



RESOURCE EFFICIENCY THROUGH MATERIAL FLOW COST ACCOUNTING IN WHEAT PRODUCTION

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ABSTRACT

This study investigated the resource efficiency through material flow accounting in a wheat farm production processes, the material flow cost accounting (MFCA) model was used in the case of the Bagwai wheat farm to highlight inefficient at each phases of wheat production process stages starting from the planting, harvest and post harvest stages of wheat cultivation for the farm manager to identify opportunities for corrective action. Consequently, we found that the implementation of the material flow cost accounting (MFCA) model identified that the bulk of wastes come from the harvesting and post-harvesting stages. Wastes that were created at the cultivation stage results from wasted seed because of planting technicalities from the use of abrogated cultivation techniques. At the harvesting stage, wastes result from cutter plane loss, masher unit loss, from separator loss, as well as other factors while during the post-harvest stage, losses arise during transportation, bagging and converting wastes. Thus, we suggested that during planting/cultivation the farmer should use the abrogate cultivation methods for the planting of the wheat seed as to reduce the dropping of seeds at the wrong place, during the harvesting phase to reduce waste generated at this stage the use of traditional method for harvesting and winnowing should be discouraged and the use of a thresher machine introduce and at the post harvest phase waste due to leakage of wheat grain resulting from damaged bags this occur due to bad sack, leakage of the sack, damage sack during transportation and poor quality of rope use in closing the mouth of the sacks. Findings reveal that the inability of the conventional accounting system in accurately capturing waste information in quantity and value limits the farm manager's ability to recognize cost-saving opportunities and commit to environmental responsibility. This paper extended the implementation of the MFCA by providing an example of how the managerial accounting system can support environmental and economic sustainability in wheat production processes. Thus, we reiterate that one way of effectively waste reduction, waste management and sound cost reduction decision is to appropriately capture the volume of waste generated in quantity and value at each wheat production process stages to improve its efficiency. This study adopted a mixed-method research method, the researcher collects and analyses data, and drawing inferences from findings obtained from both qualitative and quantitative methods. The researcher employed in-depth interviews as the primary data collection and used the Umberto Efficiency+ software to analyse the raw data collected at the various levels of the operational process.

KEYWORDS: Material Flow Cost Accounting; Current Accounting System; Waste Information ; Environmental Management System; Material Flow Transparency; Material Usage Efficiency

1.0 INTRODUCTION

Evidence shows that most managers are unaware of costs connected with their operations (Maji, Saudi, & Yusuf, 2023; Schaltegger, Christ, Wenzig & Burritt, 2022). Despite the shortfalls, innovative management accounting tools have evolved over the years to improve the limitations of the existing accounting system gradually. These management accounting tools include stream mapping, activity-based costing, product life-cycle based costing, target costing (Nartey & vander Poll, 2021; Kaur, Patsavellas, Haddad & Salonitis, 2023; Silvestri, Silvestri, Piccarozzi & Ruggieri, 2024). The various management accounting tools have proven to be effective; nonetheless, they have their shortcomings as well because of the lack of transparency about resource flows and the corresponding costs reduces the chance to reduce material wastage and opportunities for cost reduction in the decision-making process (Alakkas, Shabir, Alhumoudi, Boukhris, Baig & Khan, 2023).

In this study, our focus and contribution center on examining the current accounting system of wheat farm in Nigeria. Examines how the current system captures waste information and supports decision-making. Besides, it



implements the MFCA model on the wheat farm production process stages to assist management in capturing waste-related information to support decision-making

1.1 The wheat situation

In boosting wheat yield, Nigeria's efforts at using the River Basin Development Authorities (RBDAs) have resulted in limited success because of the failure to address questions of project design and participation and the development of the right technology. Often, planners neglect to incorporate indigenous agricultural systems into modern agricultural development strategies. Wheat farming is exclusive to northern parts of Nigeria because this arid region is suitable for its cultivation. Environmental challenges associated with wheat production in the dry lands have over-shadowed its socio-economic benefits. These environmental challenges include water logging, poor land preparation, levelling, over-irrigation, shallow groundwater, and soil salt content. Other environmental problems associated with wheat production is the waste generated at every level of wheat production (Keikha, Darzi-Naftchali, Motevali & Valipour, 2023).

