# Comparative Analysis of Export Performance of Indian Cocoa during Pre and Post MIDH Periods

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**Abstract**

A progress of cocoa cultivation was focused on the objective of estimating the growth rate of export quantity and value of Indian cocoa and identifying the trade direction of Indian cocoa. The study was based on the secondary data for 15 years (2006-07 to 2020-21), separated into period I (Pre-MIDH) and period II (Post-MIDH). Compound growth rate used to estimate the export quantity and value, Markov chain analysis for probability changes of cocoa exports to the major markets. The study found that the share of cocoa exports in agricultural exports in terms of value increased from 5.25% in 2011-12 to 10.83% in 2020–21 for the last decade of the study. The growth rate analysis, export quantity and value increased in the both periods. The transition probability matrix showed that Nepal was the most stable importing market for Indian cocoa in a period I, whereas the USA and Turkey were stable importers in period II. The other markets retained a probability share with a low probability and were considered unstable markets. Hence, the study concluded that a robust export policy is responsible for stabilizing the international market, disseminate export-oriented strategies of cocoa beans to farmers, and raise the level of price competition for Indian cocoa abroad. The government sector is responsible for setting Premium cocoa prices, building large-scale processing plants with high production rates and facilities for farmers producers organisations (FPO) to distribute cocoa beans, and luring international buyers by improving the quality of the beans.

**Keywords:** Cocoa, Export, Compound growth rate, Direction of trade, Markov chain analysis

**Introduction**

Cocoa (*Theobroma cacao L.*) is a native of South America and entered India during the 20th century. It is one of the prospective crops that can offer a profitable yield to Indian farmers (George A and Raju K V, 2021). Cocoa is hardly grown as a monocrop and demand has been increasing manifold in India with the increasing deform of cocoa seeds. Farmers have double their income through cultivation of cocoa as an intercrop with perennial gardens in India and technological advancements have taken place as an integral part of development efforts on cocoa by DCCDB in 1997 and the trajectory in international export trade (www.dccd.gov.in). In the year 2020, 12299.546 MT of Indian cocoa was exported to more than 100 countries, and its value was US $ 49.26 million. Out of the 29.34% share of total exports, the African countries accounted 19.35% from Ivory coast, Cameroon, Ghana and Nigeria; 4.24% from Central and South American countries (Brazil, Colombia, Ecuador, Venezuela and Mexico); and 5.75% from Asian countries (Indonesia, India, Malaysia and Philippines). India ranks 38th in terms of cocoa exports, accounting for 0.28 percent of total exports and 0.34% of global output (www.apeda.gov.in). The United States, Turkey, Indonesia, The Netherland, Nepal, Saudi Arabia, The United Arab Emirates, Brazil, and Germany are among the major

importers of cocoa from India. Cocoa exports increased at a 17 % annual rate, from 9 thousand crores in 2011-12 to 32 thousand crores in 2020-21(www.indiastat.com). There is scope for improving cocoa cultivation by implementing the Mission for the Integrated Development of Horticulture (MIDH) in the year 2014-15 with the objective of improving the farmer's income through integrated innovations in the cultivation of horticultural and perennial crop plantations and has been a large-scale distribution of hybrids and high-yielding varieties of cocoa, which has increased the area and production of this crop. It is a federally funded program for the comprehensive expansion of the horticulture industry that includes bamboo, coconut, cashew, root and tuber crops, flowers, spices, mushrooms, flowers, and fragrant plants (Priyadarshini M *et.al.,* 2020) As cocoa exports have been increasing in international market, the country has a wider scope to improve the sector.

Major importing countries of bamboo products from India were noticed by Gogoi J et al. in 2020, and the study's economy was growing to 31.37 percent per year (Gogoi *et.al.,*2020). Soumya and Yeledhalli in 2021 also revealed a significant growth rate and outlined a stable market for wool exports with an 80 percent retention rate (Soumya P and Yeledhalli R, 2021). The potential to attain self-sufficiency in cocoa is not realised due to the poor engagement of skilled farmers in cocoa production, according to Karpagalakshmi and Muthusamy (2019), who noted that the growth rate of cocoa goods was increasing (Karpagalakshmi S and Muthusamy A, 2019).

