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Export Performance of Agricultural Processed Food Product from India

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Abstract
This study analyzes the trends and projections of India's agricultural and food product exports from 2015 to 2024, with forecasts extending through 2030. Using data sourced from APEDA, the research explores the performance of key export commodities such as Basmati rice, non-Basmati rice, buffalo meat, and emerging products like pulses and processed foods. The total export values show an overall increase, with significant growth observed in recent years, particularly in processed food categories. Regression analysis reveals a strong positive relationship between the export period and total values, with an annual increase of approximately ₹11,766.25 million. The study concludes that while key export sectors remain strong, volatility in smaller commodities and declining niche exports highlight the need for strategic interventions to maintain India's competitiveness in the global market. The forecasts suggest a steady growth trajectory in exports, driven by diversification into high-demand, value-added products.

Keywords: India, agricultural exports, food products, Basmati rice, processed foods, export trends, regression analysis, export forecasts, APEDA, global market.

Introduction

India has established itself as a major exporter of agricultural products, leveraging its rich agro-climatic diversity and abundant natural resources. The processed food industry, which includes a wide range of products like frozen fruits and vegetables, ready-to-eat meals, pickles, spices, and beverages, has become a vital contributor to the nation's economy. The export of agricultural processed food products is a key segment within this industry, driving employment, rural development, and foreign exchange earnings. The export performance of processed food products from India has shown significant growth over the years. According to the Agricultural and Processed Food Products Export Development Authority (APEDA), India exported processed food worth over $25 billion in recent years. Major markets include the United States, the European Union, the Middle East, and Southeast Asia. Among these, products like basmati rice, buffalo meat, spices, and processed fruits have been the top contributors. Notably, India's ready-to-eat meals and frozen foods are gaining popularity, catering to global consumers' preferences for convenience and quick meals (Chengappa, P. G., 2004).

While the sector has experienced robust growth, it faces several challenges that limit its global competitiveness. Meeting the stringent quality and safety standards of importing countries, particularly in the European Union and the United States, remains a significant hurdle. Issues like pesticide residues and improper packaging lead to product rejections. Furthermore, inadequate infrastructure, such as cold storage facilities and warehousing, increases post-harvest losses, making it difficult for exporters to maintain quality. Fragmented supply chains and a lack of efficient logistics further add to the cost, reducing India's competitive edge against countries like Thailand, Vietnam, and China. Despite these challenges, the global market

presents numerous opportunities for Indian exporters. The rising demand for organic and natural food products, driven by health and wellness trends, is a notable area of growth. India, with its vast agricultural base, is well-positioned to meet this demand. Additionally, the Indian diaspora spread across the world ensures a steady demand for authentic Indian processed food products, ranging from spices to ready-to-eat meals. The growing popularity of Indian cuisine globally has further bolstered the demand for these products (Mehta, R., & George, J., 2003).
The Government of India has undertaken several initiatives to enhance the export performance of the agricultural processed food sector. APEDA has been instrumental in promoting exports through financial assistance for trade fairs, market research, and buyer-seller meets. Infrastructure programs like the Mega Food Park Scheme have been introduced to address supply chain bottlenecks by creating integrated cold storage and warehousing facilities. Additionally, exporters are encouraged to obtain certifications such as HACCP and ISO, which help meet international standards and build trust in global markets (Dubey, N. K., & Kumar, R., 2016). Looking ahead, the future of India's agricultural processed food export sector appears promising. The increasing global demand for healthy, ready-to-eat, and natural food products aligns with India’s capabilities as a major producer. By addressing quality and supply chain challenges, adopting advanced processing technologies, and strengthening government support, India can further enhance its competitiveness in international markets. India’s processed food industry is not just an economic driver but also a platform for showcasing the country's rich agricultural heritage to the world. With strategic interventions and sustained efforts, the sector has the potential to position India as a global leader in agricultural processed food exports, fostering economic growth and strengthening its presence in international trade (Murthy, S., & Yogesh, M. S.. 2014).

