



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



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EDITORIAL MESSAGE



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, 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 6th 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

Prof. Stanley Makindi
Ms. Elizabeth Mbatha
Nancy Ingoshe
Mr. Moses Marwa

- Chairman, Ag. Registrar (RIL)
- Administrative Assistant, Office of the Registrar RIL
- Senior Administrative Assistant, Office of DVC-RIL
- ICT

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 6th Bulletin on Research and Innovation highlights the aforementioned activities

MACHAKOS UNIVERSITY HOSTS THE 4TH INTERNATIONAL CONFERENCE

Machakos University holds an annual series of international conference as a way of giving its researchers opportunities to network with individuals and other researchers locally and internationally. The 4th International Conference was held virtually from 28th-30th June 2022 under the theme "Promoting Sustainable Development through Disruptive Research and Innovation"



MACHAKOS UNIVERSITY
A Preferred University of Excellence in Scholarship and Service Delivery

3RD CALL FOR ABSTRACTS AND PAPERS

4TH ANNUAL INTERNATIONAL CONFERENCE

THEME: PROMOTING SUSTAINABLE DEVELOPMENT THROUGH DISRUPTIVE RESEARCH AND INNOVATION

DATES: 28TH-30TH JUNE 2022

EMES
Climate change, Environment, Food security, Health, and resources and Tourism for Sustainable Development;
Native Research on Artificial Intelligence, Big Data, Blockchain Technology and Machine Learning for Sustainable Development;
Semantics, Statistics and Data Science for Sustainable Development;
Emerging issues in Education in the Era of digitalization, and
Applications of Innovative Research and Innovation on Law and Language Education in a Disruptive World.

ABSTRACT GUIDELINES
Abstracts of 250-300 words should be emailed to: conference2022@mku.ac.ke and copy to: conference2022@gmail.com
Please indicate whether oral or poster presentation;
Abstracts should be in one continuous paragraph and include (6 keywords for online indexing);
Abstracts should include the names of the author(s), address, postal, email and telephone contacts, with the corresponding author indicated in a footnote;
Full paper should be 3000-8000 words (6-16 pages) and in Times New Roman, size 12 font, spacing of 1.5 and double text format;
References cited in the papers should follow the APA 6th or Chicago Style;
Full paper should be emailed to: conference2022@mku.ac.ke copy to: conference2022@gmail.com
Abstracts and papers can be submitted/presented either live or downloaded depending on discipline.

IMPORTANT INFORMATION
Submitted papers will be peer reviewed.
Accepted papers will be published in the conference proceedings and will also be placed in an open access online conference archive.

REGISTRATION FEE

DESCRIPTION	AMOUNT
East African Participants (Non-Students)	KES 1,000 / USD 30
East African Participants (Students)	KES 500 / USD 15
Machakos University Students (Non-Students)	USD 50
International Participants (Students)	USD 30
Exhibitors	USD 100

PAYMENT DETAILS:
Fees MUST be deposited in the following Account:
Account Name: Machakos University
Bank: National Bank of Kenya (Machakos Branch)
Account No. 010207849481
Bank Code: 12 Branch code: 048
Swift Code: HUKENK0000000

IMPORTANT DATES

a) Deadline for submission of abstracts	29 th April 2022
b) Notification of acceptance	2 nd May 2022
c) Deadline for submission of full papers	10 th May 2022
d) Early registration deadline	27 th April 2022
e) Normal registration deadline	13 th May 2022
f) Late registration	After 13 th May 2022
g) Exhibition registration deadline	20 th May 2022
h) Conference dates	28 th 30 th June 2022

Note: Early registration will earn a 10% discount and late registration will be 5% more.

