

IMPROVING PRODUCTIVITY IN HOLLOW IMPELLER PALM NUT CRACKING MACHINE MANUFACTURING IN NIGERIA

Engr. Rufus Ogbuka Chime¹, Engr. Samuel I. Ukwuaba, Engr², Vincent I. Ngorka³, Prof. Abdulrahim Abdulbaqi Toyin⁴

¹ Institute of Management and Technology (IMT), Enugu, Enugu State Nigeria

E-mail: rumechservices@yahoo.com

² Petroleum Training Institute, Effurun Delta State. Nigeria

E-mail: ukwuabasamuel@gmail.com

³ Petroleum Resource, Port Harcourt, River State Nigeria

Email: vingorka@yahoo.com

⁴ University of Maiduguri, Maiduguri, Borno. Nigeria

E-mail: engrabdulrahimat@gmail.com

Abstract

The fast growing Agro & allied processing and manufacturing industries would survive if there is constant supply of raw materials for their production. Product manufacturers need to consider manufacturing two products: the physical products that they have always produced and the virtual product that is the information about the physical product. This virtual product can provide manufacturers with a new source of value. An improved cracker is needed for the cracking of palm kernel in large scale to satisfy this yearning. An improvement is kept in line to aid easy and quick separation by varying angle of projection using the projectile motion of the kernels and the shells. The concept is such that the machine cracks with high speed and the nature of impeller set up fan mechanism where the cracked kernel nut, shells and dust particles are blown through a projected duct at an angle (θ) and separated by density or weight with aerodynamics and the angle (θ) of projection. The centrifugal machine cracks with a rotor speed of 450rad/sec, work with a power transmission efficiency of 88.87% and cracks 2.8 tones per hour, separation is maximum at angle between 10°-15° with appreciable cracking efficiency. The process of palm kernel oil needs a nut shell cracking which is the most critical and delicate aspect which is labour intensive if done manually. The individual involved in the manual cracking endanger himself of inadvertently hitting his fingers with the impact stone. After thoroughly researching, designing and experimenting with software's final machine was developed optimizing the process, the product time was successfully reduced from several hours to 5 minute. All other engineering and customer design requirement were met, through the success of the design. In the cracking operation, it is necessary to Preserving the nuts embedded in the kernel from breaking to pieces. The spongy portion of the palm kernel makes some not to be cracked if they hit the impactor or they re-bounce, which may not subject them to secondary impact It is therefore paramount to design an improved a nut cracker with an acceptable cracking efficiency using: An optimum speed at a given rotor radius for required to deform or break a palm kernel without damaging the nut at the minimum impact force required to cause the cracking. Manufacturing is the means by which the technical and industrial capability of a nation is harnessed to transform designs into well-made products that meet customer needs. This activity occurs through the action of an integrated network that links many different participants with the goals of developing, making, and selling useful things. Manufacturing is the conversion of raw materials into desired end products. The word derives from two Latin roots meaning hand and make. Manufacturing, in the broad sense, begins during the design phase when judgments are made concerning part geometry, tolerances, material choices, and so on. Manufacturing operations start with manufacturing planning activities and with the acquisition of required resources, such as process equipment and raw materials

Keywords: Design, palm kernel Cracker, Sustainability Optimization .Management, and Manufacturing

Introduction

The oil palm (*Elaeis guineensis*) originated from the tropical rain forest region of Africa, but due to its economic important as the world highest yielding

source of edible and technical oils, it is now grown as a plantation crop in most countries with high rainfall in tropical climates within 23o N to 23o S of the equator and longitude 17o W to 102o E The pulp is made up of the exocarp and mesocarp which

contains the palm oil in its cell debris, while the central nut is made up of the shell (endocarp) and edible kernel which contains the palm kernel oil. These two distinct non-toxic edible oils from the oil palm fruits are both very important in the world trade. The three main varieties of the oil palm distinguished by their fruits characteristics are dura, pisifera and tenera. **Dura:** this has a very thin pericarp, 40 -70% of fruit weight with very little and a very big shell of about 2-5mm thickness. The kernel size is generally bigger than other varieties. **Tenera:** this has a thick pericarp of about 60% fruit weight containing very high oil and thick shell (1-2.5mm) which promotes easy cracking. **Pisifera:** this has a thicker pericarp with higher oil yield with little or no kernel. According to Anaekwe, 2011, it is generally believed that no part of the oil palm tree is useless. After the processing of the fresh fruit bunch to yield palm oil, the product that is left is the shelled palm nut which can be cracked to yield the palm kernel nut and the shell. While the shells can be used as fuels and road construction, though the market is not well developed in the country, the palm kernel nut can be crushed and processed to yield palm kernel oil and cake. Palm kernel processing industry is very popular in the third world countries because of the dependency of many companies on palm kernel and palm oil as raw material the processing of the palm kernel entails cracking the shell to produce the nut for industrial use. Cracked kernel produced must be separated from its shell to make it convenient for further processing in the industries. Separation of cracked mixture which results from the nut cracking stage and consists of kernels, broken shells, unbroken nuts and dusts requires the recovery of each of these constituents of the mixture. It is a very important activity in the kernel recovery process of palm mills. In the developing countries, small scale palm mills make use of manual labour for the separation of the kernels. The kernels are handpicked from the mixture and at the same time the unbroken nuts are recovered and taken back to the mill for cracking. This method is slow, laborious and unsuitable for large scale mills. But modern methods of cracked mixture separation have been devised which are classified into two namely: systems based on density and systems based on shape. The principle involved in the system based on density employs the difference in density

