

Title:

Benchmarking at macro level: a comparative study on fruit processing industry between India and Brazil

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Abstract:

In spite of the vast commonalties and similarities between India and Brazil, both countries stand miles apart when one compare the size and growth of fruit processing industry and also the total loss of fruits due to wastage and value destruction at various levels. Brazil process nearly 70% of the total fruit production with a total loss of around 20%, whereas India processes just 2% of the total fruit production with an alarming loss of around 35%. Hence, it calls for a benchmarking study on fruit processing industry between the two nations.

The research involves both secondary and primary research. The macro level study about this particular industry in both the countries has been made using secondary data. This data is then analyzed to know the similarities and dissimilarities between the two nations. The effort was made to know the causes for the dissimilarities between the two nations along with suggestions on policy front to elevate Indian fruit processing industry to international standards.

India should seriously think of adopting ‘Brazilian model: The Brazilian system of managing this particular industry’ at the earliest, where-in only one agency ‘**EMBRAPA**’ (Brazilian Agency for Agricultural Research and Animal Husbandry) takes care of the interests of all the stakeholders, i.e. growers, processors, mediators, etc., unlike the ‘Indian model: The Indian system of managing this particular industry’, where-in large numbers of nodal bodies (both at national level and state level) often with conflicting interests create a situation which doesn’t synergize and lead to poor growth of this industry.

Key words:

Benchmarking, Fruit processing industry, India, Brazil, EMBRAPA

TABLE-1**Key recent economic, agronomic, demographic, and agriculture related parameters**

India	Key recent parameters	Brazil
3287590	Total area in sq km	8511965
2973190	Total land area in sq km	8456510
314400	Total area covered by water in sq km	55455
Tropical in south to temperate in north	Climate	Mostly tropical but temperate in south
1703000	Total arable land in sq km (2008)	674000
100000	Total arable land under permanent crops in sq km	77000
1270190	Total non arable land in sq km	7782510
558080	total irrigated land in sq km	29200
22.80%	Total forest area (%)	56.50%
677010	Total forest cover in sq km	4776981
1110	Total population (2008) in million	189
1.70%	population growth rate	1.50%
84.70%	Urban population (%) (2008)	29.00%
2726	GNI (PPP) (2008) in USD billion	1647
911.8	GDP (Official exchange rate) (2008) in USD billion	1067.5
821	GDP per capita (2008) in USD	5648
2726	GNI Per Capita (PPP) (2008) in USD	8700
9.20%	GDP real growth rate (2008)	3.70%
18.60%	% of GDP from agriculture sector (2005)	8.40%
27.60%	% of GDP from industry sector (2005)	40%
53.80%	% of GDP from services sector(2005)	51.60%
Under developing	Country status	Under developing
496.4 million	Total labor force (2005)	90.41 million
60%	% of labor force in agriculture	20%
17%	% of labor force in industry sector	14%
23%	% of labor force in service sector	66%
8.90%	Unemployment rate	9.80%
29%	Population below poverty line (2008)	22%
99.45	Total exports f.o.b.(2005) in USD billion	118.3
138.09	Total imports f.o.b.(2005) in USD billion	77.62
-38.64	Net exports f.o.b.(2005) in USD billion	40.68
28.1% GDP	Total Investment (gross fixed) (2005)	19.9% of GDP
7.90%	Industrial production growth rate (2005)	3.40%
USD 136 billion	Forex reserves and gold	USD 53.8 billion
Rs.44.1011 per USD	Official exchange rate(2005)	2.434 reals per USD
341	No. of airports	4276
60.0 million	Internet users	25.9 million
Federal republic	Constitution of the government	Federal republic
Was Portuguese colony & got independence in 1822	History	Was British & Portuguese colony got independence in 1947
Coal, iron ore, manganese, mica, bauxite, NG, limestone, diamond, Petroleum, arable land	Natural resources	Bauxite, gold, iron ore, manganese, nickel, phosphate, platinum, tin, uranium, petroleum, timber

Source: The little green and red book series of world bank and FAO statistical year book series of UN publications

Introduction:

From the table-1 it becomes evident that India and Brazil are both developing countries and as part of BRICS have lots of commonalities and similarities economy wise and share the common history. Economic condition of the two countries is also comparable. Both countries enjoy almost similar climatic conditions. They share the long history of crop husbandry. India produced 46 million metric tons (mmt) of fruits where as Brazil produced 34 mmt of fruits contributing to 9.55% and 7.09% of global fruit production, respectively.

In spite of the vast commonalties and similarities between India and Brazil, both countries stand miles apart when one compare the size and growth of fruit processing industry and also the total loss of fruits due to wastage and value destruction at various levels. Brazil process nearly 70% of the total fruit production with a total loss of around 20%, whereas India processes just 2% of the total fruit production with an alarming loss of around 35%. Hence, it calls for a benchmarking study on fruit processing industry between the two nations. Needless to say that this particular comparative study (Benchmarking Study) would have been done with other major fruit producing countries such as USA and others. But other conditions including; Economical, Agrarian, Agronomical, Climatic, Technological, *etc.* being dissimilar, such a comparison becomes an infeasible one and would be of little use to India.

Literature review:

The review of literature in the field of fruit processing industry of India and Brazil has revealed several contemporary issues of importance. They include issues related to growth in the production of fruits, growth with respect to processing of fruits, present availability and future requirement of infrastructure, emergence of wide product range, adoption of emerging new technologies by the firms, management practices followed by both cultivators and processors, and strategies and policies pursued by all the stake holders involved for the overall growth of this industry.

