

Review Article

Trends, Opportunities, and Challenges of the Ethiopian Soybean Export Market in the Past Two Decades (2004–2022)

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The study was conducted to assess the trends, opportunities, and challenges of the Ethiopian soybean export market in the past two decades (2004–2022), and forecasted the next 10-year export performance of the sector, to identify intervention area for factors that affects soybean export performance in the country. To address the objectives most latest scientific literature was intensely reviewed and the next 10 years' export was forecasted using Box–Jenkins, ARIMA (4,1,0). The review found out that in Ethiopia more than 90% of soybeans supplied to the market have been exported with a high increase for the past two decades but not comparable with the rise in the global market. In the country, there are unexploited high production and export opportunities associated with convenient agroecology condition zones for production, cheap and abundant labor force, popularity of the oilseed in the international market, and abundant arable land in the country. Nevertheless, in the past two decades, the sector was highly challenged by low productivity and quality of the crop; political instability and security situation; high price volatility, and competition in the international market. Unless the situation is improved, the ARIMA forecasted model result indicates Ethiopia's soybean exports increase only to a certain extent in the next 10 years and the export bill of the country will be \$97.4 million in 2032. Accordingly, the study identifies intervention areas including efficiently utilizing the existing abundant arable land and cheap labor force for production, improving the grain quality provided in the global market, protecting the popularity of Ethiopian organic oilseed, encouraging soybean marketing in Ethiopian commodity exchange platform, and secure political social instability in the country to improve the performance and benefit more from the sector.

1. Introduction

1.1. Background of the Study. Nations of the world diverge in their technological advancement and resource endowment in the production of goods and services [1]. So the involvement of nations in international trade is governed by their specialization in the production of goods in which they have a comparative advantage [1]. This theory dates back to the eighteenth century when Adam Smith realized the importance of specialization and trade in the economy [2]. More importantly, international trade would increase efficiency in resource allocation and increase world output and welfare through specialization [3].

Currently, the share of developing countries in international trade has improved from 25% to 33% with a share of

Africa in the international market sticking at below 3% [2]. While the share of Ethiopia remained under 0.03% [2]. Engagement of sub-Saharan African countries in international trade is essentially on primary agricultural commodities in which they have the comparative advantage of cheap labor and favorable climate [1]; similarly, Ethiopia's export has been mainly on primary agricultural commodities [4]. It has a lower growth outlook as a result of the low-income elasticity of demand for such products [2, 5].

Ethiopia's economy is highly dependent on agriculture [6]. The average contribution of agriculture to GDP, employment, and foreign exchange was 34%, 75%, and 85%, respectively [2]. Despite its importance, the sector is based on subsistence farms and in terms of export contributes only

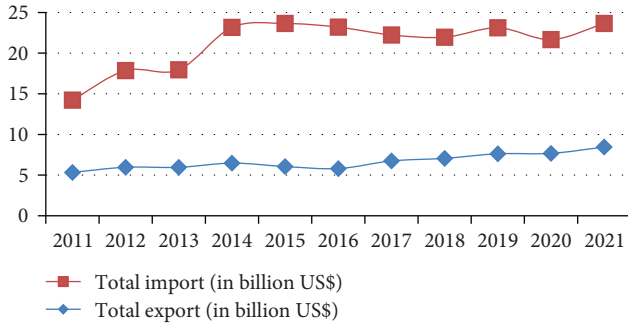


FIGURE 1: Ethiopia import–export trend 2011–2021. Source: Author’s computed using data from TrendEconomy’s [7] study.

7.6% of the country’s GDP. Figure 1 indicates the gap between Ethiopian imports and exports has been widening over the last decade. For example, in the country value of export increased from 5.33 billion in 2011 to 8.45 billion US\$ in 2021 while the value of import increased from 8.9 to 15.2 billion US\$ [7]. This suggests that the main cause for the worsening of the trade balance of Ethiopia is the incomparable import–export scenario of the country.

