

GROWTH AND INSTABILITY OF INTERNATIONAL TRADE OF JUTE IN INDIA

ABSTRACT

India is the largest producer of jute in the world. Among the important jute producing countries in the world, India had gained the first position in 2020 by producing about 1807 thousand tonnes of jute on an area of 691 thousand hectares and contributing a share of 67.21 and 49.47 per cent to the world's total production and area of jute, respectively. In the present study efforts have been made to examine the growth performance of international trade of jute in India. The study was based on secondary data for the period of 30 years (1989-90 to 2018-19). The collected data were sub-divided into three periods, and the exponential growth function was used to analyse the growth rates of jute. The instability in area, production, productivity, export and import were measured by Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI). The results of growth rate showed negative trend in area of jute but production and productivity showed positive growth rates over the study period. All the parameters viz., export quantity, export value, export unit price, import quantity, import value and import unit price shown positive growth rates during overall period and found to be significant at 1 per cent level of significance. It was concluded that, India has been associated with moderate degree of variability in the jute production and productivity in the first sub period and this variability has been reduced significantly during the second and third period, while area recorded less variability during the study period. All the parameters viz., export quantity, export value, import quantity and import value have experienced high instability while the export unit price and import unit price registered stability during the study period.

Keywords: Jute, International trade, Exponential growth rate, Coppock's Instability Index, Cuddy Della Valle's Index

1. INTRODUCTION

Jute (*Corchorus spp.*) is a dicotyledonous natural fiber crop which is popularly known as the golden fiber. Two species of jute namely, white jute (*Corchorus capsularis*) is a predominately self pollinated and tossa jute (*Corchorus olitorius*) is a partially cross pollinated grown in India from pre-historic times. These species are cultivated for fiber

purpose. Jute is however, our potential foreign exchange earner and must find its place in our economy. It is estimated that more than 4 million farm families are engaged in jute farming and majority of them belongs to small and marginal categories. Besides, 0.5 million people are involved in raw jute and finished good trading and ancillary activities.

Among the different textile fiber production in the world, Jute stands second after cotton. Jute occupies nearly 0.4 per cent of the total area under agricultural land in the country (Price Policy for Jute, 2021). It is not only the strongest but also the cheapest fiber of all the other natural fibers. Due to the golden colour of its fiber and higher monetary value, Jute is called as the "Golden Fiber" and as jute has an eco-friendly and biodegradable nature, it is contemplated as "fiber of the future". It has some advantageous properties like good insulation and antistatic, moderate moisture retention and low thermal conductivity. Production of Jute fibre creates huge employment generation to the villagers as from the entire jute plant, only 6 per cent fibre is obtained and the fibre extraction is totally completed manually that requires a long labour intensive process.

For cultivation of jute there are series of agro-climatic conditions and because of which it is grown in a handful of countries. Among the important jute producing countries in the world, India had gained the first position in 2020 by producing about 1807 thousand tonnes of jute on an area of 691 thousand hectares and contributing a share of 67.21 and 49.47 per cent to the world's total production and area of jute, respectively. The other important jute producing countries during the year were Bangladesh, Mainland China, Nepal and Zimbabwe. Out of these five major countries, India and Bangladesh together contributed nearly 98 per cent to the total area and production of jute in the world. While, Mainland China with a yield of 3.87 tonnes/ha had the highest productivity among the major jute producing countries in the world followed by India (2.62 tonnes/ha), Nepal (1.35 tonnes/ha), Bangladesh (1.18 tonnes/ha) and Zimbabwe (0.61 tonnes/ha). (FAOSTAT, 2020)

The major jute exporting countries in the world were Bangladesh, India, United Republic of Tanzania, Kenya, Belgium and Indonesia. The world's total jute export was 225.17 thousand tonnes, out of these, nearly 157 thousand tonnes was alone exported by Bangladesh and hence Bangladesh dominated the group of major jute exporting countries with 69 per cent share to the total world export of jute. Next to Bangladesh was India which contributed nearly 11 per cent share to the world's total export of jute with an export of 25 thousand tonnes. Therefore, 80 per cent of total jute export of the world was captured by only two countries, Bangladesh and India. (FAOSTAT, 2020)

The major jute importing countries of the world during the year 2020 were Pakistan, India, Mainland China, Nepal and Brazil. Out of 205.88 thousand tonnes of world's total import of jute, 67.32 thousand tonnes was imported by Pakistan alone. With these quantum of jute imported by Pakistan, it had a share of nearly 33 per cent to the world's total import of jute. The countries like Pakistan, India (20.07 per cent), Mainland China (12.51 per cent) and Nepal (12.17 per cent) together had a share of 80 per cent to the world's total import of jute. The other countries mentioned in the table which had a share of 39.95 per cent includes Spain, Saudi Arabia, Russian Federation, Republic of Korea, etc. (FAOSTAT, 2020)

