

A STATISTICAL ANALYSIS ON EXPORTS OF INDIA FROM 2014 TO 2020



PREPARED BY
SONAM

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to all those who have supported me throughout this journey.

First and foremost, I would like to thank Visva-Bharati University for the great learning it provided which were required to accomplish this project work, I would also like to thanks my friends whose valuable guidance has been the ones that helped me throughout this project and make it a full-proof success. Their suggestions and instructions have served as the major contributor to the completion of the project.

Then I would like to thank my parents and siblings who have always created a positive surrounding near me throughout various phases of the completion of the project.

Finally, I would like to thank my classmates who have helped me a lot. In conclusion, the successful accomplishment of this project would not have been possible without the support and blessings of all these wonderful individuals. I am truly humbled and grateful for their unwavering support. Thank you all for being a part of this journey and for believing in me.

- SONAM

Introductions and Facts about Indian Exports ::



(source: Shutterstock)

What is Export :

Export meaning includes such manufactured goods and services which originate in one country, but are procured by another country. Export can be of services and goods of any type, and that may be traded through electronic transmission or traditional transportation like shipping.

What is Export Trade?

Export trade is the transaction in international trade where the manufactured goods and services from one country are purchased by residents of another country. Another component of international trade is import.

Some terminologies related to Export Trade

1. Exporter Meaning

Consistent with exports meaning, one has to also know what an exporter is. An exporter pertains to such a person, firm or country that sends and sells goods or services to another country.

2. Exporting Meaning

The procedure for export essentially involves the act of exporting. Exporting is the carrying of manufactured goods or sending services to another country to be traded. For example, organic chemicals are to be shipped from India to be sold in foreign countries.

3. Import

Import is the opposite concept to export where residents of a country purchase foreign manufactured goods or services. Imported goods and services are usually expensive, owing to those being subjected to a range of tariff schedules.

4. Trade Surplus

A trade surplus takes place in a country when the exported goods and services value amounts to higher than its imports. It indicates that there is a greater inflow of the exporting company's currency from the markets in a foreign country.

5. Trade Deficit

A trade deficit occurs in a country when the imports of that country exceed its exports costs. It can be considered as problematic to the extent that it can cause foreign exchange shortages within the country.

Why Need to Export ::

There are many good reasons for exporting:

The first and the primary reason for export is to earn foreign exchange. The foreign exchange not only brings profit for the exporter but also improves the economic condition of the country.

Secondly, companies that export their goods are believed to be more reliable than their counterpart domestic companies assuming that exporting company has survive the test in meeting international standards.

Thirdly, free exchange of ideas and cultural knowledge opens up immense business and trade opportunities for a company.

Fourthly, as one starts visiting customers to sell one's goods, he has an opportunity to start exploring for newer customers, state-of-the-art machines and vendors in foreign lands.

Fifthly, by exporting goods, an exporter also becomes safe from offset lack of demand for seasonal products.

Lastly, international trade keeps an exporter more competitive and less vulnerable to the market as the exporter may have a business boom in one sector while simultaneously witnessing a bust in a different sector.

No doubt that in the age of globalization and liberalizations, Export has become of the most lucrative business in India. Government of India is also supporting exporters through various incentives and schemes to promote Indian export for meeting the much needed requirements for importing modern technology and adopting new technology from MNCs through Joint ventures and collaboration

Indian Export trend :



“India achieved its ambitious target of crossing \$400 billion exports in Wednesday with 9 days remaining in the current financial year 2021-22. With this, India has achieved a key milestone in its journey towards becoming ‘aatmanirbhar’ .” - this statement

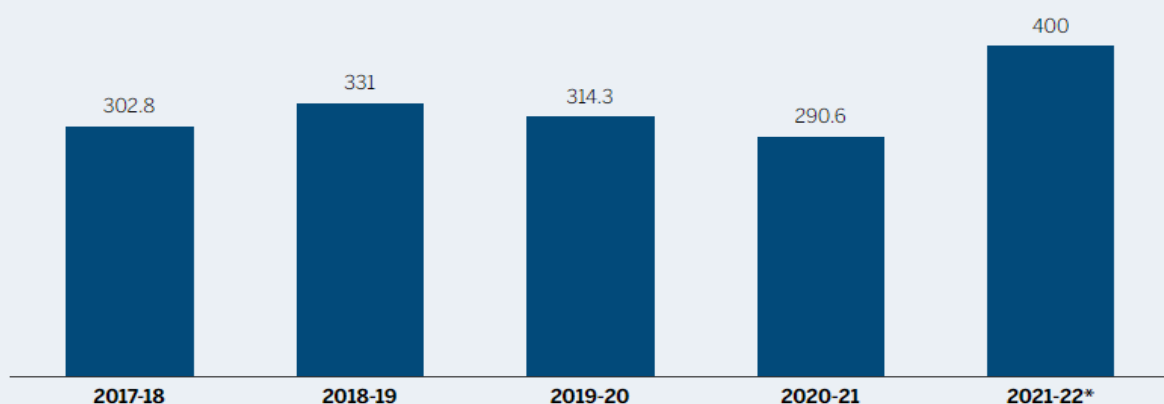
taken from Times of India clearly celebrates the joy of reaching a good position in the export trade list of World wide Trade of Exports.

The last achieved highest amount of exports by India was 320\$ billion that was in 2018-19.

The below graph showing the exports achieved is past few years :-

Exports target achieved before schedule

Exports increased by 37% to \$400 billion during April-March 22, 2021-22 against \$292 billion in 2020-21. (Figures in \$ billion for each financial year from April-March)



(source : Times Of India)

Here is a 10 years trend of Indian export from the years 2012 to 2022



- India exports for 2020 was **\$474.15B**, a **10.37% decline** from 2019.
- India exports for 2019 was **\$529.02B**, a **1.79% decline** from 2018.
- India exports for 2018 was **\$538.64B**, a **8.1% increase** from 2017.
- India exports for 2017 was **\$498.26B**, a **13.33% increase** from 2016.