The continuous trade deficit of the past two decades and the borrowing need to finance this trade deficit have led to a high level of foreign exchange shortage and debt burden and currently, the country provokes a difficult situation in foreign exchange earnings.

For instance, in 2021, the economy of Ethiopia was officially reported as having a debt-to-GDP ratio of 46.0%, indicating Ethiopia’s debt level is \$51 billion [7]. From the Ethiopian export sector oilseed industry provides a major contribution to foreign exchange returns. In the country, the major oilseed crops Sesame; Soybean; and Niger seed accounts for 20% of Ethiopian total agriculture export [8]. From them soybean export has been boosted over the last two decades and the value of the export bill was \$44.7 million in the 2022 marketing year [9].

Given the role of agriculture export to the Ethiopian economy oilseed sector particularly the soybean sector has a great opportunity to improve the current import–export scenario due to the high demand for organic seeds in the world market, good agroecological environment in the country, availability and cheap labor force, and popularity of Ethiopian oilseeds in the global market [10, 11]. But the production and export performance of the sector is below expected and highly fluctuated for instance the data from TrendEconomy’s [9] study, showed that the share of Ethiopian soybean in the international soybean market was less than 0.05% in 2022, indicating the sector is highly inefficient as result of various factors included low productivity and quality for the crop, illegal trade, and high competition in the international market [2, 12, 13].

Based on the review investigation various researchers studied the Ethiopian export sector which funded their topic on Ethiopian export performance in general [2, 5, 11, 14]. Nevertheless, studies on soybean export performance were scarce and most of the researches were conducted on oilseed

sector export performance in general [1, 4, 10]. So, the review was conducted with the objective of examine the past two-decade Ethiopian soybean export trend (2004–2022), identify opportunities and challenges of the Ethiopian oilseeds export sector, and forecast the next 10-year export of Ethiopian soybean that enable to identify intervention area for factors that affect soybean export performance in the country find possible suggestion ideas on the possibility of intervention that might improve the sector performance and benefit more from the sector.

1.2. Methodology. This study was conducted in one of the sub-Saharan African countries, Ethiopia. Primarily, this study is a review article mainly centered on secondary data which was collected earlier and 18-year time series data were taken from TrendEconomy’s [9] study. More of the past two decades Ethiopian soybean export was analyzed based on an intensive reading of journals, books, and articles. Then, the next 10-year export was forecasted using the Box–Jenkins, ARIMA. This methodology is based on autocorrelation within the time series and the time interval must be equal [15]. The time interval was equally spaced, while the model’s construction was done on stationary data [16]. This ARIMA stands for autoregressive integrated moving average (MA), and the model is separated into three components depending on the type of data [15].

The first part is the autoregressive (AR) model, in which the value of a variable in one period is related to its value in previous periods. $AR(p)$ is an autoregressive model with p lag:

$$Y_t = \alpha + \sum_{i=1}^p \beta_i y_{t-i} + \varepsilon_t, \quad (1)$$

where Y_t is the dependent variable, α is a constant, β_p is the coefficient for the lagged in time $t - p$, and ε_t is the random or white noise term that represents a shock that cannot be explained.

The other component is the MA, which possibility of a relationship between a variable and the residuals from previous periods. $MA(q)$ is a MA model with q lags:

$$Y_t = \alpha + \varepsilon_t \sum_{i=1}^q \delta_i \varepsilon_{t-i}, \quad (2)$$

where Y_t is the dependent variable, α is a constant, δ_i is the coefficient for the lagged variable in time $t - 1$, and ε_t is the error term.

The combination of the above two models, which are AR (autoregressive) and MA (moving average), gives the ARMA model, and the ARMA model can be used if and only if the data are stationary at level [17]. The ARMA models combine both p autoregressive terms and q moving average terms, also called ARMA (p, q):

$$Y_t = \alpha + \sum_{i=1}^p \beta_i y_{t-i} + \sum_{i=1}^p \delta_i \varepsilon_{t-1} + \varepsilon_t. \quad (3)$$

When a variable Y_t is not stationary, a common solution is to use a differenced variable: $\Delta Y_t = Y_t - Y_{t-1}$, for first-order differences, and by differencing the original series before using them will remove any linear time trend. If we include the third component, which is integrated into our ARMA model, it will become ARIMA.

