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Trade Dynamics of Lac Export from India

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ABSTRACT

Globally, India is one of the leading producers and exportersof Natural Resins and Gums (NRGs),notably lac, guar and *karaya* gums. Lac cultivation has long beenassociated with providing a sustainable source of income for rural peoplewho rely on forest resources for their livelihood and acting as a buffer againstcrop failure. The lac growing belt in India overlapping with the nation's major tribal belts creates better prospects for the tribals' economic sustenance by reducing drudgery and generating valuable cash flow by promoting export. This paper explores the export potential of lac with an emphasis on export competitiveness and trade direction for the past two decades (2002-03 to 2021-22). The present study employed the Revealed Comparative Advantage and first-order Markov Chain approach. RSCA index value points out that India possesses a high comparative advantage in lac export relative to agricultural export in the global market. The major export destinations for Indian lac are the USA, Bangladesh, China, Germany, Afghanistan and Iraq. The Markov chain analysis findings revealed that the lac export's stability has improved over the study period. Export of Indian lacis likely concentrated in importing countries like the USA, Bangladesh and Germany.Throughout the study period, China and Iraq remained the most unstable importers of Indian lac, as indicated by the zero probability retentioncoefficients.A careful review of the trade pattern suggests that Bangladesh will continue to be a major importer in the coming years. Even though the USA remains the leading export destination,its total export shareis declining as it is losing half its share to other countries.Although exports from this sector do not contribute significantly to the country's foreign exchange earnings, their importance lies in that roughly 3-4 million tribal people derive subsidiary income from its cultivation. Concerned efforts focusing on increased research and development,improving production, adding value in accordance with global demand, market diversification, and enhancing quality standards will help boost exports of Indian lac in the long run.

Keywords: Export competitiveness, Lac, Markov Chain, tribal upliftment, trade pattern

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INTRODUCTION

For a developing nation like India, where most of the population inhabits rural areas, forest resources provide a way of life for the people and provide economic sustenance by creating valuable livelihood avenues and cash flow from wood and Non-Wood Forest Products (NWFPs).Although forests account for roughly 1.5 – 2.0 per cent of the country's GDP, this figure does not accountfor their numerous internal and external benefits, income supplements and the value of environmental services provided. NWFPs constitute about 70 per cent of forest export revenue in India, mostly from raw and unprocessedforms (Hazari *et al*., 2023).With increased institutional intervention insustainable forest management and ecosystem preservation, NWFPs such as Natural Resins and Gums (NRGs), tendu leaves, perfumery oils and exudates from roots, stumps, and fruits of various tree specieshavebeen gaining recognition inrecent decades.Globally, India ranks among the leading producers of NRGs, especiallylac, guar and *karaya* gums.

Lac is the only insect originating froma natural resin obtained from lac insects, predominantly *Kerria* spp. (Family-Tachardiidae, Order-Hemiptera).Commercial host plants for these insects encompass *Palas* (*Butea monosperma*), Ber (*Ziziphus mauritiana*), *Kusum* (*Schleichera oleosa*), *Ficus* spp. and Semialata (*Flemingia semialata*). Lac insect strains are classified into two categories based on their preference for specific host plants: *Rangeeni* and *Kusumi*.Lacgenerates essentially three valuable components,*i.e.* resin, wax and dye. These are natural, renewable, non-toxic and eco-friendly and may be employed in various industries, including food, textiles, pharmaceutical, surface coating, electrical, and others (Kerketta, 2023).Thisnatural heritage of India has been deeply associated with providing a sustainable source of income for rural and tribal communitiesby acting as a buffer againstcrop failure due to unpredictable and uncontrolled factors (Jaiswal *et al*., 2020).

Lac productionisextensivelyconfinedto the tropical and sub-tropical regions of the world(Shah *et al*., 2015). On the global front, lac cultivation is practised in India, Thailand, Indonesia,

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Myanmar,Lao and Yuan provinces of China, the Philippines, Vietnam and Cambodia. India is the world's largest producer of lac, with 90 per cent of its production coming from the tribal and economically marginalized belts of Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra, Odisha and parts of Uttar Pradesh, Andhra Pradesh, Gujarat and North-Eastern Hilly (NEH) region. In 2021-22, Jharkhand alone accounted for about 55 per cent of the total lac production, followed by Chhattisgarh (22.4 per cent), Madhya Pradesh (11.5 per cent), West Bengal (6.7 per cent) and Maharashtra (4.8 per cent).Although lac is mainly produced in Asian countries, it is consumed and imported almost worldwide(Thomabre *et al*., 2022).

