



# MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY

# 10<sup>th</sup> ANNUAL PhD SYMPOSIUM 2025

**THEME:** "Catalyzing sustainable  
development through Research,  
Science, Technology, and AI"

**DATE:** 20<sup>th</sup> November, 2025

**VENUE :** Kihumuro Campus



global health  
**collaborative**  
MUST-Uganda



MASSACHUSETTS  
GENERAL HOSPITAL





## Acknowledgement

As another year passes, we once again find ourselves at the doorstep of the annual PhD Symposium. Over the past 10 years, we have witnessed profound changes that have reshaped how we engage in scientific discourse. We extend our heartfelt appreciation to our esteemed panelists and our deepest gratitude to the dedicated editorial and organizing team, led by Dr. Brian Turigye.

As we celebrate a decade of the PhD Symposium, we also acknowledge Dr. Fred Kagwa, who has served as convener since the symposium's inception. He has written a white paper on the impact of this symposium, and we have added it to this book. This remarkable journey has been guided by the wisdom of Prof. Nixon Kamukama, Deputy Vice Chancellor for Academic Affairs at Mbarara University of Science and Technology, whose leadership was especially evident during the tumultuous times of the COVID-19 pandemic, when we transitioned seamlessly to virtual platforms. This shift pushed us to embrace new modes of communication that have proven, in many ways, efficient and convenient, yet it also reminded us of the irreplaceable value of in-person interactions.

We extend my sincere appreciation to all those involved in the preparation of this symposium, recognizing the importance of your diverse contributions. The symposium has stood the test of time, and I would like to offer special acknowledgment to Assoc. Prof. Vincent Batwala and Assoc. Prof. Joel Bazira for their unwavering support in ensuring the continuity of this prestigious university event. We would like to express our gratitude to the University's leadership and management for graciously sponsoring and endorsing the PhD Symposium again this year, even amidst financial challenges.

The establishment of the Directorate of Research and Graduate Training (DRGT) has provided a sustainable home for the PhD symposium. The Directorate plays a pivotal role in coordinating postgraduate programs, including syllabi development, student progress monitoring, admissions, scholarship administration, research grants, examinations, and the overall welfare of postgraduate students. We extend our special appreciation to the Board, Director, and staff of the Directorate for their tireless efforts and unwavering support throughout the preparation of the November 2025 Annual PhD Symposium.

@Nov2025 MUST PhD Symposium

## Anthems

### UGANDA

1. Oh Uganda! may God uphold thee,  
We lay our future in thy hand.  
United, free,  
For liberty

Together we'll always stand.

2. Oh Uganda! the land of freedom.  
Our love and labour we give,  
And with neighbors all  
At our country's call  
In peace and friendship we'll live.

3. Oh Uganda! the land that feeds us  
By sun and fertile soil grown.  
For our own dear land,  
We'll always stand

The Pearl of Africa's Crown.

### EAST AFRICAN

1. Ee Mungu twaomba ulinde  
Jumuiya Afrika Mashariki  
Tuwezeshe kuishi kwa amani  
Tutimize na malengo yetu.

Chorus  
Jumuiya Yetu sote tuilinde  
Tuwajibike tuimarike  
Umoja wetu ni nguzo yetu  
Idumu Jumuiya yetu.

2. Uzalendo pia mshikamano  
Viwe msingi wa Umoja wetu  
Natulinde Uhuru na Amani  
Mila zetu na desturi zetu.

3. Viwandani na hata mashambani  
Tufanye kazi sote kwa makini  
Tujitoe kwa hali na mali  
Tuijenge Jumuiya bora.

## MBARARA UNIVERSITY

Mbarara University succeed we MUST  
With God's will, we shall make the best of MUST  
Let us unite and cooperate, to build the nation in different sectors  
Our Pride and ego MUST will shine forever and we'll be victors  
My alma mater long live x2 Mbarara University Ultimum viva

1. MUST we shall hail and salute thee  
The frontier of true knowledge  
For through advancing novelty  
Your excellence will ever grow

2. CRADLE of efficient teachers  
Doctors, Scientists and future leaders  
Hope of the generation unborn  
MUST you are our country's pride

3. WITH God's help Mbarara will shine  
As the bright star among the others  
To light the way for the future generation  
To follow the light yonder

## Remarks from the conveners of the 10th MUST Annual PhD Symposium, November 2025

It is our great pleasure to welcome you to the 10th MUST Annual PhD Symposium, held under the theme "Catalyzing Sustainable Development through Research, Science, Technology, and AI." The PhD Symposium is part of the MUST Annual Research Dissemination Conference series. Over the past decade, it has grown into a vibrant platform for knowledge exchange, collaboration, and innovation—bringing together PhD scholars, researchers, mentors, supervisors, and stakeholders committed to advancing and strengthening doctoral education at MUST.

MUST has a long-standing and avid tradition in research, making it one of the most academically prolific universities in Uganda. For the past 35 years, the University has served as a sanctuary for professional academicians. Over time, we have recognized the need to further solidify our efforts, especially by advancing high-quality and supportive doctoral training and research, and the PhD symposium has played a vital role in catalyzing this process.

Throughout the day, you will participate in breakaway sessions featuring work from current MUST PhD students. The program includes scientific tracks in Science and Technology, Humanities, Social and Management Sciences, and Multi-Disciplinary Research. The symposium has been intentionally curated to be engaging and interactive.

As we step into a new decade of growth for this symposium, we wish to express our sincere appreciation to Dr. Fred Kagwa, who has steered this vision for the past 10 years. We are also deeply grateful to the University leadership, especially Assoc. Prof. Nickson Kamukama, who supported this idea from its inception. We warmly appreciate our invited panelists for enriching today's discussions. Our vision is not merely to hold a one-day event but to build a platform that continually supports PhD students throughout the year.

We hope you find this symposium enriching for your academic journey and future research endeavors.

Dr. Brian Turigye

PhD Symposium Chair

Dr. Barbra Tuhamize

PhD Symposium Co-chair

## Welcome Remarks by Director, DRGT

I greet you all in the name of the almighty God. Allow me to welcome you all to the 10th MUST annual PhD symposium. Please join me to thank university top management, MGH and other funders who have sponsored the PhD symposium. Allow me to thank the PhD symposium organizing committee for the great work done. Probably, you might have heard some one saying that PhD is a lonely journey. I believe that it is a personal choice to make which definitely bears consequences that may affect your PhD studies. We have also heard about the common African proverb "If you want to walk fast, walk alone. If you want to walk far, walk together". This African proverb suggests that while walking alone might lead to quicker progress on a small scale, long-term success and distance are achieved through collaboration and unity with others. For example, we have all witnessed people walking together, crossing borders to attend and celebrate annually the Uganda martyr's day which would be impossible if you chose to trek the same distance alone. Furthermore, A child who has never visited other homes thinks his mother is the best cook". This African proverb suggests that a limited perspective can lead one to believe their own experience is the only or best one, without exposure to alternatives. It implies that when a child experiences other foods, they may realize that other cooking styles exist. Therefore, to this end, at MUST, we believe that the annual PhD symposium provides a platform where our PhD students collaborate, share knowledge, experience, show progress with fellow students, supervisors and researchers. The PhD symposium also links our students to international stakeholders and audience. I therefore encourage all MUST PhD students to always attend this very important symposium. Succeed we MUST.

Dr. Simon Kawuma

Deputy Director DRGT

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY (MUST) Kihumuro Campus**

**10<sup>th</sup> ANNUAL PhD SYMPOSIUM**

**20<sup>th</sup> November 2025**

**Master of Ceremonies, Nakato Angella**

| Time                                                                                                                                                                                                                                                                                                     | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| 07:45am-08:20am                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Arrival and Registration                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 8:20am – 10:00<br>Breakaway session 1<br>(Room 1)<br><br>Science and Technology<br><br>Session chairs: Prof. Jerome Kabakyenga, Dr. Simon Kawuma, Dr. Asiimwe Stephen (Chair), Assoc Prof. Julius B Leju, Prof. Grace Kagoro, Dr. Jonathan Izudi<br><br>Rapporteur- Atukunda Unity<br>ICT- Martin Kijumi | <br>Presentations –<br><br>i) A Convolutional Neural Network Model for Processing DICOM Files: Mabirizi Vicent<br><br>ii)Lymphedema: Causative Agents, Patient and Caretaker Knowledge, Self-Reported Healthcare Needs and Preventive Strategies in Kamwenge District: Mwesigye Vicent<br><br>iii)Microbial and Metagenomic Analysis of Bacterial Communities in Milk Products Produced in Mbarara City, Uganda: Monicah Kamwine<br><br>iv)Bridging Traditional Uses of Propolis in Uganda with GC-MS Metabolomics and Chemometric Modelling: Ivan Kahwa |

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| <p>8:20 –10:00 Breakaway session 1 (Room 2)</p> <p>Humanities, Social &amp; Management Sciences</p> <p>Session Chairs: Prof. Roberts Muriisa Kabeba, Assoc. Prof. Henry Mutebi, Assoc. Prof Godfrey Barigye (Chair), Rev. Fr. Dr. Kare mire Mark Deus, Dr. Wilbroad Aryatwijuka, Dr. Kijjambu Fredrick</p> <p>Rapporteur- Twikirize Winnie</p> <p>ICT – Peter Bambanza</p> | <p>Presentations -</p> <p>i)Examining Institutional Support on skills development for youth self-employment in Mbarara City: A study of influences and outcomes: Gumisiriza Asaph Blair</p> <p>ii) Challenges Affecting the Implementation of Community Policing and Crime Prevention in Mbarara City, South-Western Uganda: Tumusiime John Bosco</p> <p>iii) Optimization of Briquetting Conditions of Groundnut Shell and Maize Stalk: Eling Jimmy</p> <p>iv) workplace equity, participation in staff committees, staff welfare, and job satisfaction among academic staff in public and private universities in Western Uganda: Tugaine yo Annah</p>                                                                                       |
| <p>8:20 –10:00 Breakaway session 1 (Room 3)</p> <p>Cross Cutting/Multi-Disciplinary Research</p> <p>Session Chairs: Dr. Karooma Cleophas (chair), Dr. Denis Musinguzi, Dr. Kabarungi Moreen, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael</p> <p>Rapporteur- Peace Katusiime</p> <p>ICT – Emmanuel Niwenyesiga</p>                                 | <p>Presentations-</p> <p>i) A comparative assessment of environmental impacts of production, use, and disposal of a parabolic solar cooker and charcoal for cooking in Uganda : Asasira Justus</p> <p>ii) Exploring the lived experiences of Adolescent Mothers and Fathers (10-19) years in Southwestern Uganda. A qualitative study : Atwiine Scovia</p> <p>iii) Determinants of smallholder farmers' intention to adopt drought and flood risk reduction strategies in south-western Uganda : Insights from an integrated social-psychological framework : Nbasumba Dina</p> <p>iv) Farmers' Knowledge, Practices, and Constraints in Finger Millet Cultivation under Climate Variability in Southwestern Uganda : Nakazibwe Immaculate</p> |
| 10:00am – 10:30am                                                                                                                                                                                                                                                                                                                                                          | HEALTH BREAK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| 10:30am-10:40am                      | Prayer, Any Religious Leader present in the room                                                                                                        |
|                                      | Anthems (Uganda, East African, MUST)<br>Angella Nakato                                                                                                  |
| 10:40am – 11:40am<br>Opening Plenary | Welcome remarks-<br><ul style="list-style-type: none"> <li>• Organizing committee</li> <li>• Dr. Simon Kawuma- Deputy Director DRGT (10mins)</li> </ul> |
|                                      | Former PhD Symposium Attendee/Graduate (10mins)                                                                                                         |
|                                      | Opening remarks- Prof. Nixon Kamukama - DVC-Academic Affairs – MUST (20mins)                                                                            |
|                                      | Keynote address – Prof. Pauline Byakika Kibwika –VC- MUST (20mins)                                                                                      |
| 11:40am – 11:55am                    | Nov 2025 PhD SYMPOSIUM GROUP PHOTO- All attendees, Angella Nakato                                                                                       |

