DESIGN OF PADDY COLLECTING MACHINE

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Abstract

A simple mobile vacuum engine-driven pneumatic paddy collector made of locally available materials using local manufacturing technology was designed, fabricated, and tested for collecting and bagging of paddy dried on concrete pavement.

The project "Vacuum collector for bagging of paddy" is designed at the aim of time consumption, low man power and with simple vacuum mechanism. ICE farming in the Philippines took a complete turn when modern technologies were introduced which include the adoption of high yielding varieties, application of inorganic fertilizer, better crop pest control, water management, and other improved farming practices.

Paddy is collected in the cylinder at a certain suction pressure by using vacuum. This principle is based on industrial vacuum cleaners. This is a batch type machine and so the suction and collection is done at separate pressures. The paddy can be collected in sack placed in the hooks and need not be holded by the labour. The hose inlet can be attached to the sweeper and the machine can be pushed for suction. After the cylinder is filled the suction is stopped and is collected. There are four wheels attached in the bottom and are rotating type. The wheels also contain lock to make the machine hold on in a particular place.

This can be used in post harvest technology for the collection of paddy in sun drying process. This can also be used for collection of grains similar to paddy.

CHAPTER I INTRODUCTION

The project "Vacuum collector for bagging of paddy" is designed at the aim of time consumption, low man power and with simple vacuum mechanism. ICE farming in the Philippines took a complete turn when modern technologies were introduced which include the adoption of high yielding varieties, application of inorganic fertilizer, better crop pest control, water management, and other improved farming practices.

The immediate adoption of these new technologies was the result of a greater demand to increase production to cope with the fast growing population of Filipinos which was estimated to grow to 103 million by the year 2015 AD. The adoption of improved production technology increases yield and likewise gives birth for new challenges on how to deal or handle tons of wet paddy that need to be dried to maintain good rice quality, storability and high commercial value. Drying is the process that reduces grain moisture content to a level where it is safe for storage. Drying is the most critical operation after harvesting a rice crop. Delays in drying, incomplete drying or ineffective drying reduce grain quality and result in losses.

Drying and storage are related processes and can sometimes be combined in a piece of equipment. Storage of incompletely dried grain with moisture content higher than the acceptable level leads to grain deterioration regardless of storage facility used. In addition, the longer the desired grain storage period, the lower the required grain moisture content must be. Confronted by problems on drying, the government activated various agencies like the Department of Agriculture (DA), National Food Authority (NFA), Philippine Rice Research Institute (PHILRICE),

Philippine Center for Postharvest Development and Mechanization (PHILMECH), and other institutions to take steps to ease the problems. To date with all the postharvest technologies being developed and offered by the government, there are gray areas in the postharvest aspect of drying paddy that should harmonize with the practice of small farmers as well as big rice millers and traders. Several drying technologies were introduced to farmers, big rice millers and traders.

Nowadays every packaging machine is being atomized thus it necessary to develop paddy packaging machine for following reasons.

i. To achieve high efficiency

ii. To reduce the cost

iii. To reduce time consumption

iv. To reduce the mechanisms involved

v. To bring up easy man-handling machine

vi. To achieve portable machine

vii. To reduce fatigue of workers

viii. To reduce the production time

Owing to significant development of sun drying as a socially accepted technology and its possibility of development through mechanization, he also added that continuous efforts have to be undertaken to conduct development studies of local machinery based on the appropriate features of existing commercial machinery from
developed countries and emerging economies.

It is for this reason that this research was undertaken to design, fabricate a pneumatic paddy collector out of local material using locally manufacturing technology and man power that would help farmers, rice traders and millers to contribute to the reduction of losses, save time, labor, and cost of collecting and bagging.

1.1 Industrial collaboration

Bheem Industries is the leading industry for manufacturing of paddy bagging machine. The "Bheem Bagger" is a push type grain collecting machine used for cleaning and collecting cereal crops like paddy, wheat corn, sesame, rape seed etc... and bagging automatically. This machine is compact in structure, easy to be operated with automatic cleaning, ascending and bagging. This machine is highly efficient and can collect up to 6 tons per hour. But the machine designed using vacuum pressure is very simple and efficient. Paddy packing machine using vacuum is an evolution of Bheem bagger.

1.2 Problem statement

The cost of production of rice increasing due to several factors. Small and effective machines are to be developed by which manual labour can be replaced effectively. Also the time required for processing reduces. Production cost can be controlled and reduced by use of machines. Since only 2 persons can work at time which makes slow work progress. 100% effective output result cannot be obtained. Continuous electricity supply is needed.

1.3 Justification

Grains are automatically loaded into a dustpan by pushing the manual grain bagging machine with hands, a hand wheel of a drive assembly is rotated so that a

gear can push a rack to move upwards at first and then move horizontally, and a stop bar on the dustpan is blocked by a left arc baffle and a right arc baffle so that the dustpan can tilt to pour the grains into an opening bag. A simple manually operated grain collector and bagging had the following major components: frame, wheel, long pipe, vertical stand frame (bars), horizontal bars, collector, and bag. Radial flat bladed type base plate, slot bar, sweeping box, bagging area, frame and the conveyance system. Results showed significant differences on the collecting capacity, and noise level. Other parameters such as collecting efficiency, air velocity, augmented cracked grain percentage.

1.4 Objectives

The main objective of this project work is to design and develop a manually operated grain collector that can be easily manufactured locally from available local materials and low cost it will replace the old traditional process. A manually operated grain collector developed with major list of objectives.

- To fabricate and assemble the designed grain collector.
- Grain collector is small machinery for efficient collection of all types of small size grins.
- The machine has a simple construction and is light in weight which makes it easy to handle.
- To minimize manpower and reduce the hard work.
- To minimize the time for collecting.

1.5 Scopes of the project

i. To achieve high efficiency

ii. To reduce the cost

iii. To reduce time consumption

1.6 Advantages
i. Manually operated, no fuel and electricity
ii. Ease of operation
iii. Single user is sufficient
iv. Single time investment and life time validity
v. Reduces the mechanisms involvement

CHAPTER II REVIEW OF LITERATURE

Introduction
In this chapter, we present a collection of published information, materials on paddy collecting machine related areas of research, such as books and journal articles. This review identifies, evaluates and synthesis the relevant literature. It shows how knowledge has developed within the field, highlighting what has already been done, what is generally accepted, what is emerging and what is the current state of the paddy collecting machine.

