



FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

**DESIGN AND CONSTRUCTION OF A MOBILE PADDY COLLECTION
AND BAGGING MACHINE**

BY

WERE SADIKI

REG NO. BU/UP/2014/214

E-MAIL: weeresadiki@gmail.com

TEL: 0772797229



A final year project is submitted to the department of chemical and process engineering in partial fulfillment of the requirement for the award of the bachelor's degree.

ABSTRACT

This project report describes the design, construction and fabrication of a mobile paddy collecting bagging machine which is engine driven. The reason of developing the design and construction paddy collecting and bagging machine is to enable us reduce expenses on labor in paddy collecting and bagging, proneness of paddy due to un predictable weather changes and fatigue faced in the current methods. Mobile paddy rice collector and bagging consist of the main shaft, together with the screw conveyors and the driver roller/ pulley for the elevator is lowered just a few millimeters from the concrete flow. As the main shaft rotates, it rotates together with its components, the screw conveyors collect, convey and heap the paddy on to the moving buckets of the elevator inclined at an angle. The buckets dig through the heap, scoop and convey the paddy within the elevator carcass to the discharge hood where bagging takes place. Also, in the operation of the machine, the brushes setup sweeps the un-conveyed paddy towards the screw conveyor to avoid losses. The performance tests carried out on the developed machine showed an efficiency of 70.7% and an actual throughput of 6T/hr at a speed of 2 m/s. design and construct a low-cost mobile paddy bagging and collecting machine from locally available material for medium and large-scale paddy producers and millers can be affordable.

DECLARATION.

This piece of work in this project report is entirely and absolutely the results of my personal struggles and tremendous work done during this period and has not been submitted anywhere else by any other person.

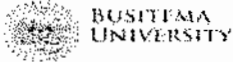
NAME: WERE SADIKI

REG. NO.: BU/UP/2014/214

SIGNATURE.....

DATE:15/05/2019.....





BUSITAMA
UNIVERSITY

APPROVAL

This project is submitted to the department of chemical and process Engineering for examination with approval of my supervisors and the contents are satisfactory for the award of the degree.

Supervisor.

Mr. Menya James

Signature:

Date: .../...../.....

ACKNOWLEDGEMENT

My greatest appreciation goes to the Only Wise, Gracious and Merciful God for being my Pillar through thick and thin of this study. He is faithful indeed!

Well acknowledged is my Sagacious and Scholarly Supervisor whom despite his tight schedules never failed to give me all the needed attention required to successfully complete of this research work.

I am heartily grateful to my amiable family for standing by me prayerfully, financially and morally to ensure that my aspiration is realized. May God reward you all for being so supportive even in the midst of challenges.

My thanks to the entire staff of the Department of Chemical and Process Engineering, Busitema University for providing me with the enabling environment suitable for research work of this kind.

With deep friendliness, I am thankful to my friends, colleagues and associates: mugabi Henry Gonansa Gerisom and Odikolo Robert for their patience and understanding, the motivators and catalyst who never relented to ensure that I give-in my best to my study.

Table of Contents

1	CHAPTER ONE: INTRODUCTION.....	1
1.1	Background.....	1
1.2	Problem statement.....	2
1.3	Justification.....	2
1.4	Objectives of the research.....	2
1.4.1	Main objective.....	2
1.4.2	Specific objective.....	2
1.4.3	Significance.....	2
1.5	Scope of the study.....	3
2	CHAPTER TWO: LITERATURE REVIEW.....	4
2.1	Paddy rice production in Uganda.....	4
2.1.1	Medium and Large-scale paddy producers and processors in Uganda.....	4
2.2	Physical and mechanical properties of paddy.....	4
2.3	Post-harvest operations in paddy value addition chain.....	5
2.3.1	Threshing.....	5
2.4	Drying, collection and bagging of paddy.....	6
2.4.1	Methods of drying paddy.....	7
2.5	Collection and bagging techniques of paddy.....	9
2.5.1	Types of collection and bagging.....	9
2.6	The existing methods on grain collection and bagging.....	11
2.6.1	Major challenges of the existing methods.....	13
2.7	The paddy collection and bagging machine design.....	14
2.7.1	Design Analysis of solid Shafts.....	14
2.7.2	Bearing Selection.....	17
2.7.3	Design analysis of chain and sprocket driving mechanism.....	17
2.8	Review of project financial analysis techniques.....	18
2.8.1	Payback period.....	18
2.8.2	Return on investment.....	19
2.8.3	Net present value (NPV).....	19
2.8.4	Life cycle costing.....	20
3	CHAPTER THREE: METHODOLOGY.....	21
3.1	Design Considerations.....	21