Despite of increasing trend in cocoa exports throughout study, the farmers are facing the problem of chocolate companies procuring the cocoa beans at a lower rate of price, and the cocoa growers have a lack of knowledge regarding the export of cocoa beans due to the unavailability of organizations to receive international market information and processing facilities at farm level. This will lead to unstable production and export of cocoa beans. With this in mind, the current study was conducted with the following specific goals and objectives:

i.      To estimate the trend and growth rate of export quantity and value of Indian cocoa.

ii.     To identify the probability changes in export of cocoa.

### Methodology

The study was based on time series data for a period of 15 years. Data were spilt up into pre-MIDH (2006-07 to 2013-14) and post-MIDH (2014-2015 to 2020-21) which were referred to as period I and period II respectively, based on the Mission for Integrated Development of Horticulture's implementation (MIDH). The share of products of cocoa export in total export and agricultural export were analysed for the period of the last 10 years (2011-12 to 2020-21). Secondary data on export quantity and value were gathered from various sources, including Indiastat, FAOSTAT, the Directorate of Cashewnut and Cocoa Development Board (DCCDB), Cochin, and APEDA, for top importing countries. The collected data was analyzed using the following tools.

**Compound growth rate:** The compound growth rate for export quantity and value of cocoa were estimated using the exponential growth function of the form given by (Gogoi *et.al.,* 2020)

$$Y = ab^t u_t$$

Where,

Y= Export quantity and value of cocoa

a = Intercept

b = Regression coefficient

t = Time variable

$u_t$ = Error term

The equation was estimated after transforming the above equation as logarithmic form:

$$\ln Y = \ln a + t \ln b + \ln u_t$$

Then, the percent CGR(g) was calculated using the relationship;

**g = {antilog of (ln b)-1} \*100**

**Markov chain analysis:** The direction of trade in exports was examined by using the Markov-Chain approach and involves the estimation of the Transitional Probability Matrix (P) and also used by (Soumya P and Yeledhalli R, 2021). The probability that exports will change over time from nation i to country j is denoted by the matrix element Pij. The diagonal Pij calculates the probability that a country will maintain its export share in the market. Therefore, a diagonal element analysis reveals a country's loyalty to a certain export's (Kusuma and Basavaraja, 2014). In the context of the current application, there are 10 exporting countries. The average exports to a particular country were considered to be a random variable which depends only on its part exports to that country which is given as:

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} P_{ij} + e_{jt}$$

Where,

$E_{jt}$ = Exports from India to $j^{th}$ country during year t
$E_{it-1}$ = Exports to $i^{th}$ country during the lagged year (t-1)
$P_{ij}$ = Probability that exports will shift from ith country to jth country.
$e_{jt}$ = Error term which is statistically independent of $E_{jt-1}$ and
r = Number of importing countries

The Transitional Probabilities Pij, which can be arranged in a (c×r) matrix, have the following properties:

$$0 \leq P_{ij} \leq 1$$
$$\sum_{i=1}^{r} P_{ij} = 1 \text{ for all "i"}$$

The diagonal elements of the matrix P indicate the probability that the export share of a particular country will remain from over the period to another. The off diagonal or transfer probabilities indicates the probability that the share of export to a particular country will change to another country over time. By multiplying the exports to these countries in the previous period (t-1) with the Transition Probability Matrix, it was possible to identify each country's planned export share for period t. The Transitional Probability Matrix is estimated in the framework by a method referred to as Minimization of Absolute Deviation (MAD). The Linear Programming formulation id stated as:

$$\text{Minimize } O'P^* + I_e$$

Subject to

$$XP^* + V = Y$$
$$GP^* = 1$$
$$P^* \geq |O|$$

Where,
P\* represents a vector of Pij's probability.
O is a vector of zeros
I is a vector of regions with the proper dimensions
e is the absolute error vector |U|
Y is the exports vectors to each country
X is a block diagonal matrix of lagged value of Y
V is the vector of errors
G is a combining matrix used to multiply the row values of P, are arranged in P\*, by one.

**Descriptive analysis:** A Descriptive analysis carried out to analyze the percentage share of cocoa exports to total agricultural export in terms of value and to identify the major 10 importing countries in terms of quantity.

