Direction and Export Performance of Coffee in India

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ABSTRACT

The present study was conducted in the Department of Economics and Sociology, College of Basic Sciences and Humanities, Punjab Agricultural University, Punjab, India to examine growth performance and share of coffee in agricultural export from 2000-01 to 2016–17. The data on quantity of coffee exports from 2005-06 to 2016-17 were collected and used to examine the direction of trade and changing pattern of coffee exports with the use of first order Markov chain analysis. The top six major destinations in each type of coffee were selected for the analysis. The share of coffee in agricultural export earnings was nearly 4% in 2000-01 and decreased to 2% in 2016–17 which is a matter of great concern. The results of Markov Chain Analysis revealed that the major destinations for Indian coffee were Italy, Germany, Belgium, USA, Turkey and Slovenia. Kuwait was the most stable destination for plantation coffee exports, while in case of Arabica cherry Belgium, for Robusta parchment Italy, Germany and Spain for Robusta cherry and for Instant coffee Turkey and Russian federation were the most stable destinations. The climatic events and supply shocks remain the real threat to the development of a balanced market and sustainable conditions for the Indian coffee economy. The Government of India is expected to announce an interest subsidy scheme for exporters in order to boost coffee exports and explore new markets.

KEYWORDS: Coffee, direction of trade, growth, markov chain analysis

1. INTRODUCTION

Coffee is an important commercial crop of the tropics and it is the largest and widely traded tropical agricultural commodity with exports valued at US$ 31.6 billion in 2016. One unique feature of the global coffee trade is that production and consumption are clearly separated. Although about 60 countries in the world produces coffee, they hardly consume about 25% of their total production (Maciejewski and Mokrysz, 2019). More than 25 million small households across the world depends on coffee as a source of livelihood. Coffee is exported more than 3 tonnes for every 4 tonnes of production, mainly from developing to industrial countries. Brazil and Vietnam are the leading producers of coffee in the world occupying nearly 50 per cent of total world production (Chengappa et al., 2016). Nowadays, coffee is the single largest exporting commodity in the international market next to petroleum and petroleum products. Moreover, coffee has been a major export earning commodity of several coffee producing countries in the world (Menji, 2010). India has become self-sufficient in food production and paid attention on the commercial/horticultural crops with special focus on the surplus production crops (Prasad and Shivay, 2020, Kashyap et al., 2015, Mitra and Panda, 2020, Jha et al., 2019, Solares, 2014). The Western Ghats in the southern peninsula of India forms the backbone of India's coffee industry, which covers the traditional coffee growing regions like Karnataka, Kerala and Tamil Nadu, which accounts for 97 per cent of Indian coffee production. However, coffee is grown to a lesser extent in Andhra Pradesh, Odisha and north-eastern states. Coffee was introduced in Kerala in 1826, Karnataka in 17th century and the first coffee plantation in Tamil Nadu was set up in 1840 (Bhat et al., 2011). India is exporting coffee more than 40 countries in world. But the top six destinations for the Indian coffee are Russian Federation, Italy, Germany, Belgium, Spain and USA, which rounds up to almost 70 per cent of Indian coffee exports (Minten et al., 2014, Chauhan et al., 2015). The total exported quantity of Indian coffee during 2016-17 was 3.9 lakh mt. Increase in international prices leads to the increase in the export value of Indian coffee from Rs 3373.73 crores during 2010-11 to 6739.18 crores during 2016-17 (Bhat, 2011). Italy was the largest importer of Indian coffee, importing around 0.80 (lakh mt), followed by Germany (0.39 lakh mt), Russian Federation (0.26 lakh mt), Belgium (0.18 lakh mt.) and Turkey (0.15 lakh mt). Significantly, value added coffee exports have improved from 0.75 lakh mt in 2007-08 to 1.36 lakh mt. in 2017-18 (Naidu, 2018, Ashoka et al., 2016, Dragusanu et al., 2014, Woodill et al., 2014). This value addition in coffee plays a critical role in increase the coffee growers and improves their standard of living (Beshah et al., 2013, Naik and Nethrayini, 2018; Dev et al., 2016).