The major jute cultivating states in India are West Bengal, Assam, Bihar, Meghalaya and Nagaland as mentioned in Table 5. Out of these states, West Bengal tops the position with highest share in area (73.15 per cent) and production (78.70 per cent) of jute in India followed by Assam and Bihar. These three states together contribute nearly 90 per cent of area and production of jute in the country. From the 1807.26 thousand tonnes of jute produced in the country, 1152 thousand tonnes was consumed during 2019-20. The yield of jute in India is higher than the world average but it is below the potential yield. (Directorate of Economics & Statistics, 2020)

It is said that India being the largest producer of jute globally, fails to acquire the position in international trade. But, no such evidence through research has been found regarding it. Hence, to know the position of India in the international market, the study was carried out with the objective of growth and instability of jute in international trade.

2. METHODOLOGY

The study was carried out through secondary data. The secondary data related to area, production and productivity has been collected from Directorate of Economics and Statistics (DES). The data related to export and import of jute has been collected from Food and Agricultural Organisation Statistics (FAO STAT) for the period from 1989-99 to 2018-19. For the analysis, the overall period was divided into three sub periods-Period I (1989-90 to 1989-99), Period II (1999-2000 to 2008-09) and Period III (2009-10 to 2018-19).

2.1 Compound annual growth rate (CAGR)

The compound growth rate analysis was carried out fitting the exponential function to the variables viz., area, production and productivity of jute w.r.t. India and leading jute growing states of India and quantity, value and price of exported jute from India and imported jute from different countries for a period of 30 years (1989-90 to 2018-19). The CAGR was fitted through the following exponential function-

$$Y_t = a.b^t \quad \dots\dots\dots (1)$$

Where,

Y = Dependent variable for which growth rate is to be estimated (Area/Production/Productivity/Export quantity/exported value/Import quantity/imported value/ unit price of export/unit price of import)

t = Time variable

b = Regression coefficient

a = Intercept

This equation was estimated after transforming (1) as follows

$$\text{Log } y = \text{log } a + t \text{ Log } b \quad \dots\dots\dots (2)$$

Then the per cent compound growth rate (r) was computed using the relationship.

$$\text{CGR } (r) = [\text{Antilog } (\text{log } b) - 1] \times 100 \quad \dots\dots\dots(3)$$

The significance of the regression coefficient was tested using the student's 't' test.

2.2 Degree of Instability

The degree of instability in area, production and productivity of jute at national and state levels, export quantity and value, import quantity and value, unit price of export and import of Indian jute was computed using the following methods-

(a) Coefficient of variation (CV)

$$\text{Coefficient of variation (CV)} = \frac{\sigma}{x} \times 100$$

Where,

σ = Standard deviation

$$\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n}}$$

Where,

\bar{X} = Arithmetic mean

X = Variable

n = Number of observations

In simple Coefficient of Variation, the problem of over estimation of instability level persists and hence to get a better measure of fluctuation, Coppock's Instability Index (Kaur and Singhal, 1988) was used.

(b) Coppock's Instability Indices (CII)

$$CII = [\text{Antilog}(\sqrt{V \log}) - 1] \times 100$$

Where,

$$V \log = \frac{\sum \left[\log \left(\frac{X_t}{X_{t-1}} \right) - m \right]^2}{N - 1}$$

Where,

X_t = Area/ Production/ Productivity of raw jute/ Production/ Export quantity/ Export value/ import quantity/ import value/ unit price of export/ unit price of import of jute in the Year 't'

N = Number of Years

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M = Arithmetic mean of the difference between the Logs of X_{t-1} and X_t

Log V = logarithmic variance of the series

(C) Cuddy Della Valle's Instability Indices (CDVI):

It was used to measure instability of jute which was close to approximation of the average year to year per cent variation adjusted for trend. The algebraic form of it was;

$$\text{Instability Index} = CV \sqrt{(1 - R^2)}$$

Where,

CV = Simple Estimates of coefficient of variation in per cent and

R^2 = Coefficient of determination from a time trend regression (linear) adjusted by the number of degree of freedom.

3. Results and Discussion

3.1 Compound growth rates of jute area in India

The compound growth rates of jute area in India clearly indicated that, there was a decline in area during period II, period III and overall period except period I.

It could be seen from the table 1 that, during period I highest growth rate was observed in West Bengal i.e., 3.44 per cent per annum and found to be significant at 1 per cent level of significance, followed by Bihar i.e., 1.89 per cent per annum and Assam which registered negative growth rate i.e. -1.26 per cent per annum. The India as whole recorded the positive growth of 2.03 per cent per annum which indicates the expansion of area under jute crop.