For more information, visit: <https://www.mku.ac.ke/recent-news/4th-annual-international-conference/>

Conference Secretariat
Machakos University
P.O. Box 136-90100, Machakos, Kenya
Email: conference2022@mku.ac.ke

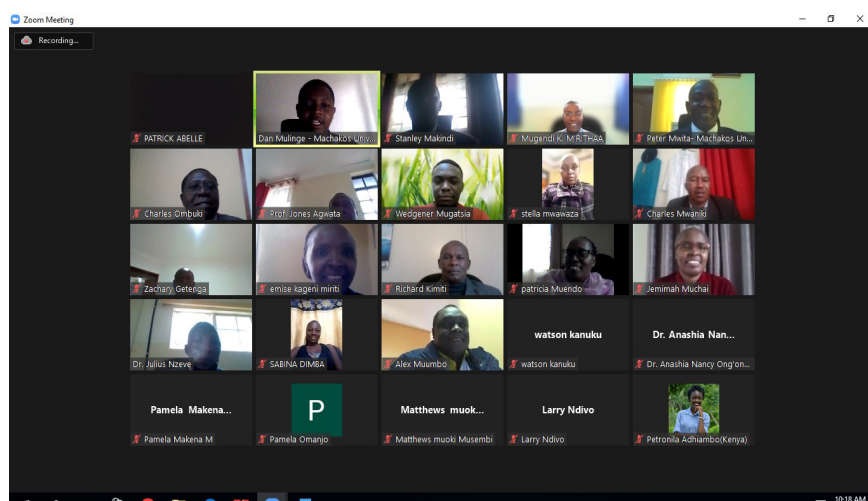


Photo session during the 4th International Conference opening ceremony

The Conference was opened by Prof. Walter Oyawa, the Director General of National Commission for Science, Technology and Innovation (NACOSTI). It focused on disruptive research and innovation where "disruptive" is viewed as a positive and negative tool for sustainable development. Researchers and Scholars came together to discuss how this has affected the socio-economic and political developments of nations and proposed short- and long-term technological and innovative solutions. The proceedings of the conference can be found at the University website using the link: <https://www.mksu.ac.ke/recent-news/4th-conference-book-of-proceedings/>.

EMBRACING TECHNOLOGY AND INNOVATION: MACHAKOS UNIVERSITY 4TH INNOVATION AND EXHIBITION WEEK

As part of the University's priorities, the Division of Research, Innovation and Linkages is mandated to promote research and innovation as guided by existing policies. The University ensures that staff and students participate in innovation and exhibitions as a way of challenging young minds to come up with ideas that can be explored to give solutions to real-world situations and problems. The University held its 4th Innovation and Exhibition week from 22nd-23rd June 2022, which saw ten (10) innovations from students exhibited and judged by Mr. Stanley Atsali from Kenya Industrial Property Institute and Mr. Fred Otswong'o, a Patent Attorney from Fred Otswong'o & Intellectual Property Associates (FOIPA). These innovations were:

No	Name of Inventor(s)	Title of Invention
1	Alvin Kimata Kihato and Karangu Lucas	Real-Time Sign Language Detection and Translation
2	Amos Shahindi Shigalu	Enhanced Mark Two/Soko
3	Wendy Frenza	NCHISEC (Gun and Bomb Dector)
4	Michael Njuna	Machakos University Comrades Application
5	Alvin Kimata Kihato and Karangu Lucas	AI Real Time Face Mask Detection and Verification System
6	David Nzai and Dickson Esamai	Noise Control System
7	Tony Blair	Programmable Fan and Bulb
8	Caleb Omolo Okumu	Attachment and Internship Placement System
9	Gilisho Leteipa, Paul Omunga, Owino Kelvin	Non-fuel Generator
10	Anthony Makanga	Formulation and Development of Policy for Sustainable Development

The Chief Guest, Mr. Lawrence Matolo, a board member of the Agricultural Society of Kenya (ASK), and an innovation master encouraged them to be more creative and aggressive in using their minds to either develop new techniques and products, or improve on the existing mechanisms that were being used in the world today. He echoed that "Every individual is an Intellect and owner of their intellectual property", eluding that we were all born geniuses with ideas that could be turned into great opportunities. As a motivational tool, the University awards annual competitive innovative grants to students to help them develop products and prototypes, and thereafter patent and protect their innovations. This year, the 5th Call for submission of proposals for internal innovation grants for Machakos University students 2022/2023 was released. More information can be found at <https://www.mk-su.ac.ke/student-communication/5th-call-for-students-innovation-challenge/>.