2.1 Study of paddy collector
Anbarasan.b (2004) stated that the main objective of this study was to design and fabricate a hand operated pedal powered thresher for threshing, separating, and cleaning rice paddies. The major components of the machine include threshing, separation and cleaning units. Threshing operation is achieved by rotational motion of a cylinder fitted with beater spikes above a stationary grid which results in the removal of the paddies from the bulk straws. After being beaten out, the grains fall into the cleaning unit which consists of a sieve that undergoes a reciprocating motion. The machine is simple, less bulky and the ergonomic consideration in the design allows for comfortable use and can easily be operated by either male or female. The designed and fabricated pedal powered paddy thresher fitted with winnowing equipment substantially reduces human drudgery in threshing at an affordable cost and also reduces the time used for threshing operation on small farms. Threshing was efficient for moisture content between 20% and 23%. Total power required by the machine was 84 watts operating at 400 rpm. This power is

produced through human operated pedal mechanism. Performance test revealed that the efficiency of the machine was 92% with a through put of 90 kg per hour.
Clapp. D (2007) designed to reduce this dependency on importation, include decreased consumption which is not a viable option, increasing tariffs on imported rice, increasing the area under current cultivation, increasing productivity and proper post-harvest practices to minimize loss and improve quality. Majority of farmers in Kenya grow rice in small scale, they therefore lack enough capacity to acquire appropriate equipment such as combine harvesters to be used for threshing. They therefore resort to manual means of threshing rice like: smashing ears of rice with hard objects to separate the paddies from the ears or straws, sometimes pedal operated threshing drums are employed in fairly big farms, or even driving trucks or tractors on the un-threshed rice. Manual threshing is tedious, time consuming and above all results in too much post-harvest losses which can be in the range of 1-15%. According to Earth trend, postharvest food loss translates not only to human hunger and financial losses to farmers but also results in tremendous environmental wastes. In Kenya, rice production has remained low both in quantity and quality because of the inefficient production and processing techniques. This research was conducted to determine ways of reducing post-harvest losses and tediousness resulting from traditional methods of rice threshing. The study involved designing of a pedal powered thresher from scrap metals and affordable power transmission element and to make the whole system affordable to the small scale farmers.
Emmanuel. B (2009) before designing the CAD model, it was essential to consider various components necessary for the designing such as; threshing drum size and speed, power required for threshing and frame design. Among the threshing methods, the threshing of grain through impact force at an average speed (350 to 500 rpm) provide minimum seed damage. Therefore, threshing of rice

paddies is based on the principle of impact force generated by beating action of the spikes. The main design considerations for the entire machine include; dried rice paddy suitable for threshing by this machine should have moisture content of 20% to 23% to ease the removal of the paddy grain from the stalk, overall height of the machine to facilitate ease of operation by a rural farmer of average height, overall width and breadth of the machine for purposes of storage space in the rural farmers granaries, weight of the equipment for easy portability during operation on and off farm, the material to be used to be cheap and easily available to peasant farmers and the material should be strong for machine durability and should not rust resistant or if otherwise be painted.The machine has the five main components that have to be designed and be fabricated accurately for its efficient working. These are: the threshing unit, power transmission system, screening unit and a collecting unit.

2.2 Collector profile
Helen Gavanio. F (2006) said that this is a mechanical device specifically designed to efficiently store rotational energy. It smoothens the power output of an energy source. It consists of 4 sprockets and two shafts. The first shafts carry one smaller sprocket and a larger sprocket, the smaller sprocket is connected to the larger sprocket on the bicycle and the larger sprocket transfer motion to the smaller sprocket on the second shaft. The second sprocket on shaft is connected to the sprocket at the drum hence transfer motion to the drum. The second shaft also provides reciprocating motion on the screen which helps in paddy grains agitation. The following design parameters were determined; the size of the shaft to carry the sprocket, the size and type of the bearing, the rotational speed (rpm) of each shaft and the twist angle on the shafts

Johntson. W (2009) designed a simple mobile engine-driven pneumatic paddy collector made of locally available materials using local manufacturing technology was designed, fabricated, and tested for collecting and bagging of paddy dried on concrete pavement. The pneumatic paddy collector had the following major components: radial flat bladed type centrifugal fan, power transmission system, bagging area, frame and the conveyance system. Results showed significant differences on the collecting capacity, noise level, and fuel consumption when rotational speed of the air mover shaft was varied. Other parameters such as collecting efficiency, air velocity, augmented cracked grain percentage, and germination rate were not significantly affected by varying rotational speed of the air mover shaft. The pneumatic paddy collector had a collecting efficiency of 99.33% with a collecting capacity of 2685.00kg/h at maximum rotational speed of centrifugal fan shaft of about 4200rpm. The machine entailed an investment cost of P 62,829.25. The break-even weight of paddy was 510,606.75kg/yr at a collecting cost of 0.11 P/kg of paddy. Utilizing the machine for 400 hours per year generated an income of P 23,887.73. The projected time needed to recover cost of the machine based on 2685kg/h collecting capacity was
2.63 year.
Macmillan ochieng (2014) took a complete turn when modern technologies were introduced which include the adoption of high yielding varieties, application of inorganic fertilizer, better crop pest control, water management, and other improved farming practices. The immediate adoption of these new technologies was the result of a greater demand to increase production to cope with the fast growing population of Filipinos which was estimated to grow to 103 million by the year 2015 AD. The adoption of improved production technology increases yield and likewise gives birth for new challenges on how to deal or handle tons of wet paddy that need to be dried to maintain good rice quality, storability and high

commercial value. Drying is the process that reduces grain moisture content to a level where it is safe for storage. Drying is the most critical operation after harvesting a rice crop. Delays in drying, incomplete drying or ineffective drying reduce grain quality and result in losses. Drying and storage are related processes and can sometimes be combined in a piece of equipment (in- store drying). Storage of incompletely dried grain with moisture content higher than the acceptable level leads to grain deterioration regardless of storage facility used. In addition, the longer the desired grain storage period, the lower the required grain moisture content must be. Confronted by problems on drying, the government activated various agencies like the Department of Agriculture (DA), National Food Authority (NFA), Philippine Rice Research Institute (PHILRICE), Philippine Center for Postharvest Development and Mechanization (PHILMECH), and other institutions to take steps to ease the problems. To date with all the postharvest technologies being developed and offered by the government, there are gray areas in the postharvest aspect of drying paddy that should harmonize with the practice of small farmers as well as big rice millers and traders.

