



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 Completes Establishment of the Kenyan Luban Workshop.....Page 4

Machakos University to Host its Third International Conference in June 2021.....Page 7

Machakos University Harnesses Internal Expertise to Build Research and Innovation Capacity of Staff and Students.....Page 8

Machakos University Dons Win Several Research Grants.....Page 9



News From The Library.....Page 11

MksU Library goes High-Tech in Security Systems.....Page 11

Observance of Covid-19 protocols in the Library taken to a higher level.....Page 11

Library interiors get a facelift.....Page 12

Keeping plagiarism at bay.....Page 13

Machakos University Broadens International and Local Linkages.....Page 13

From the Income Generating Units.....Page 13

Kenyan Youths Enhance their Employability and Enterprise Development Skills at Machakos University.....Page 13



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Editorial message

In this fourth issue of the Machakos University Biannual Research and Innovation Bulletin, we celebrate the achievements made in the pursuit of our vision and mission. Despite the challenges brought about by the COVID-19 pandemic, the University remains active in the realization of its research and innovation agenda. As you read this issue, the editorial team invites you to reflect on the poem by Lawrence Pertillar.

Is it easier to become 'creative'
When one pleasures ideals with theft?
Is it easier to manipulate,
What someone else has done...
To welcome the inspiration,
Of one who has none!

Creativity comes from something perceived.
Something produced from nothing,
That one has achieved.
But there are those who believe,
Distorting an accomplishment...
Will heighten an enlightenment of these deeds.
With no one to suspect at all...
Their minds are innovation free.
(Lawrence S. Pertillar
Friday, February 20, 2009).

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

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

Kenya's big four agenda is a roadmap towards the realization of Kenya's Vision 2030, an offshoot of the 2030 Global Agenda for Sustainable Development. The Big 4 Agenda provides ambitious opportunities that demand unprecedented initiatives in research and innovation across multiple interconnected social, economic, political and environmental issues. This puts research, innovation and resultant knowledge and technology transfer at the core business of Machakos University. The University therefore, through the Division of Research Innovation and Linkages harnesses the frontier technologies and research output towards the socioeconomic transformation of our people.

The outbreak of COVID-19 pandemic continues to pose a challenging moments as it disrupts the traditional way of doing things thereby resulting in "new normals". These new normals provide both threats and opportunities for mankind. Machakos University staff and students find these to be enriching experiences that inform their priorities in seeking both research and innovation grants. The Division will continue to enhance an enabling environment through capacity building and infrastructural development necessary for a positive research culture.

COVID-19 pandemic has underscored the central role of technologies in enhancing service to humanity. For example, the traditional classroom has moved to virtual classroom in which learners and teachers interact through different technologies. Equally, boardrooms have migrated to virtual platforms. This calls for continuous harnessing of frontier technologies combined with research to address persistent gaps in the desire to realize sustainable development. Machakos University prides in its infrastructural opportunities presented by the recently constructed Luban Workshop.

The Luban Workshop dramatically accelerates access to information that enables research data sharing, technology transfer and conferencing. This provides opportunity for big data analysis that could help to manage or solve global issues, create new scientific breakthroughs, advance service to humanity and improve decision making by providing real time streams of information. The Internet of Things at the workshop allows the condition and actions of connected objects and machines to be monitored and managed and allows effective monitoring of the natural world. We welcome all our stakeholders to exploit these opportunities.

Machakos University is alive to the fact that COVID-19 may be with us for some time, and is adapting itself to this "new normal that encourages research, innovation, knowledge sharing and technology transfer in this direction. This has informed our 3rd International Conference that will be held virtually from 22nd to 25th June, 2021 under the theme: Responding to Emerging Global Challenges through Research, Innovation and Technology for Sustainable Development, It is my humble pleasure to invite you to this conference. Machakos University will always endeavour to have fruitful cooperation in the realization of our common goals and objectives.



