KWARA STATE POLYTECHNIC, ILORIN

INSTITUTE OF TECHNOLOGY
AGRICULTURAL AND BIO-ENVIRONMENTAL ENGINEERING DEPARTMENT

A TECHNICAL REPORT ON
STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME
(SIWES)

BY

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BEING A REPORT SUBMITTED TO THE SIWES UNIT, INSTITUTE OF TECHNOLOGY CHAPTER, KWARA STATE POLYTECHNIC, ILORIN

IN PARTIAL FULFILLMENT FOR THE REQUIREMENT FOR THE STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

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DEDICATION

I dedicate this report to Almighty God for His boundless grace, unwavering love, and immeasurable faithfulness, and for preserving my life throughout the duration of my SIWES program.

I also extend my heartfelt gratitude to my family for their unwavering support and encouragement during the entire training period, and to all my supervisors and colleagues for their cooperation and companionship throughout this journey.

ABSTRACT

The Students' Industrial Engineering and Technology across Nigerian universities. The program spans 16 weeks (i.e Three (4) Months), allowing students to gain practical industry experience. Unlike a vacation job, SIWES is an essential component of academic curricula and a mandatory requirement for graduation. The scheme aims to equip students with the practical skills and exposure necessary to complement Work Experience Scheme (SIWES), also known as Industrial Training (IT), is a structured yearly program designed for students in 300 level, particularly those in the Faculties of their theoretical studies.

This technical report is a detailed account of the SIWES program undertaken by Agboola Samuel oluwaferanmi (Matric Number: ND/23/ABE/FT/0007) from the Department of Agricultural and Bio-Environmental Engineering Technology, Institute of Technology, Kwara State Polytechnic Ilorin. The training took place at the National Centre for Agricultural Mechanization (NCAM), located at Km 20 Ilorin-Lokoja Highway, Ilorin, Kwara State. The report documents the experiences, knowledge gained, and the various technical activities carried out during the program.

Overall, I gained hands-on experience across various engineering projects such as production of Biogas, Converting Maize Cub into Briquettes *and tasks, including the design and development of agricultural machinery such as the Rotary Slasher, Cassava Harvester. I participated in activities like cutting and grinding metal plates, drilling and shearing metals, and operating bending and shearing machines. I was also involved in assembling machine components, error correction, and supervising welding operations*

ACKNOWLEDGEMENT

I am deeply grateful to Almighty God, who has graciously preserved my life from the beginning to the end of this training program. The experience was truly impactful, but it would not have been possible without the support and assistance of many individuals, to whom I owe my sincere thanks.

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CHAPTER ONE

INTRODUCTION TO SIWES

1.1 Historical Background of SIWES

The Students Industrial Work Experience Scheme (SIWES) is a skill acquisition initiative introduced by the Federal Government of Nigeria with the primary objective of bridging the gap between theoretical education and practical industrial experience for students in higher institutions. The scheme is designed to equip students in Engineering, Technology, Sciences, Agriculture, Medicine, Management, and other fields with hands-on experience that complements their classroom learning. The program applies to students in universities, polytechnics, monotechnics, and colleges of education across Nigeria.

SIWES was first introduced during the 1973/1974 academic session and was initially funded by the Industrial Training Fund (ITF). At the time, there was a growing concern that graduates lacked the necessary practical skills and industrial exposure to seamlessly integrate into the workforce. Many industries had to spend extended periods retraining newly employed graduates to equip them with practical skills. The scheme was created to address this deficiency by exposing students to real-world industrial environments during their academic programs, thereby reducing the time and cost involved in training them after graduation.

The scheme has since become an integral part of the Minimum Academic Standards (MAS) as established by the National Universities Commission (NUC), the National Board for Technical Education (NBTE), and the National Commission for Colleges of Education (NCCE). SIWES plays a crucial role in ensuring that students, particularly in technical and vocational fields, experience the practical side of their studies before graduation.

