@lvswwda.go.ke)

Presentation Type  
Oral

Kenya's water sector faces growing challenges driven by climate change, pollution, and rapid urbanization. These pressures hinder equitable access to safe water and adequate sanitation, making the sector increasingly dependent on innovative solutions. However, existing Intellectual Property (IP) frameworks, where they exist, fall short of supporting, protecting, and scaling these innovations effectively. This paper examines critical deficiencies in Kenya's current IP ecosystem as it relates to the water sector, including the absence of sector-specific policies, limited institutional capacity, fragmented legal frameworks, and weak mechanisms for commercialization and technology transfer. Public agencies and research institutions often lack clear IP ownership structures and benefit sharing guidelines, which undermines incentives for innovation. These gaps limit the sector's ability to attract investment, harness research outputs, and promote local innovative solutions. The paper calls for the development of a coherent, sector-focused IP framework aligned with national innovation priorities. Strengthening IP governance will be essential to fostering a culture of innovation, protecting knowledge, and ensuring sustainable water and sanitation service delivery in line with Kenya's Vision 2030, the Bottom-Up Economic Transformation Agenda (BETA), and the Sustainable Development Goals (SDG).

**Keywords:** Intellectual Property, Water Sector, sector-focused, Innovation, Technology Transfer, Commercialization, Policy Framework, Kenya, Climate Change, Sanitation, Research and Innovation, Vision 2030, BETA, SDGs

## Assessing Intellectual Property Awareness and Implementation Among TVET Trainees and Trainers: Case Study of TVET Institutions in Kenya

Berut Zipporah<sup>1</sup> and Tom Mulati<sup>1</sup>

<sup>1</sup>Kitale National Polytechnic

Email: berutzipporah@gmail.com

Presentation Type  
Oral

In the evolving knowledge-based economy, Intellectual Property (IP) literacy is increasingly essential, particularly within Technical and Vocational Education and Training (TVET) institutions where innovation and hands-on skill development are key. This study assessed the level of IP awareness, understanding, and attitudes among trainees and trainers at TVET Institutions in Kenya. The study adopted Innovation Diffusion Theory, introduced by Everett Rogers (1962). This theory is particularly relevant to the current study, where IP knowledge and practices are conceptualized as innovations that must be adopted by both trainers and trainees in TVET institutions. A mixed-method approach was employed using a convergent parallel research design to collect both qualitative and quantitative data concurrently. The sample consisted of 120 final-year trainees selected through stratified random sampling and 50 trainers selected purposively based on their role in curriculum delivery and innovation. Data were collected using structured questionnaires, semi-structured interviews, and focus group discussions. Quantitative data were analyzed using SPSS software through descriptive statistics (means, frequencies, standard deviations) and inferential techniques including chi-square tests and regression analysis. Qualitative data were analyzed thematically using NVivo, with inductive coding to identify emerging patterns related to perceptions, challenges, and strategies. Findings revealed a significant knowledge gap in IP rights, limited exposure to IP education, and institutional challenges such as inadequate training and weak policy framework practices. Despite these challenges, participants acknowledged the importance of IP in protecting innovations and promoting entrepreneurship. The study recommended integrating IP education into TVET curricula, strengthening educator capacity, and fostering institutional collaboration with national IP agencies. These actions are critical for equipping graduates with the knowledge to protect and commercialize their creative outputs, contributing to Kenya's broader innovation and development agenda.

**Keywords:** Intellectual Property, Implementation, Awareness, Innovation, Attitudes

## **Mechanical Properties Structural suitability of Guava Timber: Comparative Analysis with Eucalyptus and Cypress**

Christine Omina Mutayi

Department of Building and Civil Engineering, Sigalagala National Polytechnic

Email: mutayichristine@gmail.com

Presentation Type  
Oral

This study aimed to evaluate the mechanical properties and structural potential of guava timber (*Psidium guajava*) to determine its suitability for use in construction and furniture manufacturing. Although guava is a fast-growing hardwood with moderate physical characteristics, it remains underutilized in industrial applications. The research employed a quantitative experimental design in which standardized mechanical tests were conducted to measure density, bending strength, compressive strength, tensile strength, and modulus of elasticity. Comparative analyses were performed against eucalyptus and cypress timbers, using Statistical Package for the Social Sciences (SPSS) software to analyze the data and determine the statistical significance of the results. Findings revealed that guava timber possesses moderate mechanical strength. Its bending, tensile, and compressive strengths were lower than those of eucalyptus and cypress, though still adequate for non-load-bearing applications. Additionally, guava exhibited natural resistance to pests and fungi, indicating its potential suitability for both interior and exterior applications where environmental resistance is desirable. The study concludes that guava timber is viable for light-load construction uses such as interior framing, partitions, furniture, and decorative purposes. It is recommended that guava be more widely incorporated into the timber industry as a renewable and sustainable material. Further research is suggested to assess its economic feasibility, long-term durability, and environmental impact within commercial and residential contexts.

**Keywords:** guava timber, *Psidium guajava*, mechanical properties, SPSS analysis, sustainable wood, structural evaluation, furniture manufacturing

## Assessing Kenya's Readiness for Vaccine and Biotherapeutics Manufacturing by Biovax: Challenges, Strategies, and Stakeholder Insights

Cecilia Wanjala<sup>1,2,3</sup>, Abook Brian<sup>2,3</sup>, Joāb Odhiambo<sup>2,3</sup>, and Serah Muteru<sup>1</sup>

<sup>1</sup>Kenya Biovax Institute Limited, Kenya

<sup>2</sup>Directorate of Economic Planning, Kenya Institute of Public Policy Research Analysis, Kenya.

<sup>3</sup>School of Pure and Applied Sciences, Meru University of Science and Technology, Kenya.

Email: [info@biovax.go.ke](mailto:info@biovax.go.ke)

In Kenya, there is a need to assess readiness for vaccine manufacturing, given the challenges in affordability and availability of vaccines and biotherapeutics. Through stakeholder mapping, this study aimed to evaluate the potential of Kenya BioVax Institute in producing vaccines and biotherapeutics in Kenya and the consequent implications for the health sector. This study aimed to evaluate the potential of Kenya BioVax Institute in driving vaccine and biotherapeutics production and its implications for Kenya's healthcare sector from stakeholder mapping. The specific objectives were to identify the key enablers and barriers influencing local production and to provide actionable policy recommendations for a sustainable biopharmaceutical industry. The research used a scenario planning methodology, concentrating on the four stages of defining the scenario question and time frame, determining the main drivers of change, and creating and using possible scenarios. The health systems strengthening framework informed this methodology. Key findings included the identification of twelve critical drivers of change, such as regulatory frameworks, technological capabilities, financial investment, workforce expertise, public and private sector collaboration, supply chain resilience, global partnerships, intellectual property policies, and ethical considerations like vaccine equity, clinical trial transparency, and biosafety measures. Regulatory support and financial investment emerged as the most significant drivers among these. The study outlined four plausible future scenarios: Full-Scale Local Manufacturing, Limited Production, Prolonged Dependency on Imports, and Manufacturing Failure. Key opportunities that can be achieved include biotech advancements, self-sufficiency in vaccine supply, economic development from domestic drug manufacturing, and Kenya's ability to establish itself as a regional vaccine manufacturing centre in Africa. Major challenges, however, are regulatory constraints, high startup capital, shortage of skillset, reliance on foreign raw materials, and public perception of vaccine efficacy and safety. The report suggests that the Kenyan government improves efficiency of the regulatory process, increases investment in research and development, puts incentives to spur foreign and private investment in place, improves public-private partnerships, and enhances trust in the public by raising awareness and communicating transparently. In addition, strengthening collaborations with international vaccine producers and research institutions will be pivotal in expediting capacity-building efforts and their integration into Kenya's healthcare ecosystem by 2030.