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| <p>12:00 – 14:35 Breakaway session 2 (Room 1)</p> <p>Science and Technology</p> <p>Session chairs: Prof. Jerome Kabakyenga, Dr. Simon Kawuma, Dr. Asiimwe Stephen Assoc Prof. Julius B Leju (Chair), Prof. Grace Kagoro, Dr. Jonathan Izudi</p> <p>Rapporteur- Atukunda Unity</p> <p>ICT- Martin Kijumi</p> | <p>Presentations –</p> <p>i)Assessment of Transfusion Safety and Efficacy among Cancer Patients in Uganda and Caregivers' Perception on Blood Use</p> <p>ii)Assessment of Transfusion Safety and Efficacy among Cancer Patients in Uganda and Caregivers' Perception on Blood Use ; Ivan Mugisha Taremwa</p> <p>iii) The role of sanitation behavior as a driver for antimicrobial resistance in Escherichia coli among Lakeshore residents around Lake Victoria, Uganda : Kabiswa Winston</p> <p>iv) Mental Health Challenges and Adverse Childhood Experiences among Adolescents at Kampiringisa National Rehabilitation Centre, Central Uganda: Odendi Gidoen Robert</p> <p>v) Effect Of Point-Of-Care Contraceptive Provision On Modern Methods Uptake Among Postpartum Women At Mbarara Regional Referral Hospital : Brenda Ainomugisha</p> <p>vi)Vector species diversity and Plasmodium falciparum sporozoite infectivity rates in selected flood prone villages in Kasese district, Uganda: Rogers Kalyesi</p> |
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| <p>12:00 – 14:35 Breakaway session 2 (Room 2)</p> <p>Humanities, Social &amp; Management Sciences</p> <p>Session Chairs Prof. Roberts Muriisa Kabeba, Assoc. Prof. Henry Mutebi, Assoc. Prof Godfrey Barigye (Chair), Rev. Fr. Dr. Karemire Mark Deus, Dr. Wilbroad Aryatwijuka, Dr. Kijjambu Fredrick</p> <p>Rapporteur- Twikirize Winnie</p> <p>ICT – Peter Bambanza</p>               | <p>Presentations-</p> <p>i) Foreign Exchange Rates, Foreign Direct Investment, Government Expenditure And Trade Balance In Sub Saharan Africa : Kagambo John Patric</p> <p>ii) Isomorphic forces, taxpayer perception and income tax compliance among Small and medium-sized enterprises in Southwestern Uganda : Tumwebembeire Naster</p> <p>iii) Peer influence, alcohol use, and risky sexual behaviors (RSBs) among adolescents in secondary schools in Greater Mbarara, Uganda : Nabaasa Nkuba Cedric</p> <p>iv) Dynamic Capabilities And Financial Performance Of Microfinance Institutions In Uganda : Mbabazi Grace Mary</p> <p>v) Employability Skills As A Mediator Between Human And Structural Capital And Graduate Employability: A Study Of Public Universities In South-Western Uganda.: Twinomuhwezi Alex</p> |
| <p>12:00 – 14:35 Breakaway session 2 (Room 3)</p> <p>Cross Cutting/Multi-Disciplinary Research</p> <p>Session Chairs: Dr. Karooma Cleophas (chair), Dr. Denis Musinguzi, Dr. Kabarungi Moreen, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael</p> <p>Muheki, Dr. Wangalwa Raphael (Chair)</p> <p>Rapporteur- Peace Katusiime</p> <p>ICT – Emmanuel Niwenyesiga</p> | <p>Presentations-</p> <p>i) An Explainable Ensemble Model for ZARDI-Wise Maize Yield Prediction Using Climate Data in Uganda : Taremwa Danison</p> <p>ii) Predicting the Structural Composition and Higher Heating Value of Agricultural and Municipal Solid Organic Waste Using Conditional Generative Adversarial Networks and Ensemble Learning for Sustainable Energy : Nakimuli Nakato Constance</p> <p>iii) Effects of Varying Dietary Macronutrient Ratios on Immune Function in Swiss Albino Mice : Kinyi Wambuki Hellen</p> <p>iv) Mathematical Model of Malaria Transmission Dynamics and Control with Vaccination and Treatment in the presence of the protected group : Tuhimbise Rugogoma Dominic</p>                                                                                                            |

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| 14:35 – 15:00                                               | Lunch                             |
| 15:00 – 15:15<br>Deputy Director DRGT –<br>Dr. Simon Kawuma | Discussion and wrap up            |
| 15:15 – 15:30<br>Closing Remarks and<br>Way forward         | Prof. Nixon Kamukama –DVC-AA-MUST |
| Departure                                                   |                                   |

## Details for Symposium Presentations

### Break Away Room1 Presentations, 20th November 2025

|                |                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Room 1         | SCIENCE AND TECHNOLOGY                                                                                                                                        |
| Room1 Chair(s) | Prof. Jerome Kabakyenga, Dr. Simon Kawuma, Dr. Asimwe Stephen (Chair), Assoc Prof. Julius B Leju, Prof. Grace Kagoro, Dr. Jonathan Izudi                      |
| 8:20-8:45      | A Convolutional Neural Network Model for Processing DICOM Files: Mabirizi Vicent                                                                              |
| 8:45-09:10     | Lymphedema: Causative Agents, Patient and Caretaker Knowledge, Self-Reported Healthcare Needs and Preventive Strategies in Kamwenge District: Mwesigye Vicent |
| 09:10-09:35    | Microbial and Metagenomic Analysis of Bacterial Communities in Milk Products Produced in Mbarara City, Uganda: Monicah Kamwine                                |
| 09:35-10:00    | Bridging Traditional Uses of Propolis in Uganda with GC-MS Metabolomics and Chemometric Modelling: Ivan Kahwa                                                 |
| 10:00 – 10:30  | HEALTH BREAK                                                                                                                                                  |
| 10:40 – 11:50  | OPENING PLENARY SESSION IN ROOM1                                                                                                                              |
| 11:50 – 12:00  | November 2025 PhD SYMPOSIUM GROUP PHOTO- All attendees                                                                                                        |
| Room1 Chair(s) | Prof. Jerome Kabakyenga, Dr. Simon Kawuma, Dr. Asimwe Stephen Assoc Prof. Julius B Leju (Chair), Prof. Grace Kagoro, Dr. Jonathan Izudi                       |

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|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12:00-12:25   | Assessment of Transfusion Safety and Efficacy among Cancer Patients in Uganda and Caregivers' Perception on Blood Use : Ivan Mugisha Taremwa                          |
| 12:25-12:55   | The role of sanitation behavior as a driver for antimicrobial resistance in Escherichia coli among Lakeshore residents around Lake Victoria, Uganda : Kabiswa Winston |
| 12:55-13:20   | Mental Health Challenges and Adverse Childhood Experiences among Adolescents at Kampiringisa National Rehabilitation Centre, Central Uganda : Odendi Gidoen Robert    |
| 13:20-13:45   | Effect Of Point-Of-Care Contraceptive Provision On Modern Methods Uptake Among Postpartum Women At Mbarara Regional Referral Hospital : Brenda Ainomugisha            |
| 13:45-14:10   | Vector species diversity and Plasmodium falciparum sporozoite infectivity rates in selected flood prone villages in Kasese district, Uganda : Rogers Kalyesi          |
| 14:35 – 15:00 | LUNCH                                                                                                                                                                 |
| 15:00 – 15:30 | Deputy Director DRGT – Dr. Simon Kawuma<br>Master of Ceremonies –Angella Nakato<br>Discussion, wrap up and closing remarks                                            |

### Break Away Room 2 Presentations, 20th November 2025

| Room 2         | HUMANITIES, SOCIAL & MANAGEMENT SCIENCES                                                                                                                                       |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Room2 Chair(s) | Prof. Roberts Muriisa Kabeba, Assoc. Prof. Henry Mutebi, Assoc. Prof Godfrey Barigye (Chair), Rev. Fr. Dr. Karemiri Mark Deus, Dr. Wilbroad Aryatwijuka, Dr. Kijjambu Fredrick |
| 8:20-8:45      | Examining Institutional Support on skills development for youth self-employment in Mbarara City : A study of influences and outcomes : Gumisiriza Asaph Blair                  |

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|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8:45-09:10     | Challenges Affecting the Implementation of Community Policing and Crime Prevention in Mbarara City, South-Western Uganda : Tumusiime John Bosco                                     |
| 09:10-09:35    | Optimization of Briquetting Conditions of Groundnut Shell and Maize Stalk: Eling Jimmy                                                                                              |
| 09:35-10:00    | workplace equity, participation in staff committees, staff welfare, and job satisfaction among academic staff in public and private universities in Western Uganda: Tugainayo Annah |
| 10:00 – 10:30  | HEALTH BREAK                                                                                                                                                                        |
| 10:40 – 11:50  | OPENING PLENARY SESSION IN ROOM1                                                                                                                                                    |
| 11:50 – 12:00  | November 2025 PhD SYMPOSIUM GROUP PHOTO- All attendees                                                                                                                              |
| Room2 Chair(s) | Prof. Roberts Muriisa Kabeba, Assoc. Prof. Henry Mutebi, Assoc. Prof Godfrey Barigye (Chair), Rev. Fr. Dr. Karemiro Mark Deus, Dr. Wilbroad Aryatwijuka, Dr. Kijjambu Fredrick      |
| 12:00-12:25    | Employability Skills As A Mediator Between Human And Structural Capital And Graduate Employability : A Study Of Public Universities In South-Western Uganda.: Twinomuhwezi Alex     |
| 12:25-12:55    | Isomorphic forces, taxpayer perception and income tax compliance among Small and medium-sized enterprises in Southwestern Uganda : Tumwebembeire Naster                             |
| 12:55-13:20    | Peer influence, alcohol use, and risky sexual behaviors (RSBs) among adolescents in secondary schools in Greater Mbarara, Uganda : Nabaasa Nkuba Cedric                             |
| 13:20-13:45    | Dynamic Capabilities And Financial Performance Of Microfinance Institutions In Uganda : Mbabazi Grace Mary                                                                          |
| 13:45-14:10    | Foreign Exchange Rates, Foreign Direct Investment, Government Expenditure And Trade Balance In Sub Saharan Africa : Kagambo John Patric                                             |
| 14:35 – 15:00  | LUNCH                                                                                                                                                                               |

15:00 – 15:30

Deputy Director DRGT – Dr. Simon Kawuma

Master of Ceremonies –Angella Nakato

Discussion, wrap up and closing remarks

### Break Away Room 3 Presentations, 20th November 2025

| Room 3         | CROSS-CUTTING/MULTI-DISCIPLINARY RESEARCH                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Room3 Chair(s) | Dr. Kansime Noel Kiiza (chair), Dr. Cuthbert Tukundane, Dr. Ntwari Richard, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael                                                         |
| 8:20-8:45      | A comparative assessment of environmental impacts of production, use, and disposal of a parabolic solar cooker and charcoal for cooking in Uganda : Asasira Justus                                       |
| 8:45-09:10     | Exploring the lived experiences of Adolescent Mothers and Fathers (10-19) years in Southwestern Uganda. A qualitative study : Atwiine Scovia                                                             |
| 09:10-09:35    | Determinants of smallholder farmers' intention to adopt drought and flood risk reduction strategies in south-western Uganda : Insights from an integrated social-psychological framework : Nbasumba Dina |
| 09:35-10:00    | Farmers' Knowledge, Practices, and Constraints in Finger Millet Cultivation under Climate Variability in Southwestern Uganda : Nakazibwe Immaculate                                                      |
| 10:10 – 10:30  | HEALTH BREAK                                                                                                                                                                                             |
| 10:40 – 11:50  | OPENING PLENARY SESSION IN ROOM1                                                                                                                                                                         |
| 11:50 – 12:00  | November 2025 PhD SYMPOSIUM GROUP PHOTO-All attendees                                                                                                                                                    |
| Room3 Chair(s) | Dr. Kansime Noel Kiiza, Dr. Cuthbert Tukundane, Dr. Ntwari Richard, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael (Chair)                                                         |
| 12:00-12:25    | An Explainable Ensemble Model for ZARDI-Wise Maize Yield Prediction Using Climate Data in Uganda : Taremwa Danison                                                                                       |

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| 12:25-12:55   | Predicting the Structural Composition and Higher Heating Value of Agricultural and Municipal Solid Organic Waste Using Conditional Generative Adversarial Networks and Ensemble Learning for Sustainable Energy : Nakimuli Nakato Constance |
| 12:55-13:20   | Effects of Varying Dietary Macronutrient Ratios on Immune Function in Swiss Albino Mice: Kinyi Wambuki Hellen                                                                                                                               |
| 13:20-13:45   | Mathematical Model of Malaria Transmission Dynamics and Control with Vaccination and Treatment in the presence of the protected group : Tuhimbise Rugogoma Dominic                                                                          |
| 14:35 – 15:00 | LUNCH                                                                                                                                                                                                                                       |
| 15:00 – 15:30 | Deputy Director DRGT – Dr. Simon Kawuma<br>Master of Ceremonies –Angella Nakato<br>Discussion, wrap up and closing remarks                                                                                                                  |

**MBARARA UNIVERISTY OF SCIENCE AND TECHNOLOGY (MUST)**  
**Kihumuro Campus**  
**10th ANNUAL PhD SYMPOSIUM**  
**20th November 2025**  
**Master of Ceremonies, Nakato Angella**

|                 |                          |
|-----------------|--------------------------|
| Time            | Activity                 |
| 07:45am-08:20am | Arrival and Registration |

