

# 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

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

## Core Values

- Integrity
- Accountability
- Professionalism
- Inclusivity
- Creativity
- Teamwork
- Equity

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**Prof. Stanley Makindi, Ph.D.  
Ag. Registrar (Research Innovation and Linkages)  
& Chairman, Editorial Board**

Machakos University has invested in research and innovation in pursuit of the realization of her mission of ‘providing scholarly education through training, research and innovation for industrial and socio-economic transformation of communities’.

Through the Division of Research, Innovation and Linkages (RIL), the University envisions being a Centre of Excellence in research, innovation, outreach and consultancy. This is achieved through coordinated research and innovation work plans and activities. The activities include building capacity for research and innovation, monitoring and evaluation of research projects, supporting innovative research in priority areas of Kenya Vision 2030, the Big Four Agenda, African Union Agenda and the Sustainable Development Goals (SDGs).

In addition, the Division in collaboration with stakeholders conducts dissemination of research findings through outreach activities; workshops; agricultural shows, and exhibitions; and also, through academic forums such as conferences, workshops, public lectures and publications. In efforts to support her staff; and students improve their skills, expertise, and competency, the University holds annual training sessions on research and innovation.

This 5th Biannual Research and Innovation Bulletin acts as a vehicle for communicating pertinent news on research, innovation and best practices enhanced by University students and staff. As always, we have so much to be proud of, and are thrilled to share just a few examples of the impact of our research with you. In the stories below, you will be able to see not only the impact that important research findings can have on society, but also how the experience of conducting research benefits the University staff, students, and the wider community.



# Editorial Team

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Member

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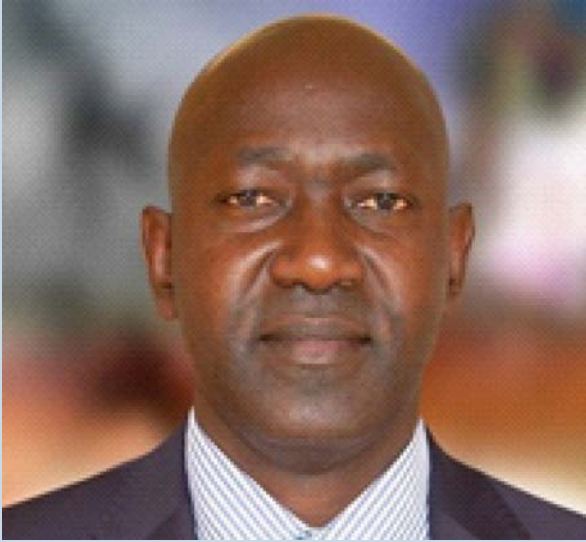
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Mr. Moses Marwa ICT →

ICT Support

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



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

Since its establishment in 2018, the office of DVC (Research, Innovation and Linkages) has seen the division expand its capacity for research and innovation, develop and review research policies, monitor and evaluate research projects, supervise staff training on proposal development, support research teams develop grant winning proposals, and facilitate and compile information on publications.

Additionally, the office of DVC (RIL) has aided in the dissemination of research findings by hosting workshops, conferences, and publication in peer reviewed journals. The Office also assists in the sourcing of consultancy services and the registration of intellectual property patents originating from the members of staff and students.

Through its diversity of staff and students, the University has received research grants and funding from external partners and donors through competitive research and development proposal writing, and also allocated research funds internally to support staff and students on research and innovation. This 5th Bulletin on Research and Innovation highlights the aforementioned activities.



# MESSAGE FROM THE DIRECTOR RESEARCH, INNOVATION AND TECHNOLOGY TRANSFER



Prof. Jones F. Agwata, Director (RITT)

The Directorate of Research, Innovation and Technology Transfer (DRITT) is within the Division of Research, Innovation and Linkages and its main function is to coordinate and oversee all Research, Innovation and Technology Transfer activities within and without the University. The Director provides the required leadership in overseeing the various research activities in the University.

Kenya, just like many countries globally, faces a plethora of challenges such as rising human population, food scarcity, pollution, climate change, land degradation, the rising cost of living and declining social safety nets that lead to widening gaps between the rich and the poor, among others. Finding appropriate and practical interventions and solutions to these problems is a daunting task and may appear to be beyond the grasp if we apply the same old traditional and conventional approaches to addressing them. Consequently, there is a need for impactful research, innovation and technology outputs to deal with these challenges. These outputs demand innovative and novel ideas from researchers and students from a variety of perspectives, such as technologies, organizations, institutional systems and social systems.