Vinodchari (2003), reported that India is among the world's major producer of food, producing over 600 million tons of food products every year. The researcher further explained that the food processing industry ranks fifth in size in the country representing **6.3% of GDP**, accounts for **13% of the country's export** and involves **6% of total industrial investment** in the country.

Biodiversity International News of Brazil, (2006), made a remark on **EMBRAPA (Brazilian Agency for Agriculture Research and Animal husbandry)**, a prime government nodal agency of Brazil, about the announcement that the number of seed samples stored in its Gene Bank had topped 102000, putting the Brazilian gene bank at No. 7 in the world in total number of accessions. More than 500 species were represented in the gene bank, which has restored lost varieties and species of local communities in Brazil. The gene bank will open four new cold storage chambers this month, doubling its capacity to 240000 accessions.

US Commercial Services Report (2000), reported that the Indian food processing industry is a high priority sector and is poised for excellent growth in the next century. The government of India has adopted a major policy decision for commercializing agriculture and packaging sectors. Agricultural production and food processing together accounts 30% of India's GDP and employs more than 70% of its work force.

MOFPI (Ministry of Food Processing Industries) in its annual report (2000-01), reported that the country's share in the world trade of processed fruits and vegetables is still less than one%. As such, abundant investment opportunities are there in the expanding domestic market and export arena. An increasing acceptance of new products together with innovative market development efforts is seen.

Surinder Sud (1998), in his article on India's revolutionary progress in food production opined that the interest shown by the domestic corporate sector and transnational corporations in setting up food processing units indicate that India would soon emerge as an important player in the international processed foods market. The Government already has approved about 343 proposals for 100% Export Oriented Food Processing Units and joint ventures since the

beginning of the economic reforms, i.e. in the early 1990's. These would involve an investment to the tune of Rs.43040 Million including foreign direct Investment worth Rs.7880 Million.

MOFPI report (2001), It's report on summary on fruits and vegetable processing documented in the report of Ministry of Food Processing Industries (MOFPI) highlights the following facts;

1. India is the second largest producer of vegetables and third largest producer of fruits.
2. Thirty percent of the fruits and vegetables get wasted due to lack of proper processing and packaging facilities.
3. Only two to three percent of the total produce is being processed in India.
4. Total cultivation area under fruit and vegetables is around 12.0 million hectares and accounts for 7% of the total cultivation area.
5. Main fruits produced in India are Mango, Banana, citrus, Guava and apple. These fruits account for 75 to 80 percent of total fruit production.

K.P.Prabhakaran Nair (2006), expressed that Indian agriculture is being undermined because of the unreformed policies in the agriculture sector that continue to encourage monoculture such as wheat and rice in Punjab and sugarcane in Maharashtra, where the cultivation has lead to exploitation of ground water causing long term environmental degradation. The extensive input subsidies which are not conducive to efficient agro practices may cause greater harm in the future. Indian agricultural extension network is comparatively inefficient when compared with the other countries like China and Brazil. According to the researcher Indian agriculture sector will bloom only when the mentality of India's agricultural fraternity will give top priority to providing necessary help and support to our farmers in the field.

Mckinsey and CII study report, (2001), in their article reported that, according to a joint study conducted by Mc Kinsey and Confederation of Indian Industry (CII), a staggering fifty percent of production of fruits and vegetables in India are lost due to wastage and value destruction. In monetary terms, the loss was estimated at over Rs.23000.00 crores a year.

Research methodology:

The research involves both secondary and primary research. To begin with secondary research on global fruit production is made. Then macro level study about this particular industry in both the countries is made using secondary data that was available. This data is then analyzed to know the similarities and dissimilarities between the two nations.

The research objectives of this benchmarking study are;

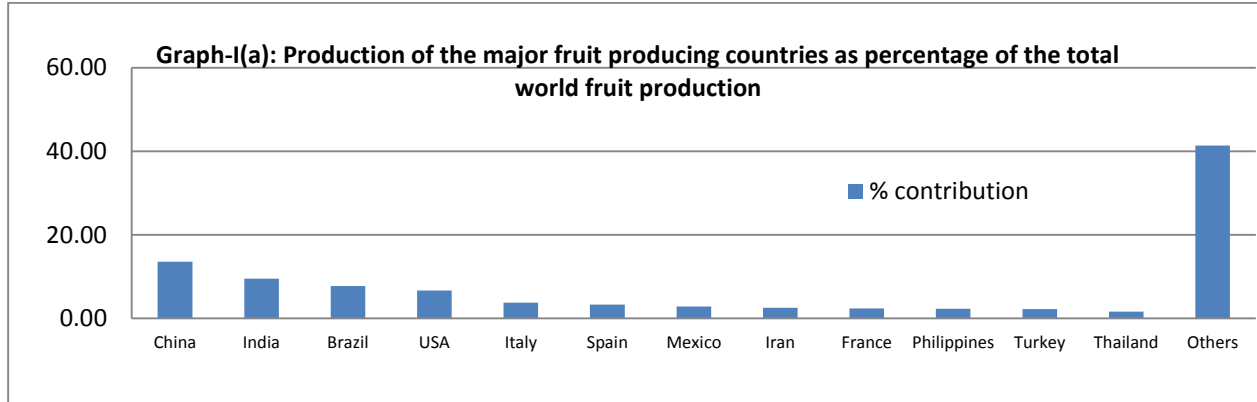
1. To study the production pattern of fruits of the entire world and also the countries of interest, *i.e.* India and Brazil over the past years.
2. To study the Agrarian structure, population distribution structure, key economic indicators including FAO indices, imports and exports of major group related to FPI (Fruit Processing Industry) of both countries, *i.e.* India and Brazil over the past years.
3. To suggest recommendations to all the stake holders involved, *i.e.* mango cultivators, mango processors, all concerned nodal agencies / Government departments / other concerned institutions, and lastly to Ministry of Agriculture, Government of India for the healthy growth of the fruit processing industry of India.

