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The U.S. Government's Global Hunger & Food Security Initiative



The Farm Diversification: Adapting Rice Fields for Co-Cultivation of Rice and Fish The Kebbi and Ebonyi States, Nigeria Examples

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Farm diversification

From rice monocrop ...



.. to rice-fish system



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• SDG 2 situation in Nigeria



SDG 2030 Targets

- By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
- By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons



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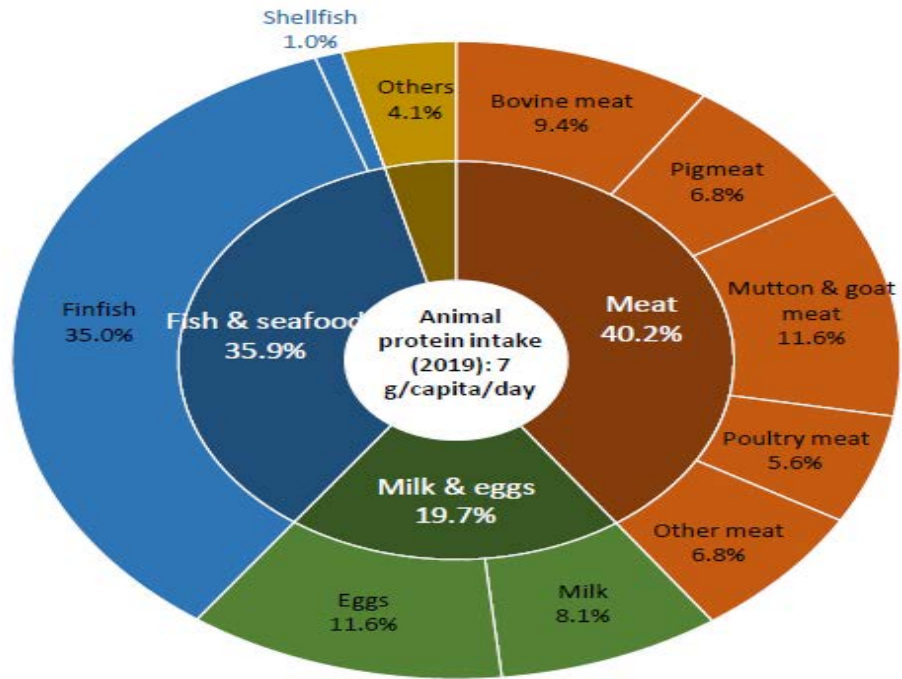
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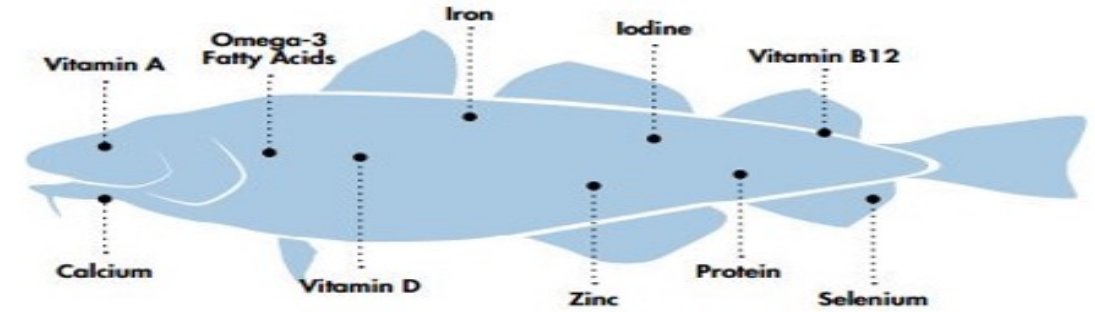
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Nigeria (2019)



Nature's superfood



LONG CHAIN OMEGA-3 FATS
Mainly found in fish and fishery products, these fatty acids are essential for optimal brain development.

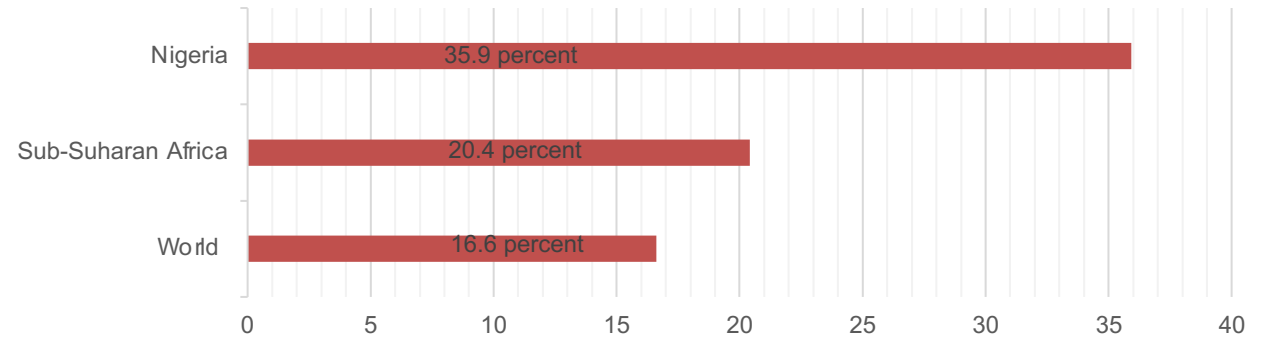
IODINE
Seafood is in practice the only natural source of this crucial nutrient. Iodine serves several purposes like aiding thyroid function. It is also essential for neurodevelopment.