between the kernels and the shells to chart paths for their independent recovery. Clay-bath and hydro-cyclones are two methods devised for cracked mixture separations based on density. These methods of separation are usually known as wet processes since water is always involved and the kernels have to be dried at the end of the separation various researchers have worked on the palm nut given its importance and multi-purpose use. Nyanjou worked on the modernization and innovation of palm oil extraction process while Adzimah and Seckley, modified the design of an already existing palm nut fiber separator. Parveen et al, reviewed the palm oil mill effluent treatment methods. Nwankwojike et al worked on the modification of the sequence of unit operations in mechanized palm fruit processing. He reported that induced free space among nuts in the press cake as the palm oil is expelled during pressing was identified as the basic cause of excessive nut breakage/crushing when screw press is used for palm oil extraction. Ezeoha et al, worked on finding out available reports on engineering properties of palm kernels and they proposed average values to be adopted in the design of process machinery while Jimoh and Olakunle, determined the effect of heat treatment during mechanical cracking of various varieties of palm nut. However, technology improvement for processing palm fruit, nut, and kernel requires accurate information on both the physical and mechanical properties. For instance, stripping and pressing are important unit operations in palm oil processing. The efficiency of these unit operations rely on the mechanical behaviour of palm fruits under compression loading since they involve the application of pressure. The physical properties of fruit, nut and kernel were studied by Akinoso and Raji. They found out that the moisture content and temperature effects on mass and force at break point of palm fruit, nut and kernel of the two varieties (tenera and dura) were significant at $p \leq 0.05$. Sphericity was not significantly ($p \leq 0.05$) dependent on treatment. From the foregoing it is evident that the problem of cracking and separation of palm nut still poses a challenge to small scale farmers in developing countries like Nigeria. This work shows the possibility of cracking and separating simultaneously using a designed cracker-separator which employs the principle of projectile motion.

Computer-based design analysis is nowadays a common activity in most development projects. When new software and manufacturing processes are introduced, traditional empirical knowledge is unavailable and considerable effort is required to find starting design concepts. The ability to create something out of nothing makes design one of the most exciting aspects of engineering. Computer technology has touched all areas of today's life, impacting how we obtain railway tickets, shop online and receive medical advice from remote location. CAD began as an electronic drafting board, a replacement of the traditional paper and pencil drafting method. Over the years it has evolved into a sophisticated surface and solid modeling tool. Not only can products be represented precisely as solid models, factory shop floors can also be modeled and simulated in 3D. It is an indispensable tool to modern engineers. The cost of importation of foreign machine for cracking is very high compared to the producer's mega resources. Generally, this affects the country's foreign reverse. Also it tends to bring down the cost of the machine to the reach of the small scale producers. Besides it creates employment opportunities for the farmers, this design was chosen for reliabilities..

- Long product development,
- Countless trial and error,
- Accountability
- Limited Profitability

The cost of machine of this type could be high when produced under small scale production. But the other advantages are that it does not require any specialist skill for its operation and it does not call for any elaborate production environment before it becomes operational and so many others. The advantages of this design outweigh the disadvantages. In fact it can be used where mass production is necessary with high efficiency

DESIGN RECOMMENDATIONS

Some general rules for minimizing materials-related costs are as follows:

1. Use commercially available mill forms so as to minimize in-factory operations.
2. Use standard stock shapes, gauges, and grades or formulations rather than specials whenever

possible. Sometimes, larger or heavier selections of a standard material are less costly than smaller or thinner sections of a special material

3. Consider the use of prefinished material as a means of saving costs for surface-finishing operations on the completed component.

4. Select materials as much as possible (consistently with functional requirements) for processibility. For example, use free-machining grades for machined parts, easily formable grades for stampings, etc. It pays to take the time to determine which variety of the basic material is most suitable for the processing sequence to be used.

5. Design parts for maximum utilization of material. Make ends square or nest able with other pieces from the same stock. Avoid designs with inherently high scrap rates

DESCRIPTION

Palm kernel is one of the main products from the oil palm fruit. It is a drupe and is made up of three layers – exocarp, spongy mesocarp which is fibrous and the endocarp which depicts the stony hard shell. The shell houses a vital embryo which is oily. It is covered with hard black integument called Testa. This is the main object of this design; as the oil gotten from the kernel is very rich. The palm tree is believed to be originated from the tropical African mostly the forest region which stemmed about 8m or more tall at maturity. Its botanical name is *Elaeis guineensis*; it is a drupe from the tribe of *coexylimae* of the family *palmaceae*. There are majorly 3 types of oil palm fruit but our concern is the thickness of their shells. Dura has 2-5mm thick shell, while Tenera is 1-2.5mm thick. *Pisiferera* has little or no kernel, hence cannot be cracked. It is mainly grown for red oil production. It is also known that the thinner the shell the easier the cracking. Nigeria was well known by the world for the cultivation of palm fruit before the advent of crude oil, the back bone of Nigeria economy. Countries like Malaysia which is now the leading oil palm producing country exploit the farming method from west Africa especially Nigeria to be specific. It is grown in the West Africa along the coastal areas. The processing of palm kernels into palm kernel oil involves cracking the palm nuts, separation of the shells from the kernel, washing and cleaning, kernel milling and Kernel oil

extraction. The major task is having an efficient cracking and separation.

CRACKING

Cracking of palm kernel nut like other fruits is as old as man. They were using club and stone to do the cracking in the olden days. It is energy consuming and time wasting using the impact method of stone. The quest to proffer a convenient method leads to the design and fabrication of a cracking machine. There are different types of cracking machine. The most common types are hollow impeller type and harmer mill type.

The efficiency of the cracking depends on:

- Impact speed (velocity)
- Cracking surface area
- Hardness of the surface area
- The size of the hollow impeller which affects the number of kernel released
- How efficient the palms were digested or milled.
- Thickness of shell
- Moisture content
- Distance between the circle described by the rotor and the internal diameter of the shelling drum

When the palm nut hits the impactor ,a force is generated termed the impact force which is absorbed as a point load that vibrates the shell enough to cause it to shear or break to pieces. This impact force is the maximum shear as a point load that can cause deformation to palm nut

MEDIUM OF SEPARATION

The techniques for separation of mixtures are numerous. The choice of separation is governed by the kind of mixture you have. Mixtures can be:Single phase (they are gases, liquids or solid alone respectively).

Multi-phase (they are of different state of matter).

