## ANALYSIS OF THE EFFECTIVENESS AND EFFICIENCY OF AN AUTOMATIC SOYBEAN MILK BOTTLE FILLING AND CAPPING MACHINE BASED ON PERFORMANCE ANALYSIS

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## ABSTRACT

The manual production process of soy milk encounters several obstacles, particularly in terms of speed, volume accuracy, and hygiene aspects. This study aims to analyze the effectiveness and efficiency of an automatic soy milk filling and bottling machine based on the Arduino Uno microcontroller. Testing was conducted by comparing the performance of the automatic machine with the manual method in terms of operational cost, production speed, filling volume consistency, and product success rate. The results showed that the machine can reduce operational costs by up to 95,6% compared to manual labor. In terms of speed, the machine with a 2 water pump configuration can produce 30 bottles in an average time of 10,05 minutes, only 1,05 minutes slower than the manual method which takes 9 minutes. The filling volume consistency showed a deviation of  $\pm 1,5$  ml with 1 water pump and  $\pm 3$  ml with 2 water pumps. The product success rate was also relatively high, namely 73,3% with 1 water pump and 66,6% with 2 water pumps.

Keywords: soybean milk, automatic machine, Arduino Uno, production efficiency, MSMEs.