An optimization model for planning milling quantities based on forecasting of paddy and rice prices

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Abstract

Rice is considered as the staple food of Sri Lanka. The conversion of paddy in to rice is a main value creation found in the Sri Lankan agricultural industries. The paper deals with the planning concerns, in the supply chain of rice. The paper discusses various issues related to production of rice at the downstream end of the supply chain and milling management decisions. Small and Medium scale milling plants around Sri Lanka are facing problems of dissolving their businesses quickly, and they are in a need to utilize their capacity in optimal way. An efficient supply chain management framework is essential for the milling to be efficient in sourcing, processing and distribution of rice under an uncertain environment. In the study, the behaviour of the Sri Lankan paddy and rice market prices volatility has been studied qualitatively and the paper discusses the validity of applying different forecasting tools**.** Mainly the SARIMA and Winters model have been used for forecasting. The study identifies and proposes two price regions for forecasting, based on the macro environmental factors. In order to attain the research objectives of optimization, the researcher has used linear programming as a continuous multi period model. The research is significant for the small and medium scale milling community to enhance their livelihood by determining the right time and right quantity for procuring, processing and stocking in a volatile market environment.

Keywords: Milling capacity optimization, Linear programming, Operation research, Sri Lankan agricultural industry, Rice supply chain

Introduction

The supply chains of different agricultural commodities in Sri Lanka face many challenges due to improper management of the sector. Rice industry has always been treated as the subject of agricultural economics but attention to this topic in supply chain studies is relatively low. This study focuses on the management decisions of rice-milling sector such as procuring, processing and stocking.

Rice millers purchase paddy during the harvesting season to build up their paddy stocks to sell when the price become high. Due to the uncertainty of the rice supply chain affected by the weather and other external factors production of the paddy and price are continuously changing (Ariyaratna, 2016). If the Milling capacity decision is not taken optimally, processing unit will not be able to maximize profits. To overcome the above issues, an optimization method for milling capacity which is sensitive to market spot price should be available to the millers.

The operations process of rice processing unit involves cleaning, drying, dehusking, and polishing (Vishal, 2013). The research assumes the whole operation as one process to reduce the complexity. A properly developed production plan is needed for the milling plants to ensure effective and efficient operation.