1.2 Aims and Objectives of SIWES

SIWES is a strategic initiative designed primarily to facilitate the acquisition of relevant skills by students in their respective fields of study. By immersing students in real-life work environments, the program enhances their employability and prepares them for the challenges they will face upon graduation. Below are the specific objectives of SIWES:

Provide Industrial Placement: SIWES offers placement opportunities in industries for students enrolled in higher institutions. These placements are approved by the relevant regulatory authorities, such as the National Universities Commission (NUC), the National Board for Technical Education (NBTE), and the National Commission for Colleges of Education (NCCE). The aim is to allow students to acquire hands-on work experience and technical skills relevant to their academic programs.

Prepare Students for the Real Work Environment: The program helps prepare students for the realities of the workplace by allowing them to experience first-hand the dynamics of the work environment. This exposure gives them a clearer understanding of professional expectations and challenges, fostering a smoother transition from school to the workforce.

Enhance Future Employment Opportunities: By offering students exposure to potential employers and work environments, SIWES also serves as a networking opportunity. Students may establish contacts with industry professionals and companies, potentially enhancing their prospects for future employment.

1.3 Importance of SIWES

Since its inception, SIWES has played a critical role in shaping the quality of education and workforce readiness in Nigeria, particularly in the fields of science, engineering, and technology. Below are some of the key contributions of the SIWES program:

1. **Improvement in Science and Technology Education:** The program has significantly enhanced the practical aspect of science and technology education in Nigeria. By providing students with hands-on experience, it complements theoretical learning and produces graduates who are better equipped to apply their knowledge in practical situations.
2. **Increased Employment Opportunities:** Graduates who have participated in SIWES are more employable due to their exposure to real-world work environments. Employers tend to prefer candidates who possess not only academic qualifications but also practical experience, which SIWES provides.
3. **Better Standard of Living:** The program indirectly contributes to an improved standard of living by producing skilled graduates who are more likely to secure well-paying jobs in the industrial and technological sectors. This contributes to national development by creating a pool of highly skilled professionals.
4. **Production of Skilled Graduates:** SIWES ensures that students graduate with not only theoretical knowledge but also the practical skills necessary to thrive in their respective fields.

CHAPTER TWO

ORGANIZATION OVERVIEW AND STRUCTURE

2.1 Brief History of the National Centre for Agricultural Mechanization (NCAM)

The history of the National Centre for Agricultural Mechanization (NCAM) dates back to 1974, when the Federal Ministry of Agriculture and Natural Resources recognized the need for an institution focused on agricultural mechanization. This need was highlighted in a report titled "Proposal for the Establishment of National Centre for Agricultural Mechanization (NCAM)," submitted by a study team. The Centre was formally established by the promulgation of Decree No. 35 of 1990, marking the beginning of its journey toward the development of sustainable mechanization technologies suited to Nigeria's unique agricultural conditions.

A variety of factors motivated the establishment of NCAM. Imported agricultural machinery often proved incompatible with Nigeria’s diverse agro-climatic conditions, crops, and farming systems. Additionally, the socio-economic realities of rural farmers, combined with poor after-sales services, irregular spare part supply, and technical difficulties in maintaining imported equipment, hindered the adoption of foreign technologies. Rural labor shortages due to urban migration, coupled with the low income associated with subsistence farming, further exacerbated the need for indigenous mechanization solutions.

The Federal Government, convinced that Nigeria’s agricultural development could only be sustained through locally developed and manufactured technologies, tasked NCAM with bridging this gap. The Centre has since become the highest level of agricultural research and mechanization in the country and stands as the largest institution of its kind in West Africa.

2.2 Aims and Objectives of NCAM

The primary aims and objectives of NCAM are geared towards advancing agricultural mechanization by developing indigenous technologies and practices. These objectives include:

1. Innovative Research and Development: Conduct adaptive and innovative research to develop locally appropriate farming and processing machines.
2. Cost-Effective Machinery Design: Design simple, low-cost agricultural equipment that can be manufactured using local materials and skills.
3. Certification of Agricultural Equipment: Standardize and certify, in collaboration with the Standards Organization of Nigeria (SON), the machinery and engineering practices used within Nigeria.
4. Evaluation of Existing Technologies: Assess and evaluate modern mechanical technologies and equipment developed by other institutions for their suitability and adoption in Nigeria.
5. Promotion of Indigenous Mechanization: Ensure that mechanization efforts prioritize local environmental, economic, and social factors, emphasizing equipment that addresses local farming challenges.

