AN INDUSTRIAL TECHNICAL REPORT

FOR

STUDENTS' WORK EXPERIENCE SCHEME

(SIWES)

UNDERTAKEN AT

NATIONAL CENTER FOR AGRICULTURAL MECHANIZATION (NCAM)

BY

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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.

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.

First and foremost, I would like to express my heartfelt gratitude to my supervisor I worked directly with: **Engr. Adewumi and Engr. Wale**. Their constant guidance, attention, and mentorship throughout the program were invaluable.

My appreciation also goes to my fellow SIWES students, **Daramola and Agboola,** for their unwavering support and camaraderie.

TABLE OF CONTENT

ABSTRACT

The Students' Industrial 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 Engineering and Technology across Nigerian universities. The program spans 12 weeks (i.e Three (3) 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 their theoretical studies.

This technical report is a detailed account of the SIWES program undertaken by Muhammad Abdur-Rahman (Matric Number: 20/30GA042) from the Department of Agricultural and Biosystems Engineering, Faculty of Engineering and Technology, University of 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 and tasks, including the design and development of agricultural machinery such as the Threshing Machine, Groundnut Decorticator, Melon Sheller, and a Shredding Machines. 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.

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:

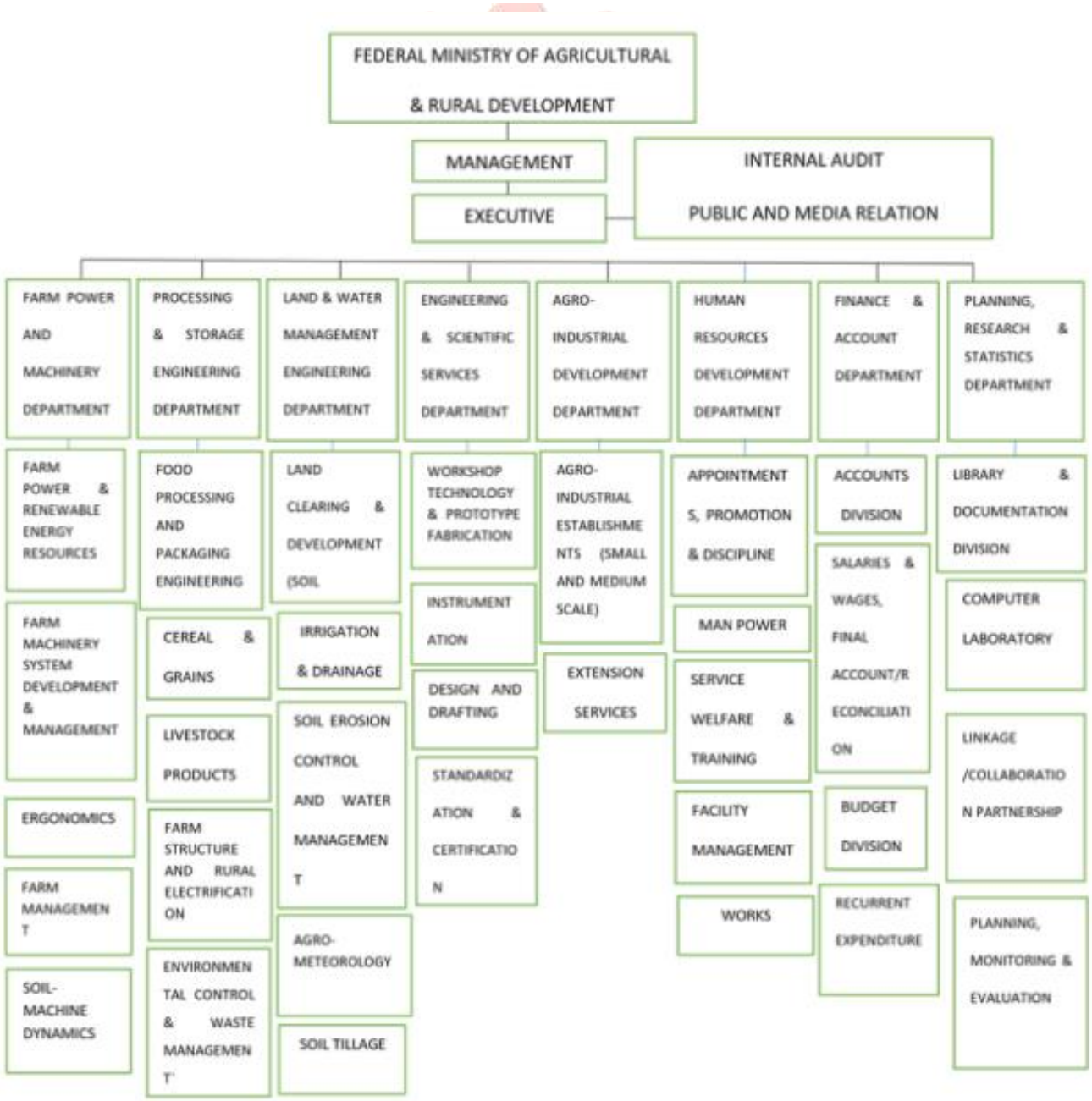

Fig. 2.1: Organizational chart of National Center for Agricultural Mechanization

CHAPTER THREE

ACTIVITIES DURING SIWES PROGRAM AT NCAM

3.1 Introduction

The Student Industrial Work Experience Scheme (SIWES) is designed to provide students with practical knowledge and industrial exposure relevant to their fields of study. During my SIWES program at the National Centre for Agricultural Mechanization (NCAM), I was assigned to the Farm Power Department, where I actively participated in various technical and mechanical operations. This experience provided me with hands-on exposure to agricultural mechanization processes and the use of advanced machinery. The department's primary focus was on designing, fabricating, and maintaining agricultural tools and equipment to enhance farming efficiency.

3.2 Activities Undertaken

Throughout my industrial training, I engaged in several practical activities that enhanced my understanding of agricultural mechanization. These activities included:

- **Briquette Making**: I join them in the briquette making by gathering maize cob. The maize cob are gamified and dried ready for carbonization. We used a carbonizing machine also known as carbonization France so that the maize cobs can be rich carbon through Turmel decomposition. We also took out the already carbonized maize cob for drying using sunlight. We spread them on a concrete surface in order to expose them to sunlight. They are yet to dry completely and dried

- **Welding of Metals**: Welding is a crucial skill in agricultural mechanization, as it is used for assembling and repairing farm equipment. During my training, I was given the opportunity to weld various metal components under supervision. This experience improved my welding skills and helped me understand the importance of proper joint formation, electrode selection, and safety precautions. I learned about different welding techniques, such as arc welding and gas welding, and how each method is applied in different fabrication processes. Handling welding equipment also required adherence to strict safety measures, including wearing protective gear and maintaining proper ventilation.
- **Learning About Agricultural Machinery**: One of the most enlightening aspects of my training was gaining theoretical and practical knowledge about various agricultural machines. These included:
  - ***Rotary Cutter***: This machine is used for cutting grass and shrubs on farms. I learned about its operational mechanism, blade adjustments, and maintenance requirements. Understanding how to handle the rotary cutter safely was essential to prevent accidents and machine damage.

- ***Mower***: A mower is an essential tool for cutting crops and maintaining fields. I observed different types of mowers, including manual and automated versions, and learned how to set blade height for optimal cutting efficiency. Maintenance procedures, such as sharpening blades and lubricating moving parts, were also demonstrated.

Mower

- ***Maize Combine Harvester***: This machine is designed to harvest maize efficiently by combining several harvesting operations, including reaping, threshing, and winnowing. I was introduced to its components, such as the cutting header, threshing drum, and cleaning

sieves. The importance of periodic maintenance, including belt adjustments and grain collection efficiency, was emphasized.

Maize Combine Harvester

- ***Cassava Harvester***: The mechanized harvesting of cassava roots improves productivity compared to manual methods. I learned how cassava harvesters operate, their soil penetration mechanisms, and the importance of depth control to avoid damaging the harvested roots.

- ***Welding Machine***: This machine is a crucial tool for joining metal parts in agricultural equipment fabrication. I practiced using different types of welding machines and understood their applications in manufacturing and repair processes.

