



MACHAKOS UNIVERSITY

Soaring Heights in Transforming Industry and Economy

BIANNUAL RESEARCH AND INNOVATION BULLETIN



FUNDAMENTAL STATEMENTS

Our Vision

A preferred University of Excellence in Scholarship and Service
Delivery

Our Mission

Provide scholarly education through Training, Research and
Innovation for Industrial and socio-economic transformation of
our communities

Our Identity

Machakos University is an academic institution committed in
transmitting knowledge, skills and attitude through science,
Technology and Innovation for the benefit of humanity

Our Philosophy

The Philosophy of Machakos University is to provide transformative
leadership in Teaching, Training, Research, Innovation, Industrial
and Technology transfer for wealth creation

Core Values

Integrity
Accountability
Professionalism
Inclusivity
Creativity
Teamwork
Equity

What's in this issue



Machakos University Elicits Thoughts on Green Growth and Green Economy.....page 4

Biosafety Concerns Clarified.....page 9



MksU Shines at the Agricultural Society of Kenya South Eastern Machakos Branch Show.....page 10

MksU Embraces Renewable Energy Technology Transfer.....page 12



Machakos University Dons Speak at the Blue Economy Conference.....page 16

Machakos University Now Bear Fruits as Partners Win United Nations (UN) and Swedish International Development Cooperation Agency (SIDA) Collaborative Grants.....page 21



Machakos University Wins At Konza Smart Cities Challenge.....page 22

Well Done Prof. Benjamin Onyango: Carnegie Scholar Winds Up his Visit.....page 24



Dr. Mark Kimathi Gets the Inter University Council for East Africa (IUCEA) Staff Mobility Award.....page 25

Machakos University Shine in the Scholarship World.....page 25



Machakos University Student Seeks to Close Election Malpractices.....page 26

Editorial team

Dr. Wycliffe Amukowa – Chairman
Ms. Nancy Ingoshe – Member
Ms. Elizabeth Mbatha – Member
Ms. Lucia Daisy Mbithe –Member
Mr. Moses Marwa –Member
Ms. Rachael Kibe –Member

Editorial

On behalf of the Editorial Board, we are pleased to present our first issue of the series of Machakos University Biannual Research and Innovation Bulletin, in which we highlight our achievements and the activities for the Third and Fourth Quarter of the Financial Year 2018/2019. The editorial board dedicated a monumental amount of time and energy towards producing this Issue and will always endeavor to do so. We would like to thank the University Management and the entire Machakos University fraternity for support towards enhancing research, innovation and technology transfer.

This publication covers a wide range of research, innovation and technology transfer including but not limited to funded research and development programs, scholarly publications, dissemination of research findings and community engagements, innovations and visiting scholars. We extend our appreciation for all your efforts and achievements and best wishes to you for your generous support as we pursue our University mission: Provide scholarly education through Training, Research and Innovation for Industrial and socio-economic transformation of our communities. We hope that you enjoy reading the newsletter and that the ideas can help to shape the current dialogue and strengthen our research and innovation agenda.



*Dr. Wycliffe Amukowa, PhD
(Registrar- Research, Innovation & Linkages)
and Chairman, Editorial Board*

FROM THE DEPUTY VICE-CHANCELLOR (RESEARCH, INNOVATION & LINKAGES)



***Prof. Peter N.
Mwita, PhD***

Universities are the drivers of socio-economic growth and development. In every agenda, whether national or international, there is a mention of the contributions of research and innovation for sustainable development. The Mission of our University has at its heart, “Research and Innovation”, as the justification for the creation of the Division of Research, Innovation and Linkages. The Division recognizes the benefits of research, innovation and collaborations in the national agenda including but not limited to Kenya Vision 2030 and “The Big Four Agenda” and the general aspirations of sustainable development. This way, it cannot be overemphasized that the Division has a duty to spur sustainable research outputs and innovations.

With many research activities now taking on a global dimension, it is imperative to discuss approaches towards achieving sustainability in the facets of development broadly conceptualized to include socio-economic, political, moral and human growth. In socio-economic terms, people need and want to earn a living that is beyond hand to mouth; politically, people want good leadership and governance; morally people want a virtuous life by appreciating character virtues among others. When it comes to research and academic conferences towards sustainability, the concern is on inculcating best research integrity practices, including examining the role of academic publications in setting the standards for sustainable development. We have with us today an opportunity to engage in stimulating research, innovation, technology transfer and production whose outcomes should equip stakeholders on the best ways to achieve sustainable development, that is maximizing the use of available opportunities and resources while being mindful of future generations.

***Prof. Peter N. Mwita, PhD,
Deputy Vice Chancellor,
Research, Innovation and Linkages***

MACHAKOS UNIVERSITY ELICITS THOUGHTS ON GREEN GROWTH AND GREEN ECONOMY

Thoughts on the place of Green Growth towards the realization of sustainable development went high during the 2nd Machakos University International Conference. Under the theme: Supporting Green Growth and Knowledge Economy through Research, Innovation and Technology for Sustainable Development, the Conference ran from 24th-26th April, 2019 and drew participants from across the world. Papers and discussions revolved around the following Conference Sub-themes:

1. Agriculture, Food and Nutrition Security
2. Health care, Leisure and Tourism Innovation
3. Language, Culture, Social Equity and Governance
4. Built Environment and Infrastructure Development, Industrialization: Emerging Technologies, Manufacturing & Agro-processing
5. Energy, water, climate Change and Environmental Sustainability
6. Mathematics, Statistics & Data Science, Basic and Applied Sciences
7. Issues in Education and Training
8. Business, Entrepreneurial Innovation, SMEs & Marketing



Dr. Pacifica Ogola, who represented the Cabinet Secretary Hon. Keriako Tobiko reads the opening the address

The Conference was officially opened by the Cabinet Secretary for Environment and Forestry, Hon. Keriako Tobiko, who was represented by Prof. Pacifica Ogola, a senior Ministry official. In his opening speech, the Cabinet Secretary noted that the Conference was an avenue to find practical and flexible approaches for achieving concrete, measurable progress across economic and environmental pillars while taking full account of the social consequences of greening the growth dynamics of economies. Consequently, it translates into the appreciation of the fact that the focus of green growth strategies is ensuring that natural assets can deliver their full economic potential on a sustainable basis. This potential includes the provision of critical life support services – clean air and water, and the resilient biodiversity needed

to support food production and human health. In turn, these are the basic foundations of the Government of Kenya's Big Four Agenda: Manufacturing, Food and Nutrition Security, Housing and Affordable Healthcare.