Table 1: State wise compound growth rates of jute Area in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	CAGR	-1.26	-2.56**	1.14	-1.36**
		t value	-1.35	-5.12	2.11	-5.07
2	Bihar	CAGR	1.89	-1.42*	-6.22**	-1.38**
		t value	1.26	-2.50	-8.75	-4.18
3	West Bengal	CAGR	3.44**	-0.85	-1.85**	0.24
		t value	3.45	-1.81	-7.27	1.12
4	India	CAGR	2.03	-1.06*	-2.10**	-0.27
		t value	1.91	-2.51	-9.68	-1.53

Note: **Significant at 1% level, * Significant at 5% level.

Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

During period II, almost all states in India registered negative growth including India as a whole. The highest decline in growth rate was recorded in Assam i.e. -2.56 per cent per annum, followed by Bihar (-1.42 per cent per annum) and found to be significant at 1 and 5 per cent level of significance, respectively. While, West Bengal recorded negative growth rate of -0.85 per cent per annum. The India as whole recorded negative growth rate of -1.06 per cent per annum and found to be significant at 5 per cent level of significance.

During period III, also almost all states in India registered negative growth including India as a whole except Assam which recorded positive growth of 1.41 per cent per annum. The highest decline in area under jute crop recorded by Bihar i.e. -6.22 per cent per annum followed by West Bengal i.e. -1.85 per cent per annum and found to be significant at 1 per cent level of significance. India as a whole recorded negative growth of -2.10 per cent per annum which found to be significant at 1 per cent level of significance.

During overall period among the three states Assam and Bihar registered negative growth rates of -1.36 and -1.38 per cent per annum, respectively and found to be significant at 1 per cent level of significance. While West Bengal recorded positive growth rate of 0.24 per cent per annum. The India as whole registered negative growth rate of 0.27 per cent per annum. Which indicates that the decline in the area under jute crop.

The results of growth rates were concluded that, the area under jute crop in India was recorded significant decreasing trend during period II, Period III and overall period. It might be due to significant portion of this crop was replaced by alternative crop like other competitive and remunerative short duration crops like maize, sesamum etc. mainly in West Bengal and Bihar, the major jute growing states. (Price Policy for Jute 2019)

3.2 Compound growth rates of jute production in India

It is evident from the Table 2 that, during period I the states viz. Bihar and West Bengal have experienced positive growth rates. The highest growth rate was achieved by West Bengal (4.19 per cent per annum) and found to be significant at 1 per cent level. Bihar recorded growth rate of 0.88 per cent per annum. However, Assam has experienced negative growth rate during this period I i.e. -1.01 per cent per annum and this negative growth rate is mostly

due to the falling of area growth rates during this period. The India's growth rate of jute production during this period was 2.65 per cent per annum and found to be significant at 1 per cent level of significance.

During period II, among the states Bihar and West Bengal registered positive growth rates except Assam, recorded negative growth rate of -1.34 per cent per annum. The highest growth rate was observed in Bihar i.e., 1.41 per cent per annum followed by West Bengal i.e., 0.32 per cent per annum. India as a whole registered less than one per cent per annum growth rate for production i.e., 0.33 per cent per annum.

Table 2: State wise compound growth rates of jute production in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	CAGR	-1.01	-1.34	3.34*	-0.62
		t value	-0.69	-0.76	2.64	-1.60
2	Bihar	CAGR	0.88	1.41	-1.76	1.01*
		t value	0.32	1.33	-1.00	2.75
3	West Bengal	CAGR	4.19**	0.32	-1.66**	1.43**
		t value	4.01	0.52	-3.40	5.80
4	India	CAGR	2.65*	0.33	-1.27*	1.06**
		t value	2.38	0.62	-2.62	5.66

Note: **Significant at 1% level, * Significant at 5% level.

Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

However, during period III, a clear opposite picture has been observed in the Indian jute production scenario. Among all the states the growth rates of jute production have been reduced significantly including India as whole except Assam which recorded positive growth rate of 3.34 per cent per annum and found to be significant at 5 per cent level. Bihar has experienced the highest setback in relation to growth rate of production with a negative growth of -1.76 per cent per annum followed by West Bengal (-1.66 per cent per annum), which was found to be significant at 1 per cent level. The India's jute production was also negative amounting to -1.27 per cent per annum and found to be significant at 1 per cent level of significance. Only Assam has been able to recover from negative production growth rate to positive growth rate over the three periods. Most interestingly, the high rate of decline in jute production was caused by the heavy decline in the area under cultivation of jute in these states.