2.3 Performance of paddy collector
Muhammed Swaleh (2016) stated that several drying technologies were introduced to farmers, big rice millers and traders. The rate of return from sun drying operation is high while the rate of return from the best mechanical dryers available in the country is low. Farmers unanimously use sun drying and none adopts mechanical dryers. In the light of this development and present practices, it is obvious that sun drying will stay as one of the technologies in the Philippines. Angeles cited the inappropriateness of imported technologies over the country‟s socio-economic conditions had created awareness of developing our own equipment and machine out of local materials using locally manufacturing

technologies and manpower. Owing to significant development of sun drying as a socially accepted technology and its possibility of development through mechanization, he also added that continuous efforts have to be undertaken to conduct development studies of local machinery based on the appropriate features of existing commercial machinery from developed countries and emerging economies. It is for this reason that this research was undertaken to design, fabricate a pneumatic paddy collector out of local material using locally manufacturing technology and man power that would help farmers, rice traders and millers to contribute to the reduction of losses, save time, labor, and cost of collecting and bagging.
Sharan. K (2014) said that the traditional sundrying method of a paddy is still widely practiced by most farmers. The practice includes hauling of a paddy in bags to the drying area, spreading out the paddy in the drying floor using wide board, then evened and slightly furrowed with wooden rakes. Mixing and turning the paddy are done regularly

to ensure that the paddy is dried evenly. After drying, the paddy is piled using a wooden board. After wards, the paddy is placed into a bag using a metal scoop (Panake). All of the above operations are done manually consuming too much time and effort. Collecting and bagging operation is considered one of the difficult tasks in sundrying. This study was then conceptualized by looking into existing designs of pneumatic conveyor from developed, emerging and developing countries that could replace manual bagging and collecting of paddy on concrete pavement during sundrying. Based on the results, good features of the existing design were considered for adoption, adaptation, and simplification to come up with the prototype machine. Design requirements satisfying local condition were identified. Design data then were based on market information of available parts and components of machine. Based on design requirements and design data, a design drawing was prepared. Fabricated

prototype was subjected to evaluation to determine its operating characteristics. The suction nozzle is an important device in vacuum conveying system. The suction head was flat. A gauge 16 galvanized iron sheet was used in the fabrication of the rectangular suction nozzle head. Downstream portion of the suction nozzle assembly was made of 80 mm Ø PVC pipe. It was provided with a G. I. pipe handle and two 37.5 mm Ø plastic wheels to regulate the suction depth during operation. A 75 mm diameter, 3 m long vinyl wire reinforced flexible hose was used as conveyance line from the suction nozzle assembly to the air-paddy inlet of the cyclone separator. The air outlet at the top of the cyclone separator was connected to the air inlet of the centrifugal fan using 100 mm vinyl wire reinforced flexible hose.

2.4 Collector profile

Anbarasan. B (2004) stated that a cyclone separator was used as air-paddy separator of the machine. The cyclone separator included a 600 mm Ø x 300 mm high cylindrical and 600 x 150 x 900 mm (upper diameter x lower diameter and height) conical truncated housing. The cylindrical housing has a 100 mm Ø axial air outlet at the top, and a 100 x 100 mm tangential air-paddy inlet at the upper wall. The conical-shaped housing was provided with a paddy outlet at the bottom in communication with the inlet of check valve and swing diverter assembly. The cyclone was made of gauge 16 galvanized iron sheets. The cyclone separator was supported by angular bar welded to the main frame and it was installed just above the bagging area of the machine. Check Valve and Paddy Diverter Assembly A swing diverter assembly was used to divert the flow of paddy into two routes for continuous bagging during operation. The assembly was made of 2.3 mm thick mild steel plate, flange bearing attached to the side wall of the valve that supports the 12 mm Ø swing gate shaft, and 15 mm Ø G. I. pipe connected to the 25 x 6 mm

flat bar arm of the swing gate shaft to actuate the swing gate in diverting the flow of paddy during bagging operation. The check valve was made of 2.3 mm thick mild steel plate; the gate was made of rubber and 2.3 mm thick MS plate welded to a 12 mm square bar; the square bar was connected to a level arm made of 6 mm x 25 mm flat bar, 10 mm Ø x 75 mm bolt with nut and 6 mm thick 75 mm Ø circular plate; the lever arm was connected to the round bar of the fabricated cylinder hinges made of G. I. pipe.

Sony Aquino (2009) designed the bagging section below the cyclone separator supports two sacks to be filled with paddy alternately for continuous bagging during operation. It was made of a 2.3 mm thick mild steel plate welded from the top of a channel bar main frame. A framed wire mesh was provided between the flat base part of the bagging section and the prime mover to protect the sack from the moving parts of the prime mover and the power transmission system. A hook welded to the frame wire mesh and the diverter valve was provided to hold the sack during bagging operation. The main frame was fabricated using 75 mm channel bar and 6 x 40 mm angular bar cross members. Upper support frame connected to main frame was made of 6 x 40 mm angular bar. The main frame was provided with two swivel caster rear wheels and two solid rubber front wheels and 32 mm Ø G. I. pipe push handles for mobility. Principles of Operation A 14.20-hp air cooled, four stroke cycle, single cylinder, direct injection high speed diesel engine provides power through the V-belt and pulley transmission system to drive the radial flat bladed centrifugal fan. The centrifugal fan provides suction to collect paddy without passing through the impeller of the fan. Paddy is collected and conveyed by an intake air stream through the suction nozzle and flexible hose where it is drawn to the cyclone separator. When the air-paddy mixture enters the cyclone separator, the paddy is separated from the air; the air is drawn to the inlet of the centrifugal fan while the paddy falls down because of its weight and

centrifugal force which cause it to move outward toward the wall during its downward helical travel. As the paddy approaches the wall, the velocity decreases because of wall friction and the paddy settles into the bottom of the cyclone separator. The check valve attached to the bottom of the cyclone separator prevents the air being sucked into the cyclone other than the suction hose during the start of the operation and unloads the grains from the cyclone separator. The swing diverter assembly at the bottom of the check valve diverts the flow of paddy into two.