**Keywords:** Vaccine Manufacturing, Biotherapeutics, Public Health, Pharmaceutical Industry, Regulatory Frameworks, Healthcare Innovation

## **Delivering bio-alkanol gel fuel as a renewable energy source to rural households in the lake basin region (Patent Number, KE/P/2019/3341)**

Jiveri Bonface<sup>1</sup> and Dr. Remmy Shiundu<sup>1</sup>

<sup>1</sup>Directorate of Research, innovation & Outreach, Kaimosi Friends University College. P.O BOX 385-50309 Kaimosi, Kenya

Email: [jkhajezo@gmail.com](mailto:jkhajezo@gmail.com)

Presentation Type  
Oral

It is estimated that in Africa, biomass fuels account for more than 90% of primary energy supply regardless of the adverse effects it has on the environment. Bio-Alkanol gel is a thick liquid fuel that is a mixture of alkanol and cellulose. It is derived from sugars in either orange, mango, banana, watermelon or papaya fruit peelings through microbial fermentation and eggshells. The conversion of fruit peeling cellulose biomass into cellulosic-alkanol on one part and eggshells into calcium acetate (gelling agent) on the other part yields Bio-Alkanol gel, a form of renewable energy that burns with a clear flame without smoke or soot. It's a novel innovation which spares a thought for those rural communities to ensure that we (a) mitigate against deforestation at L. Victoria water catchment areas (b) tame the silent killer (smoke) in the kitchens of rural East Africans resident in the L. Victoria basin. The Higher Heating Value (HHV) of gel was 20.50 MJ/kg determined from the adiabatic bomb calorimeter and the Lower Heating Value (LHV) of the gel was 17.50 MJ/kg. It's comparable to gaseous cooking fuel such as LPG in terms of cooking efficiency. The gel fuel is reusable for subsequent fireplace sessions. It has been tested that 1 litre of gel burns continuously for 10 hours on high output (1.5kW) and can be used for 4 days for a family of 5 persons. It works with a fabricated stove, which is extremely fuel efficient, a quick cooker that will attain maximum and optimum operating temperature in less than 1 minute after ignition. This is unlike a charcoal jiko, which takes longer to reach optimum temperature. It will also extinguish instantly with a turn of the flame regulator. The gel has the potential of repelling mosquitoes. The low level of emissions from the products of combustion of the gel makes it one of the most suitable fuels for use. It has the potential of Reducing In-Door Air Pollution which is a major cause of upper respiratory ailments in the population. It will reduce deforestation mainly caused by falling of trees for firewood and charcoal production. In terms of climate change mitigation, the use of Bio-Alkanol gel will reduce harmful CO emissions into the atmosphere, directly mitigating Global Warming and Climate Change. There will be zero carbon monoxide emissions within households, no soot and smell emissions, and other dangers such as fires caused by wood, charcoal and kerosene fuel and the injuries/fatalities inflicted. It also has the potential of reducing environmental pollution thus promoting conservation of biodiversity. Mass production of the gel will accelerate industrialization while promoting sustainable economic growth hence enhancing improved health and livelihood.

**Keywords:** Alkanol, Biofuel, Bio-Alkanol, Biomass, Fermentation, Gel

## Role of Intellectual Property in Fostering Innovation in Kenya's Water Sector

Elly Ochere<sup>1</sup>

<sup>1</sup>Water Sector Trust Fund

Email: Elly.Ochere@waterfund.go.ke

In an era where innovation and knowledge-driven solutions are central to achieving sustainable development goals, the strategic management of intellectual property within public institutions is becoming increasingly important. This study will investigate the role of intellectual property in fostering innovation in Kenya's Water Sector. The Sector is considered an enabler to all facets of economy traversing Agriculture, Health, Blue Economy, Transport and contributes to the Social, Economic and Political Pillars of the Kenyan Vision 2030. The Sector designs and implements innovative programmes and projects that generate intellectual assets including innovative technologies, software applications and capacity development tools. However, there remains a gap in systematic translation and management of these emerging innovations to foster sectoral growth and sustainability. The registration, management, protection and utilization of these assets for sectoral benefit remains underdeveloped. The study will therefore be anchored on understanding the barriers faced by public institutions in enhancing their innovation capacity to achieve long-term sustainability by protecting and leveraging intellectual property effectively. The research will be guided by three theoretical frameworks: Innovation Systems Theory, which emphasizes the role of institutions and interactions in fostering innovation; the Resource-Based View, which positions intellectual assets as strategic resources and Public Value Theory, which underscores the importance of delivering social and economic value through public sector initiatives. The research will further adopt a qualitative approach, utilizing document analysis, key informant interviews with Water Sector stakeholders including top leadership, management and staff in addition to development partners and case comparisons from other sectors within and outside Kenya. The study explores how an institutional Intellectual Property policy can enhance the Sector's ability to promote, manage and protect innovations, incentivize creativity among partners and facilitate collaboration with academia and the private sector. Particular attention is paid to mechanisms of intellectual property ownership, licensing, revenue-sharing models and open innovation platforms. The literature reviewed highlights that integrating intellectual property protection into the strategic framework of Water Sector has the potential to significantly improve the Sector's innovation capacity, accountability and long-term impact. It also positions the Sector as a thought leader in the management of intellectual property within the public space, paving the way for a more resilient and innovation-driven service delivery model. The study will conclude by offering policy recommendations, including the need to recognize the role of intellectual property in sectoral strategies, development of a dedicated intellectual property unit, awareness-building across the sector and alignment with Kenya's national intellectual property policy and international treaties. This research will contribute to scholarly and policy-oriented discussions on public sector innovation management, highlighting intellectual property as a vital, yet underutilized, lever for sustainability and inclusive development in essential service sectors such as water and sanitation. Ultimately, the research contributes to the broader discourse on public sector innovation management and demonstrates how intellectual property can be leveraged as a tool for inclusive, sustainable development in the water and sanitation sector.

## Screening of *Carica papaya* Seed and Flower Oil for Phytochemical Constituents, Antioxidants, Antibacterial and Anthelmintic Activities

Jiveri Bonface<sup>1</sup>

<sup>1</sup>Kaimosi Friends University, Directorate of Research Innovation & Outreach

Email: [bjiveri@kafu.ac.ke](mailto:bjiveri@kafu.ac.ke)

Presentation Type  
Poster

*Carica papaya* is a short-lived, fast-growing, woody herb which belongs to the family of Caricaceae. Papaya contains many biologically active compounds. The increasing prevalence of multi-drug-resistant strains of bacteria and the recent appearance of new aggressive strains has raised concern and urgency to search for new infection fighting strategies. The effective way of managing resistant bacteria and helminthes may require use of plant extracts instead of synthetic drugs. The aim of this study was to determine the phytochemicals and antioxidants present in aqueous and ethanolic seeds and flower extracts of Vega F1 and Red royale F1 *Carica papaya* varieties, to determine the antibacterial activity of aqueous and ethanolic seeds and flower extracts of Vega F1 and Red Royale F1 *Carica papaya* varieties on *Staphylococcus aureus* and *Salmonella typhi* and to determine the anthelmintic activity of aqueous and ethanolic seeds and flower extracts of Vega F1 and Red Royale F1 *Carica papaya* varieties on *Taenia saginata*, *Schistosoma mansoni* and *Ascaris lumbricoides*. The selection of these organisms for the study is based on their clinical significance and the need to find effective treatments against them. A laboratory experiment was laid out in a Completely Randomized Design with three replications. Five Experimental treatments where four levels of *Carica papaya* seeds and flower extracts: 25%, 50%, 75% and 100% and a synthetic drug chloramphenicol (Standard antibiotic) was used as standard check and sterile distilled water (0%) as untreated control. The test organisms used are all human pathogenic organisms of clinical origin and were obtained from Kenya Medical Research Institute, Kisumu County, Kenya. All isolates were sub-cultured onto nutrient agar. Two *Carica papaya* varieties Vega F1 and Red Royale F1 fruits were collected from a farm in Kakamega and were taken to KEMRI laboratories for processing. Seeds and flower materials were washed with tap water, rinsed in sterile distilled water, and dried under room temperature for 30 days. The materials were then cut into small pieces and ground into powder separately. One hundred grams powder was transferred into five hundred millimeter of water and 95% ethanol in conical flasks. The powder was added, stirred and mixture was allowed to stand for 24 hours. Then the mixture filtered through a Whatman filter paper No 1 after decantation. Phytochemical compounds of the flower and seed were then extracted using soxhlet apparatus using water and 95% ethanol respectively. The filtrates were concentrated with a rotary evaporator at 450C. The test organisms were subjected to five C. papaya extract concentrations of 0% (control), 25%, 50%, 75% and 100% using disc diffusion method and Mueller Hinton agar replicated three times. Plant extracts were isolated, and MIC was determined by serial dilution. Analysis of variance was carried out using SAS package. Treatment means were separated and compared using Tukey LSD at significance level  $P = 0.05$ . The study revealed the presence of alkaloids, flavonoids, tannins, phenols, saponins, glycosides, anthocyanins and terpenoids. There were significant differences among plant parts extracts, solvents used, and microorganisms tested. Ethanol seed extracts demonstrated higher activities against the test microbes with the highest activity (9.82 and 8.87 mm) against *S. aureus*. Ethanol flower extract had higher inhibition of 8.13mm in *S. typhi*. Higher ethanol extracts inhibitions may be attributed to more active components present because of high polar solubility properties of ethanol. Minimum Inhibitory Concentration for *S. aureus* and *S. typhi* was 0.025mg/ml. The antimicrobial activity of the extracts on the tested microorganisms may be due to growth inhibition resulting from alteration of the cell biochemical activities and disruption of cell wall integrity. The results provide evidence that *C. papaya* may serve as a potential source of new antimicrobial agents in the treatment of infections caused by the two test organisms.