To make the reviewed article brief, in addition to narration figures and tables were used as reviewing techniques.

2. Review of Related Literature

The literature part of the study highly discusses the previously conducted research and their findings regarding world soybean production and marketing, Ethiopian soybean export trend, and opportunities and challenges of the oilseeds export sector in Ethiopia.

2.1. World Soybean Production and Marketing. Soybean is one of the major food and industrial crops grown in every continent [18] and the most important food crop globally as an industrial and versatile crop [19]; with nine essential amino acids that are vegetable-based complete proteins [20, 21]. As a result, it has grown to be a significant source of both human and animal protein having 15% intended for direct human consumption and 85% used for animal feed [22, 23]. This kind of beans is commonly crushed into soy oil and meal and is found in hundreds of edible and nonedible products ranging from cooking oil, animal grains, vegan food, milk, and other industrial applications [23].

Globally soybean oil is the second important cooking oil after palm oil with an average protein content of 40% and is more protein-rich than any other common vegetable or animal food source and contains about 20% oil on a dry weight of grain basis, of which 85% are unsaturated and cholesterol-free [24]. The crop occupies 6% of the world's arable land [25] and is highly cultivated in the USA, Brazil, and Argentina, and they together accounted for 80% of the total soybean production in 2017 and dominated global exports [24]. In 2021, these large-scale farmers will produce approximately 80% of all soybeans, with small-scale farmers producing the remaining 20% [26].

In the past three decades, global soybean production and marketing have changed radically [22, 24]; and it has become a major export crop; for instance, in 2017 production year of 150.1 million tons of soybeans with a value of USD 58 billion were exported [27]. Then, the export sector boosted and in 2022 total market worth exceeded \$93 billion [9]. The data shows that the sector has a lot of global market transactions and has good opportunities to expand its exports.

In the international market Brazil, the USA, Argentina, Canada, and Uruguay are the top five soybean exports. For instance, as shown in Figure 2; in the 2022, marketing year Brazil was the world's largest soybean exporter accounting for 50% of the global, whereas Figure 3 shows China was the largest soybean importer in the world accounting for 70% of total world soybean with totaled importing bill of \$61 billion.

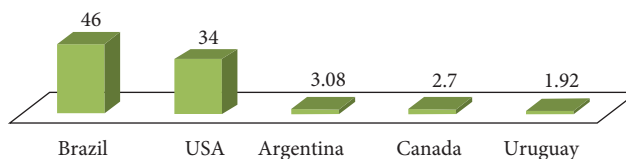


FIGURE 2: Global top five largest soybean exporters in 2022 (\$billion). Source: Author's computation using data from TrendEconomy's [9] study.

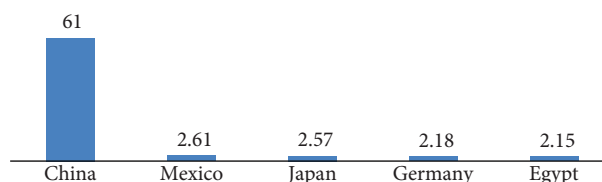


FIGURE 3: Global topmost soybean importers 2022 (\$billion). Source: Author's computation using data from TrendEconomy's [9] study.

Similarly, as indicated in Figure 4, the world import–export soybean market is highly dominated by a small number of countries and has room for others.

Also, the data showed in the 2022 marketing year, the largest international soybean export was flow from Brazil to China accounting for 43% (\$37 billion) of the world export; followed by export flow from the USA to China shared 22% (\$19.1); and from the USA to Mexico 2.92% (\$2.52 billion) [9]. It shows that small countries like Ethiopia will benefit more if they market with higher importers like China.