(To the left) MksU Council Member, Mr. Richard Mativu (and to the right) Members of staff follow the Opening Address

The official opening ceremony was also addressed by the Chairman of Machakos University Council, Prof. Gideon Hanjari, who was represented by Council Member, Mr. Richard Mativu. The Chairman said that the Council is cognizant that conferences provide opportunities for researchers, innovators, policy makers, employers among other stakeholders to share their experiences on pertinent issues. He further said that the Council will continue to promote infrastructure that can promote cutting-edge research in line with the three pillars of the Vision 2030 and the Government Big Four Agenda.

“We hope to pursue areas of interest that can increase research funding through grant proposal writing and engagement with other development partners. Apart from research, we need to develop and/or adapt innovations that can improve the quality of life of our people. I call upon members of staff of Machakos University and all other participants to be committed to scholarly undertakings to make our research and innovation outputs visible.” The Chairman said.

In her opening address, the Vice-Chancellor, Prof. Lucy Irungu, who was represented by the Deputy Vice-Chancellor (in charge of Administration, Planning & Finance) Prof. Douglas Shitanda said that the concept of sustainable development which the conference theme rode on was conceived by the United Nations in 1983 and now it has become a norm and as a pattern for social - economic transformation in many countries around the world.



Prof. Douglas Shitanda, reads the Vice-Chancellor's Official Address



The Deputy Vice-Chancellor (Research, Innovation & Linkages) and also the Chairman, Conference Planning Committee Prof. Peter Mwita, makes his official welcoming remarks

Prof. Irungu noted that Africa has lagged behind for many centuries due to simple reasons of not modeling their economies based on technology and science. She hoped that the discussions and knowledge dissemination in the conference will add value to the ongoing global debate on green growth and knowledge economy through research, innovation and technology.

In his welcome remarks, the Deputy Vice-Chancellor (Research, Innovation & Linkages) and also the Chairman, Conference Planning Committee Prof. Peter Mwita, told participants that the Second Conference focused on Green Growth as a driver of Sustainable development, a domain that informed the theme: Supporting Green Growth and Knowledge Economy through Research, Innovation and Technology for Sustainable Development. The essence is to find strategies for sustaining economic growth and job creation necessary to reduce poverty in the face of worsening resource constraints and climate crisis. Prof. Mwita urged all the participants in the Conference, to explore and deliberate freely on the strategies that would provide solutions to global challenges facing green growth so as to achieve sustainable development as was reflected in the Conference sub-themes.



Moi University Deputy Vice-Chancellor (Academic affairs), Prof. Isaac Kimengi (Left) joins other participants at the Official Opening Ceremony.



(Left) Prof. Gill making her Keynote Address (right) Prof. Fabio Santoni Making His Keynote Address

From the Conference, it emerged that:

1. The 2nd Annual International Conference elicited a deep reflection on the role of research, innovation and technology in the realization of the global, regional and national aspirations as espoused in the UN Sustainable Development Goals, AU Agenda 2063, Kenya Vision 2030, and the Kenya Government's Big 4 Agenda.

2. On research and evaluation, it emerged that realist approaches could provide another frontier characterized by analysis of contexts, mechanisms and outcomes. A key focus of realist approaches is the analysis causality in a bid to decipher which programmes work best, to whom, and why. All this is critical for sustainable development.

3. It also emerged that challenges of the 21st Century which have been conflated into the Big 4 Agenda in the short term in Kenya cannot be adequately addressed using approaches devoid of creativity and innovation. This calls for more critical, creative and design thinking initiatives for sustainable development. Climate change, food security, environmental conservation, manufacturing and housing can be addressed through innovative technologies, systems and processes.

4. Universities need to come down from the ivory tower and partner with Industry and Communities to help in finding solutions to the challenges they encounter. Let us initiate conversations on how to upscale resources for the creation and operation of innovation hubs in a bid to spearhead sustainable development.

5. From the constellation of presentations and exhibitions, one readily notices that virtually all spheres of human knowledge have a stake in green growth and knowledge economy for sustainable development. The implication is that everyone discipline is a part-solution to key global challenges. Let us push the agenda for collaborative research, innovation and technology development with renewed vigour and energy.

6. We need a framework for stakeholder engagement with the aim of developing policies that support research, innovation and new technologies in our institutions. We need to scale up funds and incentives that can spin this wheel towards sustainable development.

7. As a way forward, we need collaborations, networks and synergies coalescing into consortia of multi-disciplinary, multi-institutional, and multi-national outfits in pursuit of grants to undertake projects addressing cross-cutting concerns.

8. We need to start engaging stakeholders such as Commissions for University Education, Ministries of Education, and University Management Boards on the urgent need for recognition and support for innovation and technology development. We need to find mechanisms for translating our research outputs into real actions to improve the quality of life.

Curtains fell on the 2nd Annual International Conference on 26th April, 2019 with official address from Prof. Chacha Nyaigotti-Chacha, who is the Chairman, Commission for University Education. In his closing address, Prof. Chacha noted that the Conference was a success and presentations were of high quality and thanked the participants for their zeal. He said that the Conference theme was relevant as the world looks for ways to tackle climate change and related challenges in the light of sustainable development.

"It is indeed gratifying to see that scholars have travelled across the world, from South Africa, Malawi, Ghana, Uganda, Australia and Italy to come and share their thoughts on green growth and sustainable development. The world is a wake." Prof. Chacha said.

Prof. Chacha urged the participants to continuously mentor the upcoming young scholars to participate in conferences as one to ensure a generation of scholars and researchers. He said that established scholars could motivate their students from undergraduate to postgraduate to cultivate a research and scholarship culture.