The Trend is given below along with the GDP rate :

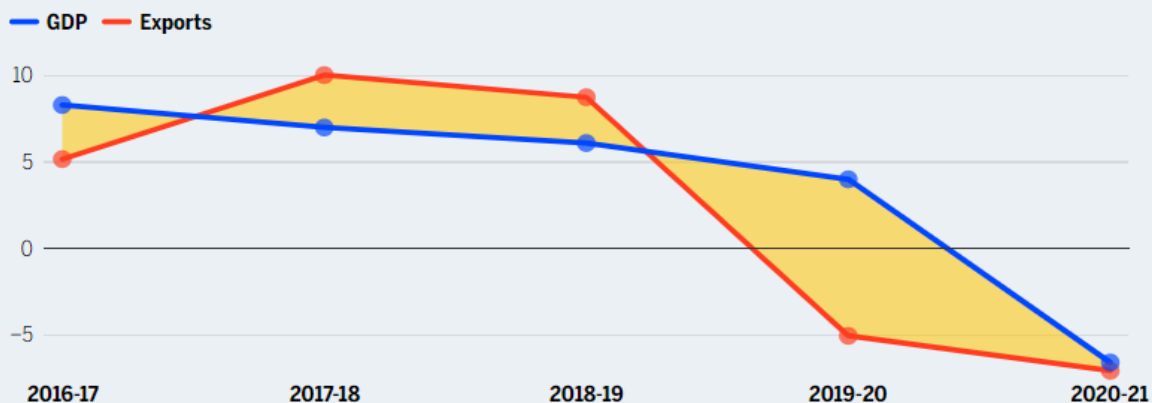
Exports and GDP ::

GDP growth had been declining even before the Covid-19 struck in 2020. The miracle GDP growth of 7% GDP was achieved in a year when the exports showed a robust 10% rise. Thereafter, with the fall in GDP, exports also started declining.

2016-17 2017-18 2018-19 2019-20 2020-21

Exports and GDP

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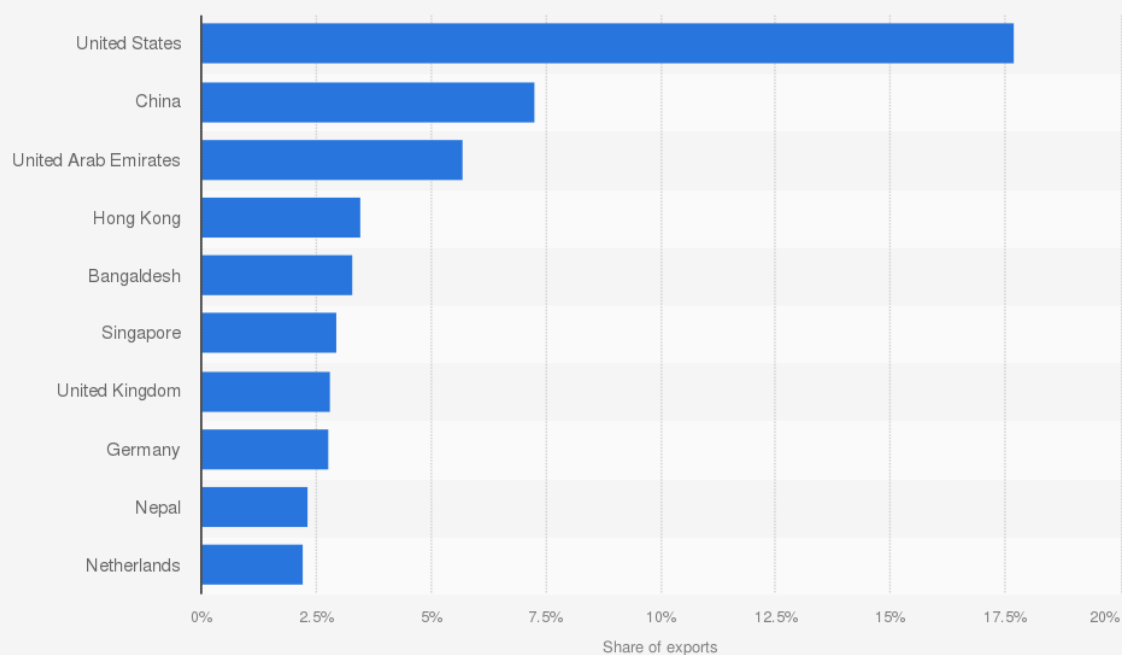
(source : Mistry Of India , TIMES OF INDIA)

Top 5 commodities & countries

The table shows top products that are exported from India and countries they are exported to.

| Commodities | Countries exported to |
|------------------------------|-----------------------|
| Engineering goods | <u>USA</u> |
| Petroleum products | <u>UAE</u> |
| Gems & jewellery | <u>China</u> |
| Organic & inorganic chemical | <u>Bangladesh</u> |
| Drugs & pharmaceuticals | <u>Netherlands</u> |

Share of leading destinations for Indian exports in financial year 2021, by country or region



Sources

DGCI&S; Department of Commerce (India)
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Additional Information:

India; DGCIS; FY 2021

Around 18% of Indian exports share is held by United States of America , then Our neighbour country China comes in 2nd place holding second place.

India in world trade of Exports ::



According to the reports ,in 2020 India was the number 6 economy in the world in terms of GDP (current US\$), the number 18 in total exports, the number 12 in total imports, the number 150 economy in terms of GDP per capita (current US\$) and the number 40 most complex economy according to the Economic Complexity Index (ECI).

The top exports of India are Refined Petroleum (\$25.3B), Packaged

Medicaments (\$17.8B), Diamonds (\$16B), Rice (\$8.21B), and Jewellery (\$7.57B), exporting mostly to United States (\$49.7B), China (\$18.5B), United Arab Emirates (\$18.1B), Hong Kong (\$9.18B), and Germany (\$8.8B).

Overview : In February 2022 India exported \$37.1B and imported \$57B, resulting in a negative trade balance of \$19.9B. Between February 2021 and February 2022 the exports of India have increased by \$9.61B (34.9%) from \$27.5B to \$37.1B, while imports increased by \$16.5B (40.6%) from \$40.5B to \$57B.

Trade :: In February 2022, the top exports of India were Petroleum Products (\$6.9B), Pearl, Precs, Semiprecs Stones (\$2.42B), Iron And Steel (\$1.76B), Drug Formulations, Biologicals (\$1.5B), and Aluminium, Products Of Aluminm (\$1.05B). In February 2022 the top imports of India were Petroleum: Crude (\$13.3B), Gold (\$4.78B), Petroleum Products (\$3.53B), Pearl, Precs, Semiprecs Stones (\$3.2B), and Coal,Coke And Briquittes Etc (\$2.86B).