# **DIGITAL TRANSFORMATION AND EMERGING FRONTIER TECHNOLOGIES**



## The Application of AI in Improving the Quality of Education in Higher Learning Institutions in Kenya: A Systematic Review

Lilian W. Muthoni <sup>1</sup>

<sup>1</sup>Mwala Technical and Vocational College

Email: [muthonililian381@gmail.com](mailto:muthonililian381@gmail.com)

Presentation Type  
Oral

Technology integration has progressively influenced education in the twenty-first century. The introduction of artificial intelligence (AI) into educational systems around the world has had revolutionary effects. The study aims to investigate the use, influence and effectiveness of AI in improving the quality of education in Kenyan TVET programs and universities. It also aims to examine the challenges and opportunities in the integration of AI. The study used a Systematic Literature Review approach. Through a comprehensive search across academic databases and literature, 72 documents were identified. Data was then extracted and thematically analyzed. Results showed that the integration of AI in tertiary institutions is still in its initial stages with TVET institutions being less advanced. However, it has shown results in improving the quality of learning, administrative tasks, and research. This review shows that this integration comes with challenges including infrastructural limitations and digital literacy gaps among educators and students. The successful and equitable integration of AI calls for a calculated and cooperative approach. This will include creating explicit national and institutional AI policies, making investments in digital infrastructure and faculty training.

**Keywords:** Artificial Intelligence, Higher Education, TVET, Kenyan Universities, Quality of Education

## Android Nurse

Jack Abibo Adem<sup>1</sup>

<sup>1</sup>Jaramogi Oginga Odinga University of Science and Technology

Email: jackadem@yahoo.com

With the upsurge in demand for efficient healthcare solutions, the integration of robotics and automation in medical assistance has gained significant attention. Healthcare facilities often experience challenges such as staff shortages, increased patient loads, need for continuous monitoring, especially in elderly care and post-operative recovery and risks of contracting communicable diseases among staff and healthcare givers. Robotics offers a potential solution by assisting medical staff in routine tasks, reducing workload, and improving patient care. The main goal of the study is to develop an Android Nurse Rover, a simple yet effective healthcare assistant platform that aids in patient care, monitoring, and medication delivery. The main objective of the study is to develop a mobile robotic assistant capable of autonomously navigating hospital rooms, sections, wards and home care environments using ultrasonic sensors for obstacle detection and avoidance. The specific objectives are; To implement a patient monitoring system by integrating temperature and pulse sensors to collect real-time health data; To design an automated medication dispensing system using a servo-controlled compartment, ensuring timely delivery of medicines to patients; To enable remote control and communication using Bluetooth or WiFi modules, allowing caregivers to monitor patient conditions and send commands to the rover; To integrate an LCD/OLED display for showing patient information, system status, and alerts and To incorporate an audio alert system using a speaker or buzzer to provide reminders and communicate important messages to patients. The methodology towards implementing this autonomous robotic system involves integrating ultrasonic sensors for obstacle detection, temperature and pulse sensors for basic health monitoring, embedding a servo-controlled compartment for medication dispensing and incorporating an L298N motor driver for mobility powering. A Bluetooth/Wi-fi module for remote control and data transmission is equally enhanced. The design will have a provision of OLED/LCD for all data real time display. The rover can autonomously navigate hospital or home environments, avoiding obstacles while assisting nurses and caregivers by providing real-time patient health updates. Additionally, a speaker enhances interaction by delivering voice alerts and reminders. By leveraging automation, patient monitoring, and remote communication, the Android Nurse Rover aims to improve healthcare efficiency and reduce the workload on medical staff. This innovation is a foundation for AI-integrated healthcare robots, offering a highly scalable solution for hospitals, elderly care homes, and home-based patient care. The development of such robotic assistants aligns with the global shift towards smart healthcare solutions, where automation, AI, and IoT play a vital role in improving patient care, ensuring timely interventions, and supporting overburdened medical professionals. Additionally, the risk of contracting communicable diseases is highly minimized.

## Application of Drone-Based LiDAR Technology for Topographical Surveys

Erastus Waweru<sup>1</sup> and Francis Kiura<sup>1</sup>

<sup>1</sup>Tana Water Works Development Agency

Email: [ewaweru@tanawwda.go.ke](mailto:ewaweru@tanawwda.go.ke)/ [fkiura@tanawwda.go.ke](mailto:fkiura@tanawwda.go.ke)

Presentation Type  
Oral

Tana Water Works Development Agency (TWWDA) is mandated to develop, maintain and manage national public water works within its area of jurisdiction which comprises Nyeri, Kirinyaga, Embu, Tharaka Nithi and Meru Counties. TWWDA conceptualized Karatina Water Supply Project which aims to improve access, quality, availability and sustainability of water supply services in Karatina Town. The proposed project's scope includes construction of a water supply treatment works and associated works. To ensure sustainability and reliability of water services, TWWDA proposed construction of Kururu 90 days water storage facility capable of storing flood water to meet community needs during low river flow periods. To assist in siting and detailed design of the 90 days water storage facility, located inside the Mt. Kenya Forest ecosystem, TWWDA undertook Light Detection and Ranging (LiDAR) survey using Unmanned Aircraft Systems (UAS)/drones as an initiative to harness the power of advanced remote sensing technology for capturing highly detailed and accurate topographic data. Accurate and detailed topographical information is fundamental to the successful planning, design, and construction of infrastructure. Traditional surveying methods, while reliable, can be time-consuming, labour-intensive, and challenging in complex or vegetated terrain. This research explored the application of LiDAR technology as a transformative approach to topographical surveying for infrastructure projects. LiDAR survey using drones offers significant advantages over conventional techniques by rapidly acquiring high-density, three-dimensional (3D) point cloud data across vast areas. This results in highly accurate Digital Elevation Models (DEMs) and Digital Terrain Models (DTMs) that precisely represent the bare earth surface, even in areas with dense vegetation that would obstruct traditional ground surveys. The speed and efficiency of data acquisition with drones drastically reduced fieldwork time and associated costs. The rich and detailed topographical data derived from the LiDAR survey provided crucial input for the various stages of design. This included enhanced site selection through detailed terrain analysis, accurate calculation of reservoir volumes, precise mapping of inundation areas, and improved planning and design of components like spillways and diversion tunnels. In conclusion, the integration of LiDAR survey technology into topographical surveying for water infrastructure offers unparalleled efficiency, accuracy, and data richness. This advanced remote sensing technique provides comprehensive and precise terrain information, leading to more informed decision-making, optimized designs, reduced risks, and ultimately, the development of safer and more cost-effective projects.

## **Kenya Road Network Knowledge Hub: Transforming Spatial Data Infrastructure into a Digital Public Good for Intelligent Planning**

Salome Wabuye<sup>1</sup>

<sup>1</sup>Kenya Roads board

Email: swabuye@krb.go.ke

Presentation Type  
Oral

Digital technology is transforming infrastructure planning and investment strategies globally, particularly in Kenya, where road connectivity is crucial for spatial justice, service access, and inclusive growth. Kenya's road network database, mobile data collection tools and a web map portal managed by Kenya Roads Board (KRB), provides a good starting point for using open data. However, its use is not optimal it does not integrate modern mapping technologies and prediction systems. This paper proposes the Kenya Road Network Knowledge Hub, a digital infrastructure designed to transform spatial systems into intelligent platforms for dynamic, localised predictive planning, Artificial Intelligence in integrating machine learning, Internet of Things (IoT), Geoinformation Information System (GIS), and big data. The Hub integrates road network datasets to enhance platform scalability, interoperability and service extension. The Knowledge Hub, a national digital public good, aims to improve infrastructure equity, accountability, and climate resilience, supporting global objectives like Vision 2030 and the SDGs. It offers a replicable model for infrastructure transformation in other developing contexts, bridging data with development priorities. Key impacts include equitable planning, technology monetization, data governance, and cross-sector partnerships, empowering county governments with data-driven insights. The Kenya Road Network Knowledge Hub is a key innovation towards integrating data systems for real-time analytics, predictive modelling and cross-sector coordination in infrastructure intelligence. It utilizes advanced geospatial technologies, AI and scalable APIs to operationalize data as an infrastructure asset, promoting intelligent digital infrastructure planning for resilient infrastructure.

## Molecular Modelling of Toxic Indole Derivatives from High-Temperature Cooking

Anthony B. Mathenge<sup>1</sup>

Kabete National Polytechnic

Email: amathenge20@gmail.com

Presentation Type  
Oral

High-temperature cooking is a common practice in many households and food industries, yet it contributes to the formation of harmful compounds with significant public health implications. This study employs molecular modelling and computational chemistry techniques to evaluate the thermodynamic behaviour and toxicity of indole derivatives produced during such cooking processes. Using Density Functional Theory (DFT), key molecular descriptors were analyzed to predict oxidative stress and carcinogenic potential. The findings provide a scientific basis for innovating safer cooking methods and inform regulatory frameworks in food safety. By integrating research and technology, this work highlights the transformative impact of computational tools in health risk assessment, aligning with the MS-CORSTI 2025 goals of promoting sustainable innovation and enhancing public welfare.