VITAMIN D
Another nutrient crucial for mental development, this vitamin also regulates the immune system function and is essential for healthy bones.

IRON
During pregnancy, iron intake is crucial so that the mother can produce additional blood for herself and the baby.

CALCIUM, ZINC, OTHER MINERALS
Diets without dairy products often lack calcium, and zinc deficiency slows a child's development.

PERCENTAGE SHARE OF FISH & SEAFOOD IN ANIMAL PROTEIN INTAKE



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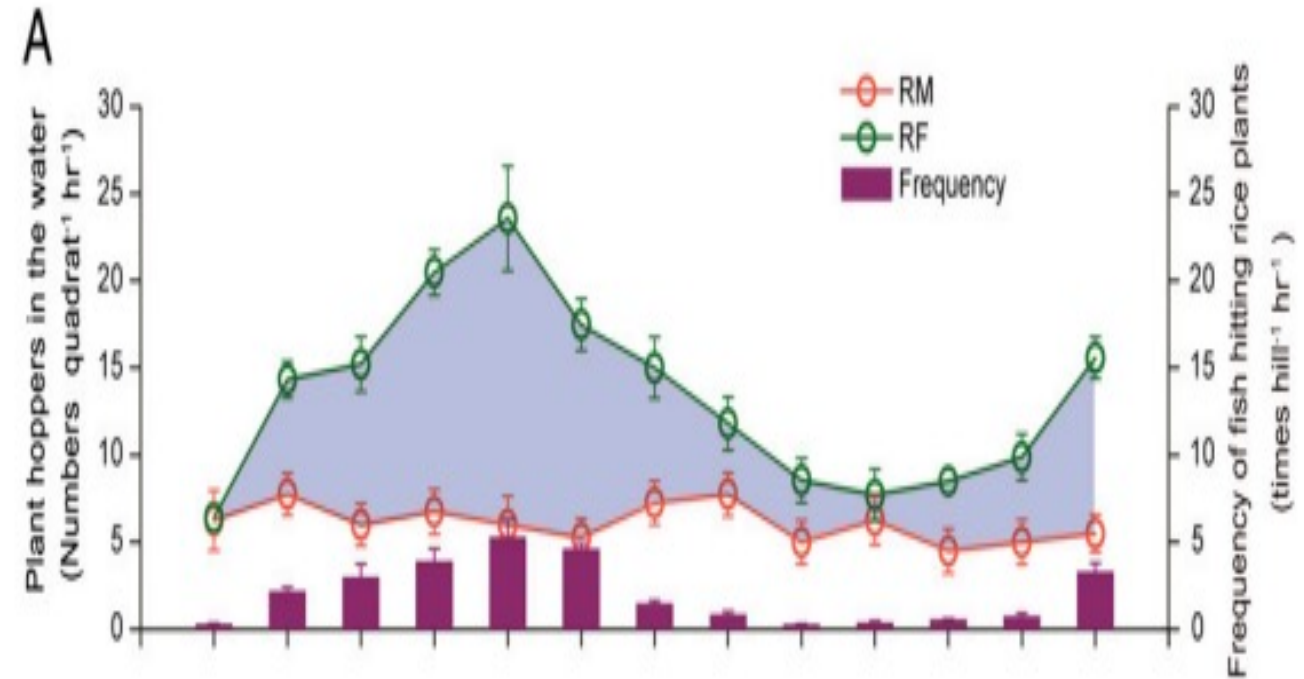


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FARM DIVERSIFICATION – MULTIPLE BENEFITS

- **More rice and more fish available on the table and for the market**
 - Volume of food production
 - Time saved searching for food
 - Income of small-scale food producers
- **Higher proportion of agricultural area under productive and sustainable agriculture**
 - Efficient use of scarce resources
 - Aquatic ecosystems and aquatic life protected
 - Rice fields
 - Adjoining wetlands
 - Ecosystem functions enhanced
 - More climate-friendly production
 - Lower incidence of pests and diseases reduces the need for agrochemicals



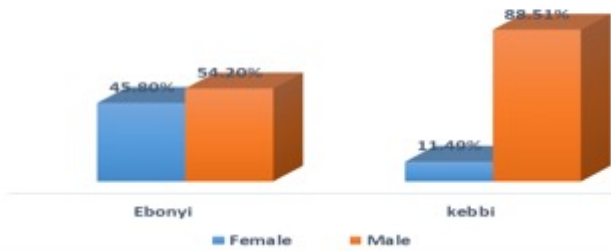


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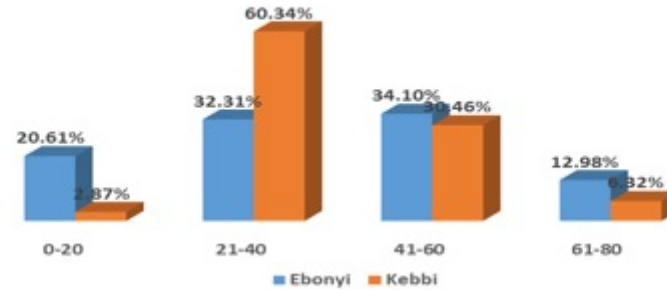
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Socio-economic Analysis of Rice farmers in Ebonyi and Kebbi State, Nigeria