Growth :: In February 2022, the increase in India's year-by-year exports was explained primarily by an increase in exports to United States (\$514M or 11.6%), South Africa (\$494M or 166%), and Australia (\$293M or 142%), and product exports increase in Pearl, Precs, Semiprecs Stones (\$403M or 22.8%), Iron Ore (\$275M or 109%), and Rice(Other Than Basmati) (\$267M or 150%). In February 2022, the increase in India's year-by-year imports was explained primarily by an increase in imports from Switzerland (\$1.43B or 158%), China (\$660M or 11%), and South Africa (\$366M or 78.2%), and product imports increase in Gold (\$2.45B or 155%), Pearl, Precs, Semiprecs Stones (\$735M or 50.2%), and Vegetable Oils (\$298M or 35.6%).

DESTINATIONS : In February 2022, India exported mostly to United States (\$6.17B), United Arab Emirates (\$2.6B), Bangladesh (\$1.59B), Netherlands (\$1.44B), China (\$1.41B), and imported mostly from China (\$8.51B), United Arab Emirates (\$4.5B), United States (\$4.46B), Saudi Arabia (\$3.71B), and Iraq (\$3.6B).

(Source : MIsnistry Of India)

Working Data

| Time | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|--|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | 193 983 .58 | 210 573 .06 | 219 810 .37 | 242 114 .44 | 306 130 .69 | 319 029 .81 | 357 765 .43 | 308 065 .37 |
| 1. Chemicals and Related Products | 346 082 .49 | 199 638 .27 | 211 509 .03 | 241 434 .52 | 325 929 .13 | 292 339 .97 | 190 471 .83 | 344 328 .26 |
| 2. Petroleum Crude and Products | 252 207 .68 | 257 415 .64 | 290 903 .32 | 267 832 .85 | 281 408 .09 | 254 114 .2 | 191 906 .08 | 214 772 .41 |
| 3. Gems and Jewellery | 227 160 .46 | 235 402 .42 | 239 898 .35 | 232 307 .62 | 257 651 .84 | 238 928 .39 | 224 179 .34 | 229 327 .88 |
| 4. Textiles and Allied Products | 184 316 .23 | 160 572 .21 | 164 594 .79 | 179 070 .11 | 199 824 .97 | 185 897 .53 | 240 190 .2 | 198 558 .47 |
| 5. Agriculture and Allied Products | 151 449 .34 | 120 845 .33 | 146 786 .63 | 181 858 .26 | 177 767 .35 | 169 499 .92 | 204 845 .69 | 259 100 .44 |
| 6. Base Metals | 120 527 .23 | 123 890 .88 | 135 081 .57 | 158 792 .42 | 203 532 .11 | 202 556 .91 | 195 646 .44 | 193 363 .37 |
| 7. Machinery | 162 901 .04 | 139 323 .14 | 155 237 .24 | 151 383 .25 | 185 574 .91 | 167 875 .27 | 149 953 .17 | 142 770 .99 |
| 8. Transport Equipments | 367 23. 31 | 373 00. 41 | 381 44. 35 | 391 48. 04 | 588 58. 07 | 795 67. 83 | 786 26. 19 | 779 79. 07 |
| 9. Electoronics Items | 403 84. 76 | 420 02. 58 | 431 72. 61 | 488 488 14 | 660 59. 14 | 583 40. 75 | 597 95. 62 | 585 37. 78 |
| 10. Plastic and Rubber Articles | 336 88. 38 | 312 19. 43 | 395 93. 78 | 476 46. 41 | 476 64. 94 | 476 18. 1 | 441 76. 03 | 454 58. 53 |
| 11. Marine Products | 345 77. 94 | 447 48. 21 | 382 33. 35 | 349 52. 96 | 436 76. 91 | 446 10. 67 | 448 73. 99 | 430 77. 38 |
| 12. Others | 378 52. 93 | 363 25. 79 | 356 08. 01 | 350 91. 46 | 370 49. 86 | 340 46. 2 | 257 81. 74 | 251 32. 99 |
| 13. Leather and Leather Manufactures | 247 01. 12 | 253 77. 41 | 274 07. 68 | 291 36. 54 | 357 92. 81 | 373 65. 86 | 418 05. 36 | 354 89. 35 |
| 14. Articles of Stone, Plaster, Cement,Asbestos, Mica or Similar Materials;Ceramic Products; Glass and Glassware | 147 31. 09 | 132 11. 29 | 218 28. 45 | 213 08. 34 | 251 91. 32 | 326 05. 4 | 480 58. 24 | 330 14. 59 |
| 15. Ores and Minerals | 133 28. 68 | 153 53. 87 | 156 55. 39 | 170 85. 42 | 244 20. 9 | 239 01. 71 | 251 95. 94 | 286 63. 57 |
| 16. Paper and Related Products | 103 10. 27 | 107 08. 74 | 126 71. 4 | 146 57. 06 | 162 44. 07 | 167 66. 74 | 164 164 60 | 156 62. 44 |
| 17. Optical, Medical and Surgical Instruments | 918 7.8 2 | 102 32. 39 | 108 04. 99 | 117 31. 69 | 116 27. 59 | 112 42. 31 | 110 65. 69 | 962 9.9 |
| 18. Plantation | 167 4.0 8 | 148 7.1 5 | 150 7.5 8 | 150 0.2 3 | 219 5.0 6 | 197 2.3 9 | 198 7.5 8 | 214 8.0 5 |
| 19. Sports Goods | 335 .54 | 585 .3 | 791 .79 | 506 .85 | 101 3.8 6 | 135 6.3 7 | 111 111 7 | 113 0.5 3 |
| 20. Office Equipments | 224 .44 | 164 .53 | 192 .86 | 142 .05 | 112 .58 | 217 .84 | 16. 74 | 24. 91 |
| 21. Project Goods | | | | | | | | |

(Source: Indiatat.com)

Description and Source Of the Data

Here we have 21 categories of the items Exported to other countries by India. The export amount is in rupees (billion) from year 2014 to 2021.

Under each category there are more categories for the shortage of space here only the principal categories are provided.