"I congratulate Machakos University for such a wonderful Conference. I happened to have attended the first conference, and I can for sure attest that Machakos University is doing well, and I pledge my total support. I now declare Machakos University 2nd Annual International Conference, officially closed"



Prof. Chacha-Nyaigotti-Chacha making official closing address

Sharpening Grant Proposal Writing and Intellectual property Skills.

Machakos University embarked on a journey of imparting skills to its members of staff on how to spot research grant opportunities, write award-winning grants, manage grants, and protect intellectual property rights. Some of these include:

a) Hands on Training on research grant proposal writing: The training was an opportunity for staff to gain insights on research grant proposal writing with real opportunity for practical trainings by experts from Kenyatta University and Prof. Benjamin Onyango (Visiting professor from Missouri state university). The practise has seen an increase in the number of proposals by members of staff most of which have received favorable consideration.

b) Intellectual property rights training: Innovations and new technology cost a lot of time, financial resources and effort and could be one of the avenues to create jobs. It becomes imperative to protect, commercialize and industrialize the innovations and technology that come from both the staff.



Dr. Runo (Chairman of the department of Biochemistry -Kenyatta University) one of the experts taking the trainees through grant proposal writing

BIOSAFETY CONCERNS CLARIFIED

Agricultural biotechnology debate oscillates between two extreme views. On one hand are the diehard proponents of biotechnology who are impatient to have technology adopted at all costs and present it as the magic bullet and panacea to the multitude of problems facing many countries. On the other hand are anti-biotechnology groups whose front concerns for human health and environmental wholesomeness are reasons to stop technology. The public as consumers and policy makers are bewildered as this debate goes on over their heads and has international dimensions as proponents who are quick to point to the successes of technology elsewhere while the opponents look to for example Europe and the crises that have been witnessed there which have undermined public confidence in the regulatory systems. It is against this background that Machakos University held a Public Lecture on the topic **“Discourse on Public Perception on Biotechnology: Role of Biosafety Regulations in Kenya and Concerns in GMOs”** at the Machakos University Hotel and Conference Centre.

The lecture was intended to provide deeper understanding of the GMOs concerns and Biosafety regulations in Kenya, with a shared American experience in public perceptions. The event was opened by the Hon. Naomi Mutie, the Machakos County Chief Executive Committee (CEC) Member for Water, Irrigation, Environment and Natural Resources, who was the chief guest. The Chief Guest not only highlighted the interest of Machakos County government in embracing new technologies, but also expressed concerns that inadequate information on technologies such as GMOs may delay their adoption. She reiterated the importance of public discussions in helping to demystify myths surrounding GMOs, especially among persons playing the role of change agents in the society.

The main speakers were:



Professor Dorington O. Ogoyi

Professor Dorington O. Ogoyi, Ph.D, CEO of National Biosafety Authority. Prof. Ogoyi spoke on Biosafety Regulatory Framework in Kenya. He informed participants that there were no commercial GMO products in the country, but two crops (Bt Cotton and Bt maize) had been granted approval for advanced evaluation (Environmental Release – National Performance Trials) to test their suitability for commercial use.

Professor Benjamin Onyango, Ph.D, a visiting Professor at the School of Business and Economics, from College of Agriculture, Missouri State University, U.S.A. Prof. Onyango spoke on Public Perceptions of Food Biotechnology, drawing on empirical work conducted in USA, European Union and some Asian Countries. In general, studies show inadequate information on GMOs among the public, and fears regarding the perceived effects of GMOs on human health and the environment.



Professor Benjamin Onyango

MKSU SHINES AT THE AGRICULTURAL SOCIETY OF KENYA SOUTH EASTERN MACHAKOS BRANCH SHOW

Machakos University out-performed other exhibitors during the Agricultural Society of Kenya Agricultural (ASK)- South Eastern Machakos Branch Show that was held from 26th to 29th June 2019 Ground, under the theme “Innovation and Technology in Promoting Agricultural Trade”. The Vice-Chancellor, Prof. Lucy Irungu, who was represented by the Deputy Vice-Chancellor (Research, Innovation and Linkages), Prof. Peter Mwita graced the occasion as Chief Guest on the second day of the Show.



(Left): Prof. Mwita Tours judiciary Stand



(Right): Prof. Mwita is introduced to Show Officials



(Left): Prof. Mwita displays his soccer skills (Right):Prof. Mwita is saluted by Kenya Police Parade



Represented by various groups of vibrant innovators, technologists and agricultural specialists drawn from both the students and staff, Machakos University scooped the following awards: **The best stand embracing Information Technology and Communication system;** and the stand that best interprets current show Theme in Education and Research.



Machakos County Deputy Governor Eng. Maliti (Centre in a red tie), DVC-RIL Prof. Peter Mwita in a photo session with the innovators of Ivoting System, one of the most impressive innovations at during the Show



Machakos County Deputy Governor Eng. Maliti (Centre in a red tie), DVC-RIL Prof. Peter Mwita and MksU ASK Committee Chairman, Dr. Jacob. J.J.O. Konyango in a photo session

The best University Stand



Deputy Vice-Chancellor (RIL) Prof. Peter Mwita and the Machakos University ASK team in a group photo in front of the University Show Stand.

The University also emerged 2nd best in **Hospitality and Catering services category** and the best stand in **Services in the Health Sector category**.



MksU EMBRACES RENEWABLE ENERGY TECHNOLOGY TRANSFER

The University has established the Centre for Renewable Energy (CREN) to harness the potential of green energy. The Centre is now conducting short courses and demonstration as a medium of transferring this technology to the society. Through this, Machakos University is now developing the much-needed human capacity (technical training) in the country, promote and advance innovation in the field of renewable energy technologies, as well as to generate and disseminate knowledge (awareness) and serves as a focal point for renewable energy projects.



Participants follow keenly a demonstration on solar energy during a T3 Grid-Tie training on 11th April 2019

The Centre has so far held several trainings targeting different groups and individuals in Solar Photovoltaic Technology. The trainees thereafter were ready for T1/T2 Technician Licensing by Energy and Petroleum Regulatory Authority (EPRA). The courses offered at the centre target groups but not limited to individuals from government, public or private institutions, electrical installation technicians, PV engineers, Solar EPC contractors, lecturers, technical institute tutors, NGO's outreach personnel and Solar Photo-Voltaic retailers.