The University through the DRITT provides a conducive environment and facilitates the conduct of Research and Innovation activities by providing internal seed funding for research, support to share research and innovation outputs in conferences, workshops, exhibitions and symposia. Appropriate and relevant capacity building and trainings on proposal writing and sourcing of funds for research and innovation is also provided to staff and students.



# MACHAKOS UNIVERSITY RANKS THIRD BEST AT THE GLOBAL HUAWEI ICT COMPETITION 2021-2022 IN SHENZHEN, CHINA

Machakos University, a powerhouse in innovation and creativity with an outstanding niche in Engineering and Technology makes it once again in the global arena. The University's team, comprising of Brian Kipkoech, Joshua Akal Misiani, and Patrick Musili, students taking BSC Telecommunication and IT Students, competed in the **Network Track Technology** which involves the use of data communication, information security, Automation, network programming, and wireless local area network technologies. The three students ranked the third best out of other students from 2,000 universities and colleges that competed across the world at the Global Huawei ICT Competition 2021-2022 in Shenzhen, China.



The Huawei ICT Competition is a competitive ICT talent exchange event developed by Huawei Technologies for institutions of higher education globally within the Huawei ICT Academy program. It brings together the industry ecosystem partners to promote the cultivation, growth, and employment of young ICT talents from universities, colleges and tertiary institutions thereby aiding the ICT talent ecosystem thrive. The Huawei ICT Competition Kenya, kicked-off last year with forty (40) universities and colleges with over three thousand (3,000+) students participating in the event.

The Huawei ICT Competition 2021-2022 Global Finals was held on 18th -25th June 2022 at Huawei's Bantian Base in Shenzhen, China.



This year's Global Final competition was held online due to the ongoing pandemic, and focused on the themes of "Connection • Glory • Future" and featured the slogan "I.C. The Future", attracting 150,000 students who represented over 2,000 universities and colleges in 85 countries and regions. A total of 132 teams from 43 countries and regions made it to the Global Finals after battling it out at their respective country-level and regional competitions.





## THE UNIVERSITY HOSTS TRANSFER MULTISORT ELEKTRONIK (TME) OFFICIALS

One of the research priorities of the University is growing its research infrastructure portfolio. Machakos University has a joint collaboration with Transfer Multisort Elektronik (TME), one of the leading global distributors of electronic components, located in Poland.




From right to left: Deputy Vice-Chancellor (RIL), Prof Peter Mwita, Ms. Agnieszka Jankowska of TME, Kelvin Kangethe of TME, Absolom Okoth of TME, and Dean School of Engineering and Technology, Eng. Dr. Charles Mwaniki

The School of Engineering and Technology under a Memorandum of Agreement with TME Education received electronic tools and equipment for teaching, namely, Arduino Educational Kit and TME's Electronics Experiments Kit. TME Education is a program that aims to promote and popularize electronics and technology-related knowledge around the world. It is an initiative launched by Transfer Multisort Elektronik.

The University hosted TME officials on 1st April 2022, and among the visitors was Madam Agnieszka Jankowska, the Education Program Coordinator from TME Education Office in Poland. The visit included a tour of the Microcontroller Laboratory which was recently established using donated equipment from TME. The Laboratory will be used by undergraduate students pursuing B.Sc. in Electrical and Electronics Engineering during normal practical lessons and final year engineering projects.




## DR. PATRICK MUMO MUINDE SPEAKS ON “THE TRILOGY OF RELIGION, POLITICAL LEADERSHIP AND THE ECONOMY”



**MACHAKOS UNIVERSITY**

**INVITATION TO A PUBLIC LECTURE**

**TOPIC: The Trilogy of Religion, Political Leadership and the Economy**




**SPEAKER**  
**DR. PATRICK MUMO MUINDE**




- PhD (Economics) from Central University of Finance & Economics (CUFE), China
- Consultant in development of County Integrated Development Plans (CIDP)
- Adjunct Lecturer in Finance & Accounting at University of Nairobi and KCA
- Trainer of top managers of County Governments
- Master trainer in Financial Education and a Personal Finance Coach
- National Champion of BPR and Green Growth and Circular Economy (GGCE)
- Resource person in documentation of Climate Change Training Case Studies in Kilifi and Narok
- Monthly Contributor to Governors' Magazine on Devolution Agenda & Economic Development
- Weekly Columnist in Saturday Standard Newspaper on 'Economic Policy, National Development, Governance and Devolution'


**DATE: 19<sup>TH</sup> OCTOBER, 2021**  
**TIME: 2:00 pm - 4:00 pm**


To join the meeting: <https://conference.ke/bRONCfdPF7i7k88jINP8GsopkxYX/>


Room passcode: publiclecture2



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Each year, the Division of Research, Innovation and Linkages holds a public lecture on contemporary issues. The 4th Public Lecture of Machakos University was held virtually on 19th October 2021. The speaker was Dr. Patrick Mumo Muinde, a trainer and consultant on Finance, Business and Economics and, a columnist of the Governor Magazine on issues of policy, governance, and development.