2.2. Trend of Ethiopian Soybean Export in the Past Two Decades (2004–2022). In Ethiopia, soybean is one of the most important crops [28]. It contributes 18% of the country's oilseed production on 6% of the area cultivated by oilseeds and production and productivity of the crop are increasing under smallholders in the country [13]. For instance, 2018/19 soybean production was 18 times more than the 2007/08 production year, and in the international market demand for Ethiopian soybean highly increasing due to its GMO-free product and it gets a competitive advantage of higher premium up to \$150 per tonne in supply chains internationally [29]. Over the past two decades, Ethiopia's soybean production has grown quickly due to an increase in the area planted particularly in commercial farms which are few but contribute about half of total soybean production and advancement in technology and practice contributed a lot for production increment [13].

In Ethiopia, majority of soybean production comes from the Amhara region shares 39% of the country's total followed by Benishangul Gumuz shares 35% and the Oromia region contributes 26%; the crop is becoming a popular food and cash crop in the international and domestic market enables getting the government attention to considered as industrial crop and in the country trading of the commodity is directing through Ethiopian commodity exchange (ECX), since December 18, 2018 [13].

Ethiopian soybean has been an exporter since 2004 [30]; and currently, more than 150 exporters participate in the

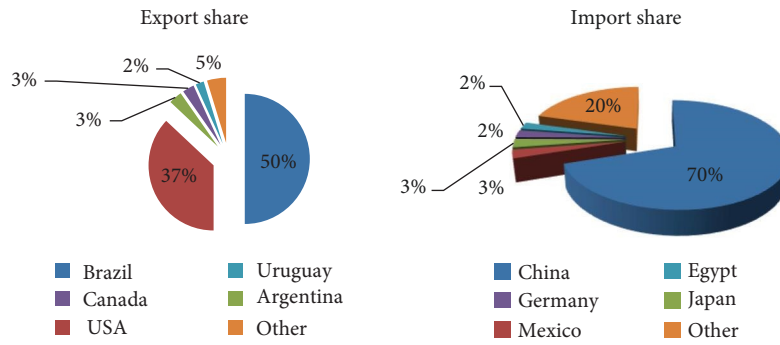


FIGURE 4: World soybean import–export share in 2022. Source: Author’s computation using data from TrendEconomy’s [9] study.