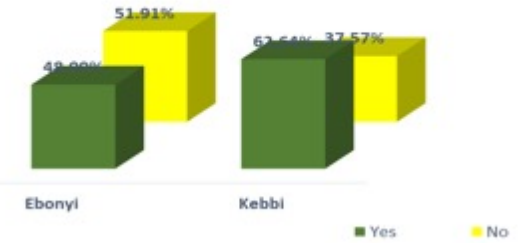
Sex of the Farmers



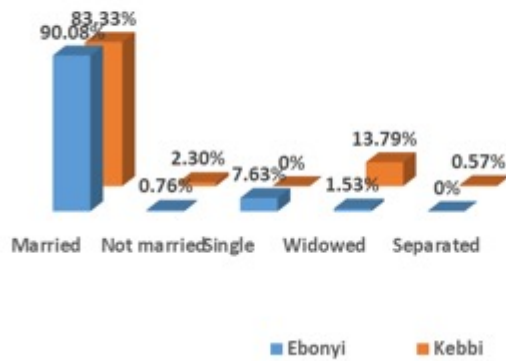
Age of the Farmers



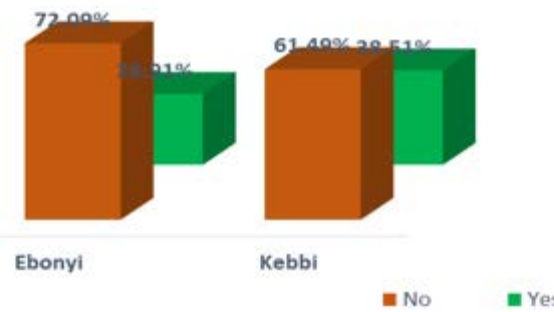
Membership of Cooperative Association



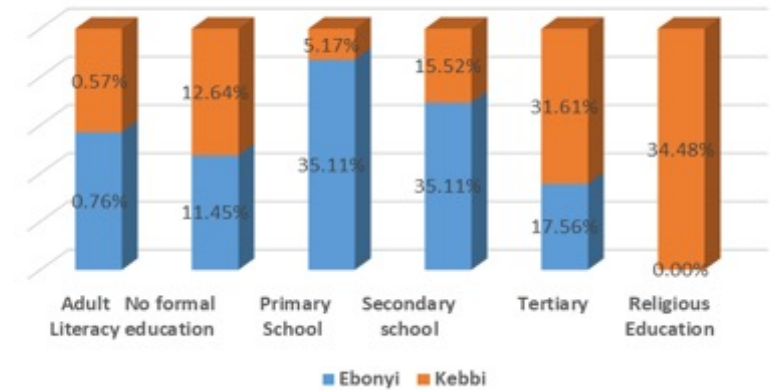
Marital Status of the Rice Farmers



Access to Credit



Education Level



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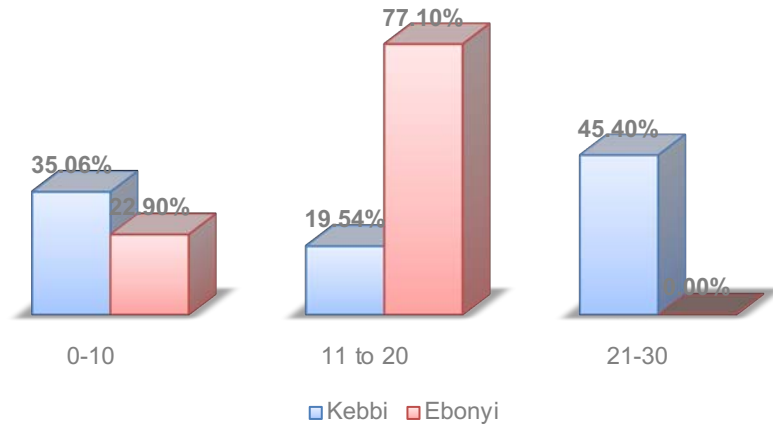


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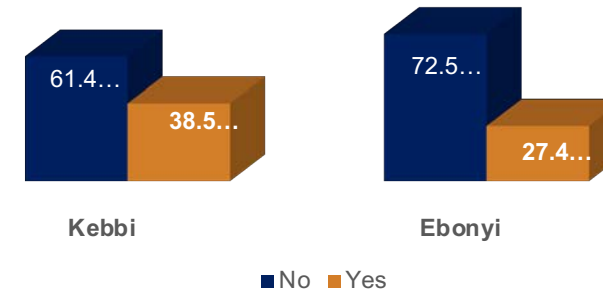
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Socio-economic Characteristics of the Farmers Continued