The wheat plant is "the plant of all plants", cultivated for over 10,000 years (Chen, Wang, Chen, Yang, Zheng, Huang & Fan, 2022). Wheat grows in different climates and used for various products. Wheat is an essential commodity traded around the world (Erenstein, Jaleta, Mottaleb, Sonder, Donovan & Braun, 2022). Wheat is favourable to different climate and soil conditions. However, climate change affects wheat cultivation; thereby reducing wheat productivity (Grosse-Heilmann, Cristiano, Deidda & Viola, 2024) especially in arid regions. Droughts slow down plant growth because it decreases plant's capacity to keep soilmoisture (Naorem, Jayaraman, Dang, Dalal, Sinha, Rao & Patra, 2023).

1.2 Environmental/ Economics impact of wheat production in Nigeria

Wheat production in Nigeria is currently at 100,000 tonnes cultivated on 95,000 hectares yielding an average of 1.05tons/ha(Dambazau, Krishnankutty & Ajitha, 2021).Nigeria is now the second-biggest exporter of the USA wheat. Despite the ban of wheat flour, pasta, pasta and spaghetti importation, Nigeria's wheat importation projection stands at 4.4 million metric tons.

1.3 Background to the Bagwai Wheat Farm

This study was carried out on Bagwai Wheat Farm in Bagwai, Kano State, Nigeria. Its headquarters are in the town of Bagwai occupying an area of 405 km² with a population of 162,847 during the 2006 census. The study area is located in the Chad Basin Development Area. The Chad Basin Development Authority is an institution which helps farmers through the agricultural-extension program and on-site (farm visit) research for increased subsistence farming. The Bagwai Wheat Farm located in this geographical area is a major producer of wheat with about 1,000 hectares of wheat plantation, producing wheat for the surrounding milling companies with a yearly output of about 1,000 metric tons (MT) per annum. The farm had six employees on its record when the researcher visited.

1.4 Bagwai wheat farm production process

The farm wheat process at the Bagwai wheat Farm described by the farm owner is listed below:

1.4.1 Seed treatment

Establishing sufficient crop stands is a precondition for a thriving wheat crop; therefore, seed treatment is an essential step in achieving these outcomes. Proper seed treatment is crucial for achieving high germination rates, a strong crop stand, and ultimately, optimal yields. Using the right pesticide during treatment can help improve germination by preventing or reducing pest infestations. Typically, the standard practice involves applying Apron Star 50DS at a rate of 10 grams per 4 to 6 kilograms of seeds.

1.4.2 Land preparation

The land preparation for wheat largely depends on the field's previous cropping history. Since wheat is a dry season crop, preparation typically starts in early November after the last rain-fed crops have been harvested. The field should be ploughed and harrowed to achieve an appropriate tilt. In Nigeria, where wheat is irrigated by gravity, ridging is generally unnecessary, as a level slope is essential for effective water movement.

1.4.3 Seed sowing: broadcasting, drilling and dibbling

Sowing technique employed by farmers is defined by available farm technologies instead of the anticipated yield. The wheat crop can be drilled, dibbled or broadcast (Fu, Yan, Wang, Jiang, Tian, Wu, & Zhang, 2024). However, broadcasting reduces plant formation because seeds can be lost to parasites and adverse weather conditions. Seed broadcasting is justified to compensate for the high seed loss rates. Drilling of wheat seed during planting has an increased germination rate, resulting in positively higher stands in contrast to the broadcasting technique (Zawar,



Yonas, Akba & Ahmad.2024). In Nigeria, the majority of the farmers prefer the broadcasting technique when planting wheat seeds and the Bagwai wheat Farm is not exempted from using this technique to plant wheat on its farm.