During overall period it has been observed that, the states viz. Bihar and West Bengal have experienced positive and significant growth rates. The highest growth rate was achieved by West Bengal (1.43 per cent per annum) followed by Bihar (1.01 per cent per annum) and found to be significant at 1 and 5 per cent level of significance. While, Assam recorded the negative growth rate of -0.62 per cent per annum Negative growth rates in Assam is mostly due to the falling in area growth rates during the study period. India as whole registered positive growth rate of 1.06 per cent per annum and found to be significant at 1 per cent level of significance. In all these two states and India the increase in growth rates of production was caused by the increment in yield growth rates and remaining portion has been due to expansion of area under jute cultivation. The researcher Ghosh and Jethi (2013) was found similar results.

3.3 Compound growth rates of jute productivity in India

It is evident from the Table 3 that, during period I almost all the states including India as a whole estimated less than one per cent per annum growth rates for productivity of jute. The states viz. Assam and West Bengal have experienced positive growth rates. The highest growth rate was achieved by West Bengal (0.72 per cent per annum) followed by Assam, which recorded growth rate of 0.25 per cent per annum. However, Bihar has experienced negative growth rate during this period I i.e., -1.00 per cent per annum. The India's growth rate of jute productivity during this period was 0.60 per cent per annum.

During period II all the states viz. Assam, Bihar, and West Bengal experienced positive growth rates, including India as a whole. The highest growth rate was observed in Bihar (2.10 per cent per annum) followed by West Bengal (1.18 per cent per annum) which found to be significant at 5 per cent level of significance and Assam (1.26 per cent per annum). India as a whole registered positive growth rate of 1.40 per cent per annum and found to be significant at 1 per cent level of significance.

Table 3: State wise compound growth rates of jute productivity in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	CAGR	0.25	1.26	2.17	0.75**
		t value	0.23	0.89	2.08	3.42
2	Bihar	CAGR	-1.00	2.87	4.76**	2.43**
		t value	-0.47	2.10	3.36	6.27
3	West Bengal	CAGR	0.72	1.18*	0.18	1.19**
		t value	1.77	2.64	0.43	12.99
4	India	CAGR	0.60	1.40**	0.85	1.33**
		t value	2.12	3.59	2.06	18.26

Note: **Significant at 1% level, * Significant at 5% level.

Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

Similar results were observed during period III that all the states viz. Assam, Bihar and West Bengal experienced positive growth rates, including India as a whole. The highest growth rate was observed in Bihar i.e. 4.76 per cent per annum and found to be significant at 1 per cent level of significance followed by Assam (2.17 per cent per annum) and West Bengal (0.18 per cent per annum). India as a whole recorded positive growth rate of 0.85 per cent per annum.

During overall period all the states viz. experienced positive and significant growth rates including India as a whole. The highest growth rate was recorded by Bihar (2.43 per cent per annum) followed by West Bengal (1.19 per cent per annum) and Assam (0.75 per cent per annum) and found to be significant at 1 per cent level of significance. India as whole registered the positive growth rate of 1.33 per cent per annum and found to be significant at 1 per cent level of significance.

It could be concluded that, the productivity of jute crop shown significant increasing trend in all the states and India as a whole during all the periods. This increase in productivity may be attributed to the jute ICARE program which was launched in 2015, an initiative to double farmers income by increasing productivity and lowering input costs. (Price Policy for Jute 2019)

3.4 Compound growth rates of jute exported from India

It was observed from the Table 4 that, growth rate of export quantity during period-I was 2.65 per cent per annum but during period-II it was increased with 21.21 per cent per annum and

found to be statistically significant at 1 per cent level of significance. While it was decreased in period-III with -9.55* per cent per annum and found statistically significant at 5 per cent level of significance. However, during overall period the export quantity recorded positive growth i.e., 5.90 per cent per annum and found to be significant at 1 per cent level of significance.

Table 4: Compound growth rates of jute exported from India

Sr. No.	Particulars		Period I	Period II	Period III	Overall
1	Export Quantity	CAGR	2.65	21.21**	-9.55*	5.90**
		t value	0.30	4.60	-3.17	4.24
2	Export Value	CAGR	-4.74	27.61**	-10.06*	10.20**
		t value	-0.46	4.00	-2.47	5.56
3	Export Unit Price	CAGR	-7.20*	5.28	-0.56	4.06**
		t value	-2.84	1.64	-0.35	3.84

Note: **Significant at 1% level, * Significant at 5% level.

Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

The same trend was observed in export value the growth rate during period-I was -4.47 per cent per annum but during period-II it was increased with 27.61 per cent per annum and found to be significant at 1 per cent level of significance. While it decreased in period-III with -10.06 per cent per annum found statistically significant at 5 per cent level of significance. However, during overall period the export value recorded positive growth i.e. 10.20 per cent per annum and found to be significant at 1 per cent level of significance. Likewise export unit price recorded negative growth rate during period I i.e. 7.20 per cent per annum and found to be significant at 5 per cent level, rate during period I i.e. 7.20 per cent per annum and found to

be significant at 5 per cent level, rate during period I i.e. 7.20 per cent per annum and found to be significant at 5 per cent level, but during period II it was increased with 5.28 per cent per annum. While it was decreased in period III with -0.56 per cent per annum. However, during overall period the export unit price recorded positive growth of 4.06 per cent per annum and found to be significant at 1 per cent level of significance. Padmane *et. al* 2019 also found positive and significant growth rate of jute export form India in terms of export quantity and export value.

3.5 Compound growth rates of jute imported in India

As regard to import quantity the growth rate during period-I was 22.10 per cent per annum which was found to be significant at 1 per cent level of significance. While during period-II and period-III the growth rate were decreased with -2.06 and -3.66 per cent per annum, respectively. However, during overall period the import quantity recorded positive growth i.e., 3.64 per cent per annum and found to be significant at 1 per cent level of significance. Similar trend was observed in import value that, during period-I the growth rate found to be significant at 5 per cent level i.e., 19.86 per cent per annum. It was recorded -4.08 per cent per annum during period-II, it was decreased by 2.78 per cent per annum during period-III. Whereas, during overall period the import value recorded positive growth i.e., 7.17 per cent per annum and found to be significant at 1 per cent level of significance. In case of import unit price, it recorded -1.83 per cent per annum growth rate during period I while during period II it was found to be increased with 6.26 per cent per annum. During period III it was

recorded 0.91 per cent growth rate in import unit price. However, overall period recorded positive growth rate of 3.41 per cent and found to be significant at 1 per cent level.

Table 5: Compound growth rates of jute imported in India

Sr. No.	Particulars	Period I	Period II	Period III	Overall	
1	Import Quantity	CAGR	22.10**	-2.06	-3.66	3.64**
		t value	3.56	-0.32	-0.73	2.87
2	Import Value	CAGR	19.86*	4.08	-2.78	7.17**
		t value	2.94	0.79	-0.53	6.10
3	Import Unit Price	CAGR	-1.83	6.26	0.91	3.41**
		t value	-0.71	2.22	0.40	5.33

Note: **Significant at 1% level, * Significant at 5% level.

Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

An attempt was made to study the fluctuations in area, production, productivity of jute along with international trade of Indian jute during study period. The degree of volatility was worked out using coefficient of variation (CV) and Coppock's Instability Index (CII).

3.6 Instability indices of jute area in India

It is evident from the Table 6 that, there was stability under jute during study period. During period I the highest instability was observed in Bihar (13.96, 12.03 and 12.75 per cent for CV, CII and CDVI, respectively) followed by West Bengal (13.24, 11.09 and 8.39 per cent for CV, CII and CDVI, respectively) and Assam (8.58, 11.20 and 7.71 per cent for CV, CII and CDVI, respectively). While, India as a whole recorded instability of 10.95, 11.18 and 9.09 per cent for CV, CII and CDVI, respectively.

Table 6: State wise instability indices of jute area in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	Mean	90.73	63.74	68.15	74.21
		CV	8.58	9.11	5.78	18.01
		CII	11.20	10.40	10.49	10.79
		CDVI	7.71	4.33	4.65	12.66
2	Bihar	Mean	134.24	138.69	104.18	125.70
		CV	13.96	6.63	19.70	17.95
		CII	12.03	10.66	10.71	11.31
		CDVI	12.75	5.02	5.97	14.27
3	West Bengal	Mean	536.61	605.30	559.27	567.06
		CV	13.24	4.77	6.05	9.70
		CII	11.09	10.47	10.35	10.75
		CDVI	8.39	4.44	2.22	9.55
4	India	Mean	787.87	818.74	746.16	784.26
		CV	10.95	4.83	6.64	8.53
		CII	11.18	10.43	10.26	10.74
		CDVI	9.09	3.61	1.84	8.17

Note: Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

During period II the highest instability was recorded by Assam in case of CV i.e., 9.11 per cent followed by Bihar (6.63 per cent) and West Bengal (4.77 per cent). The relatively speaking, Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI) regard to Bihar (10.66 and 5.02 per cent) was highest among the jute growing states of India followed by West Bengal (10.47 and 4.44 per cent) and Assam (10.40 and 4.33 per cent). However, India as whole registered instability of 4.83, 10.43 and 3.61 per cent for CV, CII and CDVI, respectively.

During period III the highest instability was recorded by Bihar in case of CV i.e. 19.70 per cent followed by West Bengal (6.05 per cent) and Assam (5.78 per cent). The relatively speaking, Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI) regard to Bihar (10.71 and 5.97 per cent) was highest among the jute growing states in India followed by Assam (10.49 and 4.65 per cent) and West Bengal (10.35 and 2.22 per cent). However, India as whole registered instability of 6.64, 10.26 and 1.84 per cent for CV, CII and CDVI, respectively.