Before the liberalization of coffee sector, coffee board was under a situation of monopoly on sale and purchase of coffee grown in India which leads to inefficiency in supply chain and delay in the cash payment to the coffee growers. After liberalization, the quantity and quality of coffee was improved which led to increased coffee export (Chengappa et al., 2016, Jarvis, 2012, Mandanna, 1998; Pramod, 2007). Post-liberalization era in coffee has undoubtedly thrown several challenges for the production and marketing of coffee. In India, 98 per cent of small coffee growers covers 60 per cent of the total area under coffee and 40 per cent of total production which is now at risk. The crisis has reached the peaks as the new coffee producing countries entered into the international market. When there is demand of one or two crops in the international market, many countries are step in to sell their export crops to increase their foreign earnings. Vietnam, the world's second largest exporter comes under this category. When there is fall in international prices of primary commodities, the need to higher foreign exchange earning has become risen by exporting more of these crops. Also, there is the structural drift in the direction of trade during the last decade (Anonymous, 2014). Thus, coffee exports play a vital role in India's foreign exchange earnings (Manoj, 2015). So, the present study is an attempt to examine the trends in Indian coffee export, market structure and direction of trade during post-liberalization period, which are essential for formulation of suitable policy.

2. MATERIALS AND METHODS

The data on quantity of coffee exports from 2005-06 to 2016-17 was collected and used in the Department of Economics and Sociology, College of Basic Sciences and Humanities, Punjab Agricultural University, Punjab, India to examine the direction of trade and changing pattern of coffee exports with the use of first order Markov chain analysis. The top six major destinations in each type of coffee were selected for the analysis. The transitional probability matrix (P) estimation is Central to Markov chain analysis. The elements P_{rs} of the matrix P shows the probability that export will switch from r^{th} country to s^{th} country with the passage of time. In the transitional probability matrix, diagonal elements represent the probability of retention of trade. The row elements represent the probability of loss of trade to other competing countries and the column elements represent the probability of gain in trade from other competing destinations.

$$E_{st} = \sum_{i=1}^{r} E_{rt-1} \times P_{rs} + e_{st}$$

Where,

E_{st} = Exports from India to s^{th} country in the year t.

E_{rt-1} = Exports to r^{th} country in the period t-1

P_{rs} = Probability that the exports will switch from r^{th} country to s^{th} country

e_{rt} = Error term which is statistically independent to E_{rt-1}

t = Number of years selected for analysis

r = Number of importing destinations

The transitional probabilities Prs which can be arranged in a (c * r) matrix, have the following properties.

$O < P_{rs} < 1$

$\sum P_{rs} = 1$, for all r

Hence, the expected export shares of each country in the period 't' were secured by multiplying the export to these destinations in the previous period (t-1) with the values of transitional probability matrix. Several techniques are used to approximate the transitional probabilities of the Markov chain model such as weighted restricted least squares, unweighted restricted least squares, Bayesian maximum likelihood, unrestricted least squares etc.

In the present study, to estimate the transitional probability indices, minimum absolute deviation (MAD) estimation procedure was employed which minimizes the sum of absolute deviations. The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is stated as

Min OM*+ Ie

Subject to,

AM*+ V = B

GM* = 1

M*> 0

Where,

O=The vector of zeros

M*=The vector in which probability P_{uv} are arranged

I=An appropriately dimensioned identity matrix

e=A vector of absolute errors

B=The vector of exports to each country

A=The block diagonal matrix of lagged values of B

V=The vector of errors

G=The grouping matrix to add the row elements of M arranged in M* to unity

This method to estimate the coefficient of direction of trade was used in the many studies (Cariappa and Chandel, 2020; Dev et al., 2016; Haribabu, 2017; Mandanna, 1998; Pramod, 2007).