**Results and Discussion**

*Share of India's Agricultural Export and Total Cocoa Export*

The study analyzed the trend to understand the share of India's cocoa export to total export and agricultural export for the last decade (2011-12 to 2020-21) in India in terms of value which were shown in figure 1.
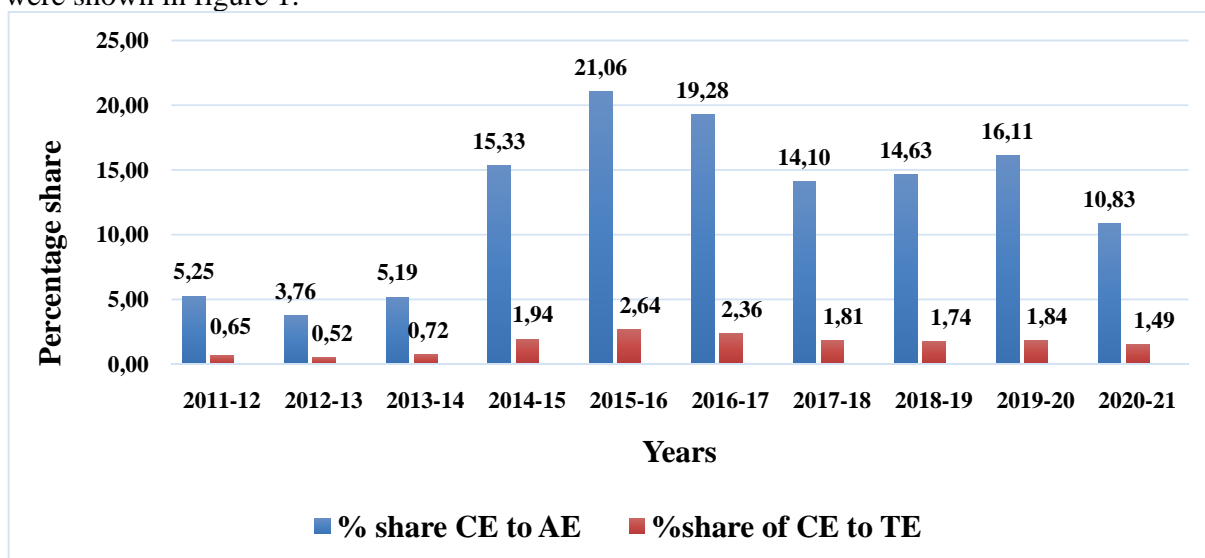


**Figure 1. Share of Cocoa Export to Total India and Agri Export**
**CE: cocoa Export; AE: Agri Export; TE: Total India Export**

The export share of cocoa products (cocoa beans, cocoa butter, cocoa powder and cocoa paste) in total export and in agricultural export were identified and the results are given in table 1. The percentage share of cocoa export to total export was 0.65% and the share of cocoa export to agricultural export was 5.25% in the year 2011-12 and both the shares were increased to 1.49% and 10.83% respectively in the year 2020-21 (Karpagalakshmi S and Muthusamy A, 2019).

**Table 1. Share of cocoa export to India's total and Agri Export, 2011-12 to 2020-21**

| S. No | Year | India's total export (value in ₹ Crores) | India's agri export (value in ₹Crores) | India cocoa export (value in ₹ Crores) | % Share of cocoa export to total export | % Share of cocoa export to agri export |
|---|---|---|---|---|---|---|
| 1 | 2011-12 | 1465959.31 | 182801 | 9589.60 | 0.65 | 5.25 |
| 2 | 2012-13 | 1634318.38 | 227192.61 | 8549.82 | 0.52 | 3.76 |
| 3 | 2013-14 | 1905011.01 | 262778.54 | 13647.89 | 0.71 | 5.19 |
| 4 | 2014-15 | 1896445.47 | 239681.04 | 36747.19 | 1.94 | 15.33 |
| 5 | 2015-16 | 1716378.05 | 215395.55 | 45363.49 | 2.64 | 21.06 |
| 6 | 2016-17 | 1849433.55 | 226651.91 | 43704.47 | 2.36 | 19.28 |
| 7 | 2017-18 | 1956514.53 | 251563.94 | 35473.61 | 1.81 | 14.10 |
| 8 | 2018-19 | 2307726.19 | 274571.28 | 40157.11 | 1.74 | 14.62 |
| 9 | 2019-20 | 2219854.17 | 252976.06 | 40761.41 | 1.84 | 16.11 |
| 10 | 2020-21 | 2161105.77 | 298145.45 | 32298.24 | 1.49 | 10.83 |