Objective

our data set consists of the export figures of 21 principal commodities for the time interval 2014-2021. here we first observe whether there exists any pattern among the plots of export figures against the time points. Our next goal is to fit appropriate trend curves for each of the 21 cases and if the trend is linear, then we will go for checking the parallelity of trend lines. If the trend lines are parallel, it implies that the export figures change identically over time for each of the cases.

Methods & Materials ::

TREND FITTING

1. **Least Square Method ::**

The least squares method is a standard approach in regression analysis to approximate the solution of overdetermined systems by minimizing the residuals sum of squares (a residual means the difference between observed value and fitted value provided or obtained from a model).

The most important application is in data fitting. the process starts with a set of data points to be plotted on x-axis and y-axis graph, Analyst using least square method will generate a best fit line that explains the linear relationship between independent and dependent variables. The common application of this method, which is sometimes referred to as "linear" aims to create a straight line that minimizes the residuals sum of squares that are generated by results of associated equations based on the model.

The least square equation tells us the story of the relationship among the data points.

▪ The mathematical estimation :

Here, think of n data points in pair format (x_i, y_i) where y_i 's are the response variable and x_i 's are the independent variables then we are to connect these two by a equation which is known as least square equation and these are in linear format .

$$y = bx + a$$

we are to calculate the constant values i.e the values of a and b , the formula is

given by :
$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$$

$$\text{and } a = \frac{\sum y - a \sum x}{n}$$

hence the estimated equation is $\hat{y} = \hat{b}x + \hat{a}$

- OLS(ordinary least square):

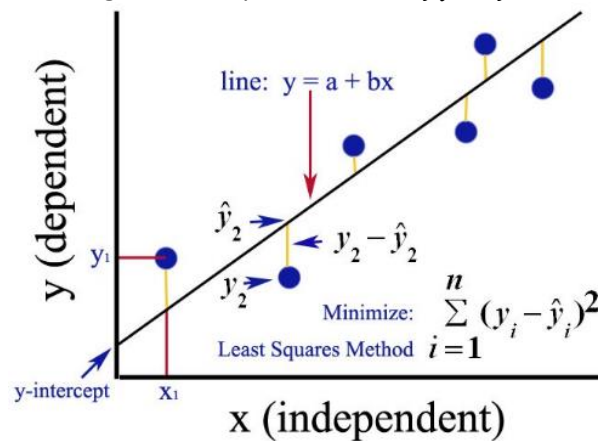
the residuals error is $SSE = \sum \epsilon_i^2 = \sum (y_i - \hat{y}_i)^2$, we will minimize this error with respect to a and b taking the differentiation with respect to a and b we will continue :

$$\frac{\partial(SSE)}{\partial b} = -2 \sum X_i(y_i - \hat{y}_i) = 0 \quad \rightarrow (i)$$

$$\frac{\partial(SSE)}{\partial a} = -2 \sum (y_i - \hat{y}_i) = 0 \quad \rightarrow (ii)$$

Now solving these two equations we will obtain the values of constants a and b.

Hence we can get the estimated figures of response variable y_i i.e $\hat{y} = \hat{b}x + \hat{a}$



2. **Parallelity::**Then the next is to test for the parallelity of the regression lines of the models of same categories (that is if curves are of upward then these are kept in one category and the downwards are kept in another category) .

The method is :-

Suppose we have p groups of observations on (x,y). The observations in the ith group may be labelled (x_{ij}, y_{ij}) , for $j=1, 2, \dots, n_i$ and $i= 1, 2, \dots, p$. we can then have p liner regression equations (considering the regression of y on x) as follows:

$$E(y_{ij}) = \alpha_i + \beta_i (x_{ij} - x_{i0})$$

Then, under the assumption that y_{ij} are independently normal with $\text{var}(y_{ij}) = \sigma^2$ for all groups, we may be interested in the null hypothesis H_0 : all β_i are equal or, in other words, in the hypothesis that the p regression lines are parallel to one another. We shall use the general procedure in deriving the test-statistics.

$$\hat{a}_i = y_{i0}, \quad \hat{B}_i = \frac{\sum (x_{ij} - x_{i0})(y_{ij} - y_{i0})}{\sum_i \sum_j (x_{ij} - x_{i0})^2} = \frac{B_i}{A_i} = b_i, \text{ say.}$$

Then the unrestricted residual SS is

$$S_1^2 = \sum_i \sum_j [y_{ij} - y_{i0} - b_i(x_{ij} - x_{i0})]^2$$

$$\begin{aligned}
&= \sum_i \sum_j (y_{ij} - y_{i0})^2 - \sum_i b_i \sum_j (x_{ij} - x_{i0})(y_{ij} - y_{i0}) \\
&= \sum_i C_i - \sum_i b_i \cdot B_i, \text{ say} \\
&= \sum_i (C_i - b_i \cdot B_i) \\
&= \sum_i (\text{unrestricted residual SS for } i\text{th group}), \text{ with } df = \sum_{i=1}^p (n_i - 2)
\end{aligned}$$

Next, we obtain the restricted (under H_0) residual SS, which is S_2^2 = minimum value of

$$\sum_i \sum_j [y_{ij} - \alpha_i - \beta(x_{ij} - x_{i0})]$$

When minimised w.r.t α_i and β , where β is the common value of β_i under H_0

$$\begin{aligned}
&= \sum_i \sum_j [y_{ij} - y_{i0} - b(x_{ij} - x_{i0})] \\
&= \sum_i \sum_j (y_{ij} - y_{i0})^2 - b \sum_i \sum_j (x_{ij} - x_{i0})(y_{ij} - y_{i0}) \\
&= \sum_i C_i - b \sum_i B_i = C_t - b B_t, \text{ say, with } df = \sum_i (n_i - 1) - 1,
\end{aligned}$$

Where the least-square estimators, under H_0 , of α_i and β are

$$\hat{\alpha}_i = y_{i0}, \quad \hat{\beta} = \frac{\sum (x_{ij} - x_{i0})(y_{ij} - y_{i0})}{\sum_i \sum_j (x_{ij} - x_{i0})^2}$$

