REPORT ON UTAB CAREER FAIR

(26th -28th February 2024)

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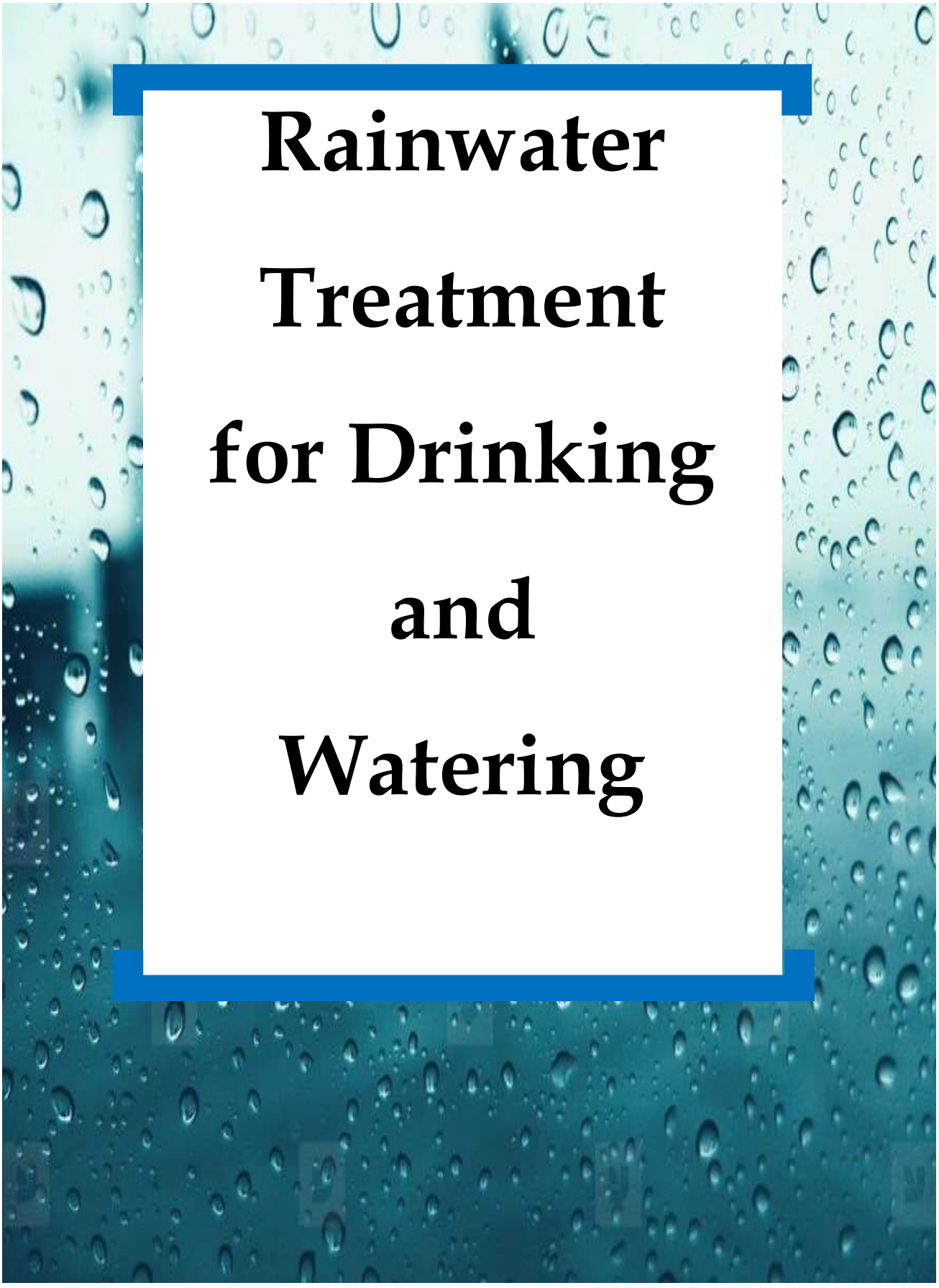

Rainwater Treatment for Drinking and Watering

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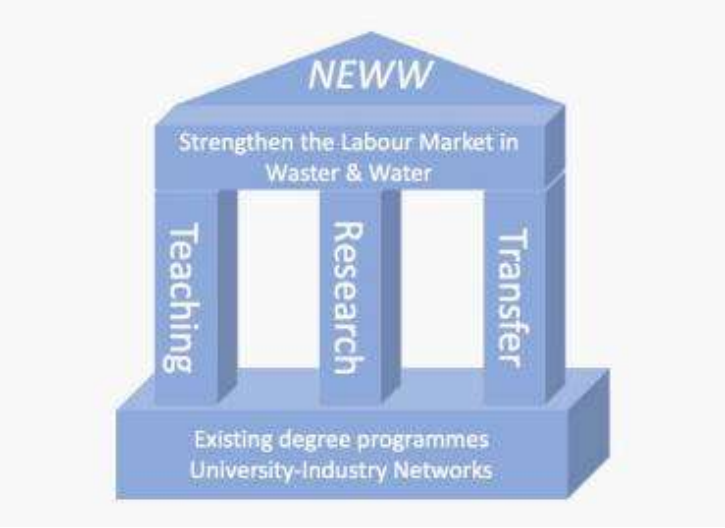
1.0 Introduction

The Network for Labour-Market Oriented Education in Waste and Water Management (NEWW) is a project aimed at tackling the challenges, failures, and instability in the labour market in the waste and water management sectors in Ghana and Rwanda. This project is a collaboration between the University of Oldenburg (UOL) in Germany, the University of Ghana (UG) in Ghana, the University of Technology and Arts of Byumba (UTAB) in Rwanda and industry players in the waste and water management sectors. To merge the interests of universities and business partners in the waste and water management sectors, the project seeks to facilitate practice-oriented teaching in the field of waste and water management in its African partner universities to ensure sustainable partnerships between the waste and water management industry and academia.

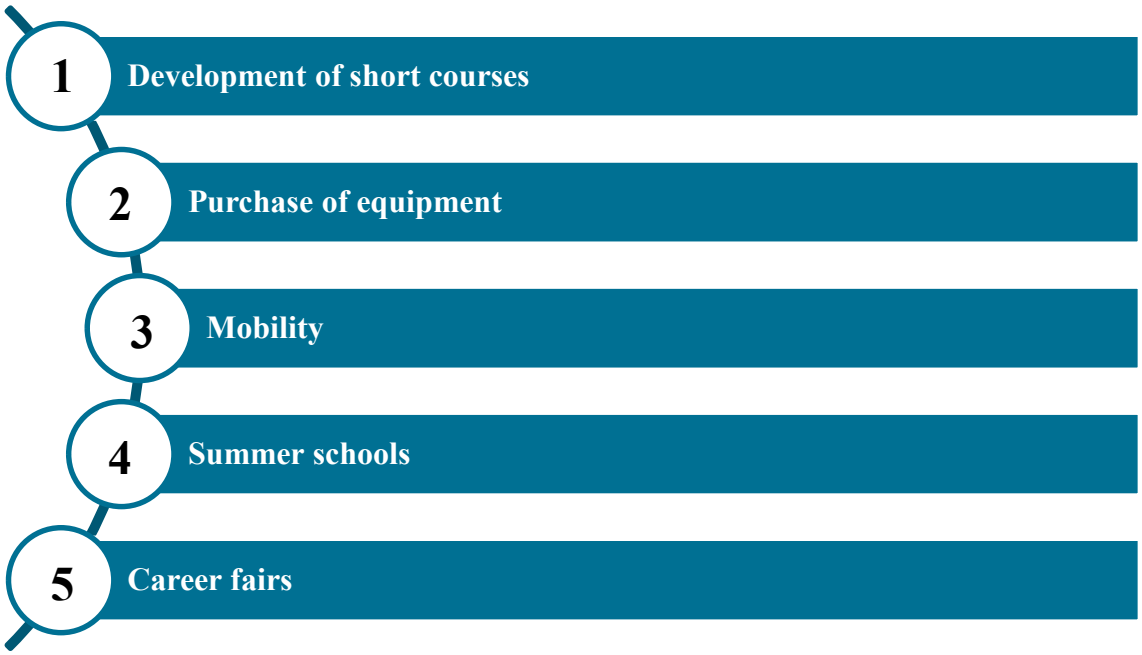
The NEWW project is thus based on three pillars:

1. **Teaching:** By equipping graduates with skills for the labour market. This is to be promoted through the development of practice-oriented modules in waste and water management.
2. **Research:** By undertaking practice-oriented research in waste and water management.
3. **Transfer:** By strengthening partnership between universities and the waste and water management industry through student internships and the carrying out of annual career promoting events with the purpose of attracting employment from waste and water management companies for students.

These three (3) pillars are founded on existing degree programs as well as local and international university-industry networks.



The main activities intended to be undertaken under the NEWW project are:



2.0 Overview of UTAB Career Fair

A career fair was undertaken by the University of Technology and Arts of Byumba (UTAB) on its campus in Byumba, Rwanda. It was a three-day event spanning from 26th to 28th February 2024. The aim of the career fair was to attract companies in the waste and water management sector for students within this field of study. The event was meant to facilitate internship and full employment opportunities as well as to create awareness on business start-up opportunities in the waste and water management sector. The career fair was centred on the theme: 'Rainwater Treatment for Drinking and Watering'. Insights drawn from the career fair were intended to be incorporated into an ongoing preparation of a short course in rainwater treatment for drinking and watering for UTAB students.

3.0 Day One (1)

Day One (1) of the event which fell on the 26th of February 2024 was marked by a project meeting which was attended by partners from University of Oldenburg, University of Ghana and University of Technology and Arts of Byumba. Highlights of the meeting were the introduction of all partners from the three (3) universities as well as a discussion and planning of the roll-out of activities for the career fair and subsequent project activities.

4.0 Day Two (2)

The career fai programme began at 10:00 am with the Master of Ceremony (MC), Isimbi Sandrine welcoming all participants and stating the event's theme. The second MC, Bizimungu Jean Baptiste then proceeded to outline the order of activities for the event and invited the Vice Chancellor of UTAB, Fr. Dr. Gilbert Munana to say a prayer to commence the program. The opening ceremony of the career fair was marked with an introductory speech by the Vice Chancellor of UTAB and a speech by the chairperson of the UTAB Governing Body.

Figure 1: The MCs: Isimbi Sandrine (L) and Bizimungu Jean Baptiste (R) Moderating the Career Fair

4.1 Introductory Speech by Vice Chancellor of UTAB

After the prayer, the Vice Chancellor subsequently gave an introductory speech to mark the start of the event. In his speech, he welcomed all participants and thanked them for attending the career fair. He subsequently gave an overview of the NEWW project, its three (3) pillars and the purpose of the career fair. He added that the theme of the career fair which is: 'Rainwater Treatment for Drinking and Watering' reflects a collective commitment to address critical challenges in waste and water management within the context of sustainable development and resource conservation. As countries around the world make efforts to navigate the complexities of environmental stewardship and public health, he emphasised the importance of acquiring knowledge, skills, and solutions for ensuring access to clean and safe water for all. He reiterated the vision of the NEWW project which aims at strengthening the labour market in the waste and water management sectors in Ghana and Rwanda and stated that the career fair plays an essential role in achieving this vision of the NEWW project by attracting companies within the waste and water management sector to students; thereby providing them with potential internship, employment, and business startup opportunities. He entreated all participants to fully partake in all activities and available opportunities at the career fair and to create meaningful networks with industry professionals and other participants of the career fair to pave the way for a future where the waste and water management sectors stand as pillars of sustainability and prosperity. He again thanked all partners, sponsors and participants who had contributed to the successful organisation of the career fair.

Figure 2: The Vice Chancellor of UTAB: Fr. Dr. Gilbert Munana Giving the Introductory Speech

4.2 Statement by Chairperson of UTAB Governing Body

The MC, Bizimungu Jean Baptiste then invited the chairperson of the UTAB Governing Body, Mr. Ivan Wulffaert to give a speech. Mr. Wulffaert talked about the importance of water to industries such as breweries and the large amount of waste such industries generate. He cited examples of how the circular economy can be incorporated into the waste and water management sectors using waste as a resource for other industries.

Considering that the pillar of the NEWW project focus on strengthening the partnership between universities and industry, Mr. Wulffaert said that internship opportunities are periodically given to UTAB students at a brewery of which he is the founder of. He subsequently talked about the challenges faced by UTAB which includes lack of adequate infrastructure to accommodate the fast-growing student population. He also highlighted the strengths of UTAB which includes its entrepreneurial and highly skilled staff as well as its favourable location in the Northern part of Rwanda which is rural and in great need of quality agricultural education. He expressed gratitude for the opportunity for UTAB to network with other universities to further raise its quality of education and the quality of graduates that it produces. He again spoke about the relatively new departments which had been created by UTAB for renewable energy and agronomy as well as future plans to create an institute for gastronomy. He stated that the institute for gastronomy which

would be created would educate the general population on the importance of good food and the importance of eating a well-balanced diet. He reiterated the importance of water and why it is the focal point of discussion at the career fair. He added that there are opportunities for UTAB to treat rainwater for drinking and for agricultural use in the area within which the university is located. He concluded his speech by emphasising on the need to exchange experience and knowledge between the partner universities and industry professionals in the waste and water management sectors at the career fair and the need to provide students with practice-oriented education to prepare them for the labour market. He then declared the UTAB career fair officially open.

Figure 3: The Chairperson of UTAB Governing Body: Mr. Ivan Wulffaert Giving A Speech

4.3 Keynote Address by Representative of the Ministry of Infrastructure of Rwanda

The MC, Isimbi Sandrine invited Mrs. Marcelline Kayitesi, the Director General of Water and Sanitation under the Ministry of Infrastructure of Rwanda to give the keynote address. In her speech, Mrs. Kayitesi thanked the three (3) partner universities for developing the NEWW project and added that this initiative would contribute to bridging the current skills gap in the local labour market in the waste and water management sectors. Mrs. Kayitesi stated that the career fair was taking place at the right time in the waste and water management sector when new reforms are

being carried out on the National Water and Sanitation Policy of Rwanda. She then proceeded to give an overview of the Water and Sanitation Policy. She stated that the Water and Sanitation Policy aims at facilitating sustainable management and equitable use of water resources. She added that this includes ensuring sustainable, reliable, and affordable access to safe drinking water and sanitation for all Rwandans to serve as a contribution to improving the quality of life, socio-economic transformation and sustainable environmental management in Rwanda. She again stated that strengthening the labour market in the waste and water management sectors is in line with one of the objectives of the National Water and Sanitation Policy which is focused on developing national human capacity for the delivery of sustainable water and sanitation services.