*Source: www.indiastat.com and www.faostat.fao.org.*

India's total export was ₹ 1465959.31 crores during 2011-12 which increased to ₹ 2307726.19 crores in 2018-19. After that, it decreased due to the covid pandemic with a growth rate of 4.18% per annum. Agriculture exports increased from ₹ 182801 crores in 2011-12 to ₹ 298145.45 crores in 2020-21, with a growth rate of 3.43 percent per year, and cocoa exports also increased, with a growth rate of 17.86 percent per year. The annual growth rate of agricultural exports (3.43%) was less than the growth experienced in the case of total exports (4.18%). However, cocoa has a potentially positive increasing trend in share and has gained importance in the uplift in environmental integrated with the economy revealed by (Suresh A and Mathur V C, 2016). The value of cocoa was increased from ₹ 9589.60 crores in 2011-12 to ₹ 32298.24 crores in 2020-21 (nearly 3.5 times in a decade).

### Compound growth rate of Indian cocoa beans in pre and post-MIDH periods

The secondary data on Indian cocoa export for period I and II were collected and analysed using compound growth rate. The results are laid out in figure 2 and revealed that the growth in quantity and value were positively increased for both periods. In the period of pre-MIDH, the growth rates of quantity and value were 28.02% and 44.29% per annum, respectively while, for the period of post-MIDH, the export quantity and value were estimated at 1.49% and 3.74% per annum (Ushunde *et.al.,* 2016). However, the quantity of cocoa exported from India has increased by 16 percent annually over a period of 15 years. This might be attributed to the country's focus on exporting significant quantities of Indian cocoa (N Patil and A J Nirban, 2010), which is in high demand in the USA and Turkey.
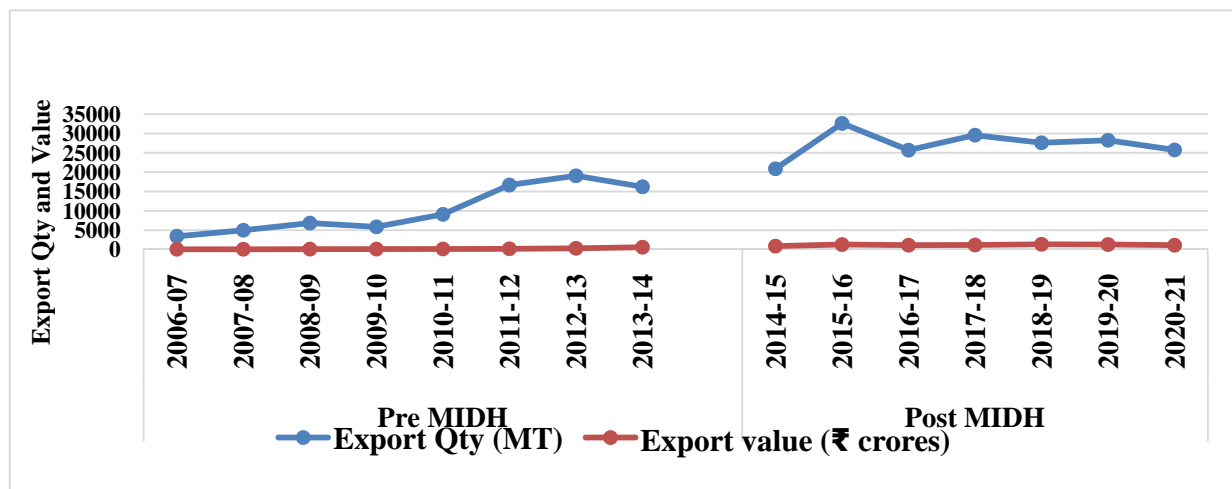


**Figure 2. Growth Rate of Export o Cocoa Beans**
**Source: www.dccd.gov.in & www.indiastat.com**

### Share of importing countries

The Figure 3 shows India's percentage of global cocoa exports in terms of quantity (MT) for the year 2020–21. The United States topped the list with a share of 26% (6695.08 MT) of the total cocoa exports from India in 2020–2021, followed by the Netherlands (2040.04 MT), which got 8% of the total exports. Turkey and Nepal are next with 6% of the market, or 1473.58 MT and 1594.04 MT, respectively. Brazil (1090.62 MT) and Indonesia (1159.05 MT) both contributed 4% of the world's total cocoa exports. UAE (929.42 MT) and Germany (1111.06 MT) earned 4% each, while Saudi Arabia received the least amount, or 3%, with a quantity of 736.24 MT, in the top 10 biggest nations. The rest of the countries other than the top 10 major countries were grouped together under