NCAM's focus includes several key agricultural processes such as land clearing, irrigation, soil erosion control, planting, weed management, harvesting, processing, packaging, and storage. By concentrating on these areas, the Centre seeks to remove bottlenecks in agricultural production, thereby promoting efficiency and sustainability. These tasks are carried out in collaboration with other research institutions, government agencies, and private sector partners to avoid duplication of efforts.

2.3 Organizational Structure of NCAM

The organizational structure of NCAM is divided into two broad components: the Administrative and Technical Departments.

(a) Administrative Departments and Units

The administrative wing of NCAM provides the necessary support to ensure the smooth functioning of the Centre. Key units under this department include:

- Director's Office: Overseeing the overall management of the Centre.
- Testing, Standardization, and Certification Section: Ensuring compliance with industry standards for agricultural equipment.
- Works and Estate Management Section: Managing the Centre's physical infrastructure.
- Library Section: Maintaining a collection of relevant academic and research resources.
- Internal Audit Unit: Ensuring financial accountability and transparency.
- Publications Unit: Responsible for documenting and publishing NCAM's research and development work.
- Linkage Program Unit: Facilitating collaboration with external organizations.
- Security Unit: Ensuring the safety and security of the Centre.
- Landscaping Unit: Managing the Centre's green spaces.
- Computing and Data Processing Unit: Handling the Centre's IT infrastructure and data management.
- Farm Management Section: Overseeing agricultural activities within the Centre.
- Personnel and Finance Department: Managing human resources and financial operations.

(b) Technical Departments

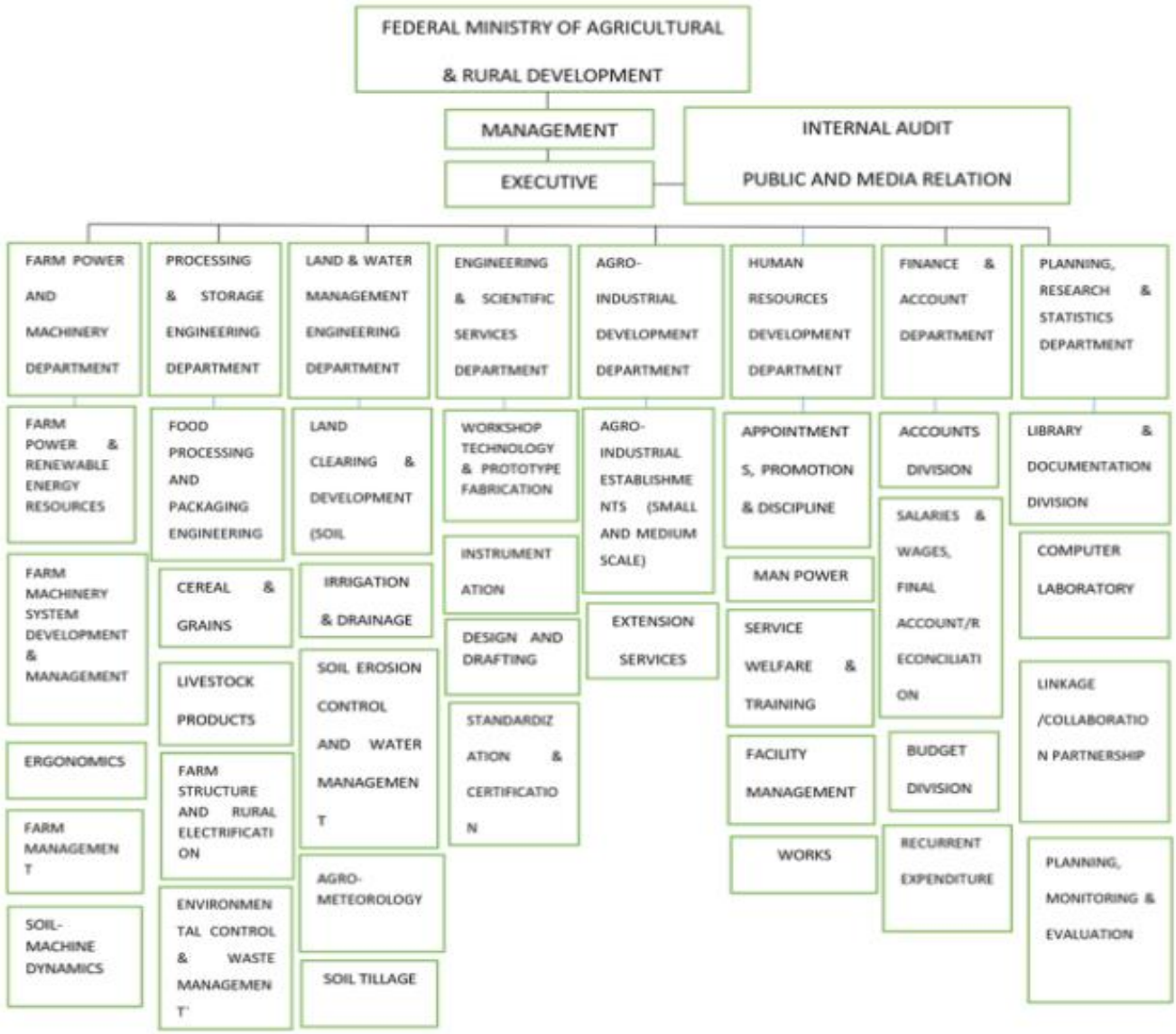
NCAM's technical departments are responsible for the research, development, and maintenance of agricultural equipment. The major departments are:

- Farm Power and Machinery (FPM): This department designs, develops, and fabricates new agricultural machinery prototypes. They are also tasked with maintaining farm equipment, including tractors and implements such as ploughs, harrows, ridgers, planters, and harvesters.
- Processing and Storage Engineering (PSE): The PSE department focuses on post-harvest processing, storage, and transportation of agricultural products. They work on optimizing the use of agricultural by-products and improving storage techniques to reduce losses.
- Land and Water Management Engineering (LWM): This department deals with soil management, irrigation systems, and crop cultivation. They are responsible for monitoring soil conditions, water usage, and the overall health of crops like tomatoes, cucumbers, and peppers grown at the Centre.
- Engineering and Scientific Services (ESS): ESS serves as the technical nucleus of NCAM, where nearly all the Centre's technical work is carried out. This department focuses on the design, construction, and maintenance of agricultural machines and equipment.

Educational, Training, and Extension (ETE): The ETE department plays a critical role in disseminating agricultural knowledge and practices to farmers across the country. It ensures that innovations in mechanization and farming techniques reach those who can apply them in the field, thus contributing to increased agricultural production.

Through these departments, NCAM works to fulfill its mandate of enhancing agricultural productivity and sustainability through mechanization tailored to Nigeria's unique challenges.

Below is the organizational chart of NCAM:



Organizational chart of National Center for Agricultural Mechanization

CHAPTER THREE

FARM POWER AND MACHINERY DEPARTMENT

3.1 Introduction to the Farm Power and Machinery Department:

This is an overview of the department's purpose and role in advancing agricultural practices.

- **Role in Agricultural Engineering:** The department focuses on integrating mechanical and technological solutions into farming to increase productivity and reduce manual labor.
- **Historical Development:** Farm power and machinery have evolved from manual tools to complex automated systems like tractors, planters, and harvesters. The department often leads research and innovation in this area.
- **Significance:** By optimizing farm machinery, this department helps enhance efficiency, reduce costs, and ensure sustainable agricultural practices.
- **Facilities:** Includes workshops, testing grounds, and laboratories for the repair, maintenance, and testing of machinery.

3.2 Functions and Responsibilities:

The department has several critical roles to ensure effective machinery use in agriculture:

- Maintenance and Repair: Regular servicing of agricultural machines like tractors, tillers, and harvesters ensures their longevity and reliability.
- Research and Development: Innovating and designing new equipment tailored to local agricultural needs, such as affordable and energy-efficient tools.
- Training and Capacity Building: Providing hands-on training for students, farmers, and technicians on the operation, maintenance, and safety of farm equipment.

- Advisory Services: Offering expert advice to farmers on choosing, using, and maintaining farm machinery to optimize their operations.
- Performance Testing: Conducting evaluations to determine the efficiency, durability, and adaptability of agricultural machinery under different conditions.