3. RESULTS AND DISCUSSION

3.1. Coffee share in agricultural exports in India

The status of coffee sector in agricultural export earnings have to be examined critically in order to know the impact of coffee in agricultural export earnings. At present, coffee account for nearly 2 per cent of total agricultural export earnings during 2016-17 (Table 1). The share of coffee in agriculture export earnings has decreased i.e., from 4 per cent to 2 per cent during 2000-01 to 2016-17. Moreover, the shares of selected coffee varieties export from total coffee export during 2016-17 have been presented in the Figure 1. Among the coffee varieties, Robusta cherry occupied the largest share (40.03%), followed by Instant (32.28%), Plantation coffee (14.14%), Robusta cherry (8.12%) during 2016-17. The share of Arabica cherry coffee was only restricted to 5.17% due to increase in white stem borer infestation (Kumar et al. 2019, Cole and Brown, 2014, Prasad and Ashwini, 2021). Many studies (Ashoka et al., 2016, Dragusanu et al., 2014, Woodill et al., 2014) conducted the research on the growth and performance of coffee and leads on the similar conclusion.

Table 1: Coffee share in agricultural exports from 2001 to 2017

Year	Coffee exports (000' US$)	Agriculture exports (000' US$)	Coffee share in total agricultural exports (%)
2000	178971	4463417	4.01
2005	236696	9623839	2.46
2010	381581	19207456	1.99
2015	540738	31575981	1.71
2017	639642	35637316	1.79

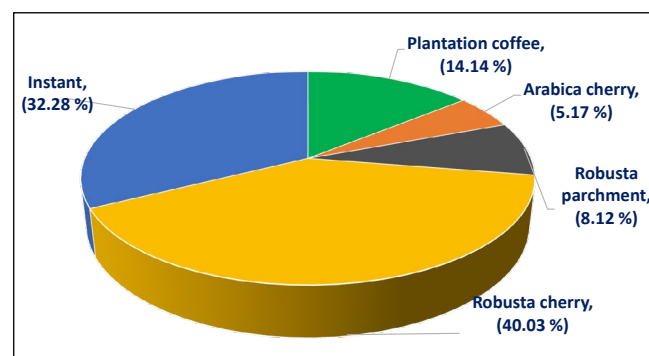Figure 1: Share of export value of major coffee varieties from India during 2016-17; (Note: Figures in parentheses indicate percentage to the total)

3.2. Direction of trade of coffee export

The direction of trade of Indian coffee export to different countries have been analyzed with the estimation of

transitional probability matrices using Markov chain analysis for annual export data (2005-06 to 2016–17). Top six countries were selected for the study in each type of coffee and the remaining are pooled under "others" category. On overview of the import destinations for major coffee varieties in India have been presented in the table 2.The table also clearly states the percent share of the importing destinations for respective coffee during 2016–17. Belgium, Italy, Germany, Jordan and Kuwait were registered as the major importing destinations of Indian plantation coffee, covering nearly 95 per cent of total export earnings. But in case of Arabica cherry, Italy, Germany and Belgium were contributing 90 per cent of export earnings. Similarly, Italy and Germany in Robusta parchment, Italy alone in Robusta cherry, Russian Federation and Turkey in Instant coffee were registered as the major importing destinations during 2016–17.

Table 2: Country wise share of coffee varieties exports from India during 2016-17

Commodity	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6
Plantation coffee	Belgium (18)	Italy (11)	Germany (11)	Jordan (11)	Kuwait (11)	Saudi Arabia (6)
Arabica cherry	Italy (32)	Germany (22)	Belgium (19)	USA (5)	Switzerland (3)	France (2)
Robusta parchment	Italy (46)	Germany (32)	Australia (5)	Belgium (2)	Spain (2)	Switzerland (1)
Robusta cherry	Italy (38)	Germany (9)	Belgium (6)	Slovenia (6)	Spain (5)	Greece (4)
Instant	Russian Federation (23)	Turkey (16)	Malaysia (6)	USA (5)	Ukraine (4)	Finland (2)

Note: Figures in parentheses indicate percentage to the total

3.3. *Plantation coffee export from India*

The perusal of the Table 3 showed the transitional probability matrix for plantation coffee export from India for the period 2005–06 to 2016–17. The major importing countries of Indian plantation coffee were Italy, Germany, Belgium, Jordan, Kuwait and Saudi Arabia.