Lac is a unique commoditythat needs specialized attention to flourish. (Sharma *et al*., 2006). Therefore, to optimize India's lac and forest product export potential by boosting foreign exchange earnings and strengthening export competitiveness in the global market, SHEFEXIL (Shellac and Forest Products Export Promotion Council) was established under the Ministry of Commerce and Industry Government of India. Lac can be considered as an export-oriented NRGs as 50-75 per cent of the lac produced in the country is exported, primarily in processed/semi-processed form, to more than 100 countries, with the remaining 15-20 per cent utilized domestically. During 2021-22, the total export of lac and its value-added products was7659.95 metrictonnes valued at 84.44 million US dollars. Based on export earnings, shellac generates maximum revenue afterseedlac, aleuritic acid, bleached lac, button lac and dewaxed lac. Lac and its products are in popular demand worldwide due to their wide range of usage. However, the availability of cheaper synthetic alternatives mitigates its demand in non-food application areas. Nevertheless, as people become increasingly aware of the positive aspects of natural products, their demand for synthetic resins is shifting back to natural resins.

According to a recent Ministry of Environment & Forests study, "Some 50 million tribal people rely on NWFPs for subsistence consumption and economic needs". We can boost employment substantially by increasing NWFPs exports and assisting this unorganized sector in becoming more competitive and effectively coping with global challenges. To revitalize this unorganized sector, R&D is crucial in understanding structural changes in the export market and analyzing the competitiveness of lac exported to major export destinations. Keeping this in view, this study assessed India's export competitiveness and trade direction for lac, as it plays a distinctive role in policy making. Also, identifying lac's trade potential is worthwhile, as previous studies have primarily focused on trend and instability analysis in the last decade. Pal (2013) studied growth and instability in the export of Indian lac for 38 years from 1970-71 to 2007-08, using the Compound Annual Growth Rate (CAGR) and the Cuddy Della Vella Instability Index. Pal (2015) analyzed the export scenario and potential of Indian lac using Compound Annual Growth Rate (CAGR) fora study period of 40 years from 1971-72 to 2010-2011. Yadav and Maurya (2023) accessed the export potentialities of lac from 2002 to 2010 using tabular analysis.

MATERIALS AND METHODS

Fundamentally, time series data on lac export from India for the past 20 years (2002-03 to 2021-22) is collected from SHEFEXIL, Directorate General of Commercial Intelligence and Statistics (DGCIS), UN Comtrade and statistical publications of ICAR-NISA, Ranchi. For better understanding, the study period is divided into two decades (Period I: 2003 to 2012 and Period II: 2013 to 2022). The statistical computation was carried out using MS Excel and Lingo 20.0.

Revealed Comparative Advantage (RCA)

The revealed Comparative Advantage (RCA) Index developed by Balassa (1965) is one of the most widely used indicators of competitiveness in international trade. Under the assumption that the commodity trade pattern reflects inter-country differences in relative costs and nonprice factors, the index is anticipated to "reveal the comparative advantage of the trading countries"(Shinoj and Mathur, 2008). The RCA indexdetermines how competitive a product is in a country's exports compared to its proportion in global trade. Changes in the levels of these indices invariably indicated changes in competitiveness. The RCA index is computed by using the following formula,

$$\mathbf{RCAij=}\frac{X_{ij}/X_j}{\mathbf{X_{iw}/X_w}}$$

where,

RCA_{ij}: Revealed Comparative advantage of the i^{th} country in commodity j

X_{ij}: Value of country i's export of commodity j

X_j: Value of country i's total agriculture exports

X_{iw}: Value of world export of commodity j

X_w: Value of world total agriculture exports

The RCA index value ranges between zero and positive infinity. If a country's RCA index valueis greater than unity, it suggests that country i has a comparative advantage in commodity j and vice versa. The RCA index has the advantage of considering the intrinsic advantage of a particular export commodity while remaining consistent with changes in an economy's relative factor endowments and productivity. However, it has the disadvantage of being asymmetrical. To address the problem of asymmetry, Revealed Symmetric Comparative Advantages (RSCA) wereworked out (Vollrath, 1991) and (Dalum *et al*., 1998).

RSCA can be expressed as,

$$RSCA = (RCA - 1)/(RCA + 1)$$

The value of the RSCA index ranges between -1 to +1. Positive index values (RSCA>0) indicates both product stability and competitiveness of a particular country, whereas negative values (RSCA < 0) indicate otherwise.