1.4.4 Fertilizer application

Fertilisers are the primary source of farming waste since they contain nutritive minerals like the NPK that makes seeds grow faster with increased yields. Nevertheless, when NPK is freedding the atmosphere (for example, being spreads by rainfall, it ends up in rivers and lakes) resulting in eutrophication and the abnormal enrichment in nutrients like carbon, phosphorus, and nitrogen. Wheat responds well to NPK fertiliser application.

1.4.5 Weed control and pest control

Understanding the dominant weed species on a farm is essential for effective herbicide application in weed management. Although the timing of wheat cultivation typically avoids the peak period of weed interference, delays in sowing can increase the risk of infestations by aphids and stem borers. Additionally, the crop is susceptible to attacks from rodents, birds, and insect pests such as crickets, harvester ants, and termites. In Bagwai wheat farms, losses due to pests and diseases can range between 30% and 35% annually.

1.4.6 Water management

In Nigeria, the production of commercial wheat relies entirely on irrigation. Water stress during the flowering stage can reduce both the number and weight of grains, thereby diminishing overall yield. According to the National Agricultural Extension and Research Liaison Services at ABU (Extension Bulletin No. 62), irrigation should be halted two weeks before harvest.

1.4.7 Harvesting

As soon as the wheat grain is primed for harvest, the wheat grain heads will begin to bend over the stalks because of the when the kernels reach full weight and display a golden hue—at about 10–12% moisture—it signals that it's time to harvest. Typically, wheat planted in mid-November is ready for harvest by April, as the grain usually takes around 110 to 130 days to mature.

Processing: Traditional method

The Bagwai Farm uses the traditional method for harvesting its wheat. The process begins with harvesting, followed by threshing and winnowing. Next, the grain undergoes de-stoning, where stones and other foreign materials are removed. This is followed by a water cleaning step to eliminate adhering soils, then draining. Afterward, the grains are de-hulled using a mortar, and a subsequent winnowing removes the bran. The de-hulled grains are then washed, sun-dried, and finally milled.

1.4.8 Utilisation

A considerable amount of wheat is starch. Wheat starch is commercially relevant, though it has a less monetary value to wheat gluten. Gluten and the starch are the significant parts of wheat grain. These can be separated through a blend of flour and water to produce a little ball of bread, lightly kneaded and cleaned in a container of water.

2.0 REVIEW OF LITERATURE

2.1 Conceptual Review

2.1.1 Environmental management accounting (EMA)

Financial information flows through business organisations and accumulated by those organisations. The role of accounting is to collate information, organise it in a meaningful way, and then share it among those who will make use of it to make decisions. Decisions prompt actions that, in turn, yield outcomes. These outcomes are then fed back into the accounting system, creating a continuous feedback loop (Martinez-Valencia, Garcia-Perez & Wolcott, 2021). Considering the varied information needs of different decision-makers, it's essential that financial data be presented in multiple formats. Traditional accounting systems often lack the transparency required to closely monitor the rising material and overhead costs in manufacturing. This shortcoming in capturing detailed waste information makes it challenging for organizations to maintain accurate waste records and to access both physical and cost-related waste data essential for better decision-making.

EMA identifies and makes resources used visible to management. It is a system of accounting designed to record the benefits and costs of environmental activities of an organisation. EMA is a guideline that measures materials and energy flow, thereby revealing organisations' environmental management actions.



2.1.2 Material Flow Cost Accounting (MFCA)-ISO 14051

ISO 14051 guides businesses on the universal application of the MFCA model. Recent developments have challenged businesses to seek ways to enhance efficiency through waste reduction (Broccardo, Zicari, Jabeen & Bhatti. 2023). MFCA- ISO 14051, was developed to assist in improving resource efficiency (Dekamin & Kheiralipour. 2023). Besides, ISO 14051 is a standard to guide organisations who are willing to adopt the MFCA model (Dekamin & Kheiralipour. 2023). ISO14051 affords reliability and credibility to the MFCA model. The MFCA model focuses on the proper evaluation of costs related to wastefulness or material damage and considers such waste or emissions the same way as products (Kokubu, Kitada, Nishitani, & Shinohara. 2023) Thus, it is need fulfilment management can implement the MFCA model to achieve manufacturing efficiency through accurate recording of waste data for enhanced waste-reduction decisions (Kuo., Peng & Kuo. 2024). Besides, the MFCA model tracks and classifies material inputs either as a product or non-product output, there by guaranteeing the transparency of available information in the wheat production processing stages.

