**Chapter One**

**Introduction**

**1.1 Background of the study**

Grains, according to Okaka (1997) are fruits of cultivated grasses belonging to the monocotyledonous family, Gramineae. The principal cereal grains of the world include wheat, barley, rye, sorghum, rice and maize. The last has become a popular staple in West Africa. Maize is another world’s most versatile seed crop. Its cultivation originated from Europe but was soon brought to Africa by explorers early in the sixteenth century. Within hundreds of years, it was well established as a staple food in areas around the north and south shores of Mediterranean Sea.

In later years, maize cultivation spread widely into Africa down to Nigeria as well as many parts of Asia all at the same span of time. Its production in the southern states of the United States of America also expanded greatly just as it was in Africa and Asia (Adaokoma 2001). The use of sticks for threshing was predominant in the pre-historic era. In Egypt, livestock was earlier employed for threshing out grains after which it was winnowed. In Palestine, threshing sledge was used 3,000 years earlier. In Nigeria, maize was threshed originally by bare hands. Other popular method was the use of pestle and mortar.

This method is still used in the rural areas today. The above methods became unsatisfactory because of their low output, tediousness and their requirement of extra strength. According to Kaul and Egbo (1985), the performance of a thresher depends upon its size, cylinder speed, cylinder concave clearance, fan speed and the sieve shaker speed. Oni and Ali (1986) reported that the factors influencing thresh ability of maize in Nigeria are field drying, maize varieties, ear size cylinder speed and feed rate. The properties of the crop that affect the thresher performance are crop variety, shape and size, hardness of the seed, the moisture content of the seed and the density.

The major steps involved in the processing of maize are harvesting, drying, de-husking, shelling, storing, and milling. For the rural farmers to maximize profit from their maize, appropriate technology that suites their needs must be used. The processing of agricultural products like maize into quality forms not only prolongs the useful life of these products, but increases the net profit farmers make from mechanization technologies such products. One of the most important processing operations done to bring out the quality of maize is shelling or threshing of maize.

In Nigeria, maize constitutes the staple food of large chunk of the populace. It is also responsible for about 60% by weight of most of livestock feed formulations. Peasant farmers are responsible for more than 70% of the maize produced annually while large scale commercial farmers constitute the remaining 30% (Adewumi, 2004). The problems of post harvest processing and storage of agricultural produce are well documented and various approaches are being employed in tackling it. For maize, one of its post harvest challenges is shelling. Kaul and Egbo, 1985 reported that maize harvested are traditionally shelled by hand or by beating sacs stuffed with maize cobs with wooden flails.

These traditional methods of shelling maize are time wasting, hazardous and associated with lots of drudgery. They also described shelling as a process of repeated pounding or dragging of plant mass over a surface through an aperture. Akubuo, 2003 described the use of pestle and mortar as a process by which the dry maize is put into the mortar and pestle is used to hit the maize with impact forces. A considerable quantity of shelling is achieved per time but the amount of grain damage is high with low cleaning efficiency (Ologunagba, 2003).

There have been various means of shelling starting from the traditional pestle and mortar to the various mechanical and electro-mechanical devices. The use of ‘cone’ sheller was reported by Kaul and Egbo, (1985), the sheller consists of a cone with three to four lines of serrated ribs. The dehusked cob is rotated in the cone by one hand while the Sheller is held in the other hand rotating the cob against the internal rib of the Sheller to detach the grain from the cob. Adewale, et al (2002) and Adegbulugbe, (2000) established that shelling process is a function of moisture content.

It is easier to shell maize dry than wet. Adewale et al (2002) also reported that the local techniques of shelling and winnowing of shelled maize is grossly inefficient judging by the serious bruises encountered by the crops. There are many types of maize shellers, but the motorized shellers are either imported or locally fabricated by local welders who have no knowledge of both the machine and crop parameters suitable for optimum performance of the shelling machines (Adewumi, 2004). Maize can also be dehusked and shelled but this is with a lot of kernel damage at the end of the processing operation (Adesuyi, 1983). Other types of devices used for shelling mechanism are cross flow rasp bar, axial flow rasp bar and spike tooth cylinder. A spike tooth cylinder is more positive in feeding than rasp bar cylinders with the added advantage that, it does not plug in easily. While rasp bars are easier to adjust and monitor and are relatively simple to operate and durable. The efficiency of shelling machines varies from one machine to the other as affected by some factors like the crop moisture content, feeding rate, shelling mechanism and the concave cylinder clearance (Adewale et al, 2002).

**1.2 Statement of the Problem**

Traditional shelling methods do not support large-scale shelling of maize, especially for commercial purposes. Locally in Nigeria, the region that is the highest producer of Maize is the northern part of the country. It was observed that most shelling of maize was done by hand shelling. Hand shelling take a lot of time, even with some hand operated simple tools. It was also observed in the study area, Nasarawa State, most mechanical shellers were designed for multi-grain threshing or shelling, which causes great damage to the maize seeds besides breaking the cob to pieces.

The available sheller locally, were equipped with rotating threshing drum with beaters or teeth, which cause damages to the seed. Besides, the cost of purchasing such shellers were high for the poor rural farmer and therefore necessitated the design of low cost system that will be affordable and also, increase threshing efficiency with reduced damage done to the seed.

**1.3 Objective of the study**

The specific objectives of the work were to design, construct, and test a low-cost maize sheller. To evaluate the efficiency of the maize sheller. To use the maize sheller in establishing an agro-processing centre for rural farmers. This project work is to achieve the following:

1. To improve the aesthetical standard as compared with other locally made corn threshing machine
2. To reduce the hardship encountered by people who cannot afford the cost of buying an imported threshing machine.
3. To have a more sophisticated and integrated corn threshing machine that can compete favourably with imported ones.
4. To minimize the farmers’ cost of securing labourers for manual corn threshing
5. To aid farmers make their produce available for people’s consumption and company use and on time too.

**1.4 Significance of the Study**

Many farmers grow maize but could not afford the cost of acquiring some of the imported threshing machines because of their cost, and such people resort to manual means of threshing which results into low efficiency. This work is necessary as it was aimed at constructing the machine that shells maize and separates the cob from the grains. Since the machine was constructed from locally available materials and its cost is very low and affordable, farmers can now adopt this kind of machine for their farming improvement.

**1.5 Scope of the Study**

This project is limited to only maize threshing machine with a hopper which is designed to be fed in a vertical position and the shaft design which has a threshing tool attached to it (by welding) at two opposing sides and a pulley mounted on it, which is used for threshing of corn effectively.

The work includes feasibility studies, planning, design, applying related calculation, material selection and procurement constructional analysis and preparation of components of the threshing and subsequent assembly.