Thus the test of H_0 is obtained by using the test statistic

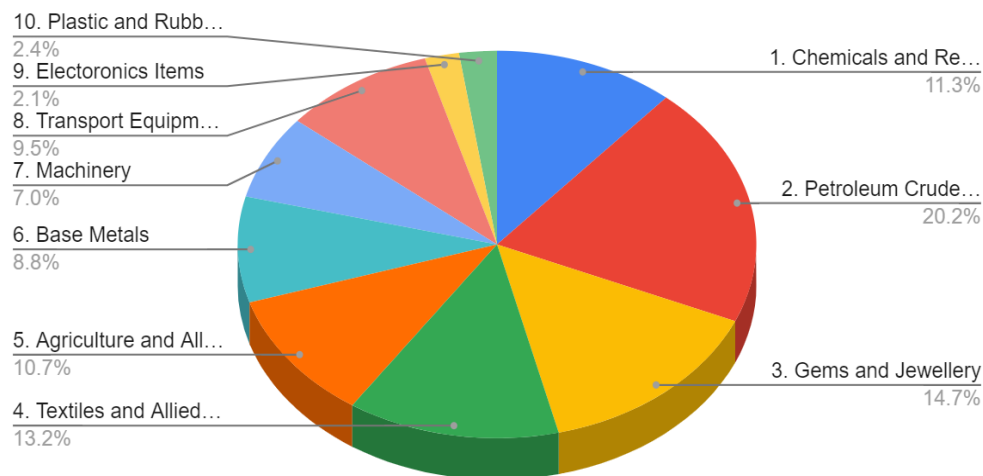
$$\begin{aligned}
F &= \frac{\frac{S_2^2 - S_1^2}{S_1^2}}{\frac{S_1^2}{n-2p}} \times \frac{\sum_i (n_i - 2)}{p-1} \\
&= \frac{(C_t - b B_t) - (C_t - \sum_i b_i B_i)}{(C_t - \sum_i b_i B_i)} \times \frac{n-2p}{p-1}, \text{ with } df = (p-1, n-2p)
\end{aligned}$$

Where, $n = \sum_{i=1}^p n_i$, $A_t = \sum_i A_i$, $B_t = \sum_i B_i$ and $C_t = \sum_i C_i$

Graphical representation of the data :

Here we have a data of exports of India from the year 2014 to 2021 where 20 principal categories are present , in this section we will draw the graphs and charts and depending on them we will try to draw some conclusions .

Pie chart of top 10 commodities exported



From this chart it can be shown ::

- Export of petroleum and crude oil product is high and have the most value
- Gems and jewellery have received second place in exports
- Textiles and allied products takes third place in export business
- Agricultural exports also have a great impact in economy of exports.

Total Exports From Year 2014 to 2020

Chemicals and Related Products

Petroleum Crude and Products

Gems and Jewellery

Textiles and Allied Products

Agriculture and Allied Products

Base Metals

Machinery

Transport Equipments

Electoronics Items

Plastic and Rubber Articles

Marine Products

Leather and Leather Manufactures

Articles of Stone, Plaster, Cement,Asbestos, Mica or Similar Materials;Ceramic Products; Glass and Glassware

Ores and Minerals

Paper and Related Products

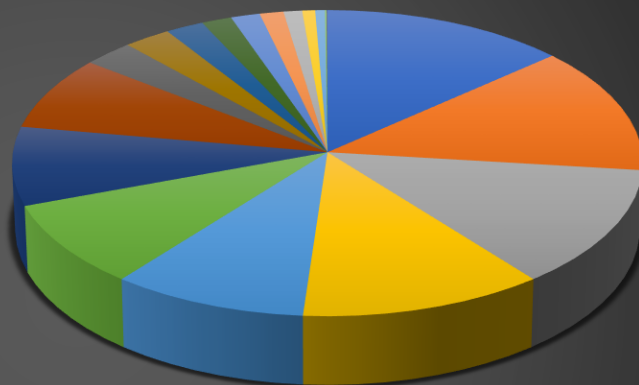
Optical, Medical and Surgical Instruments