2.1.3 Waste management systems

Waste management activities entail the collection, transportation, treatment, recycling, and disposal of waste (Khan, Anjum, Raza, , Bazai & Ihtisham. 2022). The waste management challenge is global, and for this reason, it requires an analysis of problem areas about the quantity of waste produced. Most often, improper waste storage poses an environmental threat to humanity due to the increasing unscientific and unhealthy approaches to the disposal of waste daily. The waste management hierarchy stipulates the priority order for waste management preferences (Abubakar, IManiruzzaman, Dano, AlShihri, , AlShammari, Ahmed & Alrawaf, 2022). Consequently, the Integrated Sustainable Waste Management (ISWM) model is a useful tool to allow for the realisation of the targets in the waste hierarchy (Ferreira, Dijkstra, Scholten & Sucozhañay. 2022). Nevertheless, waste management methods range from the prevention and reduction to its direct disposal at landfill sites; thus, the waste management hierarchy is fundamental to the waste management activities of an organisation (Ugrinov, Nikolić & Alivojvodić. 2024). In short, managers may prefer a waste management practice that allows cost savings and increased profitability. There is a need for organisations to adhere to environmental laws and regulations to harness their future benefits, cost savings and increased profitability (Adebayo, Paul, & Eyo-Udo 2024) the lack of resource data transparency limits the chance to reduce material wastage and opportunities for cost reduction in the decision-making process (Torkayesh, Rajaeifar, Rostom, Malmir, Yazdani, Suh & Heidrich. 2022).

2.1.4 Waste management at the Bagwai wheat Farm

The Bagwai Farm does not commit to environmental responsibility. It lacks the proper discharge of farms wastes at every stage of the farm process. Besides, the bulk of wastes come from the harvesting and post-harvesting stages. Nevertheless, wastes that were created at the cultivation stage results from wasted seed because of planting technicalities from the use of abrogated cultivation techniques. At the harvesting stage, wastes result from cutter plane loss, masher unit loss, from separator loss, as well as other factors. During the post-harvest stage, losses arise during transportation, winnowing and converting wastes, respectively. On waste occurring at the various stages, investing in suitable storage and processing facilities, post-harvesting and wheat cleaning equipment will help reduce wheat waste. Finally, to effectively manage wheat waste, there is a need to regularly draw farmers' attention to the benefits of efficient wheat farming, especially during harvesting and post-harvesting.

2.2 Theoretical Framework

The contingency theory is often used in strategic management and management accounting-based research, (Dasanayaka, Gunarathne, Murphy & Nagirikandalage.2022; Rehman, Elrehail, Nair, Bhatti, & Taamneh, 2023). The contingency theory advocates that the interplay between an organisation's operational procedures and external stakeholders have an impact on its performance. That is, an organisation with cross-functional integration may benefit from supply chain integration (SCI) with customers and suppliers for improved operational efficiency (Feng, Qamruzzaman, Sharmin & Karim, 2024; Rusli, Masnia, Usman & Mediaty, 2024). Therefore, contingency theory attempts to review the conventional accounting systems that complied with the various circumstances towards the design of each organisation's management accounting systems tailored by contingent variables for better operational performance in a wheat farm to achieve wastage reduction and enhance transparency in information generated for effective decision making. The contingent variables include size, environmental uncertainty, manufacturing technology, corporate strategy, organisational culture, and market climate (Alsharari & Aljohani, 2024; Abu-Allan & Alghizzawi. 2024).