Some innovations exhibited during the innovation week.



Judges during the 4th Innovation and Exhibition week examining innovations.

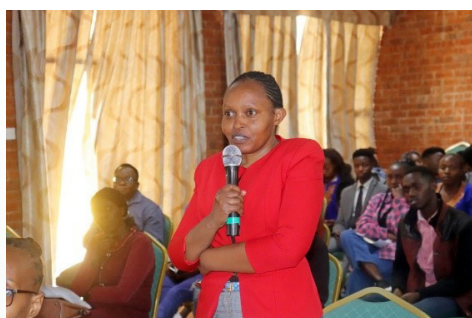
PROF. EMERITUS RATEMO W. MICHIEKA DELIVERS A PUBLIC LECTURE

Prof. Emeritus Ratemo Michieka delivered a public lecture on 21st October, 2022 under the theme “Science, Technology and Innovation: The Role of Universities in the Socio-Economic Development of Society”. Prof. Ratemo Michieka, the Chairman of the National Research Fund (NRF), talked about solutions that universities could come up with to assist citizens and the country in accomplishing its needs based on the priorities of Vision 2030 and sustainable development goals. He pointed out that societies faced various forms of socio-economic problems such as hunger, diseases, environmental degradation, global warming and climate change, and water scarcity, that wreak havoc and disrupt businesses, education, and development of society. He lamented that these problems take a toll on the world's development especially in developing nations, causing serious adverse impact on governments and their citizens. He encouraged participants to address these societal issues by undertaking research from funding agencies such as NRF who issue grants to academicians. He advised universities to identify and prioritize research on issues based on their geographical locations.



Left: Plenary session (L to R: Prof. David Mulwa, Prof. Ratemo Michieka, Dr. Christabel Muhonja and Prof. Zachary Getenga). Right: Attendance during the public lecture

The lecture was attended by members of the University Council, the University Management, invited guests from Meru University of Science and Technology, Kenya Marine and Fisheries Research Institute, staff, students and members of the public.



More photos from the Public Lecture.

RESEARCHER DOES AN INSITU-TESTING OF DEVELOPED COMPOSITE PAVING CABRO-BLOCK TECHNOLOGY.

The University commits to promote research output, innovation and technology through commercialization and industrial linkages. A Civil Engineer and researcher from the School of Engineering and Technology, Eng. Mwalimu K. Musau has developed paving cabro blocks using composite materials and is now doing an insitu-testing of the cabro-block technology. His research is based on an internal grant that he received in 2018/2019 after submitting a proposal on "Development of High Stress/Strain Resistant Composite Paving Cabro Blocks" which won a grant of KES 698,275. The project has passed through various stages and has been published in reviewed international journals and the findings presented in conferences. The cabro blocks are made of various materials including rice husks and plastics and are being tested in a designated area in the University by being subjected to strenuous use by people and automobiles. A sample wall made of rice husks was constructed to enable long term testing of the materials. The cabro-block technology as a research output will be subject to commercialization once the results are analyzed. The photos below show the different stages of the project.



The production phase of the paving cabro-blocks.





Laying of the foundation



Fixing the cabro-blocks

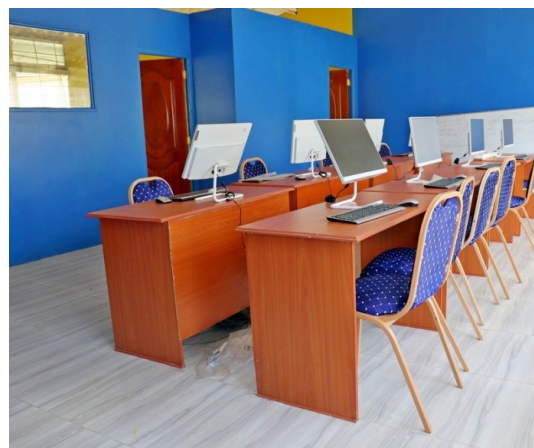
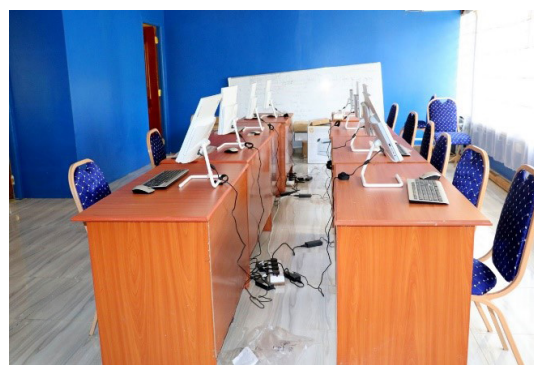