Plantation

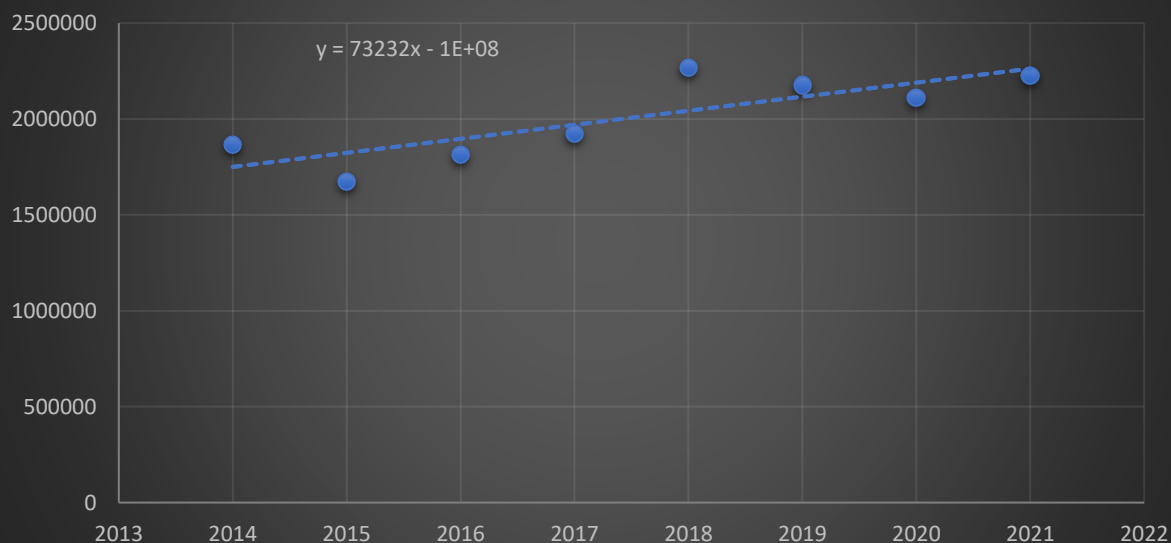
Sports Goods

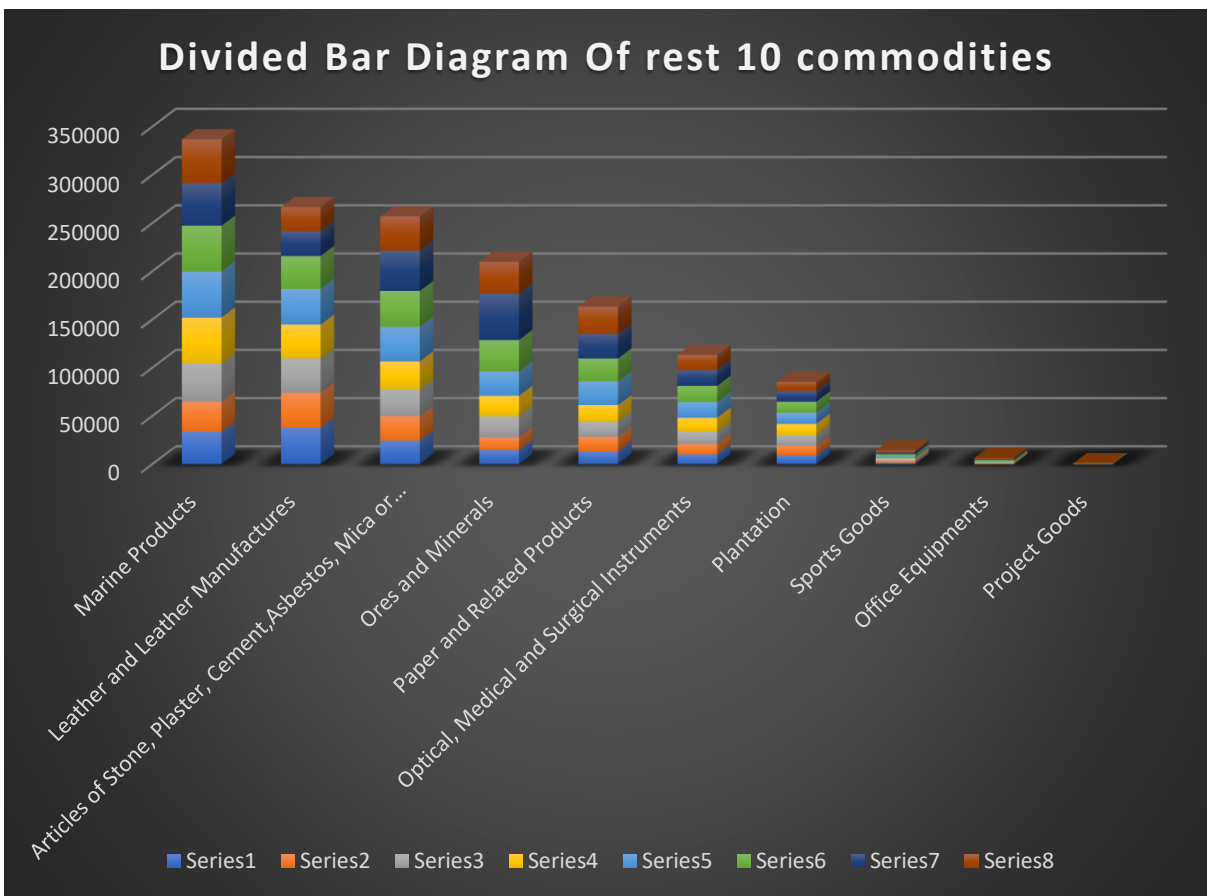
Office Equipments

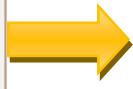
Project Goods



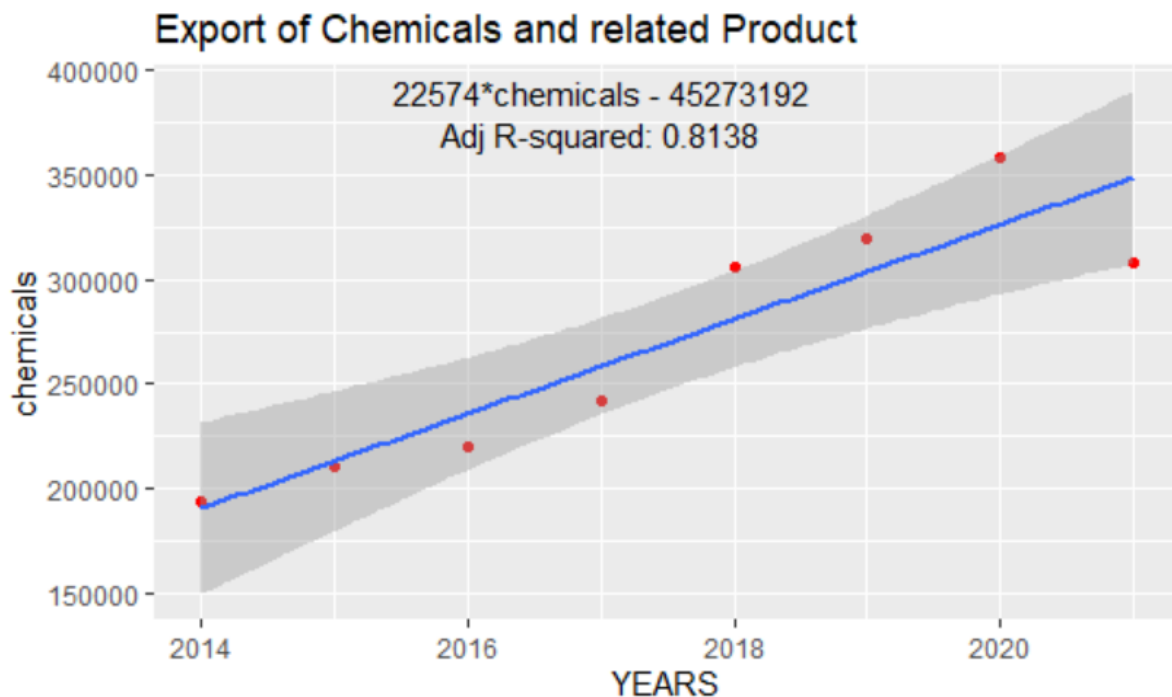
Total Exports Of Years From 2014 To 2021



