The CHITOFU family

invented in Malawi

is growing and going places

climate-friendly fish-processing
innovations for people & planet

Greening the Blue Economy

Presented in January 2023 by Christa Roth, Food and Fuel Consultants (Germany)

What is the blue economy ?

- According to the World Bank, the blue economy is the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem."
- European Commission defines it as "**All economic activities related to oceans, seas and coasts**.“

- In Malawi the blue economy sector takes up 63,000 MT of wood every year to process fish (smoking, parboiling, frying)

- Time to make the blue economy cleaner and greener

Greening the blue economy – cross-cutting topic

- value addition through climate friendly processing of fish
- reduction of post-harvest losses to preserve resources and biodiversity in water and on land
- user-centred innovations for better working conditions
- empowerment of processors, mostly women
- Job-creation (as alternative to migration)
- positive impact on nutrition, food security – end hunger
- climate change mitigation and adaptation
- …..

- Specific Goal of African Union Agenda 2063 : **(6) Blue/ ocean economy for accelerated economic growth** - Including ocean resources **and** inland water bodies
- Relates to many other Agenda 2063 aspirations and goals as well as 14 of 17 SDG

Innovation by User Centred Design

here: to reduce post-harvest fish loss and firewood use

1. **Empathise**: Identification of preferences and challenges with fish processors at the beach
2. **Define the problem**: Definition of a problem statement with the community and partners
3. **Ideate:** Joint development and drafting of problem solutions
4. **Prototype**: Make dreams come true by building first prototypes reflecting ideation results e.g. an ideal workplace
5. **Test:** Iterative process of prototype testing to guarantee complete user satisfaction.
   Efficiency test of the stove followed by refining&upscaling
6. **Roll-out** of technology – technical and business training of trainers and incubators to create access to the technology

Example from Malawi of Chitofu 3in1 for parboiling, frying & smoking of fish

- Consultations with experts - users, fisheries and biomass energy
- Marrying 2 proven technologies: Mayankho stove and Altona smoker and adding some features
  - To suit user's preferred round-bottom vessel for processing
  - To shelter fire and pot from wind with a sunken pot
  - To reduce exposure of user to smoke, heat and danger of burns

Parboiling

Baseline

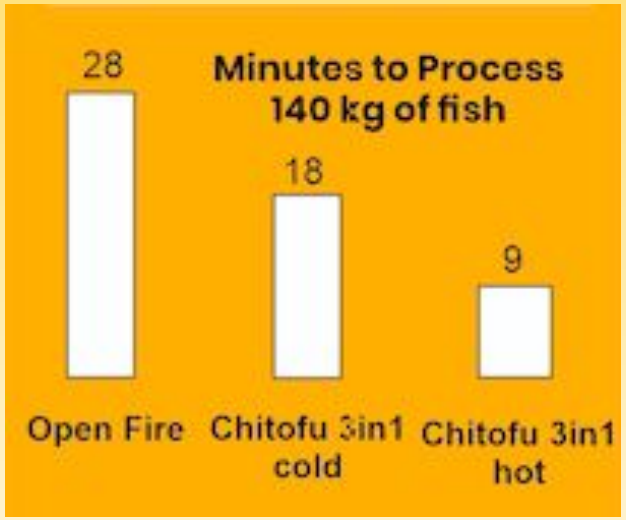
- Fish in several small bamboo baskets
- Single bath basin on unsheltered fire
- Wind on beach blows flames away from pot
- Slow and wasteful, high wood consumption
- High exposure to smoke and heat
- Danger of burns for user