3.3 Operations Carried Out at the Workshop:

This are the practical activities performed to ensure smooth machinery functionality and provide hands-on experience:

- **Routine Maintenance:** This includes cleaning, oiling, and minor repairs to keep machines like tractors and harvesters in working condition.
- **Fabrication and Modification:** Designing and assembling custom machinery or modifying existing equipment to meet specific farming needs (e.g., adapting plows for specific soil types).
- **Calibration and Testing:** Ensuring equipment operates at its optimal capacity by adjusting settings and running performance checks, such as on seed planters or irrigation pumps.
- **Practical Training:** The workshop serves as a learning environment where students gain experience handling machinery, understanding safety protocols, and diagnosing common problems.
- **Troubleshooting:** Identifying and fixing faults in machinery, which can include engine repairs, gearbox overhauls, and electrical system adjustments.

These activities collectively contribute to the effective management of farm machinery and enhance the learning experience for students in the department.

CHAPTER FOUR

PROJECT WORKED ON AND EXPERIENCE GAINED

4.1 PRODUCTION OF BIOGAS

The production of biogas involved anaerobic digestion of organic waste materials such as animal dung and food waste. I participated in mixing the feedstock, loading it into a digester, and monitoring gas production. This activity highlighted the importance of renewable energy in waste management.

4.1.1 MATERIALS NEEDED

- Organic waste (e.g., food waste, animal manure, plant material)
- Water
- Airtight container or digester tank
- Inlet and outlet pipes
- Gas collector or storage tank
- Burner or stove for utilization

4.1.2 PROCEDURE:

1. **Collect and prepare organic waste:** Gather organic waste and chop it into small pieces to increase its surface area.
2. **Mix with water:** Mix the chopped organic waste with water to create a slurry. The ideal mix ratio is 1:1 (one part waste to one part water).
3. **Load the digester tank:** Pour the slurry into the airtight container or digester tank through the inlet pipe.
4. **Seal the tank:** Close the inlet pipe and ensure the tank is airtight to create an anaerobic environment.
5. **Allow digestion:** Let the mixture digest for 15-30 days, depending on factors like temperature, pH, and the type of waste. During this time, microorganisms will break down the organic matter, producing biogas.
6. **Collect biogas:** The biogas will accumulate in the gas collector or storage tank. You can connect this tank to a burner or stove for utilization.

7. **Use the biogas:** Burn the biogas to produce heat, cook food, or power a generator.

8. **Maintain the system:** Regularly check the pH, temperature, and gas production. Add more waste and water as needed to maintain a consistent biogas supply.

DIGESTER TANK

4.1.3 SAFETY PRECAUTIONS:

- Ensure the digester tank and gas collector are airtight to prevent gas leaks and explosions.
- Use proper ventilation when working with biogas, as it can displace oxygen and cause asphyxiation.
- Keep the biogas system away from open flames or sparks.

4.2 DESIGN CONSIDERATIONS FOR A ROTARY SLASHER

In this project, I worked alongside the Engineer in charge to develop a Rotary Slasher. The machine's design was based on several key criteria. Designing a rotary slasher involves critical considerations to ensure efficient and safe performance. Below are the key factors considered :

1. **Cutting Efficiency:** The primary function of the rotary slasher is to cut grass, weeds, and shrubs evenly. The design incorporated sharp, durable blades capable of handling varying vegetation densities while maintaining precision and speed.
2. **Durability and Longevity:** The machine was designed using robust materials to withstand tough field conditions and prolonged use. Components such as the blades, deck, and gear housing were reinforced to prevent wear and tear.

3. **Adjustable Cutting Height:** To suit different field conditions, the slasher included adjustable height settings, allowing operators to modify the cutting depth according to specific requirements.

4 **Safety Features:** Safety was a priority in the design. Shielding was provided for the rotating blades to minimize risks to the operator and bystanders. Anti-vibration mounts were also considered for operator comfort.

5 **Power Source and Compatibility:** The rotary slasher was designed to be powered through a tractor's power take-off (PTO) system. It was mounted using a standard three-point linkage, ensuring compatibility with various tractor models.

6 **Noise and Vibration Control:** To enhance operator comfort, the design included features to reduce noise and vibrations during operation, ensuring compliance with workplace safety standards.

4.2.1 MATERIALS SELECTION

When selecting materials for the rotary slasher, the focus was on durability, resistance to corrosion, and suitability for harsh field environments.

