

# CHAPTER I

## INTRODUCTION

### 1.1. Background of the Study

Basic commodities play a vital role in meeting the essential living requirements of the general public. According to Presidential Regulation Number 59 of 2020, basic commodities encompass agricultural products such as rice, soybeans, chili peppers, and shallots; industrial products such as sugar, cooking oil, and wheat flour; and livestock products such as beef, broiler chicken meat, commercial chicken eggs, and fresh fish. This classification is determined by the high allocation of national household expenditures toward these items, their substantial impact on inflation rates, and/or their essential nutritional content for human consumption [1].

Humans require basic commodities to sustain their daily lives. However, various constraints frequently arise in fulfilling these needs, particularly due to price volatility. Price instability can directly affect public purchasing power, as unpredictable price fluctuations can compromise household food security [2]. Furthermore, this condition can trigger public anxiety and hinder government initiatives aimed at maintaining economic stability.

East Java is one of the largest production hubs for basic commodities in Indonesia. Based on the 2023 Strategic Food Commodity Analysis Document, East Java ranked first in 2022 for the production of primary agricultural commodities, with rice contributing 17.86%, soybeans 28.03%, and bird's eye chili 41.88% of the national output. Additionally, East Java was the second-largest producer of shallots after Central Java, contributing 24.13%. In the livestock sector, East Java held the top position in beef production with a 22.25% contribution and commercial chicken eggs with 23.61%. Meanwhile, broiler chicken meat production ranked third after Central Java and West Java, accounting for 15.58% [3]. Despite its high production capacity, East Java remains susceptible to the challenges of basic commodity price instability [4].

One of the viable approaches to mitigate basic commodity price instability is through time series forecasting [5]. Forecasting involves predicting future price

values by leveraging patterns or trends derived from historical data [6]. Through effective forecasting, various stakeholders can obtain valuable insights for strategic planning, decision-making, and policy formulation. The government can utilize these forecasts as a cornerstone for economic stabilization, business entities can leverage them to design inventory and distribution strategies, and consumers can use them as a reference for managing household budgets.

In this study, price forecasting is conducted using a Hybrid ARIMA-LSTM method. This approach is deployed because basic commodity prices in East Java frequently fluctuate irregularly over time, indicating the presence of both linear and non-linear patterns within the data structure [7]. The ARIMA model is highly effective at handling linear patterns and delivers robust performance for short-term forecasting [8]. However, its accuracy tends to degrade in long-term forecasting, and it is less effective at capturing non-linear patterns. To overcome these limitations, a hybrid configuration combining ARIMA and LSTM is implemented. LSTM is selected to complement the weaknesses of ARIMA, specifically due to its proficiency in processing non-linear patterns and providing superior performance in long-term forecasting horizons [9].

A notable study implementing the hybrid ARIMA-LSTM approach was conducted by Dave et al. (2021), who applied this hybrid framework to forecast Indonesian exports. Their hybrid approach incorporated a decomposition process to split the time series data into three distinct components: trend, seasonal, and residual. The trend component was modeled using ARIMA, while the seasonal and residual components were modeled using LSTM. The final forecast was obtained by aggregating the predicted values from all three components. By utilizing this framework, their study demonstrated that the hybrid model outperformed standalone configurations, achieving a Mean Absolute Percentage Error (MAPE) of 7.38% and a Root Mean Squared Error (RMSE) of  $1.66 \times 10^{13}$  [10].

This research adopts the Hybrid ARIMA-LSTM framework following the approach established by Dave et al. (2021). By decomposing the data into three components, this framework maximizes the distinct strengths of each individual

model. The ARIMA model, which excels at capturing linear patterns, is used to model the trend component. Concurrently, the LSTM network, which is superior in capturing non-linear relationships, is applied to model the seasonal and residual components. This study is designed to forecast basic commodity prices across future horizons of 7, 14, and 30 days.

The dataset utilizes price points from three distinct categories of basic commodities: rice (representing agricultural products), cooking oil (representing industrial products), and commercial chicken eggs (representing livestock products). The selection of these specific commodities is based on the highest average weekly per capita consumption representing each sector [11]. Territorially, the scope covers three out of eight regions that maintained a Consumer Price Index (CPI) over the 2015–2023 period: Surabaya City (representing the highest CPI), Banyuwangi Regency (representing the lowest CPI), and Kediri City (representing the moderate CPI). The designation of these CPI regions was established by BPS-Statistics Indonesia based on core economic indicators such as Gross Regional Domestic Product (GRDP) and per capita expenditure, alongside geographical factors [12].

## **1.2. Research Questions**

Based on the background of the study described above, the research questions in this study are formulated as follows:

1. How does the hybrid ARIMA-LSTM method perform in forecasting the prices of rice, cooking oil, and eggs within the CPI regions of East Java Province?
2. How does the performance of the hybrid model compare to standalone ARIMA or standalone LSTM forecasting models in terms of accuracy?

## **1.3. Objectives of the Study**

The specific objectives to be achieved in this study are:

1. To evaluate the performance of the hybrid ARIMA-LSTM method in forecasting the prices of rice, cooking oil, and eggs within the CPI regions of East Java Province.

2. To compare the performance of the hybrid ARIMA-LSTM model against standalone ARIMA and standalone LSTM forecasting models in terms of predictive accuracy.

#### **1.4. Significance of the Study**

The significance of this study lies in providing basic commodity price forecasts that can be utilized by the government as an empirical foundation for drafting price stabilization policies and food security strategies. Additionally, it serves to assist the public in managing household expenditures, while acting as a valuable reference for future researchers seeking to develop hybrid models in similar domains.

#### **1.5. Scope and Limitation**

To ensure a focused execution of the research objectives, the scope of this study is limited to three distinct regions within East Java Province: Surabaya City, Banyuwangi Regency, and Kediri City. These locations intentionally represent the regions with the highest, lowest, and moderate Consumer Price Index (CPI) metrics, respectively.