Project update

Project title (Acronym):	Decentralised postharvest processing of underutilised species into innovative value added products for improved food and nutrition security in West Africa (UPGRADE Plus)
Geographical focus:	Sierra Leone, Ghana, Nigeria
Call reference:	Innovative approaches to process local food in Sub-Saharan Africa and Southeast Asia, which contribute to improved nutrition as well as qualitative and quantitative reduction of losses
Cooperating partners:	The University for Development Studies (Ghana), Njala University (Sierra Leone), the National Horticultural Research Institute (Nigeria), German Institute for Tropical and Subtropical Agriculture (DITSL), and Innotech Ingenieursgesellschaft mbH (INNOTECH)
Duration:	15-10-2017 until 31-12-2021
Budget:	Approx. 1,100,000 €

please insert a map of the target region[1]

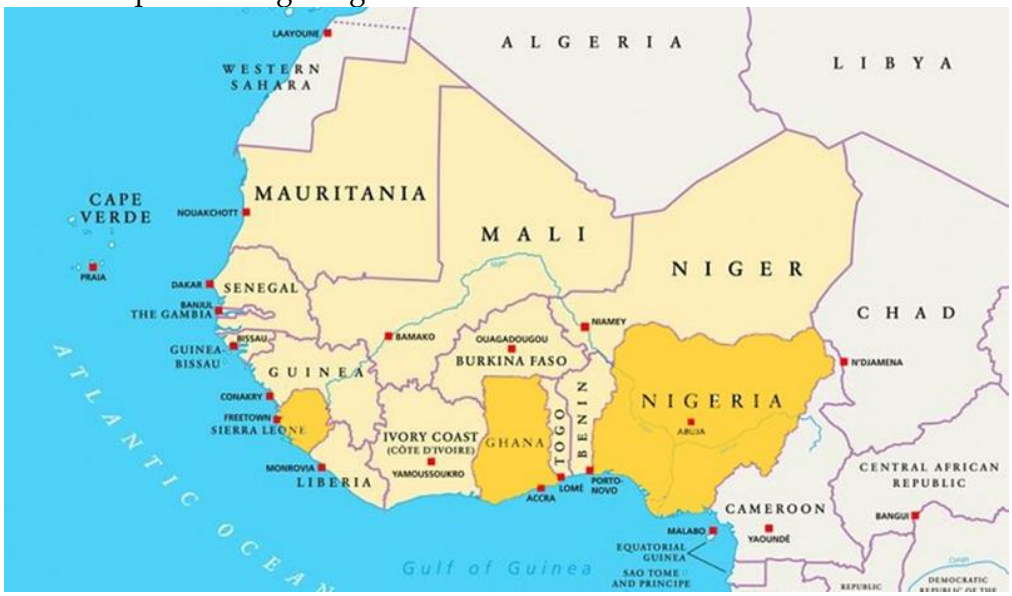

Figure 1: Map of West Africa – Target regions of the UPGRADE Plus project namely Nigeria, Ghana and Sierra Leone have been highlighted in dark yellow colour (Picture: World Atlas, 2019)

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Aim of the project:
The project aims to improve the diets of women, infants and young children while at the same time creating income generating opportunities for women's self-help groups in West Africa and reducing post-harvest losses in underutilized agricultural produce. Specifically, the project seeks to:
i) develop innovative small-scale modular, decentralised photovoltaic and solar thermal driven post-harvest food processing units suitable for local conditions,
ii) utilise high-value underutilised species for the production of innovative and diverse nutrient-rich processed food products with extended shelf-life,
iii) to empower women, especially those in self-help groups, in order to prevent micronutrient deficiencies in children as well as increase the health status of pregnant and lactating women,
iv) Stimulate the rollout of the technologies and processes through training of local artisans who will build the systems using mainly locally available materials and selected members of women groups who will train new users.
The project also seeks to enhance the development of innovative processed food products with extended shelf-life, and stimulate the local uptake of such products in close partnership with women's self-help groups. In doing so, the project seeks to add to the growing evidence suggesting USs can play a central role in nutrition, income generation, and empowerment of women in Sub-Saharan Africa.