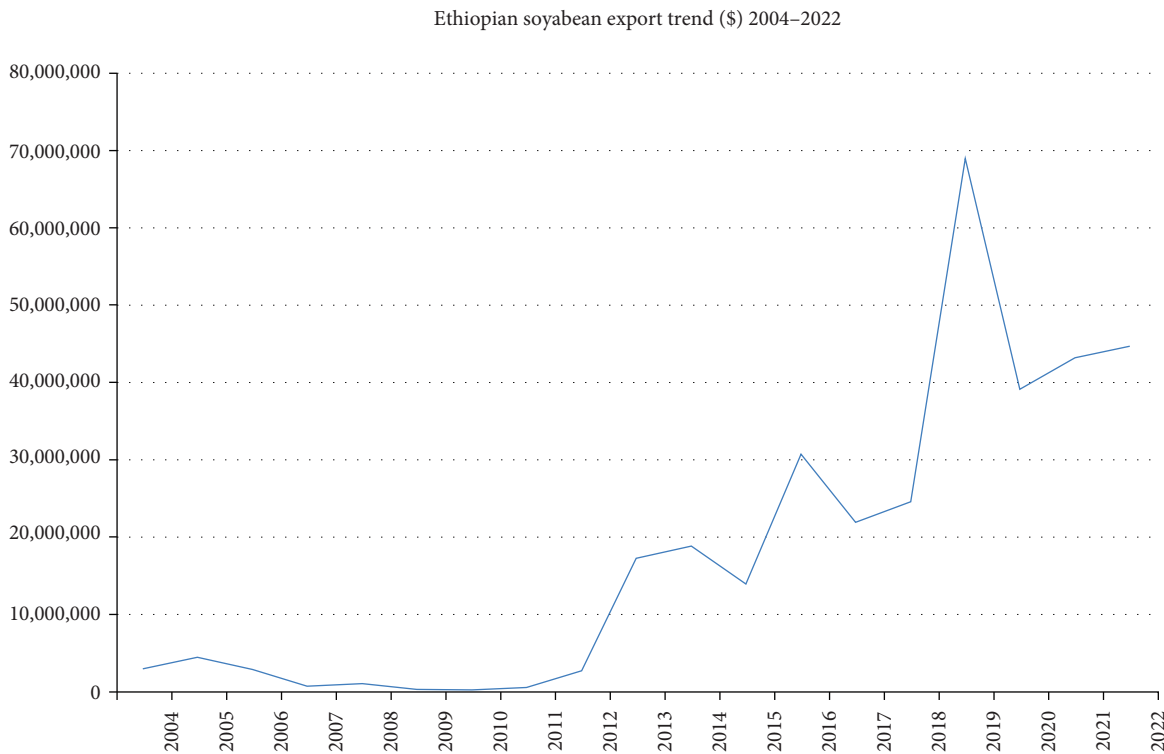


FIGURE 5: The export trend of Ethiopian soybean in the past two decades. Source: Author’s computation using data from TrendEconomy’s [9] study.

soybean international market [13]. In the nation, most of the produced soybean is exported for instance in the 2019 production year from a total of 101,703 tons of soybean provided to the market only 7.3% were consumed domestically while 93 of the grain was exported. As shown in Figure 5, in the country soybean export bill highly increased for the last two consecutive decades with an export bill of 2.5 million US\$ in 2004 then increased to some extent in the consecutive years and reached a maximum in the year 2019 totaled 69.5 million US\$ then decline in 2020 and totaled \$44 million in 2022 [9]. Of most Ethiopian soybeans exported to India, the USA, and the United Arab Emirates; for instance, as shown in Figure 6, the top five Ethiopian soybean export destinations in the year 2022 were India, the USA, the United Arab Emirates, Canada, and Spain where India was the largest destination of Ethiopian soybean with a shared of 60% (27 million US\$),

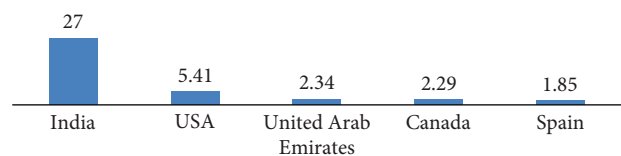


FIGURE 6: Top five export destinations of Ethiopian soybean 2022 (\$million). Source: author’s computation using data from TrendEconomy’s [9] study.

followed by the USA accounted 12% (5.41 million US\$) of total exported from the country and United Arab Emirates 5.24% (2.34 million US\$).

As the data indicated the export trend of the Ethiopian soybean sector is increasing to some extent but not comparable with world increment on the sector. For instance, the

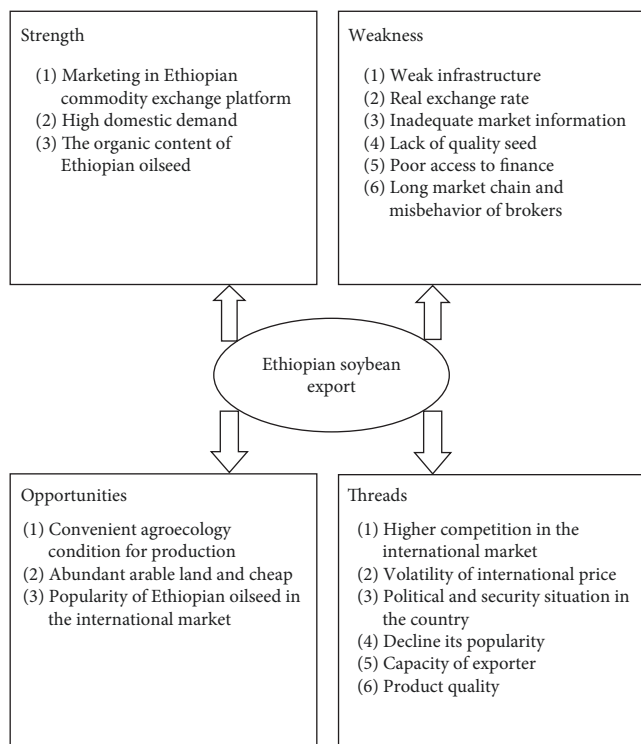


FIGURE 7: Ethiopian soybean export SWAT analysis map. Source: Author’s summary from previous studies.