Mrs. Kayitesi said that the government of Rwanda is committed to achieving the targets of Sustainable Development Goal 6 which is focused on ensuring access to sustainable water and sanitation for all Rwandans by the year 2030. To achieve these targets, she stated that the Rwandan government through the Ministry of Infrastructure has invested in the water and sanitation sector by initiating several programmes aimed at improving water and sanitation services. In the water and waste management sectors, the infrastructural initiatives being undertaken by the Rwandan government which she mentioned were increasing water production capacities by exploiting different sources of water including rainwater, development of rainwater storage systems, constructing, upgrading, and extending water distribution networks across the country and constructing centralised sewage systems and other sanitation facilities across the country. Other initiatives being undertaken by the Rwandan government in the waste management sector which she mentioned are proper containment, collection, transportation, disposal, and treatment of waste. She pledged the support of the Ministry of Infrastructure of Rwanda for the NEWW project and added that the Ministry is open to continuing to work with UTAB and other partners of the NEWW project in ensuring labour market stability in the waste and water management sector.

Figure 4: Mrs. Marcelline Kayitesi, the Director General of Water and Sanitation under the Ministry of Infrastructure of Rwanda Giving the Keynote Address

4.4 Presentation by Overall Coordinator of NEWW Project

The keynote address by the representative of the Ministry of Infrastructure of Rwanda was followed by a presentation by the overall coordinator of the NEWW project, Prof. Dr. Jorge Marx Gómez. He began his presentation by expressing gratitude to all participants of the career fair and all partners of the NEWW project. He went ahead to give an overview of the conception of the NEWW project. He stated that the project was built upon existing partnerships with universities in East Africa and University of Ghana in West Africa. He added that the project was funded by the German Academic Exchange Service (DAAD). He proceeded to give a brief introduction of the University of Oldenburg. He also stated that the University of Oldenburg is open to further collaboration with international experts.

In his presentation, Prof. Gómez said that the aim of embarking on projects like the NEWW project is to develop professional skills in university students to make them better equipped for the labour market which would in turn facilitate the establishment of stronger partnerships between academia and industry. He also talked about previous projects funded by DAAD. Key among the projects he mentioned was the Centre of Excellence for ICT in East Africa (CENIT) as well as another project involving the University of Ghana and universities in Tanzania and Mozambique. He said that the

latter project was centred on the development of a master's programme in environmental management information systems with the goal of providing education on how industries should manage and adapt to environmental risks. With regards to the current NEWW project, he thanked partners who played a pivotal role in the development of the project and expressed his anticipation for the subsequent project activities which would be held in Ghana, Germany, and Rwanda over the next three (3) years and entreated all participants of the career fair to partake in these subsequent project activities. He also stated that the established partnerships between universities and industry should be fully utilised to achieve the objectives of the NEWW project as well as future projects.

Figure 5: The Overall Project Coordinator: Prof. Dr. Jorge Marx Gómez Giving A Speech

4.5 Presentations by NEWW Project Partners

4.5.1 University of Oldenburg

After his presentation, Prof. Gómez then invited Mr. Dennis Schulte from the University of Oldenburg to give more details about the NEWW project. Dennis Schulte commenced his presentation by providing the background of the NEWW project. He said that the policy makers in Ghana and Rwanda had seen the need to mobilise resources to achieve sustainable development especially in sectors such as waste and water management. He added that in the wake of the rapidly

growing population in these countries, proper management of their human resources can play a vital role in efforts to achieve sustainable development. Within the context of the waste and water management sector, Mr. Schulte elaborated that the proper management and development of skills of human resources involves increased collaboration between universities and the waste and water management industry for the generation of a work force which is focused on quality over quantity. He went on to outline the objectives of the NEWW project which are: to strengthen the teaching structure in University of Ghana and UTAB to meet the demands of the labour market in the waste and water management sectors in Ghana and Rwanda respectively, to improve the labour market orientation of waste and water research in institutions to ensure innovation in the sector and to align the interests of universities and business partners to create sustainable partnerships.

In terms of the expected outcomes of the NEWW project, he mentioned that the project has five (5) expected outcomes which fall under the three (3) pillars of the project. The first expected outcome that he mentioned which falls under the 'Teaching' pillar aims to develop an inter-university, credit-bearing lecture series module on the circular economy which would be integrated into degree programmes. The second expected outcome which also falls under the 'Teaching' pillar aims at the development of practice-oriented modules in collaboration with business partners for the promotion of professional education. The third expected outcome which falls under the 'Research' pillar aims at the creation of relevant research projects which includes papers, presentations, and collaborations in the field of circular economy which are in line with the local conditions in the waste and water management sectors in Ghana and Rwanda. The fourth expected outcome which falls under the 'Transfer' pillar is focused on the establishment of annual career fairs in University of Ghana and UTAB with the goal of attracting companies of interest to students studying programmes relevant to the waste and water management sectors and the fifth expected outcome which falls under all three (3) pillars of 'Teaching', 'Research' and 'Transfer' is focused on the development of practice-oriented thesis topics in collaboration with business partners. He said that the thesis topics are expected to cover all locally relevant waste and water management issues in need of research to strengthen the employability of university graduates. He added that summer schools are expected to be carried out annually either in Ghana or Rwanda. He also said that these summer schools would bring together students and staff of universities as well as business partners in the waste and water management sectors and would be geared towards the showcasing of cutting-edge research in the field of circular economy in waste and water management.

After his presentation, Mr. Schulte invited the industry partners from Germany on the NEWW project: Oldenburgisch-Ostfriesischer Wasserverband (OOWV) and Ecology + Communication Unternehmensberatung (Ecco) to give their presentations.

Figure 6: Mr. Dennis Schulte (University of Oldenburg) Giving More Details about the NEWW Project

Oldenburgisch-Ostfriesischer Wasserverband (OOWV)

Mr. Egon Harms, a hydrogeologist at OOWV gave a presentation on OOWV. He started by stating that OOWV is a public water supply company in the northwest part of Germany. Mr. Harms said that OOWV has about 1000 employees, a supply area of 7500 km^2 and serves about 1.2 million people. He also stated that OOWV's water supply is solely derived from groundwater sources. Mr. Harms added that OOWV has a pipeline network of 15,000 km and 390,000 households are connected to OOWV's water supply system. He again stated that the daily consumption of drinking water per head was 125 litres and that the total drinking water supply per year was 85 million m^3. He also said that OOWV has 15 waterworks, 260 groundwater wells and a daily water delivery of 235,000 m^3. Aside from water supply, he said that OOWV also deals in wastewater disposal. He mentioned that the company has a wastewater management area of 3700 km^2, has sewer network of 5000 km, owns 44 wastewater treatment plants, treats about 35 million m^3 of wastewater per

year and owns 1100 pumping stations. He added that OOWV invested 50 million Euros in its wastewater disposal system in 2022.