Dr. Muinde spoke on “The Trilogy of Religion, Political Leadership, and the Economy”. His lecture focused on the role of religion and its impacts on the political economy of the country. He also explored options available that religious leaders could use to positively shape political leadership, and consequently the economic policy in the country. The lecture attracted 77 participants.



# MACHAKOS UNIVERSITY GENERATES INCOME FROM VARIOUS UNITS

Governments all over the world have been reducing spending on some sectors such as education with a view of redistributing scarce resources to other sectors of the economy. This has put pressure on public institutions to seek for additional income so as to ensure their growth and sustainability. One area where universities can generate income is by monetizing parts of their daily operations e.g., offering specialized courses, implementing income-generating research findings as well as offering training and consultancy services to the members of the general public.

The Income Generating Policy of Machakos University was signed in early 2019 with an intention of facilitating consistent investment approaches that would in turn cultivate perpetual long-term returns. In particular, the policy would amongst other functions guide establishment of income generation activities, utilization of available resources in income generation as well as the sharing of any surplus proceeds with direct service providers. Since the inception of the policy, various income generating units have been successfully established.

## **1. Soap and Detergent Unit**

This unit was established by academic staff members in the Department of Physical Sciences under the School of Pure and Applied Sciences. One of the most successful products produced by the unit is the Machakos University Hand Sanitizer. This product played a significant role in helping the institution combat the COVID-19 pandemic. The hand sanitizer is an alcohol-based product packaged in 500ml bottle and currently retails at Ksh 800. It is worth noting that this product is KeBS certified and is therefore ready for mass commercialization. In response to the COVID-19 pandemic, the unit further developed and started production of a scented hand washing detergent. Orders for any quantities of the products produced by this unit can be made through 0720 250 440.

## **2. Fashion Design and Marketing Unit (FADMA)**

FADMA Production Unit is an income generating unit under the Department of Fashion, Design and Marketing in the School of Humanities and Social Sciences. The unit produces and markets high quality textile products and fabrics that include uniforms, dust coats, lab coats, overalls, personal clothes, conference bags, table cloths, table skirts, curtains and sheers and their accessories, among others.

In the last few years, the Production Unit has enhanced its production capacity and is seeking to expand its market to cover institutions, industries, businesses and individual consumers within Machakos and its environs. The Production Unit has identified market potential particularly for school uniforms and branded items such as t-shirts, caps, hoods and sweatshirts, and aspires to provide a market solution by producing and selling these items. The Unit will employ a mix of strategies to market its products, including advertisements, personal selling and creation of an outlet shop within the University.



# MACHAKOS UNIVERSITY GENERATES INCOME FROM VARIOUS UNITS

### **3. The Huawei Authorized Information and Network Academy (HAINA)**

This unit offers general short courses in ICT intended for students who would like to start exploring opportunities in the technology industry. It also offers highly specialized professional courses whose target audience are individuals aiming to acquire practical skills for entry level job offers in technical industry. The courses offered by this unit are open to Machakos University staff and students at special rates and available to external clients at additional small fee.

### **4. Short Courses on Employable Skills**

This is a partnership between DEED Institute and Machakos University. DEED institute is an agency that seeks to support and mainstream the Kenyan diaspora in response to the challenges facing the youth and women in the country. Activities of the DEED Institute include capacity building, skills training, employability, enterprise development, mentorship and enterprise support and resources mobilization. As part of its skills training, DEED Institute provides Vocational Technical Education that offers to school leavers skills cutting across different trades. DEED Institute has engaged Machakos University as a Training Centre to implement its standard training programs. The university has identified specific technical courses that are already on offer at the Directorate of TVET to be offered through the partnership program

### **5. Short Course on EIA and EA**

This unit was recently launched by the School of Environment at Machakos University. The unit intends to train clients on the topics that a typical EIA/EA expert must be well versed in. The course shall be on face-to-face learning that will be offered through intensive lectures, case studies, practicals and site visits. This will ensure the candidates acquire comprehensive understanding of concepts and principles, and the practical applications of EIA and EA.