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

Machakos University Completes Establishment of the Kenyan Luban Workshop

Machakos University in partnership with the Tianjin City Vocational College (TCVC) completed establishment of the Kenya Luban Workshop hosted at the Department of Computing and Information Technology (CIT) in the School of Engineering and Technology. The Luban Workshop at Machakos University, also known as a Cloud Computing and Information Security Training Centre, is a state-of-the-art facility that is unique in Kenya and the East African region. It has modern equipment for the most current technology and is ideal for training modern skills, research, Data Centre services and data recovery and backup services. The facility will therefore enhance training and quality of the programs and courses offered by the CIT Department, including: BSc. in Computer Science, BSc. in Information Technology, Huawei Certified ICT Associate (HCIA) in Cloud computing, Huawei Certified ICT Associate (HCIA) in Artificial Intelligence, Huawei Certified ICT Associate (HCIA) in Datacom, and the soon to be launched BSc in Cloud Computing and Information Security. The Center has sub-sections that deal with Big Data Analytics, Intelligent IoT Learning, Data Centre services and Server virtualization, Data Backup and restoration, Long-range Wireless Communication Technologies (including 3G, 4G and 5G Networks), Short-range wireless Communication Technologies and Block-Chain. The fully equipped sections of the Centre are shown below.



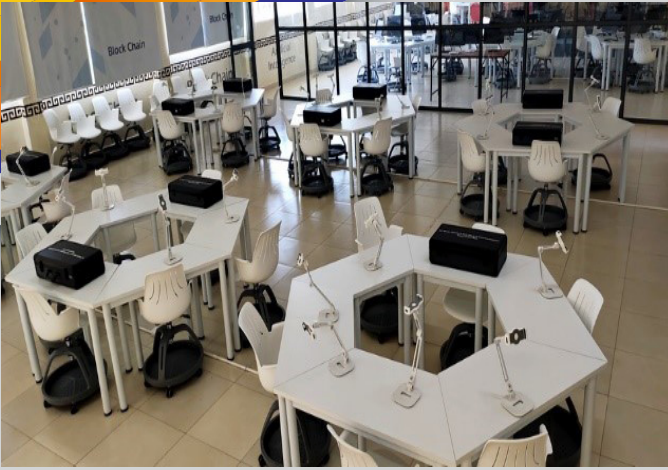
Don View and Video Conference Sub-Section



Big Data Analytics Sub-Section



Cloud Computing Training Area



Internet of Things (IoT) Training Area



IoT Training Kit



Seminar room and BlockChain Training Area



Entrepreneurship and Vocation Education Sub-Section



Staff from Machakos University and other institutions receive training on cloud computing at the Luban Workshop facilitated by Huawei



Machakos University Vice-Chancellor, Prof. Lucy Irungu (Centre) flanked by the Deputy Vice-Chancellor (Research Innovation and Linkages, Prof. Peter Mwita (right) leads TCVC Vice-Chancellor Prof. Li Yan (second right), the Tianjin City delegation and other guests to the venue for the opening ceremony of the Kenya Luban Workshop on 14th December, 2019

The Workshop seeks to enhance economic, social and cultural cooperation between Kenya and China. It will further enable Machakos University and her partners including TCVC and Huawei Technologies to design and deliver training programmes in Cloud Computing Technology and Application, to both students and staff. Such training will focus on network technology; cloud computing technology; storage technology; and “Internet of Things” technology.

Directorate of Research, Innovation and Extension Services

The Directorate of Research, Innovation and Technology (DRIT) was renamed as the Directorate of Research, Innovation and Extension Services (DRIES), as per the Machakos University Statute 2019. The new name carries with it expanded functions of promoting the culture of extension and community outreach, knowledge and technology transfer. DRIES, as it is abbreviated, is focused on organizing several trainings, workshops, International conferences, public lectures and industrial linkages in order to drive the university’s research, innovation and technology objectives and achieve the government’s BIG FOUR agenda in line with Vision 2030.

Machakos University to Host its Third International Conference in June 2021.

Machakos University's mission: "Provide Scholarly Education through Training, Research and Innovation for Industrial and Socio-Economic Transformation of our Communities", is a commitment to knowledge and technology sharing and transfer, which we embrace through hosting international conferences. The University has previously held two international conferences that embraced the themes: Harnessing Scientific Research, Innovation and Technology for Sustainable Development and Supporting Green Growth and Knowledge Economy through Research, Innovation and Technology for Sustainable Development, for first and second conference respectively. The two conferences had over 500 cumulative participation/ audience.