Final stages of the project

THE UNIVERSITY HOSTS AN AJIRY CENTER FOR THE YOUTH

Tribus-TSG, a subsidiary of Centum PLC, has established an Ajiry Center in the University with an aim of linking youths to the industry. The Center will be dedicated to youth empowerment and creation of employment for both individuals and small businesses/start-ups, just as the term 'Ajiry' defines which is a Swahili word for employ. The project is being funded by the Master Card Foundation and some Centers have already been launched in Nairobi, Kiambu, Mombasa, Bungoma and Kisii. Machakos University boasts as being the host of the 6th Center.

Ajiry Center Machakos will focus on bridging the gap between the employed and unemployed by offering a solution-based platform where youths will be equipped with the necessary skills to help them secure jobs. The University takes pride in playing a key role in transforming young lives in the community.



Photos of Ajiry Center Machakos

RESEARCHERS WIN THE ERASMUS+ MOBILITY FUNDING PROGRAMME.

Machakos University through the Division of Research, Innovation and Linkages is committed to providing its researchers with the right infrastructure to carry out research, as well as develop an individual academic portfolio. As such, staff have continuously submitted proposals to the European Union through Erasmus+, a programme that supports priorities and activities in education, training, youth and sport.

Consequently, two researchers from the University applied and won the Erasmus+ learning mobility grants:



Prof. Mugendi M'Rithaa, a researcher from the School of Humanities and Social Sciences who won the Erasmus+ learning mobility to Latvia through the Erasmus+ KA171 project proposal for higher education students and staff between Riga Technical University (RTU), Latvia, Europe and Machakos University. It will run for a period of five (5) years starting from 2022 – 2027, and;



Dr. Veronica Okello from School of Pure and Applied Sciences who won the Erasmus + mobility grant for academic staff, students and researchers through TU BAF projects between Freiberg University, Germany, and Machakos University, and other partner Universities from Ghana and Nigeria. It is being funded at 85,084 Euros and will run from 2022 to 2025.

EUROPE MEETS KENYA: RIGA TECHNICAL UNIVERSITY VISITS MACHAKOS UNIVERSITY

In fulfillment of the Erasmus+ Agreement between Riga Technical University (RTU), Latvia, Europe and Machakos University, a team of three (3) staff from RTU; Ms. Zane Purlaura, Ms. Maija Lebedeva and Dr. Mikelius Dzikevics, through the Erasmus+ Mobility grant visited Machakos University from 13th to 16th December 2022. Riga Technical University is the largest science-based University in the Baltic states where Latvia is located. During the visit, the two universities explored areas that would be beneficial to each institution in order to strengthen their collaboration.

The programme will open opportunities for staff and students to study at various levels in bachelors and Ph.D. programmes.



L: The Ag. Registrar (Research, Innovation and Linkages) 3rd from right, Prof. Jones Agwata (Director, Research, Innovation and Technology Transfer) 2nd from right, and Albert Kitaka far left, with team from Riga Technical University. R: Staff and Students with team from Riga.