### **6. Machakos University Hotel and Conference Center**

This is a semi-autonomous unit within Machakos University. It boasts of excellent conferencing and accommodation facilities and is located at a walking distance from Machakos town along the Machakos-Wote Road. The hotel offers state of the art facilities for conferences, events, exhibitions, wedding parties, luncheons, dinners & seminars whether it is to an individual traveler, a group or a corporate clientele.



The University library is committed to providing quality services to all its clients. This is made possible by regular training and desking of library staff as well as partnering with relevant stakeholders in efforts of improving service delivery. The following section shows some of the tasks that have been completed in the recent past.

### **1. THE EMERALD KNOWLEDGE AMBASSADORS PROGRAMME**

The knowledge ambassador's club members have been very instrumental in marketing the library services to other students, which has resulted to increase in the library users. To deliver on this important mandate, the club members participated in The Emerald Knowledge Ambassador Programme from 1st May to 30th November 2021. Speaking on the importance of this competition, the club patron, Mr. Albert Kitaka said that the Emerald Knowledge Ambassador Programme was about a student end-user stakeholder who is familiar with and uses Emerald electronic -resources available in their institution such as e-Journals, eBooks, e-Cases and Expert Briefings. The Knowledge Ambassador must be able to create awareness about the electronic resources accessible from their institution's library. The programme therefore aimed at increasing access awareness on usage of Emerald research content.



Machakos University Emerald Knowledge Ambassadors Club members with their Patron (in black T-Shirt)



## 2. BENCHMARKING EXERCISE BY MACHAKOS TEACHERS TRAINING COLLEGE

Machakos Teachers Training College visited the library on 2nd September 2021. The visit was aimed at establishing the systems in use and services offered in the library. Speaking during the visit, the Head of Curriculum from the College emphasized that the benchmarking exercise was aimed at borrowing the best practices that would inform setting up a Learning Resource Centre that meets the demands of the newly established Competence Based Curriculum (CBC).



Machakos Teachers Training College Visits the University Library to Conduct Benchmarking on 2nd September, 2021

## 3. VISITATION BY SCHOOLS

As part of community service initiatives, the library allows visitation by schools. These visits are aimed at cultivating a reading culture among students. High school students are also offered career guidance by the Office of Career Services. ACK Mutituni secondary school visited the library on Friday 11th February 2022, where the University Librarian implored the students to change their mindset from reading books for examination purposes to knowledge acquisition for Creativity, Innovation, and Problem-solving. She further emphasized that the university curriculum was being arraigned to the demands of the newly established curriculum (Competence Based Curriculum) in order to make students job creators instead of job seekers upon graduating.



ACK Mutituni Secondary School Visits the University Library on 11th February, 2022

### 4.ISO INTERNAL AUDIT

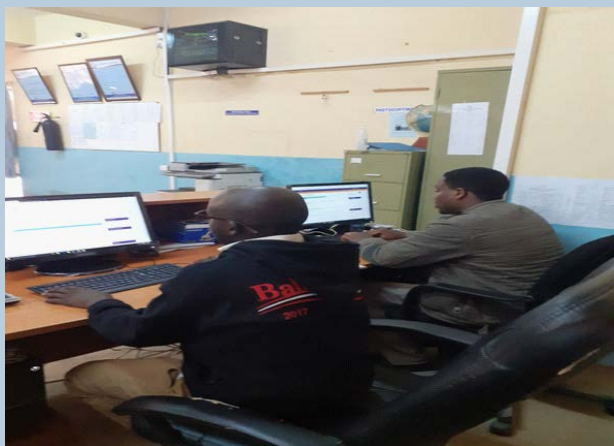
The ISO internal audit was conducted on 29th September 2021. Speaking during the audit, the lead auditor from the directorate of Performance Contract and Quality Management System Mr. Ndiku, said that the exercise was aimed at preparing for the external audit, which was scheduled for October, 2021. The auditors identified a few areas of improvement which the library has since corrected. However, another ISO internal audit is scheduled for 8th March, 2022.