**Keywords:** High-temperature cooking, indole derivatives, computational chemistry, DFT, food safety, public health, sustainable innovation

## **An Artificial Intelligence-Based System for Automated Detection of Plant Diseases using Thermal Imaging and Image Processing as a Tool for Enhancing Food Security**

David Ochieng Oduor

Kabete National Polytechnic, Nairobi Kenya

Email: davidochieng.od@gmail.com

Presentation Type  
Oral

Early detection and accurate diagnosis of plant diseases are crucial for effective disease management. This study proposes an artificial intelligence-based system for automated detection of plant diseases using thermal imaging and image processing techniques. This research involves collecting thermal images and RGB images of healthy plants and plants with different types of diseases. Ensuring that the images are of good quality and represent a variety of disease stages and plant species. Preprocessing the images to remove noise, correct for illumination, and enhance the features relevant to disease detection. This step is crucial for accurate disease detection. Extracting features from the preprocessed images that are relevant to disease detection. This can be done using techniques such as texture analysis, color analysis, and shape analysis. Training an artificial intelligence model, such as a deep neural network, using the extracted features and labeled images. The model can accurately classify healthy and diseased plants. Evaluating the performance of the trained model using a test set of images that the model has not seen before. This step helps to ensure that the model is generalizing well on new data. Deploying the model in a system that can automatically detect plant diseases in real-time. The system can detect plant diseases at an early stage, suggest most effective chemicals to be applied to the plants, enabling timely interventions to prevent crop losses. The system has the potential to revolutionize plant disease management.

**Keywords:** Artificial Intelligence, Image Processing, Thermal Imaging, Plant Diseases, Disease Management.

## Evaluating Challenges in Utilizing Intelligence, Surveillance, and Reconnaissance Systems for Effective Force Protection in Military Operations

Ishmael Papa<sup>1</sup> and Anthony Luvanda<sup>1</sup>

<sup>1</sup>National Defense University – Kenya

E-mail: luvanda@gmail.com

Presentation Type  
Poster

Force Protection (FP) involves safeguarding military personnel, civilians, and critical assets to ensure mission continuity and operational effectiveness. Intelligence, Surveillance, and Reconnaissance (ISR) systems are central to FP by providing real-time situational awareness, enabling risk mitigation, and informed decision-making. However, their integration into military operations faces challenges such as technological limitations, data overload, and interoperability issues. This study examines the operational constraints surrounding ISR deployment in FP and highlights the need for technological innovation, adequate training, and holistic approaches. Addressing these barriers is vital for enhancing FP capabilities in complex and dynamic threat environments. Using a mixed-methods approach, data was gathered from defense experts, military personnel, and secondary literature to assess awareness, training participation, ISR integration, and data utilization in FP practices. Findings indicate that although FP protocols are widely acknowledged, implementation gaps persist due to inadequate training attendance, technological constraints, limited interoperability, and insufficient real-time data processing. Additionally, there is a shortage of trained ISR personnel and minimal incorporation of ISR systems in foundational military training. The study recommends enhancing FP through the use of digital platforms, AI-enabled learning, and gamification for training, as well as deploying modular ISR platforms and edge computing for real-time intelligence. Emphasis is also placed on developing robust data collection frameworks, establishing fusion centers, and using predictive analytics to support decision-making. The study underscores the need for a holistic systems-thinking approach that blends technological innovation, training, and strategic data use to optimize the effectiveness of ISR in safeguarding personnel and assets, thereby enhancing mission success in modern operational environments.

**Keywords:** Force Protection (FP), Intelligence, Surveillance, and Reconnaissance (ISR), Military operations

## Impact Of Artificial Intelligence on Technical and Vocational Education and Training

Cyrus King`ori Maina<sup>1</sup>

<sup>1</sup>Mukiria Technical Training Institute, Kenya

Email: cyrusmaina1993@gmail.com

Presentation Type  
Poster

Technical and Vocational Education and Training (TVET) plays a critical role in preparing students with essential skills for the labour market. As technological advancements continue to reshape industries, traditional teaching methods are often challenged in providing flexible and innovative learning experiences to a diverse group of learners. In response, there is a growing need to incorporate emerging technologies, such as Artificial Intelligence (AI), into TVET curricula. AI has the potential to predict future job market trends, and the skills required, which is vital for the relevance and sustainability of TVET training. AI's application in education is already improving administrative functions and enhancing teaching methods. This study investigates the influence of AI on TVET, focusing on its impact on the learning and teaching processes, assessment and grading methods, and the career prospects of graduates. The research further explores how AI can help TVET graduates acquire new and relevant skills for the workforce. The sample consisted of 660 students, 110 academic staff members, 10 administrators, 45 technical staff, and 32 former students, chosen using the Taro Yamani model and random sampling. This research employed both descriptive and explanatory designs, and secondary data was gathered through desktop library research. The data were analyzed using the chi-square statistical method at a 5% significance level. Participants were selected through random sampling. The findings revealed that AI enhances personalized learning by adapting the content to meet the unique needs and learning styles of each student and there is positive correlation between AI and teaching effectiveness in TVET. The study suggests that integrating AI into TVET curricula could improve educational outcomes.

**Keywords:** TVET, artificial Intelligence, curriculum, personalized learning.

# **REGULATORY AND POLICY FRAMEWORKS FOR RESEARCH, SCIENCE, TECHNOLOGY AND INNOVATION**



## **Strengthening Research Ethics and Security Towards Managing Intellectual Property and Technology Transfer in Universities in Kenya**

Susan Musembi<sup>1</sup>, Richard Oduor<sup>1</sup>, Judith Kimiywe<sup>1</sup>

<sup>1</sup>Kenyatta University, PO BOX 43844-00100, Nairobi, Kenya

Email: musembi.susan@ku.ac.ke

Presentation Type  
Oral

As universities strive to generate economically relevant knowledge, there is growing pressure to adopt practices similar to the private sector, including technology transfer and intellectual property (IP) management. However, scientific advancements also expose research—particularly in STEM, and emerging technologies—to risks of unauthorized access and misuse. Ensuring compliance with evolving global and national regulations is thus essential. This study aimed to identify vulnerabilities in the implementation of research ethics and security in Universities in Kenya, focusing on safeguarding IP and technology transfer. A cross-sectional, descriptive study was conducted using purposeful sampling among Kenyan universities. It examined institutional frameworks for research security, the factors influencing responsible research, and the knowledge and training available to stakeholders. Respondents included research managers, faculty, and postgraduate students from various disciplines. The study explored three key areas: organizational leadership and management, policy frameworks, and training related to responsible research and research security. Findings revealed a variety of research governance structures, such as research directorates and ethics boards. While there are notable efforts to institutionalize ethics and responsible research policies, these structures often lack adequate support for effective policy implementation. Vulnerabilities include weak mechanisms for IP and data transfer, insufficient auditing, ineffective conflict-of-interest management, poor due diligence in collaborations, and gaps in data protection and research misconduct response. Training on research integrity is limited, non-mandatory, and narrowly focused on ethics. The study recommends increasing awareness among university management and faculty about IP risks, strengthening policy development and enforcement, and introducing practical tools for conflict-of-interest assessments and due diligence. Universities should implement mandatory, discipline-specific training programs in research integrity and security to foster responsible and secure research environments.

## **Adaptation at the Margins: Reframing Policy Priorities for Africa's Coastal Communities through Scientific Evidence**

Rael Adhiambo<sup>1,3</sup>, Blessing Charuka<sup>2,3</sup>, Donatus Angnuureng<sup>3</sup>

<sup>1</sup>National Commission for Science, Technology and Innovation (NACOSTI)

<sup>2</sup>Rhodes University, South Africa

<sup>3</sup>Centre for Coastal Management, University of Cape Coast, Ghana

Email: rael.adhiambo@nacosti.go.ke

Presentation Type  
Oral

Africa's coastal communities are on the frontlines of climate change yet remain at the margins of adaptation decision-making. This presentation interrogates the politics that shape climate adaptation in coastal regions—who gets funded, whose knowledge counts, and which communities are prioritized. Drawing on both research and policy practice, particularly through the lens of work at Kenya's National Commission for Science, Technology and Innovation (NACOSTI), this paper explores how adaptation interventions often reproduce existing inequalities when power dynamics, political visibility, and uneven knowledge infrastructures are not addressed. The authors argue for a justice-centred approach to adaptation policy, one that embeds scientific evidence in participatory processes and prioritizes marginalized voices in shaping research agendas. Through illustrative examples and policy reflections, it offers pathways for advancing equitable, evidence-informed adaptation frameworks across Africa's coastal zones. The study calls for a reimagining of adaptation science as not only technically sound but politically conscious and socially inclusive.

**Keywords:** Climate adaptation, Coastal communities, Climate justice, Science-policy interface, Equity

## **An analysis of Innovation policy framework for Kenya's transformative change**

John Ayisi<sup>1</sup>

<sup>1</sup>Directorate of Research, Innovation and Outreach (DRIO), Kaimosi Friends University (KAFU), P. O. Box 385-50309, Kaimosi, Kenya.