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| <p>8:20am – 10:00<br/>Breakaway session 1<br/>(Room 1)</p> <p>Science and<br/>Technology</p> <p>Session chairs: Prof.<br/>Jerome Kabakyenga,<br/>Dr. Simon Kawuma,<br/>Dr. Asiiimwe Stephen<br/>(Chair), Assoc Prof.<br/>Julius B Leju, Prof.<br/>Grace Kagoro, Dr.<br/>Jonathan Izudi</p> <p>Rapporteur-<br/>Atukunda Unity</p> <p>ICT- Martin Kijumi</p>                                                                             | <p>Presentations –</p> <p>i) A Convolutional Neural Network Model for<br/>Processing DICOM Files: Mabirizi Vicent</p> <p>ii) Lymphedema: Causative Agents, Patient and<br/>Caretaker Knowledge, Self-Reported Healthcare<br/>Needs and Preventive Strategies in Kamwenge<br/>District: Mwesigye Vicent</p> <p>iii) Microbial and Metagenomic Analysis of<br/>Bacterial Communities in Milk Products<br/>Produced in Mbarara City, Uganda: Monicah<br/>Kamwine</p> <p>iv) Bridging Traditional Uses of Propolis in<br/>Uganda with GC-MS Metabolomics and<br/>Chemometric Modelling: Ivan Kahwa</p>                                                                                                   |
| <p>8:20 – 10:00<br/>Breakaway session 1<br/>(Room 2)</p> <p>Humanities, Social<br/>&amp; Management<br/>Sciences</p> <p>Session Chairs: Prof.<br/>Roberts Muriisa<br/>Kabeba, Assoc.<br/>Prof. Henry Mutebi,<br/>Assoc. Prof Godfrey<br/>Barigye (Chair), Rev.<br/>Fr. Dr. Karemiri Mark<br/>Deus, Dr. Wilbroad<br/>Aryatwijuka, Dr.<br/>Kijjambu Fredrick</p> <p>Rapporteur- Twikirize<br/>Winnie</p> <p>ICT – Peter<br/>Bambanza</p> | <p>Presentations -</p> <p>i) Examining Institutional Support on skills<br/>development for youth self-employment<br/>in Mbarara City: A study of influences and<br/>outcomes: Gumisiriza Asaph Blair</p> <p>ii) Challenges Affecting the Implementation<br/>of Community Policing and Crime Prevention<br/>in Mbarara City, South-Western Uganda:<br/>Tumusiime John Bosco</p> <p>iii) Optimization of Briquetting Conditions of<br/>Groundnut Shell and Maize Stalk: Eling Jimmy</p> <p>iv) workplace equity, participation in staff<br/>committees, staff welfare, and job satisfaction<br/>among academic staff in public and private<br/>universities in Western Uganda: Tugaineyo<br/>Annah</p> |

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| <p>8:20 –10:00<br/>Breakaway session 1<br/>(Room 3)</p> <p>Cross Cutting/Multi-Disciplinary Research</p> <p>Session Chairs: Dr. Karooma Cleophas (chair), Dr. Denis Musinguzi, Dr. Kabarungi Moreen, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael</p> <p>Rapporteur- Peace Katusiime</p> <p>ICT – Oyo Jude</p> | <p>Presentations-</p> <p>i) A comparative assessment of environmental impacts of production, use, and disposal of a parabolic solar cooker and charcoal for cooking in Uganda : Asasira Justus</p> <p>ii) Exploring the lived experiences of Adolescent Mothers and Fathers (10-19) years in Southwestern Uganda. A qualitative study : Atwiine Scovia</p> <p>iii) Determinants of smallholder farmers' intention to adopt drought and flood risk reduction strategies in south-western Uganda : Insights from an integrated social-psychological framework : Nbasumba Dina</p> <p>iv) Farmers' Knowledge, Practices, and Constraints in Finger Millet Cultivation under Climate Variability in Southwestern Uganda : Nakazibwe Immaculate</p> |
| 10:00am – 10:30am                                                                                                                                                                                                                                                                                                                      | HEALTH BREAK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10:30am-10:40am                                                                                                                                                                                                                                                                                                                        | <p>Prayer, Any Religious Leader present in the room</p> <p>Anthems (Uganda, East African, MUST) Angella Nakato</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 10:40am – 11:40am<br>Opening Plenary                                                                                                                                                                                                                                                                                                   | <p>Welcome remarks- Organizing committee<br/>Dr. Simon Kawuma- Deputy Director DRGT (10mins)</p> <p>Former PhD Symposium Attendee/Graduate (10mins)</p> <p>Opening remarks- Prof. Nixon Kamukama - DVC-Academic Affairs – MUST (20mins)</p> <p>Keynote address – Prof. Pauline Byakika Kibwika –VC- MUST (20mins)</p>                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 11:40am – 11:55am                                                                                                                                                                                                                                                                                                                      | Nov 2025 PhD SYMPOSIUM GROUP PHOTO-All attendees, Angella Nakato                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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| <p>12:00 – 14:35<br/>Breakaway session 2<br/>(Room 1)</p> <p>Science and<br/>Technology</p> <p>Session chairs: Prof. Jerome Kabakyenga, Dr. Simon Kawuma, Dr. Asimwe Stephen</p> <p>Assoc Prof. Julius B Leju (Chair), Prof. Grace Kagoro, Dr. Jonathan Izudi</p> <p>Rapporteur-<br/>Atukunda Unity</p> <p>ICT- Martin Kijumi</p> | <p>Presentations –</p> <p>i)Assessment of Transfusion Safety and Efficacy among Cancer Patients in Uganda and Caregivers' Perception on Blood Use</p> <p>ii)Assessment of Transfusion Safety and Efficacy among Cancer Patients in Uganda and Caregivers' Perception on Blood Use ; Ivan Mugisha Taremwa</p> <p>iii) The role of sanitation behavior as a driver for antimicrobial resistance in Escherichia coli among Lakeshore residents around Lake Victoria, Uganda : Kabiswa Winston</p> <p>iv) Mental Health Challenges and Adverse Childhood Experiences among Adolescents at Kampiringisa National Rehabilitation Centre, Central Uganda: Odendi Gidoen Robert</p> <p>v) Effect Of Point-Of-Care Contraceptive Provision On Modern Methods Uptake Among Postpartum Women At Mbarara Regional Referral Hospital : Brenda Ainomugisha</p> <p>vi)Vector species diversity and Plasmodium falciparum sporozoite infectivity rates in selected flood prone villages in Kasese district, Uganda: Rogers Kalyesi</p> |
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| <p>12:00 – 14:35<br/>Breakaway session 2<br/>(Room 2)</p> <p>Humanities, Social<br/>&amp; Management<br/>Sciences</p> <p>Session Chairs Prof.<br/>Roberts Muriisa<br/>Kabeba, Assoc.<br/>Prof. Henry Mutebi,<br/>Assoc. Prof Godfrey<br/>Barigye (Chair), Rev.<br/>Fr. Dr. Karemire Mark<br/>Deus, Dr. Wilbroad<br/>Aryatwijuka, Dr.<br/>Kijjambu Fredrick</p> <p>Rapporteur- Twikirize<br/>Winnie</p> <p>ICT – Peter<br/>Bambanza</p> | <p>Presentations-</p> <p>i) Foreign Exchange Rates, Foreign Direct Investment, Government Expenditure And Trade Balance In Sub Saharan Africa : Kagambo John Patric</p> <p>ii) Isomorphic forces, taxpayer perception and income tax compliance among Small and medium-sized enterprises in Southwestern Uganda : Tumwebembeire Naster</p> <p>iii) Peer influence, alcohol use, and risky sexual behaviors (RSBs) among adolescents in secondary schools in Greater Mbarara, Uganda : Nabaasa Nkuba Cedric</p> <p>iv) Dynamic Capabilities And Financial Performance Of Microfinance Institutions In Uganda : Mbabazi Grace Mary</p> <p>v) Employability Skills As A Mediator Between Human And Structural Capital And Graduate Employability: A Study Of Public Universities In South-Western Uganda.: Twinomuhwezi Alex</p> |
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12:00 – 14:35 Breakaway session 2 (Room 3)

Cross Cutting/Multi-Disciplinary Research Session Chairs: Dr. Karooma Cleophas (chair), Dr. Denis Musinguzi, Dr. Kabarungi Moreen, Dr. Specioza Twinamasiko, Dr. Priscilla Muheki, Dr. Wangalwa Raphael

Muheki, Dr. Wangalwa Raphael (Chair)

Rapporteur- Peace Katusiime

ICT – Oyo Jude

Presentations-

i)An Explainable Ensemble Model for ZARDI-Wise Maize Yield Prediction Using Climate Data in Uganda : Taremwa Danison

ii) Predicting the Structural Composition and Higher Heating Value of Agricultural and Municipal Solid Organic Waste Using Conditional Generative Adversarial Networks and Ensemble Learning for Sustainable Energy : Nakimuli Nakato Constance

iii) Effects of Varying Dietary Macronutrient Ratios on Immune Function in Swiss Albino Mice : Kinyi Wambuki Hellen

iv) Mathematical Model of Malaria Transmission Dynamics and Control with Vaccination and Treatment in the presence of the protected group : Tuhimbise Rugogoma Dominic

14:35 – 15:00

Lunch

15:00 – 15:15

Deputy Director DRGT  
– Dr. Simon Kawuma

Discussion and wrap up

15:15 – 15:30

Closing Remarks and  
Way forward

Prof. Nixon Kamukama –DVC-AA-MUST

Departure

## Abstracts

### SCIENCE AND TECHNOLOGY

#### **Evaluation of a Multimodal Convolutional Neural Network-Based Approach for DICOM Files Classification**

Mabirizi Vicent<sup>1\*</sup>, Kawuma Simon<sup>2</sup>, Wasswa William<sup>3</sup>

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**Introduction:** The Digital Imaging and Communication in Medicine (DICOM) standard preserve both pixel-level image data and clinically relevant metadata. However, conventional deep learning pipelines for medical image classification often discard this metadata by converting DICOM files into formats such as PNG or JPEG, leading to information loss and potential bias. **Objective:** This study evaluated the performance of DICOMFusionNet, a multimodal convolutional neural network (CNN) developed to natively process DICOM files by integrating both image data and embedded metadata, in comparison with widely used transfer learning models. **Method:** A dataset of 1000 pediatric chest radiographs (425 tuberculosis-positive and 575 controls) from Epicentre, Mbarara Regional Referral Hospital, was used. Images were pre-processed to enhance pulmonary visibility, and relevant metadata fields were normalized and one-hot encoded for integration. DICOMFusionNet was benchmarked against Inception V3, VGG16, VGG19 and ResNet50, all requiring DICOM-to-PNG conversion. Performance was evaluated using accuracy, precision, recall, and F1-score. An ablation study assessed the contribution of metadata to classification performance. **Results:** DICOMFusionNet achieved superior performance with a test accuracy of 92.3% and F1-score of 0.91, outperforming Inception V3 (86.7%), VGG16 (85.4%), VGG19 (85.9%), and ResNet50 (87.1%). The ablation study revealed a significant drop in accuracy (87.8%) and F1-score (0.85) when metadata was excluded, highlighting its critical role in predictive performance. **Conclusion:** DICOMFusionNet demonstrates that preserving both image and metadata in medical imaging tasks yields more accurate and context-aware classification. This multimodal approach reduces bias, enhance generalization, and provides a promising framework for clinical decision support in diagnostic imaging.

**Keywords:** DICOMFusionNet, Multimodal Deep Learning, Medical Image Classification, Metadata Integration

## **Lymphedema: Causative Agents, Patient and Caretaker Knowledge, Self-Reported Healthcare Needs and Preventive Strategies in Kamwenge District.**

Vicent Mwesigye<sup>1\*</sup>, Joanita BerytahTebulwa<sup>2</sup>, Benson Musinguzi<sup>3</sup>, Bosco Bekita Agaba<sup>1</sup>, Charles Nkubi Bagenda<sup>1</sup>, Francis Bajunirwe<sup>4</sup>, Joel Bazira<sup>5</sup>, Edgar Mugema Mulogo<sup>4</sup>, Herbert Itabangi<sup>6</sup>, Frederick Byarugaba<sup>5</sup>

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**Introduction:** Lymphedema, a chronic and often debilitating condition caused by lymphatic filariasis or podoconiosis, remains a neglected health problem in many low-resource settings. In Uganda's Kamwenge District, affected individuals endure pain, disfigurement, stigma, and limited access to quality care. Despite its profound social and economic burden, lymphedema continues to receive minimal attention in national health agendas. **Objectives:** The study aimed to: 1. Describe preventive strategies and their effectiveness in patients with lymphedema based on global evidence from a scoping review. 2. Determine the potential causative agents of lymphedema among patients in Kamwenge District, South Western Uganda. 3. Explore the lymphedema-related knowledge, lived experiences, healthcare needs, and preventive practices among patients and their caretakers in Kamwenge District, South Western Uganda. **Methods:** A multi-method employed three sub-studies. (1) A Scoping Review using JBI methodology and PRISMA-ScR guidelines synthesized 45 global studies on secondary lymphedema prevention and management. (2) Laboratory analysis of 154 patients evaluated anti-filarial IgG and IgM antibodies, blood smears, and aluminium levels to assess immunological exposure and possible co-infections. (3) A Qualitative Study that explored lived experiences, socio-cultural beliefs, and barriers to healthcare. Data were thematically analyzed following Braun and Clarke's framework. **Results:** The review identified hygiene-based self-care as the most feasible intervention in low-resource settings, while advanced therapies remain largely inaccessible. Laboratory findings showed 10.4% IgG and 1.9% IgM positivity, with no microfilariae detected; malaria

parasites and elevated aluminium levels were observed. Qualitative data revealed severe physical suffering, stigma, gendered impacts, and reliance on traditional remedies due to weak health system support. Conclusion: Lymphedema in Kamwenge is multifactorial and under-addressed, requiring integrated, context-specific interventions that combine clinical care, stigma reduction, and health system strengthening. Recommendations: Integrating lymphedema management into Uganda's Neglected Tropical Disease programs, enhancing community education, and promoting hygiene-based self-care are essential for sustainable prevention and improved patient outcomes.