During overall period the highest instability was recorded by Assam in case of CV i.e. 18.01 per cent followed by Bihar (17.95 per cent) and West Bengal (9.70 per cent). The relatively speaking, Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI) regard to Bihar (11.31 and 14.27 per cent) was highest among the jute growing states in India followed by Assam (10.79 and 12.66 per cent) and West Bengal (10.75 and 2.55 per cent). However, India as whole registered instability of 8.53, 10.74 and 8.17 per cent for CV, CII and CDVI, respectively.

The researchers like Ghosh and Jethi (2013), Padmane *et al.*, (2019) Kumari *et al.*, (2018) also found similar results during their study. Kumari *et al.*, (2018) found that, there was less variability in area during the study period (1990-91 to 2015-16) and the decreasing trend in variability under area during different periods under study as during first period it was 11.67 per cent, in second period it was 6.88 per cent and 4.22 per cent in third period.

3.7 Instability indices of jute production in India

It could be seen from the Table 7 that, there was less variability in jute production in India during the study period. During period I the highest instability was recorded by Bihar in case of CV i.e., 23.78 per cent followed by West Bengal (15.57 per cent) and Assam (12.82 per cent). The relatively speaking, Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI) regard to Bihar (13.60 and 23.38 per cent) was highest among the jute growing states of India followed by Assam (12.40 and 12.48 per cent) and West Bengal (11.29 and 9.03 per cent). However, India as whole registered instability of 12.59, 11.35 and 9.67 per cent for CV, CII and CDVI, respectively.

During period II the highest instability was observed in Assam (13.72, 12.29 and 13.13 per cent for CV, CII and CDVI, respectively) followed by Bihar (9.98, 11.26 and 8.99 per cent for CV, CII and CDVI, respectively) and West Bengal (5.39, 10.70 and 5.32 per cent for CV, CII and CDVI, respectively). While, India as a whole recorded instability of 4.60, 10.62 and 4.51 per cent for CV, CII and CDVI, respectively.

During period III, that the highest instability was observed in Bihar (15.37, 11.34 and 14.59 per cent for CV, CII and CDVI, respectively) followed by Assam (14.09, 11.25 and 10.13 per cent for CV, CII and CDVI, respectively) and West Bengal (6.69, 10.73 and 4.31 per cent for CV, CII and CDVI, respectively). While, India as a whole recorded instability of 5.70, 10.66 and 4.20 per cent for CV, CII and CDVI, respectively.

During overall period the highest instability was recorded in Bihar (18.57 and 12.39 per cent for CV and CII, respectively) followed by Assam (18.08 and 11.97 per cent for CV and CII, respectively) and West Bengal (15.51 and 10.70 per cent for CV and CII, respectively). In

case of CDVI the highest instability was observed in Assam (17.13 per cent) followed by Bihar and West Bengal i.e. 16.48 per cent and 10.56 per cent, respectively. While, India as a whole recorded instability of 11.98, 10.97 and 8.20 per cent for CV, CII and CDVI, respectively.

Table 7: State wise instability indices of jute production in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	Mean	840.01	620.93	726.29	729.08
		CV	12.82	13.72	14.09	18.08
		CII	12.40	12.29	11.25	11.97
		CDVI	12.48	13.13	10.13	17.13
2	Bihar	Mean	1045.27	1125.84	1288.33	1153.15
		CV	23.78	9.98	15.37	18.57
		CII	13.60	11.26	11.34	12.39
		CDVI	23.38	8.99	14.59	16.48
3	West Bengal	Mean	6182.35	8107.28	8242.60	7510.74
		CV	15.57	5.39	6.69	15.51
		CII	11.29	10.70	10.73	11.01
		CDVI	9.03	5.32	4.31	10.56
4	India	Mean	8321.21	9938.96	10347.73	9535.97
		CV	12.59	4.60	5.70	11.98
		CII	11.35	10.62	10.66	10.97
		CDVI	9.67	4.51	4.20	8.20

Note: Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

From the above results it was concluded that, India, has been associated with moderate degree of variability in the jute production in the first sub period and this variability has been reduced significantly during the second and third period. Similar results were observed by the researcher Ghosh and Jethi (2013).

3.8 Instability indices of jute productivity in India

The Table 8 depicts that, there was less variability in jute productivity in India during the study period. During period I the highest instability was observed in Bihar (16.15, 12.40 and 16.11 per cent for CV, CII and CDVI, respectively) followed by Assam (9.51, 11.58 and 9.49 per cent for CV, CII and CDVI, respectively) and West Bengal (4.07, 10.54 and 3.44 per cent for CV, CII and CDVI, respectively). While, India as a whole recorded instability of 3.05, 10.35 and 2.45 per cent for CV, CII and CDVI, respectively.