More photos of the visit

THE WATER ESSENCE-AFRICA MASTERS RESEARCH GRANT

The University received funding from the Norwegian Development Agency for a Water ESSENCE-Africa project which is being funded under the NORHED II program. The NORHED II Programme (2021-2026) is a programme with a consortium of partner Universities from Norway (the University of Bergen, Norwegian University of Life Sciences, Norwegian University of Science and Technology), Ghana (University for Development Studies, University of Ghana), Rwanda (University of Rwanda), South Sudan (University of Juba), Ethiopia (Addis Ababa University), Kenya (Machakos University, University of Nairobi) and Uganda (Makerere University). It is aimed at strengthening capacity in higher education institutions in developing countries in order to produce higher-quality graduates, higher-quality research, and more inclusive higher education.

The Water ESSENCE Africa project as part of the programme, will focus on co-developing, improving, and retaining the skills, knowledge, tools, and other resources needed for the education of higher quality graduates of water-related study programs, conduct more and higher quality water research, and increase inclusiveness of the partner universities.

It will also look at the existing and emerging challenges associated with freshwater resources and sanitation systems, and addresses these challenges through a matrix of three vertical cross-disciplinary issues on health, climate change, and energy, and two horizontal topics: gender equality, and digitalization.

The University through the NORHED Programme will offer scholarships for TWO masters students who are in their project implementation stage and registered in one of the partner institutions.



MACHAKOS UNIVERSITY STUDENTS EMERGE SECOND POSITION IN THE META-COM COMPETITION

The Computer Science and Information Technology Students participated in the MetaCom competition alongside other universities at the United States International University (USIU) Africa. The competition was organized by Yel-bridges, a profound cybersecurity company in conjunction with other key stakeholders in the ICT industry.

The competition aimed at challenging students to come up with ideas in the areas of virtual and augmented reality, implement and develop applications that can run in the Metaverse. Machakos University was represented in two teams working on two projects. The first being development of an application on fashion and design which clients will be able to sample African outfits, fit the attire using avatars in the metaverse before making an order. The other project was on tourism which involved coming up with an application that would showcase various tourist attraction sites in Kenya and beyond, majorly featuring various game parks, game reserves and the entire wildlife ecosystem. Upon the implementation of the project, tourists will be able to exclusively immerse themselves into the virtual world encompassing the tourism ecosystem and experience the sensual feel and touch that mimics the real-world wild tour. The team emerged second position in the final competitions held in December 2022.



THE UNIVERSITY LEAVES GLOBAL IMPRINT WITH BARIDI-SANA PROJECT.

The BARIDI-SANA Project, borne from the collaboration between Machakos University, Sapienza University of Rome, and In-Quattro is expected to be launched in 2023. BARIDI SANA, named after the Swahili term 'baridi' meaning 'cold', is a project that was first launched in 2019 designed to develop a two-phase cooling system for satellites. It has been undergoing a series of tests and analysis and is now in the final stages of development. It will be sent to the Chinese Space station named Tiangong once completed. The project is being funded by the United Nations and was featured in the Nation newspaper on 24th October 2022.



A Simulated image of the Chinese Space Station, Tiangong (photo courtesy of The Daily Nation, Newspaper)

UNESCO CHAIR ON CLOUD COMPUTING FOR SUSTAINABLE DEVELOPMENT

Machakos University (MksU) was awarded the rare and prestigious UNESCO Chair on Cloud Computing for Sustainable Development within the UNITWIN/UNESCO Chairs Programme for a period of four years. It will start in 2023 under the leadership of Prof. Mugendi K. M'Rithaa, Professor of Industrial Design and Dean of the School of Humanities and Social Sciences. Under this design-led transdisciplinary research project, Machakos University will lead a dynamic private-public partnership that will address five sub-themes, namely: Health and Well-being; Agriculture and Food Security; Education and Training; Climate Resilience and Environmental Sustainability; and Space Science and Surveillance.



Prof. Mugendi K. M'Rithaa, UNESCO Chair on Cloud Computing

The UNITWIN/UNESCO Chair will build upon the Luban Workshop to consolidate its role as a reputable center of excellence and innovation within the [East] African region. It is worth noting that the MksU Luban Workshop is one of the first such centers on the continent. Consequently, it will act as a major catalyst for innovation in Cloud Computing applications whilst bolstering a variety of fields and disciplines.