He went on to highlight some of the challenges faced by OOWV in its operations. This included climate change related issues, groundwater pollution as well as the need to drill new wells and widen OOWV's water supply system to meet the growing demands of industries and the rapidly increasing population. Another challenge he cited was the issue of nature conservation associated with installing new water pipes in areas such as wetlands. Apart from the challenges, he also talked about the achievements of OOWV which included the successful connection of 99.9% of people in OOWV's area of operation to the grid system.

After the presentation by Mr. Harms, there was a questions and answers session. During this session, Mr. Ivan Wulffaert, the chairperson of the UTAB Governing Body asked about the partnerships OOWV has with universities. In response, Mr. Harms stated that OOWV has partnerships with University of Oldenburg and a university in Hannover (Germany). He added that OOWV needs such partnerships with experts in universities and industry players for the undertaking of research on the options available for minimising the possibility of soil pollution associated with OOWV's operations. Mr. Wulffaert again asked what OOWV uses its treated wastewater for. In response, Mr. Harms said OOWV returns about 90% of treated wastewater back to nature and supplies the remaining percentage of treated wastewater as a raw material for paper manufacturing companies, chemical industries, amongst others.

Figure 7: Mr. Egon Harms Giving A Presentation on OOWV

ECOLOGY + COMMUNICATION UNTERNEHMENSBERATUNG (ECCO)

Mrs. Laureen Pahl, a representative of ECCO, was the next to give a presentation about her organisation. In her presentation, Mrs. Pahl said that ECCO which was founded in 1993 as an institution affiliated to the University of Oldenburg. She however added that Ecco is not financed by the University of Oldenburg but rather generates its own funds for its operations.

She mentioned that ECCO permits students at the University of Oldenburg to select thesis topics which are in line with the operations of Ecco; thereby facilitating the incorporation of the practice-oriented perspective of Ecco into their thesis. In terms of their functions, Mrs. Pahl stated that the core theme of Ecco is entrepreneurial sustainability and that, their operations as an institution includes the provision of expert advice on management systems, living occupational safety as well as leadership and strategy through the supporting of companies in strategic issues as well as through the supporting of managers in their development.

With regards to management systems, she elaborated that ECCO is engaged in several facets of management such as quality management, energy management, information security management, occupational health management, safety in the supply chain, environmental management, amongst others. In addition to these, she added that ECCO deals in sustainability management (which includes the sustainable management of waste), climate management as well as sustainability reporting. She explained that sustainability reporting has to do with companies' communicating their level of sustainability for clients to make an informed decision about which company to engage with. With regards to climate management, she mentioned that Ecco is involved in the calculation of CO_2 footprint of its clients and the development of climate adaptation strategies for its clients such as the development of strategies to protect clients from coastal and rainwater-related hazards.

Figure 8: Mrs. Laureen Pahl Giving A Presentation on ECCO

4.5.2 University of Technology and Arts of Byumba (UTAB)

After Mrs. Pahl's presentation, the MC invited Fr. Dr. Lucien Hakizimana, a senior lecturer of UTAB to give the next presentation. In his presentation, he said that under the NEWW project, UTAB was focused on the rainwater component while University of Ghana was focused on the waste management component. He explained that UTAB took the component of rainwater because rainwater is a problem Rwanda is experiencing. He stated that Rwanda falls within a very mountainous region. Hence, it is highly susceptible to erosion, landslides and floods caused by rainwater. He said that by focusing on the rainwater component, UTAB aims to develop solutions to solve this problem. He stated that the career fair, summer school and short course under the NEWW project are some of the platforms through which UTAB would be finding solutions to the rainwater problem.

He then proceeded to give background information about Rwanda. He mentioned that Rwanda is a landlocked country and that approximately 40% of Rwanda's land is classified as having a very high erosion risk while about 37% requires soil retention measures to be carried out before the undertaking of agricultural activities. He added that in the wake of rapid urbanisation, Rwanda's

natural water resources are becoming more strained annually. He also said that Rwanda is among the countries with the lowest per capita water availability and water storage capacity in Africa. He said that despite these issues, Rwanda has a high potential to use rainwater as a resource since it receives an average annual precipitation of 1200 mm. He said that the annual precipitation in the Eastern Province of Rwanda is about 800 mm and about 2000 mm in the hillier Northern Province of Rwanda. He again said that Rwanda has two rainy seasons: with the minor one lasting from mid-September to mid-December while the major one lasts between mid-February and mid-May. He stated that this bimodal rainfall pattern could meet the annual water storage demand of Rwanda. He also mentioned that harvested rainwater has the potential to be used for watering crops and for drinking (after it has undergone treatment).

With regards to rainwater harvesting, Fr. Dr. Hakizimana stated that UTAB installed rooftop water harvesting systems on its existing buildings in 2023. He added that UTAB has been experimenting with using harvested rainwater for plumbing and for sprinkler systems for irrigation. Apart from these, he also spoke about the potential socio-economic and environmental benefits of UTAB's rainwater harvesting initiative. This included the use of rainwater as an alternative source of water and the supply of harvested rainwater from the rainwater harvesting system to neighbouring communities for household use. He also said that the efficient use of the rainwater harvesting system would lead to a reduction in the municipal water supply bill, ensure a return on the investment into the installation of the rainwater harvesting system, provide a green landscape and enable erosion control. Another community outreach initiative to be undertaken by UTAB which he spoke about was the incorporation of circular economy into rainwater management.

He said that the use of rainwater as a water source would decrease the damage caused by rainwater. He also said that it could lead to job creation for more people in the water management sector. After his presentation, Fr. Dr. Hakizimana invited the industry partners from Rwanda on the NEWW project: Vision Agrobusiness Farm Ltd. (VAF) and Sina Gérard/Ese Urwibutso to give their presentations.

Figure 9: Fr. Dr. Lucien Hakizimana Giving A Presentation

Vision Agrobusiness Farm Ltd. (VAF)

Mr. Alexis Ndayambaje, the representative of VAF, gave a presentation on VAF and the role it plays in the waste and water management sectors. At the beginning of his presentation, Mr. Ndayambaje gave a brief history of VAF. He stated that VAF was established in 2008 and was legally registered in 2014. He also said that VAF was established to tackle the critical needs in crop and livestock production to ensure food security. He added that the company is in Gicumbi District in the Northern Province of Rwanda. He went on to mention some of the achievements of VAF which included contribution to the development of the piggery industry in Rwanda through the improvement of the quality of pig breeds.

With regards to the waste and water management sector, Mr. Ndayambaje said that VAF has a rainwater harvesting system which can collect about 1500 m^3 of rainwater annually. He said that the harvested rainwater is used as drinking water for livestock, for fish farming activities and also for watering crops. He mentioned that the use of rainwater for a considerable number of its

operations has led to a significant reduction in the water bills of the company. He also added that VAF has five (5) students of UTAB currently undertaking internships with the company.

He also mentioned some of the upcoming plans of VAF. This included plans to establish fish hatcheries for its fish farming department to increase the fish production of the company, plans to expand its irrigation system for the enhancement of its vegetable production, plans to provide households with wastewater treatment systems for the treatment of wastewater for reuse and plans to plant trees for the protection of lakes, rivers, and hills with steep slopes. He also added that VAF aims to assist farmers with integrated water management and fish farming, offer training on hydroponics and train the youth as well as women on innovative ways of managing water. He said that the plans would result in a reduction in the cost of water used in agriculture and households, would create new jobs for the youth and women, increase production and yield of crops and fish, decrease the occurrence of diseases associated with the use of contaminated water and lastly, enhance the control of erosion.

