



School of Science and Engineering
The Natural and Built Environment

December 31, 2023

Director Rodney Uphoff
University of Missouri South African Education Program (UMSAEP)
213 Hulston Hall
Columbia, MO 65211

Dear Prof. Uphoff,

This report summarizes our exchange activities in Cape Town, South Africa from January 13, 2023, to January 22, 2023. The University of Missouri South African Education Program (UMSAEP) funded the project.

1. Participants:

Prof. Sejun Song (Computer Sciences, University of Missouri – Kansas City (UMKC))

Prof. Jejung Lee (Earth and Environmental Sciences, UMKC)

Mr. Samuel Akinyede (Ph.D student in Computer Sciences, UMKC)

UWC Host: Prof. Osden Jokonya (Information Systems, University of Western Cape)

2. Project Activities

a. Orientation at UWC

Upon arrival at Cape Town, the UMKC-UWC team gathered at the UWC campus to share ongoing research and projects from both sides and plan site visits. The faculty and students in the Department of Information Systems at UWC were invited during the orientation. Prof. Jokonya presented his ongoing projects about food supply chain model development with Prof. Haitao Li at the University of Missouri – Saint Louis. He also addressed the importance and need for farm smart sensors for better-growing practices against the threat of climate change in Cape Town. Prof. Song presented his ongoing development of smart sensors for soil moisture, humidity, temperature, and weather conditions using lidar and ultrasonic signals. He addressed how precision agriculture could be achieved with low-cost sensors. Prof. Lee shared his ongoing projects for smart urban farming toward a better food ecosystem in Kansas City. He suggested potential collaborative opportunities between UMKC and UWC by having funding from the National Science Foundation and US AID.

b. Site Visit to Mhani Gingi



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The team visited the Mhani Gingi (<https://mhanigingi.co.za/>). This non-profit organization supports marginalized communities, especially single mothers and victims of domestic violence, and educates them to learn various growing practices for a better living and life. Director Lillian Masabenza hosted the team and provided a guided tour of facilities, the history of the organization, and various success stories of women from their activities. The UMKC team found a common interest between Mhani Gingi and non-profit organizations in Kansas City, such as Cultivate KC and Antioch Urban Growers; both are project partners for the UMKC team. One of the primary missions of these organizations is to help marginalized and vulnerable populations with urban farming. The UMKC-UWC team discussed connecting these organizations through various funding sources.



Figure 1. The scenes from Mhani Gingi. Far left: the entrance of the main office, Center: Director Lillian explains the organization's history, Far right: the indoor vertical growing practice in a high tunnel.

c. Site Visit to Middlepos Farm

The Team visited the Middlepos Farm (<http://inspirechildrenandyouth.org/>), a non-profit organization that helps rural women and children who are abused or abandoned. The organization provides shelters, education for children, and growing practices for women to establish financial stability by producing wines and olive oils together. Director Ingrid Lestrade invited the team to join the ceremonial gathering with sponsors and local government sectors. They provided the team with a guided tour to show grapes and olive farms, various facilities including shelters, education buildings, newly built single-family houses, and production lines of wines and olive oils. One of the challenges they faced was a need for more water supplies. As grapes and olives require excessive water to grow, the

current water supply system, which relies on rainwater and a nearby pond, was not sustainable. Prof. Lee checked the nearby groundwater wells and discussed the potential use of groundwater for their growing. The team will continue the discussion for future collaboration.



Figure 2. The scenes from the Middlepos Farm. Left: Ms. Ingrid gave participants a presentation on their Inspire program; right: Women were working on growing at the grape farm.

3. Project outputs

- a. Based on the information from the site visits, Prof. Song's smart sensing lab developed more universal low-cost sensors to deploy in Cape Town. Those sensors, including two sets of weather station sensors, were provided to Prof. Jokonya during his visit to Kansas City in June 2023.
- b. The UMKC-UWC team is developing a research paper titled "*The application of sensors in promoting efficient fertilizer usage in resource-scarce smallholder farmers in the Western Cape.*"

4. Ongoing Efforts

- a. The visit to UWC and Cape Town has led to multiple project development between UMKC and UWC. Below are the projects under development since Prof. Jokonya's exchange visit to Kansas City in June 2023.



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- NSF Smart Connected Communities Project: This project focuses on the convergence of precision agriculture and smart food supply chains to enhance food security in

marginalized communities in urban settings. Prof. Jokonya's team and two non-profit organizations in Cape Town will participate as international partners in the project. Prof. Haitao Li from UMSL is also a Co-Principal Investigator of the project to integrate his food supply chain models developed with Prof. Jokonya.

- NSF International Research Experiences for Students (IRES) Project: The NSF IRES program addresses advanced research opportunities for US students in international sites. We are developing a collaborative research project focusing on smart growing, women and gender, and agripreneurship in Cape Town. The UMKC team includes professors from the Department of Race, Ethnic, and Gender Studies, the Department of Global Entrepreneurship and Innovation, and the School of Science and Engineering.
 - Kauffman Foundation's Innovation and Entrepreneurship Grant: This grant supports innovative curriculum development toward community entrepreneurship. We target agripreneurship curricula in marginalized communities by exchanging community partners and students. UMKC Department of Race, Ethnic and Gender Studies has a well-established curriculum for issues of gender and food security in Senegal. We plan to expand this program into South Africa through the Kauffman Foundation grant.
- b. Ongoing research in collaboration with the UMKC Smart Sensing Lab is exploring the application of sensors to promote efficient fertilizer usage among smallholder farmers in the Western Cape, particularly in resource-scarce regions. This initiative is expected to contribute to the advancement of sustainable and technology-driven agriculture in the Western Cape.

5. Acknowledgment

The UMKC team sincerely appreciates the financial and logistic support from the UMSAEP, Mhani Gingi, Middlepos Farm, and our host colleague, Prof. Jokonya, at UWC. Thanks to their support and collaboration, the UMKC team achieved the exchange goals in Cape Town during the visit.

Best regards,

A handwritten signature in black ink, appearing to read 'Jejung Lee', is written in a cursive style.

Jejung Lee, Co-PI
Professor in Earth and Environmental Sciences
Director of Center for Applied Environmental Research



Sejun Song, PI

Associate Professor in Computer Sciences

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