2.5 Collector Machines

Sunil Kumar (2004) computed collecting efficiency of the machine at varying rotational speed of centrifugal fan shaft is presented in Table II. Collecting efficiency exhibited by the machine was 98.99, 98.77, 99.33 % at 3800, 4000, 4200 rpm respectively. Parallel to the results obtained in the preceding section regarding the decrease of collecting capacity when operated at 3800 to 4000 rpm, again the same scenario was observed on collecting efficiency of the machine. Consistency in operating the suction nozzle might be the reason of a slight decrease in the collecting efficiency when the machine was operated from 3800 to 4000 rpm. Analysis of variance revealed that the collecting efficiency of the machine was not significant as influenced by rotational speed of air mover shaft. Results of study support the claim of Walinga incorporated that flat suction nozzle was effective and efficient in collecting grain left over the floor of silos that cannot be collected by round suction nozzle.

Terestio (2006) conducted a study to design, fabricate, and evaluate the performance of mobile engine pneumatic paddy collector. It aimed to evaluate the operating characteristic of the machine, evaluate the quality of grain collected in terms of augmented crack grain percentage and germination rate, and perform

simple cost analysis. The machine was tested at varying rotational speed of air mover shaft (T1: 3800rpm, T2: 4000 rpm, T3: 4200 rpm) with three replicates arranged in completely randomized design. Analysis of variance (ANOVA) was used to determine if there were significant differences among means. Duncan"s Multiple Range Test (DMRT) was used to determine which among the means would be significantly different from each other. The mobile engine-driven pneumatic paddy collector had the following major components: power transmission system, air mover, conveyance system, bagging area, and frame. Results of the performance test showed that the mobile engine-driven pneumatic paddy collector had a mean collecting capacity of 2685.00 kg/h when operated at air mover rotational speed of 4200 rpm having a collecting efficiency of 99.33 percent. The noise level produced by the machine significantly increased as the rotational speed of air mover shaft increased. The maximum air velocity at the inlet of the suction nozzle of the machine was 13.05 m/s at 4200 rpm. The fuel consumption of the machine significantly increased from 1.16 to 1.43 L/h from 3800 to 4200 rpm. The average augmented cracked grain percentage ranging from 0.33 to 0.67 % did not differ from each other as affected by varying rotational speed of the air mover. The germination rate was statistically comparable at any rotational speed of air mover shaft. The machine entailed an investment cost of P 62, 829.25; break-even point of 510,606.75 kg/yr (P 56,166.74); annual generated income of P 23, 887.73 at a collecting cost of 0.11 P/kg. The projected time needed to recover cost of the machine based on 2685 kg/h collecting capacity was 2.63 year.

Uday Prasad (2009) designed the process of creating a new product which has to be accepted by the customers. In a broad concept, it is essentially the efficient and effective generation and development of ideas through a process that leads to new product. In a systematic approach, product designers will

conceptualize and evaluate ideas, turning them into tangible inventions and products. The product designer's role is to combine art, science, and technology to create new products so, that the consumers can use. To check the losses of agricultural grain crops in the field, it is needed to measure the amount of grains fall to the ground during harvest by combine. Separating the grains from the soil and collecting them from the ground and in the groove of the land by hand and by holders is a hard work and time consuming to that is not precisely done. Hence the need for a machine to collect the grains in the field has been identified. The development of a growing population increases the need of food day by day. This project aims to design and fabrication of collecting and storing of grains by manually. Main objective behind designing and fabricating the bagging and collecting of grains is to reduce the human effort and also reduce time taken for storing. This project mainly helpful to the former the problems faced by small scale farmers relating with availability of labors and cost of collecting and storing finally It is also capable of reducing time wastage, reduction in breakage of the grains.

Victoeino. T (2014) made the traditional sun drying method of a paddy is still widely practiced by most farmers. The practice includes hauling of a paddy in bags to the drying area, spreading out the paddy in the drying floor using wide board, then evened and slightly furrowed with wooden rakes. Mixing and turning the paddy are done regularly to ensure that the paddy is dried evenly. After drying, the paddy is piled using a wooden board. After wards, the paddy is placed into a bag using a metal scoop (Panake). All of the above operations are done manually consuming too much time and effort. Collecting and bagging operation is considered one of the difficult tasks in sun drying. This study was then conceptualized by looking into existing designs of grain collector good features of the existing design were considered for adoption, adaptation, and simplification to

come up with the prototype. Design requirements satisfying local condition were identified. Design data then were based on market information of available parts and components of grain collector. Based on design requirements and design data, a design drawing was prepared. Fabricated prototype was subjected to evaluation to determine its operating characteristics. Shows the conceptual framework of the study. A review of the literature reveals that, different types of grain collector machines have been successfully used for grain colleting bagging machine. However, most of the studies deal with effect of change in power sources likes electrically operated, engine operated, hydraulically, Pneumatic machines etc. to run a machine and collecting grains. Survey also provides clear idea about the drawbacks of traditional type of grain collector machine and how this machine can overcome from these drawbacks. The benefit of manually mechanically operated systems and without using electric power source is not found in the literature till date. So, came to know there is no machine is used for collecting grains, therefore we develop our model to overcome those problems. The present work explores this possibility by mechanically operated collecting grains without use of electric power. The current work divided into two portion front consists of hopper and back side consists of frame, handle and base plate. The frame is an important part of the collector and it must provide flexibility to withstand all loads and support for remaining parts of the collector. It is made up of mild steel L section having a height 31 mm, width 31mm and thickness 3mm. It consists of 11 L section pieces these L section mild steel pieces are welded. 3 pieces are cut into 550mm length, 4 pieces are cut into 755mm length and 4 pieces are cut into 610mm length. The two rectangular section mild steel are welded to reduce the bending of frame and increase the strength of the frame. The cross section of the rectangular section is 5mm×30mm and cut into 760mm length. At the bottom of frame base plate is fabricated and it is having thickness of 3mm and it is cut into 610mm×550mm

cross section. The main function of the base plate is to takes the overall weight of the bag. The circular handle is made up of mild steel having a diameter of 32mm and 142mm length. There are two handles are welded to a top backside of the frame to move the collector towards grains which is spread over the floor. The lifter is made up of mild steel L section and one hallows circular tube. The L section material cut into 6 pieces, 2 pieces are cut into 1590mm, 2 pieces are cut into 590mm and remaining 2 pieces are cut into300mm. diameter of hallow circular shaft is 50mm, thickness is 3mm and length is 550mm. A solid circular shaft is made up of mild steel having length of 550mm and diameter is 25mm is welded to frame at the bottom. Wheels are attached to both ends of the shafts with the help of bearings and the diameter of wheels is 126mm and thickness is 20mm.