In this regard the mixture is of single phase. It is just solid. The governing factors in this are:

- ❖ weight as it affects density
- ❖ shape as it affects drag and air resistance on the body which means their aerodynamic properties

Hence, following the aerodynamic properties of the kernel nuts and the shell, it is seen that when these two are projected, the nut travels far because of little or no drag based on its stream line shape but the shell that has irregular shape is affected by drag force.Ranges of kernel shell and dust.

The analysis and the design parameters: The dominant properties found to influence nut cracking were rotor speed, rotor radius nut size, mass and moisture content Machine development; the hollow impeller palm nut cracker machine is made of the cracking unit. Feedhopper, impeller shaft crack drum, impeller blade, the nut fall by gravity through the hopper channel into the cracking drum where the cracking process takes place through the help of impeller blade that flap the palm kernel nut against the wall of cylindrical cracking drum

HOPPER

The hopper was designed based on the principle of self-delivery which is aided by the energy absorbed by the vibration of the working machine. It is aimed to avoid clogging that will impend delivery and cracking. Hence, the angle was lowered far below 38°which is the angle of repose of palm kernel. The vibration aid slow movement of the kernel into the delivery channel shown in fig 7

DELIVERY CHANNEL

This is a cylindrical channel which bends slowly into the centre of the front plate to locate the eye of the rotator hollow impeller centre to center axis of rotation to allow a fall and quick delivery of the palm nuts. A radial clearance of 5mm between the rotating diameter of eye of the rotating impeller and diameter of the delivery channel. They are seen mouth to mouth to each other

BELT SELECTION

Belt selection is necessary for adequate power transmission. The power (P) transmitted by a belt driven system is a function of the tensions and the speed of rotation

V – Belt is used for this purpose as it transmit more torque and minimize power lost than flat belt. It has long service life, best for tractive forces and speed. . Shown in Fig1

MATERIAL

The belt is made up of rubber and fiber. It is tough but flexible for functionality. It is least expensive

SHAFT

The shaft design is based on the principle of moments and determination of the size that will carry a particular load in this design the weight of the hollow impeller is considered and weight of the pulley neglected

COMPONENT OF THE MACHINE

1. 2 hp high speed Electric motor
2. The projector
3. The hopper
4. Cracker[hopper]
5. Pulley\V-belt
6. V-belt
7. The frame and the casing
8. Delivery channel
9. Air Blade