3.0 METHODOLOGY

We did a case study and implemented the MFCA model to highlight waste generated areas within the wheat production processing stages. We also sought to understand whether the use of the existing conventional accounting system by the Bagwai wheat farm was sufficient in capturing the volume and monetary value of



waste generated during the wheat production process to improve waste management and cost reduction decisions. The case study approach could aid the generalization from individual cases in a logical way (Younas, & Durante, 2023) . Moreover, we utilized the case study approach to incorporate participants' views as it is often used in management accounting research to provide an understanding of practices appropriate for the context being investigated . Direct observation was expedient for this study because it provided insight into the everyday activities that participants in the study do not report. For this study, Umberto Efficiency+ software was used.

4.0 RESULTS AND DISCUSSION

4.1 Presentation of Results

Data collection for this study started with an in-depth interview, direct observation, and the use of physical artifacts (which is the use of the Umberto Efficiency+ software) as the primary data collection method. In a case study design, direct observation is often employed. The Umberto Efficiency+ software was designed by ifu Hamburg GmbH (Hamburg, Germany). It is an MFCA tool and instrument used to identify and calculate the real cost of process waste and material losses, and identifies cost drivers for processes, material, and energy within the production system. Umberto Efficiency+ software, through the Sankey diagram captures process cost at every quantity center, and when adequately analyzed, it reveals processes where inefficiency happens; thus, corrective action can be taken to save, reduce, or eliminate resource losses. The green nodes or circles represent the input, the blue cookies represent the quantity center, the yellow circles represent the intermediate goods, and the red nodes or circles represent output ("good" or "negative")



Table 4. 1: QC T1 - Clearing

| Input | | | | | | | Output | | | | | | |
|-------------|--------------------|---------------|-------------|------|----------------------|--------------------|----------|---------------|---------------|-------------|------|--------------------|--------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| Labour-1 | P2: Labourers | Good | 12.00 | Unit | 700.00 Naira/unit | 8,400.00 Naira | AFTCLR | P3: AFTCLR | Good | 45.00 | kg | 486.67 Naira/kg | 21,900.15 Naira |
| Wheat Grain | P1: Seed Treatment | Good | 45.00 | Kg | 300.00 Naira/kg | 13,500.00 Naira | | | | | | | |

Table 4. 2: QC T2 - Planting

| Input | | | | | | | Output | | | | | | |
|-----------------|-------------------|---------------|-------------|------|------------------------|--------------------|----------|---------------|---------------|-------------|------|----------------------|--------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| AFTCLR | P3: AFTCLR | Good | 45.00 | Kg | 486.67 Naira/kg | 21,900.15 Naira | AFTPLT | P7: AFTPLT | Good | 36.00 | kg | 1,646.67 Naira/kg | 59,280.12 Naira |
| Fertiliser-UREA | P5: Fertilizer | Good | 1.00 | Kg | 9,000.00 Naira/kg | 9,000.00 Naira | LDTPM | P6: LDTPM | Material Loss | 9.00 | kg | 1,646.67 Naira/kg | 14,820.03 Naira |
| Fertilizer-NPK | P5: Fertilizer | Good | 4.00 | Kg | 6,800.00 Naira/kg | 27,200.00 Naira | | | | | | | |
| Labour-2 | P4: Labourers | Good | 16.00 | Unit | 1,000.00 Naira/unit | 16,000.00 Naira | | | | | | | |

Table 4. 3: QC T3 - Nurturing

| Input | | | | | | | Output | | | | | | |
|--------------------|------------------|---------------|-------------|------|----------------------|--------------------|------------|----------------|-----------------------|-------------|------|----------------------|--------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| 2-4DO-Herbicide | P8: Herbicide | Good | 5.00 | m3 | 400.00 Naira/m3 | 2,000.00 Naira | Farm Yield | P6: Farm Yield | Reference Flow (Good) | 36.00 | Kg | 1,774.45 Naira/kg | 63,880.20 Naira |
| AFTPLT | P7: AFTPLT | Good | 36.00 | Kg | 1,646.67 Naira/kg | 59,280.12 Naira | | | | | | | |
| Butastar-Herbicide | P8: Herbicide | Good | 2.00 | m3 | 900.00 Naira/m3 | 1,800.00 Naira | | | | | | | |
| Labour-3 | P9: Labourers | Good | 1.00 | Unit | 800.00 Naira/unit | 800.00 Naira | | | | | | | |