As the reality of COVID-19 creates a "new normal" so comes the challenges of newness and adaptation. It is in this regard that under the theme: Responding to Emerging Global Challenges through Research, Innovation and Technology for Sustainable Development, we have endeavoured our 3rd International Conference to be held from 22nd to 25th June, 2021. For more information, visit www.conference.mksu.ac.ke



MACHAKOS UNIVERSITY

A Preferred University of Excellence in Scholarship and Service Delivery

3RD AND FINAL CALL FOR ABSTRACTS AND PAPERS

3RD ANNUAL INTERNATIONAL CONFERENCE

THEME: RESPONDING TO EMERGING GLOBAL CHALLENGES THROUGH RESEARCH, INNOVATION AND TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

DATES: 22ND – 25TH JUNE 2021

SUB-THEMES

1. Strategies for Promoting Sustainable Agriculture and Food Security During a Pandemic
2. Economic Survival Through Responsive Entrepreneurship in the Era of Global Disruption
3. Catalyzing Change for Inclusion and Access to Education During Pandemics
4. Cloud Computing and ICT-Driven Strategies for Fostering Resilience and Sustainable Development
5. Implications of Climate Change on Sustainable Environmental & Natural Resources Management
6. Post-COVID-19 Recovery Measures in the Hospitality and Tourism Sector
7. Mitigating the Impact of Social Disruptions in a Global Pandemic
8. Enhancing Health and Quality of Life for Sustainable Livelihoods through Science and Technology

SUBMISSION GUIDELINES

1. Abstracts of 250-300 words* should be emailed to: conference2021@mksu.ac.ke and copy to: mksuconference2021@gmail.com
*clearly indicate whether oral or poster presentation;
 2. Abstracts should be in one continuous paragraph and include up to 6 keywords for online indexing;
 3. Abstracts should include the names of the author(s), affiliations, postal, email and telephone contacts, with the corresponding author indicated in a footnote;
 4. The full paper should be 3000-8000 words (6-16 pages) prepared in Times New Roman, size 12 font, spacing of 1.5 and in editable text format;
 5. All references cited in the papers should follow the APA 6th Edition Citation Style;
 6. The full paper should be emailed to: conference2021@mksu.ac.ke copy to: mksuconference2021@gmail.com
- Abstracts and papers can be submitted/presented either in English or Kiswahili depending on discipline.

IMPORTANT INFORMATION

- All submitted papers will be peer reviewed.
- All presented papers will be published in the conference proceedings and will also be placed in an open-access online conference archive.

VENUE:

MACHAKOS UNIVERSITY VIRTUAL PLATFORM

REGISTRATION FEE

	DESCRIPTION	AMOUNT
1	East African Participants (Non-Students)	KES. 3,000 / USD 30
2	East African Participants (Students)	KES. 2,000 / USD 20
3	International Participants (Non-Students)	USD 50
4	International Participants (Students)	USD 30
5	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. 01020078499400
Bank Code: 12 Branch code: 048
Swift Code: NBKEKENXXX

IMPORTANT DATES

- | | |
|-------------------------------------------|----------------------------------------------|
| a) Deadline for submission of abstracts | 26 th April 2021 |
| b) Notification of acceptance | 30 th April 2021 |
| c) Deadline for submission of full papers | 10 th May 2021 |
| d) Early registration deadline | 27 th April 2021 |
| e) Normal registration deadline | 7 th May 2021 |
| f) Late registration | after 14 th May 2021 |
| g) Exhibition registration deadline | 17 th May 2021 |
| h) Conference dates | 22 nd -25 th June 2021 |

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

For more information,

Visit: <https://dvc-rii.mksu.ac.ke/index.php/conferences/3rd-annual-international-conference-2/> or contact:

Conference Secretariat
Machakos University
P.O. Box 136-90100, Machakos, Kenya
Email: conference2021@mksu.ac.ke

Machakos University Harnesses Internal Expertise to Build Research and Innovation Capacity of Staff and Students

Machakos University continues to build research and innovation capacity of her staff and students. During the first half of 2020/21 financial year, DRIES undertook three trainings for staff and students, on research and innovation. The topics covered were: (i) How to write a grant-winning proposal to respond to emerging global challenges (2nd September, 2020); (ii) leveraging Machakos University capabilities to harness talents to respond to the challenges posed by Covid-19 and other pandemics (23rd September, 2020); and (iii) research ethics and standards (11th November, 2020). The trainings were facilitated by seasoned researchers and innovators from Machakos University, including Prof. Mugendi M’rithaa, Prof. Jones Agwata, Prof. Fredrick Ogola, Prof. Geoffrey Maroko, Dr. Charles Mwaniki, Dr. Heshborne Tindih and Mr. Lawrence Matolo.