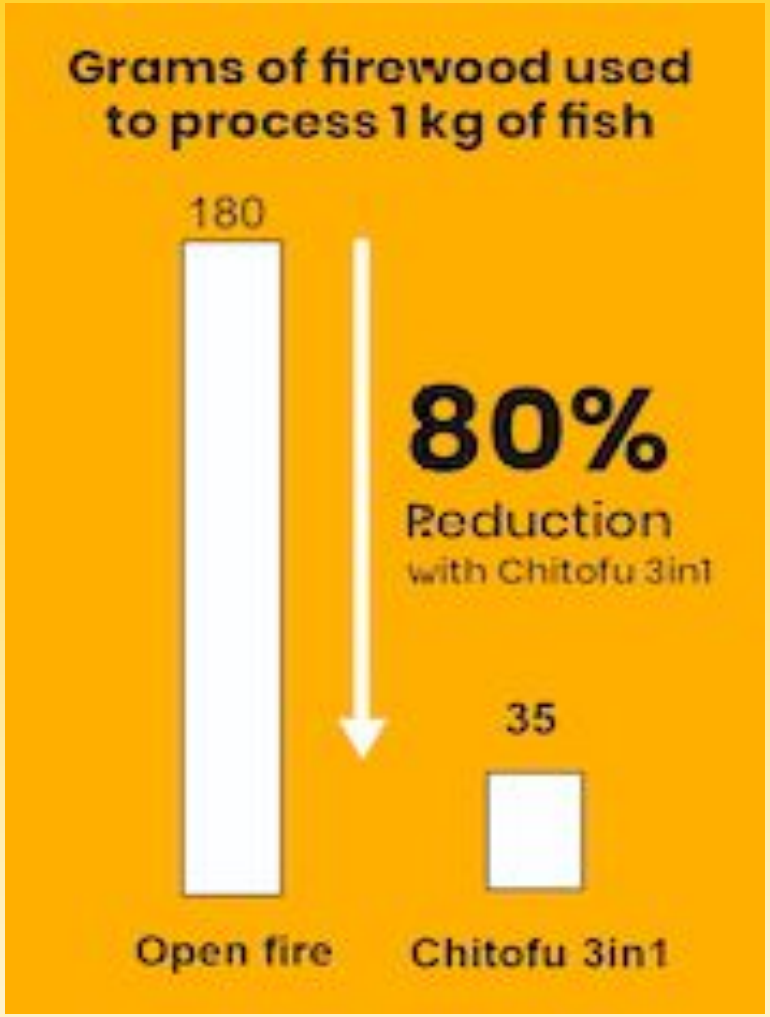
Chitofu 3in1

- Fish in one basket, insulated handles
- Two sunken vessels on sheltered fire
- Fire directly hitting bottom of vessel
- 80% less firewood than open fire
- Fast, two vessels at the same time
- No exposure of user to smoke or heat

Impact of parboiling with Chitofu 3in1

- ’Cool’ stoves
- Faster
- Saving 80% of firewood
- Happy users





Based on data from field trials in November 2021 in Msaka (Mangochi District)

Frying

Baseline

- Same unsheltered fire on windy beach
- Fish scooped out with ladle (slow, partial over-frying, high breakages of fish)
- Fish on bicycle rim, often falling in sand
- Oil dripping in bucket below, not reusable
- Expensive oil burns faster and is wasted

Chitofu 3in1

- Fish scooped out of oil at once with basket
- Less breakages of fish, no over-frying
- Better and uniform quality of fish
- Less burns of fish as it does not touch the bottom of the vessel so oil stays clear long
- Oil is recovered dripping from basket into frying vessel below
- Important economic savings from oil

Smoking

Baseline

- Smoke-drying, no separate curing and smoking
- Fire outside of smoker to avoid overheating
- Creation of ‘smoke’ by incomplete combustion
- Up to 4 layers of fish on bicycle rims
- No enclosure for smoke to condense on fish
- Fat dripping in embers (danger of PAH)

Chitofu 3in1

Grease pan

- Curing and smoking in separated phases, makes thick white smoke on demand after curing
- Full control of heat through firewood control
- Full control of smoke through air supply control
- Up to 8 layers of trays in enclosed cupboard
- Smoke has enough time to condense on fish
- Flavouring with smoke can be extended to meet the leve of intensity preferred by customers
- Sand-filled grease pan to avoid burning of fat