Figure 1: □

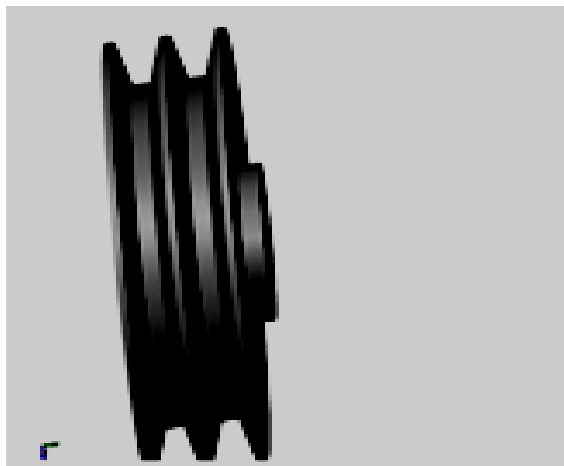


Figure 2: V-pulley

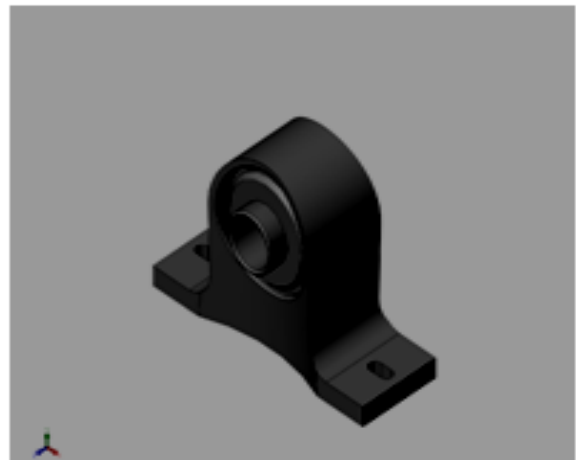


Figure 3: Puma Block Bearing

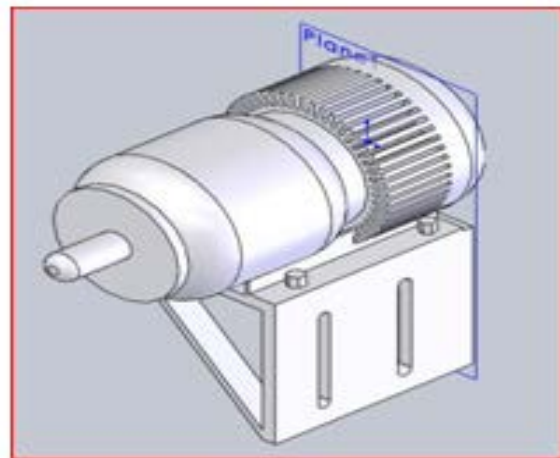


Figure 4: Electric Motor

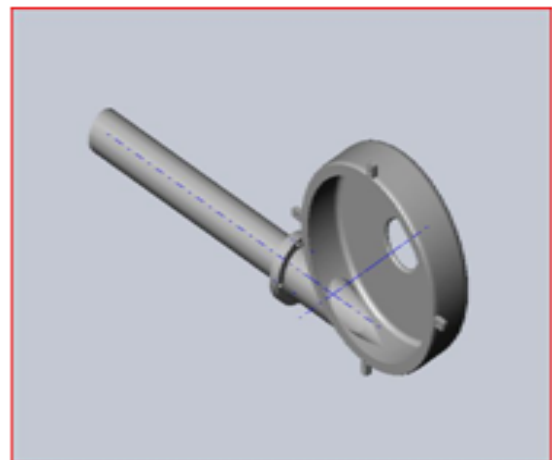


Figure 5: electric motor Assemble

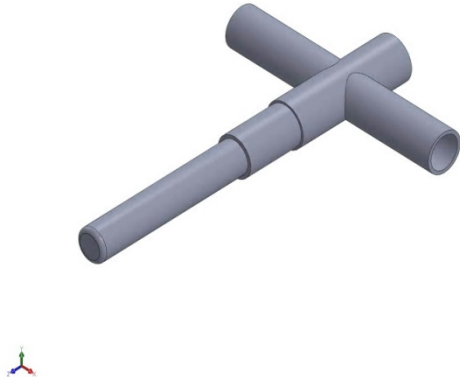


Figure 6: Fig 6 Cross Hollow Rotor Shaft

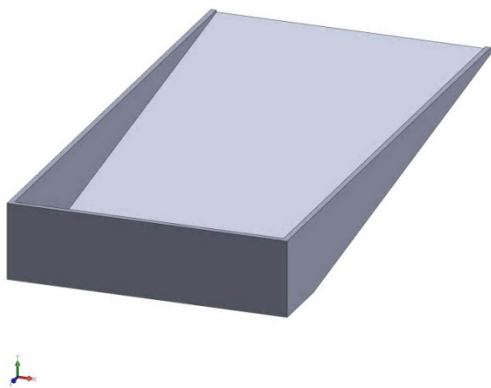


Figure 7: 7th the Hopper

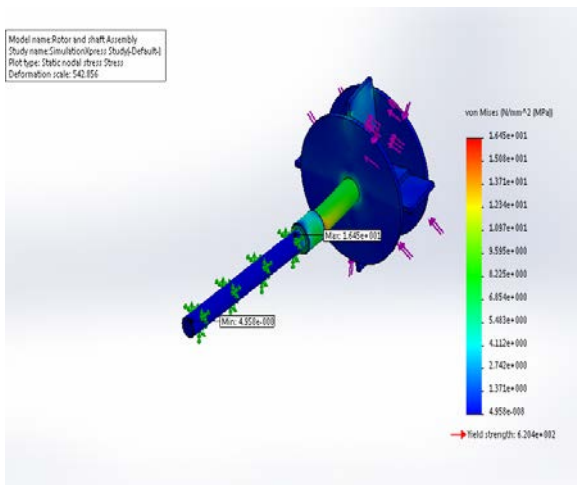
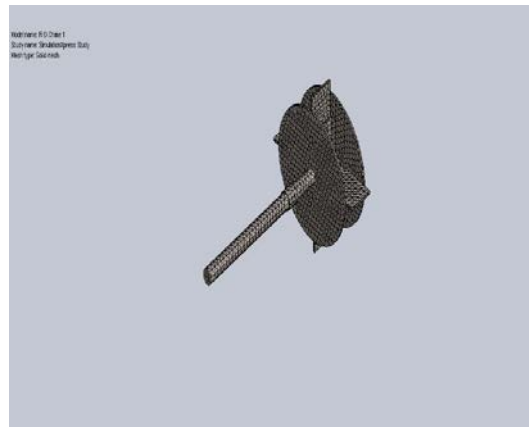