Markov Chain Analysis

From 2002-03 to 2021-22, six major importing countries were considered for the study. A probability model based on a first order Markov chain approach is used to quantify market retention and switching. The Markov chain is a dynamic

program for solving a stochastic decision process. It can be used to describe systems that follow a series of linked events, where what happens next is solely determined by the system's present state (Bagalkoti *et al*., 2019). Markov chain analysis helps determine the change and directions of trade growth, *i.e.* retention, gains and losses, and predicting future growth values(Latha *et al*., 2022).Estimating the transitional probability matrix (P) for export value was central to the analysis.

Algebraically represented as;

$$E_{ji} = \sum_{i=1}^{r} E_{ji} = 1\ P_{ij} + e_{ji}$$

where,

E_{jt}= Exports from India to the j^{th} country in the year t

E_{it-1}= Exports of i^{th} country during the year t-1

P_{ij}= probability that exports will shift from i^{th} country to j^{th} country

e_{ji}= the error term, which is statistically independent of E_{it-1}

n= the number of importing countries

The transitional probabilities P_{ij}can be arranged in a (c × r) matrix and have the following properties:

$$\mathbf{0 \le P_{ij} \le 1}$$

$$\sum_{j=1}^{r} P_{ij} = 1 \text{ for all } \mathbf{i}$$

The transitional probability matrix (TPM) was estimated using a linear programming method referred to as the minimization of the mean absolute deviation (MAD) (Fisher, 1967; Wagner, 1959).This satisfies the properties of transitional probabilities under non-negativity restrictions and row sum constraints in estimation. The linear programming formulation is stated as

$$\mathbf{Min, OP^* + I\ e}$$
$$\mathbf{Subject\ to\ X\ P^* + V = Y}$$
$$\mathbf{GP^* = 1}$$
$$\mathbf{P^* > 0}$$

where,

0= Vector of zeroes

P^*= Vector in which Probability P_{ij} are arranged

I= Appropriate dimensioned column vector of units

e= Vector of absolute error (|U|)

Y= Vector of export to each country

X= Block diagonal matrix of lagged values of Y

V= Vector of errors

G= Grouping matrix to add the row elements of P as arranged in P^* to unity

Using the estimated transitional probability matrix, the export value of lac to major export destinations were predicted by multiplying the same with the respective shares of the base year. The formula used can be expressed as

$$\mathbf{B_t = B_0 * T}$$
$$\mathbf{B_{t+1} = B_{t+i-1} * T}$$

where,

B_0 = Quantity exported in base years

B_{t+1} = Quantity exported in the next year (prediction)

T = Estimated Transitional probability matrix

RESULTS AND DISCUSSION

Major export destination of Indian lac and its product

Indian lac is exported to roughly 100 countries around the world in processed/semi-processed form owing to its diverse application in the food, textiles, and pharmaceutical industries in addition to surface coating, electrical, and other fields. To identify the top importers of Indian lac export over the study period (2002-03 to 2021-22), individual importers' share in India's total lac export value was estimated.

Table 1: Major Destinations of India's Lac Exports

Year/Rank	First	Second	Third	Fourth	Fifth	Sixth
2004	USA	Indonesia	Germany	Egypt	Spain	Italy
	(21)	**(16.63)**	**(14.48)**	**(9.32)**	**(6.29)**	**(4.51)**
2007	USA	Indonesia	Germany	Egypt	Spain	Bangladesh
	(16.19)	**(13.65)**	**(10.53)**	**(10.30)**	**(5.75)**	**(5.14)**
2010	Bangladesh	Germany	USA	Indonesia	Pakistan	Egypt
	(11.68)	**(9.93)**	**(8.26)**	**(7.84)**	**(6.90)**	**(3.62)**
2013	Germany	Pakistan	USA	Switzerland	Egypt	Indonesia
	(14.13)	**(11.25)**	**(10.39)**	**(8.42)**	**(8.16)**	**(7.41)**
2016	USA	Bangladesh	Switzerland	Pakistan	Germany	China
	(19.94)	**(12.60)**	**(11.50)**	**(11.22)**	**(9.13)**	**(6.89)**
2019	Bangladesh	USA	Germany	Pakistan	China	Switzerland
	(18.85)	**(13.68)**	**(9.88)**	**(9.73)**	**(8.85)**	**(6.57)**
2022	USA	Bangladesh	China	Germany	Afghanistan	Iraq
	(28.29)	**(15.61)**	**(10.65)**	**(9.94)**	**(6.21)**	**(4.86)**