Sources of secondary data collection include; FAO commodity year books, International trade statistics from www.trademap.com, FAO Production year books, FAO statistical year books, the little green and red data book series of WB (World Bank), etc. Relevant research papers and articles published in various journals of both nations, news papers, magazines, etc. have all been explored to get the required information. Nevertheless, official websites of UNCTAD, DGFT, ITC, WB, FAO, etc., have been explored deeply to get hands on the required information. Tabulation techniques are used for collecting secondary information.

Various statistical, mathematical and computational tools and techniques including Average% increase or decrease analysis, Average% contribution analysis, CGR (Compound Growth Rate) analysis, independent t-test, etc. using MS-EXCEL are being used to analyze the secondary information.

Important research findings and discussion:

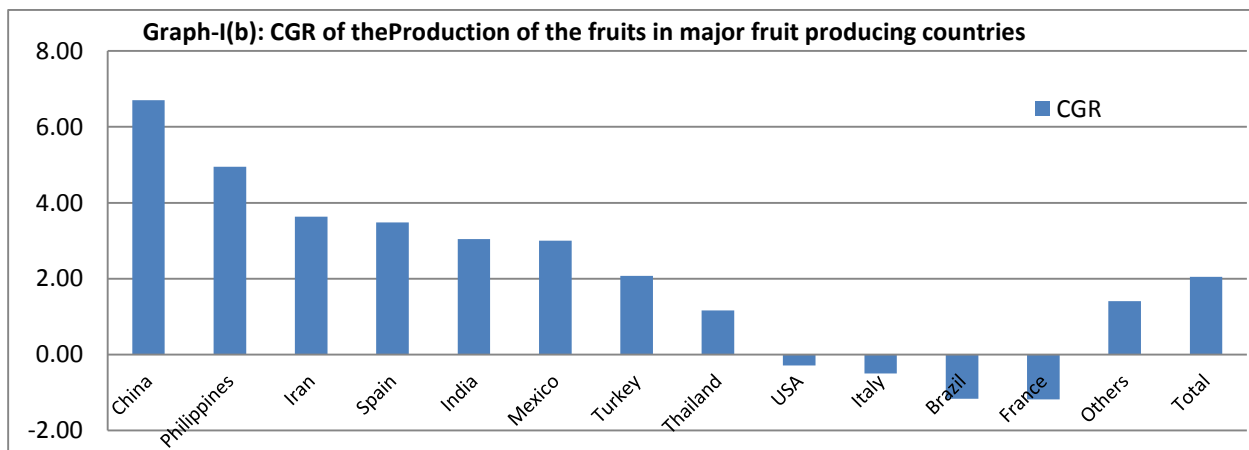
I. Average % contribution of major fruit producing countries and CGR of the production of fruits



Refer Appendix-II for detailed tabular analysis

The graph shown above clearly rank China, India, Brazil and USA as the top four producers of fruits in the world. Percentage contribution of India and Brazil, towards total fruit production of the world, is comparable. Both India and Brazil enjoy the significant share of the total fruit production, which is next only to China.

But when it comes to fruit processing, India is lagging far behind Brazil. Brazil processes around 70% of the total fruit production, whereas India processes just around 5%. India has to strengthen its fruit processing industry with a strategic re-orientation and integrated approach, in order to exploit the huge potential.

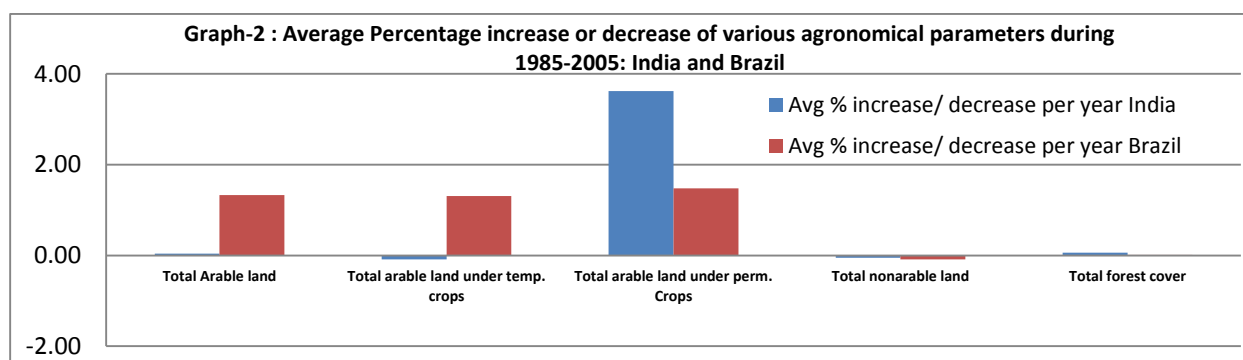


Refer Appendix-II for detailed tabular analysis

The graph displayed above reveal that China and Philippines are the countries which are growing significantly when it comes to total fruit production. This clearly indicates the fact that China has realized the tremendous potential that is being hidden in this sector and is trying to exploit the same before any other country does. CGRs of Iran, Spain, Mexico and India are more or less comparable.