The centre is currently partnering with Swedish and German companies to install a mega Solar PV Plant and solar water heating system at the university which both will support and enhance hands-on demonstrations in the current Solar PV professional short courses being offered by the centre, reduce power bills within the university, promote research, innovation and technology transfer.

The Library Expands the Quest for Intellectual Discovery and Lifelong Learning

Machakos University vested with the traditional roles of acquiring, organizing and disseminating information has its library advance the quest for intellectual discovery and lifelong learning by fostering the creation, sharing and preservation of knowledge in the University as it is the nerve centre of the institution which provides a leading intellectual and learning environment that creatively fulfils the needs of its users. This is achieved by acquiring, organizing and disseminating a diverse array of resources as well as providing expertise assistance to users. The facility benchmarks itself with global best practices and Commission for University Education Guidelines (2014).

Moreover, it offers a wide range of services such as information literacy, access to resources (Print & E-resources) and reprographic services amongst many others. These services are manned by qualified cadre of eighteen members of staff who create avenues for knowledge creation and sharing through conducting in-house training and regular deskilling of members.



Library Staff Attending In-House Training

The Library Embraces RemoteX to Increase Access to Its Resources: the provision of relevant and up to date services to users' form a part of core mandate of research and academic libraries. In this vein, the University has procured an e- resource off campus access RemoteX Software that promotes usage of e-resources. Library users can conduct their research activities remotely and disseminate the findings through the institutional repository



The Librarian training students on how to use the Institutional Repository and RemoteXs Off Campus Access

Institutional Repository Promotes Open Access to Research and Knowledge

The repository has provided the university scholars with an avenue to promote their research work and enhance public access to their intellectual output and this has enhanced the visibility of the institution and promoted free access of new generated knowledge at a single interface among other advantages. Currently, Machakos University digital repository has a total of 4,404 digital documents. In 2018, the University created an institutional repository to collect, preserve and disseminate digital copies of the intellectual output. The Institutional Repository (IR) prides invarious merits including:

- Collecting, preserving and distributing digital materials available at Machakos University
 - Enhancing the visibility of the University and promoting free access of the research at a single interface.
 - Facilitating Webometric ranking
 - Members of staff are increasingly becoming aware of the benefits of the IR and open access and are therefore submitting their research for uploading and this has promoted staff visibility
- Besides the IR, it is mandatory for Machakos University staff to have Google Scholar accounts. This makes it easier for the library to harvest research by Machakos University researchers. The Google Scholar Account:

- 1) Enhances visibility of Scholars- citations on Google scholar
- 2) Increases collaborations with the global research community
- 3) Facilitates availability of Reference materials for Scholars
- 4) Lead to invitations to conferences as key note speakers for members of staff.

Putting an End to Plagiarism: Turnitin Anti-Plagiarism Software Procured

To enhance the quality research output and ethical issues, the University has procured Turnitin anti-plagiarism. Consequently; Machakos University staff and students shall test their work for plagiarism using this software. Scholarly work such as research proposals, projects and theses should have an overall similarity index of less or equal to (20%) and less or equal to two percent (2%) from individual articles or documents.

Any scholarly work that is found to have an overall similarity index of twenty percent (20%) or above shall be rejected. Penalties shall apply to all concerned parties once any scholarly work is deemed as plagiarized. Penalties for detected cases of plagiarism by MksU community shall depend on the degree of similarity to other people's works as follows: -

- a) Plagiarized work ranging from 21% to 50% shall be classified as minor. The offender may be penalized as follows:
 - i. Retraction of work(s)
 - ii. Warning
 - iii. Academic Counselling
 - iv. Resubmission of work after alteration
- b) Plagiarized work above 51% shall be classified as major which is serious literary theft. The offender may be penalized as follows:
 - i. Expulsion
 - ii. Blacklist
 - iii. Revoke recognition /award(s) or both
 - iv. Dismissal
 - v. Legal action

Information Literacy Training Outreach Initiatives

As part of open access initiatives, the library staff also conducts Information Literacy training sessions for users. This has yielded results since usage of resources has increased tremendously. The faculty is expected to offer guidance to students on academic integrity, standards and policies that guide quality academic writing. Further the Library engaged community service initiatives, by hosting several secondary and primary schools. Visitations create avenues for mentorship and linkage with institution's stakeholders.



Fr. Makewa High School outside the library



Fr. Makewa High School during the library visit

Electronic Security System Installed in the Library

To safeguard the University books and other information resources, the Library boasts of installation of an electronic security system.



Library staff tagging books in preparation for intergration with the library security system



Library Electronic system

Library opens to the public users

The library allows members of public to access its resources. This is done by making a formal request to the Vice-Chancellor through the office of the Deputy Vice-Chancellor (Research, Innovation and Linkages). However, charges for such services apply and the application form for public users is available through the library website.



Students and members of the public studying in the library

MACHAKOS UNIVERSITY DONS SPEAK AT THE BLUE ECONOMY CONFERENCE



Dr. Cornelius Okello (pictured) from the School of Environment and Natural Resources Management and Dr. Patricia Muendo, from School of Pure and Applied Sciences were speakers during the Sustainable Blue Economy Conference held in Nairobi, Kenya from 26th to 28th November 2018. The two scholars and researchers were nominated by the Ministry of Foreign Affairs. This was the first global conference on the sustainable blue economy that aimed at harnessing the potential of our oceans, seas, lakes and rivers to improve the lives of all, particularly people in developing states, women, youth and Indigenous peoples and to leverage the latest innovations, scientific advances and best practices to build prosperity while conserving our waters for future generations. Over 4,000 participants from around the world came together to learn how to build a blue economy. Dr. Cornelius Okello made a presentation on “Climate Action, Water Management and Pollution-free aquatic Systems”. We congratulate our dons on this achievement.