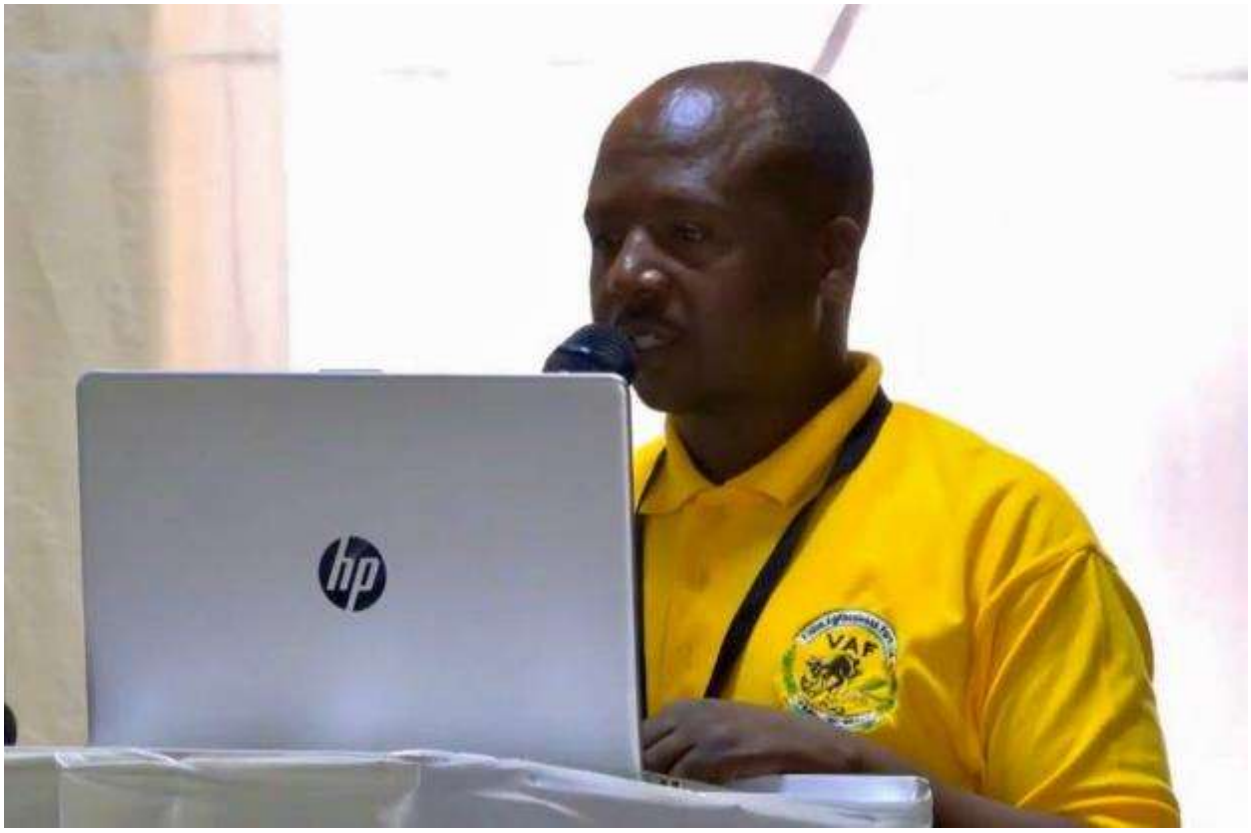


Figure 10: Mr. Alexis Ndayambaje Giving A Presentation On VAF

Sina Gérard/Ese Urwibutso

Mrs. Pascaline Bahati and Mrs. Alice Dukundimana, the representatives of Sina Gérard/Ese Urwibutso were the next to give a presentation about their company. In the presentation, Mrs. Bahati gave background information on the company. She said that Sina Gérard/Ese Urwibutso is a food manufacturing company that was founded in 1983 by Sina Gérard, a Rwandan entrepreneur. She gave examples of some products of the company; one of which is Akandi Natural Mineral Water which is made from treated water from a spring at the Gitare Hill in Rwanda. She then handed it over to Mrs. Dukundimana to continue with the presentation. Mrs. Dukundimana stated that water drawn from the spring is filtered using Rapid Sand Filtration System, Sediment Filtration System and Pleated Absolute Filtration System. At the end of their presentation, Mrs. Bahati expressed her gratitude to UTAB for partnering with Sina Gérard/Ese Urwibutso on the NEWW project. She also said that the company is interested in acquiring knowledge on rainwater treatment. She expressed anticipation for the field visit to the company which was to take place the following day.

Figure 11: Mrs. Pascaline Bahati (L) and Mrs. Alice Dukundimana (R) presenting on Sina Gérard/Ese Urwibutso

4.5.3 University of Ghana

Dr. Daniel Nukpezah, a senior research fellow of the Institute for Environment and Sanitation Studies (IESS) of the University of Ghana was the next to present. He started by giving an overview of Ghana as a country and the University of Ghana. The overview of Ghana which he provided included information on its location in the western part of Africa, the countries it shares border with (Burkina Faso, Cote d' Ivoire, Togo, and the Gulf of Guinea), its capital which is Accra, its population which is approximately 31 million, its rate of urbanisation, amongst others.

In the background information which he provided about the University of Ghana, he talked about the fact that the university was established in 1948 and has a population of close to 70,000. He also provided brief information on the colleges, schools as well as the institutes at the University of Ghana. He subsequently spoke about the Institute for Environment and Sanitation Studies (IESS). He stated that the institute was established in 2010 with the mission of meeting the nation's needs for broad based education, training and research in the science, policy, and management of environmental and sanitation processes in the wider African and global context. He also said that IESS runs solely Masters and PhD Programmes, and currently has about sixty (60) and seventy-five (75) Masters and PhD students respectively enrolled at different levels. He cited examples of some of the research activities of IESS in water management, environmental quality, climate change, amongst others.

He went on to talk about the state of water resources and waste management in Ghana. With regards to the state of water resources in Ghana, he said that Ghana has a total annual runoff of about 54.4 billion m^3. Of this volume, he stated that only about 13% is abstracted for use; indicating that Ghana's water resources are largely underdeveloped. He also said that Ghana has dams and wastewater treatment plants as well as other water-related infrastructure. He however added that the water-related infrastructure is not evenly distributed across the country. He also spoke about the fact that about 60% of Ghana's surface water resources are of poor quality. He again said that one of the major factors accounting for the poor quality of some of the water resources in Ghana is mining activities. He stated that such activities result in high turbidity and high heavy metal concentration in Ghana's water bodies which in turn leads to high cost in water treatment. He also talked about the excessive removal of vegetative cover as another factor accounting for the poor quality of Ghana's waters. He stated that the excessive removal of vegetative cover increases the occurrence of erosion and the delivery of total suspended solids into Ghana's waters. Other anthropogenic sources of water pollution in Ghana which he spoke about are the discharge of effluent from industries, the release of domestic wastewater as well as the discharge of sewage into streams and rivers.