Brazil, the benchmarking partner of India, has experienced a negative growth of -1.16% like that of many other countries. This is a cause of concern for Brazil, which should be addressed.

II. Average % increase / decrease of important agronomical parameters



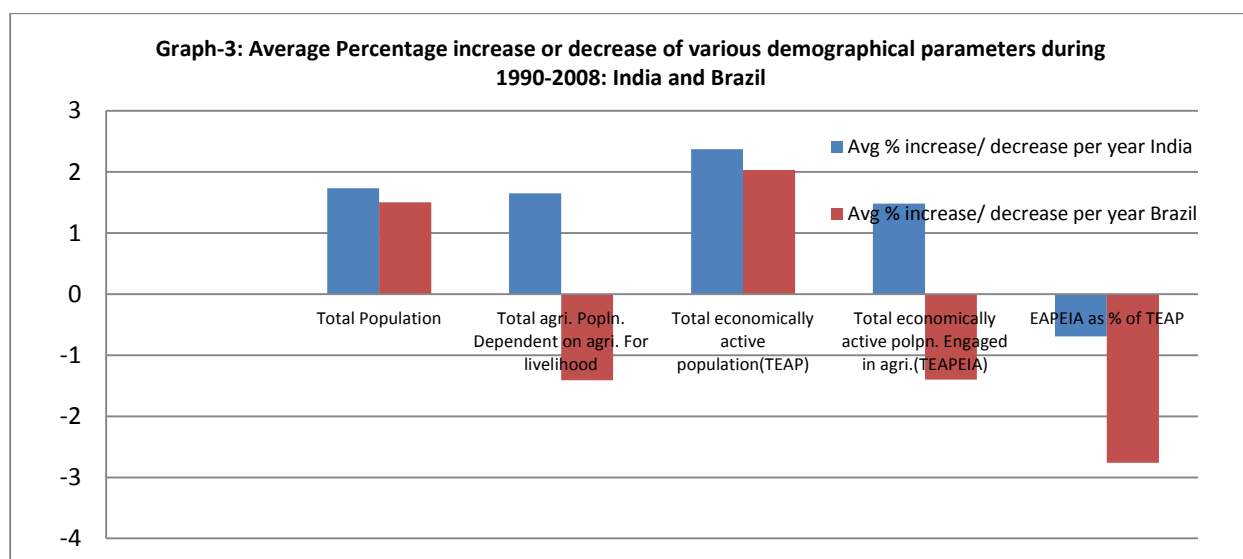
Refer Appendix-III for detailed tabular analysis

Total arable land in India has increased marginally when compared with Brazil. This indicates that much of the non arable land is being transformed in to arable land through human efforts in Brazil. India should make serious attempts to transform huge tracts of non arable land available in to arable one, like Brazil.

The total arable land under temporary crops has experienced negative growth in India. But the total arable land under permanent crops, which is area of interest for this research, has increased by 3.62% during 1985-2005 in India compared to 1.48% for Brazil. The total non arable land and the total forest cover have shown no major changes for both the countries.

In spite of Brazil being nearly 2.6 times bigger than India w.r.t. total area, total arable area of Brazil remains very small compared to India (nearly 40% of that of India). The total area under permanent crops of Brazil also remains small compared to India (nearly 77% of that of India). This is primarily due to huge forest cover (56.5% of total land area), surrounding Amazon in Brazil compared to India (22.8% of total land area). *As confirmed by t-test, there is no significant difference between the two countries when we compare the per capita arable land (refer appendix-I).*

III. Avg. % increase / decrease of important demographical parameters during 1990-2008: India and Brazil

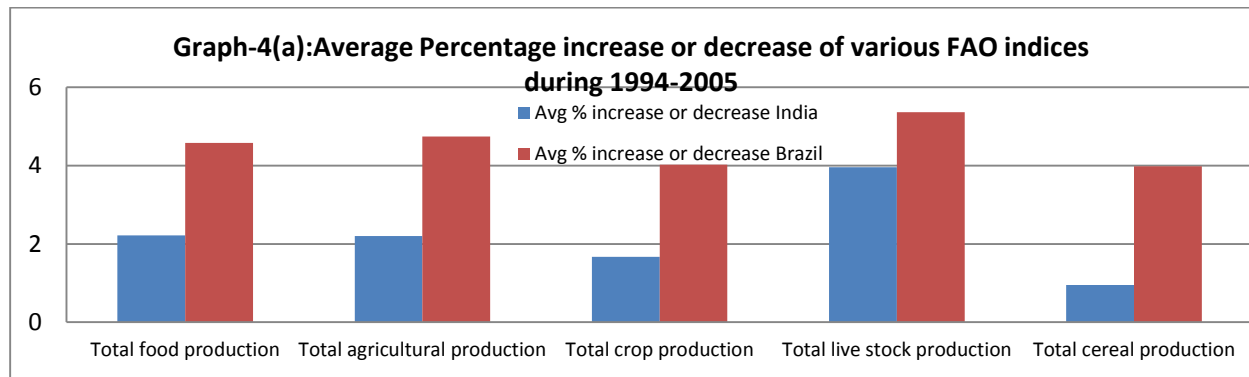


Refer Appendix-IV for detailed tabular analysis

As revealed from the above graph the population of India was increasing at the rate of 1.73% compared to 1.50% in Brazil. But when we compare the total agricultural population dependent on agriculture for their livelihood, India has experienced growth of 1.65% where as Brazil has shown decline by 1.41%. This coupled with the fact that nearly 72% of the total Indian population is dependent on agriculture for their livelihood compared to just 18% in Brazil, reveals that Indian economy to a great extent is dependent on agriculture than Brazil. Thus India is expected to be much aggressive, superior and advanced in the agriculture sector than Brazil, but it is not. The above argument remains valid when we compare the percentage of total economically active population engaged in agriculture (which is 58.70% for India and just 15.60% for Brazil). *But when we compare per capita arable land there is no significant difference between India and Brazil (refer t-test table from appendix-I)*

Still the study becomes more relevant and important for India than Brazil as much larger chunk of the total population of India is dependent on agriculture.