Review of Literature

The export of agricultural processed food products from India has been extensively studied, highlighting various dimensions such as challenges, opportunities, growth trends, and economic impact. This section reviews the key findings from the literature, providing a comprehensive understanding of the factors influencing this sector.
Lagzi and Thimmarayappa (2012) examined the challenges and opportunities in the export of agricultural processed food products from India. The authors identified quality standards, inadequate infrastructure, and global competition as significant barriers to export growth. However, they also emphasized the opportunities presented by the growing global demand for Indian spices, fruits, and ready-to-eat products. Their study underscored the need for policy interventions to improve infrastructure and ensure compliance with international quality standards.
Singh, Tegegne, and Ekanem (2012) analyzed the broader food processing industry in India, discussing its pivotal role in supporting agricultural exports. The study highlighted how the sector bridges the gap between agriculture and international markets, adding value to primary agricultural products. The authors also pointed out challenges such as a lack of modern processing facilities, regulatory issues, and inefficiencies in the supply chain, which limit the sector's potential.
Bansal et al. (2017) provided an empirical analysis of the export status of processed agricultural food products in India. The study highlighted a consistent increase in export volumes and revenue over the years, driven by products such as basmati rice, spices, and fruits. The authors emphasized the role of government schemes like the Mega Food Park Scheme and subsidies in enhancing export performance. However, they cautioned that global competition and quality compliance issues could hinder sustained growth.
Angamuthu (2022) focused on the growth trends in the export of agricultural and processed food products during the 2022-23 period. The study revealed that India’s processed food exports have shown resilience despite global challenges such as the COVID-19 pandemic. The

author attributed this growth to increasing global demand for organic and ready-to-eat foods, supported by government initiatives and improved processing technologies.

Agalya et al. provided insights into the marine products export sector in India, which shares similarities with agricultural processed food exports. The study highlighted the strategic importance of marine products in India's export basket and underscored the challenges of quality assurance, cold chain logistics, and market access. The authors suggested leveraging technology and strengthening trade agreements to enhance export performance in this segment.

The reviewed studies collectively highlight the dynamic nature of India's agricultural processed food export sector. While there is significant growth potential, challenges such as quality compliance, infrastructure gaps, and market competition need to be addressed. The role of government policies and international market trends emerges as a recurring theme, indicating that strategic interventions and technological advancements are crucial for sustaining growth in this sector.

Objectives of the Study

1. To analyze the historical trends in total values over the period 2015–2024 and identify patterns in the data sourced from APEDA.
2. To forecast the total values for the period 2025–2030 using a regression model and provide insights for strategic planning and decision-making in the agricultural export domain.

Methodology

Data Collection

The data for this study was sourced from the Agricultural and Processed Food Products Export Development Authority (APEDA). The dataset includes annual totals for the years 2015 to 2024, representing export values (or similar metrics) relevant to the agricultural sector. APEDA's data repository ensures reliability and accuracy in capturing the trends in agricultural exports over the selected timeframe.

Research Design

The study employs a descriptive research design to analyze historical data and develop forecasts. This approach is suitable for identifying patterns, relationships, and trends in time-series data.

Analytical Method

The regression analysis method was used to derive a predictive equation for forecasting. The regression equation $Y=85{,}677.117+11{,}766.246\times X$ was developed, where:

- Y represents the total value, and
- X represents the sequential period (e.g., 1 for 2015, 2 for 2016, and so on).

This model was validated with historical data, showing a strong linear relationship indicating that 74.6% of the variation in the total values can be explained by the sequential periods.

Analysis and Interpretation

The table represents the export values (in millions) of various agricultural and food products from 2014-15 to 2023-24. The data highlights trends, fluctuations, and key changes across different commodities.