During period II the highest instability was recorded in Bihar (14.53 and 11.67 per cent for CV and CDVI, respectively) followed by Assam (11.39 and 10.68 per cent for CV and CDVI, respectively) and West Bengal (5.11 and 3.75 per cent for CV and CDVI, respectively). In case of CII the highest instability was observed in Assam (11.97 per cent) followed by Bihar and West Bengal i.e., 11.40 per cent and 10.44 per cent, respectively. While, India as a whole recorded instability of 5.33, 10.39 and 3.34 per cent for CV, CII and CDVI, respectively.

Table 8: State wise instability indices of jute productivity in India

Sr. No.	States	Particulars	Period I	Period II	Period III	Overall
1	Assam	Mean	1666.18	1753.68	1913.51	1777.79
		CV	9.51	11.39	10.62	11.78
		CII	11.58	11.97	11.08	11.52
		CDVI	9.49	10.68	8.42	9.70
2	Bihar	Mean	1398.41	1471.24	2274.14	1714.60
		CV	16.15	14.53	17.03	28.54
		CII	12.40	11.40	11.07	11.92
		CDVI	16.11	11.67	11.22	17.53
3	West Bengal	Mean	2069.81	2413.12	2653.61	2378.85
		CV	4.07	5.11	3.72	11.07
		CII	10.54	10.44	10.61	10.56
		CDVI	3.44	3.75	3.68	4.16
4	India	Mean	1898.94	2188.11	2499.72	2195.59
		CV	3.05	5.33	4.35	12.15
		CII	10.35	10.39	10.56	10.49
		CDVI	2.45	3.34	3.53	3.50

Note: Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

During period III the highest instability was recorded in Bihar (17.03 and 11.22 per cent for CV and CDVI, respectively) followed by Assam (10.62 and 8.42 per cent for CV and CDVI, respectively) and West Bengal (3.72 and 3.68 per cent for CV and CDVI, respectively). In case of CII the highest instability was observed in Assam (11.08 per cent) followed by Bihar and West Bengal i.e., 11.07 per cent and 10.61 per cent, respectively. While, India as a whole recorded instability of 4.35, 10.56 and 3.53 per cent for CV, CII and CDVI, respectively.

During overall period the highest instability was observed in Bihar (28.54, 11.92 and 17.53 per cent for CV, CII and CDVI, respectively) followed by Assam (11.78, 11.52 and 9.70 per cent for CV, CII and CDVI, respectively) and West Bengal (11.07, 10.56 and 4.16 per cent for CV, CII and CDVI, respectively). While, India as a whole recorded instability of 12.15, 10.49 and 3.50 per cent for CV, CII and CDVI, respectively.

From the above results it was concluded that, India, has been associated with moderate degree of variability in jute productivity during the overall period. However, the instability during period I, period II and period III were found remarkably decreased.

3.9 Instability indices of jute exported from India

The Table 9 shows that the instability indices were highest during all the study periods in terms of exported quantity of jute from India. The overall period registered 18.27 per cent of CII and 60.74 per cent of CDVI. Moving towards the sub-periods, highest instability was observed during period I (CII- 22.30 per cent and CDVI- 61.72 per cent) followed by period II (CII- 17.65 per cent and CDVI- 36.95 per cent) and period III (CII- 14.78 per cent and CDVI- 31.36 per cent). Similarly, instability indices for value of jute exported were also highly volatile with 21.10 per cent of CII and 88.81 per cent of CDVI during overall study period. Period I with 25.33 per cent CII and 85.57 per cent of CDVI recorded the highest instability

for export value of jute. Next highest instability was observed during period II (CII- 20.05 per cent and CDVI- 58.83 per cent) followed by period III (CII- 16.15 per cent and CDVI- 44.20 per cent).

Whereas, unit price of exported jute had the moderate instability indices of 13.09 per cent CII and 44.82 per cent CDVI during overall period. The CII and CDVI with 12.73 per cent and 26.32 per cent, respectively were observed during period I. Period II recorded the moderate instability with indices as CII- 12.79 per cent and CDVI- 30.54 per cent and period III had the instability indices as CII with 11.73 per cent and CDVI with 14.08 per cent. The high instability for jute export from India was observed by researchers during their studies (Kumari *et al.*, 2020)