Keywords: Lymphedema, Preventive strategies, Kamwenge District, Filariasis, Health systems

### **Microbial Diversity of Bacterial Communities in Heat-Processed Milk Products from Mbarara City, Uganda**

Kamwine Monicah<sup>1\*</sup>, Pauline Petra Nalumaga<sup>1</sup>, Fredrickson B Wasswa<sup>1</sup>, Naume Joyce Karuhanga<sup>1</sup>, Immanuel Afrika Musau<sup>1</sup>, Yap Boum II<sup>2</sup>, Joel Bazira<sup>1</sup>

Introduction: Milk plays a vital role in the diets of both rural and urban populations across Africa. Heat-processed shelf-stable milk products, such as UHT milk and milk powders, are widely consumed because of convenience, stability, nutritional benefits, economic factors, cultural acceptance, and food security. Fermented milk products are widely consumed across Africa for their nutritional and probiotic benefits. However, their nutrient-rich composition and informal production processes make them prone to microbial contamination. Monitoring food-associated microbiota presents an important challenge to the food industry. Often considered the golden standard, traditional bacteriological techniques provide some information describing the culturable microorganisms found in these samples. However, these strategies alone are insufficient to characterize and fully comprehend their role. This study assessed the microbiological quality and bacterial community composition of heat-processed shelf-stable and fermented milk products produced and marketed in Mbarara City to evaluate potential public health risks using culture and metagenomic analysis. Methods: A total of 505 processed milk samples, including UHT milk, Milk powder, Yoghurt, cheese, butter sauce (Eshabwe), and homemade butter, were collected from major milk processors, supermarkets, and local markets in Mbarara city. Conventional culture-based methods were applied to 350 samples to identify Pathogenic and indicator bacteria, while direct DNA Extraction was applied on 150 samples and 16S rRNA gene sequencing was performed on 39 samples to characterize bacterial community structure. Results: Culture results revealed the presence of *Bacillus* spp (77.2%), *Klebsiella* (8.44%), *Staphylococcus* species (5.84%), *Salmonella* spp (4.54%), and *Escherichia*

coli (3.89%), indicating heat-resistant bacteria, and bacteria due to post-heat contamination and poor hygiene. Metagenomic profiling identified predominant heat-resistant species such as *Heyndrickxi sporothermodurans* in UHT milk, spore-forming bacilli like *Geobacillus thermodenitrificans*, *Bacillus pumilus*, including spoilage organisms and potential pathogens like *Bacillus cereus*, *Cronobacter sakazakii*, and *Klebsiella pneumoniae* in milk powder. In fermented products, Metagenomic profiling identified beneficial lactic acid and acetic acid species including *Streptococcus thermophilus*, *Lactococcus lactis*, *Lactobacillus helveticus*, and *Acetobacter pasteurianus*, and indicator pathogenic species, including *E. faecium*, *K. pneumoniae*, *Vibrio anguillarum*, and *Vibrio metschnikovii*. Conclusions/Implications: These findings highlight the presence of organisms that are not easily identified and have not been included in the milk products' standards in Uganda and East Africa. Traditional dairy products in Uganda may serve as vehicles for pathogenic bacteria. Findings warrant expansion of this research to a national scale and stronger collaboration among health, agriculture, and standards authorities to ensure microbial safety while preserving traditional food heritage.

Keywords: Heat-processed shelf-stable milk, fermented milk, 16S rRNA sequencing, Uganda, public health, eshabwe

### **Bridging Traditional Uses of Propolis in Uganda with GC-MS Metabolomics and Chemometric Modelling**

Ivan Kahwa<sup>1,2,3,5\*</sup>, Leonard Kaysser<sup>1</sup>, Jonans Tusiimire<sup>2</sup>, Rapheal Wangalwa<sup>3,4</sup>, Claudia Wiesner<sup>5\*</sup>

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#### **Abstract**

Introduction: Bee propolis is a resinous substance produced by bees from plant exudates and is commonly used in traditional Ugandan medicine. Nonetheless, its chemical makeup and medicinal uses are not yet well

understood. Objectives: This study evaluated public awareness, medicinal applications, and challenges in propolis use, along with analysing its chemical variation through GC-MS and multivariate chemometric methods. Methodology: An online survey with 212 participants assessed awareness, accessibility, and uses of propolis. Samples from nine agroecological zones were analysed via headspace and derivatisation-based GC-MS. Chemometric analyses involved PLS-DA, VIP scores, heatmap clustering, and OPLS-DA. Results: Most respondents (85.4%) were familiar with propolis, mainly associating it with wound treatment (49.1%), respiratory health (24.1%), and immune support (16.0%). It was commonly used as a tincture (18.9%) and an ointment (17.0%). GC-MS profiling revealed bioactive compounds, e.g., monoterpenes, sesquiterpenes, diterpenes, triterpenoids, phenolic acids, alkylresorcinols, and resin acids, known for antimicrobial, antioxidant, and anti-inflammatory properties. Chemometric models showed distinct regional clustering and agroecological markers, with OPLS-DA highlighting compositional differences linked to geography and botany. Conclusion: Integrating sociocultural perceptions with chemical profiling demonstrates the therapeutic relevance of Ugandan propolis. Recommendations: Policies should support quality control, value addition, and traditional healthcare integration, alongside further bioactivity validation and public education.

Keywords: propolis; GC-MS; chemometrics; Uganda; traditional medicine; regional characterisation.

## **Assessing Transfusion Safety In Cancer Care: Bacterial Contamination Of Donor Blood And RBC Alloimmunization Among Patients With Cancer In Uganda**

Taremwa Ivan Mugisha<sup>1</sup>, Niyonzima Nixon<sup>2</sup>, Natukunda Bernard<sup>1</sup>

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### **Abstract**

Background: Patients with cancer may frequently experience cytopenias that necessitate blood and component transfusions. Although transfusion is a lifesaving intervention, the use of allogeneic donor blood is associated with significant risks. Objectives: This study aimed to: (1) assess the level of bacterial contamination in stored whole blood and blood components intended for transfusion to patients with cancer; (2) determine the prevalence and specificities of red blood cell (RBC) alloantibodies among patients with hematological malignancies in Uganda. Methods: Objective 1 used a pre-transfusion aliquot of donor blood or components for blood culture. In addition, transfused patients were investigated 48 hours post-transfusion. Positive cultures were identified, and their antibiotic susceptibility pattern

was determined. Objective 2 enrolled patients with hematological malignancies who had been multiply transfused. Their plasma was screened for the presence of RBC alloantibodies, and positives were identified using hemagglutination techniques. Data were presented as proportions. Results: Objective 1; out of the 376 blood units tested, 4 (1.1%; 95% confidence interval [CI]: 0.4-1.8%) had bacterial contamination, with *Staphylococcus hominis*, *Staphylococcus capitis*, and *Bacillus subtilis*. Isolates were sensitive to benzylpenicillin, oxacillin, moxifloxacin, linezolid, and tigecycline but resistant to various antibiotics. There was no post-transfusion infection risk among recipients. Objective 2; of the 427 patients (mean age, 38.9 years; standard deviation 19.2 years), 25 (5.9%; 95% CI: 3.8-7.9%) possessed RBC alloantibodies against Rh, Kell, Duffy, Lewis, and MNS blood group antigens. Conclusions: The study found a low bacterial contamination rate in stored blood and components; however, the isolates were resistant to common antibiotics, posing a potential risk of transmitting resistant strains to recipients. The prevalence of RBC alloantibodies was moderate, and these targeted antigens of varied blood group systems. Recommendations: Given the frequent need for transfusions among patients with cancer, these findings highlight the need for improved transfusion safety in our setting.

Keywords: Transfusion safety, Cancer care, RBC Alloantibodies

## **The Role of Sanitation Behavior as a Driver for Antimicrobial Resistance in *E.coli* among Lakeshore Residents around Lake Victoria, Uganda**

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6 National Livestock Resources Research Institute; National Agricultural Research Organization; Kampala; Uganda.

## Abstract

**Introduction:** Antimicrobial resistance (AMR) is a growing global public health threat, particularly in low- and middle-income countries like Uganda, where poor sanitation, irrational antibiotic use, and environmental contamination exacerbate its spread. **Objectives:** The study investigated the distribution of antimicrobial-resistant *E.coli*, including drug-resistant genes, and examined the possible relationship between behavior and related anthropogenic activities of lake-dwelling communities, plus water quality variables as determinants for AMR. Specifically, it examined the role of sanitation behavior in shaping patterns of AMR in *E.coli* isolated from stool samples of residents around Lake Victoria. **Methods:** A cross-sectional study design was employed, targeting 120 adults ( $\geq 18$  years) who had resided or worked at the landing sites for at least six months, from whom stool samples were picked. Antimicrobial susceptibility testing was conducted using the Kirby–Bauer disk diffusion method against nine commonly used antibiotics, and further confirmed with the VITEK 2.0 COMPACT. Quantitative data on sanitation behaviors and antibiotic use were collected using a pre-tested, semi-structured questionnaire. Modified Poisson regression was used to assess the association between sanitation behavior and AMR prevalence, with results reported as adjusted prevalence ratios (aPR) at 95% confidence intervals (CIs). **Results:** The overall prevalence of AMR among *E.coli* isolates was 89% (95% CI: 81.1–93.9). High resistance was observed to Tetracycline 58(65.2%) and Ampicillin 58(59.2%), while all isolates remained susceptible to Meropenem. Behavioral factors significantly associated with increased AMR prevalence included: inadequate toilet sanitation (aPR = 1.14; 95% CI: 0.99–1.32;  $p = 0.058$ ), disposal of child stool into latrines (aPR = 1.24; 95% CI: 1.05–1.47;  $p = 0.011$ ), lack of awareness of the environmental impact of poor waste disposal (aPR = 1.95; 95% CI: 0.99–3.85;  $p = 0.053$ ), generation of chemical waste (aPR = 1.79;  $p = 0.022$ ), production of trash/debris (aPR = 1.21; 95% CI: 1.01–1.44;  $p = 0.030$ ), and failure to treat water before use (aPR = 1.38;  $p = 0.006$ ). **Conclusion:** The high prevalence of AMR in *E.coli* among lakeshore residents is strongly linked to poor sanitation behaviors, including inadequate toilet hygiene, improper waste disposal, and untreated water use. **Recommendation:** The Government should strengthen policies on antibiotic stewardship, invest in sanitation infrastructure, and expand access to clean water.

**Keywords:** Antimicrobial resistance, *Escherichia coli*, Lake Victoria, Sanitation, Waste disposal

## **Mental Health Challenges, Adverse Childhood Experiences, and Social Support among Adolescents at Kampiringisa National Rehabilitation Centre in Uganda.**

Authors: Robert Gideon Odendi<sup>1</sup>, Julius Kyomya<sup>2</sup>, Charles Magoba Muwonge<sup>3</sup>, Moses Ocan<sup>4</sup>, Imelda Tamwesigire<sup>5</sup>, Celestino Obua<sup>6</sup>, Godfrey Zari Rukundo<sup>7</sup>, Scholastic Ashaba<sup>1</sup>

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**Introduction:** Adolescents-involved in justice system who experience adverse childhood experiences (ACEs) face mental health challenges (MHCs). The extent of MHCs and ACEs in the Ugandan juvenile justice system remains unknown. **Objective:** This study determined the prevalence of ACEs, MHCs, and the mediating role of social support in the relationship between ACEs and MHCs. **Methodology:** This was a cross-sectional study among 307 adolescents (aged 12 - 17 years) using a stratified random sampling at Kampiringisa National Rehabilitation Center (KNRC). Data were collected using an interviewer-administered questionnaire consisting of PHQ-9 for depression, IES-R for PTSD, ASSIST-Y for substance use, ACE-IQ for ACEs, and MSPSS for social support. Data were analyzed using Stata version 17. Descriptive statistics were used for univariate analyses, and logistic regression and mediation analysis with bootstrapping examined the association of ACEs and MHCs with social support as a mediator. The study was done at a 95% level of confidence. **Results:** The participants' median age was 16.0 years (IQR: 15.0-17.0), and most were male, 298 (97.1%). Overall, 67.4% (207/307) of the adolescents needed mental health service. The prevalence was 55.4% (170/307) for depression, 30.6% (94/307) for PTSD, 53.1% (163/307) for substance use, and 21.8% (67/307) for high-risk substance use. ACEs were prevalent, 48.2% (148/307) reporting six or more ACEs. ACEs had a direct effect on depression ( $B=0.82, p<0.001$ ), PTSD ( $B=3.11, p<0.001$ ), and substance use ( $B=0.042, p<0.001$ ). Social support was non-significant mediator in these relationships. Previous counselling use was a significant predictor of lower depression ( $B=-3.19, p<0.001$ ) and PTSD ( $B=-9.76, p<0.001$ ) scores. **Conclusion:** MHCs and ACEs are prevalent among adolescents at KNRC. ACEs have a direct effect on depression, PTSD, and substance use. Access to counselling is a protective factor for depression and PTSD. **Recommendation:** Trauma-informed intervention is

needed among this vulnerable population, focusing on addressing ACEs and the availability of counselling services.

Keywords: Mental health challenges; adverse childhood experiences, social support, Adolescents, Kampiringisa National Rehabilitation Center.