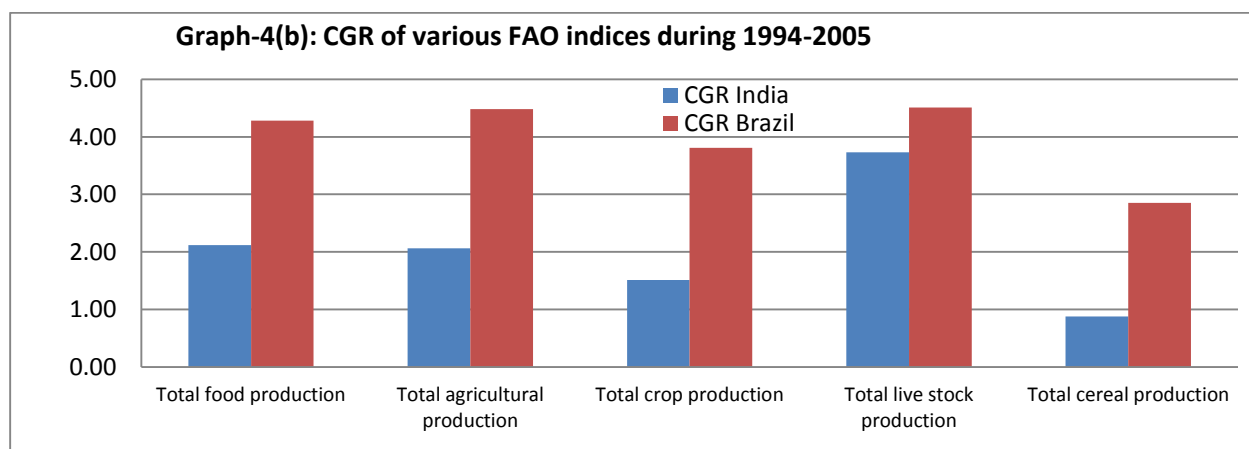
IV. Average Percentage increase or decrease of various FAO indices and CGR of the same during 1994-2005:



Refer Appendix-V(a) and V(b) for detailed tabular analysis

It becomes evident from the above graph that Brazil has fared better in all the areas mentioned above compared to India. Average percentage increase in total food production and total agricultural production of Brazil is more than 2.0 times that of India. Average percentage increase for Brazil is nearly 2.4 times that of India for total crop production and 4.2 times that of India for total cereal production. The average percentage increase in total live stock production of Brazil stands at 1.35 times that of India. *As the t-test table from appendix-I reveals there is no significant difference between India and Brazil when we compare the FAO indices and CGR of the same.*

The overall performance of Brazil in the agriculture sector including livestock production is much superior to India. India has to learn a lot from Brazil, especially in this sector.



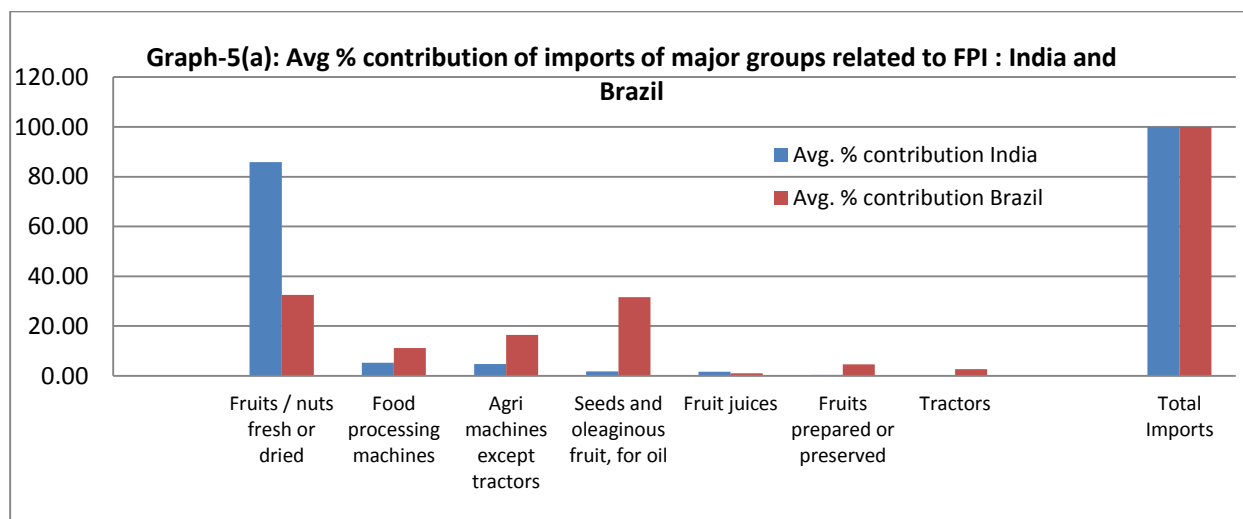
Refer Appendix-V(a) and V(b) for detailed tabular analysis

The above graph reveal some important findings pertaining to CGR of; total food production, total agricultural production, total crop production, total live stock production and also the total cereal production of both countries.

