Figure 1. UNSW students Oliver Jackson, Junias Tjanaria, Kornpol Suriyophasakon, Peikun Qi and To Fan at the WFP.

Integrating humanitarian food science and technology: food security and sustainable development

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A global assessment of food security and nutrition in 2022 described a world still recovering from the global pandemic and the war in Ukraine, impacting the global food and energy markets.[1]

The convergence of the major drivers of food insecurity and malnutrition – conflict, climate extremes, economic downturns and growing inequality, is also challenging our efforts to achieve UN Sustainable Development Goals (SDGs) 2 (Zero Hunger) and 3 (Good Health and Well-Being).

Such threats are expected to continue, compelling us to build resilience through effective policies and strategies to meet these goals. Providing nutritious and safe food to those affected by natural disasters, conflicts or economic turmoil in the right quantity at the right time in the right place is a significant challenge.

An international symposium on Humanitarian Food Science and Technology (HFST) was held in 2017 in Sydney through the Australian Institute of Food Science and Technology.[2] A global network was established following the symposium to initiate and facilitate projects that demonstrate the application of HFST concepts through case studies.

A case study in Sri Lanka

The United Nations World Food Program (WFP) is the world's largest humanitarian agency fighting hunger worldwide. The mission of WFP is to help the world achieve zero hunger (SDG 2) in our lifetime.

WFP has been present in Sri Lanka since 1968 providing assistance with emergency response after the 2004 tsunami, supported the protracted recovery interventions during and in the aftermath of the 27-year conflict and responded to recurrent natural disasters (economic crisis, droughts, floods and landslides).

WFP is currently into its second five-year Country Strategic Plan (CSP 2023-2027) developed in consultation with the government and other stakeholders. In full alignment with the United Nations Sustainable Development Cooperation Framework (UNSDCF) 2023-2027, this CSP will have a strong emphasis on supporting systems, including those at both national and subnational levels that contribute to the production and distribution of, and access to, food and nutrition by the broad population and by the most vulnerable.[3]

Since 2005, the Government of Sri Lanka has been instrumental in reaching about 1.1 million primary school children through its National School Meal Program (NSMP). WFP had been providing technical support as well as in-kind food assistance when required to sustain the program with full national ownership. A freshly cooked breakfast each school day, for many children, has been the main and only nutritious meal for the day.

In 2024, the Government set an ambitious goal to expand the coverage to 1.7 million primary school children (Grades 1-5), which is the total number of primary school children in the country. WFP is also focusing on micronutrient fortified supplementary food products

manufactured through a local government supported enterprise called Sri Lanka Thriposha Ltd. This project is designed to achieve an optimally nourished food product through raw materials such as soy and corn or rice to be distributed for free to children aged between six months and five years, and pregnant and breastfeeding women, through the country's extensive public health network.

UNSW food science and chemical engineering students had an invaluable opportunity to travel to Sri Lanka and work as WFP volunteers, learning about their operations in Sri Lanka, with a focus on process operations, nutrition and food safety. These placements were supported by the New Colombo Plan mobility funding through the Department of Foreign Affairs and Trade (DFAT) in 2024.

Students had the opportunity to be immersed in Sri Lankan culture by participating in local cultural events and also visiting the Australian High Commission in Colombo on invitation to discuss their projects.

The students' visits to Sri Lanka had the following objectives:

1. Contribute to the WFP programs through:
   a. Improving the process understanding of the Thriposha manufacturing facilities and the impact of processing parameters on product quality attributes such as nutrition
   b. Undertaking a whole supply chain analysis to ascertain the source of aflatoxins in locally grown corn in the Thriposha product and making recommendations on appropriate interventions to minimise aflatoxin contamination
   c. Developing training resources on food safety for the school meal caterers involved in the NSMP.
2. Providing an experiential learning opportunity on the application of food science and technology principles, nutrition, food safety and engineering by interacting with the WFP team and its stakeholders. This includes field visits to Thriposha supplementary food manufacturing facilities, government health and education departments, universities, research institutes and agricultural facilities.

Figure 2. Oliver Jackson and Kornpol Suriyophasakon interacting with Thriposha factory staff.

In addition, regular interactions between the students' supervisors at UNSW and the WFP team in Sri Lanka facilitated stronger linkages that are likely to result in longer term collaborative projects in the areas of food security, nutrition and humanitarian food science and technology, such as the following:

- **Assessing the process performance of the extruder cooker and product quality at Thriposha supplementary food manufacturing facility**

Three students focused their activities on the operation of the Thriposha factory where a product fortified with micronutrients is made with corn and soya flour.