Email: jayisi@kafu.ac.ke

Presentation Type  
Oral

Policy framings including those directed at Research, Science, Technology and Innovation (RST&I) evolve over time and change when they become inadequate with circumstances. Three frames of thought influence RST&I policy. Frame 1 (1960s-1980s) was based on the proposition that public investment in science was desirable for economic growth through Research and development (R&D) and Regulation. It rationalized this investment using economic arguments for 'market failure'. Frame 1 is a 'linear model' of innovation, hence little/slow commercialization. Frame 2 (1980s – To date) is the one in which innovation is conceived as a more complex national system of innovation – where in addition to R&D, there is a wider range of other actors including firms, universities and users shaping the innovation processes. Frame 2 focuses more on learning and interactions among actors. Among the important actors in Frame 2 include entrepreneurs and the many engineering and technical personnel necessary to develop inventions into commercialized products and services. This model of innovation is therefore synergistic, demand-based with increased speed of diffusion. While these two frames were supposed to lead to economic development, they are associated with negative consequences of economic growth such as climate change, resources depletion, production of waste and growing global inequality. Frame 3 (emerging) advocates that any transformative RST&I policy must address grand global challenges facing the world such as inclusivity; and social and environmental sustainability summarized in 17 SDGs. It is defined as bottom up promoting social, frugal or pro-poor innovations with civil society and communities as actors. These three frames are discussed with reference to Kenya's RST&I ecosystem.

## Technology Innovation Hubs: Interlink between Universities and County Governments

Kelvin K. Omieno<sup>1</sup>

<sup>1</sup>School of Computing and Information Technology, Kaimosi Friends University

Email: [komieno@kafu.ac.ke](mailto:komieno@kafu.ac.ke)

Presentation Type  
Oral

Technology innovation hubs have emerged as critical catalysts for regional development, entrepreneurship, and knowledge transfer. This paper explores the evolving role of innovation hubs as strategic bridges between universities and county governments, particularly in fostering socio-economic transformation. Universities, as centres of research and innovation, provide the intellectual capital and technical expertise necessary for nurturing startups and developing scalable solutions. County governments, on the other hand, offer regulatory support, funding, and alignment with local development agendas. The paper discusses models of partnership, best practices, and challenges, emphasizing the need for structured frameworks that ensure mutual benefit, sustainability, and measurable impact. Together, they create environments that stimulate startups, enhance skills development, and promote technology transfer. The study adopts a mixed-methods approach. Primary data were collected through semi-structured interviews with university innovation managers, county government officials, and hub coordinators across selected counties. Secondary data were drawn from policy documents, strategic plans, and case studies of existing innovation hubs. Data were analyzed using thematic analysis to identify key enablers, challenges, and best practices in university–county partnerships. Findings reveal that successful hubs are characterized by strong governance structures, sustained funding, community engagement, and shared ownership between universities and county governments. It concludes that strengthening the university–county government nexus through innovation hubs is essential for building resilient, knowledge-based local economies.

**Key words:** Startups, Technology transfer, Technology innovation hubs, Sustainability

## Enhancing Innovation Capacity through Managing Plagiarism and Academic Dishonesty in TVET Institutions in Kenya.

Stephen Musilngómbe Wafula<sup>1</sup> and Dr Berut Zipporah<sup>1</sup>

<sup>1</sup>Kitale National polytechnic

Email: wafulastephen92@gmail.com

Presentation Type  
Oral

As the country advances the Competency-Based Education and Training (CBET) model to enhance practical skills and entrepreneurship, the prevalence of unethical academic practices threatens to undermine these innovation efforts. The study was guided by the Theory of Planned Behaviour (Ajzen, 1991)—which explains how attitudes, perceived norms, and behavioural control influence ethical conduct. The study focused on three key objectives: (1) how plagiarism and academic dishonesty affect trainers' and trainees' ability to generate original and innovative ideas; (2) the perceptions of trainers and trainees regarding the relationship between academic integrity and innovation capacity; and (3) the effectiveness of strategies aimed at promoting academic honesty to strengthen innovation in TVET environments. The study adopts a mixed-methods research design, combining both qualitative and quantitative approaches for triangulation and deeper insight. The target population includes trainers and trainees in both public and private TVET institutions across Kenya. A multistage sampling technique was used to select a representative sample, consisting of 320 respondents (240 trainees and 80 trainers) from ten institutions, proportionately distributed across urban and rural settings. Quantitative data were collected through structured questionnaires, while qualitative insights were obtained from key informant interviews and focus group discussions. Descriptive statistics, inferential analysis and thematic content analysis were employed to analyze the data. The findings revealed a significant negative relationship between academic dishonesty and innovation capacity, with unethical academic behaviours diminishing the originality and critical thinking necessary for innovation. The study also highlighted the importance of institutional policies, ethical training, and the use of plagiarism detection tools in fostering a culture of integrity. By embedding academic honesty into the TVET system, institutions can enhance their role in producing creative, industry-ready graduates aligned with Kenya's Vision 2030.

**Keywords:** Innovation Capacity, Academic Honesty, Plagiarism, Practical Skills

## **“Hanging by a thread”: an analysis of vulnerabilities facing Maasai group conservancies in Amboseli Ecosystem, Kenya**

Richard Dimba Kiaka<sup>1</sup>, Joy Oakes<sup>2</sup> and Jennifer Wanyingi<sup>2</sup>

<sup>1</sup>Wyss Academy for Nature at the University of Bern

<sup>2</sup>School for Field Studies

Email: richard.kiaka@wyssacademy.org

Presentation Type  
Oral

This paper critically examines the socio-political and economic vulnerabilities threatening the sustainability of community conservancies in the Amboseli Ecosystem, Kenya. Drawing on extensive ethnographic fieldwork—including key informant interviews, focus group discussions, and participatory observation—the study explores the shifting motivations, benefits, and tensions that shape the conservancy model introduced to replace exclusionary conservation practices. While initially motivated by promises of economic gains and later by efforts to safeguard communal grazing lands, the conservancies are increasingly under pressure due to privatization incentives, generational shifts in land values, and heavy dependence on non-governmental organizations for financial and managerial support. The analysis reveals four key vulnerabilities undermining the resilience of conservancies: the growing temptation to sell or lease land for more profitable agricultural ventures; intergenerational shifts in the perceived value of land; donor dependency and NGO dominance; and emerging conflicts with tourist investors. The study concludes that without significant restructuring toward locally owned, economically competitive, and politically autonomous governance models, the community conservancies in Amboseli remain precariously “hanging by a thread.” This case contributes to broader debates on the viability of community conservation in neoliberal land markets and underscores the need to reframe conservation not only as an ecological imperative but also as a just and inclusive social contract.

**Keywords:** Community Conservation, Land subdivision, wildlife conservation, Maasai Group Conservancies, Amboseli, Kenya

## **From Conflict to Coexistence? Evaluating the Promise and Pitfalls of the Mbirikani Predator Consolation Fund in Kenya**

Richard Kiaka<sup>1</sup>, John Kiringe<sup>2</sup> and Jennifer Wanyingi<sup>2</sup>

1. Academy for Nature at the University of Bern

2. School for Field Studies (SFS)

Email: richard.kiaka@wyssacademy.org

Presentation Type  
Poster

Human-lion conflict remains one of the leading threats to lion conservation in Kenya's Amboseli region, where predation on livestock by lions results in significant economic losses for Maasai pastoralists. In retaliation, communities often kill lions, further endangering their populations. To mitigate this conflict, the Mbirikani Predator Consolation Fund (PCF) was established in 2003, aiming to reduce retaliatory killings while fostering positive attitudes and tolerance toward lions. Drawing on 1,018 household surveys and key informant interviews conducted in Mbirikani Group Ranch, this study evaluates the effectiveness of the PCF and identifies the challenges it faces. Findings indicate a striking 93.5% reduction in retaliatory killings and a measurable improvement in community attitudes toward lions (mean score:  $2.75 \pm 0.17$ ). However, overall tolerance for lions remains low (mean score:  $2.11 \pm 0.32$ ), suggesting that attitude change has not yet translated into deep behavioural or perceptual shifts. Respondents cite persistent concerns over the adequacy of consolation payments, including mismatches with market values, low rates, and delays in disbursement. At the programmatic level, funding limitations and understaffing further hinder effective implementation. The study concludes that for consolation schemes to meaningfully support human-lion coexistence, they must address both financial and operational shortcomings and more effectively enhance community tolerance of lions.

**Keywords:** Lion Conservation, Human-Lion-Conflict, Predator Consolation Fund, Community Attitudes, Community Tolerance, Amboseli Ecosystem.