the category of other countries and their share of cocoa export was 35 percent (8930.95 MT) of the total cocoa exported from India. According to the trend, it is predicted that 42965MT of cocoa will be exported in the upcoming year of 2025.
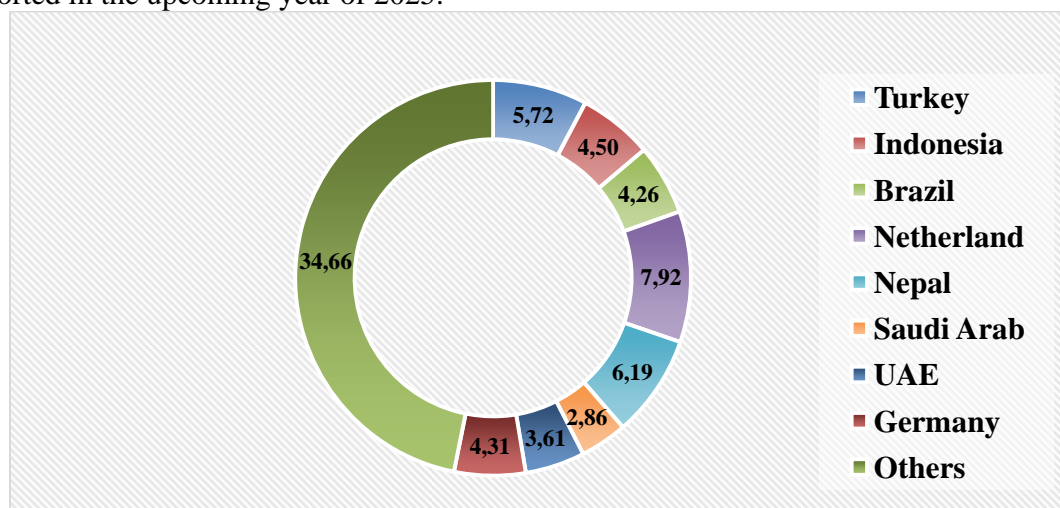


**Figure 3. Share of Importing Countries (2020-2021)**
**Source: APEDA**

***Probability changes in the export of Indian cocoa: Markov chain approach***

The Export of cocoa in India was analysed using a Markov probability matrix, which provides an indication of dynamic changes in the direction of cocoa export from India (R S Patil *et.al.,* 2018). The diagonal and the other diagonal elements of the transition probability matrix signified the opportunity to maintain the market share from the previous year as well as the gain or loss of a specific nation from other countries. When Indian cocoa is exported to foreign nations, the values of the column components represent the possibility of profit, while the values of the row elements represent the probability of loss. The value of the diagonal element is greater than 0.5, which revealed that the country would be a stable market for Indian cocoa and showed the loyalty of the importing country to the particular commodity.

The Markov chain method was used for the major nine countries, which are the United States, Turkey, Indonesia, Brazil, the Netherlands, Nepal, Saudi Arabia, the United Arab Emirates, and Germany. The analysis was carried out for period I and period II separately. The tables 3 and 4 provide the findings, which show that the most stable markets for Indian cocoa was Nepal, which retained 62% of its initial market share, and in the period II, the USA and Turkey, which had probabilities of retention of 54.68% and 54.69% of its genuine share, respectively. Despite the reduced levels of cocoa exports, the values of greater stability kept their proportion of the initial share of stable markets (K Kumaresh and C Sekar, 2013).

**Table 2. Transitional Probability Matrix of India's Cocoa exports in pre-MIDH**

| Country | USA | Turkey | Indonesia | Brazil | Saudi | Nepal | UAE | Netherland | Germany |
|---------|-----|--------|-----------|--------|-------|-------|-----|------------|---------|
| U S A | **0.117** | 0.000 | 0.000 | 0.000 | 0.000 | 0.244 | 0.000 | 0.639 | 0.000 |
| Turkey | 0.000 | **0.000** | 0.017 | 0.000 | 0.000 | 0.504 | 0.072 | 0.280 | 0.127 |
| Indonesia | 1.000 | 0.000 | **0.000** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Country | USA | Tur-key | Indone-sia | Bra-zil | Sau-di | Nep-al | UAE | Nether-land | Germa-ny |
|---|---|---|---|---|---|---|---|---|---|
| **Brazil** | 0.000 | 0.000 | 0.000 | **0.000** | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 |
| **Saudi** | 0.774 | 0.000 | 0.000 | 0.000 | **0.000** | 0.000 | 0.226 | 0.000 | 0.000 |
| **Nepal** | 0.380 | 0.000 | 0.000 | 0.000 | 0.000 | **0.620** | 0.000 | 0.000 | 0.000 |
| **UAE** | 0.000 | 0.000 | 0.864 | 0.000 | 0.136 | 0.000 | **0.000** | 0.000 | 0.000 |
| **Nether-land** | 0.000 | 0.081 | 0.000 | 0.000 | 0.117 | 0.057 | 0.267 | **0.365** | 0.113 |
| **Germany** | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | **0.000** |