Students designed trials in collaboration with Thriposha Ltd and WFP to demonstrate that the product quality attributes depended on the measured residence time distribution and calculate the Specific Mechanical Energy (SME) under different operating conditions.

This enabled the team to better understand the operation of the extruder, how the thermo-mechanical energy of the extruder affects the viscosity of the reconstituted product, the amount of dry matter in a given volume and the energy density, which must be controlled accurately when feeding malnourished children and other target groups.

Some key recommendations to WFP included a factory cleaning policy, reducing manual handling of raw material, improving process control efficiency, regular risk assessment and management protocols in the factory, and developing a standard operating procedure for the extruder.

After returning to Sydney, the students drafted a plan to use the extruder available in the School of Chemical Engineering to develop a fortified product using rice and mung bean - which are locally available in Sri Lanka - that could replace imported corn and soybean. This work will continue until the end of 2024.

- **Assessment of critical stages along the food value chain to minimise and/or eliminate aflatoxin contamination in Thriposha**

Aflatoxins - carcinogenic fungal toxins - present significant food safety and paediatric health challenges for Thriposha production, as corn is a major ingredient. Due to the shortage of fertilisers during the COVID-19 pandemic affecting local corn production in Sri Lanka, corn is currently sourced from international suppliers, making it both costly and unsustainable. To facilitate the Thriposha Ltd company's transition to using local corn, this project aimed

to identify critical control points (CCPs) in their corn supply chain for developing locally practical aflatoxin control measures.

The Romer Labs AgraQuant rapid test system was set up in Thriposha Ltd and training was provided to local staff to facilitate on-site analysis. The students' field assessments, conducted in collaboration with WFP Sri Lanka and Thriposha Ltd, identified several critical areas for intervention. The study thus provided a foundation for the future development of multi-sectoral solutions to improve food safety, quality and sustainability in the production of Thriposha in Sri Lanka.

- **Developing training resources on food safety and hygiene for caterers involved in the NSMP**

In recent years, concerns have arisen about the lack of information and evidence on food safety risks associated with school meals and the potential for causing foodborne illness in vulnerable children. Consequently, a Food Safety Risk Assessment (FSRA) study of NSMP in Sri Lanka was commissioned by WFP in 2022 and findings highlighted some potential food safety risks.

Capacity strengthening on food safety for caterers involved in the NSMP is now a current priority for WFP. The students' research project aimed to develop tailored food safety and hygiene training tools for school caterers focusing on behavioural change. Drawing on the results of the FSRA study, on-site visits to caterers' homes and adapting the WHO's *Five Keys to Safer Food* messages, informative supplementary training resources were produced, including two new food safety information posters and a pocketbook.

Conclusion

Despite long lead times to project implementation due to the COVID-19 pandemic combined with the economic crisis in Sri Lanka, the student placements and learnings in partnership with the WFP (SDG 17-Partnerships for achieving the goals) make this work in recovery even more significant to tackle SDGs two and three.

The WFP has been instrumental in gaining insights into food security challenges and understanding the local landscape, providing essential context to the students' undergraduate education in food science and chemical engineering.

Some of the key learnings for students were:

1. Understanding the challenges facing developing countries like Sri Lanka in assuring food security when exposed to 'external and internal shocks' (COVID-19, economic crisis in 2022, loss of yields in local crops)
2. The importance of partnering with key local stakeholders when placing students in overseas locations and identifying a local host
3. Having a well-defined objective for the students and a detailed plan with realistic timelines
4. Ensuring that adequate local resources were allocated to the students
5. The importance of good communications and teamwork.

In their own words:

"*I had the honour to collaborate with the World Food Program, the largest humanitarian organisation in the world. It was amazing to see all of the work they are doing in Sri Lanka, and I am excited to see how I can contribute over the next year through my undergraduate engineering thesis project*".

"*One of my highlights was having the opportunity to see a commercial scale extruder at Thriposha and be able to experiment with it. This was not only an eye-opening experience as to how extruders work within the industry but also how factories operate in Sri Lanka*".

Today there are exciting new career opportunities available for talented food science and technology, and engineering graduates in the life saving and life changing areas of humanitarian emergency response, food assistance and food security.

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