Table 4. 4: QC T4 - Wheat harvesting

| Input | | | | | | | Output | | | | | | |
|-------------|------------------|---------------|-------------|------|--------------------|-----------------------|-------------|--------------------|---------------|-------------|------|------------------------|-----------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| FARMYIELD-1 | P2: AFTHARV-1 | Good | 1 600.00 | Kg | 731.01 Naira/kg | 1,169,616.00 Naira | FARMYIELD-1 | P3: FARMYIELD-1 | Good | 1 580.00 | kg | 731.01 Naira/kg | 1,154,995.80 Naira |
| | | | | | | | Labour-4 | P3: FARMYIELD-1 | Good | 30.00 | unit | 1,000.00 Naira/unit | 30,000.00 Naira |
| | | | | | | | LDTMH | P21: LDTMH | Material Loss | 20.00 | kg | 750.00 Naira/kg | 15,000.00 Naira |

Table 4. 5: QC T5 - Winnowing

| Input | | | | | | | Output | | | | | | |
|-------------|--------------------|---------------|-------------|------|--------------------|-----------------------|----------|---------------|---------------|-------------|------|----------------------|-----------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| FARMYIELD-1 | P3: FARMYIELD-1 | Good | 1 580.00 | Kg | 731.01 Naira/kg | 1,154,995.80 Naira | AFTWIN | P4: AFTWIN | Good | 1 580.00 | kg | 729.49 Naira/kg | 1,152,594.20 Naira |
| | | | | | | | Labour-5 | P4: AFTWIN | Good | 8.00 | unit | 300.00 Naira/unit | 2,400.00 Naira |

Table 4. 6: QC T6 - Bagging

| Input | | | | | | | Output | | | | | | |
|----------|---------------|---------------|-------------|------|--------------------|-----------------------|-----------------|--------------------|-----------------------|-------------|---------------|-----------------------------|---------------------|
| Material | Place | Material Type | Coefficient | Unit | Price | Value | Material | Place | Material Type | Coefficient | Unit | Price | Value |
| AFTWIN | P4: AFTWIN | Good | 1 580.00 | Kg | 729.49 Naira/kg | 1,152,594.20 Naira | Labour-6 | P5: ProcessedWh | Reference Flow (Good) | 2.00 | Unit | 800.00 Naira/unit | 1,600.00 USD |
| | | | | | | | Processed Wheat | P5: ProcessedWh | Reference Flow (Good) | 1 578.00 | Kg | 722.11 Naira/kg | 1,139,489.58 USD |
| | | | | | | | Rope | P5: ProcessedWh | Reference Flow (Good) | 2.00 | M | 75.00 Naira/m | 150.00 USD |
| | | | | | | | Sack | P5: ProcessedWh | Reference Flow (Good) | 31.56 | Unit | 120.00 Naira/unit | 3,787.20 USD |
| | | | | | | | S-Tablet | P5: ProcessedWh | Reference Flow (Good) | 1 578.00 | Kg | 0.80 Naira/kg | 1,262.40 USD |
| | | | | | | | Transportation | P5: ProcessedWh | Reference Flow (Good) | 1 578.00 | metric ton*km | 4.00 Naira/metric ton*km | 6,312.00 USD |
| | | | | | | | LDTMB | P5: ProcessedWh | Material Loss | 2.00 | Kg | 729.49 Naira/kg | 1,458.98 USD |

A graphical representation is depicted in figure 1. This presented the researcher with a chance to directly observe how wheat seeds are planted and harvested then the document finding by asking questions during the tour. We information participants of their ethical rights during the in depth interview and that they could decline to answer if they were uncomfortable with it.