Table No. 1: Descriptive Statistics - Export Performance for Agricultural commodities in India

	2019-20	2020-21	2021-22	2022-23	2023-24
Basmati Rice	31025.88	29849.89	26416.54	38524.11	48389.18
Non Basmati Rice	14364.66	35476.61	45652.35	51088.72	37804.48
Buffalo Meat	22668.47	23460.38	24613.24	25648.1	31010.1
Miscellaneous Preparations	4147.89	5866.44	7406.98	8889.18	10989.97
Groundnuts	5096.39	5381.61	4697.1	6735.25	7135.35
Cereal Preparations	3871.81	4705.81	4862.19	6051.6	6976.25
Processed Vegetables	2760.53	3718.63	3986.45	4987.36	6523.47
Pulses	1533.74	2116.69	2834.29	5397.86	5689.4
Processed Fruits, Juices & Nuts	3086.44	3173.42	3626.08	4754.83	5659.47
Guargum	3261.6	1949.07	3334.77	4944.6	4489.4
Fresh Onions	2320.7	2826.53	3432.16	4522.79	3922.78
Other Fresh Fruits	2065.82	2233.31	2900.7	2736.99	3759
Prepared Animal Feeder	0	0	0	3587.04	3703.98
Maize	1019.3	4675.78	7615.42	8987.13	3660.1
Jaggery & Confectionery	1633.29	2659.57	2797.85	4330.07	3570.77
Fresh Grapes	2176.87	2298.45	2302.16	2543.42	3460.7
Alcoholic Beverages	1648.62	2386.91	2070.92	2546.44	3107.5
Other Fresh Vegetables	2064.77	2143.2	2160.74	2443.04	2938.27
Cashew Kernels	4018.35	3112.22	3377.4	2868.72	2808.8
Dairy Products	1341.01	1491.66	2928.8	2269.85	2260.94
Cucumber and Gherkins(Prepd. & Presvd)	1241.21	1651.82	1487.3	1761.1	2127.07
Poultry Products	574.58	435.53	529.8	1081.62	1530.2
Cocoa Products	1274.34	1108.38	1145.48	1242.13	1521.94
Natural Honey	633.79	716.13	1221.18	1622.77	1470.84
Milled Products	1064.62	1513.44	2286.11	2223.94	1432.64
Fruits & Vegetables Seeds	723.44	808.4	750.67	827.13	1004.96
Floriculture	541.61	575.98	771.41	707.81	717.83
Sheep/Goat Meat	646.69	329.96	447.58	537.18	643.55
Mango Pulp	584.32	714.41	924.54	1189.66	624.29
Millet	425.69	435.8	469.36	608.11	587.73
Fresh Mangoes	400.21	271.88	327.45	378.49	495.46
Wheat	439.14	4037.6	15840.34	11826.9	470.83
Others (Betel Leaves & Nuts)	137.13	137.79	215.23	534.73	443.04
Animal Casings	398.5	416.54	474.04	326.02	399.21
Other Oil Cake/Solid Resdus	0	0	0	939.66	270.77

Albumin(Eggs & Milk)	82.35	94.97	89.82	266.88	173.06
Casein	7.55	180.41	592.78	816.32	150.24
Cardanol	20.4	18.27	25.59	57.08	61.19
Other Cereals	12.45	15.15	17.44	27.4	49.35
Processed Meat	14.72	11.92	10.56	11.72	20.55
Walnuts	52.78	29.79	73.98	25.83	20.02
Cashewnut Shell Liquid	2.69	1.45	6.92	56.39	16.02
Other Meat	16.32	18.06	45.52	16.93	6.82
Total	1,19,400.67	1,53,049.86	1,84,769.24	2,20,942.90	2,12,097.52

Source: (APEDA, 2024)

1. Overall Trends
   The total export value has shown a steady increase over the years, with a notable peak in 2022-23 (₹220,942.90 million). However, a slight decline is observed in 2023-24 (₹212,097.52 million), indicating possible global market changes or export challenges.
2. Key Commodities and Trends
   Basmati Rice
   - Trend: Exports have grown significantly from ₹27,597.89 million in 2014-15 to ₹48,389.18 million in 2023-24.
     - Observation: A dip was observed in 2015-16 and 2016-17, but exports recovered strongly post-2017-18, peaking in 2023-24. The demand for Basmati rice remains strong in global markets.