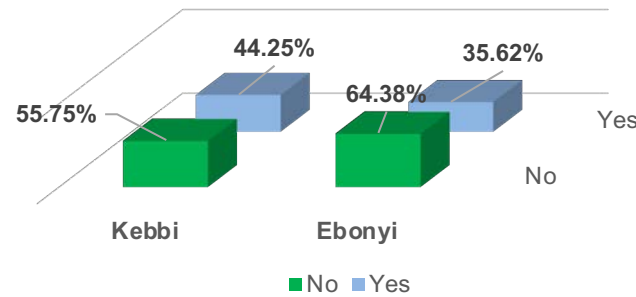
Households Size



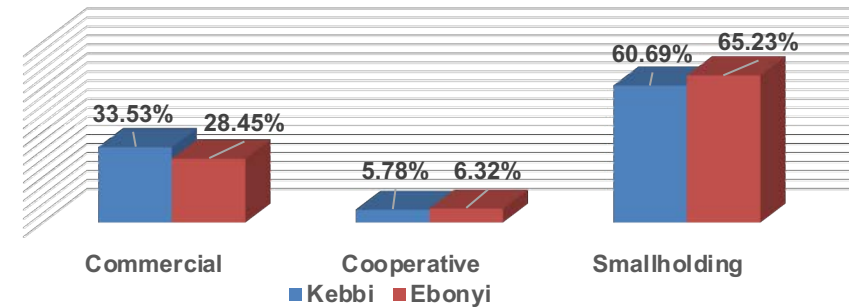
Access to Credit



Access to Agricultural Training



Rice production System



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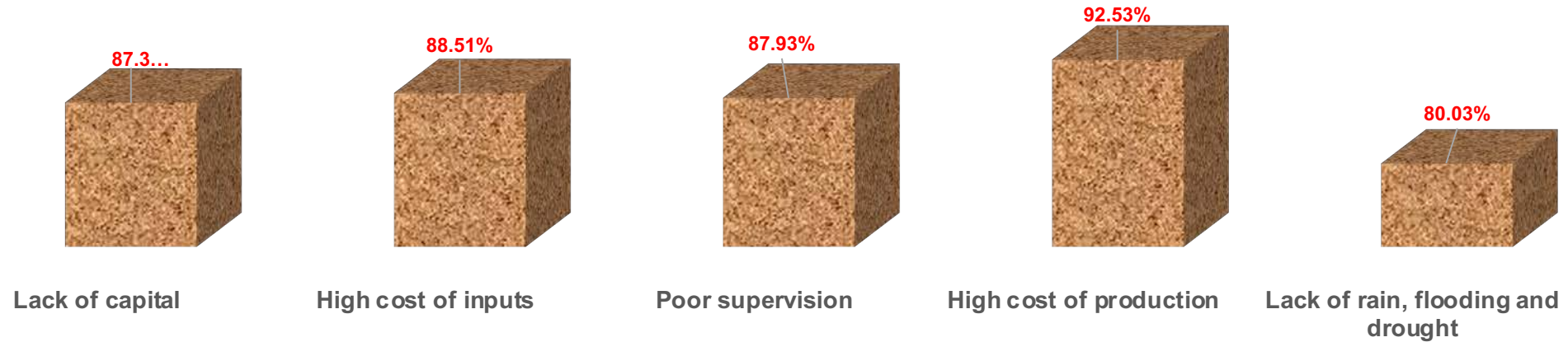
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Top five Constraints Facing rice production in the study area.



Other constraints faced by the farmers include lack of support from government and private agencies, inconsistencies in government policies, lack of technical-know-how, Crop failures/pest infestation, destruction by animals grazing, lack of labour, training/poor extension service, and land accessibility.



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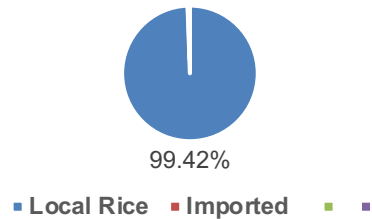


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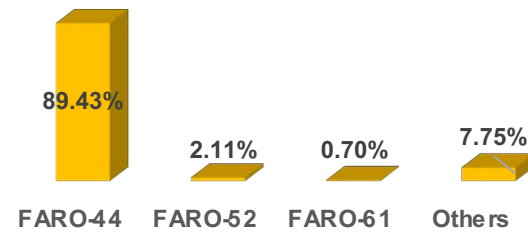