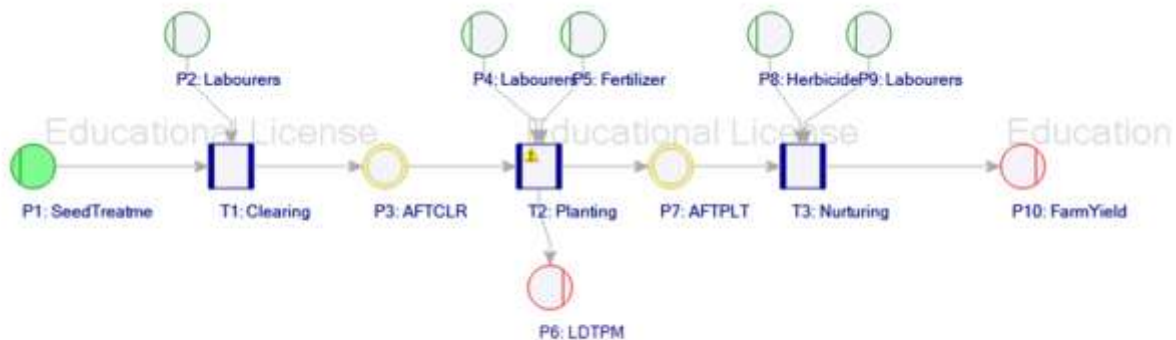
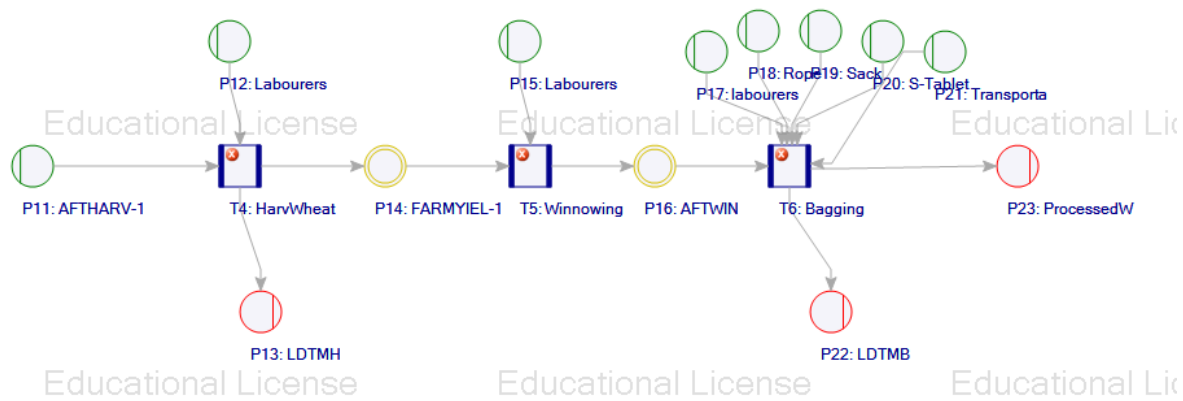


Figure 1: Sankey diagram depicting the Bagwai's farming process

Source: Author's description of the Bagwai's farming process

Figure 2: Sankey diagram depicting the Bagwai's post farming process



Source: Author's description of the Bagwai's post farming proceed

Figure 2 represents the total flow at BagwaiFarm from the planting stage to the harvest stage and the bagging stage. The green circle represents the input, the blue cookies represent the quantity centre, and the yellow circle represents the intermediate goods while the red circle represent output (good or negative). Also, Figure 1 highlights the main stages in the production of wheat (planting and harvest) existing at the Bagwai wheat Farm. Figure 1 shows the planting stage where T1 to T3 (where T1= quantity centre 1 is clearing, T2 = quantity centre 2 is planting and T3= quantity centre 3 for nurturing). Figure 2 represents the harvesting stage where T4 to T6 (where T4= quantity centre 4 is the harvested yield, T5 = quantity centre 5 is for winnowing and T6 = quantity centre 6 is for the bagging). After data collection, the researcher used the *Umberto Efficiency+* software to calculate process information.

