A CONCEPT NOTE

SUBMITTED BY

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TO

TERTIARY EDUCATION TRUST FUND (TETFUND)

TITLE OF PROPOSED RESEARCH:

The potential economic benefit of using microcontroller in the palm wine tapping process

THEMATIC AREA:

Science, Technology, and Innovation – Industry, Innovation and Infrastructure

BACKGROUND TO THE RESEARCH:

Palm wine is an important source of natural alcoholic drink and income generator to people in rural areas. Nigeria uses crude tools to produce palm wine. Technology inclusion in palm wine tapping will boost palm wine production and make it globally competitive (Okereke, 2019).

Fresh palm wine is sweet, clear, juice containing 12–15% sucrose and trace sugars including glucose, fructose, maltose. Half of the fermentation occurs during the first 24 hours and the ethanol content reaches a maximum of 5.0–5.28% after 48 hours. It is important to transport this sap quickly. The study looks at potential economic benefit of using technology to make this tree-to-market journey efficient and commercial competitive for palm wine. Findings made, will enable producers exploit technology to lower cost, ensure quality and increase the volume of sap extracted. Also, efficiency generated will benefit the environment because of a minimized human interaction with the trees.

STATEMENT OF THE PROBLEM:

Many researchers have developed and dealt with the palm wine tapping process, but no work has been done on improving yield using technology.

The shelf life of palm wine is short and is best consumed in about 48hours. A technique to remove the sap quickly will improve yield.

The activities of palm tapping could disturb local animal population including bees etc that can expose the climbers to increased danger.

Presently, palm wine tapping process use local means to extract the sap which has deficiencies including low production quantity of palm wine. This project is justified because it will go a long way in mitigating the problem of sap wastage, climbing the trees regularly to check the level of sap excretion and condition of the scar on the tree.

OBJECTIVES OF THE RESEARCH:

1. Study, design, and implement the micro-controller technology for palm wine tapping process
2. Produce and test the palm wine samples for biochemical composition.
3. Log production data with the eventual view to predict the optimal production quantity for palm wine tapping at specific periods.
4. Evaluate the impact of the micro-controller on the palm wine tapping process.

RESEARCH QUESTIONS:

1. Can we increase palm wine production by the integration of microcontroller technology?
2. Will integration of a microcontroller alter the quality of the palm wine produced?
3. Can information gathered by the microcontroller be used to make intelligent decisions about the palm wine tapping process?

LITERATURE REVIEW:

Palm trees secrete sap which when fermented by wild yeast produces palm-wine. Only the oil-palm and Raphia palm trees are tapped in Nigeria (Morah, 2010). Santiago-Urbina and Ruíz-Terán (2014) determine the physicochemical characteristics and microbiological aspects of its fermentation. During the tapping process of the palm

wine, lactic-alcoholic-acetic fermentation is conducted by the lactic acid bacteria (LAB), yeast and acetic acid bacteria (AAB), respectively. The palm wine composition depends on the stage of tapping and period in which it is consumed. Ezeagu et al (2003) studied the biochemical constituent, which includes sugars, protein, amino acid, lipid, alcohol, mineral and trace elements of palm wine.
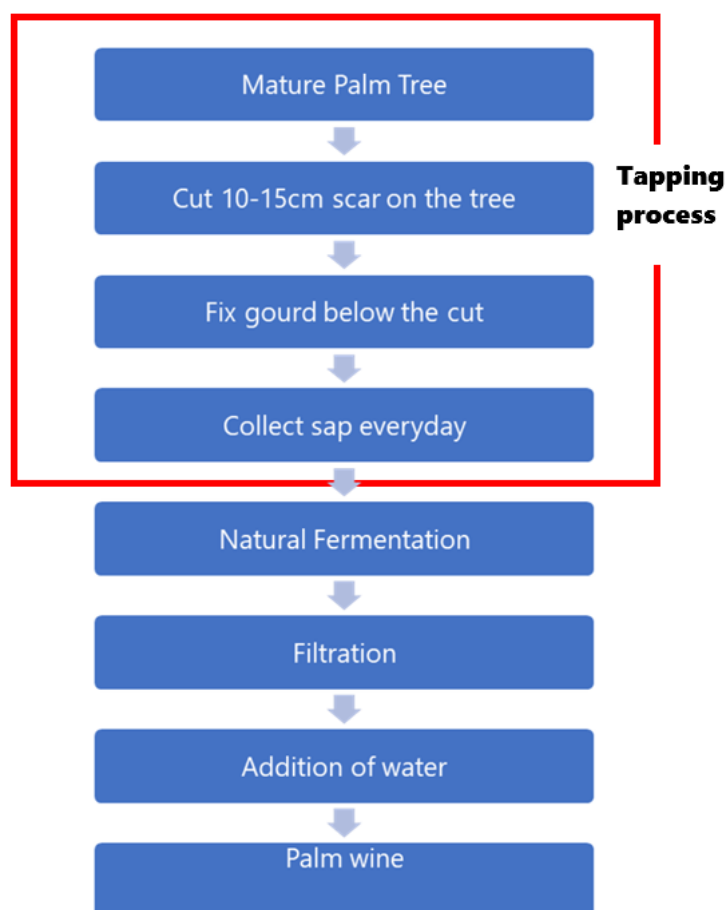