The results of the study revealed that the most stable market for plantation coffee export was found to be with Kuwait with a retention probability of 52 per cent of its previous value, while it had lost 23.78 per cent share to Saudi Arabia market and 14.74% share to Belgium and 9% to Italy. At the same time, Kuwait gained 22.97% share from Jordan and 6% share from Germany. Export of Plantation coffee to Italy was retained to the tune of 41.11 per cent and the remaining share lost to Germany (35.91%) and Jordan (12.95%). Belgium had held 40.88 per cent of its original share and the leftover share had lost to Jordan (41.81%) and Saudi Arabia (9.41%). Similarly, Germany and Jordan had retained 30.43 per cent and 21.95 per cent of its previous share. Germany had lost 41.2% and 12.24% to Italy and Belgium, and gained 35.91% from Italy and 10.26% share from other countries. In case of other countries, the retention probability was very high i.e., 86.79 per cent of its original export share.

3.4. *Arabica cherry*

The proportion in the export of Indian Arabica cherry coffee to different countries over a period of time and the changing pattern of trade were analyzed. This was achieved

Table 3: Transitional probability matrix of plantation coffee export from India, 2005-06 to 2016-17

Country	Italy	Germany	Belgium	Jordan	Kuwait	Saudi Arabia	Others
Italy	0.4111	0.3591	0.1003	0.1295	0.0000	0.0000	0.0000
Germany	0.4120	0.3043	0.1224	0.0000	0.0622	0.0428	0.0564
Belgium	0.0000	0.0000	0.4088	0.4181	0.0000	0.0941	0.0790
Jordan	0.0000	0.0000	0.1303	0.2195	0.2297	0.0954	0.3251
Kuwait	0.0945	0.0000	0.1474	0.0000	0.5204	0.2378	0.0000
Saudi Arabia	0.5702	0.0000	0.4298	0.0000	0.0000	0.0000	0.0000
Others	0.0000	0.1026	0.0006	0.0000	0.0289	0.0000	0.8679

by examining the gains and losses in the export share of Indian Arabica cherry coffee employing Markov chain model with respect to major importing countries. The transitional probability matrices of Indian Arabica cherry coffee exports to different countries over a period of time were represented in the Table 4. The markets selected for study are Italy, Germany, Belgium, Switzerland, France and USA. The remaining countries were kept under others category.

The results of the study revealed that during the study period, Belgium was the most stable market for Indian Arabica cherry exports with a retention probability of 73.09% of its previous share. However, it had lost 16.22% share to Germany and 9% share to other countries and had gained 4.64% from Italy and 2.36% from other countries. Italy and Germany had recovered 62.79% and 29.26% of its previous share respectively. Italy had grabbed 42.79% from Germany, 41.63% form Switzerland and 46.87 per cent share from USA and lost to Germany (12.63%) and other countries (16.97%). Similarly, Germany had lost its major share to Italy (42.79%) and USA (19%), and it had gained (100%) from France and Switzerland (58.37%). The most unstable importers of Indian Arabica cherry exports were Switzerland, France, USA and other countries.

Table 4: Transitional probability matrix of Arabica cherry coffee export from India, 2005-06 to 2016-17

Country	Italy	Germany	Belgium	Switzerland	France	U.S.A	Others
Italy	0.6279	0.1263	0.0464	0.0297	0.0000	0.0000	0.1697
Germany	0.4279	0.2926	0.0000	0.0000	0.0000	0.1904	0.0890
Belgium	0.0000	0.1622	0.7309	0.0000	0.0151	0.0000	0.0918
Switzerland	0.4163	0.5837	0.0000	0.0000	0.0000	0.0000	0.0000
France	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
U.S.A	0.4687	0.0000	0.0000	0.3897	0.0000	0.0000	0.1415
Others	0.0000	0.2249	0.0236	0.4486	0.1453	0.1576	0.0000

3.5. Robusta parchment

Table 5 reveals the transitional probability matrices of Indian Robusta parchment exports during the period of 2005-06 to 2016-17. The important destinations for Indian Robusta parchment are Italy, Germany, Belgium, Spain, Australia and Switzerland. The remaining countries are pooled and put under others category.