4.2 Discussion

Cost Tables

The results of the analyses are presented in Tables 1–6. The following coloration depicts the different phases of the wheat production processes. The green color represents input material, and other resources (good) used at each phase. The orange color depicts the intermediate output, while the red color represents inefficiency or waste (negative). The light blue color represents the final salable output.

Table 4.1 represents the QC T1 (Clearing process) in the planting stage shows the quantity and the monetary value of the different input at quantity centre T1. It includes 45kg of wheat seeds at N486.67/kg, 12 labourers at



₦700 per labourer, seed treatment of 45kg at ₦300/kg. It shows the total output from this process represented as AFTCLR and transferred to the next process stage known as planting.

Table 4.2 shows that the second stage of the planting process is planting. The output of QC T1 becomes the input of QC2 because it is a process. In this quantity centre, the inputs are 45kg of AFTCLR at ₦486.67/kg. Besides, fertiliser UREA of 1kg at ₦9000/kg, NPK of 4kg at ₦6,800/kg and 16 labourers at ₦1000 per labourer.

Table 4.3 shows the third stage of the planting process called nurturing. The output of QC T2 becomes the input of QC T3 because it is a process. In quantity centre T3, the farmer used 36kg of AFTPLT at ₦1, 646.67/kg.

Table 4.4 shows the fourth stage of the harvesting process is called the harvest wheat. The output of QC T3 becomes the input of QCT4 because it is a process. At this quantity centre, the inputs are 1,580/kg of farm yield at ₦731.01/kg and 30 labourers at ₦1000 per labourer. The total output from this quantity centre is 1600/kg of 'good' product at ₦731.01/kg represented as AFHARV in Table 4.4.

Table 4.5 shows the fifth stage of the harvesting process called the winnowing. The output of QC T4 becomes the input of QC T5 because it is a process. At this quantity centre, the inputs are 1,580/kg of Farm yield-1 at ₦731.01/kg and eight labourers at ₦300 per labourer. The total output from this quantity centre is 1580/kg of 'good' product at ₦729.49/kg represented as AFWIN in Table 1.5. This material becomes an input to the next process known as bagging.

Table 4.6 shows the sixth stage of the harvesting process called the bagging. The output of QC T5 becomes the input of QC T6 because it is a process. At this quantity centre, the inputs are 1,580/kg of AFTWIN at ₦729.49/kg, also two (2)labourers at ₦800/per labourer, two (2)rope at ₦75, sack 31.56 pieces at ₦120/per sack, 'S-tablet' 1578 at 80 koboper tablet and transportation 1578/metric ton at ₦4/per metric ton. The total output from this quantity centre is 1578/kg of 'good' production at ₦722.11/kg represented as processed wheat in Table 4.6.

5.0 CONCLUSION AND RECOMMENDATION

Bagwai wheat farm have an obligation to decrease its effects on the environment by lessening their waste production for improved sustainable business performance. The accounting function needs to be strengthened to supply sufficient and accurate waste information so that farm managers can make informed and suitable waste-reduction decisions. Findings showed that the general lack of a specified waste accounting technique like the MFCA model used to capture production waste information in Bagwai wheat farm. Though the waste information gathering challenge might not be that peculiar to the examined cases; it could have characteristics shared by other wheat farms. The current accounting systems of Bagwai wheat Farm is insufficient to capture waste and the related cost information. A more specific waste capturing system is needed to make visible the actual waste and corresponding costs to support the manager's decision-making

This paper has shown that extending the implementation of the MFCA model on a wheat production process is potentially achievable to reduce overall waste generation. While this study focused on Bagwai wheat Farm , the results may still be generalised to the other wheat farm. Finally, findings from this study highlighted the possible benefits of having access to waste cost information to improve waste-reduction decisions within the wheat farm.

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