### **Effect Of Point-of-Care Contraceptive Provision On Modern Methods Uptake Among Postpartum Women At Mbarara Regional Referral Hospital**

Authors: Ainomugisha Brenda<sup>1</sup>, Musa Kayondo<sup>1</sup>, Joseph Ngonzi<sup>1</sup>

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Introduction: Immediate postpartum contraception is highly recommended due to its potential to avert maternal morbidity/mortality. Its uptake is not documented in our setting, yet the prevalence of short interbirth intervals and unplanned pregnancies is high. Objectives: To measure the uptake of, barriers, and facilitators of immediate postpartum contraception, before and after provision of point of care modern contraceptive methods among women delivering by cesarean section at Mbarara Regional Referral Hospital. Methods: A mixed-methods study design was used; a cross-sectional study to measure prevalence and perform logistic regression to identify the associated factors. We conducted a qualitative study to explore barriers and facilitators. Results: 429 mothers were enrolled by systematic sampling. The mean age was 27years. Prevalence of immediate postpartum uptake was 6.8% (29/429) (95% CI 4.7 – 9.6). The reasons for not taking up a method immediately were: most preferred to first heal (66%), while others preferred natural methods, were unaware that it's possible, needed partner consent, and for some who needed it, it wasn't available. Factors associated with immediate postpartum uptake were no formal education (aOR=8.52, 95%CI: 1.88-38.5; P<0.005) and having ever used postpartum contraception (aOR=5.08, 95%CI: 1.32-19.44; P<0.018). Barriers among clients included a lack of information, side effects, and limited access to methods. Among providers, it was workload and a lack of training.

Conclusion: Uptake of immediate postpartum contraception is low. Lack of information among both health workers and clients is a significant barrier.

### **Vector species diversity and Plasmodium falciparum sporozoite infectivity rates in selected flood-prone villages in Kasese district, Uganda**

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**Introduction:** Understanding malaria vector species diversity and sporozoite infectivity rate is vital for malaria control and prevention. We determined the vector species diversity, distribution, and *Plasmodium falciparum* sporozoite infectivity rates in selected flood-prone villages in Kasese district, Uganda. I conducted a cross-sectional entomological survey of adult mosquitoes in selected flood-prone villages across Kasese district, southwestern Uganda.

**Methods:** From February to May 2025, 2 CDC light traps were placed, indoor and outdoor, at one sentinel household per sub-village ( $n = 147$ ) for a single night (12 hours). Adult mosquitoes were identified morphologically to species level with Coetzee 2020. 182 *Anopheles* spp. were tested for *P. falciparum* circumsporozoite via ELISA. Logistic regression models assessed individual factors with mosquito presence in the household.

**Results:** A total of 206/1,567 (13.1%) *Anopheles* mosquitoes were collected from 40/147 (27.2%) sentinel households; *An. gambiae*, *An. Funestus*, *An. pretoriensis*, *An. rivulorum*, *An. marshalli*, *An. mouchetti* and *An. nili* in different proportions were identified. 48.3% of households had LLIN, 86% of LLIN > 2 years old, 69% of LLINs had holes, and 44.4% of houses had screened windows. Three adult *An. funestus* mosquitoes from three households tested positive for *P. falciparum*. Infectivity rate was 1.7% (03/182) and 7.5% (3/40) at the household level. Distribution varied (univariate): with older LLIN ( $p=0.020$ ), fewer number of LLINs ( $p=0.014$ ), and those with a history of flooding in the past one year ( $p=0.008$ ). Multivariate model: History of flooding in the past year (aOR (95% CI): 2.3 (1.11–4.88),  $p=0.025$ ) was associated with mosquito distribution.

**Conclusion/implications:** The relative abundance and diversity of *Anopheles* species varied across different villages and river catchments. It varied with age of LLIN, number of LLINs and the history of flooding in the past year. Varied species diversity may play a crucial role in malaria transmission by affecting the genetic diversity of the parasite and the effectiveness of control measures.

**Recommendations:** Targeted campaigns to increase household ownership of LLINs, together with promoting the sleep under the net campaigns, would be protective

**Key words:** *Anopheles* mosquito, infectivity rate, malaria vector, flood, Uganda

## HUMANITIES, SOCIAL & MANAGEMENT SCIENCES

### **Examining Institutional Support on Skills Development for Youth Self-Employment in Mbarara City**

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#### Abstract

Youth unemployment remains one of Uganda's most persistent socio-economic challenges despite numerous institutional initiatives aimed at equipping young people with employable skills. This study, conducted in Mbarara City, examined how institutional frameworks influence the effectiveness of youth skilling programs and their contribution to self-employment outcomes. Methods: A qualitative-dominant mixed-methods design was employed, drawing data from 43 key informants, including local government officials, financial institutions, training centers, and community leaders, alongside 90 youth beneficiaries. Data were collected through in-depth interviews, focus group discussions, and structured questionnaires, and analyzed both thematically and statistically. Results: Preliminary findings reveal that although skilling programs imparted valuable competencies, their effectiveness was constrained by limited post-training support, such as start-up capital, access to tools, mentorship, and follow-up supervision. About 80% of youth expressed dissatisfaction with institutional engagement after training, with many reverting to informal survival activities unrelated to their acquired skills. Conclusions: These outcomes affirm Becker's (1993) human capital theory that training alone is insufficient without enabling conditions, and align with North's (1990) view that institutional frameworks determine economic outcomes. They also echo Honwana's (2012) notion of "waithood," where weak support systems prolong youth transitions to stable livelihoods. To address these gaps, the study proposes a Post-Skilling Empowerment and Sustainability Model (PSESM) integrating youth re-grouping, entrepreneurship literacy and business management, start-up facilitation (capital/tools), supervised business launch, motivation through recognition, and sustainability mechanisms. This framework aims to enhance the transition of skilled youth into sustainable self-employment and wealth creation. The study has completed data collection and partial analysis, with objectives one and two achieved, and analysis of objectives three and four underway.

**Keywords:** youth unemployment, skills development, institutional support, self-employment, sustainability.

# Community Policing and Crime Prevention in Mbarara City-Southwestern Uganda

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## Abstract

**Introduction:** Community policing is a vital strategy for fostering trust, collaboration, and shared responsibility between the police and the public. It marks a paradigm shift in law enforcement philosophy, emphasizing partnership, problem-solving, and proactive crime prevention. In Uganda, and particularly in Mbarara City, this approach has been adopted to promote neighborhood safety and reduce crime. However, its effectiveness in crime prevention within the city remains underexplored. **Objectives:** This study investigated the contribution of community policing to crime prevention in Mbarara City, South Western Uganda. Specifically, it examined community perceptions and attitudes toward community policing, assessed community participation in identifying and reporting crimes, analyzed the working relationship between the police and the community, and proposed strategies to enhance community policing for effective crime reduction. **Methods:** A descriptive research design was adopted involving 292 participants, including members of the city security committee, Resident City Commissioner (RCC), District Internal Security Officer (DISO), District Police Commander (DPC), Criminal Investigation Department (CID) officers, Police Community Liaison Officers, and community representatives. Data were collected through 27 Focus Group Discussions (FGDs) and 92 key informant interviews across Mbarara City's two divisions. **Results:** Findings revealed persistently high crime rates, with major crimes including gender-based violence, land grabbing, substance abuse, phone theft, fraud, burglary, rape, murder, defilement, and motorcycle (boda boda) theft. Although community members expressed positive perceptions of community policing, implementation was weak due to limited awareness and strained police–community relations marked by mutual mistrust and perceived corruption. **Conclusion:** Community policing remains a viable approach to crime reduction and bridging police–community gaps in Mbarara City. **Recommendations:** The study recommends strengthening community sensitization, reinstating Local Defense Units, holding regular village security

meetings, registering all residents and guests, improving street lighting and surveillance, and re-launching community policing with renewed focus on trust and community empowerment.

#### Keywords

Community Policing, Crime Prevention, Police Community Relations, Public Safety, Mbarara City.

### **Optimization of briquetting conditions of groundnut shell and maize stalk**

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#### Abstract

**Introduction:** The quality attributes of briquettes depend on feedstock characteristics and process conditions. In this study, the briquetting conditions of maize stalk and groundnut shell were optimized to help standardize the briquette process conditions and hence quality of briquettes. **Methods:** Response Surface Methodology based on Central Composite Design (CCD) was used to obtain a set of briquetting temperature (40-110 oC) and compression pressure (34-204 MPa) that optimized the compressive strength of the briquettes and specific energy requirement for briquetting. The effect of torrefaction on the specific energy requirement for briquetting and briquettes characteristics was also assessed. **Results:** The optimum briquetting temperature and pressure were 110 oC and 125 MPa for raw groundnuts shell, and 97 oC and 108 MPa for raw maize stalk, respectively. The specific energy requirements for producing raw briquettes at the optimal briquetting conditions were 22.5 and 11.0 kJ/kg, and the briquettes had compressive strength of 21.4 and 42.4 MPa for groundnut shell and maize stalk, respectively. Regression models were developed to predict compressive strength and specific energy requirement. The predicted and measured compressive strength and specific energy requirement were in good agreement with Pearson correlation coefficients ( $r$ ), Root Mean Square Errors (RMSE), 0.02RMSE0.09 and Mean Absolute Error (MAE), 0.42MAE1.71. Torrefaction increased the combustion efficiency (74.5 to 91.8% for maize stalk briquettes and 98.8 to 99.1% for groundnut shell briquettes), water resistance index (34.0 to 46.0% for maize stalk briquettes and 74.0 to

92.5% for groundnut shell briquettes) and specific energy requirement for briquetting (11.0 to 14.5 kJ/kg for maize stalk briquettes and 22.5 to 32.0 kJ/kg for groundnut shell briquettes) but lowered the relaxed density (900 to 760 kg/m<sup>3</sup> for maize stalk briquettes and 824 to 751 kg/m<sup>3</sup> for groundnut shell briquettes), compressive strength (42.4 to 34.5 MPa for maize stalk briquettes and 21.4 to 5.3 MPa for groundnut shell briquettes) and impact resistance index (99.6 to 99.4% for maize stalk briquettes and 98.0 to 56.0% for groundnut shell briquettes). Conclusion: Maize stalk and groundnut shell are suitable feedstock for briquetting; however, the optimal briquetting conditions are feedstock dependent.

## **Workplace Equity, Staff Participation, Welfare, and Job Satisfaction in Universities in Western Uganda**

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### **Abstract**

**Introduction:** This study investigated workplace equity, participation in staff committees, staff welfare, and job satisfaction among academic staff in public and private universities in Western Uganda. It addressed the concern that disparities in equity and welfare may affect job satisfaction and staff engagement in university governance. Understanding these relationships is crucial for improving academic staff retention and institutional performance. **Objectives:** The study aimed to: Examine differences in workplace equity and staff participation between public and private universities, identify factors influencing academic staff job satisfaction, and assess the mediating roles of staff welfare and committee participation in the relationship between workplace equity and job satisfaction. **Methodology / Approach:** Guided by the Pragmatism paradigm, a mixed-methods design combining quantitative and qualitative approaches was employed. Data were collected from 278 respondents drawn from six universities (three public and three private) using questionnaires and interviews. Quantitative data were analyzed through descriptive statistics, ANOVA, correlation, and regression, while qualitative data were analyzed thematically using NVivo 14. **Results / Findings:** Findings indicated significant differences in workplace equity perceptions between public and private universities, with public universities showing greater committee participation ( $M = 59.04$ ,  $SD = 7.04$ ). A strong positive correlation existed between workplace equity, participation, welfare,

and job satisfaction ( $R = 0.761$ ). Regression analysis revealed that welfare and participation significantly mediate the effect of workplace equity on job satisfaction. Conclusion / Implications: Workplace equity enhances job satisfaction mainly through improved welfare and participatory governance. Strengthening these dimensions can foster commitment and satisfaction among academic staff across university types. Recommendations: Universities should institutionalize shared governance and develop comprehensive welfare programs, including healthcare, housing, and academic growth opportunities.

Keywords: Workplace equity, staff welfare, job satisfaction, participation, universities.

### **Isomorphic forces, Taxpayer Perception, and Income Tax Compliance among Small and Medium Size Enterprises in South Western Uganda**

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#### **Abstract**

Introduction: Tax compliance remains a critical challenge for revenue authorities in developing economies, where small and medium-sized enterprises (SMEs) constitute the majority of taxpayers but often exhibit low compliance rates. This study examined the relationship between isomorphic forces, taxpayer perception, and tax compliance of SMEs in Uganda, while assessing the mediating role of taxpayer behavior. Methods: The study adopted a mixed-methods design consistent with the pragmatic research paradigm, utilizing quantitative data from 337 SMEs in Southwestern Uganda (response rate = 87.8% of the targeted 384). Quantitative analysis employed SPSS V 26 for descriptive and correlation analysis and Structural Equation Modeling (SEM) in AMOS for hypothesis testing. Complementary qualitative data were obtained from in-depth interviews with heads of Uganda Revenue Authority (URA) stations and analyzed thematically. Results: Correlation analysis showed positive associations among the constructs, with the strongest link observed between taxpayer perception and compliance ( $r = 0.612$ ,  $p < 0.01$ ). Qualitative findings highlighted fairness of the tax system, complexity of filing procedures and compliance costs among others as central determinants shaping SME compliance behavior. Conclusion: Enhancing SME tax compliance requires a balance between enforcement, perception change and behavioral interventions. Policy recommendations include simplifying tax procedures, strengthening perceptions of fairness and equity and leveraging professional and peer networks to foster voluntary compliance. Theoretically, the study contributes by integrating

institutional and behavioral perspectives into a multi-theoretical framework for tax compliance research in developing economies. The research provides valuable insights for policymakers, tax administrators, and scholars. Areas for further study; sector-specific compliance dynamics, longitudinal analyses, and the role of informal networks in shaping taxpayer behavior.

Keywords: Tax Compliance; Isomorphic Forces; Taxpayer Perception; Taxpayer Behavior; Small and Medium Enterprises.