world export bill for soybeans in the 2022 marketing year exceeded \$93 billion while Ethiopian total export bill was only \$44 million which means the country contributed only 0.055% of the world soybeans it showed though the country has a comparative advantage in world production and marketing of soybean, the country not well benefited from the sector.

2.3. Opportunities and Challenges of Ethiopian Oilseeds Export Sector in the Past Two Decades. As shown in Figure 7, Ethiopian oilseed export market has ample opportunities with faced challenges and forecasted threats in the way that Ethiopia is one of the producers and exporters of oil seed in the world, and the sector is characterized by the existence of a high opportunity to compute well in the international market as a result of great opportunities in production and marketing for the sector as identified in different studies [1, 10, 12, 13]. For instance, in the country trading of soybeans through the Ethiopian commodity exchange platform has contributed significantly to the market access and sales volume of the exporters in the oilseed export marketing [31]. Also study by Amsale [10], on challenges of Ethiopian sesame export identified high demand for organic Ethiopian oilseeds in the international market, availability of cheap labor force, good agroecology conditions, abundant arable land, better market position, and market price as opportunities to increase the export performance of the sector [10], the findings were supported by Debas [11] and Abdulkadir [12], that relatively cheap cost of production and good geographical location are opportunities for Ethiopian oilseeds export sector [11, 12]. Further, the study identified high potential for

product diversification, the organic content of Ethiopian oilseed, and the popularity of Ethiopian oilseed in the international market as major opportunities of the sector [12]. Another study by Bereket [5], on the determinants of agricultural export in Ethiopia using an error correction model finds that both in the short run and long run export diversification and real GDP affected agricultural export positively [5]. The findings supported that real output and nominal exchange rate affect positively the export sector of Ethiopian oilseed [1].

Nevertheless, various studies specified Ethiopian oilseed export sector has ample opportunities [5, 10, 11], return from the sector is lower than expected and the trend highly fluctuated in the past two decades. Per the report of the United States Department of Agriculture’s foreign agriculture service on Ethiopia oilseeds identified distortion of local market price that means local dealing price is higher than the world market price is the major constraint in the Ethiopian soybean export sector. For instance, as stated in the report 2019, soybean export prices (FoB) on average was \$476 per metric ton, whereas the local trading price for the crop was \$556 per metric ton which means Ethiopian exporters sold on average 13% or \$63 per metric ton below local trading price [26].

Another study by Lemma and Ali [32], on the challenges and performances of the Ethiopian export market identified inadequate market information, low level of investment, and poor access to finance as major challenges of the export sector in Ethiopia [32], the result was supported by different studies includes lack of complete, accurate and accessible international marketing information, inefficient marketing system [13, 32], lack of infrastructure and road network [2, 12, 33], and poor access to agriculture financing affected the sector negatively [33].

Similar studies identified production/productivity, foreign price level, real exchange rate, and infrastructure hinder the performance of the sector [12], and results supported that real exchange rate challenges the sector [33, 34]. Similar findings were revealed by Ebrahimi et al. [35] except for some factors including domestic price, term of trade, and fertilizer input. Another study on determinants of Ethiopian agricultural exports using two-step GMM by Eshetu and Mehare [2], revealed that the road network, the corruption index of the country, gross domestic product, and lagged export values as causes for low performance of the sector, consistency findings were revealed that the corruption index of the country [33] and impurity or adulteration supply of products for instance 90% of the soybean has been rejected as a result of poor quality in terms of size and color as major challenge on the sector [13].