Table 9: Instability indices of jute exported from India

Sr. No.	Particulars	Period I	Period II	Period III	Overall	
1	Export Quantity	Mean	7413.50	19254.70	21112.50	15926.90
		CV	61.93	69.09	45.36	71.04
		CII	22.30	17.65	14.78	18.27
		CDVI	61.72	36.95	31.36	60.74
2	Export Value	Mean	2069.30	4121.50	13510.20	6567.00
		CV	92.54	101.10	58.15	109.11
		CII	25.33	20.05	16.15	21.10
		CDVI	85.57	58.83	44.20	88.18
3	Export Unit Price	Mean	258.51	185.60	621.20	355.10
		CV	37.16	36.52	14.20	59.24
		CII	12.73	12.79	11.73	13.09
		CDVI	26.32	30.54	14.08	44.82

Note: Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

and Padmane *et al.*, 2019) This high volatility in jute export may be due to the vast domestic consumption of raw jute in India and the low quality of jute fiber.

3.10 Instability indices of jute imported in India

The table 10 depicts that, that the instability indices in import quantity and import value were highest during all the study periods. As regard to import quantity the overall period registered instability of 55.66, 19.62 and 51.40 per cent for CV, CII and CDVI, respectively. The highest instability was observed during period I i.e., 71.30 and 47.59 per cent for CV and

Table 10: Instability indices of jute imported in India

Sr. No.	Particulars	Period I	Period II	Period III	Overall	
1	Import Quantity	Mean	54163.30	82124.20	92899.30	76395.60
		CV	71.30	46.61	47.91	55.66
		CII	18.74	22.21	18.10	19.62
		CDVI	47.59	46.13	46.31	51.40
2	Import Value	Mean	15350.20	22957.10	55642.00	31316.43
		CV	57.06	35.93	48.15	77.15
		CII	20.35	18.81	18.39	18.99
		CDVI	35.59	33.34	34.61	57.07
3	Import Unit Price	Mean	300.82	303.83	608.09	404.24

		CV	23.32	29.94	19.08	42.68
		CII	13.23	13.37	11.98	13.06
		CDVI	22.85	22.89	19.00	29.10

Note: Period I (1989-90 to 1998-99), Period II (1999-00 to 2008-09), Period III (2008-09 to 2018-19) and Overall period (2089-90 to 2018-19)

CDVI, respectively followed by period III (47.91 and 46.31 per cent for CV and CDVI, respectively) and period III (46.61 and 46.13 per cent for CV and CDVI, respectively). While in case of CII the highest instability was found in period II (22.21 per cent) followed by period I (18.74 per cent) and period III (18.10 per cent).

As regard to import value the overall period experienced the instability about 77.15, 18.99 and 57.07 per cent for CV, CII and CDVI, respectively. The highest instability was observed during period I (57.06 and 35.59 per cent for CV and CDVI, respectively). followed by period III (48.15 and 34.61 per cent for CV and CDVI, respectively) and period II (35.93 and 33.34 per cent for CV and CDVI, respectively). While in case of CII the highest instability was found in period I (20.35 per cent) followed by period II (18.81 per cent) and period III (18.39 per cent).

In case of import unit price, the moderate level of instability observed during all the sub-periods. The highest instability was observed during period II (29.94, 13.37 and 22.89 per cent for CV, CII and CDVI, respectively) followed by period I (23.32, 13.23 and 22.85 per cent for CV, CII and CDVI, respectively) and period III (19.08, 11.98 and 19.00 per cent for CV, CII and CDVI, respectively). While overall period recorded instability of 42.68, 13.06 and 29.10 per cent for CV, CII and CDVI, respectively).

4. CONCLUSIONS

The results of growth rates were concluded that, the area under jute crop in India was recorded significant decreasing trend during period II, Period III and overall period. The increase in growth rates of production in Bihar, West Bengal and India were caused by the increment in yield growth rates and remaining portion has been due to expansion of area under jute cultivation during particular period. The productivity of jute crop shown significant increasing trend in all the states and India as a whole during all the periods. All the parameters viz., export quantity, export value, export unit price, import quantity, import value and import unit price shown positive growth rates during overall period and found to be significant at 1 per cent level of significance. There was less variability in area during the study period and the decreasing trend in variability under area of jute during different periods under study i.e., period I, period II and period III has been recorded. It was concluded that, India, has been associated with moderate degree of variability in the jute production and productivity in the first sub period and this variability has been reduced significantly during the second and third period. All the parameters viz., export quantity, export value, import quantity and import value have experienced high instability while the export unit price and import unit price registered stability during the study periods. Thus, the study clearly indicates that India has a very good opportunity to take the advantage of this international market. What require are the diversifications of the products made from this nature fiber and improvement of the quality of jute fiber by developing improved varieties, ensuring availability and distribution of certified seeds to the growers, integrated disease and pest management system, appropriate soil testing system, availability of water tanks and ponds under some scheme of government with improved retting techniques.

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