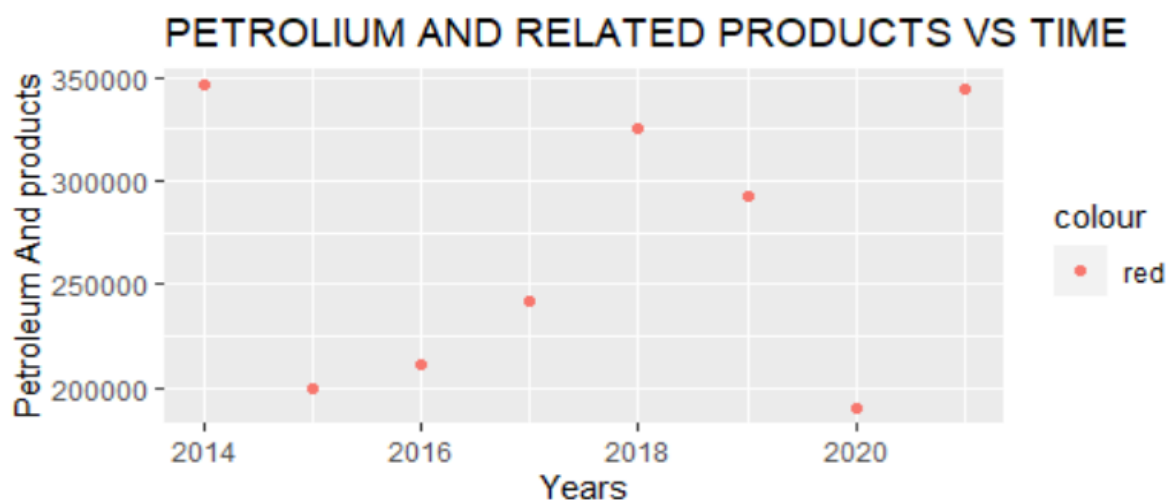
[illegible]



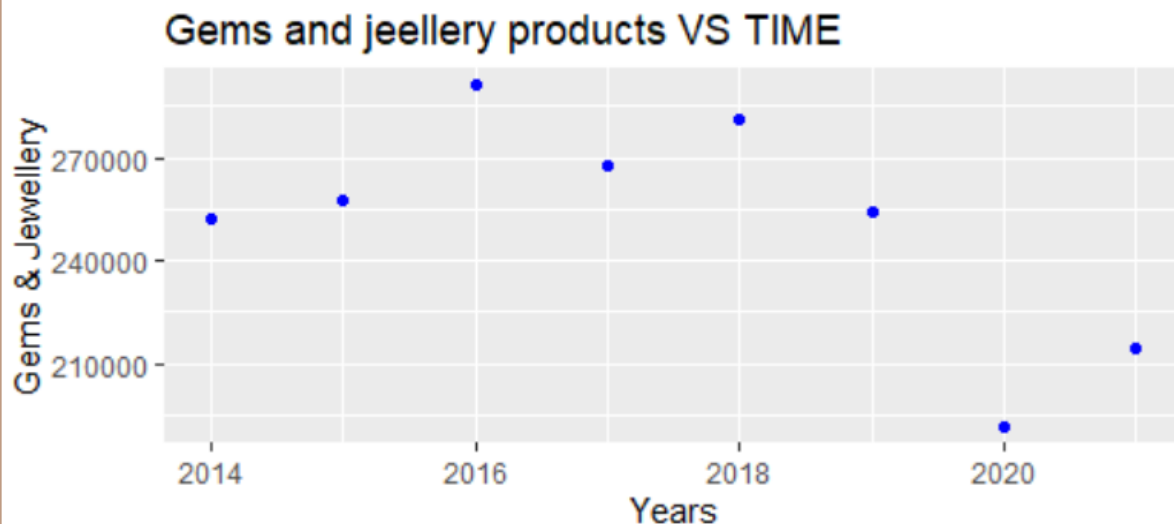
Scatter plots , Trends and Informations ::



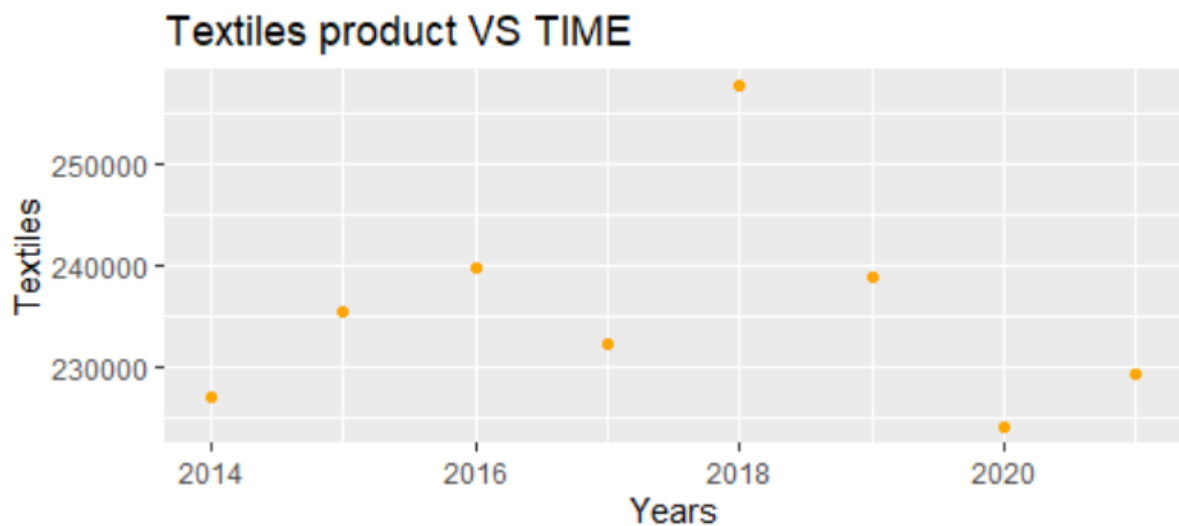
- We can see from the Graph that Chemicals and Related Products are growing by the years and in 2020 we have the disaster of Covid-19 so that there is a drop at between the year 2020 and 2021. Exports of Indian Chemicals has registered growth of 106% in 2021-22 over 2013-14. India's exports of Chemicals for 2021-22 hit a record at US\$ 29296 Million, whereas in 2013-14 India's Chemical exports was US\$ 14210 Million. Today Indian Chemical industry has become global player and earns foreign exchange for the nation with "Make in India" approach. India is the 6th Largest producer of Chemicals in the world and 3rd in Asia. India ranks 14th position in export of chemicals.



