

Chitofu 3-in1 Food Processing Technology designed in Malawi

What is the Chitofu 3in1 about?

The Chitofu 3in1 is an innovative platform that can be used for firewood-saving parboiling, frying and smoking of fish and other foods.

The Chitofu 3in1 is a unique food processing unit designed by Owen Mbilizi and Christa Roth in Malawi since 2019. It has evolved over time and there are different versions that all belong to the Chitofu-design family e.g. fixed versions made from brick and mortar for one or two vessels or metal mobile units for one vessel.

There are different sizes and versions for square and round trays like the 'mawayas' from old bicycle rims commonly found with smokers along Lake Malawi.

We combined the best of two worlds by 'marrying' two technologies whose design has matured over many years in mass distribution: The base is an adapted institutional Mayankho stove, that gives the users a nearly smokeless combustion and an efficient heat transfer into a pot for deep frying and parboiling, so that the processing is faster and uses less firewood.

The fire is contained in the (insulated) firechamber so that the users are protected from heat, danger of burns and exposure to smoke.

We only adapted the design to fit their preferred vessel shape with a round-bottom. We sank the vessels into the stove on top of the sheltered fire to avoid cooling by the wind. We added a basket with insulated handles so they can lift the fish out of the vessel at once.

For smoking we added an enclosure on top following the Altona-kiln design.

The Chitofu 3in1 is unique as it gives fish processors full flexibility to choose the processing method their customers require, without the need to invest into a different device for each processing method.

The Chitofu development started with a fixed version by marrying 2 proven technologies: the bottom is adapted from a Mayankho stove to suit parboiling and frying and the smoking chamber on top adapted from the Altona-smokers.



The most unique design feature of the Chitofu is that it allows to make a nearly smokeless flame from firewood in the curing phase of fish or other foods and smoke without flame in the smoking phase to add flavour and colour as well as preservation of the fish or other foods.

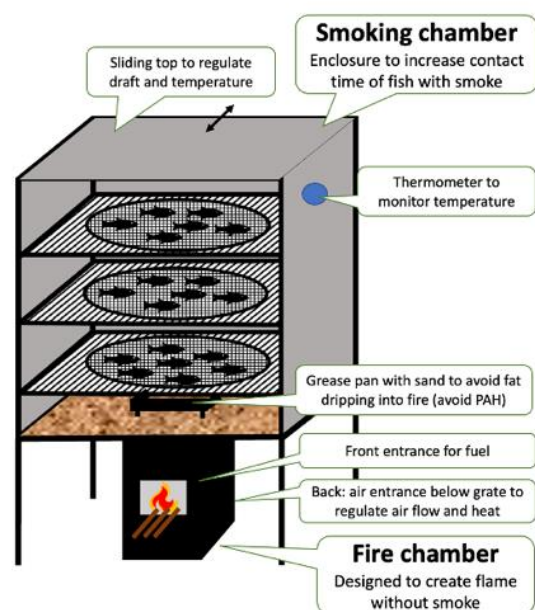
All Chitofu-versions have similar specifications and their own accessories like special baskets for frying and parboiling adapted for its specific vessel for the water or oil.

All designs can be used for any type of fish found in Malawi.

All 'members of the Chitofu-family' share the following unique design features that are the essence of the functionality of a Chitofu:

Smoking chamber to keep heat and smoke enclosed to increase contact time of fish with smoke, removable for parboiling and frying

1. Sliding top with handle to regulate draft and temperature
2. Thermometer to monitor temperature
3. Smoking cupboard to keep heat and smoke enclosed
4. Round trays from woven bicycle rims for durability, stability and familiarity of users with existing smoking methods
5. Triangle shelves to stabilize round trays
6. Door with handle and lock
7. Grease pan filled with sand to avoid fat dripping into fire (to reduce the formation of Polycyclic Aromatic Hydrocarbons)
8. Bottom plate with opening to fit to firechamber, covered with sand



For the mobile version (like in the drawing) the smoking chamber comes with legs to match the height of the firechamber.