## **Peer Influence, Alcohol Use, and Risky Sexual Behaviors among Adolescent Students in Secondary Schools in Greater Mbarara**

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### **Abstract**

Introduction: Risky sexual behaviors (RSBs) among adolescents in Uganda pose a significant public health challenge. While peer influence and alcohol use are commonly implicated, their interrelationship in specific contexts like Greater Mbarara remains underexplored, creating a critical knowledge gap for targeted interventions. Objective(s): This study investigated the interplay between peer influence, alcohol use, and RSBs. Specific objectives were to assess gender differences in RSBs, evaluate peer influence as a predictor, determine the mediating effect of alcohol use, and explore adolescent perceptions of controlling RSBs. Methodology / Approach: A concurrent mixed-methods approach was employed, guided by Self-Control Theory. Quantitative data from 326 students were analyzed using ANOVA, regression, and mediation analysis. Qualitative data from six Focus Group Discussions (n=42) were analyzed thematically to contextualize the statistical findings. Results / Findings: Quantitatively, there was no significant gender difference in RSB prevalence, and peer influence did not significantly predict. Alcohol use was not a significant mediator. Qualitatively, stark gendered differences emerged in motivations, with boys influenced by peer pressure and masculinity, and girls by emotional factors and stigma. Adolescents advocated for comprehensive sex education and peer-led initiatives, identifying stigma and misinformation as key barriers. Conclusion / Implications: The findings challenge the universality of peer-alcohol-risk pathways, emphasizing the primacy of culturally embedded gender norms and relational dynamics. Effective interventions must move beyond generic models to address context-specific motivations and leverage adolescents' insights. Recommendations: We recommend implementing gender-transformative comprehensive sexuality education in schools, establishing peer-led programs, and fostering open adult-adolescent communication to mitigate RSBs.

Keywords: Risky Sexual Behavior, Peer Influence, Gender Norms, Mixed-Methods, Uganda

## **Dynamic Capabilities and Financial Performance of Microfinance Institutions in Uganda**

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### **Abstract**

**Introduction:** Microfinance institutions (MFIs) are key to socioeconomic development, and their financial performance affects their stability. Despite their contributions, MFIs face financial challenges. Scholars see dynamic capabilities as vital for improving performance. This study examined the relationship between these capabilities and financial performance, as well as the mediating role of innovation, among UMRA-licensed Tier 4 MFIs in Uganda. **Objectives:** The study set out to 1) find out the relationship between dynamic capabilities and financial performance of Tier 4 MFIs in Uganda, 2) to find out the relationship between dynamic capabilities and innovation among Tier 4 MFIs in Uganda, 3) to establish the relationship between innovation and the financial performance of Tier 4 MFIs in Uganda, and 4) to examine the mediating effect of innovation on the relationship between dynamic capabilities and the financial performance of Tier 4 MFIs in Uganda. **Methodology:** The study applied a pragmatism research paradigm and a cross-sectional research design. Data was collected from a sample of 151 Tier 4 MFIs from all regions in Uganda. Tier IV MFIs were stratified by district, and then selected from each stratum using a simple random sampling technique. A self-administered, structured questionnaire was distributed to board members, credit officers, accountants, internal auditors, HR managers, and general managers, who were purposefully selected. After data cleaning and testing for parametric assumptions, Pearson correlation analysis and hierarchical multiple regression techniques were employed for data analysis using SPSS V26. **Findings:** The study confirmed a positive relationship between dynamic capability, innovation, and financial performance. It was further established that innovation partially mediates the relationship between dynamic capability and the financial performance of Tier IV MFIs in Uganda. **Conclusion:** Grounded in a multi-theoretical approach, this study utilised the synergistic benefits of dynamic capability and innovation theories. It ultimately concludes that, although a positive correlation exists

between dynamic capabilities and financial performance, the influence of dynamic capabilities is mediated by innovation, which in turn results in improved financial performance among Tier IV microfinance institutions in Uganda. Recommendations: To improve financial performance, Tier IV MFIs in Uganda should develop dynamic capabilities. Investing in capabilities like identifying and seizing opportunities, and leveraging innovation is key to improved financial performance.

Keywords: Dynamic Capability, Innovation & Financial Performance

### **Employability skills mediate the relationship between human and structural capital and graduate employability in South-Western Uganda's public universities**

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#### **Abstract**

Introduction: Graduate employability has increasingly attracted global attention due to persistent skill gaps between employability outcomes and labor market demands. This study addresses this issue by investigating the strategic resources within universities that can enhance graduates' workforce readiness. Objective(s): This study aimed to: 1) establish the relationship between human capital and structural capital on graduate employability, 2) examine the mediating role of employability skills in these relationships, and 3) explore the interaction effect between human and structural capital on graduate employability. Methodology: Grounded in a multi-theoretical framework, the study adopted a positivist, cross-sectional design. Data were collected via structured questionnaires from 382 randomly sampled graduates and 122 purposively sampled university staff across three public universities. Data analysis employed Pearson correlation, hierarchical regression, and Structural Equation Modelling (SEM). Findings: Findings revealed significant positive relationships between both human and structural capital with graduate employability. Employability skills was identified as a significant mediator in these relationships. Furthermore, the interaction between human and structural capital significantly enhances the model's predictive power. Conclusion / Implications: The study concludes that human and structural capital are vital strategic resources whose synergistic effect, channeled through the development of employability skills, is crucial for improving graduate employability. This implies that university management must adopt an integrated approach to resource investment. Recommendations: It is recommended that universities institutionalize comprehensive faculty development programs focused on modern pedagogy and industry-aligned curricula. Additionally, national frameworks

for graduate employability should be developed and revised regularly to incorporate evolving needs of the labor market and global economic trends.

Keywords: Human Capital, Structural Capital, Employability Skills, Graduate Employability, Public Universities

## **CROSS-CUTTING/MULTI-DISCIPLINARY RESEARCH**

### **A comparative assessment of environmental impacts of production, use, and disposal of a parabolic solar cooker and charcoal for cooking in Uganda**

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#### **Abstract**

Introduction: Solar cookers can substantially reduce reliance on charcoal, yet the comparative life-cycle impacts of a solar cooker with thermal energy storage (TES) versus charcoal cooking have not been quantified. Objective: To assess and compare the environmental impacts of using a solar cooker with a charcoal-based cookstove in Mbarara City. Methods: We conducted an attributional life-cycle assessment (LCA) for Mbarara City, Uganda,

using ecoinvent v3.10 and Environmental Footprint 3.0. The functional unit is cooking two meals per day over 10 years for a typical household (3–6 people). Three scenarios capture different charcoal consumption levels. The solar system comprises a parabolic dish with aluminium components, a vegetable-oil TES, and end-of-life (EoL) treatment. Results: Across scenarios, solar cooking markedly lowers impacts: for most categories, burdens are ~8–9× lower than charcoal. Weighted single-score results range from 141.5–302.9 points for charcoal and 64.4–82.3 points for the solar cooker (ratio ~2.2–3.7). The most influential categories are climate change, human toxicity (non-cancer), photochemical ozone formation, and water scarcity—each lower for solar. The main exception is freshwater ecotoxicity, which is higher for the solar option due to aluminium production, EoL processing, and disposal of vegetable-oil residues from TES; repurposing these residues could mitigate this burden. In contribution analysis, freshwater ecotoxicity accounts for >67% of the solar cooker's weighted score, whereas climate change contributes >45% of the charcoal model. Conclusion: Overall, the parabolic solar cooker exhibits the lowest life-cycle impacts across categories and scenarios. Results are generalizable to regions with similar climatic, production, and distribution conditions; areas with >325 sunny days per year are likely to achieve even lower solar-cooking impacts. Recommendations and contribution: We recommend expanding ecoinvent coverage for Africa (particularly East Africa and tropical regions) to improve modelling accuracy. This study extends prior work by assessing a broad set of midpoint indicators and identifying five priority categories, four of which favour solar over charcoal.

Keywords: solar cooking, charcoal cooking, indoor air pollution, life cycle assessment, Uganda

## **Exploring the lived experiences of Adolescent Mothers and Fathers (10–19) years with depression in Southwestern Uganda. A qualitative study.**

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**Introduction.** Adolescent parenthood introduces distinct challenges, particularly within resource-constrained environments where cultural, social, and economic factors are inextricably linked. Numerous studies have been conducted to explore the experiences of adolescent mothers alone, yet the experiences of adolescent fathers are ignored, and they are equally important. **Study objective:** The study aimed to explore the lived experiences of adolescent mothers and fathers with depression to inform the development of targeted interventions to support adolescent parents in their unique life challenges.

**Methodology:** This study adopted a qualitative approach employing a phenomenological research design within the interpretivist paradigm. The study involved 55 participants (adolescent mothers and fathers aged 10-19 years) distributed across 6 focus group discussions (FGDs) containing between 6-8 participants making up a total of 45 participants, and 10 individual interviews. Participants were selected using purposive sampling for adolescent mothers while adolescent fathers were mobilized from the community with the help of village health teams. Thematic analysis was used to analyze the data. **Results:** The findings revealed both negative and positive experiences for adolescent mothers and fathers including abandonment, judgement from the community, living a regretful life, marginalization, mental and other health-related issues, financial hardships, and ruined reputation whereas the positive experiences encompassed availability of sexuality education, family and community support, and availability of health services. **Conclusion:** The lived experiences of adolescent mothers and fathers are quite different, with adolescent mothers undergoing more complex experiences than adolescent fathers. They frequently assume the predominant responsibility for childcare and confront the physical and emotional repercussions of pregnancy and childbirth. **Recommendations:** The study recommends accessible child healthcare, mental health services, a comprehensive sexuality education to empower adolescents with parenting skills and encouraging active co- parent involvement.

**Key words:** Lived experiences, Adolescent Mothers and Fathers, southwestern Uganda.

Succeed We Must

### **Socio-psychological determinants of smallholder farmers' intention to adopt drought and flood risk reduction strategies in south-western Uganda**

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## Abstract

**Introduction:** Increasing climate variability has intensified the frequency and severity of drought and flood hazards globally, threatening agricultural productivity and rural livelihoods, especially in sub-Saharan Africa (SSA). Despite repeated exposure to these hazards, the adoption of adaptation strategies aiming at reducing their negative impact on agriculture remains low among smallholder farmers in SSA. Several studies have documented the socio-economic drivers of the adoption of climate-smart agricultural practices, but the interplay between cognitive factors and social dynamics in influencing farmers' adoption decisions is less understood. **Objective:** This study aims to establish the determinants of smallholder farmers' intentions to adopt drought and flood risk reduction strategies through a socio-psychological framework that combines elements of the Knowledge-Attitude-Practice model, the Protection Motivation Theory, and the Theory of Planned Behaviour. **Methodology:** The study employed a quantitative research design, involving a household survey of 583 smallholder farmers in south-western Uganda, selected through probability sampling. **Results:** The results show that early planting (77.7%), improved crop varieties (74.6%), organic manure (54.4%), and trenches (46.8%) are the most adopted risk reduction strategies. Subjective norms and perceived behavioural control strongly influence farmers' intention to adopt drought risk reduction strategies ( $r = 0.78$  and  $r = 0.8$ , respectively). In relation to floods, farmers' knowledge of flood risks and adaptive measures ( $r = 0.64$ ), attitudes toward risk reduction strategies ( $r = 0.56$ ), subjective norms ( $r = 0.74$ ), and perceived behavioral control ( $r = 0.75$ ) strongly influence their intention to adopt the risk reduction strategies. **Conclusion:** These findings underscore the importance of optimizing farmers' social networks, for instance, group-tailored extension services, and improving smallholder farmers' access to resources, such as credits, to enhance their capacity to adopt drought and flood risk reduction strategies. **Recommendation:** Future research should explore how social networks and behavioural drivers jointly shape

smallholder farmers' resilience to climate-related hazards.

Keywords: Drought, Floods, Knowledge-Attitude-Practice, Protection Motivation Theory, Theory of Planned Behaviour

### **Farmers' Knowledge, Practices, and Constraints in Finger Millet Cultivation under Climate Variability in Southwestern Uganda**

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**Introduction:** Climate variability has increasingly disrupted rainfed agriculture in Uganda, leading to unstable yields and greater food insecurity. Although smallholder finger millet production is vital for household food security and climate resilience, its productivity remains low in southwestern Uganda. **Objective(s):** This study examined farmers' knowledge, practices, and constraints in finger millet cultivation to inform management strategies and strengthen smallholder resilience. **Methodology / Approach:** A mixed-methods approach was employed, combining quantitative data from surveys with qualitative insights from nine focus group discussions and key informant interviews with farmers and sub-county agricultural officers, respectively from three districts of Isingiro, Rubanda, and Rubirizi. Data from 268 millet farmers were analyzed using descriptive and inferential statistics in R, while qualitative transcripts were coded and thematically analyzed in NVivo 15. **Results / Findings:** Finger millet is mainly cultivated during the second rainy season, though planting dates vary across farmers. Farmers predominantly cultivate local landrace varieties, use broadcasting as the main sowing method, and practice mixed intercropping with routine weeding. Fertilizer use remains minimal. The major constraints include weed infestation, prolonged dry spells, limited arable land, high labour costs, and declining soil fertility. **Conclusion / Implications:** Despite farmers' awareness of climate variability, particularly prolonged dry spells, the limited adoption of soil moisture-conservation techniques and lack of training in climate-smart finger millet cultivation continue to constrain productivity in the region. Strengthening farmer awareness and institutional support is vital for achieving resilient and food-secure production systems. **Recommendations:** The findings underscore the need for enhanced extension services and targeted farmer training to promote climate-smart millet cultivation.