Figure 8: Shaft under Stress



XX

Figure 9: Shaft and Rotor under Deformation



Figure 10: Rotor and shaft Maintained factor

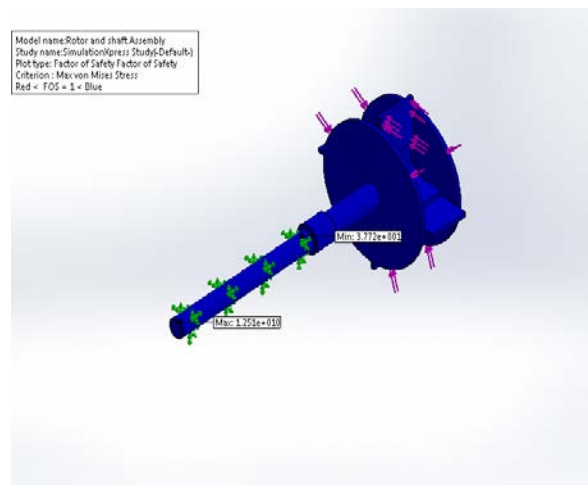


Figure 11: shaft displacement

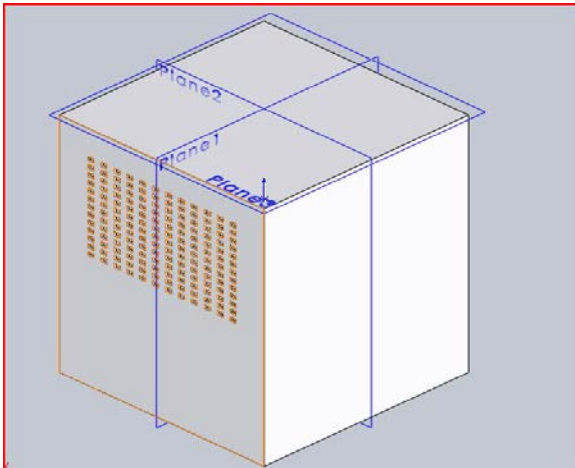


Figure 12: mild steel

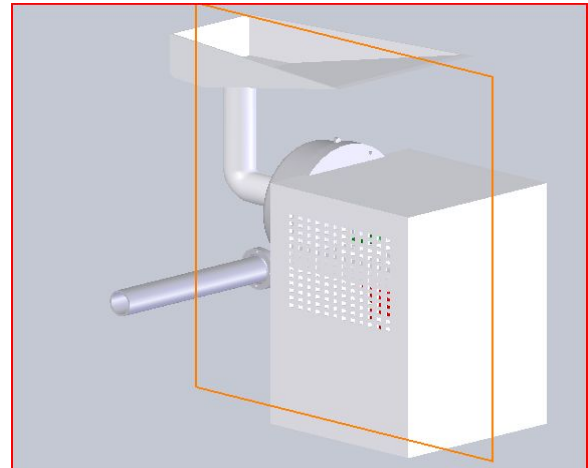


Figure 15: Isometric View

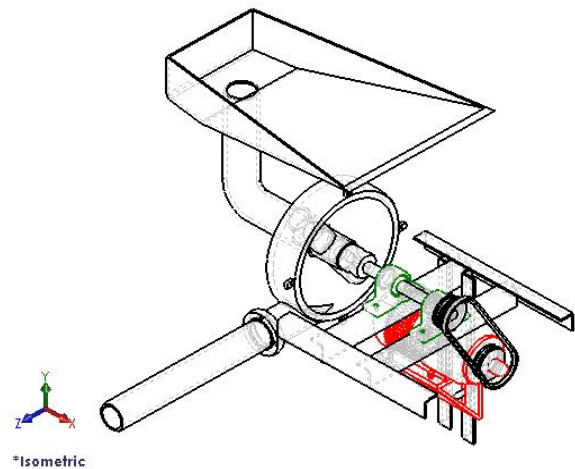


Figure 13: Wire Frame

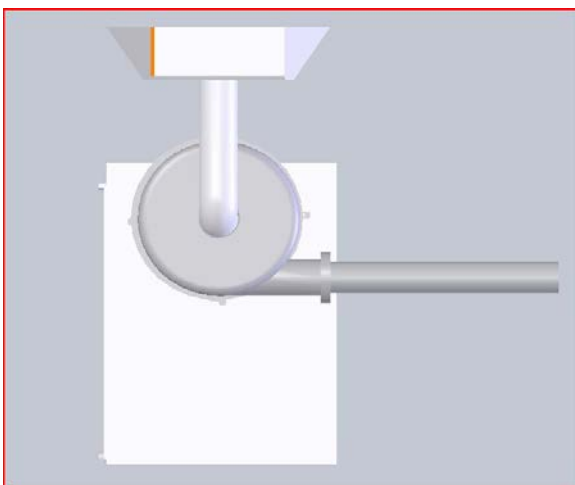


Figure 14: light view of palm kernel cracker and Aerodynamic separator

COMPUTER AIDED DESIGN

CAD began as an electronic drafting board, a replacement of the traditional paper and pencil drafting method. Over the years it has evolved into a sophisticated surface and solid modeling tool. Not only can products be represented precisely as solid models, factory shop floors can also be modeled and simulated in 3D. It is an indispensable tool to modern engineers. Engineers use CAD to create two- and three- dimensional drawings, such as those for automobile and airplane parts, floor plans, and maps and machine assembly while it may be faster for an engineer to create an initial drawing by hand, it is much more efficient to change and adjust drawings by computer. In the design stage, drafting and computer graphics techniques are combined to produce models of different parts. I. Using a computer to perform the six-step 'art-to-part' process: The first two steps in this process are the use of sketching software to capture the initial design ideas and to produce accurate engineering drawings. Next, engineers use analysis software to ensure that the part is strong enough. Step five is the production of a prototype, or model. In the final step the CAM software controls the machine that produces the part, during the design of the machine and the drafting, software was used to draw the orthogonal views, Isometric views, exploded drawings fig; 1 -6 shows the component parts of the machine, modeling and simulation was done before the commencement of the fabrication processes.

WIRE FRAME is a skeletal description of a three dimensional object. It consists only of points, lines,

and curves that describe the boundaries of the object. There are no surfaces in the wireframe model. Three-dimensional wireframe representations can cause the viewer some confusion because all of the lines defining the object appear on the two-dimensional display screen. This makes it hard for the viewer to tell whether the model is being viewed from above, inside or outside shown in fig;14.

MODELING

Modeling is the process of producing a model; a model is a representation of the construction and working of some system of interest fig; 1-6, 13-16. A model is similar to but simpler than the system it represents. One purpose of a model is to enable the analyst to predict the effect of changes to the system. On the one hand, a model should be a close approximation to the real system and incorporate most of its salient features. On the other hand, it should not be so complex that it is impossible to understand and experiment with it. A good model is a judicious tradeoff between realism and simplicity. Simulation practitioners recommend increasing the complexity of a model iteratively. An important issue in modeling is model validity. Model validation techniques include simulating the model under known input conditions and comparing model output with system output. Generally, a model intended for a simulation study is a mathematical model developed with the help of simulation software. Mathematical model classifications include deterministic (input and output variables are fixed values) or stochastic (at least one of the input or output variables is probabilistic); static (time is not taken into account) or dynamic (time-varying interactions among variables are taken into account). Typically, simulation models are stochastic and dynamic

SIMULATION

Simulation technology can provide a highly effective means for evaluating the design of a new manufacturing system or proposed modifications to existing systems. This technology can be especially useful in supporting agility, sustainability, supply chain integration, as well as the development of new advanced processes. Manufacturing simulations are often used as measurement tools that predict the behavior and performance of

systems that have not yet been implemented, or to determine theoretical capabilities of existing systems. Simulations are essentially experiments. As defined in Jerry Banks Handbook of Simulation, a simulation is: "the imitation of the operation of a real-world process or system over time. Simulation involves the generation of an artificial history of the system and the observation of that artificial history to draw inferences concerning the operational characteristics of the real system that is represented. Simulation is an indispensable problem-solving methodology for the solution of many real-world problems. Simulation is used to describe and analyze the behavior of a system, ask what-if questions about the real system, and aid in the design of real systems. Both existing and conceptual systems can be modeled with simulation." Shown in figure 9-12

PRODUCT

All products start out as virtual products shown in fig6. That is ideas and information about what the physical product should be. These virtual products are then realized in physical form through the manufacturing process. The manufacturing of products can be divided into three phases: making the first one, ramp-up, and making the rest. "Making the first one" entailed getting a physical product that embodied the ideas of what the virtual product was required to accomplish. Ramp-up and production ("making the rest") relied on the premise that these products would be close enough to the first one so as to be functionally and physically equivalent. The accuracy of that premise varies widely even today, which is why expensive quality audit inspection processes are required of the actual product instances themselves

Virtual manufacturing

Lawrence (1994) argues that virtual manufacturing is: "...a modelling and simulation environment so powerful that the fabrication/assembly of any product, including the associated manufacturing processes, can be simulated in the computer." Here, two types of virtual manufacturing approaches that can be used to enable DFM activities are described, specifically computer-aided manufacturing and simulations of manufacturing processes using finite element analysis.