(Figure in parenthesis indicates TE averages of per cent shares in export value terms)

Table 1 shows the triennium ending (TE) average of importers' share in terms of export value for the past two decades. Based on the triennium average, the major export destinations of India's lac export are the USA (28.29 per cent), Bangladesh (15.61 per cent), China (10.65 per cent), Germany (9.94 per cent), Afghanistan (6.21 per cent) and Iraq (4.86 per cent). The USA, Bangladesh, and Germany have consistently been among the top three major importing countries. Indonesia's share has consistently declined from TE 2004 To TE 2013. It is also evident that Afghanistan and Iraq have recently entered the top six destinations for India's lac exports. Pakistan and Switzerland lost their positions, while Afghanistan and Iraq gained export shares from TE 2022.

Export Competitiveness of Lac from India

Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) are used to quantify a country's comparative advantage or disadvantage regarding commodity export. This helps to arrive at an insightful conclusion about a country's specialization pattern and competitiveness in global trade. Further, it could also assist in framing trade policies to improve competitiveness in the concerned sector. Table 2 depicts the RCA and RSCA indexes for lac export during the study period.

Table 2 revealed that lac exports from India had a high comparative advantage throughout the study period, as indicated by a higher RCA index and a positive RSCA index value. The average RCA and RSCA values during the first period were 10.96 and 0.82, respectively, but dropped to 9.55 and 0.81, respectively, during the second period, indicating decreased competitiveness as countries like Thailand, Afghanistan and Indonesia emerged as major competitors of lac in international trade in recent decades. The export share of Indian lac in global trade has also fluctuated in recent times due to the unavailability of healthy brood lac in the Indian subcontinent and also export quality standards. However, the overall RCA and RSCA indexes during the study period were 10.26 and 0.82,depicting that India possesses a vast comparative advantage in lac exports in the global market regarding agricultural exports.

Table 2: Export Competitiveness of lac export from India

Year	RCA	RSCA
2002-03	11.48	0.84
2003-04	10.07	0.82
2004-05	10.20	0.82
2005-06	9.06	0.80
2006-07	5.34	0.68
2007-08	11.11	0.83
2008-09	12.29	0.85
2009-10	12.28	0.85
2010-11	16.43	0.89
2011-12	11.36	0.84
Average	**10.96**	**0.82**
2012-13	11.69	0.84
2013-14	9.71	0.81
2014-15	9.01	0.80
2015-16	10.95	0.83
2016-17	9.02	0.80
2017-18	8.82	0.80
2018-19	9.89	0.82
2019-20	9.38	0.81
2020-21	9.06	0.80
2021-22	8.02	0.78
Average	**9.55**	**0.81**
Overall Average	**10.26**	**0.82**

Trade direction of India's lac export

The direction of lac exports' trade to various destinations was investigated by estimating the transitional probability matrix obtained using the first-order Markov chain approach. This provides a broad understanding of the export share, economic relationships and structurally changing patterns of trade flow between trading countries. It also assists in interpreting probable changes and opportunities through market retention and switching. The transition probability matrix was estimated for export value for the major importing countries over two sub-periods (Period I: 2002-03 to 2011-12 and Period II: 2012-13 to 2021-22). In the context of the present study, the six major importing countries of Indian lac are the USA, Bangladesh, China, Germany, Afghanistan and Iraq, with the remaining countries pooled under the "other countries" category.

The diagonal element of a transitional probability matrix indicates the retention coefficient, i.e. the probability of retaining the current market share of the export or, in a nutshell, the loyalty of an importing country to a particular country's export (Gohain *et al.*, 2022).The off-diagonal elements in the transitional probability matrix indicate the extent of market share loss and gain on account of trading countries. While columns exhibit the probability of a country's gain from other countries, rows reveal the probability of a country losing to other countries with respect to a specific commodity export (Sirisha and Rao, 2020).

Trade direction of export of lac from India during PeriodI (2002-03 to 2011-12)

Table 3 demonstrates the transitional probability matrix of India's lac exports for period I in terms of export value (US$ million).Table 3 delineates that importing countries pooled under the category of "other countries" were likely to be the most stable market for Indian lac, as reflected by a high probability retention of 0.6281 (i.e., the probability that other countries retained their export share from one period to another was about 63 per cent) during period-I. Similarly, Bangladesh's probability retention was 0.2349, Germany's was 0.1706, and Afghanistan's was 0.0671.USA, China and Iraq were the least stable (most unstable) importers of Indian lac during the first period, as indicated by the zero-probability retention.