He spoke about the natural sources of pollution in Ghana's water resources which include geologic formations and runoff from biological decay. He said that these natural sources of pollution lead to an increase in the total suspended solids, turbidity, and nutrient inflow into Ghana's water resources. He also mentioned that the quality of Ghana's water resources is determined using Water Quality Index (WQI). He said that the determination of WQI is based on parameters such

as dissolved oxygen, Biochemical Oxygen Demand, ammonium nitrogen, faecal coliform, pH, nitrate, phosphate, conductivity, temperature, and total suspended solids. He also stated that there are four (4) classes under WQI namely: Class One (1) which has a score greater than 80 representing good water quality; Class Two (2) which has a value in between 80 and 50 representing fairly good water quality, Class Three (3) which has a score between 50 and 25 representing poor water quality and lastly, Class Four (4) which has a score which is less than 25 representing grossly polluted water. Dr. Nukpezah stated that the water quality challenges Ghana is facing reveals the need to train more persons in the water management sector. He explained that the training needs include training in wastewater treatment technologies, water purification technologies for rural communities, low-cost household water treatment technologies, mineral water production and packaging as well as integrated water resources management. He added that the successful training of the youth in these fields would enable them to develop entrepreneurial skills in these areas.

With regards to the state of the waste management sector in Ghana, Dr. Nukpezah said that as of 2021, Accra alone was producing between 2500 to 3000 tonnes of waste daily and that it is expected that this figure would double by 2025. He also spoke about the main issues faced by Ghana in the waste management sector. The issues he spoke about included poor waste handling, ineffective waste collection and difficulties in processing waste. To solve these issues, he stated that Ghana would have to incorporate the circular economy into its waste management system. He added that feasibility studies would have to be undertaken to analyse the challenges and training would have to be given to people in the waste management sector on how to tackle these issues. He subsequently spoke about the stakeholder diversity in Ghana's waste management sector. He said that the main waste management stakeholders are governmental agencies, non-governmental organisations, private enterprises, and informal waste pickers. He went on to talk about the waste management structure in Ghana. He said that the sources of waste in Ghana include households, government agencies and industries. He gave examples of types of waste that are generated in Ghana. These include construction waste, paper waste, metal waste, glass waste, textile waste and plastic waste. He stated that plastic waste makes up 14% of the waste stream in Ghana. He also said that there are a lot of economic activities within Ghana's waste management value chain. Some of the economic activities which he spoke about with regards to plastic waste are the transformation of plastic waste into useful products such as through the conversion of plastic bottles into pellets for the making of waste containers, water storage containers, amongst others.

He mentioned key players in the plastic recycling industry in Ghana. This included Jekora Ventures, Recyclers Ghana Ltd., Coliba Ghana, amongst others. He stated that the strengths of these players include access to international markets, achievement of economies of scale, value addition to aggregated and recycled products and innovative marketing strategies. He also spoke about research that was done by IESS which involved the use of organic waste from local markets for compost to improve agriculture in the Ga West Municipality in the Greater Accra Region of Ghana.

Dr. Nukpezah highlighted some of the problems regarding policies in Ghana's waste management sector. This included a lack of specific local by-laws for effectively managing the waste sector. He also talked about the training needs of Ghana's waste management sector which included training on composting, training on pelletising plastic waste, training on technologies for waste conversion into useful products and entrepreneurship training in the plastic waste value chain. He also gave some recommendations for a sustainable future in the waste value chain such as the development of a competitive edge for businesses, the establishment of strategic partnerships, the development of policies, the provision of incentives and training as well as the promotion of buyback centres. At the end of his presentation, Dr. Nukpezah spoke about the vision for Accra in terms of waste management which is a cleaner and healthier Accra which is a leading example of innovative waste management; where waste is a resource and employment opportunities in the waste management sector are created for the youth and sustainability is a way of life. He added that it is hoped that the NEWW project would contribute towards the achievement of this vision.

After the presentation, Dr. Benjamin Dankyira Ofori, a senior research fellow of IESS contributed to the discussion. He stated that the waste recycling sector in Ghana is a vibrant industry. He cited examples of types of waste which undergo recycling such as plastic waste, metal waste and organic waste. He said that plastic and metal waste are the two types of waste which mostly undergo recycling in Ghana. He however added that organic waste recycling is lagging in the waste recycling sector. He spoke about the training programme on composting undertaken by IESS and said that it is one of the ways in which the organic waste recycling sector can be improved. He recommended that such initiatives be incorporated into the NEWW project.

There was subsequently a questions and answers session. A question was asked about how the release of Bisphenol A (a plastic additive) into the environment is controlled during the pelletisation of plastics. In response, Dr. Ofori said that the Ghana Standards Authority is currently developing standards for plastic recycling. He added that the establishment of the standards would

provide a strong basis for regulating the activities of persons involved in the plastic recycling business in Ghana. Another question was asked about how mine tailings are treated to prevent them from polluting the environment in Ghana. In response, Dr. Nukpezah stated that there are standards for the mining companies in Ghana which requires them to treat their tailings. He also said that it was illegal miners who do not treat their tailings.

Figure 12: Dr. Daniel Nukpezah Giving A Presentation

Figure 13: Dr. Benjamin Dankyira Ofori Contributing to Discussion

4.6 Presentation by Representative of the Ministry of Infrastructure of Rwanda

After the lunch break, activities at the career fair resumed at 2:30 pm with the MC, Isimbi Sandrine inviting Mrs. Marcelline Kayitesi, the Director General of Water and Sanitation under the Ministry of Infrastructure of Rwanda to give a presentation on the key highlights in the policy framework in the water and sanitation sector in Rwanda. She started her presentation by speaking about the vision of the National Water and Sanitation Policy of Rwanda which is to facilitate sustainable management and equitable use of water resources, while ensuring sustainable, reliable and affordable access to safe drinking water and sanitation for all Rwandan citizens, as a contribution to improving the quality of life, socio-economic transformation and sustainable environmental management. She also talked about the mission of the policy which is to ensure the protection, conservation, restoration, and rational use of water resources and to promote, plan, build and deliver water and sanitation services in a sustainable, efficient, and equitable manner. She stated that previously, there were separate policies for water resources, water supply and sanitation. She added that the new National Water and Sanitation Policy combined these three (3) separate policies into one.

She went on to talk about the long and medium-term planning tools for Rwanda's water and sanitation sector which comprised of Vision 2050 that provides a long-term strategic direction for a better Rwanda; National Strategy for Transformation (NST1) which aims at providing universal access to safe water and sanitation by 2024; Sector Strategic Plan under the National Strategy for Transformation (SSP) and District Development Strategies (DDS). She proceeded to highlight some of the challenges of the water and sanitation sector in Rwanda which the National Water and Sanitation Policy aims to tackle. This included an increase in the adverse effects of climate change, the depletion of water resources, soil erosion, a financial gap in the implementation of water supply and sanitation related activities, low level of sustainability in water supply as well as sanitation and hygiene services especially in rural areas, lack of water resources data to inform decision-making at the national and international level, environmental pollution which affects the quality of water resources as well as increased water demands as a result of urbanisation, population growth and socio-economic development.