Results:
The year 2020 has been significantly challenging for all project partners due to COVID-19. Despite, the unusual situation, the partners have given their best to achieve as many goals as reasonably possible during this year.
In the year 2020, NIHORT in Nigeria developed noodles from OFSP-wheat composite flours to assess their nutritional, antioxidant and antinutrient properties. The results show the developed noodles consisting of high nutritional value both in terms of fibre and mineral compositions. Furthermore, on conducting sensory evaluation on the developed noodles, it was revealed that a flour ratio of 90:10 and 80:20 (OFSP:Wheat) was acceptable among the panelists. Additionally, a sensory study and quality evaluation was conducted for cocoyam chips. The study reveals general acceptable of the chips and thus, increasing the utilization and processing of the Cocoyam crop.
NU in Sierra Leone conducted 24 h recalls to help identify food consumption trends and diversity in diets. The results show respondents having a generally diversified and nutritious diet with more than 80% consumption of at least 1 food from each of the food groups. Additionally, organoleptic and consumer acceptance analysis of value-added product made from OFSP, pumpkins and mangoes were also performed. The review indicate preference towards baked products as compared to fried products across majority of the people. NU also performed resource mapping to identify the resources available in the targeted communities as well as prepared a seasonal calender to provide a clearer picture of the changes in seasonality. This mapping allowed to further understand the gender specific changes in livelihoods over

the year, food availability, gender-specific income and expenditure, water, land ownership and control.
UDS in Ghana worked on the characterization of key quality attributes and processing steps for some of the identified underutilized species in Ghana for development of novel food products. This included drying of OFSP and production of high-quality flour/powders, development and evaluation of composite cookies, development and optimization of dough and bread and storage stability studies. UDS has also been working on the optimization of the roasting conditions of the *Parkia biglobosa* seeds for preparation of powder as a tea. In line with NIHORT and NU, UDS also conducted some consumer acceptability studies for the wheat-OFSP cookies. Cookies with more than 30 % of the OFSP flour showed to have a decrease in consumer acceptability as well as the crispness and aroma within the cookies. To resolve while maintaining the nutritional status of the cookies, UDS incorporated dehydrated coconut meat with 50 % OFSP flour. The final coconut wheat-OFSP cookies had shown to have the highest sensory performance in terms of flavour, texture, taste and overall acceptability from OFSP.
In the year 2020, DITSL has been working with extras precautions and supervision due to COVID – 19 circumstances. WP 6 has continued to work intermittently over the entire year in Ghana and Nigeria with four research assistants and one Master's student. Activities contributed to Task 6.3 for setting up record-keeping and participatory monitoring and evaluation for tracking the processing of underutilized species in the group businesses run by four women's groups. Associated with Task 6.4, activities and analyses were undertaken regarding the supply issues of the African Locust Bean (*Parkia biglobosa*) , Orange Fleshed Sweet Potato (*Ipomoea batatas*) and Cocoyam (*Colocasia esculenta*) as well as improving quality of the finished product such as through improved packaging and more hygienic drying conditions. Acute water shortage in Ghana was addressed through a series of community meetings that were facilitated with the conclusion to purchase water tanks for water harvesting. Over the last year, INNOTECH has designed and developed a solar dryer that is modular and can be transported from one place to another. The developed dryer is lightweight and easy to install. The first prototype of the dryer was delivered to UNI KS in 2020 where preliminary tests were conducted. The findings from these tests were integrated into the optimisation process of the other prototypes. The new optimised solar dryer will be delivered to the partner countries in the 2021. UNI KS has also been supporting INNOTECH in the design and development of the modular unit, which would eventually be delivered in to the selected women's group in the partner countries. Based on the data evaluations of the experimental investigations conducted in Germany and the information obtained through the partners, UNI KS is currently is in the process of forming a processing guideline for innovative food products. In terms of project results dissemination across all project partners, over the last year, UPGRADE Plus has been successfully represented at 4 conferences. Especially, at the Tropentag conference with 5 accepted submissions. An online training workshop "Creating Actions to Support Food Security through Diverse Media", was also conducted by DITSL for capacity building of researchers in Sierra Leone and Nigeria, along with researchers from other BLE project. In the year 2020, 8 scientific journal articles were published within peer-reviewed journals and many more scientific publications are currently under preparation.

Key statements and policy advice:

- Based on nutritional analysis, USs are rich in essential nutrients that can meet daily nutritional requirements of all age groups.
- Food products developed fortified with USs crops are preferred over non – fortified products.
- Modular processing units will allow small scale processors to develop innovative food products.