As it is evident from the table 10 that the Italy, Germany, Spain and other countries were pound to be the stable markets for Indian Robusta parchment coffee exports. Germany had retained 74.51 per cent of its previous share, while, it had gained from Spain (36.63%), the remaining share lost to Italy (15.60%). Likewise, Italy had held 64 per cent of its previous share. However, Italy had gained a major part of the export share from Australia (100%) and other countries (68.64%). Similarly, Spain had retained 31.85% share previous export share, while it had lost share to Germany (36.63%) and Belgium (31.52%). Australia and Switzerland were considered to be the most unstable markets. However, Australia had given up its 100% share to Italy and Switzerland had lost 100% to other countries. In case of other countries, India had retained 14.39% of its previous share and had lost major shares to Italy (68.64%), Belgium (9.73%) and Australia (5.9%).

3.6. Robusta cherry

Table 6 gives the transitional probability matrices of Indian Robusta cherry exports during the period 2005-06 to 2016-17. The major importers of Indian Robusta cherry are Italy,

Table 5: Transitional probability matrix of Robusta Parchment coffee export from India, 2005-06 to 2016-17

Country	Italy	Germany	Belgium	Spain	Australia	Switzerland	Others
Italy	0.6405	0.1459	0.0125	0.0000	0.0063	0.0131	0.1816
Germany	0.1560	0.7451	0.0000	0.0193	0.0732	0.0064	0.0000
Belgium	0.0000	0.0000	0.0000	0.0970	0.0000	0.0374	0.8656
Spain	0.0000	0.3663	0.3152	0.3185	0.0000	0.0000	0.0000
Australia	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Switzerland	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Others	0.6864	0.0000	0.0973	0.0000	0.0598	0.0126	0.1439

Table 6: Transitional probability matrix of Robusta cherry coffee export from India, 2005-06 to 2016-17

Country	Italy	Germany	Belgium	Slovenia	Spain	Greece	Others
Italy	0.1308	0.0905	0.0608	0.0000	0.0615	0.0270	0.6294
Germany	0.2184	0.3829	0.0000	0.3785	0.0000	0.0201	0.0000
Belgium	0.0000	0.0000	0.0000	0.1535	0.0000	0.0000	0.8465
Slovenia	0.7513	0.0000	0.0000	0.2487	0.0000	0.0000	0.0000
Spain	0.0000	0.0000	0.2070	0.0159	0.5507	0.2264	0.0000
Greece	0.6600	0.0000	0.0000	0.3400	0.0000	0.0000	0.0000
Others	0.6723	0.0000	0.0892	0.0000	0.0000	0.0591	0.1794

Germany, Belgium, Slovenia and Greece.

It is evident from the table 6 that highest retention of Robusta cherry exports was observed in Spain i.e. 55.07% of its original share and give up its remaining share to Greece (22.64%) and Belgium (20.70%). Germany had retained reasonable export share of the Robusta cherry i.e. 38.29% and it had lost 37.85% share to Slovenia and 21.84 per cent share to Italy. Likewise, Italy had retained 13% share of its previous share and grabbed share of 75.13% followed by from Slovenia other countries (67.23%) and Greece (66%). The most unstable markets for Indian Robusta cherry coffee exports were Belgium and Greece. In case of other countries, India had retained 17.94 per cent of its previous share and gained major shares from Belgium (84.65%), Italy (62.94%) and had lost its major share to Italy (67.23%) and Belgium (8.92%).

3.7. Instant coffee

Table 7 gives the transitional probability matrices of Indian Instant coffee exports during the during the study period. The leading importing countries of Indian Instant coffee are Russian Federation Turkey, USA, Ukraine, Malaysia, Finland.

The most stable markets among major importers for export of Indian Instant coffee during the study period were Turkey and Russian federation reflecting highest probability retention of 95% and 69.12% of its previous share, respectively. Russian Federation had gained 80.16%

share from Malaysia, 23.72% share from Ukraine and 17.73% from Finland. Similarly, Turkey had lost 4.96% share to other countries and grabbed 1.86% share from other countries. USA, Ukraine, and Finland had retained 10.32%, 40.83% and 63.91% of its previous share. USA had lost 51 per cent share to Malaysia and other countries (38.66%). Likewise, Ukraine gained 18.91% share from Malaysia and 5.21% share from Finland, and Finland had absorbed 35.44% share from Ukraine. Malaysia could not retain its previous import share of Indian instant coffee and lost to Russian Federation (80.16%) and Ukraine (18.91%). However, India retained 79.82% of its previous share to other importing countries, whereas it had grabbed shares from USA (38.66%), Russian Federation (26.13%) and Turkey (4.96%).