Speaking while opening the trainings, the Deputy Vice Chancellor-Research Innovation and Linkages (DVC-RIL), Prof. Peter Mwita, challenged the researchers to adopt the best practices for research and innovation in line with the NACOSTI guidelines and requirements of funding agencies. He noted that this will help to add value to the quality of our research proposals, data collection, data analysis and report writing processes. Prof. Mwita further encouraged researchers and innovators to respond to calls for proposals that are continuously circulated to staff through their corporate emails.



Prof. Jones Agwata



Dr. Charles Mwaniki



Prof. Geoffrey Maroko



Dr. Heshborne Tindih



Prof. Mugendi M’Rithaa

MACHAKOS UNIVERSITY DONS WIN SEVERAL RESEARCH GRANTS

During the first half of the 2020/21 academic year, researchers at Machakos University demonstrated their prowess in research by winning several grants to undertake research in different disciplines.

1. The Higher Education Programme for Sub-Saharan Africa (HEPSSA)

Machakos University (MksU), in partnership with the Technical University of Kenya (TUK), Masinde Muliro University of Science and Technology (MMUST) and Murang'a University of Technology (MUT), won grants to implement the Higher Education Programme for Sub-Saharan Africa (HEPSSA) project. The overall objective of HEPSSA is to form and strengthen relationship between academia and industry, to ensure that the higher education system in Sub-Saharan Africa produces engineers with the skills and knowledge required to meet the needs and challenges of the industry in the region.

HEPSSA is funded by UK Royal Engineering Academy to the tune of UD\$ 140,000 and implemented through a “hub and spoke” model, whereby TUK plays the role of the HUB while MksU, MMUST and MUT play the role of spoke. Machakos university is represented by Dr. Charles Mwaniki (Dean school of Engineering and Technology) as the coordinator and Mr. Peter Mutisya, the Chairman, Department of Mechanical Engineering. Machakos University is set to benefit from this project through capacity building of staff. Under HEPSSA, the University will nominate two members of staff to work in the industry for a period of at least six months. While the staff members are away, the University will receive funds to engage part-time lecturers to take up the workload of the intern lecturers. This will enable the lecturers to be up to date with the industry practices, technology transfer, teaching and the teaching materials they prepare. The University Management Congratulates Dr. Mwaniki and Mr. Mutisya and wishes them success



Mr. Peter Mutisya



Dr. Charles Mwaniki

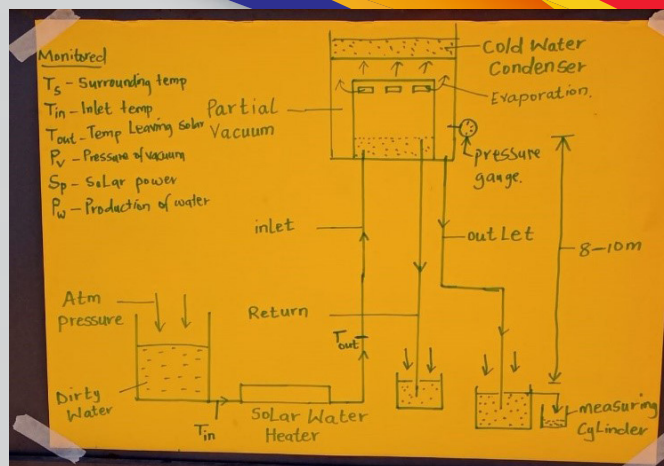
2. Water Desalination Research Projects at Thwake Water Multipurpose Dam



Mr. Benson Wang'ombe

Machakos university researcher Mr. Benson Wang'ombe won internal research grant to carry a project on Water desalination. The project has since been scaled up and supported by the National Drought Management Authority (NDMA). Mr. Wang'ombe now runs two projects. The first is “Design of a Vacuum Solar Water Desalination Plant to investigate purification of River Athi Water”, which is partially sponsored to the tune of one million Kenya Shillings by the NDMA and European Union (EU), which forms part of Mr Wang'ombe's PhD work at Kenyatta University. The second, entitled “Solar Water Desalination in a Vacuum of Infinite volume”, is funded by Machakos