Table 3: Transitional Probability Matrix for the shift in behaviour of Lac Exports from India during Period I (2002-03 to 2011-12)

Country	USA	Bangladesh	China	Germany	Afghanistan	Iraq	Other Countries
USA	**0.0000**	0.0000	0.0000	0.0000	0.0033	0.0000	0.9967
Bangladesh	0.0000	**0.2359**	0.0000	0.3171	0.0000	0.0000	0.4470
China	0.0000	1.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000
Germany	0.1393	0.0000	0.1486	**0.1706**	0.0000	0.0000	0.5415
Afghanistan	0.0000	0.0000	0.0000	0.9329	**0.0671**	0.0000	0.0000
Iraq	0.0000	1.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000
Other Countries	0.1758	0.0484	0.0000	0.1467	0.0002	0.0008	**0.6281**

The USA has lost 99.7 per cent of its export share to other countries and 3 per cent to Afghanistan, while China and Iraq lost 100 per cent of their export share to Bangladesh. Meanwhile, Bangladesh retained almost 23.59 per cent of its imports by gaining export share from China and Iraq. Although Germany gained nearly 93 per cent of Afghanistan's exports, it retained only 17.06 per cent after losing 54.15 per cent of its share to other countries, followed by 13.93 per cent to the USA and 14.86 per cent to China. Considering the results of the probability matrix for period I, it could be inferred that other importing countries were the stable market, followed by Bangladesh and Germany.

Trade direction of export of lac from India during Period II (2012-13 to 2021-22)

The export trade direction of lac from India during Period II (2012-13 to 2021-22) is presented in Table 4. The results show that Afghanistan was the most stable market for Indian lac as reflected by a high retention probability of 0.6876, followed by other countries, Germany, USA and Bangladesh, with retention coefficients of 0.6714, 0.6271, 0.5252 and 0.2948, respectively. China and Iraq experienced zero-probability retention, indicating that they were the most unstable importers of Indian lac during the second study period.

Afghanistan sustained its original share of 68.76 per cent and emerged as the most stable importing country during the second period. It has lost 16.27 per cent and 14.97 per cent of its export share to China and Germany, respectively. Germany has also shown stability in the export market by retaining 62.71 per cent of its original share while losing its remaining export share to the USA. Although the USA is the leading lac export destination, the trade pattern shows it could retain only 52.52 per cent of its share during the second period. While it gained a high percentage of export share from China and Germany, it lost 47.48 percent of its share to other countries that imported it. Table 4 portrays China and Iraq as the most unstable export destinations during the second period, as they could not retain their original share. China lost 89.33 per cent of its export share to the USA and 10.67 per cent to Iraq. Although Iraq gained 24.04 per cent of its export share from other countries, it lost 100 per cent of its share to Bangladesh.

Table 4: Transitional Probability Matrix for the shift in behaviour of Lac Exports from India during Period II (2012-13 to 2021-22)

Country	USA	Bangladesh	China	Germany	Afghanistan	Iraq	Other Countries
USA	**0.5252**	0.0173	0.1905	0.0073	0.0000	0.0608	0.1989
Bangladesh	0.0000	**0.2948**	0.2254	0.1917	0.0000	0.0161	0.2720
China	0.8933	0.0000	**0.0000**	0.0000	0.0000	0.1067	0.0000
Germany	0.3729	0.0000	0.0000	**0.6271**	0.0000	0.0000	0.0000
Afghanistan	0.0000	0.0000	0.1627	0.1497	**0.6876**	0.0000	0.0000
Iraq	0.0000	1.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000
Other Countries	0.0174	0.1838	0.0637	0.0069	0.0000	0.0568	**0.6714**

It is prominent from the results of the Transitional Probability matrix that Afghanistan, Germany, and the USA are the major stable markets of Indian lacduring the study period, as reflected by an increase in the probability of retention, and they are also likely to remain the leading importer of lac from India in the coming years. Bangladesh and other countries that import goods will also remain importantin the coming years. China and Iraq continue to be the most unstable importers of Indian lac. This could be due to the impact of other exporting countries entering the global market and possibly due to a shift in demand caused by the availability of lac and synthetic resins at comparatively cheaper rates than India.