ENVIRONMENTALLY SUSTAINABLE DESIGN

Designers make decisions on the use of resources, of consumption and the lifecycles of products and. Environmentally sustainable design (also referred to as 'green design' or 'eco-design') aims to ensure that products, services and systems are produced and provided in a way that reduces the use of non-renewable resources and minimises environmental Impact. It is increasingly important within the fields of architecture, urban design and planning, engineering and design in general.

OPTIMIZATION An optimization system may be regarded generally as a resource allocation problem in which limited resources are assigned to activities in a manner that will produce the best value for a selected measure of performance. Such a measure of performance may typically involve minimization of cost or maximization of profit. A simple example of an optimization system involves the determination of the level of production of a number of products that compete for limited raw materials, with the objective of maximizing the total profit for all products. In this situation, each product represents an activity whose optimal production level is determined from the solution of the model

PRODUCTION PLANNING AND CONTROL

Production planning and control can be defined as the process of planning the production in advance setting the exact route of each item, fixing the starting and finishing dates for each item to give production orders to shops and to follow up the progress of products according to orders the principle of production planning and control lies in the statement 'First Plan Your Work and then Work on Your Plan'. Main functions of production planning and control includes Planning, routing, scheduling, dispatching and follow-up.

Planning is deciding in advance what to do, how to do it, when to do it and who is to do it. Planning bridges the gap from where we are, to where we want to go. It makes it possible for things to occur which would not otherwise happen.

Routing may be defined as the selection of path which each part of the product will follow, which being transformed from raw material to finished products. Routing determines the most

Advantageous path to be followed from department to department and machine to machine till Raw material gets its final shape.

Scheduling determines the programmed for the operations. Scheduling may be defined as the fixation of time and date for each operation' as well as it determines the sequence of Operations illustrated in Appendix A-C

Dispatching is concerned with the starting the processes. It gives necessary authority so as to start a particular work, which has already been planned under 'Routing' and 'Scheduling'. Therefore, dispatching is 'release of orders and instruction for the starting of production for anytime in acceptance with the route sheet and schedule charts'. The function of **follow-up** is to report daily the progress of work in each shop in a prescribed proforma and to investigate the causes of deviations from the planned performance.

QUALITY CONTROL

Quality Control (QC) may be defined as 'a system that is used to maintain a desired level of quality in a product or service'. It is a systematic control of various factors that affect the quality of the product. Quality control aims at prevention of defects at the source, relies on effective

Feedback system and corrective action procedure. Quality control can also be defined as 'that industrial management technique by means of which product of uniform acceptable quality is manufactured'. It is the entire collection of activities which ensures that the operation will produce the optimum quality products at minimum cost. The main objectives of quality control are: To improve the companies income by making the production more acceptable to the customers *i.e.*, by providing long life, greater usefulness, maintainability, etc.

- To reduce companies cost through reduction of losses due to defects.
- To achieve interchangeability of manufacture in large scale production.
- To produce optimal quality at reduced price.
- To ensure satisfaction of customers with productions or services or high quality level, to build customer goodwill, confidence and reputation of manufacturer.

- To make inspection prompt to ensure quality control.
- To check the variation during manufacturing

PROJECT MANAGEMENT

Project management Tasks for the project were divided equally among the four team members. Modeling and Simulation was completed by Rufus and VIN, while Samuel and Toyi managed the tasks and deadlines of the project. Many of the experiments were conducted with at least two members present and each team member was responsible for taking observations and developing design ideas. Online Regular team meetings were held to discuss shortcomings and progress of the project. A Henry Gantt chart can be found in Appendix A displaying the Individual task assignments and deadlines. This chart was used to guide the team and assure timely completion of the project. Each experiment provided insight for the project and so Gantt chart was updated regularly with new tasks to accomplish

PRODUCTIVITY

Business Managers, see productivity not only as a measure of efficiency, but also connotes effectiveness and performance of individual organizations. For them, productivity would incorporate quality of output, workmanship, adherence to standards, absence of complaints, customer satisfaction, etc. (Udo-Aka, 1983). The administrator is more concerned with organizational effectiveness, while the industrial engineer focuses more on those factors which are more operational and quantifiable, work measurement and performance standards (Adekoya, 1989). Productivity can be computed for a firm, industrial group, the entire industrial sector or the economy as a whole. It measures the level of efficiency at which scarce resources are being utilized. Higher or increasing productivity will, therefore, mean either getting more output with the same level of input or the same level of output with less input. Let us look at the sub-concepts.

TOTAL-FACTOR PRODUCTIVITY: This is the ratio of output to the aggregate measure of the inputs of all the factors of production. Theoretically, this is the true measure of productivity as it incorporates the contribution of all the factor inputs. Factor

Productivity is often seen as the real driver of growth within an economy and studies reveal that whilst labour and investment are important contributors, Total Factor Productivity may account for up to 60% of growth within economies. Technology growth and efficiency are regarded as two of the biggest sub-sections of Total Factor Productivity, the former possessing "special" inherent features such as positive externalities and non-rivalness which enhance its position as a driver of economic growth

Simulations of manufacturing processes using finite element analysis

With simulations the act of creating a model, i.e. an approximation, of the real world for use in predicting parameter values of the real world is in focus. Finite element analysis (FEA) offers a way to solve problems, e.g. structural and fluid dynamics, defined

by a geometry, boundary conditions and initial conditions (Bathe, 1996). The geometry is divided into a finite number of elements and properties e.g. stress, displacement, pressure, are calculated for each element and all elements together give a solution to the problem. There is CAD-software for FEA to calculate displacements and stresses for geometrical representations of products, but these software seldom handle non-linear relations and large displacements common in manufacturing processes. For this task separate software such as MSC Software7 Marc™ and Simulia™8 (former Abaqus) can be used to simulate, for example cutting (Kalhori, 2000). When a model, e.g. to simulate cutting, is created it is possible to generate stresses and displacement results for the product caused by the manufacturing operation. This information can be used when ensuring that the manufacturing facilities of a company can fulfil the dimensions and tolerances of the product.