Preference for Local and Foreign Rice

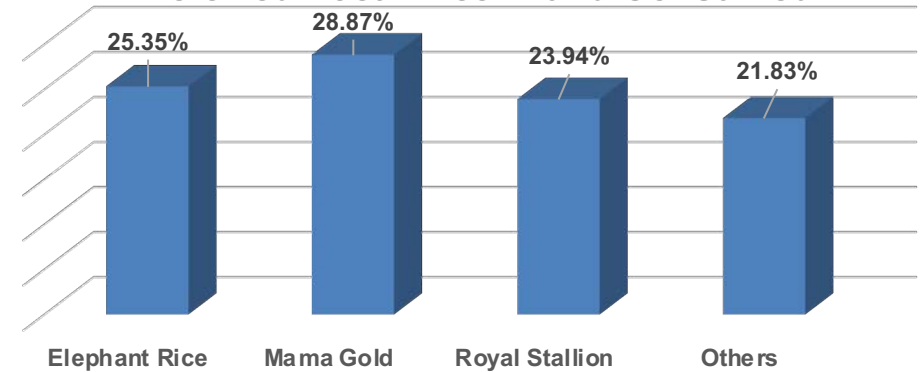
Preferred rice to buy/consume



Preferred Local rice variety



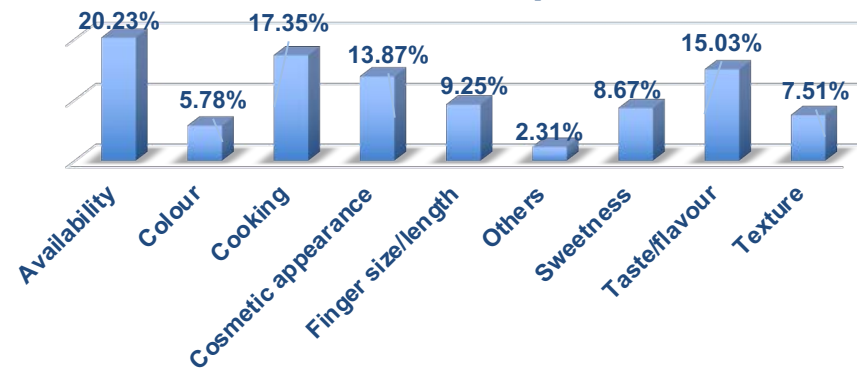
Preferred Local Rice Brand Consumed



Preferred Packaged preference for Rice



Local Rice Attribute preference



Amount willing to pay for 1 MUDU or RUBBER of local rice



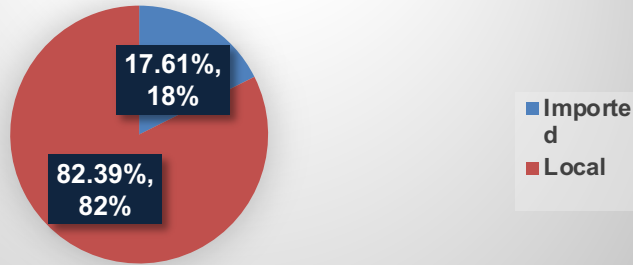


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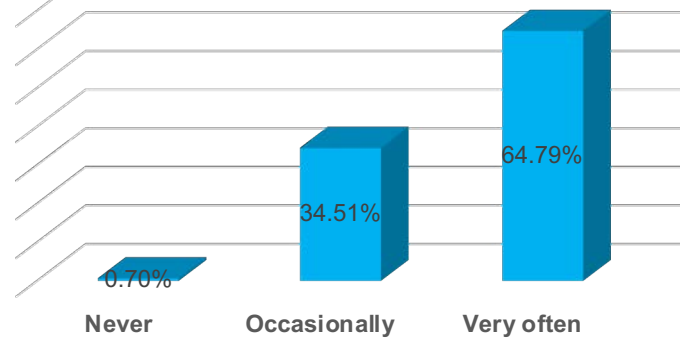
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Preference for Local fish