2.6 Suction analysis

Anbarasan.b (2004) fabricated value-added process that involves the construction of machines and structures from various raw materials. The process of fabrication is started in the fabrication shop on the basis of engineering drawings generated in the design process after assessing the capabilities of the shop with respect to metal cutting, foaming, welding and machining. Metal fabrication jobs usually start with shop drawings including precise measurements then move to the fabrication stage and finally to the assembly to the project. The grain collector, mainly consist of six parts. They are as follows, Frame, Bottom plate, Hopper, Lifter, Handle, Wheels. The frame is an important part of the equipment. It must provide flexibility which is equivalent of suspension to give good grip. So, the proposed mode equipment does not consist of any suspensions. It is made up of mild steel L- section having a cross section of 31mm X 31mm. It consists of 4 channels, which are cut into the length, of 610 mm and other 2 Pieces are cut into 550 mm length. And also, it can be arranged according to the need as shown in the

figure. The arranged pieces are welded at the joining section to form the base frame of the equipment. The most traditional frame material, steel, has been used by frame builders for over a century. Many types of steel channels are available and the material is easy to bend and shape. It also offers excellent ride quality, durability and is easily repaired and affordable. And, while there are new steels almost impervious to corrosion, most types can rust if treated carelessly. Hopper is used for the temporary storage of materials, they are designed so that stored material can be dumped are fed to process easily. Hopper specifications include volume capacity, weight capacity, depth or length, width or diameter, height and materials of construction. Most hoppers are made of plastic, metal or composite material. In this project hopper is made of galvanized sheet metal. These are value added steel products which are tough, sturdy, light weight, bright, corrosion resistant and easy to transport. These are usually produced in the thickness range of 0.15mm to 2.0mm and width range of 800mm to 1560mm. The metal sheets are fragile and highly deformable. The steel used is mild steel for forming, which is galvanized to increase the durability of the metal sheets and consequently allowing them to better withstand the weather.

Clapp. D (2007) designed grain collector useful for collecting grains from the floor and a conceptual model was implemented and fabricated successfully. It has considerable potential to greatly increase the efficiency of collecting grain with comparison of other traditional available techniques. The main task now is to promote this technology and have available to users at an affordable price. The grain collector is made up of local components in workshop. This can be sourced at an inexpensive price from local traders. By using local materials, collecting of grains can be achieved. A manual grain bagging machine that collects grains from the concrete pavement floor through the collecting bin and made to fall into the bag placed adjacent to it. This machine has vast application in India due to lack of

electricity and investment for the poor formers. This became the main motivation to fabricate this manual bagging machine. This machine reduces the grain collecting time and labour cost. As the main goal to reduce the usage of electricity we don"t suggest the future scope with motors rather the belt drive mechanism can be designed to reduce the time and mechanical force of labour or operator.

2.7 Collection energy

Helen Gavanio. F (2006) The project "Design and fabrication of automatic pipe cutting machine" was done in SLI at SIDCO. Automatic pipe cutting machine is a device that cuts multiple pieces efficiently and comparatively it reduces the time consumed than that of ordinary cutting operations. They are used in Job and Mass production. This invention relates to pipe cutting machines used for cutting pipe into different lengths based on requirements. The primary object of the invention is to provide an improved machine of the character mentioned which is purely automatic in operation, and one which cuts the pipe in an expeditious and effective manner. This operation is usually performed by hand and is slow and laborious and involves making templates for each pipe diameter, and for each combination of pipe diameters when one of the pipes is smaller than the other. The objective of the present invention is to provide a machine for doing this work quickly and automatically and which may be set to handle pipes of various different diameters. In this project an automatic pipe feeding mechanism and a cutting machine is used. In the pipe feeding mechanism a motor is used to feed the bar. There are four rollers mounted, in-between them the bar is feed. Two rollers shaft is connected with a chain drive and these rollers are driven rollers. The driving arrangement is placed at the bottom of the driven rollers and all the three are connected by means of chain drive. The chain drive and the other end is connected with motor arrangement. As the three drives are connected through chain every roller rotates when the motor is rotated. Thus, pipe is feed with the

help of the rollers. A stopper with proximity sensor is provided at the end to maintain uniform length. Once the rod is fed, using the clamping arrangement the rod is clamped. With the help of the cutting machine attached the pipe will be cut. Then the split pipe will drop down. Again, the motor is rotated to feed the rod which is stocked already and the cutting machine is operated pneumatic cylinder to cut the pipe. The process can be continued to cut the pipe.

Johntson. W (2009) Product design is the process of creating a new product which has to be accepted by the customers. In a broad concept, it is essentially the efficient and effective generation and development of ideas through a process that leads to new product. In a systematic approach, product designers will conceptualize and evaluate ideas, turning them into tangible inventions and products. The product designer's role is to combine art, science, and technology to create new products so, that the consumers can use. To check the losses of agricultural grain crops in the field, it is needed to measure the amount of grains fall to the ground during harvest by combine. Separating the grains from the soil and collecting them from the ground and in the groove of the land by hand and by holders is a hard work and time consuming to that is not precisely done. Hence the need for a machine to collect the grains in the field has been identified. The development of a growing population increases the need of food day by day. This project aims to design and fabrication of collecting and storing of grains by manually. Main objective behind designing and fabricating the bagging and collecting of grains is to reduce the human effort and also reduce time taken for storing. This project mainly helpful to the former the problems faced by small scale farmers relating with availability of labors and cost of collecting and storing finally It is also capable of reducing time wastage, reduction in breakage of the grains.

