

### FACULTAD DE INGENIERÍA

Escuela Académico Profesional de Ingeniería Industrial

Tesis

# Optimization of the Yellow Corn Cleaning Process with the Implementation of a Mechanical System

Haru Helen Mallco Segura Yanira Malena Chavez Esteban Samir Genoary Rojas Santana José Antonio Velásquez Costa

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#### Autores:

- 1. Haru Helen Mallco Segura EAP. Ingeniería Industrial
- 2. Yanira Malena Chavez Esteban EAP. Ingeniería Industrial
- 3. Samir Genoary Rojas Santana EAP. Ingeniería Industrial
- 4. José Antonio Velásquez Costa EAP. Ingeniería Industrial

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## Optimization of the Yellow Corn Cleaning Process with the Implementation of a Mechanical System.

Haru Helen Mallco Segura Department of Industrial Engineering Universidad Continental Huancayo, Peru 74898575@continental.edu.pe Yanira Malena Chavez Esteban Department of Industrial Engineering Universidad Continental Huancayo, Peru 72268491@continental.edu.pe

José Antonio Velásquez Costa Department of Industrial Engineering Universidad Continental Huancayo, Perú jvelasquezc@continental.edu.pe

Abstract— This work optimizes the yellow corn cleaning process through the implementation of a mechanical system in a company of the food sector, for which the production processes and customer requirements have been analyzed, based on the analysis of the time taking, the examination of each process with the Ishikawa diagram and through indicators in the Pareto diagram, decisions were made to improve their production times since initially there was a daily production of only 92.84 bags/day in a daily workday of 8 hours, with a minimum requirement of 400 bags/day. Finally, after evaluating the necessary requirements and the required production, a new corn cleaning machine was implemented, which was built and verified, the new production times, in which the productivity was improved by 357 %, managing to produce 424.53 bags/day in a workday of 8 hours a day, likewise it generates an improvement of 78.13% in the production process, on the other hand, the cleaning process has been reduced by 87.38%, being the activity that took the most time for the company, secondly, the times not only decreased in a specific area but in all the corresponding processes such as, in the process of receiving raw material, humidity control, verification of species, feeding to the corn well, weighing control, sack sewing and storage.

Keywords— Optimization, Mechanical System, Hard Yellow Corn, Pre-cleaning, Time Taking, Ishikawa Diagram, Pareto Diagram.

#### I. INTRODUCTION

The National Institute of Statistics and Informatics (INEI), in its technical report on Peru in the year 2023, mentioned that in February, yellow corn production reached 130,415 tons [1], on the other hand, the acquisition cost of hard yellow corn is 1.53 soles per kilo in the city of Lima, Peru, according to the Ministry of Agrarian Development and Irrigation (Ministry of Agrarian Development and Irrigation) [2], but this leaves farmers with very low profit margins, as they require 1.1 soles per kilo for production, which at certain times does not cover their operating costs [3]. This is due to the requirement of several cleaning processes, generated by the impurities in the corn, which results in economic losses since the cost of operation is increased and the commercial price of the product is reduced if the cleaning process is not adequately treated [4]. Despite the existence of machines for the cleaning process based on sieve systems in the grain harvesters, they are often blocked by the corn cobs, which results in the percentage of dirty corn of low quality and consequently the farmer suffers losses in the process of marketing his producto [5].

Samir Genoary Rojas Santana

Department of Industrial

Engineering

Universidad Continental

Huancayo, Peru

74126520@continental.edu.pe

In China, prototypes have been developed to monitor the cleaning of corn, since farmers in the process of harvesting and cleaning presented a high rate of loss, so the Ministry of Agriculture and Internal Affairs has established a suitable design to monitor the losses of corn in the cleaning process based on the use of a metal plate of stainless steel 304, a piezoelectric, ceramic, a circuit to process the signals emitted by the sensor, which have parameters to analyze the size, material, tonality, among other aspects related to the corn product, for which a test was performed to evaluate the mechanism, providing adequate dimensions for its operation, in which the plate should be placed at an angle of 30 degrees, with a height of 30 cm, being the most optimal position since it was possible to obtain a monitoring of corn kernels at 92. 82% while the mixture of cobs with broken corn kernels was 90.07% [6] [7].

On the other hand, a prototype was evaluated in the academy of agricultural engineering sciences in which it was established to reduce the content of impurities in the cobs in the stalk crushing process in the harvesting process of fresh corn, through a high pressure design using a double fan based on operating conditions in which speeds of 1200,1300,1400 rpm were evaluated with an operation of 6,8,10 km/hm obtaining impurities of cobs to only 0. 25% to 0.50% which would meet the operating requirements for which it was designed [8][9].