Figure 1: The Palm wine making process

The techniques for tapping palms are numerous demonstrated by Borassus aethiopium in Africa and Borassus flabellifer in Asia. The non-destructive techniques used in predominantly eastern-Nigeria preserve the palms. However, there are no existing literature that show the use of technology to maximise sap extraction.

THEORETICAL FRAMEWORK:

There has been automation in agriculture, but these gains have not been applied to palm wine tapping. With the need for Nigeria to diversify her economy, exploring the potential increase in yield of sap produced for palm wine manufacture is crucial.

This work was designed on the basis that micro-controller technology for palm wine tapping could potentially improve production efficiency and the quality of the palm-wine.

RESEARCH METHODOLOGY:

STUDY DESIGN: Explorative and insight study

STUDY POPULATION: Anambra state Palm and Raffia trees

STUDY SITES: Nnamdi Azikiwe University Awka campus Palm and Raffia trees.

INCLUSION CRITERIA: Palm wine production ready Palm and Raffia trees.

EXCLUSION CRITERIA: Palm and Raffia trees not ready for Palm wine production.

SAMPLE SIZE: Fifty Palm wine producing trees.

SAMPLE TECHNIQUE: Purposive sampling

ETHICAL APPROVAL: -

TIMELINE: 18 – 24 Months

PROCEDURE:

- Design and test micro-controller through simulations.
- Construction of micro-controller.
- Install micro-controller prototype for palm wine tapping on some sample trees.
- Compare palm wine production from local tapping process with micro-controller process.
- Compare economic indices of the two processes using chi-square analysis.

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FOR ANALYSIS: Python, MATLAB, Solid works, STATA, Excel

EXPECTED RESULTS:

The results expected will be.

1. The development, programming, design, and production of micro-controller that is environmentally friendly, with low cost but high capacity.
2. Production of palm wine at a potential cost of the 10,000litres capacity being < ₦ 420,000.00.
3. Production, experimentation, analysis, and tests of palm wine tapping process using micro-controller technology system
4. Evaluation of the production quantity and quality using microcontroller method of palm wine tapping process
5. Simulation results of the micro-controller system and that of the local method
6. Evaluation of the economic benefit of micro-controller process and its benefit to the local consumers and the industrial consumers

INNOVATION:

i. Micro-controller use in the extraction of palm tree sap
ii. Simulation of micro-controller impact on palm wine production

ESTIMATED BUDGET:

DESCRIPTION	TETFUND NRF (N)	NAU (N)
PERSONNEL COST / ALLOWANCE	2,800,000.00	2,500,000.00
EQUIPMENT	1,800,000.00	
SOFTWARE DEVELOPMENT	2,000,000.00	
DATA/SAMPLE COLLECTION	1,000,000.00	
TRAVELS	1,200,000.00	
SUPPLIES AND CONSUMABLES	2,000,000.00	
DISSEMINATION AND PUBLICATION	2,000,000.00	

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MISCELLANEOUS	500,000.00	
TOTAL DIRECT COST	15,800,000.00	
INDIRECT COST (5% OF TETFUND COMPONENT OF DIRECT COST)	790,000.00	
GRAND TOTAL	**16,590,000.00**	

REFERENCES:

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Morah Frank (2010): The Nigerian Palm-Wine: Science And Socio-Economic Importance. A faculty lecture delivered at the faculty of science, university of calabar, on 4th november, 2010; b.sc., m.sc., ph.d. (ibadan), mipan, fcsn, ficcon; professor of chemistry.

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RESEARCH TEAM:

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