Winners of 2nd Round of Machakos University Internal Research Grants Announced

The second call for internally funded research proposals 2018/19 closed on 30th September, 2018. A total of 23 proposals were received and reviewed by both internal and external reviewers. Nine (9) proposals were shortlisted for award from which eight (8) were awarded as shown in the table below.

No	Name of Project	Principal Investigator	Partners	Amount Awarded in Kshs.
1	Management and Use of Sewage Water in Machakos Town And Its Implication to Human Health	Dr. Julius Kioko Nzeve	Prof. (Eng.) Douglas Shitanda, Prof. Fuchaka Waswa	700,000
2	Entrepreneurial Competencies and Performance of Dairy Cooperatives in Machakos County	Margaret Nganu	Margaret Musyoka, Benedict Mutuku	699,862
3	Artisanal Mining and Food Security: Mitigating Strategies and Policy Framework for Kenya	Prof. Robert Arasa	John Achuora Dr. Cornelius Okello	696,000
4	The Relevance of Science, Technology, Engineering and Mathematics Programmes in Universities on Meeting Industry Needs in Kenya	Dr. David Mulwa	Prof. Josphat Kiweu Dr. Pamela Muriungi Dr. Jacinta Kinyili Dr. Richard Kimiti Prof. James Muola Ms. Angeline Mwambu	700,000
5	The Impact of Blockchain Technology on Insurance Business Models: A case of Kenya	Prof. Douglas Shitanda	Mr. Watson Kanuku Ms. Margaret Nganu	700,000
6	Modelling the dynamics of emergency evacuation from a lecture hall at Machakos University	Ngesa Joel Ochola	Japhet Kiragu Mark Kimathi	700,000
7	Development of High Stress/Strain Resistant Concrete Composite Paving Cabro Blocks	Eng. Mwalimu K. Musau,	Prof. (Eng.) Douglas Shitanda Mr. Michael M. Githinji	698,275
8	Modelling Production of Oyster Mushroom (<i>Pleurotus ostreatus</i>) for Food and Nutritional Security in Machakos County	Martin Kasina	Dr. Marther Ngigi Dr. Elijah Muange Dr. Alice Kosgei Dr. Julius Nzeve Kioko Hellen Ndinda	700,000

Awardees of 1st Internal Research Grants Wind up Their Projects

In the financial year 2017/2018, the University initiated a competitive annual research grant for faculty members and funded 8 staff (with a total grant amount of Kshs. 3.75 Million) in various research areas. Some of the beneficiaries of this grant, who are now finalizing their research projects are:

BENSON WANG'OMBE NG'ANG'A

Solar Water Desalination in a Vacuum of Infinite Volume



Presence of fluoride in drinking water sources is a global concern as it causes dental and skeletal fluorosis. This leads to health complications, because the bones of the victims are weakened and results to disability. Furthermore, it affects children personality, especially when their teeth are attacked and tan; smile is beauty. The most common water desalination method is reverse osmosis but it is an expensive undertaking in terms of electric power bills and it is also not accessible to the poor. Places like Kitui, Njoro, Naivasha, Turkana and Baringo, dental and skeletal fluorosis is real. Coincidentally or fortunately, these areas enjoy massive solar energy which can be harnessed to desalinate water sources. A research is currently underway in Machakos University, to apply solar thermal energy to pre-heat water before it is sent into a vacuum created

and based on the principle of barometric height. This is illustrated in the figure. Here, reduction in pressure, cause water to flash or in a more common word, boil, at temperatures below room temperature. Condensing water is then trapped and channeled for drinking purposes. The volume of the vacuum is made infinitely large to counteract negative effects of the non-condensable gases, as they can lead to its rapid depletion. A degassing unit will also be installed to remove these gases before they enter the vacuum.

DR GEOFFREY MAROKO

The Impact of Research Infrastructure on the Quality of Postgraduate Research Outputs in Selected Kenyan Universities.



Researchers 1) Dr. Geoffrey Maroko 2) Dr. Sophia Njeru 3) Dr. Larry Ndivo

The grant awarded by Machakos University for the project was Kenya Shillings four hundred thousand. The specific objectives of the project are to: evaluate the postgraduate research support infrastructure in selected Kenyan Universities; assess how the research infrastructure impact the quality of research training; evaluate the quality of postgraduate research outputs in the universities.

An Investigation of Factors Influencing Maize Productivity in Kenya: A Case of Selected counties (Trans-Nzoia & Machakos)



The purpose for this study was to investigate input-production factors for realization of optimum productivity of maize in Trans-Nzoia and Machakos counties. The study adopted descriptive survey design which was used to obtain information to describe the existing phenomena. The target population was farmers in the two counties. The examining system utilized was the multistage stratified arbitrary inspecting strategy. Data collection was done through the use of questionnaire, focus group discussion and interview schedule. The study found that maize productivity is affected positively by the land of size, amount of seed planted, amount of fertilizer used and amount of pesticide used. The study revealed that amount of manure and human labour used were statistically insignificant hence they

can exclude in the model. The study also found that credit accessing Machakos County had positive influence on maize productivity and was significant at 5% level. The results indicated that a unit increase in the access to credit maize productivity by 13.046 units. The other variables that had positive significant influence on maize productivity include farming experience, extension services, group membership, education level of the farmer, size of the family and household income. This study concludes that the government should ensure that the farmers get farm inputs in time and at good price in order to enable them produce more crops. This will grow the economy and therefore address the issue of unemployment. On addition the government should put more money on the sector of agriculture to ensure there is an easy working channel by the farmers to improve maize production and also consider to revise the Land tenure system.