University internal Research Grant to the tune of Kenya Shillings four hundred and fifty thousand, to investigate effect of increasing the volume of the vacuum chamber on water desalination. Besides research output, the two projects provide linkages at the dam site for Machakos University, that could open up opportunities in the areas of field attachments and internships for engineering students interested in dam construction, tunnel drilling, and environmental and safety engineering. Besides, employment opportunities exist at the dam site for consultancies.



Mr. Wang'ombe (Centre) introduces his project to Prof. Mwita (left) and Dr. Amukowa (to the right) during a project monitoring trip.

3. OWSD Early Career Fellows Programme and the Carnegie African Diaspora Fellowship Program (CADFP)



Dr Veronica Okello

Machakos University won the 2020 OWSD (Organization for Women in Science for the Developing World) Early Career Fellows Programme. The fellowship awardee, Dr. Veronica Okello, was among the 23 women selected globally for the Programme. Her project seeks to develop an easy-to-use, widely available water filter that can screen fluorides (F-) and Perchlorates (PCs) whose presence in ground and surface water can cause health problems such as softening of bones, thyroid disruption, and cancer. The filter, that can also potentially remove other microorganisms such as bacteria, will be linked to end-users through existing market systems for wastewater treatment. With the support from the Early Career fellowship, Dr. Okello will be able to buy equipment including an electrochemical analyser and Ion-Selective Electrode, as well as establish an electrochemical lab for teaching and research, and support three postgraduate students.

Dr. Veronica Okello also won the Carnegie African Diaspora Fellowship Program (CADFP) to be hosted by Machakos University. Under this program, the University will host two African Diaspora scholars from the United States (Dr. A. Jean-Luc Ayitou, Illinois Institute of Technology, and Dr. Kefa Onchoke, Stephen F. Austin State University) to work on a collaborative project. The project will focus on the development of polymeric materials for the removal and detection of perchlorates and fluorides in water, and a Master of Science in Analytical Chemistry degree program. The University congratulates and wishes her well in these projects.

4. ICGEB Research Grants 2020



Dr. Heshborne Tindih

Dr. Heshborne Tindih submitted a proposal to the International Centre for Genetic Engineering and Biotechnology (ICGEB) and won the grants for the Collaborative Research Programme (CRP) to be undertaken at Machakos University. The research aims to investigate presence of and characterize the SARS-CoV-2 virus and antibodies in animals. Further, the study will assess human-animal transmission of the SARS-CoV-2 virus. The project is expected to build capacity of researchers in Machakos University through training of MSc Students and equipping of the biological sciences laboratory. The University congratulates and wishes him well in the project.

MKSU staff brave the COVID-19 storm to put a stellar performance in research

Machakos University researchers continued to engage in research activities, Despite the COVID-19 pandemic, as evidenced by various research outputs. During the first half of the 2020/21 academic year, members of staff published thirty (30) papers in referred journals; ten (10) members of staff participated in external conferences, while 118 attended internal workshops or trainings.

MksU Library goes High-Tech in Security Systems

In a bid to enhance security in the library, Machakos University installed an Intrusion Control System in the facility on 24th November, 2020. Speaking during the installation of the system, the Proprietor of Double Four Supplies indicated that the access control system is responsible for restricting and granting access to specific people into particular areas. The goal of the software is to minimize unauthorized access to places, assets, and systems. In her remarks, the University Librarian expressed optimism that the system would complement existing systems including the electronic security systems, CCTV cameras and human security personnel, to boost security of library users and human and information resources.