Estimation of Indian lac exports to major importing countries

Using the transition probability matrix, the projected shares of Indian lac over the entire study period were estimated and compared with the actual export shares. Fig. 1 illustrates the actual and predicted trend of India's lac export to major

markets. For almost all the selected countries, the expected shares over time, as determined by the Markov model, are more or less close to the observed values, indicating that the fitted model is valid. Afghanistan's actual and predicted shares in lac exports show an increasing trend over the study period. In the case of Bangladesh, there is a significant increase in export shares. The predicted values showa similar trend to the actual values. The export shares of countries such as the USA, China, Germany, and other pooled countries showed an increasing trend from 2002-03 to 2013-14 and then declined till 2019-20. However, they have gained their export share over the last three years. In the case of predicted values, any differences over a few years are primarily due to the model's limitations, which require that the present estimates depend solely on the previous year's observations.

Fig. 1. Actual and Predicted trend of Indian lac export to major markets

Projected export share of lac to major importing countries

Table 5 summarizes the projected export share of Indian lac to major importing countries over the next five years, from 2023 to 2027. The results suggest that the USA would be a major market for Indian lac (31.4 per cent) during 2023, followed by other countries and Bangladesh. However, in the coming years, the projected exports of the USA will show a decreasing trend both in absolute value and percentage of total exports, as it is losing nearly 50 percent of its market share to other importing countries. Regarding Bangladesh and other countries, the projected value shows an increasing trend in absolute and relative to total lac exports from India. It is clear that, even though the USA holds a good share in total lac exported from India, Bangladesh and other countries will emerge as a new stable market for Indian lac.

CONCLUSION

As the predominant producer of lac and with favourable climatic conditions for lac cultivation, India should profitably capitalize on this opportunity by ensuring sustainable supply,

Table 5: Projected export shares of lac to major importing countries (in terms of million USD)

Year	USA	Bangladesh	China	Germany	Afghanistan	Iraq	Others
2023	26.50	11.42	9.46	8.64	2.31	4.01	22.10
	(31.4)	(13.5)	(11.2)	(10.2)	($^{2.7}$)	(4.8)	(26.2)
2024	25.98	11.90	9.41	8.30	1.59	4.06	23.21
	(30.8)	(14.1)	(11.1)	(9.8)	(1.9)	(4.8)	(27.5)
2025	25.54	12.28	9.37	8.07	1.09	4.10	23.99
	(30.3)	(14.5)	(11.1)	(9.6)	(1.3)	(4.8)	(28.4)
2026	25.21	12.57	9.34	7.93	0.75	4.11	24.53
	(29.9)	(14.9)	(11.1)	(9.4)	(0.9)	(4.9)	(29)
2027	24.97	12.76	9.32	7.85	0.52	4.13	24.90
	(29.6)	(15.1)	(11)	(9.3)	(0.6)	(4.9)	(29.5)

improving the quality of primary produce and reducing market volatility. Lac exports have been found to be highly competitive, giving them a significant comparative advantage in the global market. This is indicated by the RSCA index value greater than zero for all years, with an average index value of 0.82, 0.81 and 0.82 for periods I, II, and overall, respectively. The Markov chain analysis indicates that the stability of lac export has improved over the study period. Export of Indian lac will probably be concentrated in importing countries such as the USA, Bangladesh and Germany.

In the first period, importing countries pooled under "other countries", and Bangladesh was the most stable market of Indian lac as indicated by high probability retention. Meanwhile, the USA, China, and Iraq were the unstable importers of Indian lac, as reflected by the zero retention coefficient. In the second period, the results revealed that Afghanistan was the most stable market for Indian lac, followed by Germany, other countries, the USA and Bangladesh. At the same time, China and Iraq remained the most unstable importers of Indian lac. According to the trade pattern of Indian lac, Bangladesh will continue to be a major importer in the coming years. Despite the USA maintaining its top position as an export destination, it is experiencing a decline in total exports, losing half of its export share to other countries. Therefore, relying heavily on one or two export markets would increase long-run trade risk. To remain sustained in the international trade, it is necessary to improve production according to market demand, diversify market concentration and maintain long-term stable trading partners to increase foreign revenue.

Although exports from this sector are not worth billions of dollars or significantly boost the country's foreign exchange earnings, their importance stems from nearly 3-4 million tribal people, representing the socioeconomically weakest link in the Indian population, earning a subsidiary income from its cultivation. Concerned initiatives focusing on increased research and development, value addition, and product development in response to global demand, market diversification, and quality improvement will help boost lac export in the long run.

CONFLICT OF INTEREST

All the author both individually and collectively, affirms that they do not possess any conflicts of interest either directly or indirectly related to the research being reported in the publication.

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