Uday Prasad (2009) designed the traditional sun drying method of a paddy is still widely practiced by most farmers. The practice includes hauling of a paddy in bags to the drying area, spreading out the paddy in the drying floor using wide board, then evened and slightly furrowed with wooden rakes. Mixing and turning the paddy are done regularly to ensure that the paddy is dried evenly. After drying, the paddy is piled using a wooden board. After wards, the paddy is placed into a bag using a metal scoop (Panake). All of the above operations are done manually consuming too much time and effort. Collecting and bagging operation is considered one of the difficult tasks in sun drying. This study was then conceptualized by looking into existing designs of grain collector good features of the existing design were considered for adoption, adaptation, and simplification to come up with the prototype. Design requirements satisfying local condition were identified. Design data then were based on market information of available parts and components of grain collector. Based on design requirements and design data, a design drawing was prepared. Fabricated prototype was subjected to evaluation to determine its operating characteristics. Shows the conceptual framework of the study. The testing is done by comparing the specifications of traditional or conventional methods with the collection of grains on the basis of labour required, labour cost and the time required for the collection of grains from the floor. Trial tests were conducted to see the time required for collecting of grains and to check that the grain collector equipment is functioning properly or not. The results show that they are functioning properly as expected.

CHAPTER III MATERIALS AND METHODS

3.1 Introduction

The traditional sun drying method of a paddy is still widely practiced by most farmers. The practice includes hauling of a paddy in bags to the drying area, spreading out the paddy in the drying floor using wide board, then evened and slightly furrowed with wooden rakes. Mixing and turning the paddy are done regularly to ensure that the paddy is dried evenly. After drying, the paddy is piled using a wooden board. After wards, the paddy is placed into a bag using a metal scoop. All of the above operations are done manually consuming too much time and effort. Collecting and bagging operation is considered one of the difficult tasks in sun drying. This study was then conceptualized by looking into existing designs of grain collector good features of the existing design were considered for adoption, adaptation, and simplification to come up with the prototype. Design requirements satisfying local condition were identified. Design data then were based on market information of available parts and components of grain collector.

This materials and methods chapter is about the mechanism of the project, components used, conceptual design, and calculation procedure.

3.2 Conceptual design

The demand for grain-bagging of households with more cultivated lands, the household automatic grain-bagging machine is composed of grain conveyer device, opening and hanging bag device, automatic weighing measurement device, grain bagging device, sewing bag device and control system. 3D models are built

up by Solid Works software in structure design and analysis. Four opening and hanging bag mechanisms installed on a rotatable platform to complete four main processes of automatic grain-bagging. The system uses one DC motor.(Reference from Lidbe, Manisha B. (2015) "Design and Fabrication of Mini Vaccum collector"")

3.3 Selection of mechanism

In this design and development of paddy collecting operation, the mechanised used is that the paddy is being sucked by using the vacuum pressure and is collected. That is the collecting operation is done by vacuum method by which the energy needed for creating vacuum pressure is given by the motor.

Grains are automatically loaded into a dustpan by pushing the manual grain bagging machine with hands, a hand wheel of a drive assembly is rotated so that a gear can push a rack to move upwards at first and then move horizontally, and a stop bar on the dustpan is blocked by a left arc baffle and a right arc baffle so that the dustpan can tilt to pour the grains into an opening bag. A simple manually operated grain collector and bagging had the following major components: frame, wheel, long pipe, and bag. Radial flat bladed type base plate, slot bar, sweeping box, bagging area, frame and the conveyance system.

3.4 Machine components

The paddy collecting and bagging machine is consists of the following components to full fill the requirements of complete operation of the machine.

i. Motor
ii. Switch
iii. Cylinder
iv. Hose
v. Frame work
vi. Fabrication process
vii. Handle
viii. Wheel

3.5 Motor

Motor, centrifugal fan, filter are three important design items to take care of to improve the performance of the grain aspiratory machine. Friction, noise, power, consumption, suction pressure are the design variables that govern the aerodynamics and mechanical device factors. The nozzle and narrow compartment geometry play important role in maintaining the pressure and grain flow pattern. A motor is the heart of any machine so does the paddy bagging machine. Its attached to a fan which forces air over the exhausted unit. The suction pressure and performance depends on the motor power only. High power motor offers more sucking capabilities eventually but you should look other factors as well to determine the best performance of the paddy bagging machine. It is reliable, versatile, durable, cost effective, easy to manufacture and can be simply tailored by varying wire diameters, coil sizes and coil numbers to produce the torque characteristics necessary to drive a vacuum generator for optimum effectiveness. It can be made in sizes and weights suitable for use in the whole range of vacuum cleaners from battery operated to mains canister and upright types. It is also suitable to drive agitators independently of the main motor.

These motors generally have a high efficiency in converting electrical energy to mechanical (rotation) energy, 95% being typical. Improvements in bearings, windings and commutation have resulted in higher motor speed being achieved over the past 20 years. Typically up until the 1970s maximum motor speeds were limited to 30,000 rpm, the latest universal motors are capable of speeds up to 40,000 rpm. The speeds at maximum suction power have increased from 25,000 rpm to around 32,000 rpm. Losses are slightly higher at such speeds due to air friction and bearing losses but this reduction is measured as less than

2%. One benefit of higher speeds is the ability to reduce the number of fan stages and another is to make small weight savings.

3.6 Switch

Power switch or on/off switch can be located different part of the paddy bagging machine. Many canister vacuums peddled for on/off which can be tapped with hand. So, you take brake quickly and easily.

3.7 The centrifugal fan

The paddy bagging machine"s fan creates a pressure difference that generates the suction. Directly after the fan, the air particles become denser, which leads to a high pressure area. Since gasses travel from areas of high pressure to low pressure, the air travels from the fan to the exhaust port. Just as a high pressure area is created after the fan, a low pressure area is created before the fan. Therefore, an airstream will travel from the relatively high pressure inlet to the low pressure area before the fan. Overall, this creates a stream of air that travels from the inlet to the exhaust. The grain aspiratory machine uses a centrifugal fan to generate the pressure difference instead of an axial fan. In a centrifugal fan, the air enters the fan axially and flows out radially .