4.2.2 COMPONENT DESCRIPTION

1. **Frame and Deck:** The main structure and protective housing of the slasher were made from heavy-duty steel to withstand impacts and environmental exposure.
2. **Cutting Blades:** The blades were crafted from high-carbon steel for sharpness and durability. They were heat-treated to resist wear during operation.
3. **Gearbox and Drive System:** A robust gearbox, coupled with the PTO shaft, was used to transfer power efficiently to the blades.
4. **Height Adjustment Mechanism:** Adjustable brackets and pins made from reinforced steel allowed for easy modification of the cutting height.
5. **Mounting System:** A three-point linkage made of high-strength steel ensured compatibility with tractors.

4.2.3 MY PARTICIPATION

Throughout the construction of the rotary slasher, I actively participated in various stages of the fabrication and assembly process.

- Cutting and Fabrication: I was responsible for cutting the metal sheets for the deck and frame using precision tools to meet design specifications.
- Welding and Assembly: I assisted in welding the frame components and assembling the gearbox, blades, and linkage system.
- Bending and Drilling: I worked on bending steel to form the frame and deck angles and drilled holes for mounting bolts and blade attachments.
- Testing and Calibration: I participated in the initial field test, helping to calibrate the cutting height and ensuring the blades operated smoothly without vibration or imbalance.

4.2.4 TOOLS AND EQUIPMENT USED

1. Welding Machine – For joining metal components of the frame and deck
2. Angle Grinder – For cutting and smoothing metal sheets and components.
3. Drilling Machine – To create holes for bolts and other attachments.
4. Measuring Tape and Steel Ruler – For accurate measurements during fabrication.
5. Hacksaw – For manual cutting of smaller metal pieces.
7. Hammer and Mallet – For assembling and aligning parts.
8. Spanner Set – For tightening bolts and nuts during assembly.
9. Clamps – To hold metal parts in place during welding and cutting.
10. Protective Gear – Such as welding gloves, goggles, and helmets for safety.
11. Bench Vice – For holding metal parts securely during cutting, drilling, or grinding.
12. Power Saw – For precision cutting of thicker metal pieces.
13. Pliers – For gripping and bending small components.
14. File Set – For smoothing sharp edges after cutting.
15. Multi Meter: used for taking reading

10-in-1 screwdriver and nut driver

Klein heavy-duty side-cutting pliers

Hammer & Mallet

These tools ensured accuracy and efficiency during the fabrication and assembly process.

4.3 MAKING MAIZE COBS INTO BRIQUETTES

We transformed maize cobs into briquettes as an alternative energy source. The process involved collecting maize cobs, grinding them into smaller particles, and compressing them into briquette molds using a manual press. This activity demonstrated how agricultural waste can be recycled for sustainable energy production.

4.3.1 MATERIALS NEEDED:

- Maize cobs
- Crusher or grinder
- Mixer
- Binder (e.g., starch, clay, or molasses)
- Water
- Briquetting machine
- Drying equipment (optional)

4.3.2 PROCEDURE:

1. **Collect and dry maize cobs**: Gather maize cobs and dry them to a moisture content around 10-15%.
2. **Crush or grind the maize cobs**: Use a crusher or grinder to break down the maize cobs into smaller pieces.
3. **Mix with binder**: Mix the crushed maize cobs with a binder (e.g., starch, clay, or molasses) to help hold the briquettes together.
4. **Add water**: Add a small amount of water to the mixture to help bind the particles together.
5. **Mix thoroughly**: Mix the mixture thoroughly to ensure everything is well combined.
6. **Briquetting**: Use a briquetting machine to compress the mixture into briquettes. The machine will apply high pressure to form the briquettes.
7. **Drying**: If necessary, dry the briquettes to remove any excess moisture. This can be done using a drying oven or by air-drying them.
8. **Final product**: The resulting briquettes can be used as a sustainable energy source for cooking, heating, or other applications.

4.3.3 CONSIDERATIONS

- **Moisture content:** Ensure the maize cobs are dry enough to produce good-quality briquettes.
- **Binder selection:** Choose a suitable binder that is compatible with the maize cobs and the briquetting process.
- **Briquetting machine:** Select a briquetting machine that is designed for biomass briquetting and can handle the moisture content and density of the maize cob mixture.
- **Energy density:** The energy density of the briquettes will depend on the moisture content, density, and composition of the maize cobs.