MANUFACTURING

Manufacturing is the means by which the technical and industrial capability of a nation is harnessed to transform innovative designs into well-made products that meet customer needs. This activity occurs through the action of an integrated network that links many different participants with the goals of developing, making, and selling useful things. Manufacturing is the conversion of raw materials

into desired end products. The word derives from two Latin roots meaning hand and make. Manufacturing, in the broad sense, begins during the design phase when judgments are made concerning part geometry, tolerances, material choices, and so on. Manufacturing operations start with manufacturing planning activities and with the acquisition of required resources, such as process equipment and raw materials. The manufacturing function extends throughout a number of activities of design and production to the distribution of the end product and, as necessary, life cycle support. Modern manufacturing operations can be viewed as having six principal components: materials being processed, process equipment (machines), manufacturing methods, equipment calibration and maintenance, skilled workers and technicians, and enabling resources. There are three distinct categories of manufacturing:

- Discrete item manufacturing, which encompasses the many different processes that bestow physical shape and structure to materials as they are fashioned into products. These processes can be grouped into families, known as unit manufacturing processes, which are used throughout manufacturing.
- **Continuous materials processing**, which is characterized by a continuous production of materials for use in other manufacturing processes or products. Typical processes include base metals production, chemical processing, and web handling.
- **Micro- and Nano-fabrication**, which refers to the creation of small physical structures with a characteristic scale size of microns (millionths of a meter) or less. This category of manufacturing is essential to the semiconductor and mechatronics industry. It is emerging as very important for the next-generation manufacturing processes.

Modern Manufacturing:

Manufacturing technologies address the capabilities to design and to create products, and to manage that overall process. Product quality and reliability, responsiveness to customer demands, increased labor productivity, and efficient use of capital were the primary areas that leading manufacturing companies throughout the world emphasized during the past decade to respond to the challenge of global competitiveness. As a consequence of

these trends, leading manufacturing organizations are flexible in management and labor practices, develop and produce virtually defect-free products quickly (supported with global customer service) in response to opportunities, and employ a smaller work force possessing multidisciplinary skills. These companies have an optimal balance of automated and manual operations. To meet these challenges, the manufacturing practices must be continually evaluated and strategically employed. In addition, manufacturing firms must cope with design processes (e.g., using customers' requirements and expectations to develop engineering specifications, and then designing component

DISCUSSIONS AND CONCLUSION

It is general knowledge that those who are engaged in agriculture are the poor in comparison with those who engaged in other sector of the economy in Nigeria that is to say their standard of living is so low that shortage of funds to enable them facilities has been a major handicap in the development. Investigation shows that the few available small scale processing equipment are not very efficient. This lack of efficiency small scale processing equipment to farmers has increased the inability of their farming activities.

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. While individual products are usually measured by weight, their varying densities make measuring overall agricultural output difficult. Therefore, output is usually measured as the market value of final output, which excludes intermediate products such as corn feed used in the meat industry. This output value may be compared to many different types of inputs such as labour and land (yield). This measure of agricultural productivity was established to remedy the shortcomings of the partial measures of productivity; notably that it is often hard to identify the factors cause them to change. Changes in Total Factor productivity are usually attributed to technological improvements. Today It is rare to find an engineering design, or architectural firm of any size without a working CAD system, running on a personal computer or workstation. Many of the individual task within the overall design process can be performed using a computer. As each of these tasks is made more efficient the efficiency of overall process increases as well. Computer aided design

uses the mathematical and graphic processing power of the computer to assist the engineer in the creation, modification, analysis, and designs many factors have contributed to CAD technology becoming the necessary tool in the engineering technical data base, CAD combines the characteristic of designer and computer that are best applicable to the design process, the combination of human creativity with computer technology provides the design efficiency that has made CAD such as popular design tool. CAD Has allowed the designer to bypass much of the Manuel drafting and analysis that previously required, making the design process flow more smoothly and much more efficiently.

Simulation tools enable us to be creative and to quickly test new ideas that would be much more difficult, time-consuming, and expensive to test in the lab. (Jeffrey D. Wilson, Nasa Glenn Research Center) It also help us reduce cost and time-to-market by testing our designs on the computer rather than in the field. It is against this background that our research theme was derived and the advantages are as following

COST EFFECTIVE: The cost of this machine is very low and can be affordable by both poor and rich, it requires little or no frequent maintenance

INCREASE IN PRODUCTIVITY (level) increased productivity lead to increases in wealth of a nation. Productivity of Cracker will help in no small measure to increase in productivity level of a nation which will increase value addition to GDP

POVERTY REDUCTION AND JOB CREATION: It help to create job for people since it is affordable and this reduce in rural –urban migration

ENCOURAGE DIRECT AND INDIRECT INVESTMENT: It will help in the expansion of domestic and international trade. It will equally increase rapid national economic growth and development.

ENCOURAGE INNOVATION THROUGH USAGE AND OBSERVATION BY LOCAL FABRICATORS. Since the machine is fabricated locally, the usage will help local fabricator to innovate or improve in their fabrication. By so doing, it will help in the living standard of rural people

REDUCTION IN UNEMPLOYMENT. The reduction of unemployment is of two fold which includes those

fabricating machine and those using the machine will be the beneficiaries

ENCOURAGE DIRECT AND INDIRECT INVESTMENT, It will help in no small measure in the creation of industries for oil processing manufacturing and other processing ventures. It will equally increase rapid national economic growth and development.