Further, studies identified various bottlenecks that hinder the export performance of the oilseed sector including lack of quality seed, postharvesting loss and problems with quantity and quality produced [10], high domestic demand in low domestic production, long market chain, capacity of the exporter, impurity of products in the market, unstable domestic market, misbehavior of brokers and transportation cost [36], firms capacity, foreign market characteristics, product characteristics

[14], local market price distortion, higher competition on the international market, volatility of international price, low productivity, and volatile political and security situation in the country [12], trade openness, capital expenditure and domestic credit [34], and high involvement of informal commission agents in both local and international market as major challenge in the sector [13]. Moreover, the lack of adequate warehouses, grading, and sampling systems and higher penalty costs for not withdrawing commodities from the warehouses on time highly affected the oilseed export sector in Ethiopia [31].

Whereas the export of other African country influenced by different factors. For instance in East African countries industrialization, foreign direct investment, and exchange rates have a positive impact on the export value of agricultural products [37]. While in Egypt agricultural product exports are affected positively by exchange volatility and challenged by transportation costs [38], in Sudan both domestic and trading partner infrastructure play positive and significant roles in enhancing the export performance of agricultural products [39], in Uganda, the formation of COMESA and EAC had a significant positive effect on Uganda's exports [40], economic real per capita GDP, trade liberalization, and exchange rate have a positive impact on export performance in Tanzania [41].

2.4. Forecasting the Next 10-Year Export Performance of Ethiopian Soybean

2.4.1. Step 1: Model Identification. The data were checked for stationary both in graph and ADF (Augmented Dickey–Fuller test). The graph showed systematic changes in the mean and variance and no periodic variation. Similarly, the ADF test statistic was smaller than the critical level and the p -value 0.6234 greater than 0.05, indicated that the data were nonstationary at level. Then, data were differentiated and achieved stationary at first difference. The result Dickey–Fuller test (-6.515) was less than the critical value (3.750) at the 1% level, and the p -value was statistically significant (p . 0.0000). Then, the study used the autocorrelation (ACF) and partial autocorrelation (PACF) to decide the suitability of the MA and autoregressive components, respectively. Per the AC and PAC correlogram, the study finds ARIMA (4,1,0) and ARIMA (5,1,0), as the two plausible ARIMA models.

2.4.2. Step 2: Model Estimation. A more appropriate model was selected based on the one with the highest log-likelihood value, and most significant coefficients, and with the lowest BIC and AIC values. Per the criteria as shown in Table 1, ARIMA (4,1,0) is the most appropriate model.

2.4.3. Step 3: Model Diagnostic Checks. The Portmanteau (Q) test for white noise was tested and found that a p -value of 0.9856, which is greater than 0.05 indicated that residuals are white noise. Then, covariance stationary was checked using the ARroot test and finding out all roots inside the circle indicated that the model was covariance stationary.

2.4.4. Step 4: Forecasting. After a test for the overall significance of the model, the study forecasted the coming 10 years export performance of the country. As shown in Figure 8, in the coming 10-year soybean foreign trade from Ethiopia will

TABLE 1: Model selection criteria.

Criteria	Model		Best model
	Modal A ARIMA (4,1,0)	Modal B ARIMA (5,1,0)	
C, AR, and MA	3/1	3/1	=
Log-likelihood	-302.7396	-301.8863	A
AIC	617.4792	617.7726	A
BIC	622.4785	623.6051	A

Source. Own computation.

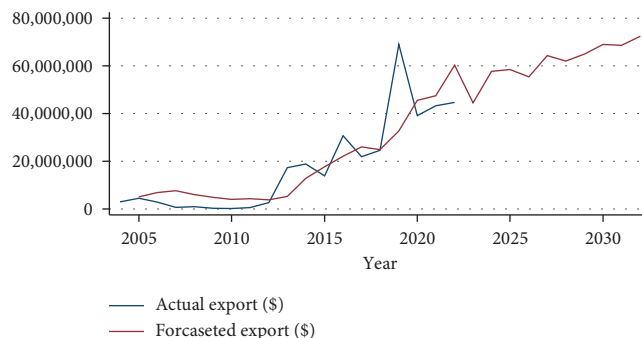


FIGURE 8: Forecasted Ethiopian coming 10-year soybean export. Source: Author's computation using data from TrendEconomy's [9] study.

increase to a certain extent and will reach 97.4 million dollars in 2032, as set in Table 2.