PROF. JAMES MUOLA (LEAD INVESTIGATOR)

Practical Mentorship Model for Raising Learning Outcomes among Academically Low Achieving Students in Machakos University

Researchers: 1) Prof. JamesM. Muola, (Principal investigator), 2) Dr. Wycliffe Amukowa (Co-Principal Researcher), 3) Dr. David Mulwa (Researcher) and 4) Dr. Peter Kimiti (Researcher)



This research project was motivated by the fact that the academic performance of university students has been deteriorating despite the existence of student mentorship programmes that do not seem to be effective. According to the Audit Report of 2017 by the Commission for University Education (CUE), more than 30% of students were having issues with respect to their academic performance. Some of the areas of concern were; missing marks, high failure rates and too many examination disciplinary cases. A team of researchers from the School of Education attempted to address this problem through a research project focusing on the development of a model on academic mentorship to establish whether after subjecting low achieving students to a rigorous mentorship process can improve their performance and minimize the failure

rate. It was hypothesized that a well-structured and modeled academic mentorship programme will result into improved academic performance and progression rates among academically at-risk students and enhanced mentorship competences of faculty academic staff. So far, the baseline survey findings show that students have a fairly positive perception towards academic mentorship and that there is need for mentorship to address issues related academic orientation, examination preparation, development of a good study schedule/habits, maintaining high grades, setting academic and career goals among other areas.

Development of Hybrid Renewable Energy Production Digesters in Machakos County



The proposed research main objective is to design hybrid energy production digesters for sustainable energy supply in Machakos University and its surrounding community. This main project will be achieved through the following specific activities:

- 1.To perform load assessment of electricity demand for domestic and commercial use in Machakos University and its environs.
- 2.To assess Biomass and Solar thermal energy resource potential in Machakos County.
- 3.To fabricate and design small Solar-Biomass hybrid renewable production digester prototypes for available renewable energy resources.
- 4.To compare the operations of the hybrid digester prototypes with different bio-wastes to obtain the optimal production for use.

Objectives 3 and 4 were carried out simultaneously up to the end in March 2019. The project has incorporated a Masters student (MSc. Energy Technology) from the Institute of Energy and Environmental Technology (IET), JKUAT. The student is helping in the collection of data for objectives 1 and 2. He is expected to graduate by June 2019. The equipment and asset acquired so far in the implementation of the research project includes solar power pack, revolution counter, digester unit system, Tesla meter, bar foot solar lamps and generator coils.

Enhancing Community Participation in Sustainable Management of Chyulu Water Catchment in Southern Kenya. Principle Investigator: Samuel Kimani Kiumbuku School of Environment and Natural Resource Management



The research project is being done to enhance community participation of Chyulu water catchment with specific focus of determining utilization of Chyulu catchment resources by local communities, environmental impacts of human activities on the catchment; current institutional arrangement for community participation in the management of the catchment; and to identify the gaps if any in community participation in the management of the catchment. Despite being one of the most important dry land catchments in Kenya, Chyulu catchment has been largely degraded by inappropriate anthropogenic commercial and livelihood activities that include logging, farming, charcoal burning, and livestock

incursions. Its management has also been characterized by conflicts between conservation agencies and local communities concerning access and utilization of resources. After part of the catchment was gazetted as a national park, government conservation agencies have been working to completely keep community members out of the protected area. However this has led to prolonged confrontations with the communities whose livelihoods have depended on the catchment for decades. From the preliminary results of this project it was established that illegal encroachment into the catchment is still rampant and that these management efforts have not deterred further degradation. For purposes of sustainability in management of the catchment the project seeks to enhance co-management involving local communities and other stakeholders in order to establish consensus and a trade-off between conservation and community livelihood needs.



**Dr. David Wafula
Wekesa**

The Collaboration between Machakos University and Sapienza University of Rome and In-Quattro has begun bearing fruits after the three partners won a United Nations grant for their project entitled ‘BARIDI SANA-High Performance Micro-2-Phase Cooling Systems for Space Applications’ and is being implemented by three (3) institutions from two countries (Kenya and Italy), Sapienza University of Rome and In-Quattro in Italy and Machakos University in Kenya. The collaborative project seeks to conduct research and testing for the next generation of cooling systems for space applications by replacing ordinary liquid cooling loops with two-phase cooling systems.

The research areas involve microgravity fluid physics and space technology. The project total funding is USD 220,000 by the United Nation Office for Outer Space Affairs (UNOOSA). The project Co-PIs are Prof. Fabio Santoni and Dr. Wekesa. Dr. Wekesa and MksU team will coordinate design of a microgravity fluid physics model and simulate its application in a virtual space environment.

In another development, Dr. David Wekesa and a team of other collaborators from Ghana and Uganda won a grant from SIDA. Their project entitled ‘Enhancing Sustainability and Resilience of African Cities through a Water-Energy-Food Nexus Approach’ was applied and is being implemented by Water Research Institute of the International Council of Scientific and Industrial Institute (Ghana) and the Centre for Renewable Energy of the Machakos University (Kenya). The project seeks to adopt a nexus approach to address Water, Energy and Food (WEF) challenges in Nairobi and Accra as part of the Leading Integrated Research for Agenda 2030 in Africa (LIRA 2030 Africa) programme. The Project co-PIs Dr. David Wekesa (Kenya) and Dr. Fatuma Aziz (Ghana) will attend an inception, co design and co-production workshop in Accra in Ghana from 15th to 31st July, 2019. The project total funding is 90,000 Euros by the International Development Cooperation Agency (SIDA).



Prof. Fabio Santoni

INNOVATING FOR THE BIG FOUR AGENDA

Beginning 2017/2018 Financial year, Machakos University allocates funds to support innovation activities by students and members of staff within the University. The purpose of this fund is to offer students and staff opportunities to actualize their innovative ideas and patent their innovations. To be eligible, applicants must be full time student or member of staff at Machakos University. This fund is administered under Machakos University Students’ Innovation Challenge.

The Innovation Challenge is an annual call that seeks to offer student opportunities to make solid contributions towards socio-economic growth and sustainable development. The challenge is an opportunity for Machakos University students to strengthen their innovation and entrepreneurial skills. Students are asked to submit proposal(s) formulated in line a theme as provided in each call. A panel then selects finalists from all the received application, who are invited to pitch their ideas to a select audience and thereafter make funding decisions. The objectives of this call are to:

- i) Promote students’ creativity and participation towards social and economic development
- ii) Generate tangible prototypes and proven services to increase the university competitiveness in innovation
- iii) Provide an opportunity for students to actualize and patent their innovations.
- iv) Contribute towards the realization of the national, regional and global agenda

Several students have received funding for their innovations that are directly contributing towards the Big Four Agenda. These are projects are at different levels of development towards the attainment of registerable status by the Kenya Industrial Property Institute (KIPI) as Intellectual Properties (IPs).