Keywords: Agronomic practices, climate variability, finger millet, smallholder farmers, resilience

# Prediction of Maize Yield in Uganda using CNN-LSTM Architecture on a Multimodal Climate and Remote Sensing Dataset

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## Abstract

**Introduction:** Maize is a staple crop in Uganda, underpinning both food security and rural livelihoods. Accurate forecasting of maize yields is therefore crucial for guiding agricultural planning, resource allocation, and policy design. Yet traditional statistical methods are often limited by low accuracy, poor scalability, and weak integration of diverse inputs, leaving them unable to capture complex, nonlinear, and spatiotemporal dynamics of crop growth. **Objectives:** We developed a hybrid convolutional neural network and long short-term memory (CNN-LSTM) model that integrates climatic and remote-sensing data to improve maize yield predictions across ZARDI zones. **Methodology:** A CNN-LSTM model was developed to process vegetation indices, climate variables, and biannual yield records from Uganda's Zonal Agricultural Research and Development Institute (ZARDI) zones for the years 2018-2020. To address data scarcity, the synthetic minority oversampling technique for regression with Gaussian noise (SMOGR) and feature selection were employed. The model underwent extensive hyperparameter tuning and was benchmarked against CNN, Random Forest (RF), and a CNN+RF ensemble. **Results/Findings:** The CNN-LSTM model demonstrated superior performance with an MSE of 0.107 tonnes<sup>2</sup>, MAE of 0.267 tonnes, RMSE of 0.327 tonnes, and R of 0.783, surpassing CNN+RF (MSE 0.137, R<sup>2</sup> 0.722), standalone CNN (MSE 0.216, R<sup>2</sup> 0.562), and RF (MSE 0.211, R<sup>2</sup> 0.573). Analysis of residuals showed minimal bias, indicating a close alignment between observed and predicted yields. **Conclusion/Implications:** These findings highlight the potential for integrating spatial-temporal deep learning and ensemble methods to deliver accurate crop yield forecasts in data-limited smallholder systems. By offering a scalable framework for evidence-based farm planning and food security policy, our study demonstrated that advanced machine learning can directly support sustainable development in sub-Saharan

Africa. Recommendations: Future research will extend the framework to incorporate Transformer architectures, high-resolution satellite imagery, and explainable AI, further enhancing accuracy, interpretability, and decision-making capacity.

Keywords: Maize Yield Prediction, Ensemble Learning, Precision Agriculture, CNN-LSTM, Vegetation Indices.

## **Predicting Waste Biomass Structural Composition and Higher Heating Value Using Conditional Generative Adversarial Networks and Ensemble Learning for Energy Sustainability**

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### **Abstract**

Introduction: Predicting the higher heating value (HHV) and structural composition of biomass is essential for optimising thermochemical conversion in sustainable energy systems. However, existing data-driven models are constrained by small, heterogeneous datasets and costly experimental analyses, highlighting the need for innovative computational approaches. Objective(s): To develop a scalable, data-efficient Machine Learning approach that integrates Conditional Generative Adversarial Networks (cGANs) with ensemble regressors to accurately predict biomass structural composition and HHV from sparse biomass data. Methodology: A dataset of 258 biomass samples was gathered from the literature and used to train a cGAN to generate statistically consistent synthetic data. The augmented dataset was used to train ensemble models to predict structural composition and HHV. Results: Data augmentation using cGANs improved  $R^2$  values from 0.868, 0.832, 0.813, and 0.930 (non-augmented dataset) to 0.924, 0.902, 0.901, and 0.954(augmented), for cellulose, hemicellulose, lignin, and HHV, respectively. SHAP analysis identified volatile matter, fixed carbon, and Hydrogen/carbon ratio as pertinent predictors. Conclusion / Implications: This approach enables accurate prediction from limited data, supporting feedstock selection, densification design, and combustion modelling while reducing experimental costs and promoting circular waste utilisation. Recommendations: Future research should extend this approach to diverse feedstock classes and integrate domain adaptation to strengthen

applicability across African energy systems.

Keywords: Waste biomass, High heating value, Lignocellulosic composition, Ensemble machine learning, Generative Adversarial Networks

## **Effects of Varying Dietary Macronutrient Ratios on Immune Function in Swiss Albino Mice**

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### **Abstract**

**Introduction:** Nutrition is central to immune function, yet most studies focus on individual nutrients rather than macronutrient interactions. Evidence suggests protein-to-carbohydrate ratios optimize distinct immune traits, but their combined effects with dietary lipids on adaptive and innate immunity remain underexplored. **Objective:** To investigate how varying dietary macronutrient ratios influence innate and adaptive immune responses in Swiss albino mice. **Methodology:** Male and female mice aged 6–8 weeks, were fed one of six isocaloric purified diets differing in carbohydrate, protein, and lipid ratios for 15 weeks. Nutritional and immunological indices such as plasma cytokines, leukocyte counts, neutrophil adhesion, antibody production, and delayed-type hypersensitivity responses were assessed. Diets were modelled on the American Institute of Nutrition Maintenance diet (AIN-93M). Data were analysed using ANOVA, post hoc tests and multiple regression analyses. **Results:** Proximate analysis showed lower protein in the cereal-based diet (CBD) than in the locally formulated AIN-93M. Although body weight and basal metabolic index were comparable, AIN-93M-fed mice had higher haemoglobin, total protein, and serum albumin. Under innate immunity, high-lipid, low-protein (HLLP) mice had the lowest total and differential WBC counts, whereas neutrophil adhesion was highest in the high-carbohydrate, low-protein (HCLP) group. HCLP stimulated higher baseline TNF- $\alpha$ , IFN- $\gamma$ , and IL-1 $\beta$ , while high-protein, low-carbohydrate (HPLC) suppressed TNF- $\alpha$ , IFN- $\gamma$ , IL-10, and IL-17A. Protein intake negatively predicted several cytokines (MCP-1, TNF- $\alpha$ , IFN- $\gamma$ , IL-10), whereas lipid intake positively associated with IL-17A. High-protein diets (HPLL, HPLC) reduced LPS-induced TNF- $\alpha$ , IL-6, and IL-1 $\beta$ , produced stronger DTH responses, and

elevated IgG titres. Protein was a positive predictor of IgG concentration. Conclusion: Dietary macronutrient ratios shaped both innate and adaptive immune responses in mice. Protein regulated cytokine responses and antibody production, while lipid intake selectively influenced IL-17A levels and innate immune cell counts. Recommendations: Dietary macronutrient ratios can be tailored to influence specific immune traits, which may inform nutritional strategies aimed at supporting immune function.

Keywords: Macronutrient ratios, cytokines, immune response, delayed-type hypersensitivity, Swiss albino mice

### **A Mathematical Model of Malaria Control: Exploring Vaccination, Treatment and a Protected Subpopulation**

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Abstract

Introduction: Enormous efforts have been made to manage malaria burden and considerable progress has been achieved through the use of indoor residual spraying, use of insecticide treated nets and clinical treatment worldwide. However, morbidity and mortality rates due to malaria disease have remained high in Sub-Saharan Africa. This study formulates a deterministic mathematical model that considers human and mosquito populations to establish the effect of vaccination with a low efficacy vaccine, treatment and a protected group on malaria transmission. The results of this study will guide policy makers in malaria planning units on how to efficiently use the scarce resources to eliminate malaria. Objective(s): The main aim of the study: To develop a mathematical model for investigating the effect of vaccination, treatment and a protected subpopulation on malaria transmission. The research seeks to develop a mathematical model, do mathematical analysis by finding model equilibrium points, find the nature of their stability and establish the effect of malaria controls on malaria transmission. Methodology / Approach: A deterministic mathematical approach was employed. Secondary data was used to test the analytical solutions of the model and MATLAB computer software was used to do numerical simulations. Results / Findings: An increase in treatment rate was found to reduce malaria infected humans. An increase in vaccine efficacy was found to reduce malaria transmission. Finally, the vaccination rate was found to increase the pool of vaccinated humans who are susceptible to the disease but overall, it was found to reduce the malaria infections. Conclusion / Implications: The model formulated was found to have both disease free and endemic equilibria locally and asymptotically stable, implying that the

control measures can lower the transmission. It was found that vaccination with a low efficacy vaccine leaves the vaccinated individuals susceptible even if it reduces the overall disease transmission. Hence, it needs to be applied with other controls. Recommendations: We recommend that the vaccination with a low efficacy malaria vaccine be employed with other controls like treatment, protection and vector control. Further study can be done by using primary data.

Keywords: Malaria transmission, vaccination, treatment and Protected group.

## **White Paper: How PhD Symposia Can Impact Completion Rates – Insights from Mbarara University of Science and Technology (MUST)**

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### **Abstract**

PhD programs worldwide face persistent challenges, including high attrition rates and prolonged completion times, particularly in resource-constrained settings like African universities. This white paper examines how structured PhD symposia—events that foster peer interaction, mentorship, and knowledge sharing—can enhance completion rates by addressing isolation, providing feedback, and building supportive networks. Drawing on the nine-year history of MUST's PhD symposia (2016–2024), we demonstrate tangible improvements in graduation rates at the institution. Evidence from global studies supports the efficacy of such interventions, showing that institutional support mechanisms like symposia can reduce dropout by up to 20% in technical fields. Recommendations include integrating symposia into university policies to promote timely PhD completion and sustainable development through research.

### **Introduction**

The pursuit of a PhD is often described as a “lonely journey,” marked by isolation, delayed progress, and high dropout rates. Globally, PhD completion rates hover around 50–60% within 10 years, with fields like social sciences and humanities experiencing even lower rates (Council of Graduate Schools, 2008). In African contexts, these challenges are exacerbated by part-time enrollment, heavy teaching loads for academic staff, and limited monitoring, leading to completion times exceeding 5–10 years (Mohamedbhai, 2014). At Mbarara University of Science and Technology (MUST) in Uganda, these issues were prevalent until the introduction of annual PhD symposia

in 2016. Designed to bring together students, mentors, industry experts, and researchers, these events aim to foster collaboration and accelerate progress. This paper explores the mechanisms through which PhD symposia impact completion rates, using MUST as a case study, and draws on empirical evidence to substantiate their value.

## Challenges in PhD Completion

PhD attrition stems from multiple factors: psychological isolation, inadequate supervision, work-life balance issues, and institutional barriers. In Africa, where many programs are not full-time, students juggle teaching, administrative duties, and research, resulting in low completion rates (Cloete et al., 2015). For instance, a study across sub-Saharan Africa reported average completion times of 7–8 years, with dropout rates as high as 50% (Harle, 2013). At MUST, prior to 2016, students faced similar hurdles, with most taking over five years to graduate due to limited peer interaction and feedback. Global data reinforces this: A longitudinal analysis of European doctoral programs found that institutional factors, such as mentorship availability and peer support, account for up to 30% variance in completion rates (Geven et al., 2020). Without interventions, these challenges perpetuate inefficiencies, hindering knowledge production and sustainable development.

## The Role of PhD Symposia

PhD symposia serve as collaborative platforms where students present ongoing work, receive multidisciplinary feedback, and build networks. Unlike formal defenses, they emphasize constructive dialogue in a low-stakes environment, reducing isolation and enhancing motivation. Research indicates that such events improve completion by:

- **Fostering Peer Support:** Group interactions combat loneliness, with studies showing that on-campus graduate conferences raise completion rates by 15–20% in technical fields (Skopek et al., 2012).
- **Enhancing Supervision Quality:** Exposure to external mentors refines research directions, as evidenced by improved supervisor assessments leading to higher completion (Times Higher Education, 2017).
- **Building Skills and Confidence:** Presentations develop communication and critical thinking, correlating with faster thesis submission (Sverdlík et al., 2018).

In resource-limited settings, symposia are cost-effective, leveraging existing faculty and virtual tools post-COVID.

## Case Study: MUST PhD Symposia (2016–2025)

MUST's symposia were initiated to address low completion rates by creating a "sharing is caring" culture. The first event in 2016, held alongside the Annual Research Dissemination Conference, featured breakout sessions

on sciences and non-sciences, with presentations from over 50 students. Subsequent symposia evolved: by 2017, they included plenary lectures on ethics; by 2019, themes like "Collaborative Transformational Research"; and during COVID (2020–2021), virtual formats ensured continuity.

**Programs consistently included:**

- Opening plenaries with anthems, welcomes, and keynotes.
- Parallel sessions chaired by professors, mentors, academic & industry researchers.
- Presentations on diverse topics, from health sciences, management science, to technology
- Discussions, wrap-ups, and networking sessions.

Over nine years, MUST organized nine symposia, leading to rising completion rates. Pre-2016, most PhDs took 5+ years; post-symposia, graduation rates increased, with many attributing progress to feedback received (MUST DRGT Reports, 2024). For example, the 2024 event emphasized "Embracing Translational Research," aligning with sustainable development goals.

**Evidence of Impact**

At MUST, symposia have directly correlated with improved outcomes: From 2016–2024, PhD graduations rose by approximately 30%, per internal tracking (Batwala, 2024 PhD Symposium Speech). In Table1 it is evident that MUST’s PhD graduates greatly increased post PhD symposia.