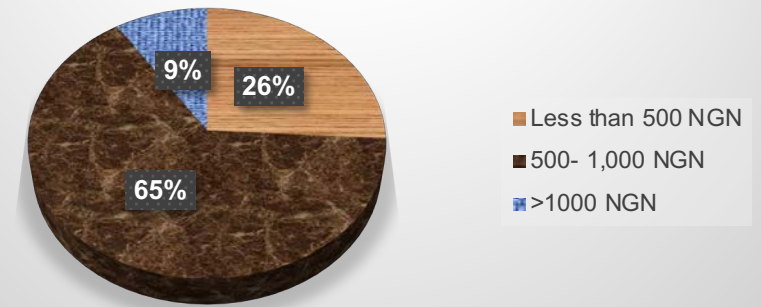
Preferred Fish Types



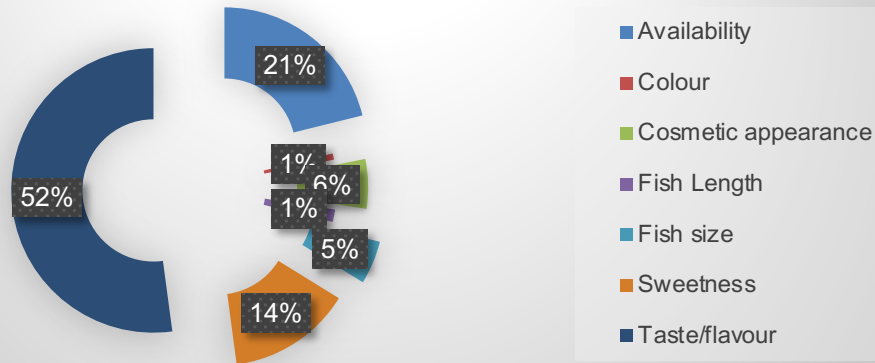
How often Consumed Local Fish



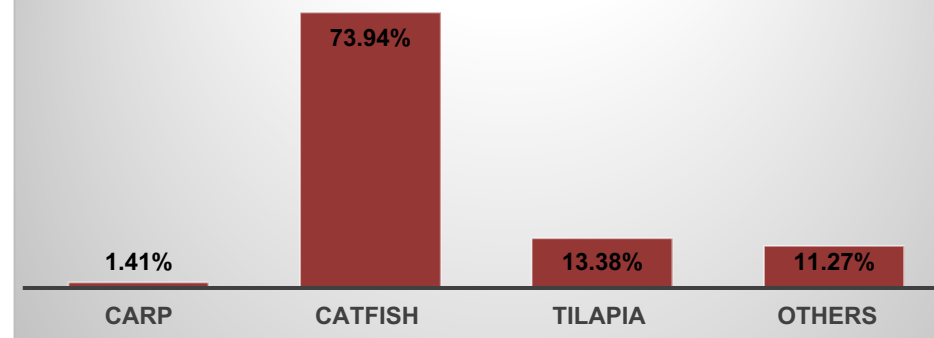
Amount willing to pay for 1kg of preferred local fish



Reason for Preferred Local Fish



Preferred Local Fish Consumed



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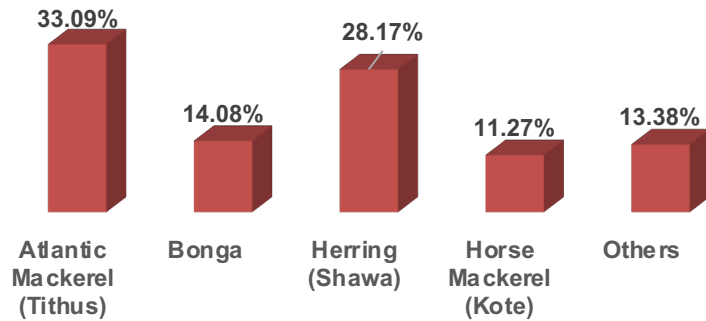


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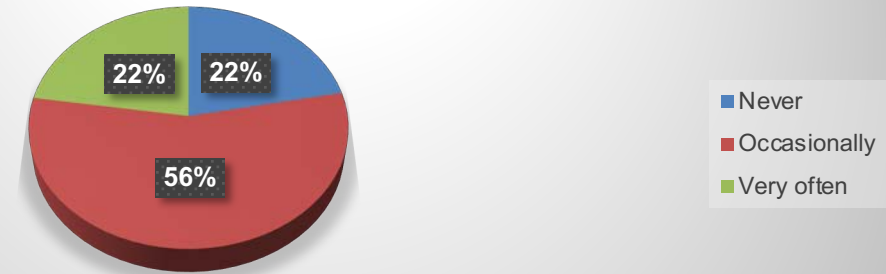
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Preference for foreign fish

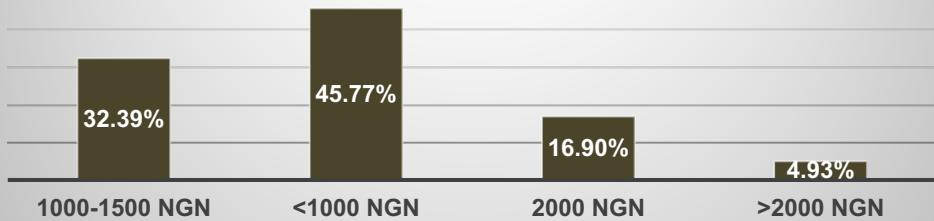
Preferred imported fish



How often they consumed Imported fish



Amount willing to pay for 1kg of your preferred imported fish



Amount willing to pay for 1kg of your preferred imported fish



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The process: Farm diversification in project sites

Community stakeholder meeting and appraisal using the principle of IAR4D's Innovation platform establishment



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The process: Farm diversification in project sites