   Non-Basmati Rice
   - Trend: Exports have fluctuated, with a notable dip in 2019-20 (₹14,364.66 million) but a strong recovery afterward, peaking in 2022-23 at ₹51,088.72 million.
     - Observation: The sharp rise in 2020-21 and 2021-22 highlights increased demand, possibly influenced by changing global supply chains during the COVID-19 pandemic.

   Buffalo Meat
   - Trend: Buffalo meat exports have remained relatively stable, ranging between ₹22,668.47 million (2019-20) and ₹31,010.1 million (2023-24).
     - Observation: There is consistent demand, with a moderate recovery in recent years.

   Miscellaneous Preparations
   - Trend: This category shows consistent growth, with exports rising from ₹2,437.81 million in 2014-15 to ₹10,989.97 million in 2023-24.
     - Observation: Reflects increasing diversification of processed food products and their acceptance in global markets.

   Groundnuts
   - Trend: Exports exhibit fluctuations, with a peak in 2022-23 (₹6,735.25 million) and consistent growth in the later years.
     - Observation: The 2019-20 increase suggests a shift in export demand or production capacity improvement.

   Processed Fruits, Juices & Nuts
   - Trend: A steady growth trend is evident, from ₹1,899.75 million in 2014-15 to ₹5,659.47 million in 2023-24.
     - Observation: Reflects the growing global preference for processed food products from India.

3. Emerging Categories
   Maize
   - Trend: Exports surged significantly post-2020-21, peaking in 2022-23 (₹8,987.13 million), before dropping sharply in 2023-24 (₹3,660.1 million).
     - Observation: This reflects fluctuating production levels or international demand shifts.

   Pulses
   - Trend: Notable growth, especially in 2022-23 (₹5,397.86 million), highlighting increasing global demand for Indian pulses.
     - Observation: Consistent upward movement shows India's strengthening position as a pulse exporter.

   Cereal Preparations
   - Trend: A steady upward trajectory is observed, with exports growing from ₹3,038.76 million in 2014-15 to ₹6,976.25 million in 2023-24.
     - Observation: The data reflects increasing global interest in Indian cereal-based processed foods.

4. Niche Commodities
   Floriculture
   - Trend: Floriculture exports have remained modest, with slow growth from ₹460.77 million in 2014-15 to ₹717.83 million in 2023-24.
     - Observation: Indicates limited but stable international demand.

   Dairy Products
   - Trend: Exports showed a sharp increase in 2018-19 (₹2,423.01 million) but have fluctuated since, ending at ₹2,260.94 million in 2023-24.
     - Observation: Reflects the volatile nature of the dairy export market, impacted by global competition and local production constraints.

5. Significant Declines
   Wheat
   - Trend: A drastic decline in exports from ₹4,991.84 million in 2014-15 to just ₹470.83 million in 2023-24, except for a brief spike in 2021-22.
     - Observation: Could be due to domestic policy restrictions or reduced global competitiveness.

   Guargum
   - Trend: Exports have sharply declined, with only minor recovery in 2022-23 (₹4,944.6 million) before dropping again in 2023-24.
     - Observation: Reflects reduced demand for Guargum globally, which is often tied to the oil industry.

6. Overall Observations
   - Processed Foods: Categories like Miscellaneous Preparations and Processed Vegetables have shown robust growth, reflecting India’s increasing focus on value-added products.
   - Staple Commodities: Exports of staples like Basmati Rice and Non-Basmati Rice remain key contributors to overall export revenue.
   - Volatility in Smaller Commodities: Categories such as Cashew Kernels, Sheep/Goat Meat, and Dairy Products exhibit fluctuations, indicating dependence on specific market conditions.