## Leveraging Indicator Species and Citizen Science for Cost-Effective Biodiversity Monitoring of Restoration in Naibunga-Mukogodo Landscape in Laikipia

Dickens Odeny<sup>1</sup>, Philista Malaki<sup>2</sup>, Titus Imboma<sup>2</sup>, Timothy Mwinami<sup>2</sup>, Bernard Agwanda<sup>2</sup>, Ogeto Mwebi<sup>2</sup>, Christopher Odhiambo<sup>3</sup>, Agnes Lusweti<sup>2</sup>, Brenda Monchari<sup>2</sup>, Walter Nyamolo<sup>2</sup>, Ann Nyandiala<sup>2</sup>, Grace Kioko<sup>2</sup>, Beryl Bwong<sup>2</sup>, Jacob Mueti<sup>2</sup>, Titus Adhola<sup>4</sup>, Stalin Kibet<sup>4</sup>, Amanda Koech<sup>1</sup>, Alex Kimiri<sup>1</sup>, Anthony Wandera<sup>1</sup>, Richard Kiaka<sup>1</sup>, Benson Okita<sup>1</sup>, Margaret Owuor<sup>5,6</sup>

1. Wyss Academy for Nature at the University of Bern, Nanyuki, Kenya

2. National Museums of Kenya, Nairobi, Kenya

3. Technical University of Kenya, Nairobi

4. The University of Nairobi, Kenya

5. Wyss Academy for Nature, Hub Bern, Switzerland.

6. Institute of Ecology and Evolution, University of Bern, Switzerland

Email: richard.kiaka@wyssacademy.org

Conventional biodiversity monitoring methods, though scientifically rigorous, are often financially and logistically unsustainable in remote or resource-constrained landscapes. To address this challenge, we introduce a cost-effective, community-based biodiversity monitoring framework centered on indicator species. This approach was developed following comprehensive baseline biodiversity surveys in the Naibunga–Mukogodo landscape, which yielded a robust species checklist. From this, ecologically sensitive and locally recognizable indicator species were selected across key taxonomic groups—plants, invertebrates, herpetofauna, birds, and mammals. The selection process combined expert ecological input with participatory validation from local communities to ensure scientific accuracy and cultural relevance. Community members, trained as local monitors, are now systematically collecting data through structured citizen science protocols. These data include species occurrence, abundance trends, and observable shifts in habitat conditions that offers early signals of ecological and climatic changes in areas undergoing restoration, such as sites using semi-circular bunds to combat land degradation. This approach significantly reduces the cost of traditional biodiversity assessments while increasing data coverage and frequency. Just as importantly, it enhances community ownership and ecological literacy, embedding conservation monitoring within local stewardship practices. The result is a scalable, adaptive model for long-term biodiversity tracking that maintains scientific integrity while fostering inclusivity and resilience in restoration. We envision refining and expanding this approach to other dryland restoration contexts, demonstrating how community-anchored monitoring can effectively support landscape restoration goals under constrained budgets.

**Keywords:** Indicator species, Community-based monitoring, Citizen Science, Restoration and Cost-effective biodiversity assessment

# ENTREPRENEURSHIP AND STARTUPS IN SCIENCE AND TECHNOLOGY



## **Perceived Bias and Learner Attitudes in the Implementation of Outcome Based Education Assessments in Kenyan TVET National Polytechnics**

Peter M. Musyoka<sup>1</sup>

<sup>1</sup>Mathenge Technical Institute

Email: musyoka43@gmail.com

Presentation Type  
Poster

This study explored trainee attitudes and perceived bias in the implementation of competency-Based Assessment (CBA) in Kenyan national polytechnic automotive departments. As TVET institutions embrace Competency-Based Education and Training (CBET), fairness, inclusivity, and effectiveness in assessment practices are paramount in guaranteeing effective learning and acquisition of skills. The study employed simple random sampling, purposive sampling and stratified sampling techniques. The study had a sample size of 317 participants out of which 296 took part in the study. The 296 responded comprised of 272 automotive trainees, 18 Automotive engineering Trainers and 6 institutional administrators. Quantitative data were collected by structured questionnaires administered to trainers and trainees and qualitative data were collected by semi-structured interviews administered to administrators. The validity of the research instruments was established by having the instruments critiqued by three experts from the University of Eldoret. The internal consistency was established using Cronbach's coefficient which was above 0.70. the data was analyzed using descriptive statistics in form of frequencies, percentages and means. The analysis was aided by SPSS version 29. The results revealed that Trainers ( $r=0.907$ ,  $p=0.000$ ) and Trainees ( $r=0.874$ ,  $p=0.000$ ) indicated the existence of a strong significant positive relationship between the attitude, biasness and effectiveness of assessments at 0.01 level in a two tailed test. The findings pointed to a good learning environment but suggested more transparency and preparation of learners. The study informs policy deliberations on how to create improved assessment practice in CBET and how to enhance the participation of learners in Kenya's TVET system.

**Keywords:** Competency-Based Assessment (CBA), Learner Attitudes, Perceived Bias TVET (Technical and Vocational Education and Training)

# STEM EDUCATION AND TALENT DEVELOPMENT



**Effect of Curriculum on Mechanical Engineering Technician Training on the  
Effectiveness of OBE Implementation and Monetization in Public TVET Institutions,  
Mount Kenya Region**

Apollo M. Maingi<sup>1</sup>

<sup>1</sup>Mathenge Technical Training Institute

Email: [amaingi123@gmail.com](mailto:amaingi123@gmail.com)

Presentation Type  
Oral

Outcome-Based Education (OBE) is a model through which skills, attitude and knowledge is facilitated to individual learners. The focus of the model is on what a trainee can do and its practical nature. This model has come fully into practice in September 2023 in technical vocational education and training (TVET) institutions. The purpose of this study was to evaluate the effect of the mechanical engineering technician curriculum structures on effectiveness of OBE implementation in Public Technical and Vocational Institutions in Mount Kenya region. The study employed simple random sampling, purposive sampling and stratified sampling techniques. The study had a sample size of 288 participants out of which 281 took part in the study. The 281 responded comprised of 249 mechanical engineering technician training, 24 Mechanical engineering Trainers, 4 mechanical Engineering Heads of departments and 4 TVET Principals. The study was guided by OBE theory. Data was collected using questionnaires for mechanical engineering technician training and mechanical engineering trainers and interview schedules which were subjected to principals and Hods. The validity of the research instruments was established by having the instruments critiqued by three experts from the University of Eldoret. The internal consistency was established using Cronbach's coefficient which was above 0.70. the data was analyzed using descriptive statistics in the form of frequencies, percentages and means. The analysis was aided by SPSS version 29. The results revealed that Trainers ( $r=0.907$ ,  $p=0.000$ ) and Trainees ( $r=0.874$ ,  $p=0.000$ ) indicated the existence of a strong significant positive relationship between the curriculum structures and effectiveness of OBE implementation at 0.01 level in a two tailed test. The study concluded that curriculum structures had a statistical effect on effectiveness of OBE implementation in Public Technical and Vocational Institutions in Mount Kenya region. It was also found to foster innovation, productization and monetization. The study recommends that managers of the public TVET institutions in Mount Kenya region should have collaboration with TVETA and CDACC to ensure that the design of curriculum, reviews are initiated based on updates from TVETA and CDACC. Moreover, the academic board to be involved in reviewing the curriculum that supports OBE, incorporating innovation and entrepreneurship components to enhance IPP outcomes hence making necessary adjustments where possible.

**Key Words:** Curriculum structures, Mechanical Engineering Technician Training, Effectiveness of OBE implementation, OBE Programs & TVET Institutions

## **ChemEzzy: A digital chemistry education platform for enhancing the teaching and learning of chemistry**

Victor O. Shikuku<sup>1</sup>

<sup>1</sup>Department of Physical Sciences, Kaimosi Friends University, 385-50309 Kaimosi

Email: [vshikuku@kafu.ac.ke](mailto:vshikuku@kafu.ac.ke)

Presentation Type  
Oral

The launch of the competency-based curriculum and education (CBE) has seen a significant effort to shift from teacher-centred pedagogy to a learner-centred approach in education in Kenya. This will have a particularly important impact in chemistry education. Game-based learning is an emerging instructional approach because it emphasizes “hands-on” and “minds on” activities in chemistry classrooms, allowing the use of computers and mobile phones in learning chemistry. However, currently there is no game-based chemistry education technology tailored for the Kenyan curriculum at high school or college level for enhancing students' motivation and understanding of chemistry concepts. Chemezzy App is a digital platform, designed with chemistry content for secondary schools, international schools' chemistry curricula and college-level chemistry content and available for both desktop, mobile phone and web-based use, for enhancing student-centred minds-on learning through gaming. Autogenerated certificates and medals awarded at each level will both test and motivate students to learn chemistry concepts. The App allows hosting of chemistry contests with real time results for students with a class, between classes or interinstitutional contests with no need for students to travel. This groundbreaking technology provides a new pedagogical platform for a student-centred chemistry education experience.