Community stakeholder meeting and appraisal using the principle of IAR4D's

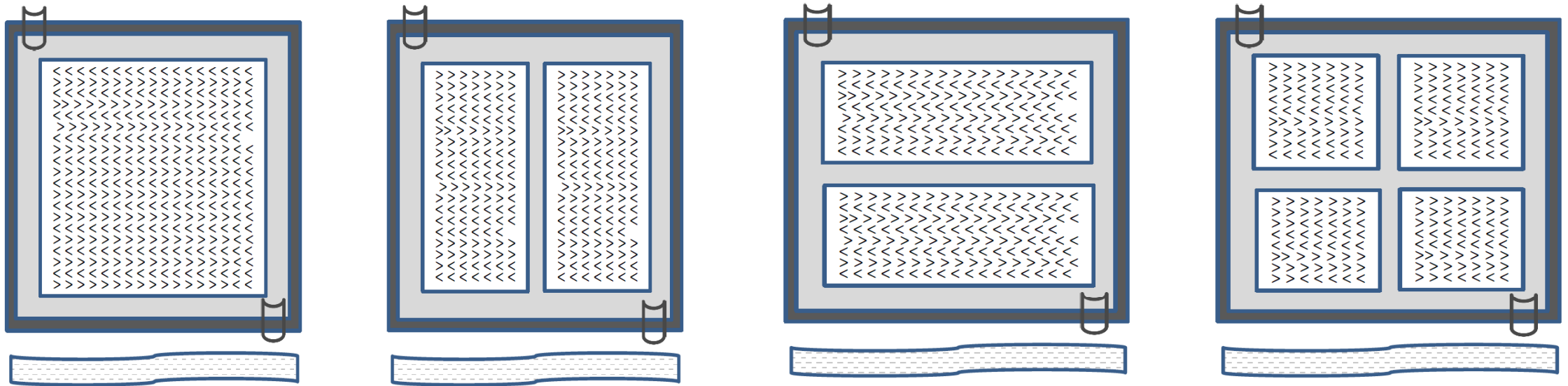
- Appraisal Report
 - The demographic
 - Mostly rice farmers (85%) with little or no experience in fish farming
 - Male dominated at the base of the rice value chain (70% men) but youth involvement of 60%
 - Small holder farmers average farmland of between 1 acre (mostly in Ebonyi) and 4 acres (- Kebbi)
 - Experience –average of 15 years





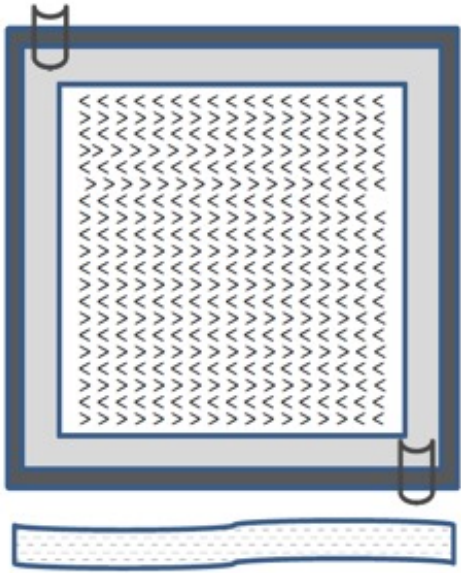
The process: Farm diversification in project sites

Different rice field modification proposed to farmers at stakeholders' engagement





Rice field modification system selected by beneficiary farmers in Nigeria



-  dikes
-  trench
-  water canal
-  rice
-  water inlet/outlet



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The process: Farm diversification in project sites

Site selection

- 6 sites in Kebbi and Ebonyi states
 - Covering six geo-political senatorial zones
- 1 institutional site each at the University of Ibadan and Usmanu DanFodiyo University Sokoto

Each site is unique

- Farm diversification is based on prevailing local situation in each site
- Farm diversification parameters are slightly different in each project sites





The process: Farm diversification in project sites

Farm diversification: Introducing fish into rice fields

Factors to consider

- **Site selection**
 - Soil suitability
 - Not prone to flooding
 - Wetland mapping??
 - Accessibility
- **Seasonality and water availability**
 - At what time of the year is rice produced?
 - Is there water all year round to make fish thrive or is there an irrigation system for water supply?
 - Is rice-fish integration possible all year round or limited to the rainy/wet season?





The process: Farm diversification in project sites

Farm diversification: Introducing fish into rice fields

Factors to consider cont'd

- **Farm modification**
 - Preferred rice field modification by farmers
 - Decision by the farmers

- **Access to fish seed and size of fish to stock**
 - On farm hatchery or purchase from supplier?
 - Could start with 8- 10 g of fish in the absence of predatory birds.
 - In the case of fish loss due to actions of predatory birds, the following solutions are proposed:
 - Stocking of 30g size fish
 - Covering the field with net to guard against predatory birds
 - Using special hapa to first raise the fish for 4 weeks before release into the rice field





The process: Farm diversification in project sites

Farm diversification: Introducing fish into rice fields

Factors to consider cont'd

- **Rice variety:**
 - Consideration for variety resistant to disease and pests
- **Fish feed**
 - Fed Vs Non-Fed
 - Access to fish feed
 - Cost effectiveness
 - Waste to feed
 - Non conventional feed – insect protein





The process: Farm diversification in project sites

Farm diversification: Introducing fish into rice fields

Factors to consider cont'd

- **Fertilization**
 - Working towards 0% mineral fertilizer use at the end of 3 years
 - Organic manure use is encouraged
- **Market size**
 - According to consumer preference- Rice market has been standardised
 - Market demands especially as regards smoked fish products





The process: Farm diversification in project sites

Rice field modification training and processes

- Fish trench size (1m width X1m depth)





The process: Farm diversification in project sites

Rice transplanting and stocking of fish

- Rice variety (FARO 40)
- Rice spacing (20 X 20 cm)
- Fish species stocked

- Total fish stocked





The process: Farm diversification in project sites

Management

- Water retention challenge
- Effects of weather/rainfall pattern
- Eco-friendly?
 - Solution: eliminate plastic lining
 - Consideration for farm diversification during the rainy season