To tackle the challenges pertaining to water resources management, she stated that the National Water and Sanitation Policy has the objective of improving the knowledge base in Rwanda's water resources and enhancing the potential for sustainable water resources management, development,

and protection. She added that some of the ways by which the policy aims to achieve this objective are the conduction of groundwater inventories and the strengthening of the national capacity to collect, store, process and disseminate hydrological information. The second objective of the policy for tackling the challenges pertaining to water resources management is to increase the involvement of Rwanda in dialogues and data sharing and to enhance the management and development of transboundary water resources. She again mentioned some of the ways by which this policy objective aims to be achieved. This included the enhancement of institutional capacity to strengthen the active involvement of Rwanda in transboundary water issues. The third objective which she spoke about was the rehabilitation of degraded catchments and the protection of catchments for the improvement of ecosystems. To achieve this objective, she said that Rwanda aims to control soil erosion by involving local communities and institutions, introducing adaptive planning at different catchment levels for sustainable management and effective implementation and developing appropriate awareness campaigns focused on catchment protection and management. The fourth policy objective which she mentioned was the promotion of equitable water allocation. She said that this was to be achieved through the mapping of all water users and the giving of water use permits and through the development of national capacity for the enforcement of laws, regulations, standards, and procedures that facilitate appropriate decisions on water allocation and use. Other objectives of the National Water and Sanitation Policy which she spoke about included ensuring the management of water-related disasters for the reduction of the vulnerability of communities, increasing the availability of water resources through the prioritisation of the use of storage infrastructure and the enhancement of storm water management for the mitigation of impacts on properties, infrastructure, human health, and the environment.

With regards to challenges in water supply, some of the objectives in the National Water and Sanitation Policy for tackling the issues include ensuring access to rural water supply, ensuring sustainable functionality of rural water supply infrastructure by strengthening operation and maintenance management arrangements, ensuring safe, reliable and affordable urban water supply services for all as well as strengthening and consolidating the sector's institutional, legal and capacity-building framework. With regards to sanitation, the policy objectives for tackling challenges in the sector which Mrs. Kayitesi mentioned were the increase and sustenance of household sanitation coverage, the implementation of basic and safe sanitation for schools, health facilities and other public institutions, the development of safe, well-regulated and affordable off-site sanitation services for densely populated areas, the implementation of integrated solid waste management and the safe management of electronic waste, industrial waste, nuclear waste and

healthcare waste. She ended her presentation by talking about cross-cutting areas considered in the National Water and Sanitation Policy to ensure the sustainability of Rwanda's water resources, water supply and sanitation. These cross-cutting issues are the environment, gender, climate change and capacity building. She urged UTAB to incorporate the policy objectives into the short course which the university is currently developing under the NEWW project.

4.7 Presentation by Representative of Water and Sanitation Corporation (WASAC)

The next presentation was given by Mr. Théoneste Sindikubwabo, a representative of WASAC. In his presentation, Mr. Sindikubwabo talked about the supply of treated drinking water in Rwanda and opportunities for rainwater use in Rwanda. He stated that rivers, lakes, and groundwater are water sources from which Rwanda obtains water for treatment and supply. He said that the two (2) major drainage basins within which Rwanda's surface water resources falls is the Nile Basin which accounts for about 90% of Rwanda's water supply and the Congo Basin which accounts for about 10% of its water supply. He again stated that Rwanda's surface water bodies occupy a total of 135,000 hectares which represents about 8% of the country's surface area. He added that Rwanda consists of 101 lakes, a network of 860 disconnected wetlands and 861 rivers. He said that WASAC has over twenty (20) water treatment plants. He also stated that water treatment in Rwanda involves processes like flocculation, sedimentation, filtration, and chlorination. He added that some water sources such as springs located in rural areas which already have good water quality sometimes only require disinfection and pH adjustment. He also said that according to the recent population and housing census in Rwanda, 82.3% of households have access to improved drinking water. He again stated that the Rwandan government recognises that access to water is a human right and a necessity for the improvement of living standards. He added that this has led the Rwandan government to make significant investments in the water sector to ensure access to potable water for Rwandans.

With regards to the rainfall pattern in Rwanda, he stated that the northwest portion of Rwanda receives a relatively high amount of rain. He said that this provides opportunities for the harvesting of rainwater for various uses. He reiterated that the Rwandan government is promoting the adoption of rainwater harvesting as one of the key outputs under the National Water and Sanitation Policy. He said that rainwater harvesting is already widely practiced by schools, households, and various institutions. He again said that rainwater harvesting must be promoted as part of

infrastructural development to achieve water augmentation and storm water management. He ended his presentation by emphasising the need to strengthen research, innovation and capacity building for rainwater harvesting.

Figure 14: Mr. Théoneste Sindikubwabo Giving A Presentation on WASAC

4.8 Presentation by Representatives of Rwanda Polytechnic – Integrated Polytechnic Regional College (RP-IPRC)

The presentation by the Rwanda Polytechnic was given by Ir. Clement Ngendo and Eng. Edgard Umuhoza. Ir. Ngendo started the presentation by giving an overview of the polytechnic. He said that the polytechnic gives its students practical-oriented training in applied sciences. He added that it is imperative that polytechnics collaborate with research-based universities to share knowledge and experience. He said that IPRC is one of the eight (8) colleges of Rwanda Polytechnic. He also mentioned that it is in the northern part of Rwanda and offers water management related courses such as water and sanitation programmes as well as other programmes like crop production and highway engineering. He also stated that IPRC has a modern water quality laboratory.

Eng. Edgard Umuhoza continued the presentation by talking about rainwater treatment technologies which can be used by households to treat water for drinking. He talked about a rainwater treatment system which operates using reverse osmosis. He stated that treatment of rainwater using reverse osmosis is an affordable method of treating rainwater for drinking. He spoke about another affordable rainwater treatment system which involves the disinfection of rainwater using ultraviolet radiation. He again spoke about a rainwater harvesting and treatment system made by IPRC students. He said that this rainwater harvesting system has an in-built filtration system which separates the rainwater from suspended matter. He stated that the filtered water then undergoes biological treatment with ultraviolet radiation. He concluded his presentation by reiterating that rainwater is a relatively less polluted source of water which can be treated in households for drinking.

After the presentation, Ir. Ngendo asked students of Rwanda Polytechnic three (3) questions pertaining to water management in Rwanda. The first question he asked was why a significant number of Rwandans were previously not making use of rainwater despite the high amount of rainfall Rwanda experiences. In response, one of the students said that rainwater was believed to be contaminated; hence, people preferred to obtain water from sources which they were certain had already undergone treatment. Ir. Ngendo stated after the response that water can only be considered uncontaminated and safe for drinking after it has undergone laboratory analysis. He cited examples of seemingly clean water from other sources which turned out to be unsafe for drinking after laboratory tests were run whiles a sample of rainwater was considered safer for drinking after laboratory analysis. The second question he asked was why Rwanda's rivers have high turbidity. In response, another student of Rwanda Polytechnic said that Rwanda's rivers have high turbidity due to soil erosion. The last question Ir. Ngendo asked was why farmers not actively undertake agricultural activities during the dry season in Rwanda. In response, a student of Rwanda Polytechnic said that during the dry season, there is a significant decrease in the amount of water available for irrigation. She added that this shows that there is a need for farmers to store water for the dry season.