MksU Innovators Win Various Awards

During the Africa Public Week held from 21st-23rd June, 2019 in Nairobi, the University presented eight (8) innovation entries (See table 1). The entries were adjudicated by officials from the Ministry of Education and NACOSTI. Out of 102 institutions that were adjudicated, the University won trophies in following two categories:

- a) The most promising hub/Centre of innovation.
- b) Institution with the highest number of innovators.

Table 1: Innovation Entries Presented at Africa Public Service Week

S/N	TITLE OF INNOVATION	INNOVATOR (S)
1	Electronic Voting System (EEVU)	a) Abisalom Okoth b) Charles Maina c) Moses Ongwenyi
2	SMART Hinge door alarm D	avid Wafula
3	Interoperability in healthcare system G	ladys Kaburu
4	Huduma Ng'ombe K	akuko Muketi
5	5-Axis CNC Machine	Ondari Maxwell
6	Millet thresher	Jasper Kaloli
7	Fairgram A	mbrose Oyamo
8	The King's Pyramid	a) Victor Karume Kariuki b) Emmanuel Matara

i. **Electronic Voting System (EEVU):** Is a web-based application that aims at making the voting process foolproof to give credible results in any election process.

ii. **SMART Hinge door alarm:** Is a multiple security sensor for doors and windows

iii. **Interoperability in healthcare system:** Is a healthcare management system

iv. **Huduma Ng'ombe:** Is a livestock insurance application for animal healthcare

v. **Fairgram:** Is a social media application enabling interaction between people and groups

vi. **Kings Pyramid:** Is a five-tower mind game.

vii. **5-Axis CNC Machine:** Is a 3 D Machine for making various types of spare parts

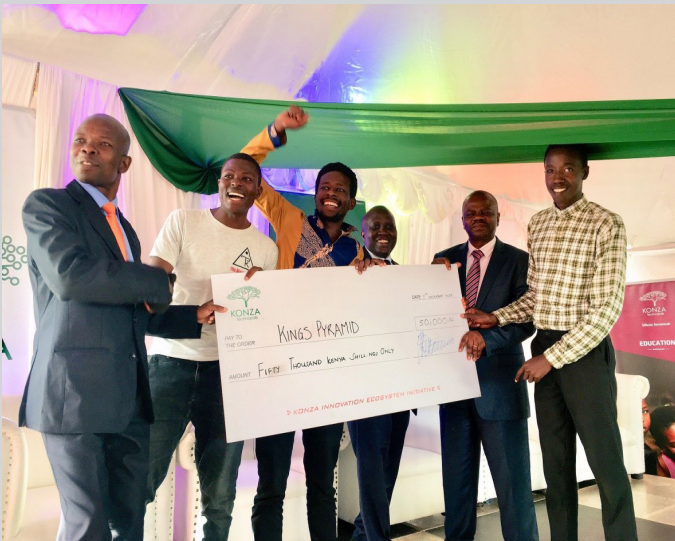
viii. **Millet thresher:** Is a grain (millet) cleaning machine.

MACHAKOS UNIVERSITY WINS AT KONZA SMART CITIES CHALLENGE

The University produced impressive innovations that won the hearts of many, during the Konza Technopolis Development Authority hackathon competition on Wednesday 5th, December, 2018 at Konza Technopolis City that brought a number of innovators from universities, colleges and the general public. In this event participants in groups of about 2-5 individuals, dived into an innovative way of problem solving. Two groups from Machakos University impressed the judges and won first and third prizes: **The Kings Pyramid and the Electronic Voting system.**

KINGS PYRAMID

King's Pyramid, developed by Mr. Victor Karume won the First Prize of Kshs.50, 000. It is 5-Mind Game collection concept aimed at aiding in brain development, multi-tasking & social skills as well as judgment and problem solving.



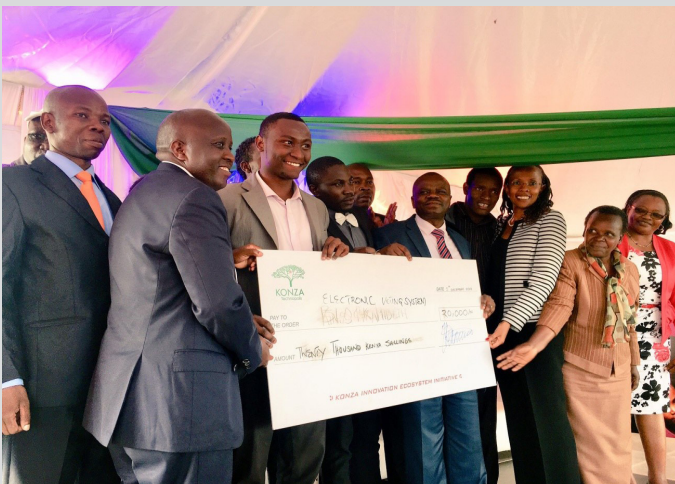
Mr. Victor Karume (2nd left) and his team members receive a cheque of Kshs.50,000 being the First Prize for their innovation (King's Pyramid) from the Principal Secretary, ICT Mr. Jerome Ochieng (2nd Right)



A group member plays King's Pyramid

The Electronic Voting system

Our students, led by Mr. Kevin Njoroge came up with an idea on an electronic voting system they hope could cascade from the university elections to national elections came 3rd in the Konza Smart Cities Challenge



Konza Technopolis Development Authority CEO, Eng. John Tanui presents a cheque of Kshs.20,000 being the 3rd Prize to the students who have come up with electronic voting system.