**Keywords:** chemistry, student-centred pedagogy, chemezzy,

## Literacy, Technology and Innovation for Monetization of the Kenyan Youth

Beatrice K.C Obwoye<sup>1</sup>

<sup>1</sup>Turkana University College

Email: [bmbori@tuc.ac.ke](mailto:bmbori@tuc.ac.ke)

Presentation Type  
Oral

The youth have the potential to transform Kenya's economy in agriculture, technology and realize food security. All that is required is to empower the youth with knowledge, skills and opportunities in industry to generate income. The youth are, however, not prepared to move with speed in the fast-moving and dynamic world of work. The youth are inadequate of literacy, numeracy required in problem solving skills to meet the challenges and opportunities that would enable them fit into the global job market. Education being the equalizer ought to enable the youth to use their talents and abilities to improve their lives and solve problems in society. Literacy is a lifelong basic human need which entails acquisition of reading and writing. It goes beyond reading to encompass financial and digi-literacy and numeracy skills as well as nurturing talent through STEM Education. Subjects such as Mathematics, Science and Technology rely on the learner's grasp of the language to perform well and excel. English as a medium of instruction broadens the minds of the learners in other learning areas. English orthography, grammar rules and intricacies of sentence structure such as verb and tenses can be very confusing and may pose challenges to the learners and result in hindering talent development. Simple classroom methodology was used to conduct research and draw conclusions based on observations made. Grade six learners in one stream formed the experiment group upon which language learning used emoticons. Another stream of Grade six classroom formed the control group where language learning did not use emoticons. Observations were made and conclusions drawn. The paper is hinged on Eckman's Markedness Differential Hypothesis. Eckman's Markedness Differential Hypothesis (EMDH of 1977, 1981 and 1985) stipulates that areas of  $L_2$  which are different from  $L_1$  and which are more marked will be difficult to acquire; the degree of difficulty depends on the degree of markedness of the areas in question. This poses a challenge which needs to be broken since language is a bridge to understanding science and technology related knowledge. According to Eckman (1985) children have a fixed order in which they acquire linguistic features when learning. Learners in Kenya face numerous challenges while learning to acquire these literacy skills. Learning through emoticons present opportunities that can quickly fix these problems and allow the Kenyan to learn new skills, bring out their talent which will enable them to connect with the global youth and exchange ideas, create e-opportunities online where they can market their content and engage in global business.

**Keywords:** Emoticons, English, Innovations, Proficiency, Science, Talent, Technology

# **RESEARCH AND TECHNOLOGY SECURITY, INTEGRITY AND ETHICS FOR PROSPERITY**



## Securing Intellectual Property: The New Frontier of National Prosperity

Major General Bernard Waliaula<sup>1</sup>

<sup>1</sup>Kenya Defence Forces

Ethics and integrity in governance and management of Intellectual Property (IP) within the Research, Science, Technology and Innovation (RSTI) ecosystem are essential for its security. RSTI is a strategic national asset that requires a full complement of comprehensive security and sound management. The importance of epistemic security and cyber security is now comparable to national security. The correct RSTI corporate governance culture must be vigorously nurtured and enforced since no amount of grassroots effort can undo the effects of corporate neglect. In this context, the security of the RSTI ecosystem is not a one-time event but a ceaseless process, just like cybersecurity is not a set of products but a set of continuous practices. This paper explores how the challenge of securing intellectual property is unfolding at this critical point in time characterized by large-scale global upheavals and rapid technological turnover. It suggests securitization of the RSTI ecosystem in the context of Kenya. It argues that strengthening governance frameworks, enforcing transparency and ethical accountability, and aligning regulatory practices with global standards of ethics and integrity are essential to the security of the national RSTI ecosystem. It builds a case for strengthening and more robust enforcement of ethics and integrity regulatory provisions to secure and maximize the benefits of local RSTI potential in a structured approach.

**Keywords:** Securitization, Ethics, integrity, innovation, commercialization, intellectual property.

## **Bridging The Ethical Gap in Research and Innovation in Technical and Vocational Education and Training in Kenya for Public Good, Safety and Security**

Winrose K. Burale<sup>1</sup>

<sup>1</sup>Matili Technical Training Institute

Email: winrosesitati72@gmail.com

Presentation Type  
Oral

Ethical consideration is a critical concern to all researchers/innovators. Ethical considerations in doing research are essential to producing reliable results. As put by Hammersley and Atkinson (2007), to say that the goal of research is the production of knowledge, then, is not to say that this goal should be pursued “at all costs” without due regard to ethics. So, this paper, briefly, discusses the following fifteen (15) key ethical considerations that should be considered by researchers/innovators in Technical and Vocational Education and Training (TVET) to ensure public good, safety and security: choice of the research problem; choice of research design; choice of methods; use of the term participant-not subject; informed consent; confidentiality and anonymity; privacy; protection from harm; deception; falsified data; faking results; plagiarism; payment; access and acceptance; and vulnerable groups. The difficulties of doing research in accordance with ethical norms are also addressed, as is the need of constant introspection and review. There is also discussion of ethical research practices and maintaining a high standard of research integrity. Understanding the significance of research ethics and learning how to do research in a responsible and ethical way are the primary goals of this work, which should be used as a resource for researchers, innovators and scientists.

**Key words:** TVET, Research Ethics, Ethical Dilemmas, Conflicting Interests



# Showcasing Excellence: Selected Abstracts from NRF-Funded Projects



## Improving Neonatal Care through Affordable Phototherapy Solutions in Kenya

<sup>1</sup>G. Kamucha, <sup>2</sup>G. Irimu, <sup>1</sup>P. Akuon, <sup>1</sup>D. Segera, <sup>2</sup>B. Maugo, <sup>1</sup>J. Kariuki, <sup>1</sup>W. Ngugi, <sup>3</sup>E. Odera,  
<sup>1</sup>J. Ounza

<sup>1</sup>Department of Electrical and Information Engineering

<sup>2</sup>Department of Pediatrics and Child Health

<sup>3</sup>Department of Mechanical and Manufacturing Engineering  
University of Nairobi, Kenya.

Email:

Neonatal jaundice affects many newborns, both preterm and term, and is typically treated using phototherapy lights (PTLs). However, these machines are scarce in local hospitals for two main reasons: their high cost of importation, especially with fluctuating exchange rates, and the difficulty in repairing imported units due to limited local spare parts and technical expertise. As a result, many affected infants end up with permanent brain damage while others die from inadequate treatment. This paper presents the design and optimization of a low-cost PTL device which can be repaired and maintained by locally trained personnel. The device uses a blue light-emitting diode (LED) array, optimized to deliver uniform light at standard heights from the patient. It includes an electronic controller that monitors LED lifespan and is adaptable for remote control and device tracking capability via GSM and IoT terminals. Additionally, a calibrated light meter is integrated to display spectral irradiance, which is tuneable for standard (25–30  $\mu\text{W}/\text{cm}^2/\text{nm}$ ) and intensive (30–35  $\mu\text{W}/\text{cm}^2/\text{nm}$ ) treatment settings. Technicians in the micro-scale industry assemble the device on PCBs co-designed with students, while local Jua Kali artisans produce the casing and movable stand. The Kenya Bureau of Standards (KEBS) has tested the PTL device against electrical and mechanical benchmarks, confirming compliance. The project is currently under Ethical Review Committee (ERC) consideration. Production model samples are being made for training of other stakeholders from the County Governments of Nairobi and Siaya. Clinical trials at Kenyatta National Hospital are scheduled within the next month, followed by mass production. The projected cost of designed PTL is 50% lower than existing market options, with funding from NRF sufficient to bring it to the market. A sustainable business model through a spinoff company is being established to support national distribution, aiming to reduce neonatal jaundice-related deaths and disabilities countrywide.

**KEYWORDS:** Neonatal jaundice, Phototherapy Lights, irradiance, GSM, IoT

## Upscaling African Indigenous Vegetables Climate Smart Technologies for Food & Nutrition Security in Kenya (UPSCALE-AIVs)

Abukutsa Mary<sup>1</sup>, Anne Aswani<sup>4</sup>, Anselimo Makokha<sup>1</sup>, James Shikwati,<sup>2</sup> Patrick Amunavi<sup>1</sup>, Esperance Chesoli<sup>2</sup>, Judy Mumba<sup>3</sup>, Joyce Njenga<sup>1</sup>. Eucabeth Majiwa<sup>1</sup> & Muchiri Nyaggah<sup>3</sup>

<sup>1</sup>Jomo Kenyatta University of Agriculture & Technology (JKUAT)

<sup>2</sup>IREN-Growth Pad Ltd

<sup>3</sup>Local Development Research Institute Ltd (LDRI)

<sup>4</sup>Masinde Muliro University of Science & Technology (MMUST)

Email: abukutsam@jkuat.ac.ke or Abukutsa.mary@gmail.com

There is increasing food and nutrition insecurity in Kenya due to adverse climate change effects. Previous studies have established that African indigenous vegetables (AIVs) are among the crops with great potential to address the problem. The goal of the project was to contribute to achieving food and nutrition security in the context of climate change challenges facing Kenya by promoting the sustainable production, commercialization and utilization of AIVs. This project aimed at **upscaling** the commercial production of **registered varieties** of two AIVs, the African nightshade (*Managu*) and Jute Mallow (*Mrenda*) through application of climate smart technologies (Frass fertilizer from Black Soldier Fly-**BSF- Technology**- in their production. The project sites were in **Kakamega** and **Kiambu** counties. The project addressed 6 specific objectives including: (i) To assess farmer acceptability of registered two African Nightshade and two Jute Mallow varieties, in Kakamega and Kiambu Counties. ii. To upscale the production of African nightshade and Jute mallow in Kakamega and Kiambu counties using climate smart technologies and registered varieties. iii. To promote the use of **standardized recipes** of African nightshade and Jute mallow in selected institutions in Kakamega and Kiambu counties. iv. To promote the **commercialization** of African nightshade and Jute mallow in Kakamega and Kiambu counties. v. To promote the use of preservation and value addition technologies of African nightshade and Jute mallow in Kakamega and Kiambu counties. vi. To repackage technical information, disseminate, and promote African nightshade, Jute mallow and other priority AIVs using diversified platforms. **Key outputs** (1) Established two Farmer Field Schools (FFS) for AIVs Climate smart Technologies in Kakamega and Kiambu counties; (2) Trained **50** Train of Trainers (ToTs) and **600 farmers** in Kiambu and Kakamega counties; (3) Distributed **2,000 packets** of AIVs quality seeds including African nightshade and Jute mallow; (4) The vegetable drying capacity of the industry player upscaled by **60%**; (5) Githunguri Level 5 hospital set up **Kitchen gardens** for teaching expecting and breast feeding mothers that come for pre and post-natal clinics; (6) Technical information on all the technologies repackaged, **disseminated** and promoted in various platforms including shows and exhibitions, social media and print media to popularize AIVs. The main impacts are increased organic production, commercialization and consumption of registered AIVs in Kenya.