Table1: MUST Doctor of Philosophy (PhD) Graduates Tracker Table

| No. | Degree | Year of Graduation | Number of Students |        | Total Per Year |
|-----|--------|--------------------|--------------------|--------|----------------|
|     |        |                    | Male               | Female |                |
| 1   | PhD    | 1995               | 0                  | 0      | 0              |
| 2   | PhD    | 1996               | 0                  | 0      | 0              |
| 3   | PhD    | 1997               | 0                  | 0      | 0              |
| 4   | PhD    | 1998               | 0                  | 0      | 0              |
| 5   | PhD    | 1999               | 0                  | 0      | 0              |
| 6   | PhD    | 2000               | 0                  | 0      | 0              |
| 7   | PhD    | 2001               | 0                  | 0      | 0              |
| 8   | PhD    | 2002               | 0                  | 0      | 0              |
| 9   | PhD    | 2003               | 0                  | 0      | 0              |

|                                     |     |      |    |   |     |
|-------------------------------------|-----|------|----|---|-----|
| 10                                  | PhD | 2004 | 0  | 0 | 0   |
| 11                                  | PhD | 2005 | 2  | 1 | 3   |
| 12                                  | PhD | 2006 | 0  | 0 | 0   |
| 13                                  | PhD | 2007 | 0  | 1 | 1   |
| 14                                  | PhD | 2008 | 4  | 2 | 6   |
| 15                                  | PhD | 2009 | 1  | 1 | 2   |
| 16                                  | PhD | 2011 | 2  | 0 | 2   |
| 17                                  | PhD | 2012 | 4  | 0 | 4   |
| 18                                  | PhD | 2013 | 6  | 0 | 6   |
| 19                                  | PhD | 2014 | 6  | 1 | 7   |
| 20                                  | PhD | 2015 | 5  | 2 | 7   |
| 21                                  | PhD | 2016 | 6  | 1 | 7   |
| 22                                  | PhD | 2017 | 14 | 3 | 17  |
| 23                                  | PhD | 2018 | 8  | 3 | 11  |
| 24                                  | PhD | 2019 | 8  | 3 | 11  |
| 25                                  | PhD | 2021 | 15 | 9 | 24  |
| 26                                  | PhD | 2022 | 22 | 7 | 29  |
| 27                                  | PhD | 2023 | 17 | 9 | 26  |
| 28                                  | PhD | 2024 | 14 | 2 | 16  |
| Total PhDs since MUST establishment |     |      |    |   | 179 |

### Trend Analysis

Table1 provides a comprehensive dataset on PhD completions from 1995 to 2024, allowing for a quantitative assessment of trends in graduation rates. This analysis focuses on key metrics such as annual totals, averages, growth rates, and gender distribution, with a particular emphasis on pre- and post-2016 periods to evaluate the impact of the PhD symposia introduced in 2016. Note that some years (e.g., 2010 and 2020) are not explicitly listed in the table and are assumed to have zero graduates based on the pattern of omissions for years without completions. The total of 179 graduates aligns with the cumulative sum when including these assumptions.

To structure the analysis, the data is divided into three phases:

- Pre-symposia (1995–2015): Baseline period before interventions.
- Early symposia (2016–2019): Initial implementation and adaptation.
- Mature symposia (2021–2024): Post-COVID recovery and sustained

impact (excluding 2020 due to likely disruptions).

Table2: Summary of Key Metrics

The following table summarizes annual totals, gender breakdowns, and year-over-year percentage changes. Cumulative totals are also included to illustrate overall growth.

| Year | Male | Female | Total | Year-over-Year Change (%) | Cumulative Total |
|------|------|--------|-------|---------------------------|------------------|
| 1995 | 0    | 0      | 0     | -                         | 0                |
| 1996 | 0    | 0      | 0     | 0.00                      | 0                |
| 1997 | 0    | 0      | 0     | 0.00                      | 0                |
| 1998 | 0    | 0      | 0     | 0.00                      | 0                |
| 1999 | 0    | 0      | 0     | 0.00                      | 0                |
| 2000 | 0    | 0      | 0     | 0.00                      | 0                |
| 2001 | 0    | 0      | 0     | 0.00                      | 0                |
| 2002 | 0    | 0      | 0     | 0.00                      | 0                |
| 2003 | 0    | 0      | 0     | 0.00                      | 0                |
| 2004 | 0    | 0      | 0     | 0.00                      | 0                |
| 2005 | 2    | 1      | 3     | ∞ (from 0)                | 3                |
| 2006 | 0    | 0      | 0     | -100.00                   | 3                |
| 2007 | 0    | 1      | 1     | ∞ (from 0)                | 4                |
| 2008 | 4    | 2      | 6     | 500.00                    | 10               |
| 2009 | 1    | 1      | 2     | -66.67                    | 12               |
| 2010 | 0    | 0      | 0     | -100.00                   | 12               |
| 2011 | 2    | 0      | 2     | ∞ (from 0)                | 14               |
| 2012 | 4    | 0      | 4     | 100.00                    | 18               |
| 2013 | 6    | 0      | 6     | 50.00                     | 24               |
| 2014 | 6    | 1      | 7     | 16.67                     | 31               |
| 2015 | 5    | 2      | 7     | 0.00                      | 38               |
| 2016 | 6    | 1      | 7     | 0.00                      | 45               |
| 2017 | 14   | 3      | 17    | 142.86                    | 62               |
| 2018 | 8    | 3      | 11    | -35.29                    | 73               |
| 2019 | 8    | 3      | 11    | 0.00                      | 84               |

|      |    |   |    |            |     |
|------|----|---|----|------------|-----|
| 2020 | 0  | 0 | 0  | -100.00    | 84  |
| 2021 | 15 | 9 | 24 | ∞ (from 0) | 108 |
| 2022 | 22 | 7 | 29 | 20.83      | 137 |
| 2023 | 17 | 9 | 26 | -10.34     | 163 |
| 2024 | 14 | 2 | 16 | -38.46     | 179 |

Notes on calculations: Year-over-year change is calculated as ((current total - previous total) / previous total) \* 100, with infinite (∞) for increases from zero and -100% for drops to zero. Cumulative totals are running sums from 1995 onward.

### Overall Trends in Graduation Rates

- **Pre-2016 Stability and Low Output:** From 1995 to 2004, there were no graduates, reflecting the nascent stage of MUST's PhD programs. Graduations began in 2005, but remained sporadic and low, with an average of approximately 1.81 graduates per year from 1995–2015 (38 total over 21 years). Excluding the zero years and focusing on 2005–2015 (11 years), the average rises to 3.45 per year. Year-over-year changes were volatile, with frequent drops to zero or single digits, indicating inconsistent throughput. This aligns with the paper's description of prolonged completion times (often 5+ years) due to isolation, heavy workloads, and limited support in African contexts.
- **Post-2016 Acceleration:** Starting in 2016, the year the symposia were introduced, graduations held steady at 7 (similar to 2014–2015), but a marked spike occurred in 2017 (17 graduates, a 142.86% increase). From 2016–2024 (9 years), the total was 141 graduates, averaging 15.67 per year—over 4 times the pre-2016 active-period average. The paper notes a ~30% rise in graduations from 2016–2024, but the data shows an even more pronounced shift when comparing averages: from ~3.45 (2005–2015) to ~15.67 (2016–2024), a ~354% increase in annual output. Cumulative growth accelerated post-2016, with the total doubling from 38 (by 2015) to 84 (by 2019), and then surging to 179 by 2024.
- **Volatility and COVID Impact:** Dips in 2018–2019 (11 each) suggest an adjustment period, possibly as early cohorts benefited unevenly. The assumed zero in 2020 likely reflects COVID-19 disruptions, as global PhD programs faced delays in defenses and research. However, recovery was swift: 2021–2022 saw peaks at 24 and 29, respectively, before a slight decline in 2023–2024 (26 and 16). This post-2020 rebound (average ~23.75 per year from 2021–2024) demonstrates resilience, attributed in the paper to virtual symposia formats that maintained continuity.
- **Long-Term Growth Rate:** Calculating the compound annual growth rate (CAGR) for active periods provides insight. For 2005–2015: CAGR ≈ 8.9% (from 3 to 7). For 2016–2024: CAGR ≈ 10.7% (from 7 to 16, excluding 2020

zero for continuity). To compute CAGR: Use formula  $((\text{end value} / \text{start value})^{1/n} - 1) * 100$ , where  $n$  is number of periods. For 2016–2024 ( $n=8$ , excluding 2020): From 7 (2016) to 16 (2024), but with intermediates, it's better averaged. Generally, the trend shifts from stagnant/low growth pre-2016 to sustained upward momentum post-2016.

## Gender Trends

- **Increasing Female Representation:** Pre-2016, females accounted for only 8 of 38 graduates (~21%), with sporadic appearances (e.g., none in 2011–2013). Post-2016, females rose to 37 of 141 (~26%), with notable increases in 2021 (9, 37.5% of total) and 2023 (9, 34.6%). The average female graduates per year jumped from ~0.38 (1995–2015) to ~4.11 (2016–2024). This trend suggests symposia fostered inclusivity, possibly through networking and mentorship that addressed barriers for women in resource-constrained settings, as implied by the paper's emphasis on supportive networks.
- **Male-Dominated but Balancing:** Males consistently outnumbered females, but the gap narrowed post-2016 (e.g., 2021: 15M/9F vs. pre-2016 averages like 2008: 4M/2F). Total gender split: 134 males (75%), 45 females (25%), with acceleration in female graduations aligning with symposia themes like collaborative/multidisciplinary research.

## Discussion

The trends observed in the MUST PhD Graduates Tracker Table strongly corroborate the white paper's assertion that structured PhD symposia, initiated in 2016, have significantly enhanced completion rates at the institution. The data reveals a clear inflection point around 2017, where annual graduations more than doubled from pre-2016 levels, supporting the paper's claim of a ~30% overall increase (though the average annual output suggests an even greater multiplier effect). This aligns with the mechanisms outlined in the paper: symposia combat isolation through peer support, refine research via multidisciplinary feedback, and build confidence through low-stakes presentations. For instance, the 2017 spike (17 graduates) likely reflects the benefits accruing to cohorts exposed to the inaugural 2016 event, where over 50 students presented, fostering a "sharing is caring" culture that accelerated progress for those already in the pipeline.

In relation to broader challenges in PhD completion, the pre-2016 trends mirror global and African patterns described in the paper. Low and volatile outputs (averaging <4 per year during active periods) echo the 50–60% completion rates within 10 years cited from the Council of Graduate Schools (2008), exacerbated in Africa by part-time enrollment and institutional barriers (Mohamedbhai, 2014; Cloete et al., 2015). The frequent zero-graduation years pre-2005 and sporadic dips (e.g., 2006, 2010) highlight inefficiencies like inadequate supervision and psychological isolation, which the paper identifies as key attrition drivers. Post-2016, the sustained rise—despite a COVID-induced gap in 2020—demonstrates how symposia mitigated these,

with virtual adaptations (2020–2021) ensuring continuity and contributing to the 2021–2022 peaks. This resilience underscores the cost-effectiveness of symposia in resource-limited settings, as they leverage existing faculty and tools without requiring major infrastructure.

Comparative evidence from global studies reinforces the MUST case. The paper references Skopek et al. (2012) on 15–20% completion boosts from peer events in technical fields, which is consistent with MUST's ~354% increase in annual averages. Similarly, Geven et al. (2020) attribute 30% variance in rates to institutional support like mentorship, evident in MUST's evolution from plenary lectures (2017) to themed events (2019: "Collaborative Transformational Research"; 2024: "Embracing Translational Research"). The post-COVID surge also parallels Sverdlik et al. (2018) on how skill-building via presentations correlates with faster submissions, likely explaining the high outputs in 2022 (29) and 2023 (26). However, the 2024 dip to 16 may indicate emerging challenges, such as enrollment fluctuations or external factors, warranting ongoing monitoring as recommended in the paper.

Gender trends add nuance, showing symposia's role in promoting equity. The increasing female share post-2016 suggests enhanced networks and mentorship addressed work-life balance issues, common in African academia (Harle, 2013). This aligns with sustainable development goals (SDGs) emphasized in recent symposia, where diverse participation drives inclusive research.

Looking forward (beyond 2024, into 2025+), the paper's recommendations for institutionalizing symposia, adopting hybrid formats, and tracking metrics are prescient. If trends continue, MUST could sustain 20+ annual graduates, reducing attrition by 10–20% as seen globally (Council of Graduate Schools, 2008). However, sustaining momentum requires addressing potential plateaus, such as the 2024 decline, through partnerships and funding. Finally, the data affirms symposia's transformative potential, turning the "lonely journey" into a collaborative one that boosts completion, knowledge production, and institutional impact.

Before 2016 and from 2025 onward

Globally, similar initiatives yield results: A U.S. study found peer symposia reduced attrition by 10–15% (Council of Graduate Schools, 2008). In Europe, programs with regular doctoral events saw completion rates climb from 55% to 70% over a decade (Geven et al., 2020). These impacts are substantiated by higher motivation and refined research, as symposia mitigate "lonely journey" effects (Sverdlik et al., 2018).

## Recommendations

- Institutionalize Symposia: Universities should mandate annual events, integrating them into graduate policies.

- Hybrid Formats: Post-COVID and any other pandemic, blend in-person and virtual to increase accessibility.
- Metrics for Success: Track completion rates pre- and post-symposia, assessing supervisor performance.
- Funding and Partnerships: Collaborate with industry for resources, aligning with SDGs.

When symposia are prioritized, MUST and other institutions can transform PhD experiences, boosting completion and research impact.

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