ECONOMIC DEVELOPMENT AND INDUSTRIALIZATION.

It will help in economic development and industrialization because it will lead to the creation of a new investment culture, wealth creation and increased economic and social welfare.

CONCLUSION

Many of the individual tasks within the overall design process can be performed using a computer. As each of these tasks is made more efficient, the efficiency of the overall process increases as well. The computer is well suited to design in four areas, which correspond to the latter four stages of the general design process. Computers function in the design process through geometric modeling capabilities, engineering analysis calculations, testing procedures, and automated drafting, from the result of testing and affordability in term of cost, it can be concluded that the project is successful, therefore software design should be encouraged in our institution of higher learning base on the following facts, long product development, countless trial and error, and accountability and limited profitability

Reference

1. Food and agricultural Organization [FAO} Small scale palm oil processing in African FAO Agricultural services bulletin 148:/www.fao.org/document/showedr/DOCREP/Y4355E/4355E03 HTM
2. Stephen. A and Emmanuel.S, Modification in the design of already existing palm nut-fiber Separator African Journal of Environment Science and Technology Vol 3(11) pp.387-398
3. Hartley.C.S.The Oil palm Longman Group limited London Pp67 (1988)
4. Hartley C.W.S The decline of oil palm industry in Nigeria” NIFOR, Benin Nigeria, 1963.
5. Koya O.A and Faborode M.O(2005) Mathematical modeling of palm fruit cracking

- based on Hertz's Theory" Bio systems Engineering, Vol.91 No. 4 pp 471 – 478.
6. Black P.H. and Adams E. O.Jr., (1982)"Machine Design "NewYork. International Students Edition.pp281-297.
 7. Oriaku E.C,Agulanna C,N,Edeh J.C. Nwannewuiha H.U (2013) Determination Of Optimal Angle Of Projection And Separation Of Palm Hut Shell And Kernel Using A Designed Cracker/Separator International Journalof Scientific & Technology Research Volume 2, Issue 10
 8. http://www.simetric.co.uk/si_materials.htm.Mass,Weight,Desity or specific Gravity of bulk materials.
 9. Akinoso R., Raji A.O.; —Physical properties of fruit, nut and kernel of oil palm . International Agro physics, 25, 85–88. (2011)
 10. Raji A.O. and Favier J.F.; —Model for the deformation in agricultural and food particulate materials under bulk compressive loading using discrete element method II: theory, compression of oilseeds . Journal of Food Engineering, 64, 373–380 (2004):
 11. Nwankwojike B.N., Odukwe, A.O., and Agunwamba J.C.; —Modification of Sequence of Unit Operations in Mechanized Palm Fruit Processing Nigerian journal of technology Vol.30, No.3, 2011
 12. Pro.M. Thenmozhi Evolution of Management Theory Management Science 1 Indian Institute of Technology Madra
 13. Dr. Michael Grieve. (2009) Dual Manufacturing both Real and Virtual Products, NASA MSFC/UNIVERSITY OF IOWA
 14. Charles Mclean (2009) Manufacturing Simulation; The need for Standard Methodologies, Model, and Data Interfaces
 15. R.O. Chime, Ukwuaba S .I, and Nwachukwu U. (2013), Design, Modelling Simulation and Fabrication of Screw Press Palm kernel oil expeller NSE International Conference
 16. Akinlo, E. A. (1996), Improving the Performance of the Nigerian
 17. Manufacturing Sub-Sector after Adjustment, The Nigerian Journal of Economic and Social Studies, Page 9.
 18. Candace Carlson (2010) Improving Productivity in Mold Design and Fabrication
 19. Amber Beck, Nick Dalbec, James Zoss (2005)Design of a manually operated mixing Machine for Shea Butter application
 20. Productivity in Nigeria, Proceedings of a National Conference, Edited by Osoba, A.M., Page 75
 21. Law, A. M., and M. G. McComas. (1991) Secrets of Successful Simulation Studies, Proceedings of the 1991 Winter Simulation Conference, ed. J. M.
 22. Project management for small business made easy / by Sid Kemp. p. cm. ISBN 1-932531-77-7 (alk. Paper)

APPENDIX A

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Sep '15		
							30	6	13
1	SCREW PRESS EXPELLER FOR PALM KERNEL O	0 days	Tue 9/8/15	Tue 9/8/15					◆ 9/8
2	market analysis	25 days	Tue 9/8/15	Mon 10/12/15		marketing (1)			
3	Product design	20 days	Tue 9/8/15	Mon 10/5/15		Industrial(2)Development			
4	Manufacturing	20 days	Tue 9/8/15	Mon 10/5/15		Industrial(2)Development			
5	prodct design selection	10 days	Tue 9/8/15	Mon 9/21/15		development,purchasing			
6	Detailed marketing plan	15 days	Tue 9/8/15	Mon 9/28/15		marketing (1)			
7	manufacturingt process	20 days	Tue 9/8/15	Mon 10/5/15		Industrial(2)Development,Industr			
8	detailed product design	40 days	Tue 9/8/15	Mon 11/2/15		design(1)Development(1)purchas			
9	Testing prototype	10 days	Tue 9/8/15	Mon 9/21/15		design(1)Development			
10	finalized product design	25 days	Tue 9/8/15	Mon 10/12/15		marketing(1)development(1)desig			
11	order components	10 days	Tue 9/8/15	Mon 9/21/15		purchasing			
12	order of prodction equipment	14 days	Tue 9/8/15	Fri 9/25/15		purchasing			
13	install production equipment	30 days	Tue 9/8/15	Mon 10/19/15		Industrial(1)Development,design			
14	documentation	2 days	Tue 9/8/15	Wed 9/9/15		design(1)Development			design(1)Dev
15	celebrate	1 day	Tue 9/8/15	Tue 9/8/15		design(1)Development(1)purchas			design(1)Deve
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

Project: screw press expeller start anc Date: Wed 9/9/15

Task Split Progress Milestone ◆

Page 1

APPENDIX B

Gantt chart