The data highlights India's export diversification in agricultural and food products, with significant growth in processed food categories. While staples like rice and buffalo meat continue to dominate, emerging categories like processed fruits and pulses offer promising growth potential. However, volatility in some commodities and declining trends in niche exports require policy and market interventions.

The regression analysis evaluates the relationship between the independent variable (case sequence) and the dependent variable. The results reveal a strong positive correlation and statistically significant model fit, explaining a substantial portion of the variance in the dependent variable.

Table No. 2- Regression Estimates - Export Performance for Agricultural commodities in India

Model Summary					
R	R Square	Adjusted R Square		Std. Error of the Estimate	
.864	.746	.714		22042.041	
ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	11421675545.245	1	11421675545.245	23.509	.001
Residual	3886812644.362	8	485851580.545		
Total	15308488189.607	9			
Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Case Sequence	11766.246	2426.749	.864	4.849	.001
(Constant)	85677.117	15057.581		5.690	.000

Source: (APEDA, 2024)

The model summary indicates that 74.6% of the variation in the dependent variable is explained by the case sequence, as shown by the R Square value (0.746). The Adjusted R Square (0.714) confirms the model's strength even after accounting for sample size. The Standard Error of the Estimate (22,042.041) reflects the average deviation of observed values from the regression line, indicating a moderate degree of prediction accuracy. A high correlation coefficient (R = 0.864) demonstrates a strong positive relationship between the variables.

The ANOVA table confirms the model's statistical significance (F = 23.509, p = 0.001), indicating that the independent variable significantly impacts the dependent variable. The coefficients show that for every unit increase in the case sequence, the dependent variable increases by 11,766.25 units, with a significant t-value of 4.849 (p = 0.001). The constant (85,677.117) represents the baseline value of the dependent variable when the case sequence is zero. Overall, the results suggest that the case sequence is a significant predictor with a strong positive effect.

Thus the regression equation is: (Y=85,677.117+11,766.246×X)

Using the above regression equation making forecast for the next 6 years till 2030 to know the trends of export performance of the Indian agricultural processed food product. The table provides actual total values for the years 2015 to 2024 and forecasts the totals for the years 2025 to 2030 using the regression model. The forecasts are derived using the regression equation Y=85,677.117+11,766.246×X, where X represents the sequential period.

Table No. 3: Forecasted value from regression equation

Year	Period	Total

2015	1	1,31,343.00
2016	2	1,07,482.86
2017	3	1,13,857.98
2018	4	1,25,858.09
2019	5	1,35,112.60
2020	6	1,19,400.67
2021	7	1,53,049.86
2022	8	1,84,769.24
2023	9	2,20,942.90
2024	10	2,12,097.52
2025 (Forecasted)	11	(Y=85,677.117+11,766.246×11) - 2,15,105.83
2026 (Forecasted)	12	(Y=85,677.117+11,766.246×12) - 2,26,872.07
2027 (Forecasted)	13	(Y=85,677.117+11,766.246×13) - 2,38,638.32
2028 (Forecasted)	14	(Y=85,677.117+11,766.246×14) - 2,50,404.57
2029 (Forecasted)	15	(Y=85,677.117+11,766.246×15) - 2,62,170.81
2030 (Forecasted)	16	(Y=85,677.117+11,766.246×16) - 2,73,937.06

Source: (Secondary data)

Historical Trends (2015–2024):From 2015 to 2024, the total values show an overall increasing trend, with fluctuations in certain years. For instance, a decrease is observed in 2016 compared to 2015, and again in 2020 compared to 2019, likely reflecting variations in external factors. However, the upward trajectory is evident, culminating in a significant increase from 2021 onward, with the total peaking at 2,20,942.90 in 2023 and slightly decreasing to 2,12,097.52 in 2024.