Quality Management System and Performance Contracting Officers  
Conducting ISO Audit to members of Library staff on 29th September,  
2021

### 5.POPULATING OF INSTITUTIONAL REPOSITORY

As part of open access and knowledge management Initiatives, the university has an Institutional repository. This platform facilitates the creation, sharing, and dissemination of knowledge both locally and globally. A total of 10,785 documents have been uploaded to the institutional repository and they can be accessed via Google scholar search engine. This facilitates visibility and Webometrics ranking of the institution



Members of staff Populating Institutional  
Repository

## 6. ORIENTATION OF 1ST YEAR STUDENTS

In her effort to achieve effective service delivery, the library conducts orientation programs for new students/users. The students are taken through the services offered in the library and the requirements for accessing the services. New library user orientation programmes are meant to make the role of reference librarian easier. This entails: recommending, interpreting, evaluating, and/or using information resources to help patrons with specific information needs. The library held an orientation programme on 15th September, 2021 where the Deputy Librarian informed students said that the session is aimed at redeeming the time for the user in locating the information thus complying with Dr. Ranganathan's (1932) fourth law of librarianship "Save the time of the user."



Library Staff Conducting Orientation to the new users

## 7. KNOWLEDGE SHARING

Continuous sharing of tacit and explicit knowledge among library staff is key to effective and efficient service delivery. The knowledge-sharing session touches on all aspects of librarianship which include:

- ✓ Classification and cataloging of information materials.
- ✓ Registration of new users.
- ✓ Charging and discharging of information materials.
- ✓ E-resources and MyLoft.
- ✓ Populating institutional repository and library website.
- ✓ Reference and Customer care service.

Speaking during the knowledge-sharing session held on 7th January 2022 the university librarian emphasized on the importance of such session every semester given that tacit knowledge is sticky in nature and therefore only known by experienced individuals. She further alluded that frequent face to face interactions among individuals aids in transferring this kind of knowledge. Given that library staff have diverse expertise, topics are allocated to members a week prior to knowledge sharing session for planning and preparation purposes.



Members of staff sharing Knowledge with the rest of the library staff on 7th January, 2022



## 8. FIXING OF DOORS AND WINDOWS AT THE LIBRARIAN'S OFFICE

Libraries around the world are heading into the future, creating for their staff and patrons a more dynamic, multi-level environment for learning, work and pleasure. To realize this, partitioning of the University Librarians' office was done to meet the requirements of Commission for University Education (CUE) for library space. Further, the outlook of the library was rebranded by fixing doors and windows in order to improve aesthetics, increase warmth and at the same time regulate the natural light.

Speaking to library staff during the tour to the librarians' office, the librarian asserted that a request for new library building that would accommodate extra staff offices and modern library amenities had already been done



## 9. BOOK DONATION FROM MS. DAMARIS MAKENZIE

The University solely funds the library. Occasionally, the library accepts book donations provided that they fall within its collection priorities, and do not conflict with the vision, mission and values of the University. Ms. Damaris Makenzie, Kenyan Living in the USA donated University level books on 11th February, 2022. Speaking during the handing over ceremony by donor representative Dr. Waweru, the Registrar in charge of Division of Research, Innovation and Linkages (RIL) alluded that the donation will support the university in achieving her core mandate of Teaching, Learning, Research, Collaboration and Community service. The books donated totaled to 345 volumes.



The Registrar (2nd from left) and the University Librarian (1st from right) Receive books Donated from Ms. Damaris Makenzi on 11th February, 2022

## 10. INFORMATION LITERACY TRAINING

In trying to achieve her core mandate, Machakos University acknowledges the role played by library instruction as a basic human right to promoting lifelong learning. Speaking at a previous training session, the Deputy University librarian emphasized that there is need of continued user education programmes to empower students, staff and members of public to be independent seekers of knowledge and information. In relation to this, the library provides information literacy training sessions that empower students with the information literacy skills needed to be self-sufficient in finding, selecting, evaluating and using information.

The training covers the following areas:

- i. Library resources and services
- ii. Plagiarism
- iii. Search strategies
- iv. Citation and referencing tools

Information seeking behavior of library user(s) is motivated by an information gap. The requests for user instruction sessions are directed to the library management. Whenever an instruction session is requested, the librarian customizes the session to best fit the faculty's or student's course and assignment requirements. The user critically evaluates information sources and use information ethically and legally.