For axial fans, the air enters and flows out perpendicular to the fan. Centrifugal fans produce airflow by rotation of an impeller with curved vanes or blades which guide and drive the airflow to the periphery of the impeller or fan, as it rotates, in such a manner that, when it emerges it has velocity and direction which is close to tangential to the impeller. As the air passes across the fan it creates a lower pressure at the inlet that "sucks" in more air to continue the flow. In simple terms the height of the fan blades is proportional to the amount of airflow and the diameter proportional to the amount of suction, see sketch below. Rotational speed is proportional to both suction and airflow. As the fan rotates, airflow can "spill" over the top of the blades causing turbulence and losses. In a dirty air situation where dust and dirt are also passing through the fan it is normal to leave the blades "open". However in a clean air situation it is normal to add a cover to the fan, which prevents such losses. This cover or shroud is open at the inlet to the blades. Conventionally clean air fans are made from sheet aluminium. The back and shroud are pressed out in circular form from the sheet. Blades are

also pressed out and subsequently shaped into curves which when fixed to the fan allow the air to be given energy as it is forced to pass over their surfaces during rotation. The curves are backward in relation to the direction of rotation. The curve is a complex shape to ensure energy is given to the airflow consistently as it passes outwards over the blades to the periphery. The suction Mouth is a part which provides Suction Surface Area and covers the required surface of the floor which is to be cleaned, to create the desired Suction Pressure. The Suction mouth has two components connected to it: brush and dust collecting hose. This suction mouth is a combination of two Geometries: Half Cylinder and rectangular cross-section. The suction mouth is employed to cover suction surface to make the suction effective.

The closer the shape is to its mathematical derivative, the more efficiently energy is transferred. However in many cases blades are simple circular arcs to allow easy manufacture.As the air passes from the inlet to the periphery its velocity is increasing; to match this, the blade height should be reducing towards the periphery to ensure smooth flow and the shroud should be formed to match this. For simplicity this often results in a conical form but as with the blade curve it is theoretically more complex than that for highest efficiency. In many cases this shaping is ignored and the fan is flat in form, leading to inefficiencies of flow. In a dirty air system the fan is often a die-casting or a plastic moulding. This makes it ideal for giving all the shaping necessary to both blade curving and height variation. To a degree this will help offset the losses occurring at the top of the blades as previously mentioned. When the airflow leaves the periphery of the fan it has a high rotational velocity and ideally should be contained within a volute, which increases in cross sectional area until it reaches an outlet point that is tangential to the radius. .(Reference from Khurmi, R.J and Gupta, J.K (2017) a text book of collector design, New Delhi-110055, Eurasia Publishing House).

3.9 **Calculation**

Cost involved for manual collection of paddy,

Time taken to collect 60kg = 12 mins Amount of paddy collected in 1hr = 60/12 x60 = 300kg/hr

Cost involved per kg = 300/300 = Rs 1

Cost involved for machine collection of paddy,

Time taken to collect 60kg = 25 mins Amount of paddy collected in 1hr = 60 x 60 / 25 = 144 kg/hr Quantity of sacks filled per day by machine,

Amount of paddy collected per hr = 60 x 60 /25 = 144 kg/hr

Since 1 sack consist of 60kg,

Number of sacks filled per hr = 144/60 = 2.4 sacks/hr

During 6hr of working,

Number of sacks filled per day = 14.5 sacks/day Quantity of sacks filled per day manually,
Amount of paddy collected per day = 300kg/hr Number of sacks filled per hr = 300/60 = 5 /hr

During 6hrs of working,

Number of sacks filled per day = 30 sacks/day

i. Depreciation = C-S / Hours of usage = 25000 – 2500 / 5000 = Rs 4.5 /hr

ii. Interest = C + S/2 x7/100 x1/1000 = Rs 0.96/hr

iii. Repairs = C x 10/100 x1/1000 = 25000 x 10/100 x1/1000 = 0.25/hr

iv. Wages per day = Rs 400/day = 400/8 hr = Rs 50 / hr
v. Electricity per hour = Rs 5 /hr
Total cost involved by machine = Rs (4.50+0.96+0.25+50+5) = Rs 61/hr = Rs 0.42/kg

Total cost involved by manual = Rs 0.30/kg

3.10 Hose

Any tear or holes in the hose could also reduce the suction. Constant usage over a period of time could result in wear and tear. Replace the hose with the new one. After every use check the level of dust in the sieve. Clean the sieve, and wipe the sieve dry. Look for any loose strings sticking to the sieve. Spending a little time on maintenance would help to extend the life of the grain aspiratory machine. It is very easy to put the pipe up and down; And the minimum height for the mechanism grip convenient enough; it is light enough to lift the handle and pull the mechanism up (if can"t bend); It is very easy to understand how it works. All found it very easy to push it down/pull it up very easy. The suction cylinder consists of the axial flow fan fitted inside it. Half of the suction cylinder acts as the storage tank. As the Suction Pressure is produced in the Cylinder due to the Axial Flow Fan rotation, the dirt or garbage is sucked inside the cylinder and gets stored into the cylinder bottom due to self weight of the garbage. The storage capacity of the storage tank is of 79 litres, which makes it able to store more garbage. And also the number of times of removing dust bag reduces due to more storage capacity.

3.11 Frame work

The frame is an important part of the equipment. It must provide flexibility which is equivalent of suspension to give good grip. So, the proposed mode equipment does not consist of any suspensions. It is made up of mild steel L- section having a cross section of 31mm X 31mm. It consists of 4 channels, which are cut into the length, of 610 mm and other 2 Pieces are cut into 550 mm length. And also, it can be arranged according to the need as shown in the figure. The arranged pieces are welded at the joining section to form the base frame of the equipment. The most traditional frame material, steel, has been used by frame builders for over a century. Many types of steel channels are available and the material is easy to bend and shape. It also offers excellent ride quality, durability and is easily repaired and affordable. And, while there are new steels almost impervious to corrosion, most types can rust if treated carelessly (protect that paint job).