**Keywords:** AIVs, upscale, climate smart, quality seed, BSF, recipes, solar drying, commercialization

## A digital intervention for the prevention and early detection of depression and suicide among the youth in Kenya

Faith Mueni Musyoka<sup>1</sup>, Collins Otieno Asweto<sup>2</sup>, Kirema Nkanata Mburugu<sup>3</sup>, Jane Karimi<sup>4</sup>, Peter Kailemia<sup>2</sup>, Ian Igado<sup>1</sup>, Roy Douglas Otieno<sup>5</sup>, Arthur Onyango<sup>5</sup>

1. Department of Computing and Information Technology, University of Embu
2. Department of Community Health, University of Embu
3. Department of Agricultural Economics and Extension, University of Embu
4. Department of Educational Psychology and Technology, Mount Kenya University
5. TINADA Youth Action Africa

Email: [mueni.faith@embuni.ac.ke](mailto:mueni.faith@embuni.ac.ke)

Mental health challenges, including depression and suicidal ideation, are increasingly prevalent among youth in Kenya, especially within university settings. Limited access to timely psychological support, stigma, and low mental health awareness continue to aggravate these issues. The AkiliBora project was conceived in this project to assess the effectiveness of a mobile-based digital intervention in addressing these challenges through early detection, prevention, and referral mechanisms. A 12-week randomized controlled trial was conducted with 148 full-time undergraduate students, aged between 18-29 years, who met specific inclusion criteria, including a Perceived Stress Scale (PSS) score of 14 or higher. Participants in the intervention group used the AkiliBora mobile application for a minimum of 10 minutes daily, with follow-up assessments every two weeks. Results indicated significant differences between the intervention and control groups across all primary outcomes related to depression prevention and early detection (all  $P < .04$ ), with effects sustained at follow-up (all  $P < .03$ ), except for the non-reacting subscale of mindfulness ( $P = .08$ ). Perceived stress levels in the intervention group decreased significantly ( $P < .001$ ), while no meaningful change was observed in the control group ( $P > .19$ ). Effect sizes across outcomes ranged from moderate (0.59) to large (1.24). Additionally, significant interactions between group and time were found in models related to sleep disturbances, although other health-related behaviours such as diet and physical activity did not show notable differences. Socio-economically, the app provides an affordable and accessible solution for underserved youth populations. Environmentally, it contributes to low-carbon healthcare alternatives by reducing the reliance on in-person consultations. Politically, the intervention supports national objectives on youth mental health and offers a scalable model for university health systems. Societally, early digital intervention may mitigate mental health crises, enhance academic success, and alleviate long-term public health burdens.

**Keywords:** Youth mental health, Digital intervention, Depression prevention, Suicidal behavior, Mobile health (mHealth), AkiliBora app

## Quality Improvement of Hides and Skins in Garissa Sub-County through Capacity-Building of Slaughter Operators, Flayers, and Traders

<sup>1</sup>Julius M. Huho, <sup>1</sup>Irura Ng'ang'a, <sup>1</sup>Ahmed Warfa, <sup>1</sup>Ahmed Maalim, <sup>1</sup>Kevin Macharia, <sup>2</sup>Peris Wainaina, <sup>2</sup>Heckman Ochieng, <sup>3</sup>Elizabeth Masai, <sup>4</sup>Kennedy Nyaga, <sup>5</sup>Peter Wekesa

<sup>1</sup>Garissa University

<sup>2</sup>Kenya Leather Development Council

<sup>3</sup>County Government of Garissa

<sup>4</sup>REDDAMAC Leather Centre

<sup>5</sup>Kenya National Qualification Authority

Email: [kevinngangal6@gmail.com](mailto:kevinngangal6@gmail.com)

The "Quality Improvement of Hides and Skins in Garissa Sub-County through Capacity Building of Slaughter Operators, Flayers, and Traders Project" addresses the persistent issue of production of poor-quality hides and skins in Kenya, primarily resulting from man-made defects during flaying and handling. A collaborative baseline survey by Garissa University, Kenya Leather Development Council, REDDAMAC Leather Centre, Kenya National Qualification Authority and the County Government of Garissa sought to establish the current state and challenges facing the hides and skins sector in Garissa Sub-County and provide actionable insights to enhance the quality and economic benefits of hides and skins for the local households. Data was collected from livestock owners (butchers), flayers and hides and skins traders through random and purposive sampling methods. Structured interviews and focus group discussion were the main methods used for data collection. Data was collected from 60 livestock owners (butchers), flayers and traders using structured interviews and focus group discussions. Findings revealed that flaying, often an apprenticeship-based and male-dominated practice, prioritized quantity of carcass slaughtered over the quality of hides/skins due to a lack of market. Consequently, hides and skins in Garissa Sub-County were perceived to be of zero value, leading to their neglect during flaying, resulting in disposal or minimal sales. The observed defects included flay cuts, poor handling and staining, exacerbated by inappropriate flaying knives, absent market incentives, limited flaying skills, inadequate storage and policy gaps. To address these challenges, the project has developed a training manual for educating slaughter operators, flayers and traders on proper slaughtering, curing, and storage methods and who will be certified through Recognition of Prior Learning (RPL). A leathercraft has been established and training started on production of leather products at Garissa University. However, the establishment of direct market linkages, revival of local tanneries, promotion of cottage industries and support for cooperatives to foster sector growth is recommended.

**Keywords:** Leather, Hides, Skins, Capacity-Building, Garissa County

## Capacity Building for Job Creation and Growth of Leather Goods and Footwear Manufacturing Enterprises in Kenya

<sup>1</sup>Paul Tanui, <sup>1</sup>Benson Ongarora, <sup>1</sup>Raja Kannan, <sup>1</sup>Louret Atsenga, <sup>2</sup>Mercy Kyalo, <sup>3</sup>Consolata Njai

<sup>1</sup>Dedan Kimathi University of Technology

<sup>2</sup>Yallo Leather Limited

<sup>3</sup>Rukira Vocational Training Centre

Email: [paul.tanui@dkut.ac.ke](mailto:paul.tanui@dkut.ac.ke)

Presentation Type  
Oral

Leather sector has a potential to create the much-needed jobs in Kenya. However, the sector's projected growth is yet to be realised. This project was aimed at establishing the gaps that exist, after which selected participants were trained as a way of building their capacities in relevant areas. The training was organised into three phases each spanning over about a week. A survey was conducted in the selected counties namely; Nyeri, Nyandarua, Isiolo, Kisumu, and Nakuru. The survey involved about 20 participants from each county, out of which 5 were selected for capacity building. Although the training was mainly conceived for the youth, women and those living with disability, in some counties, it was found that the target groups could not be achieved. Further, the stakeholders in footwear and leather goods sector in most counties lacked a formal structure to support their activities. In addition, a significant number of participants had either Primary or Secondary education, which impacted the curriculum delivery. Upon selection, successful candidates were invited for Phase One training which took place at Dedan Kimathi University of Technology (DeKUT) from March 2024. 24 trainees attended Phase One of the workshop where participants were taken through the whole leather value chain. Phase Two workshop was held at Rukira VTC in September 2024 andt focused on leather goods manufacture. It covered design, patternmaking, cutting, skiving, stitching, and finishing. During the final phase, trainees covered leather footwear manufacture including pattern making, pattern-cutting, skiving, clean stitching, lasting, construction of shoes, and finishing techniques. Furthermore, 19 students of Rukira VTC who were not among the initially selected trainees also benefitted during the final phase, making the number of beneficiaries to be 39. Overall, the consortium was able to deliver the project within the stipulated timelines and budget lines.

**Keywords:** Leather, Value-addition, Training, Workshop, MSMEs



**National Commission for Science Technology and Innovation (NACOSTI)**

**off Waiyaki Way, Upper Kabete,**

**P. O. Box 30623, 00100 Nairobi, KENYA**

**Mobile: 0713 788 787 / 0735 404 245 / 020-8001077**

**E-mail: [customercare@nacosti.go.ke](mailto:customercare@nacosti.go.ke) / [info@nacosti.go.ke](mailto:info@nacosti.go.ke)**