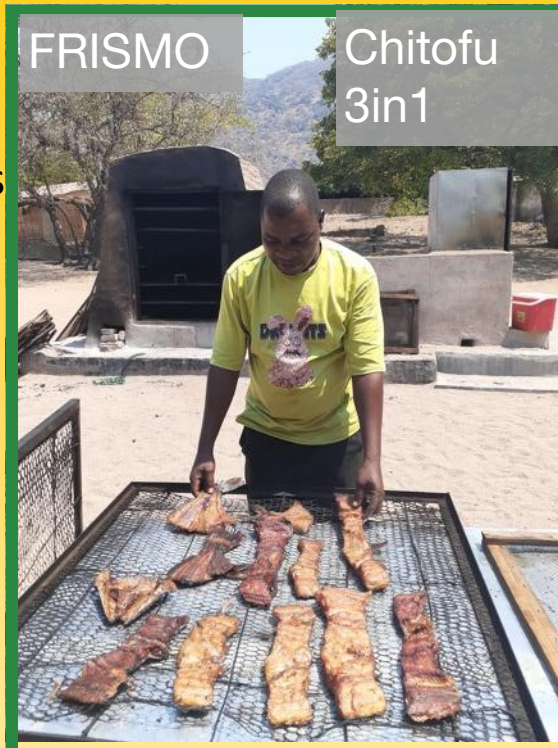
Smoking is an art, kiln performance highly dependant on user behaviour

Pending

- Fuel use comparison with baseline at larger operations
- Fuel use comparison with other improved kiln types in Malawi e.g. FRISMO kiln, Makawa kiln... (guesstimate‘ of potential further firewood savings up to 50% compared to other improved kilns
- Product quality, customer acceptance, business case etc.

Advantages of Chitofu so far established

- Usage of sawdust, maize bran etc. to create smoke further reduces wood use
- More intense smoke flavour of processed products
- Trays can be carried by one person, up to 8 trays in one cupboard
- Cupboard also used for drying with the residual heat from the Chitofu 3in1 over night
- Especially fuel efficient if used after parboiling or frying when stove is already hot



Smoking cupboard of Chitofu 3in1 works for any fish species

Can also produce other high-quality gourmet food (showcase at restaurant

For slow-cooked meat, pizza, and many other delicacies

Showpiece built in March 2021at a restaurant in Malawi's capital Lilongwe

Analysis of factors contributing to **successful adoption and sustained**

- Users were at the centre of the design process
  - Ownership of design
  - Convenience, ease of use, no change of fuel needed
  - Safety and speed of processing, high profitability

- Biomass energy experts made it perform to their expectations
  - Convenient, cool, easy to use - close to their dream-stove
  - Substantial firewood savings
  - Superior quality of product (sensory scores, microbial count)
  - Higher quantity of product (less handling, less breakages, more income)

- Chitofu adaptable for other uses e.g. chips frying, roasting, baking..
- Chitofu can be built from local materials with local skills
- Successful adaptation for larger volumes of fish in Senegal
- Now spreading to other countries

What’s new since Jan 2022 - the Chitofu family is growing!

Mobile Chitofu = game changer

- Easy to demonstrate the principle of the Chitofu mainly for smoking and frying
- Easy to transport, dismantlable to L-shapes or flat packs (e.g. 2x23 kg flight luggage !)
- Portable, can be shared between users or moved to a better location if not in use
- Cheaper and faster to build in larger numbers than a fixed stove

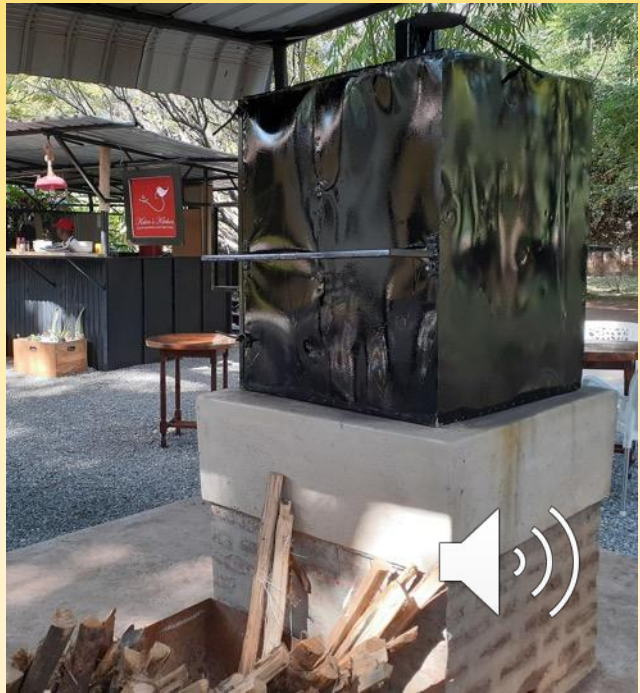
The mobile game-changer already in West-Africa