3.12 Fabrication process

Metal fabrication is a value-added process that involves the construction of machines and structures from various raw materials. The process of fabrication is started in the fabrication shop on the basis of engineering drawings generated in the design process after assessing the capabilities of the shop with respect to metal cutting, foaming, welding and machining. Metal fabrication jobs usually start with shop drawings including precise measurements then move to the fabrication stage and finally to the assembly to the project.
Owing to significant development of sun drying as a socially accepted technology and its possibility of development through mechanization, he also added that continuous efforts have to be undertaken to conduct development studies of local machinery based on the appropriate features of existing commercial machinery from
developed countries and emerging economies.

It is for this reason that this research was undertaken to design, fabricate a pneumatic paddy collector out of local material using locally manufacturing technology and man power that would help farmers, rice traders and millers to contribute to the reduction of losses, save time, labor, and cost of collecting and bagging. (Reference from Gavino, Victorino T. Taylan, and Teresito G. Aguinaldo (2017) . "Design, Fabrication and PerformanceEvaluation of Mobile Engine- Driven Pneumatic Paddy Collector")

3.14 Handle

The circular handle is made up of mild steel having a diameter of 32 mm and 142 mm length. There are two handles are welded to a top backside of the frame to move the collector towards grains which is spread over the floor.
3.15 Wheel

The wheels are designed to carry the load of the runner itself and mass placed at top. According to load, wheels are selected from standard size. two wheels are attached to the frame in order to move the machine in specific direction the diameter of the is 125mm.

3.16 Estimation of time

Time taken to fill the chamber = 27 seconds

S.No	Diameter	Time taken (in seconds)
1.	Outlet valve	27
2.	Joint valve	23

3.17 Testing of calibration

Speed in ft/second
CHAPTER IV

RESULTS AND DISCUSSIONS

"Vacuum collector for bagging of paddy"was designed and fabricated as explained in sub-chapters 3.1 to 3.8. Overall specification with cost estimation of fabricated Paddy collecting and bagging machine is dealt in this chapter.
4.1 Paddy collecting machine

The work study of the components for which the Paddy collecting and bagging machine are planned to be fabricated mainly involves the method study and the time study for the components.
4.2 Method study

The method study of the components for the Paddy collecting and bagging machine are studied in detail. The method study mainly involves the different operations involved in the fabrication and the sequence of its operation.
4.3 Fabrication process

The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc.
The following four types of principle properties of materials decisively affect their selection.
i. Physical

ii. Mechanical
iii. From manufacturing point of view
The various physical properties concerned are melting point, thermal conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc.
The various Mechanical properties Concerned are strength in tensile, Compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit and modulus of elasticity, hardness, wear resistance and sliding properties.
4.5 Manufacturing case

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.
4.6 Quality required

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go casting of a smaller number of components which can be fabricated much more economically by welding or hand forging the steel.
4.7 Availability of materials

Some materials may be scarce or in short supply, it then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. The delivery of materials and the delivery date of product should also be kept in mind.

4.8 Space consideration

Sometimes high strength materials have to be selected because the forces involved are high and space limitations are there.

4.9 Operation

The motor in the paddy bagging machine creates low air pressure inside the chamber. Air from outside the machine gushes in to fill the low pressure area inside the chamber. Dirt and dust is sucked in when the grains flows in. The grain inside the chamber is directed to flow through a sieve which collects the grains. The grain deposits in to a bag or a container placed under the machine. Hence, the most important parts in a standard paddy bagging machine is the motor, fan, sieve. Fan attached to the motor is what creates a vacuum inside the chamber.

4.10 Aim of the project

The main aim of the project is to reduce the time consumption of the workers. It is also aimed in reducing the human efforts. The machine is of light weight and easily handled. Since wheels are attached to the machine it is portable with lock in the wheel. The machines for paddy collecting are not affordable for the farmers to buy so this machine with less cost considered.

4.11 Advantages

i. Manually operated, no fuel and electricity
ii. Ease of operation
iii. Single user is sufficient
iv. Single time investment and life time validity
v. Reduces the mechanisms involved
vi. Brings up easy man-handling machine

vii. Achieves portable machine
viii. Reduces fatigue of workers
ix. Reduces the production time

CHAPTER V SUMMARY AND CONCLUSIONS

The industry was in need of vacuum collector for bagging of paddy and decreasing its labour, especially for low investment. A paddy collecting and bagging machine is designed and fabricated as discussed in the previous chapters would serve this need. The summary & conclusion of the whole project with the benefits are discussed in this chapter.

5.1 Summary

Initially while starting the project work, the availability of spare parts were checked in the market and the parts which were not readily available in the market were designed separately and then manufactured. All the parts and components used in the project were designed and analysed with the help of solid works 2018. Each part was initially designed separately and then assembled into a single component. The dimensions were then marked on the raw material bought for manufacturing the machine and a number of processes were carried out which were explained in details in chapter 3.

5.3 Benefits of this project

Paddy collecting and bagging machine using vacuum, that is designed and developed enables students to realize the real-time experience on manufacturing of the project with proper design and calculations. By choosing the materials by considering the property and its behaviour could be understood by conducting experiments and observations during test of the project.

5.4 Learnings from the project

i. Day to day engineering concept will solve many industrial problems.

ii. Designing and making of prototype.

iii. Field study of other competitive equipment‟s.

iv. Dealing with associates – Communication.

v. Discipline, Punctuality, Dedication, Commitment and Time management.

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the limited time successfully. The Paddy collecting and bagging machine using vacuum is designed with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

5.5 Conclusions

Paddy collecting and bagging machine using vacuum is useful for collecting grains from the floor and a conceptual model was designed successfully. It has considerable potential to greatly increase the efficiency of collecting grain with comparison of other traditional available techniques. The main task now is to promote this technology and have available to users at an affordable price. The grain collector is made up of local components in workshop. This can be sourced

at an inexpensive price from local traders. By using local materials, collecting of grains can be achieved.

A manual paddy bagging machine that collects grains from the concrete pavement floor through the collecting bin and made to fall into the bag placed adjacent to it. This machine has vast application in India due to lack of electricity and investment for the poor formers. This became the main motivation to fabricate this manual bagging machine. This machine reduces the grain collecting time and labour cost. As the main goal to reduce the usage of electricity we don‟t suggest the future scope with motors rather the belt drive mechanism can be designed to reduce the time and mechanical force of labour or operator.

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