Table 2 revealed that, with a share of around 62 percent of the Indian cocoa exported during the first period, Nepal was the only largest and most reliable buyer of Indian cocoa. It gained nearly 6% of its share from the Netherlands but lost the majority to Turkey (50%) and the United States (24%). The Netherlands was the second-largest importer, with 36.5 percent of the market, but it lost nearly 64 percent to the United States and 28 percent to Turkey. Indonesia acquired a 100% stake in the Netherlands.

**Table 3. Transitional Probability Matrix of India's Cocoa exports in post-MIDH**

| Country | U S A | Tur-key | Indone-sia | Bra-zil | Sau-di | Nep-al | UAE | Nether-land | Germa-ny |
|---|---|---|---|---|---|---|---|---|---|
| **U S A** | **0.546** | 0.035 | 0.155 | 0.000 | 0.012 | 0.106 | 0.000 | 0.147 | 0.000 |
| **Turkey** | 0.000 | **0.547** | 0.000 | 0.453 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Indonesia** | 1.000 | 0.000 | **0.000** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Brazil** | 0.000 | 0.000 | 0.000 | **0.012** | 0.000 | 0.000 | 0.000 | 0.988 | 0.000 |
| **Saudi** | 0.000 | 0.183 | 0.000 | 0.000 | **0.000** | 0.058 | 0.046 | 0.000 | 0.713 |
| **Nepal** | 0.366 | 0.000 | 0.000 | 0.000 | 0.364 | **0.004** | 0.266 | 0.000 | 0.000 |
| **UAE** | 0.323 | 0.000 | 0.000 | 0.000 | 0.097 | 0.581 | **0.000** | 0.000 | 0.000 |
| **Nether-land** | 0.273 | 0.000 | 0.000 | 0.000 | 0.092 | 0.230 | 0.296 | **0.109** | 0.000 |
| **Germany** | 0.0233 | 0.106 | 0.412 | 0.000 | 0.000 | 0.000 | 0.237 | 0.000 | **0.221** |

Table 3 revealed that Turkey and the USA were the two main importing countries following the enactment of MIDH with retention capacity of 55 percent. Germany retained 22% of the market share over the same time period, demonstrating that after the adoption of MIDH, high-quality cocoa beans were imported to meet the rise in demand for Indian cocoa in Germany. The United States surpassed Indonesia, Nepal, the United Arab Emirates, and the Netherlands in market share. Less than 20% of Turkey's gains came from Saudi Arabia and Germany. Brazil took 98 percent of Germany's market share.

### Conclusion

Contribution share of cocoa export to agricultural export increased from 5.25% in 2006-07 to 10.83% 2020-21 and the share was more in post MIDH period compared to the pre-MIDH period. Cocoa registered positive and substantial growth in export quantity and value for the period of the

study. In period I, the study found that Nepal was the main steady importer, however in period II, the USA and Turkey were the main consumers of Indian cocoa. The export market for cocoa has a high possibility of retention, which opens up a world of possibilities. The research concluded that a robust and balanced export-import strategy is required to ensure the stability of Indian cocoa exports, boost demand for our cocoa beans internationally, and foster healthy competition with other markets. The central and state governments must develop policies to promote export-oriented techniques, as well as to disseminate information well about the international market and other trade matters to Indian cocoa farmers to increase the area under cocoa, which will lead to increased production, bean exports, and price competition of Indian cocoa in the international market. The government sector entails setting premium prices for cocoa, establishing processing facilities in high-production cocoa areas, and establishing facilities for the distribution of cocoa beans through Farmers Producers Companies (FPO), as well as attracting foreign consumers by improving bean quality.

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