Forecasted Period (2025–2030): The regression model predicts a steady annual increase in the totals for the years 2025 to 2030. The total for 2025 is forecasted at 2,15,105.83 and is projected to grow linearly, reaching 2,73,937.06 by 2030. This consistent growth suggests a stable upward trend in the observed metric, assuming no major external disruptions. The projected values align well with the historical trend, validating the robustness of the regression model.

The analysis indicates a strong linear relationship between the period and the total, with an annual incremental growth of approximately 11,766.25 units. The regression model effectively captures this trend and provides a reliable forecast for future planning and decision-making.

Findings

The analysis of the total export values from 2015 to 2024 indicates a steady increase in exports, with some fluctuations observed in certain years. The highest total export value was recorded in 2023 (₹220,942.90 million), with a slight decrease in 2024 (₹212,097.52 million), which could be attributed to changing global market conditions or domestic challenges. The regression analysis identified a strong positive relationship between the period and the total export values, explaining 74.6% of the variation in the data. Forecasting for the years 2025 to 2030 suggests a consistent upward trajectory, with projected values reaching ₹273,937.06 million by 2030, reflecting a steady growth pattern in agricultural and food exports.

The analysis also highlighted several key trends in individual export categories. Basmati rice and non-basmati rice exports have shown consistent growth, with a notable peak in 2023-24 for both. Buffalo meat exports have remained stable, while the miscellaneous preparations category has experienced substantial growth, indicating India's increasing focus on processed food products. Emerging categories like pulses and cereal preparations have shown significant upward trends, while niche commodities like floriculture and dairy products have seen modest growth. Declining trends were noted in commodities such as wheat and guargum, suggesting the need for targeted interventions.

Discussion

The findings from the analysis underscore India's growing prominence in agricultural and processed food exports. Categories like Basmati rice and buffalo meat continue to be the backbone of India's export economy, demonstrating stable demand in global markets. However, there is a clear indication of diversification in the export portfolio, with sectors like processed foods, pulses, and cereal preparations experiencing strong growth. This diversification not only helps in mitigating risks associated with dependence on a few key commodities but also opens new avenues for export expansion.

The forecasted growth in exports over the next five years supports the optimism for continued positive trends, particularly in processed foods and emerging categories. However, the slight decline in exports in 2023-24, especially in maize and other smaller commodities, raises concerns about external market factors or changes in domestic production capacities. These fluctuations point to the volatile nature of agricultural exports, which are susceptible to shifts in global demand, production conditions, and policy changes.

The model's high R-square value (0.746) and statistical significance ($p < 0.01$) indicate that the period is a significant predictor of total export values, with a clear upward trend driven by incremental growth. This linear growth is encouraging for future export projections, suggesting that India can maintain its upward trajectory in the global export market, provided there are no major disruptions. However, attention must be given to volatile commodities and declining exports to niche markets, as these could impact the overall export performance if not addressed through strategic interventions and market expansion efforts.

Conclusion

The study provides valuable insights into the trends and future projections of India's agricultural and food product exports from 2015 to 2024, with forecasts extending to 2030. The analysis reveals a steady increase in the total export values, despite some fluctuations in certain years. Commodities like Basmati rice, non-Basmati rice, and buffalo meat continue to be the key drivers of export revenue, while emerging categories such as processed foods, pulses, and cereal preparations show promising growth potential. However, challenges such as the decline in exports of wheat and guargum, as well as fluctuations in smaller commodities, require careful attention to ensure long-term sustainability and competitiveness in global markets.

The regression model used in the study effectively captures the linear relationship between the period and total exports, confirming that the observed trends are likely to continue in the near future. With an annual increase in export values projected, the study highlights the potential for continued export growth, provided that targeted interventions are made to address the volatility of certain commodities and the overall market dynamics. The findings suggest that diversification into value-added products and emerging export categories will be crucial for India’s continued success in the global export market.

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