Mr. Kevin Njoroge explains how the electronic voting system works

WELL DONE PROF. BENJAMIN ONYANGO: CARNEGIE SCHOLAR WINDS UP VISIT

Machakos University hosted Prof. Benjamin Onyango, of Carnegie African Diaspora Fellowship from 1st April to 30th June 2019. The Carnegie African Diaspora Fellowship Program (CADFP) is a scholar fellowship program for educational projects at African higher education institutions. The fellowship is for scholars born in Africa who received their education in Canada or the United States. It gives them the opportunity to give back what they have learned and also contributes to brain circulation and global networking of ideas creating new knowledge in a non-hierarchical empirical. The fellowship has been going on for six years and is funded by the Carnegie Corporation of New York.

Benjamin Onyango is a Professor at the Department of Agribusiness, Agricultural Education and Agricultural Communication, College of Agriculture, Missouri State University, U.S.A. and a researcher in diverse areas of agricultural business. His extensive research includes: emerging food markets, Food security/safety and Agricultural risk-investment analysis. Prof. Onyango worked with his host Prof. Charles Ombuki, Dean, School Business and Economics.

During his stay in Machakos University, he together with Prof. Ombuki were able to accomplish the collaborative objectives which included;

- Creating a master's program in agricultural economics;
- Training and mentoring academic staff;
- Enriching agricultural economics related courses through review;
- Engaging with students in the program.



Prof. Onyango (2nd from left) with hosts from School of Business

Apart from his co-mandate, Prof. Onyango actively participated in various activities of the University, including Machakos University 2nd International Conference where he got an opportunity to attend and co-chair the session on the Sub-theme; “Agriculture, Food, Nutrition and Security” where he presented a paper on Organic Food Purchases in Emerging Food Markets. He was also a speaker during a public lecture ‘Public Perceptions of Food Biotechnology’ and spoke on ‘Public Attitude towards Biotech: The US Case’. Being a good mentor, he provided mentorship to the faculty and many upcoming scholars in the School of Business and School of Agricultural Sciences.

Dr. Mark Kimathi Gets the Inter University Council for East Africa (IUCEA) Staff Mobility Award



Dr. Mark Kimathi who is a senior lecturer of applied mathematics, and currently the Dean, School of Pure and Applied got the Inter University Council for East Africa (IUCEA) staff Mobility Award. Dr. Kimathi has since 21st July 2019, proceeded to teach Nelson Mandela African Institute of Science and Technology (NM-AIST) in Arusha, Tanzania for 3 months. He will mainly handle mathematical modeling with differential equations and numerical computations to postgraduate students in the School of Computational and Communication Sciences and Engineering (COCSE).

MR. AGUMBA DICKENS WINS GRADUATE SCHOLARSHIPS IN KOREA



Mr. Dickens Agumba who is a Lecturer in the Department of Mechanical Engineering got a PhD Scholarship at Inha University in South Korea which will see him proceed to teach Structural Mechanics in South Korea for a period of 3 years beginning from 22th August, 2019

DR. ELIZABETH NDUNDA WINS FUTURE LEADERS AFRICAN RESEARCHERS FELLOWSHIP 2019 AWARD



Dr. Elizabeth Ndunda, a Lecturer at Machakos University, won the Future Leaders –African Independent Research (FLAIR) fellowship grant (UK£300,000). This is after a competitive selection of her proposal in a pool of more than 700 applicants. The grant will extend for a period of two years in supporting her proposed research titled “Towards real-time in-situ determination of polychlorinated biphenyls using molecularly imprinted polymers-based sensors.” Her main research focus is on synthesis of molecularly imprinted polymers (so-called artificial receptors) for application in sensor systems and as adsorbents for detection of environmental pollutants of global concern

Ms. Monica Masake Awarded Africa Mental Health Phd Scholarship



Ms. Monica Masake from the School of Health Sciences has been awarded a PhD scholarship by Africa Mental Health to study at the University of Turku in Finland. This follows successful research collaboration with the School. Ms. Masake will join a strong team of mental health specialists to carry out her PhD studies around mental health Issues in University students, with Machakos University being one of the target populations. Ms. Masake travelled to the University of Turku in August 2019, for a five days’ research induction meeting. She holds a BSc in Nursing and a Master’s Degree in Quantitative Research Methods.

MACHAKOS UNIVERSITY STUDENT SEEKS TO CLOSE ELECTION MALPRACTICES



Kelvin Roman Njoroge

Disturbed by the effects malpractices every electioneering period, Machakos University, Engineering student, Kelvin Roman Njoroge has wondered through the odds and invented Intelligent Voting (iVoting), a foolproof computerized voting system. The intelligent voting system or iVoting, copyright, is the first ever self-replicating, adaptive voting system in the world designed to be a lasting global solution to all voting modes and to achieve free, fair, credible & secure voting. This coupled with its ease of use brings convenience to the voter to their doorstep. The system is designed for everyone regardless of location, race, class and network coverage and can be found at <https://ivoting.co.ke>. All this is made possible by the Veronica AI and secured by the custom made RACT Blockchain coupled with other security measures. The system

is designed on the domains of public or private environment. Private Environments are designed for specific people and voting topics and can range from politically motivated elections, board votes, student governing council elections to any other mode of election that the user deems suitable. They are created by the Environment Administrator who invites the users to participate in the poll. Public environments are created by the environment administrator with the aim of collecting public opinions. They can be accessed by everyone from the applications public page. In both environments, results are in Real Time and the standard rule is one user one vote and the data analysis module does the rest. The system aimed at achieving its vision of Peace in Technology, that of Machakos University, President Uhuru Kenyatta's Big Four Agenda and the United Nation's Sustainable Development Goals (SDGs). iVoting is a free service and can be accessed by anyone, anywhere and at any time from <https://ivoting.co.ke>. Mr. Kelvin works with colleagues, Claries Ingosi Kwaya, Titus Kipkirui & Adelide Kanini. "We believe that peace is the single most important ingredient for any utopia to thrive."



Kelvin and his colleagues doing a presentation





2019 Research Quote

*"Afrog decided to reach the top of a tree.
All frogs shouted,
"It's impossible, It's impossible."
Still the frog reached the top.
How...?
Because he was deaf and he thought
everyone was encouraging him to
reach the top."*

*"BE DEAF TO NEGATIVE THOUGHTS
IF YOUR AIM IS TO REACH YOUR GOAL"*



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