Suppliers installing intrusion control system in the library

Observance of Covid-19 protocols in the Library taken to a higher level

Being cognizant of the COVID-19 pandemic, Machakos University is keen to ensure strict observance of the protocols to mitigate the spread of the disease within the institution. At the University Library, a range of prevention and mitigation measures have been put in place, including regular fumigation, wiping and sanitization of surfaces, hand washing, and wearing of face masks. To complement these measures, the University issued face shields to library staff on 5th November, 2020. Speaking during the issuance of the face shields, the University Librarian observed that while the library is a critical facility of any higher learning institution, it is a high-risk area for contraction and spread of communicable infections such as COVID-19. This is because routine operations of the library involve extensive and frequent physical contact with surfaces such as books, shelves, chairs and tables, by multiple users. The library is also a converging point for a large section of the university staff and students. The Librarian said that donning of face shields will further minimize the risk of staff contracting and spreading COVID-19 within the facility.



Library circulation desk staff donned in facemasks and shields



A worker sanitizing library surfaces after every three hours daily



Fumigation process in progress

Library interiors get a facelift

Libraries the world over have adopted modern designs that give staff and users more reasons to cherish their Libraries not only as reading facilities but also destinations for relaxation, discussions and hangouts. In light of this, MksU library has acquired and mounted new window curtains to improve aesthetics, increase warmth, as well as regulate natural light. In addition, partitioning of the University Librarians' office is in progress, which will enable the Library to comply with the requirements of the Commission for University Education (CUE).



Workers fitting curtains and sheers on a library window



A worker painting partitioned librarian's office

Keeping plagiarism at bay

Machakos University gives high priority to and promotes integrity in academic and research work. To this end, the University Library has Turnitin anti-plagiarism software that tests documents such as student and staff projects, thesis and assignments for similarity index. To create awareness and build capacity among university staff and students, the Library held a Turnitin training on 18th November, 2020. Speaking during the training, the Deputy Librarian challenged members of academic staff to ensure that assignments and research works emanating from Machakos University were authentic enough to stand the test of the time. In this regard, the deputy Librarian further urged academic staff members to liaise with library staff to test for plagiarism of research and academic works conducted in the University.



Deputy Librarian and lecturers from School of Humanities and Social Sciences, Department of Fashion Design and Marketing after the training

MACHAKOS UNIVERSITY BROADENS INTERNATIONAL AND LOCAL LINKAGES

Machakos University continues to explore opportunities for local and international collaboration to enhance her research, innovation, and knowledge and technology transfer. During the second half of the year 2020, the University entered into partnerships with four (4) organizations, namely, (i) Convoy of Hope (COH), Missouri State University & KAG East University (ii) I Choose Life - Africa, (ICL), (iii) Solar Afric Inc.; and (iv) Diaspora Institute of Employability and Enterprise Development (DEED).

KENYAN YOUTHS ENHANCE THEIR EMPLOYABILITY AND ENTERPRISE DEVELOPMENT SKILLS AT MACHAKOS UNIVERSITY

Machakos University supports initiatives that empower and transform communities. In November 2020, the University entered into partnership with the Diaspora Institute of Employability and Enterprise Development (DEED Institute) to implement a training program on employable skills development targeting youthful school leavers. DEED Institute is contracted under the World Bank/GoK – sponsored program: Kenya Youth Employment Opportunities (KYEOP) to offer 2-month courses to students in the fields of (i) Agriculture (agribusiness); (ii) Electrical and electronics; (iii) Solar PV technology; (iv) Plumbing; (v) Fashion and design; (vi) Food and Beverages; (vii) Event management; (viii) Hair and beauty; (ix) Motor vehicle mechanics; (x) ICT; and (xi) Welding. Machakos University will offer the training through the Directorate of Technical and Vocational Education and Training (TVET) at a fee agreed upon between the University and DEED Institute. The first cohort of 172 trainees was received in December 2020 and are expected to complete their training in February 2021.



Students are taken through an ICT lesson



Students attending a Motor Vehicle Mechanics class



Ms. Doreen Kanini takes students through a practical hair and beauty training session at the University's Cosmetology Workshop



Hair and beauty Students practise facial treatment at the Cosmetology Workshop



Agribusiness students learn by doing, how to make a maple trough garden for urban farming at a client's house, under tutorship of Mr Kevin Nyamwaya



The maple garden ready for planting



Research Quote

"At a time when science plays such a powerful role in the life of society, when the destiny of the whole of mankind may hinge on the results of scientific research, it is incumbent on all scientists to be fully conscious of that role, and conduct themselves accordingly." ~ Joseph Rotblat



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**MACHAKOS UNIVERSITY IS
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