CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Solar dryers improve the quality of cacao Beans (Bonaparte, Alikhani, Madramootoo and Raghavan, 1998; Ajala and Ojewande, 2014; Hii et al., 2006). When weather conditions are not favorable, artificial drying method can be resorted to by using fan or blower to drive air across heating elements, raising the temperature and eventually reducing the moisture content of the cacao beans (Musa, 2012). Preservation of agricultural products is an essential process required for long time storage without the quality of the product being affected. In developing countries large quantities of farm produce get spoiled due to inadequate infrastructure and insufficient processing capacities (Giz Hera, 2022). Food preservation methods include dehydration, canning and freezing (Ogundana et al., 2022).

Drying is probably one of the oldest food preservation methods employed to reduce post-harvest losses and ensure all year round supply since production is seasonal (Alamu et al., 2010).It involves the removal of moisture from food products to inhibit the growth of microorganisms thereby preventing decay and spoilage (Salisu et al., 2020;Dare-Adeniran & Areola, 2022). Reducing the water content leads to the physical and chemical stability of the product. In addition, the weight and volume of the product are reduced, thereby reducing transportation costs (Shikhare et al., 2018). In Nigeria open-air (sun) drying frequently done on the ground is commonly practicedsince the source of energy is free and sustainable with no complexity (Soumendra et al., 2015;Gatea, 2018).

Despite the advantages of this method, it still has significant draw backs which are; contamination from dust, insects, and birds, as well as dependency on favourable weather condition, thereby affecting the product quality. Also, the process is labour intensive; It requires large area of land and the time required for drying a given commodity is quite long which may results in post-harvest losses (Seveda & Jhajharia,2012)(Gupta et al., 2017).

Therefore, open-air drying method typically fails to meet the necessary quality standards which may prevent the items from being sold in the global market (Elwakeel et al., 2023)

Among the rural populace in Nigeria, fire wood is also used to provide hot-air for drying agricultural products, but this method increases the level of air pollution and deforestation level which according to the United Nation Collaborating Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries(UN-REDD) is estimated at 3.7% which is one of the highest in the world .Apart from the effect on the environment, the quality of the products may also be affected adversely(Salisu et al., 2020;Deng et al., 2021).the disadvantages highlighted above of the traditional methods of drying and the concern of the rising population, climate change and food security there is needs to minimize the over-dependency on fossil fuels as a step in reducing the level of greenhouse gas emissions. Applications of renewable energy have been the subject of much research as a result. In addition to improving the environment, renewable energy boosts the economy by creating job opportunities and increases food security by changing food preservation systems like solar dryers (Maundu et al., 2017).the need for solar dryers and their implementation has drawn the attention of researchers due to it taking up less space and time for drying and also being relatively cheap when compared to artificial mechanical drying. Lower relative humidity, lower product moisture content, higher temperatures, and less spoilage during the drying process are further advantages. Thus, the solar dryer can be regarded as one of the answers to the world's food and energy crises and is a superior substitute for all the drawbacks of natural drying (Oria & Palconit, 2022; Alamu et al., 2010)

1.2 Problem statement of the study

Cocoa seed drying, a critical step in cocoa processing, is often hindered by unreliable and inefficient traditional drying methods, resulting in poor quality cocoa beans, reduced yields, and economic losses for small-scale cocoa farmers, thereby necessitating the development of a sustainable and energy-efficient drying solution."

1.3 Aim and objectives of the study

The main aim the project is to design and develop an innovative solar –powered cocoa seed with automated temperature control and battery backup While:

Specific Objective

This study objectives are to evaluate the quality of cocoa beans after continuous drying, investigate the effects of continuous drying on cocoa's physical, chemical, and sensory properties, and identify the optimal continuous drying conditions for maintaining high-quality cocoa beans.

1.4 Scope of the study

The scope of this study is to design and develop a solar-powered cocoa seed dryer with temperature control and battery backup, and to evaluate its performance in terms of drying time, energy efficiency, and cocoa seed quality. The study will focus on small-scale cocoa farmers and will investigate the economic viability of the solar-powered dryer.

1.5 Justification of the study

The justification for this study is multifaceted, driven by the need to improve cocoa quality, address energy poverty, enhance sustainability, support small-scale farmers, and fill a knowledge gap in the use of solar-powered dryers in cocoa production, ultimately contributing to the development of a reliable and efficient solar-powered cocoa seed dryer with temperature control and battery backup.