For the fixed version the smoking chamber it is placed on top of the brick stove.



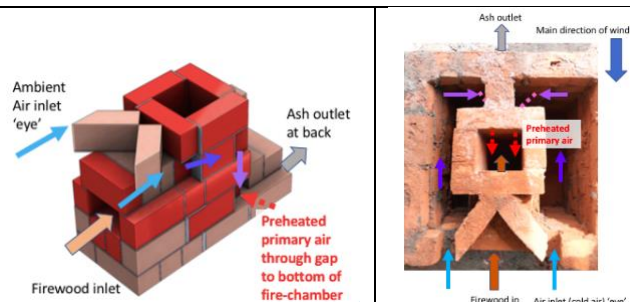
The smoking chamber can also have an insulation e.g. from plywood to increase efficiency. It can accommodate square or round trays.

Fire chamber

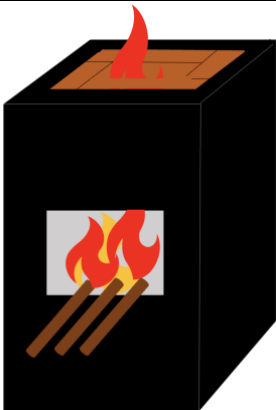
designed to create flame without smoke (complete combustion: time, temperature, turbulence)

Fixed Chitofu example:

Air-insulated fire-chamber so that the outside of the Chitofu does not get hot. The radiating heat from the firechamber stays inside and preheats the primary air that enters the firechamber underneath the firewood grate through a gap at the bottom. Preheated air helps to complete combustion and reduce smoke.



Fire chamber (mobile Chitofu example)

<ol style="list-style-type: none">1. Tall body from sturdy metal, lined with solid bricks to protect metal and keep fire hot (burn up the smoke)2. Front entrance for fuel, the tray doubles-up as door to close during smoking phase3. Grate from sturdy metal bars below fuel entrance level to hold embers up from the floor and allow air underneath. When covered with smoking making fine materials (madeya, sawdust, rice husk) the embers are the motor of making smoke without flame.4. Air entrance below the grate with door to regulate air flow and heat of the embers during the smoking phase (regulate smoke output), also serves to remove ashes after operation with the provided scraper.5. Sturdy base with a wide footprint for stability	
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Viability of the Chitofu 3in1

From user feedback we have established the following advantages of the technology:

- 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

In trials done for parboiling with Fisheries Extension worker and the Fishland Ladies in Msaka in November 2021, the Chitofu has proven to save up to 80% of firewood compared to an open fire. It was also faster and reduced boiling time per basin of fish from 28 minutes on the open fire to 9 minutes when the Chitofu was getting hot inside.

Users for parboiling and frying like the convenience of using the Chitofu that stays cool outside so that they are not exposed to heat from the fire.

Fish smokers like the convenience of keeping the smoke going with the maize bran (madeya) for extended periods of time without much effort or supervision and that the smoke is contained in the smoking chamber and they are not exposed to it.

The current smoking chamber was dimensioned for aquaculture farmers smoking 10-25 kg of Tilapia at a time. The smoking chamber can be adapted for larger volumes, which is proven in countries with marine fishing like Senegal and the Gambia where the Chitofu-design was already to process up to 1,000 kg of fish per day. This is yet to be tried in Malawi.

Accessibility

So far there is only one producer in Lilongwe. Under an upcoming franchise model to be implemented in 2024 accessibility will improve.

The actual costs depend on the version and the location. Payment terms are being developed to facilitate access to users on a commercial basis.

All designs share the unique features described above that are the essence of the functionality of a Chitofu and shall be protected under a trademark.

The Chitofu is intellectual property of Owen Mbilizi and Christa Roth and the manufacturing company Climate Friendly Fish Processing (CFFP), Area 49, 1470/1/49 Lilongwe, Phone Owen Mbilizi +265 994 496 201, obmbilizi@aol.com.