

An Optimization Model for Processed Food-grade Flour from Off-grade Cavendish Banana Supply Chain Network Design: The Case of AMS Employees' Fresh Fruits Producers Cooperative

Ritchie Mae T. Gamot*, Yllyssa C. Fordan, May Anne E. Mata, and Larry N. Digal

University of the Philippines Mindanao

*Correspondence

Department of Mathematics,
Physics, and Computer Science,
College of Science
and Mathematics,
University of the Philippines
Mindanao, Mintal, Tugbok District,
Davao City 8022, Philippines

E rrtgamot@up.edu.ph

Keywords

Cavendish bananas;
mixed integer linear
programming; profit
maximization; supply chain

Abstract

One of the fundamental issues in Philippine agriculture is the low income of small-scale farmers of Cavendish banana despite the increasing demand for it. The AMS Employees' Fresh Fruits Producers Cooperative (AMSEFFPCO), for instance, was observed to generate unpleasing profit in the production process of converting off-grade Cavendish banana into food-grade flour. We hypothesized that the profit may be increased by determining the optimal number of components of the production process, i.e., the number of delivery trucks and mills to be operated, as well as the number of nonregular (e.g., peelers, washers) and regular laborers (e.g., slicers, dryers) to be hired. From the constructed supply chain network design of the production process, we formulated and solved a mixed integer linear programming model to obtain the optimal values of the components. Our findings showed that the profit of the cooperative can be maximized if they operate two trucks and one mill and hire nine nonregular laborers and fourteen regular laborers. Moreover, we also studied how the changes in the volume of supplied off-grade bananas affect the values of the optimal components of the supply chain. By implementing the results of this study, the cooperative is expected to generate approximately PhP 9000 per batch delivery, i.e., 4000 kg of off-grade bananas. The methodology developed in this study can also be applied in other banana producer's organization with similar supply chain network.