3. Conclusion and Recommendation

3.1. Conclusion. Ethiopian oilseed industries have been major contributors to generating foreign exchange earnings. In the country, the three major oilseed crops (sesame, soybean, and Niger seed) contribute 20% of Ethiopian total agricultural export. Soybean is one of the most important oilseeds in the world and its demand is grown mainly for its protein and oil-rich crop. Brazil, the USA, and Argentina were the world's largest producers and exporters of soybeans. In Ethiopia, soybean production has been quickly increasing over the last two decades, and currently, the crop accounts for 18% of the country's oilseed production on 6% of the area planted to oilseeds with more than half of production coming from large commercial farms.

Ethiopian soybean marketing is characterized by export lead and from the total provided to the market 92.63% of the grain is exported and only 7.37% is provided in the domestic market. In the past two decades, the export trend for soybeans increased by 15 times and the value of exports totaled \$44.7 million in 2022. In the country higher export record was gained in the 2019 marketing season have 69.5 US\$. India, the USA, the United Arab Emirates, Canada, and Spain were the major destinations of Ethiopian soybeans. In the country, though the export bill has increased in the past decade, the return from the sector is less than expected and the share in the international market is insignificant for

TABLE 2: Forecasted Ethiopian soybean export (2023–2032).

Year	Forecasted export (\$)	Year	Forecasted export (\$)
2023	49,300,000	2028	73,700,000
2024	69,600,000	2029	81,900,000
2025	66,500,000	2030	89,800,000
2026	63,300,000	2031	84,800,000
2027	82,200,000	2032	97,400,000

Source: Author's computation using data from TrendEconomy's [9] study.

instance in the 2022 production year, and the share of Ethiopian soybean in the international market was less than 1%.

The popularity of Ethiopian oilseed crops in the international market, abundant arable land, conducive agroclimate conditions, availability of abundant and cheap labor, and higher demand for organic Ethiopian oilseed in the international market are major opportunities in the Ethiopian soybean export sector. Whereas poor quality grain supply in the international market, volatility of market price at local and international levels, high competition in the international market, high domestic demand for the crop, domestic illegal trade, inadequate market infrastructure, low market efficiency, corruption, volatile political, and security situation were the major challenge of the sector in the past two decades. The Box–Jenkins, ARIMA model result showed that unless intervention measures that enable the utilization of the available opportunities and overcome the faced challenges are taken in the coming 10-year Ethiopian soybean export bill will be increased to only a certain extent and the annual export bill of the country will remain less than \$100 million in coming 10 years.

3.2. Recommendation

- (i) Based on the findings, the study recommended the following basic interventions and empowering actions for the Ethiopian soybean export sector.
- (ii) To increase soybean production in the country available abundant arable land and a cheap labor force might need to change in production; thus, it is better to encourage youth unemployed and investors to ward agriculture.
- (iii) Might be important to improve the quality of the grain provided in the international market by arranging training for producers, middlemen, and exporters on the standards of the international market and it might be good if laboratory tests were conducted before commodity exchange.
- (iv) Through certifying Ethiopian organic seed or another method, it might be important to conserve the popularity of Ethiopian oilseed in the global market unless this opportunity can be taken away.
- (v) International price volatility and competition might be overcome through increased production efficiency and improved quality and instead of exporting raw seeds, it might be worth of export products in the form of processed and semiprocessed products.
- (vi) The political security and instability in the country might affect productivity and investor attraction so it might be worthwhile if the government improves the situation.
- (vii) The current marketing for the crop in ECX might be good in shorting the market chain, protecting illegal traders, and reducing corruption so it is better to encourage soybean marketing in the ECX platform.

Data Availability

Data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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