Figure 15: Ir. Clement Ngendo (L) and Eng. Edgard Umuhoza (R) Giving Presentations

4.9 Closing Remarks by Overall Project Coordinator and the Vice Chancellor of UTAB

The overall coordinator of the NEWW project, Prof. Dr. Jorge Marx Gómez thanked all participants for making time to be a part of the career fair. He also thanked the organisers of the career fair for staying committed to making the event a success. He expressed gratitude to all the people who gave presentations for sharing their knowledge and experience with other participants at the career fair. He subsequently urged all participants of the career fair to take part in the next line-up of activities of the NEWW project which includes a summer school and international conference which would also be hosted by UTAB. He entreated participants of the career fair to make use of the partnerships which have been established under the NEWW project.

The Vice Chancellor of UTAB, Fr. Dr. Gilbert Munana again thanked all persons who took part in the career fair and all partners from the University of Oldenburg, University of Ghana as well as partners from the waste and water management industry. He added that UTAB is open to working with partners to develop solutions to the issues pertaining to waste and water management which were spoken about at the career fair. He announced that career fairs would be held every year in UTAB. The career fair ended at 4:00 pm.

At the end of the career fair, certificates of participation were given to all the people who took part in the career fair. Other activities which were undertaken to mark the end of the career fair were the taking of group photographs and a cultural performance by students of UTAB.


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Figure 16: Group Photographs Taken at the End of Career Fair

Figure 17: Cultural Performance by Students of UTAB

5.0 Day Three (3)

5.1 Project Meeting

On the last day of the event which fell on 28th February 2024, a project meeting was held at 10:00 am by partners of the NEWW project to plan and schedule dates for the next project activities. It was proposed at the meeting that UTAB holds a summer school from 16th September 2024 to 18th September 2024. It was also proposed that an international conference be held in Kigali (Rwanda) by UTAB and partners on the CENIT project from 19th September 2024 to 20th September 2024. It was planned that students would be given the opportunity to present papers and have poster presentations during these events.

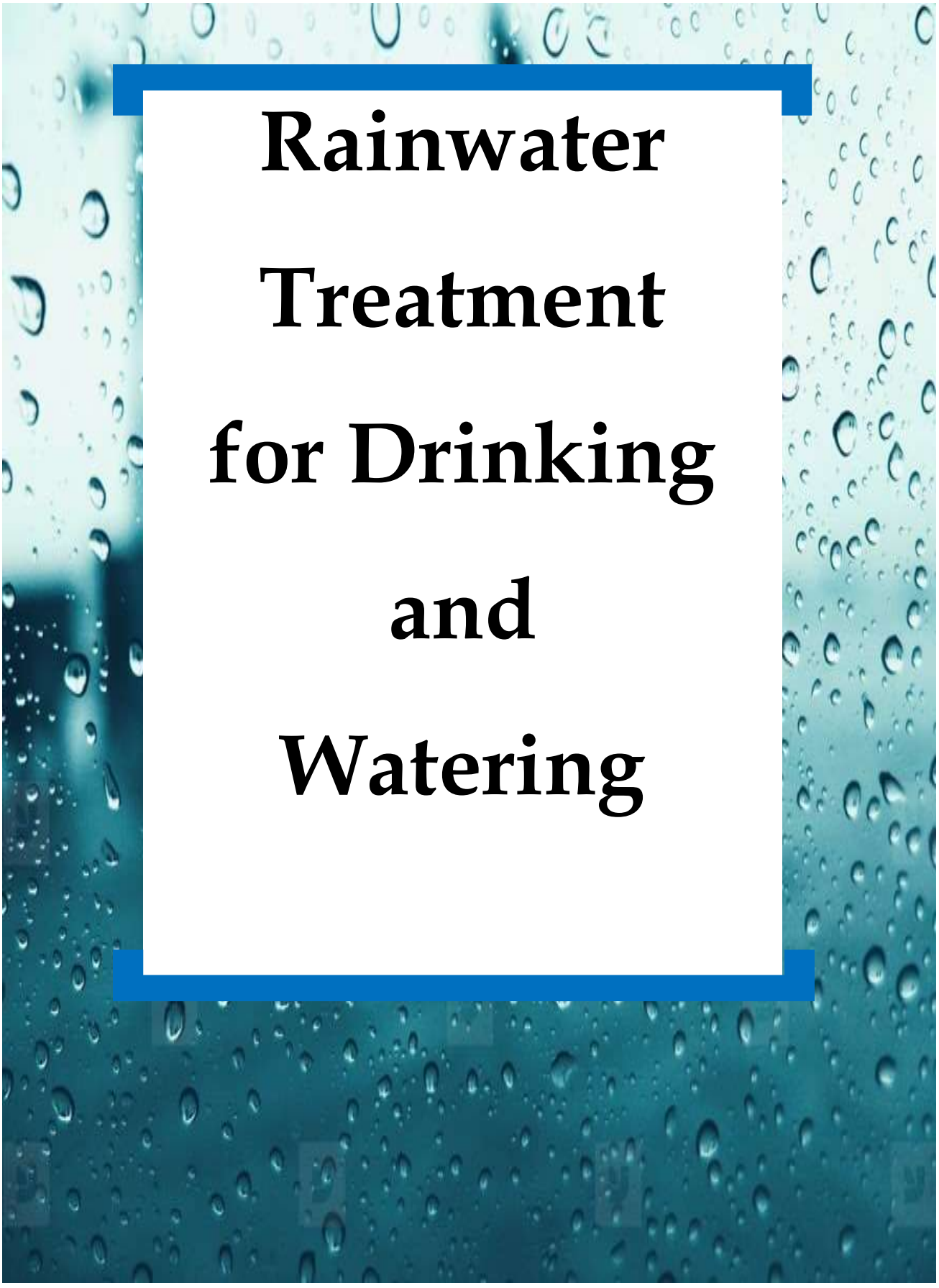
For the UTAB events, it was proposed that the three partner universities would each delegate eleven (11) persons comprising of two (2) institutions from the waste and water management industry, four (4) researchers and five (5) students to attend the events. Another outcome of the project meeting was the scheduling of a conference and exhibition to be held at the University of Ghana in the second week of November 2024. It was proposed that on the following day after the conference which is to be organised by the University of Ghana, a discussion should be held on the outcome of the conference and plans should be made on how the results of the conference and practical contributions from industry players at the conference would be incorporated into existing degree programmes at the university.

5.2 Meeting with the Legal Representative of UTAB

A meeting was held with Bishop Papias Musengamana, the Legal Representative of UTAB to give him an overview of the NEWW project, how the UTAB career fair went and to make him aware of the next line-up of activities to be undertaken under the project. Bishop Musengamana expressed his readiness to work with all partners on the NEWW project.

5.3 Visit to Sina Gérard/Ese Urwibutso

After the meeting with the Legal Representative of UTAB, the partners of the NEWW project took a trip to Sina Gérard/Ese Urwibutso. At Sina Gérard/Ese Urwibutso, the partners of the NEWW project were given a brief history of the company as well as information regarding its operations. They also shown samples of the various products manufactured by the company which included Akandi Natural Mineral Water, fruit juice, Akabanga chilli oil, ketchup, honey, jam, coffee, ice cream, yoghurt, flour, amongst others. They were subsequently given a tour of the water, fruit juice and ice cream production facilities of the company.



Rainwater Treatment for Drinking and Watering