Brazil has fared better in all the areas mentioned above, compared to India. CGR of total food production and total agricultural production of Brazil is nearly 2.0 times that of India. CGR of Brazil is nearly 2.4 times that of India for total crop production and 3.2 times that of India for total cereal production. Total live stock production of Brazil is growing at CGR of 4.51, which is nearly 1.2 times that of India. CGR of cereal production of Brazil is much higher than that of India.

Thus it can be concluded that Brazil, in the agriculture sector as a whole, is growing much faster than India. India has to benchmark the best practices followed by Brazil in this sector and try to adopt the same with tailor made modifications and fine tunings.

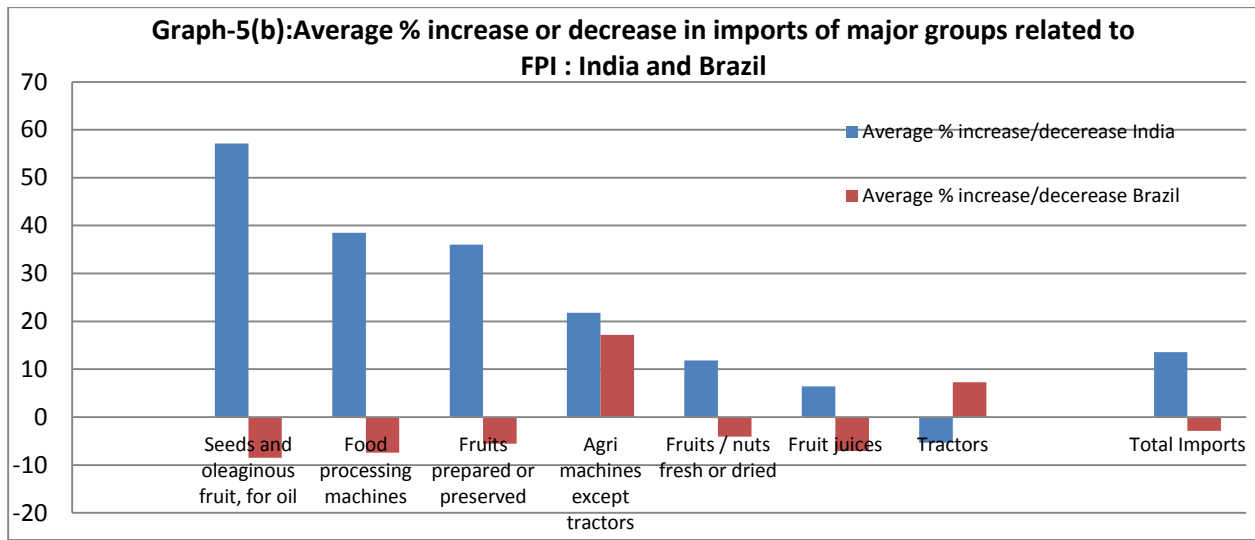
V. Average % contribution and average % increase or decrease of imports of major groups related to FPI to total imports:



Refer Appendix-VI for detailed tabular analysis

The graph shown above explains the composition of total imports, related to FPI (Fruit Processing Industry), of both the countries. India is importing mainly (86%) the fruits / nuts (fresh or dried) and to some extent (around 5% each) the food processing machines and agricultural machines except tractors. Whereas Brazil is importing food processing machines and

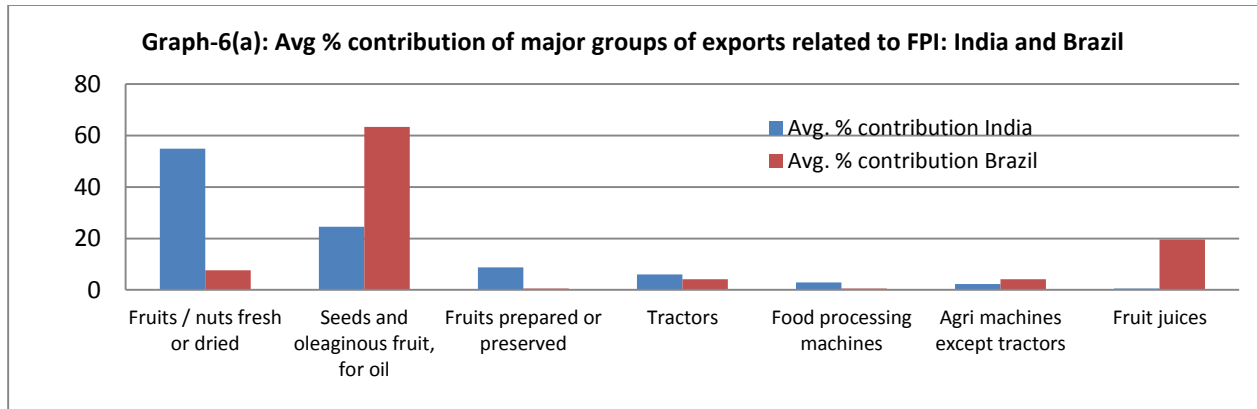
agricultural machines and tractors, which collectively account for around 30% of total imports. This clearly indicates the fact that Brazil is keen on upgrading technology on continuous basis and hence it is importing capital technological goods from the advanced countries. The domestic demand for imported fruits/nuts (fresh or dried) is quiet significant and is increasing. This is primarily due to sharp rise in the income levels of middle class population and also due to steep increase in the middle class population itself.