EMPOWERING STAFF THROUGH TRAININGS

Virtual Training on Grant Proposal Writing and Sourcing for Funds

To build the capacity of researchers and innovators at Machakos University, it is imperative to continuously undertake the training of academic staff and students on research and innovation activities. In line with this, a training on 'Grant Proposal Writing and Sourcing for Funds' was undertaken on 5th October, 2022 which was attended by seventy (70) participants. The training was facilitated by our own staff; Dr. Tindih Heshborne and Dr. Christabel Muhonja from the School of Pure and Applied Sciences and Mr. Joseph Njogu from Research Beeline.



Dr. Heshborne Tindih



Dr. Christabel Muhonja



Mr. Joseph Njogu

The objectives of the training were to enhance the capacity of the researchers so as to write fundable research proposals that respond to emerging global challenges, to inculcate the culture of mentorship by utilizing internally available expertise and to create a platform for knowledge sharing amongst staff of Machakos University.

Virtual Training on Solar Photovoltaic Technology: Principles and Applications

The Virtual Training on solar photovoltaic technology was conducted on 14th October, 2022 and was attended by thirty-five (35) participants. The training was facilitated by Dr. Fredrick Nyang' the Director of the Economic Regulation, Energy and Petroleum Regulation Authority (EPRA)



Dr. Fredick Nyang'- Facilitator of the training on Solar Photovoltaic Technology

The main objective of the training was to induct staff and students on the key principles and applications of Solar Energy as an important form of renewable energy and how the resource can be harnessed using Solar Photovoltaic Technology, as well as appreciate the advantages of Solar Energy in the development of the Country. Of importance also, was the critical role that the University played in establishing a solar plant within the University that will ensure utilization of the resource within and outside the University, and to enable assemble, production and distribution of solar panels for use by the surrounding community.

STUDENTS AWARDED THE CHINESE AMBASSADOR'S SCHOLARSHIP AT THE LUBAN WORKSHOP

H.E. Dr. Zhou Pingjian, the Chinese Ambassador to Kenya paid a visit to Machakos University on Wednesday, 30th November 2022 where he awarded five (5) Ambassador's Scholarship to Machakos University students undertaking courses in Cloud Computing and Information Security at the Luban Workshop facility at Machakos University. These students were The five (5) students were; Wabwire Benjamin, Mokaya Nyandwaki, Okello Eldadi, Maweu Magdalene and Jackson Kipkosgei. This was an opportunity for Kenya and China to enhance their ties, deepen educational cooperation and offer a chance for students to exchange ideas and learn more about Chinese culture. It will also cement the already existing mutual partnership between Machakos University and Tianjin City Vocational College (TCVC) of China. The scholarship will relieve the burden of tuition fees for students.



H.E. Dr. Zhou Pingjian, Chinese Ambassador to Kenya with Prof. Lucy Irungu, the Vice Chancellor, Machakos University



One of the beneficiaries of the Ambassador's Scholarship



H.E. Dr. Zhou Pingjian having a one on one meeting with the scholarship beneficiaries



MACHAKOS UNIVERSITY REPRESENTS KENYA IN THE REGIONAL HUAWEI FINAL 2022-2023 COMPETITIONS

The University will represent Kenya in the Regional Huawei ICT Competition that will be held in South Africa in 2023. The competitions kicked off in September 2022 with over thirty-six (36) universities in the country participating. The competition was categorized into three tracks, i.e. Network track, Cloud Track, and Innovation track. Our university was ranked number four (4) according to the number of student participants with over fifty (50) students representing universities. Ten (10) students qualified in the Network Track and one (1) student qualified in the Cloud Track. The students took the National Finals qualification exam on 17th December, 2022 at the University of Nairobi, Chiromo Campus, and emerged top. They will represent Kenya in the Regional Finals scheduled to be held in South Africa on 22nd February, 2023.



Participants during the Huawei ICT Competition



Huawei academy instructors and staff from Huawei Technologies Kenya pose for a photo with the Director of Huawei Partner Development East Africa, Mr. Andy Li, during the Huawei ICT Competition National Finals at The University of Nairobi, Chiromo Campus