New partners to reach more people

- Through partnership with GIZ Aquaculture Value Chain Programme in Malawi mobile Chitofu 2in1 now in 22 Fish Farming Groups in 17 districts of Malawi

Chitofu evolving from production equipment to lifestyle asset

Chitofu as an aspirational stylish but safe and efficient fireplace with removable smoker to create gourmet delicacies at a private house and a food court in Lilongwe



Going places - Expansion to other countries

- We have taken the Chitofu-concept to Senegal and Eritrea, and now to Gambia
- In Senegal together with the RKTC CERER we developed large dedicated smoking kilns as people process up to 2,000 kg of sardines at once
- Retrofitted a FTT smoker, that is promoted heavily by FAO, the Senegalese Government and others, but hardly in use

Senegal – Baseline fish smoking is wasteful and polluting

Smoking on the ground or in rudimentary stoves taking up to 2,000 kg at a time

No control of fire
so fish gets burnt

Senegal – Graveyards of unused ‘improved’ stoves

Especially the FTT stove developed by FAO is heavily promoted but rarely found in use

Senegal - ‘Four Nopalé’ = relax for the women

User feedback early on:

Features of a ‘dreamstove’

- Dedicated smoker for minimum 150 kg of fish
- Reduced exposure to heat and smoke
- Cut fuel cost
- Collect grease for sale

The first prototype built by GIZ Endev got the local name “ Nopalé “

Senegal - ‘Four Nopalé’ = relax for the women (ctd.)

- Adaptation und further development with CERER (the Regional knowledge and Testing Centre)
- Fuel efficiency – 156 kg of fish processed with 5.1 kg of firewood vs. ca. 30 kg with baseline
- Saving 80% of fuel on average at 4 sites surveyed
- Logo developed with GIZ endev
- Certification and quality control of technology by CERER

Senegal – more partners convinced about Nopalé

- Italian NGO ISCOS changed plans to adopt the Nopalé model and built 13 stoves in 2 sites in partnership with GIZ Endev

The **Nopalé Four x 4** – working towards the 2 tons per day

4 Nopalé sharing inner walls

Each stove with 4 levels can carry ca. 250 kg

Total processing capacity when used as ‘round robin’

Ca. 2,000 kg per day

Senegal – unused FTT retrofitted with Nopalé-feature

- First prototype transformed in Kaffountine in December 2022 with permission of the owners
- First load of fish was deemed good
- User feedback outstanding but apparently stove in use now

Eritrea in Dec 2022 with COMFWB

- Mobile Chitofu fitted in 2 x 23 kg flight luggage
- Demonstrated principle
- Built smaller cupboard with wooden door at Ministry of Fisheries close to Red Sea

Outlook for 2023

- Expansion to The Gambia with the GIZ ECOWAS Fund for Regional Stabilisation and Development
- Field testing to get more data for the business case
- Diversify technology according to customer feedback and demand
- Address issues of salt-corrosion at the seaside
- Expand cooperation with existing partners GIZ AVCP, Global Programme Fish, COMFWB and find new partners

Mobile Nopalé on the ferry t[illegible]Banjul

Interested to innovate the blue economy in your country?

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we work also in French,
Portuguese,
Spanish and German

Chitofu 3 in 1

Climate Friendly Fish Processing (CFFP)

One device for high-quality Frying – Parboiling – Smoking of fish

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Chitofu 3 in 1

Climate Friendly Fish Processing Technology

One device for high-quality Frying – Parboiling – Smoking of fish

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