Welding Machine

3.3 Skills Acquired

During my time at NCAM, I acquired several essential skills that have contributed to my professional development:

- **Technical Skills**: I gained practical knowledge of metal fabrication and welding techniques, improving my ability to cut, shape, and join metal components accurately.
- **Operational Knowledge**: My understanding of agricultural mechanization and machine operations expanded, allowing me to comprehend the functions and maintenance of various agricultural tools.

- **Teamwork and Problem-Solving**: Collaborating with supervisors and colleagues enabled me to develop teamwork and problem-solving skills, as we worked together to address technical challenges.
- **Safety Awareness**: I learned the importance of adhering to safety measures in a mechanical environment, including the proper handling of equipment, the use of protective gear, and fire safety protocols in welding operations.

CHAPTER FOUR

CHALLENGES AND SOLUTIONS

4.1 Challenges Faced

While my SIWES experience was enriching, I encountered several challenges that required adaptation and perseverance:

- **Lack of Prior Experience**: As a first-time participant in industrial work, I initially found it challenging to adapt to the practical aspects of metal fabrication and welding. Many of the tasks required precision and attention to detail, which took time to master. I had to familiarize myself with the tools and techniques involved in welding and metalwork, which was initially overwhelming.
- **Handling Heavy Machinery**: Operating and understanding the functions of agricultural machines required guidance and patience. Some of the machines, such as the maize combine harvester and cassava harvester, involved complex mechanisms that were difficult to grasp at first. Proper handling of these machines was essential to prevent accidents and ensure efficiency.
- **Technical Difficulties**: Some equipment required advanced knowledge, which took time to understand fully. For instance, learning how to set up and operate the welding machine involved several steps, including adjusting the voltage, selecting the appropriate electrode, and ensuring a steady hand during welding.
- **Environmental and Safety Concerns**: Exposure to welding fumes, metalwork hazards, and machine-related risks posed health and safety challenges. Working in a mechanical

environment required strict adherence to safety protocols, such as wearing protective gear, maintaining proper ventilation, and handling tools carefully to avoid injuries.

4.2 Solutions and Adaptation

To overcome these challenges, I implemented the following strategies:

- **Continuous Learning and Practice**: I paid close attention during training sessions and actively practiced welding and metal fabrication techniques under supervision. By repeatedly engaging in these tasks, I gradually improved my confidence and skill level.
- **Seeking Guidance from Supervisors**: I sought clarification from experienced supervisors and colleagues whenever I encountered difficulties. Their guidance helped me understand the correct procedures for handling machinery and performing technical tasks effectively.
- **Adhering to Safety Protocols**: I prioritized safety by consistently using protective gear, such as welding helmets, gloves, and safety boots. I also ensured that I worked in well-ventilated areas to minimize exposure to harmful fumes during welding operations.
- **Collaborating with Peers**: Engaging in teamwork and collaborative problem-solving allowed me to learn from my colleagues and share ideas on improving efficiency in various tasks. By working together, we were able to address challenges and complete assignments effectively.

By overcoming these challenges, I was able to fully immerse myself in the learning process and gain valuable hands-on experience that will be beneficial in my academic and professional journey.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS, AND SUGGESTIONS

5.1 Conclusion

My SIWES program at NCAM provided invaluable hands-on experience in agricultural mechanization. The training allowed me to bridge the gap between theoretical classroom knowledge and practical industrial applications. Through my participation in welding, metal fabrication, and machine operations, I developed technical skills that will be beneficial in my academic and professional journey.

5.2 Recommendations

Based on my experience, I recommend the following:

- **Enhanced Practical Training**: More hands-on training should be integrated into the academic curriculum to prepare students for industrial exposure.
- **Better Equipment Accessibility**: Institutions should provide access to modern machinery to facilitate learning before students proceed for SIWES.
- **More Supervision and Guidance**: Companies should assign mentors to guide students through technical processes effectively.
- **Safety Training Sessions**: Regular safety briefings should be conducted to ensure students are well-prepared for industrial hazards.

5.3 Suggestions for Future Participants

For future SIWES participants, I suggest:

- Developing an interest in practical work before commencing industrial training.
- Actively seeking guidance and learning opportunities from supervisors.
- Prioritizing safety by using protective gear at all times.
- Embracing teamwork and collaboration to enhance problem-solving skills.

With these insights, future SIWES students can maximize their learning experience and effectively contribute to industrial growth.