UMSAEP Project Report

Developing Data-Driven Optimization Capabilities for Agribusiness Supply Chains in South Africa

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Research Activities Prior to the UWC Visit

Our collaborative research started in the Fall of 2019 to address the data-driven decision needs for configuring an end-to-end food supply chain. The focus was on the food supply chain configuration problem (FSCCP) with supply-side uncertainties to capture the impact of supply risks and disruption, which are ubiquitous in a food system. For instance, production yield is often uncertain due to extreme weathers and natural disasters; supply capacity may fluctuate due to workforce availability; transportation lead time may vary due to port congestion and driver shortage.

Although Dr. Li's originally planned

Research Seminars

Dr. Li gave two research seminars to the UWC faculty and student with details below. Both

Farm Visits: The Mhani Gingi Foundation

While Mhani Gingi has been quite successful fulfilling its social responsibilities, it has been experiencing significant challenges on the business and operational sides since the Covid-19 pandemic. Due to shrink of government funding, shortage of labor, and recent increase of fertilizer and fuel costs, its profit margin has become very thin, which significantly impacted the economic viability of Mhani Gingi.

We discussed the following decision needs at Mhani Gingi for which our

decent price in the market, yet little credit or profit region was attributed to Middlepos.

As a starting point, the research team planned to help Middlepos Farm address their produce portfolio and crop production/rotation decisions, which aligns well with the research work with the Mhani Gingi Foundation.

<u>2022 UMSAEP Proposal</u>

The knowledge and information collected during the two farm visits provided guidance for the research team's focus and plan moving forward, which led to a new 2022 UMSAEP proposal entitled "Climate-Smart Decision-Support for Farms and Agribusiness in South Africa". We now had an expanded team that included Dr. Noel Aloysius, a crop scientist, from UM – Columbia.

The overarching theme of this project is to develop and implement data-driven decision-support tools that enable climate-smart farm planning and agribusiness operations in South Africa. It aims to achieve the following goals:

Efficient utilization of resources (land, water, labor, etc.) to optimally balance the tradeoffs among yield, cost, and environmental impact, e.g., greenhouse gas (GHG) emission.

Better matching production/supply with demand by considering market factors including demand, diet/nutrition need, accessibility, and equity.

Improved operations for adaptation to (reactive) and preparation for (proactive) clin.;(m)-3 (ani)-2 (ng a

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Deliverables and Summery

The deliverables of this project include:

This Project Report
A working paper targeted at top journals such as Transportation Research: B, International Journal of Production Economics, etc.:
"Optimizing the Configuration of Agri-food Supply Chains with both Demand- and Supply-Side Risks", 2022, Duxian Nie and Haitao Li, Working Paper, University of Missouri – St. Louis.
Factors affecting the adoption of big data technologies in Agri-food Supply Chains by Small holder farmers, 2021, Osden Jokonya, Working Paper, and presentation, etc.

The research team thanks the continuing support of UMSAEP program. Moving forward, we will be working with Dr. Jejung Lee and Dr. Sejun Song at the University of Missouri – Kansas City with their expertise and contribution in sensors and GIS for land and water use. We plan to apply for an external funding opportunity from, e.g., NSF, USDA NIFA, among others.

References

Dougill, A. J., T. D. G. Hermans, S. Eze, P. Antwi-Agyei and S. M. Sallu (2021). "Evaluatiing climate-

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