Machine used when converting Maize Cobs into Briquettes

4.4 CONSTRUCTION AND FABRICATION OF A CASSAVA HARVESTER

The cassava harvester was designed to reduce the labor-intensive process of manual cassava harvesting. It was constructed with durability and efficiency in mind, using readily available materials.

4.4.1 MY PARTICIPATION

I was actively involved in the entire construction process, from planning and designing to testing the harvester. My specific tasks included cutting and shaping the digging blade, assisting in frame assembly, and participating in field testing and adjustments.

4.4.2 MATERIALS USED

- Mild steel plate
- Square pipes
- Angle iron
- Bolts and nuts
- Rubber wheels
- Paint

4.4.3 TOOLS USED

- Welding machine
- Grinder
- Electric drill
- Measuring tape
- Hacksaw

4.4.4 STEPS IN CONSTRUCTION

1. Design and Measurement: I assisted in developing the design plan and marking the dimensions on steel plates and pipes.
2. Fabrication of the Digging Blade: I contributed to cutting and sharpening the blade and welding it to the frame at the correct angle for efficient soil penetration.
3. Construction of the Frame: I helped construct the frame, assemble the wheels, and ensure structural stability.

4. Handle and Lever Mechanism: I worked on assembling the handle and attaching the lever mechanism, including fitting the springs for easy operation.
5. Testing and Adjustment: I participated in testing the harvester in the field, observed its performance, and worked on adjustments to improve its efficiency and root extraction.
6. Finishing: I was part of the painting team to protect the harvester from rust and improve its appearance.

FABRICATED CASSAVA HARVESTER

4.5 CHALLENGES FACED

- Limited access to advanced tools during the construction of equipment.
- Difficulty in sourcing quality materials for fabrications.
- Time-intensive processes in briquette making and biogas production.

4.6 SKILLS ACQUIRED

- Fabrication and assembly of agricultural equipment.
- Hands-on experience in sustainable energy production using biogas and briquettes.
- Knowledge of waste recycling in agriculture.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Throughout this program, I was involved in multiple aspects of the design, fabrication, assembly, and testing of various agricultural machinery.

My hands-on experience with cutting, bolting, coupling, and fabricating metal components provided me with a deep understanding of the mechanical aspects of agricultural machinery. This internship not only enhanced my technical skills but also offered valuable insights into the practical challenges and solutions involved in developing agricultural equipment.

Collaborating with engineers and fellow students fostered a team-oriented environment that reinforced the importance of communication and cooperation in engineering projects. Overall, this experience has equipped me with essential skills and knowledge for my future career in agricultural engineering.

5.2 RECOMMENDATION

5.2.1 FOR THE ORGANIZATION (NCAM)

I recommend that NCAM continue to promote hands-on learning opportunities for interns by providing structured training programs that cover a wide range of topics related to agricultural machinery design and fabrication. This will not only enhance the skills of future interns but also contribute to the development of innovative solutions for the agricultural sector.

5.2.2 FOR ITF

The Industrial Training Fund (ITF) should consider enhancing support for organizations like NCAM to facilitate better training infrastructure. This includes funding for modern equipment and technologies that will help interns gain relevant and up-to-date experience in the field. Regular workshops and seminars can also be organized to bridge the gap between theory and practice.

5.2.3 FOR THE INSTITUTION (KWARA STATE POLYTECHNIC)

The Kwara State Polytechnic should strengthen its collaboration with industries by fostering partnerships that provide students with more internship opportunities. Integrating practical training into the curriculum will prepare students better for real-world challenges and enhance their employability upon graduation. Additionally, hosting guest lectures from industry professionals can provide students with insights into current trends and practices in agricultural engineering.

5.3.4 FOR THE GOVERNMENT

The government should increase its investment in agricultural technology research and development to promote innovation in the sector. By providing grants and incentives to organizations that focus on developing agricultural machinery, the government can encourage the creation of cost-effective and efficient solutions for smallholder farmers. Additionally, establishing policies that support vocational training in agricultural engineering can equip the workforce with the necessary skills to meet the growing demands of the industry.