3.2	Machine description and mode of operation of the machine.	21
3.2.1	Machine description.....	21
3.2.2	Mode of operation.....	22
3.3	Design of the machine and sizing of components.....	23
3.3.1	Design of the screw conveyor.....	23
3.3.2	Determination of the power required to drive the conveyors.	24
3.3.3	Designing for the required driving force F of the screw conveyor.....	24
3.3.4	Design analysis of the shaft.	25
3.3.5	Driving mechanism.....	26
3.3.6	The belt	27
3.3.7	Design of the paddy elevator.	29
3.3.8	Design for the minimum force required for discharge of the material at the discharge hood.	30
3.4	Fabrication of the paddy collection and bagging machine.....	30
3.4.1	Material Selection Criteria.....	30
3.4.2	Fabrication Methods and Processes to be used.....	31
4	CHAPTER FOUR: RESULTS AND DISCUSSION.....	34
4.1	DESIGN CALCULATIONS FOR THE MACHINE COMPONENTS.....	34
4.1.1	The pitch of the screw conveyor on the shaft.	34
4.1.2	Determination of the power required to drive the conveyors.	35
4.1.3	Designing for the required driving force F of the screw conveyor.....	35
4.2	FABRICATION AND ASSEMBLY OF MACHINE COMPONENTS.....	44
4.3	Performance evaluation of the machine.....	45
4.3.1	The bagging efficiency.	46
4.3.2	Mechanical damage rate.	46
4.3.3	Economic evaluation of the machine.....	47
5	CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS.....	48
5.1	Conclusions.....	48
5.2	Recommendations for further improvements.....	48
	References.....	49
6	APPENDIX	51
6.1	APPENDIX A: working drawings of different components.....	51
6.2	Appendix A-1: Showing the orthographic view of the frame.....	51

List of Tables

Table 2.1 shows the mean values of the physical properties of paddy at 13-15% moisture content dry base	5
Table 2.2 shows the recommended values of K_b and K_t for different nature of load on shafts.:. 15	
Table 3.1 material selection criteria.....	32
Table 4.1 Design calculation for the pitch of the screw conveyor.....	34
Table 4.2 Determination of the power required to drive the conveyors.	35
Table 4.3 Designing for the required driving force F of the screw conveyor.....	35
Table 4.4 Driving mechanism.....	36
Table 4.5 V-belt design and selection.....	36
Table 4.6 Belt selection.....	37
Table 4.7 showing torsion and bending moment	38
Table 4.8 procedure and sketches for the fabricated parts.....	44
Table 4.9 performance test results	46
Table 4.10 Mechanical damage rate	46
Table 4.11 Economic evaluation of the machine.....	47

List of Figure

Figure 2. 1: shows paddy staked in the field for drying.....	7
Figure 2. 2: paddy drying on concrete and cement floors.....	9
Figure 2. 3: collecting by sticks and hoes(left), by shovels(middle) and manual bagging(right). 10	
Figure 2. 4: shows the designed machine	12
Figure 2. 5: shows the designed machine	12
Figure 2. 6: Shows the designed machine.....	13
Figure 2. 7: chain and sprocket driving mechanism	17
Figure 3. 1: Conceptual Diagram.....	23
Figure 3. 2: illustrates tension in the belts	28

LIST OF ACRONAMES

UBOS Uganda Beaura of statistics

MT Metric turns

ha hectare

UV ultraviolet light

ROI Rate of return on investment.

NPV Net present value.

1 CHAPTER ONE: INTRODUCTION.

1.1 Background.

Rice (*Oryza sativa L.*) is one of the most important cereals cultivated worldwide, constituting the basic food for large number of human beings, sustaining two-thirds of the world population (Prashant, 2012). Rice is the major source starch, proteins, vitamins and essential minerals in the human health. Uganda's production area is presently 140,000 ha and total annual rice production stands at 140,000 MT of milled rice representing about 70% of the national rice demand estimated to be 200,000 MT (Odokonyero, 2009). Rice post-harvest handling and value addition chain in Uganda involves different unit operations like threshing, drying, collection and bagging, milling and packaging. paddy growing and value addition chain is a very labor-intensive process with various hectic activities including threshing, spreading, collection and bagging of threshed paddy during sun drying on tarpaulins, pavements and concrete floors. They further urged that government (perhaps through partnership with the private sector) needs to facilitate farmers to acquire labor saving farm equipment and tools (Irri, 2013).

In Uganda, drying of paddy in medium and large-scale producers and millers is done by traditional open sun drying with drying mechanisms ranging from spreading the crop thin-layer (2 – 5 cm) on firmed ground, on plastic sheeting (mainly tarpaulin), woven mats. In large scale paddy production units such as those at Olweny, Doho and Kibimba paddy schemes, formal drying on concrete floors is being employed. Due to its cheap access, it continued to be a major drying procedure in Uganda for some time to come (Odogola, 2006).

In the current drying method, collection and bagging of paddy is done manually using collecting sticks and hoes, it is heaped at various points of the drying yards then plastic and wooden shovels are used to tip the paddy into baskets and other containers which are the carried manually and the paddy is tipped into the bags. (Patil, 2016) The method is labor intensive, takes a lot of time, encourages human long exposure to UV light from the sun. It makes the crop prone due to sudden whether changes due to its time-consuming operation. Though sunshine is free of charge, the method is more expensive in terms of labor and time. The purpose of this study is therefore to design and construct a low-cost mobile paddy bagging and collecting machine from locally available material for medium and large-scale paddy producers and millers to bridge the gaps identified above.