3.8. Total coffee

Table 8 showed the transitional probability matrices of Indian total coffee during the study period. Top six markets for India total coffee exports were Italy, Germany, Russian Federation, Belgium, Turkey and Slovenia. Rest of the countries are kept under others category.

It is evident from the table that Turkey is the most stable market for Indian total coffee during the study period, with a retention tune of 86.84% of its previous share. The residual share was lost to Italy (9.45%) and Germany (3.70%). However, it had gained 4.57% share from Germany. Similarly, Russian Federation had retained 38.69% of its

Table 7: Transitional probability matrix of Instant coffee export from India, 2005-06 to 2016-17

Country	Russian Federation	Turkey	USA	Ukraine	Malaysia	Finland	Others
Russian Federation	0.6912	0.0000	0.0000	0.0475	0.0000	0.0000	0.2613
Turkey	0.0000	0.9504	0.0000	0.0000	0.0000	0.0000	0.0496
USA	0.0000	0.0000	0.1032	0.0000	0.5102	0.0000	0.3866
Ukraine	0.2372	0.0000	0.0000	0.4083	0.0000	0.3544	0.0000
Malaysia	0.8016	0.0000	0.0093	0.1891	0.0000	0.0000	0.0000
Finland	0.1773	0.0000	0.0000	0.0521	0.1217	0.6391	0.0098
Others	0.0065	0.0186	0.0851	0.0000	0.0916	0.0000	0.7982

Table 8: Transitional probability matrix of total coffee export from India, 2005-06 to 2016-17

Country	Italy	Germany	Russian Federation	Belgium	Turkey	Slovenia	Others
Italy	0.0000	0.1326	0.0678	0.0000	0.0000	0.0000	0.7996
Germany	0.0000	0.2565	0.3164	0.2124	0.0457	0.1690	0.0000
Russian Federation	0.4475	0.0000	0.3869	0.1422	0.0000	0.0234	0.0000
Belgium	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Turkey	0.0945	0.0370	0.0000	0.0000	0.8684	0.0000	0.0000
Slovenia	0.7091	0.0000	0.0000	0.0000	0.0000	0.2909	0.0000
Others	0.3905	0.0759	0.0167	0.0433	0.0000	0.0063	0.4672

previous share by losing to Italy (44.75%), Belgium (14.22%) and to Slovenia (2.34%). Even though, it gained share from Germany (31.64%), Italy (6.78%) and 1.67% from other countries. Likewise, Slovenia and Germany had retained 29.09% and 25.65% of its previous share, respectively. Slovenia had lost its major share to Italy (70.91%). However, it had grabbed shares from Germany (16.90%), and Russian Federation (2. 3%).While, Germany had lost its major share to Turkey (45.57%), Russian Federation (31.64%), Belgium (21.24%) and to Slovenia (16.90%). Italy and Belgium seems to be the most unstable countries for Indian total coffee Italy had lost its major share to other countries (79.96%), Germany (13.26%) and Russian Federation (6.78%). Similarly, Turkey had lost its total share to, Italy (9.45%) and Germany (3.70%). Study conducted by Naik and Nethrayini, 2018 also presented the same results.

Other countries with a retention probability of 46.72% were another loyal customer of Indian total coffee. They had absorbed 100% share from Belgium and 79.96% share from Italy. Similar results were also found in the study conducted by Minten et al., 2014; Dev et al., 2016.

4. CONCLUSION

The study concludes Turkey and the Russian Federation were the most stable importers of Indian Instant coffee. Kuwait was the most consistent destination for plantation coffee exports, retaining 52% of its previous share. Spain retained the most Robusta cherry, while Germany was the most stable market for Robusta parchment coffee export. Exports to Kuwait for plantation coffee, Belgium for Arabica cherry, Italy, Germany, and Spain for Robusta parchment and Robusta cherry were the most stable.

5. FUTURE RESEARCH

The climatic events and supply shocks remain the real threat to the development of a balanced market and sustainable conditions for the Indian coffee economy. Government and financial institution should take appropriate steps to increase the credit facility to the growers, which will increase the production of coffee all over India and will help the country to face competition in the international market in the present globalized era.

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