The process: Farm diversification in project sites

Management

- Dyke improvement in a site





The process: Farm diversification in project sites

Management

- Feeding
 - Feed development
 - Rice bran and fish offal
 - Fish feed with complete replacement of rice bran for maize developed. 27- 30% inclusion of rice bran in the diet
 - Imported fish meal completely replaced with fish offal (waste from smoked fish production)





The process: Farm diversification in project sites

Other management considerations

- Water management
 - Eliminating plastic lining of ponds
 - Without any option of irrigation, the process should be restricted to raining season
 - Tube well option may not worked at the peak of dry season
- Alternative fish feed production
 - Black soldier fly larvae option
 - IAA waste products conversion to fish feed





The process: Farm diversification in project sites

Other management considerations

- Fish breeding
 - Locally adaptable fish seed production techniques for African catfish and tilapia
 - The facilities (hapas or fibre glass) used in the development of the hatching structures are available locally.
 - This innovation leads to efficient water utilization and can also improve the production of tilapia seed by 80% with a simple all male tilapia technology design.
 - This innovation led to provision of good employment opportunities especially for youths and women especially in the areas of hatchery operation and seed development in the region.
 - Support availability of good fish seed to farmers leading to increase yield, food security and improve income





The process: Farm diversification in project sites

Harvesting

- Harvest size
 - Home consumption and sales
 - Value addition





The process: Farm diversification in project sites

Value addition

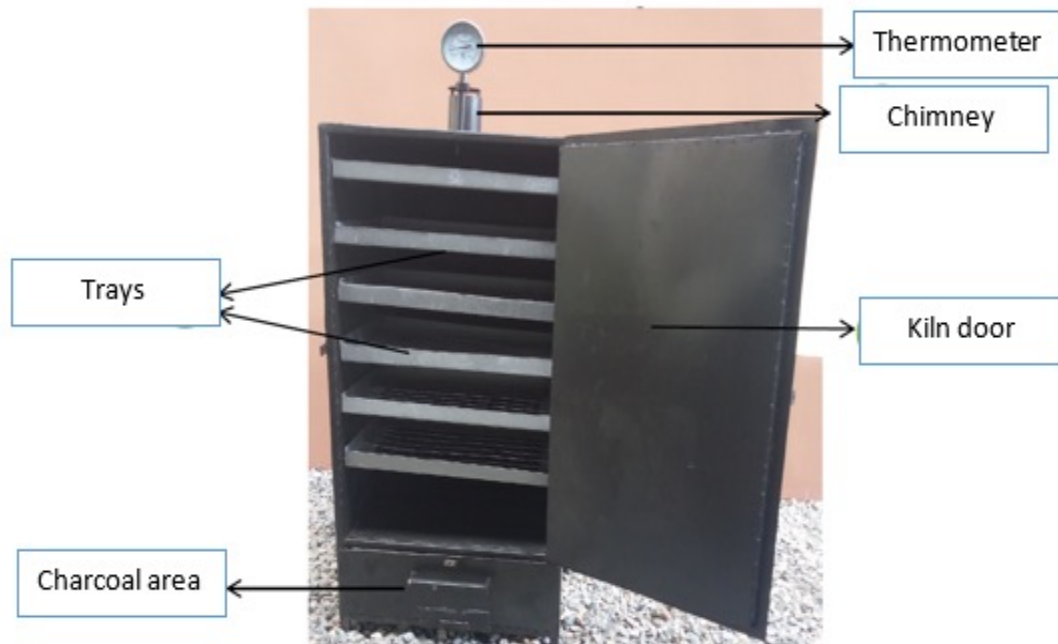
- Training on the use of a smoking kiln for fish
 - Food loss reduction
 - Food security: Availability for longer period within a year
 - Increase in margins of income
 - Improve market access and export potentials of the products





The process: Farm diversification in project sites

The Smoking Kiln



- Standard thermometer is installed to measure and regulate the drying temperature
- The mild steel plate gauge is thick enough to withstand heat, corrosion and wear
- The machine is detachable with good smoke vent to prevent carbon deposits.
- The smoking kiln design is simple with cheap structure and drying time is less than 8 hours.
- Total Capacity of the smoking kiln is 50kg of fish.
- The Poly-aromatic hydrocarbon level in the product is within internationally acceptable limits
- The product quality is excellent in term of taste, appearance and odour





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The process: Farm diversification in project sites

Outputs so far (from on field trials)

- Fish yield per hectare
- Rice yield per hectare



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THANK YOU FOR LISTENING

- ✓ *We gratefully acknowledge financial support from the Feed the Future Fish Innovation Lab under the project: Aquaculture and rural communities: Farm diversification strategy integrated aquaculture agriculture (IAA) systems and nutrition sensitive value chains for better nutrition outcomes in Ebonyi and Kebbi States, Nigeria.*
- ✓ *Equally, we appreciate the Food and Agriculture Organization (FAO), Department of Aquaculture and Fisheries Management, University of Ibadan, Ibadan, Nigeria and University of Georgia, Atlanta.*



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