Library users being taken through Information Literacy Training on 17th September 2021



# » A STAFF DELIVERS A TALK AT LAWRENCE BERKELEY NATIONAL LABORATORY



**Dr. Veronica Okello**

Dr. Veronica Okello a lecturer from the Department of Physical Sciences, Machakos University, was invited to deliver a talk at the Molecular Foundry User Meeting on Friday, August 19, 2022 at Lawrence Berkeley National Laboratory, US during the “Advancing Diversity, Equity, and Justice in Science and Innovation” research symposium. This was a follow up to an exciting profile in Nature career feature, ‘Voices from Africa’ series, <https://www.nature.com/career/articles>.

This annual conference, brings together scientists from a diverse range of disciplines to focus on the most exciting work being done in nanoscience. Her work in green

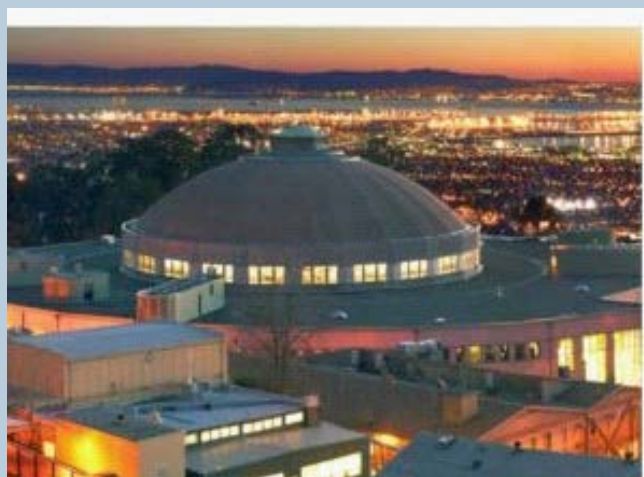
approaches to cleaning up heavy metals in the environment will be of great interest to Molecular Foundry staff and users, and others at Berkeley Lab.

The Molecular Foundry is a US Department of Energy Office of Science User Facility for nanoscale science serving hundreds of academic, industrial, and government scientists from around the globe each year. This program gives users access to expertise and equipment for cutting-edge nanoscience in a collaborative, multidisciplinary environment. Users come to the Molecular Foundry through a competitive peer-reviewed proposal process to conduct non-proprietary research at no cost. The user community includes many world-leading academic researchers as well as junior faculty, industry researchers, postdoctoral fellows, and students, resulting in a vibrant and energetic User Meeting. Dr Veronica Achieng Okello was among 23 women selected globally for the 2020 OWSD Early Career Fellows Programme.

Organization for Women In Science For The Developing World (OWSD) is the first international organization for women scientists from the developing world with the objective of strengthening their role in the development process and promoting their representation in scientific and technological leadership.

Dr. Okello’s project seeks to develop an easy-to-use, widely available water filter that can screen F- and PCs and will be linked to end-users through existing market systems for wastewater treatment; given its nanosized pores, the filter should also remove other microorganisms such as bacteria.

Dr. Okello’s findings will also be able to inform policy decisions aimed at reduced contamination. With the support from the Early Career fellowship, she will be able to buy equipment including an electrochemical analyser and Ion-Selective Electrode, as well as to establish an electrochemical lab for teaching and research and to support three postgraduate students.



# » WATER PRODUCTION THROUGH SOLAR WATER DESALINATION



Mr. Benson Wang'ombe

Staff in the Department of Physical Sciences, School of Pure and Applied Sciences. Mr. Wang'ombe won an internal research grant which he used to start off the project which was

The earth is full of water that is either saline or polluted and with only less than 3% being fresh water. This makes it hard to drink because of the impurities like fluoride, heavy metals or sewerage pollutants which cause dental flourisis and diseases like cancer and typhoid.

The University identified a way of purifying water through a solar desalination process which involves creating a barometric vacuum. The project was tested in Thwake Multipurpose Dam.

This innovation was discovered by Mr. Benson Wang'ombe, a member of

Solar Water Desalination plant



## **SOLAR ASSEMBLY AND MANUFACTURING PLANT**

The University through the School of Engineering and Technology is set to start manufacturing and assembling solar panel systems through a partnership established with Solar Afric Company. The Memorandum of Understanding, which was signed in June 2022 is for a duration of 10 years.

By tapping through solar energy, the University will help the community in focusing on renewable energy as an alternative to electricity generated by the Kenya Power & Lightning Co. The Assembly plant will be operated by trainers who will be trained on how to operate the machinery.

The University has already produced samples that are being used to do demonstrations around Machakos County and other neighboring counties. In line with Kenya's Vision 2030, the University aims at improving the livelihoods of communities around and transforming them through renewable energy.