Refer Appendix-VI for detailed tabular analysis

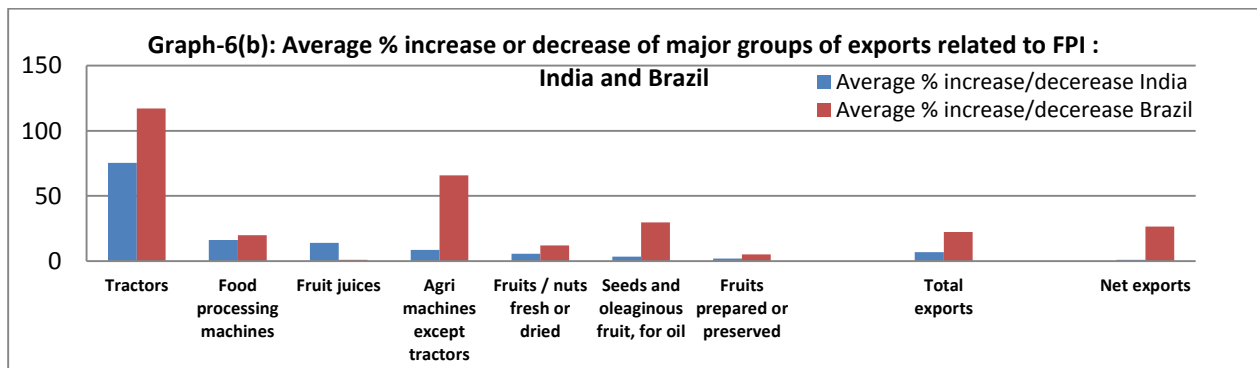
The graph shown above reveal that except Agri. Machines and tractors, Brazil has experienced decrease in the imports of all the major groups pertaining to FPI, whereas India has experienced significant increase (ranging from 6 to 57%) in the imports of all the major groups related to FPI (Fruit Processing Industry) except tractors. The total imports of all the major groups related to FPI stands at 74 million USD for India, which is much higher compared to Brazilian imports worth 47 million USD. The average percentage increase in total imports related to FPI stands at 13.56% for India whereas the same is -2.86% for Brazil. This clearly means India is more dependent on imports than Brazil and is steadily increasing. Brazilian imports over the past years had shown a small fluctuation (from 47 to 54 million US\$), whereas Indian imports revealed a wide fluctuation (from 30 to 74 million US\$). As the t-test table from appendix-I reveals there is no significant difference between India and Brazil when one compares total imports between India and Brazil.

VI. Average % contribution and average % increase or decrease of major groups of exports related to FPI : India and Brazil:



Refer Appendix-VII for detailed tabular analysis

The graph shown above reveal the composition of total exports of major groups related to FPI (Fruit Processing Industry), of both the countries. Indian exports constitute of; the fruits / nuts (fresh or dried) (55%), seeds and oleaginous fruit for oil (25%) and the preserved and prepared fruits (9%). Whereas Brazilian exports constitute of; the seeds and oleaginous fruit (63%), fruit juices (20%) and the fruits / nuts (fresh and dried) (8%). This clearly gives the signal that Brazil is keen on exporting value added processed fruit products like fruit juices than simply the fresh fruits / nuts, which India is doing. Moreover the byproducts of fruits like seeds have been put to waste in India, whereas Brazil is earning significant FOREX through exporting the same. So India has to shift her attention from exporting basic fruits to exporting the value added processed fruit products, which in turn will strengthen the BoP (Balance of Payments) position of India and generate more employment. Moreover the byproducts of fruits like seeds shouldn't be wasted.

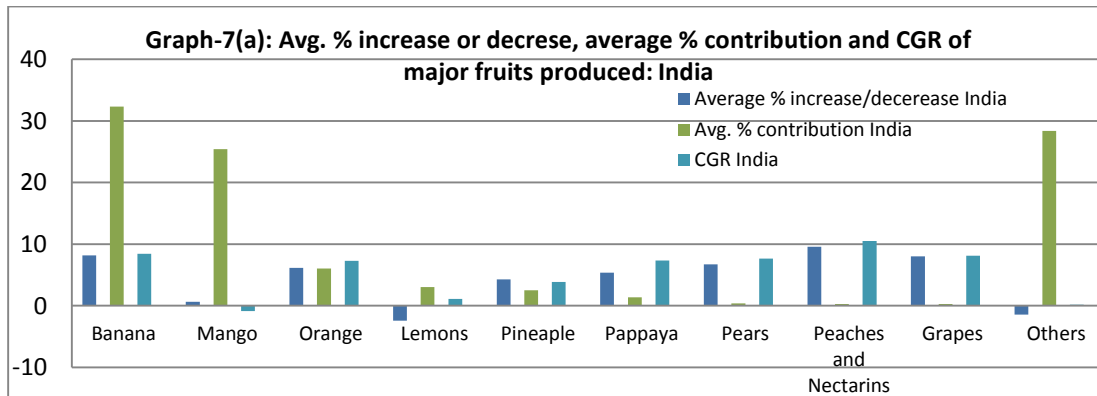


Refer Appendix-VII for detailed tabular analysis

As revealed by the above graph shown above, exports of tractors and food processing machines have shown a tremendous growth, collectively, for both India and Brazil. India has experienced significant increase as far as exports of fruit juice is considered. Whereas in all the other groups including; fruits / nuts (fresh or dried), agricultural machines except tractors, and seeds and oleaginous fruits, Brazil has experienced significant increase in their exports than India. Brazil has experienced significant growth compared to India, when we consider the total exports of major groups related to FPI and also the net exports (because total Brazilian imports of major groups related to FPI has shown decline). It can be concluded that there lies tremendous scope for exports in this sector.

As the independent t-test reveals, there is a significant difference ($t\text{-critical} = 2.306$; $t\text{-stat} = -5.55$) between India and Brazil, when we consider total exports and net exports of each nation. Mean value of Brazilian exports is US\$ 508 million, whereas mean value of Indian exports is US\$ 55 million (Refer t-test table from Appendix I. Value of Brazilian exports is nearly tenfold as that of India).

VII: Important parameters pertaining to major fruits produced in India and Brazil

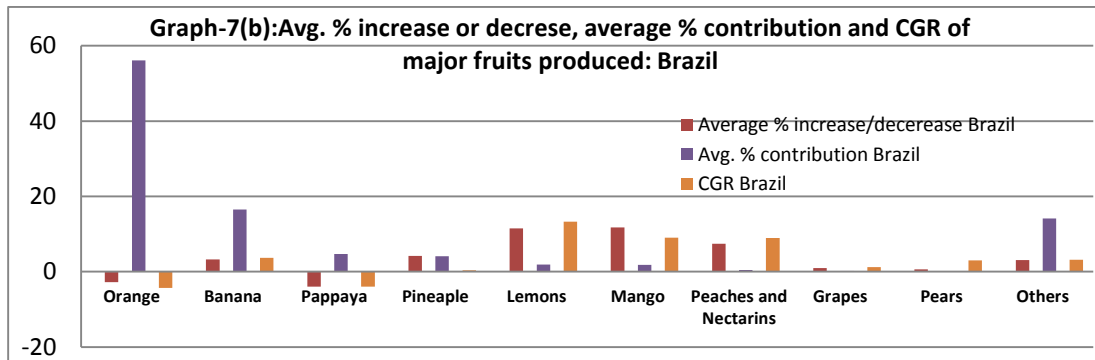


Refer Appendix-VIII(a) and VIII(b) for detailed tabular analysis

It can be noticed from the above table and graph that Mango accounts for nearly 25% of the total fruit production in India, next only to Banana which accounts for nearly 33% of total fruit production. Orange, lemon, pineapple and papaya occupy the next slots, accounting, collectively, for around 13% of total fruit production.

It can be further noticed that banana, orange, papaya, pears, peaches & nectarines, and grapes have all experienced a healthy growth trend (CGR of 7 – 9%). Surprisingly, mango has shown marginal negative growth. This is in fact a cause for concern for mango processing

industry of India and needs to be addressed. When we compare the growth rate of the total fruit production, India is well placed with a CGR of 3.04% compared to -1.16% of Brazil.



Refer Appendix-VIII(a) and VIII(b) for detailed tabular analysis

From the above table and graph, it can be noticed that Mango accounts for just 1.8% of the total fruit production in Brazil. Oranges and Banana, collectively, account for nearly 73% of total fruit production. Papaya, pineapple, and lemon occupy the next slots accounting, collectively, for around 11% of total fruit production.

It can be further noticed that lemon, mango, and peaches and nectarines have all experienced a healthy growth trend (CGR of 9 – 13%). Situation is apparently favorable for the mango processing industry of Brazil. But marginal negative growth rate (-1.16%) of the total fruit production of Brazil is definitely a cause of concern for the fruit processing industry of Brazil.

Conclusion:

As the appendix-I (t-test table) reveals, in spite of the vast commonalties and similarities between India and Brazil, both countries stand miles apart when one compare the size and growth of fruit processing industry, especially exports and net exports. Hence following the footsteps of Brazil, wherein majority of cultivators are so big that they have their own processing facility. Those processors who don't own farms will enter into buy back agreement through under contract farming with big cultivators. This, ultimately mean that all cultivators are processors and vice versa. 'EMBRAPA' provides necessary extension support to both groups

and ensure that there lies harmony between the two groups and creates a “**WIN-WIN**” environment for both.

‘EMBRAPA’ employs 120000 farmer agro-technology extension agents who work shoulder to shoulder with cultivators in the field using a ‘Bottom Up’ approach, innovating all the time. Whereas in India, there lies a huge gap between these two groups, *i.e.* cultivators and processors. This has paved the way for ‘**middle men menace**’, the serious problem facing this industry. The concept of “**farm gate to customers’ plate**” has remained a concept only. NHB (National Horticulture Board), the Apex nodal body of India, employs 134 people altogether out of which 32 people are directors. It employs a ‘Top Down’ approach and focus on; launching new schemes; seeking grants from the Government; and distributing the same to cultivators and processors.

This means there lies a most promising scope to import the ‘Brazilian Model’ where in a single nodal agency ‘**EMBRAPA**’ (Brazilian Agency for Agricultural Research and Animal Husbandry)’ takes complete care of both farming community and processing industry by having a fool proof mechanism/system in place to address all their concerns/problems and working in an integrated fashion with clear cut objectives, strategies and policies to sort out the contemporary upcoming issues. This is the secret of the success of Brazilian fruit processing industry. Unlike the ‘Indian model: The Indian system of managing this particular industry’, where-in large numbers of nodal bodies (both at national level and state level) often with conflicting interests create a situation which doesn’t synergize and lead to poor growth of this industry.

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