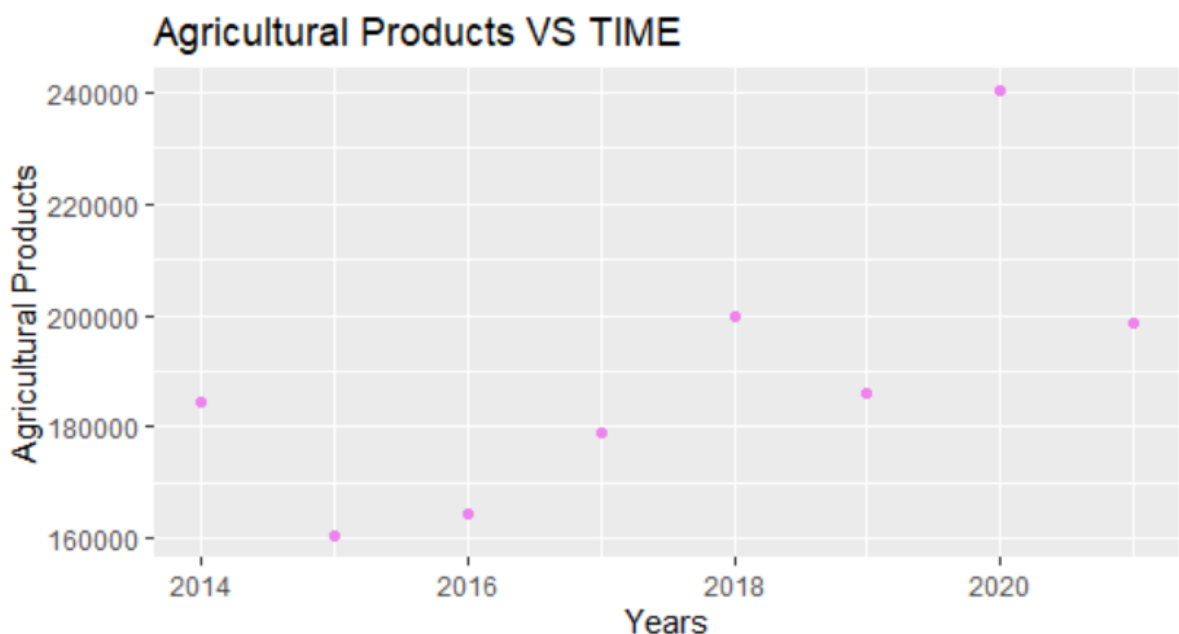
- these include petrol, diesel, gasoline, naphtha, jet fuel, liquified petroleum gas (LPG), and lubricants. India ranks among the top five exporters of refined petroleum, catering largely to markets like the US, UAE, China, Singapore, and the Netherlands. India is also the second largest refiner in Asia after China. Petroleum products exports were severely impacted by Covid-19 in 2020-21 due to the imposition of lockdowns and mobility restrictions and declined 37.3 percent year-on-year. However, they have made an impressive rebound this year



- These include diamonds (rough as well as cut and polished), gold jewellery, coloured gemstones, pearls, non-gold jewellery, and synthetic stones. India is the fifth largest exporter of gems and jewellery with a 5.8 percent share in global exports. Exports of cut and polished diamonds lead this segment, followed by gold jewellery. The US, Hong Kong, UAE, Belgium, and Israel are the top importers. Gems and jewellery make up 14 percent of India's total merchandise exports. After a disappointing 2020-21, when exports fell 27.5 percent year-on-year, this commodity segment has seen a healthy revival in 2021-22. India exported gems and jewellery worth \$18.98 billion in April-September 2021, 136.95 percent up from \$8.01 billion in the corresponding period last year and an impressive 5.13 percent growth from the same period in pre-pandemic 2019. Exports of cut and polished diamonds are up 125 percent this year.



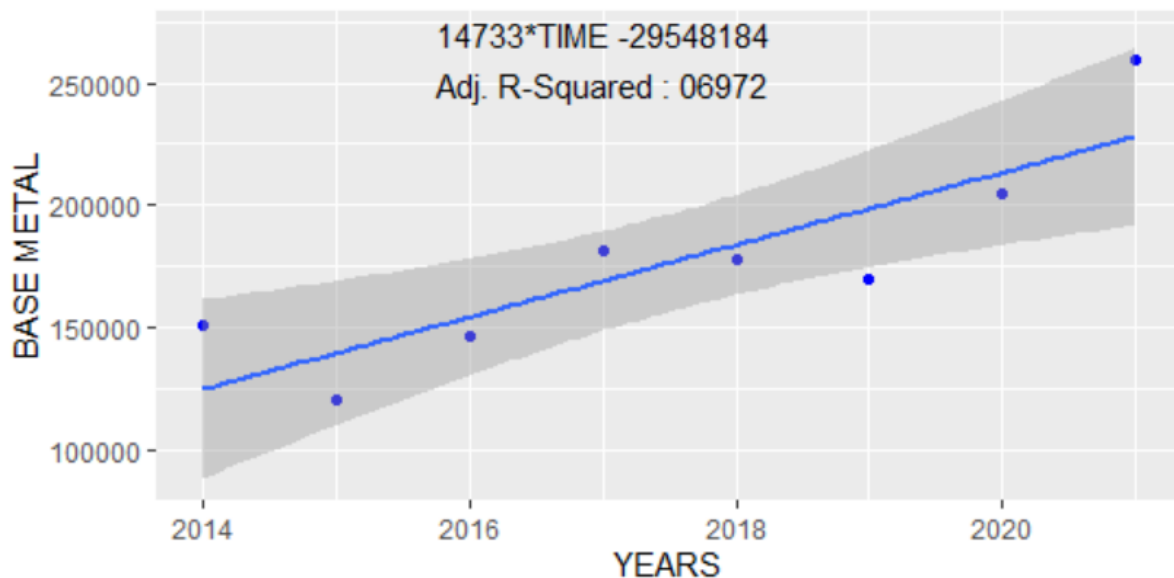
- The trade of Textile and Clothing had a share of 5.38% in India's total trade during 2019-20. Although, India's textile trade has been constantly increasing since 2016-17, a slight decline in trade was witnessed during 2019-20. The total textile trade in 2019-20 stood at USD 42.36 billion compared to USD 44.89 billion in 2018-19. The export of Textiles stood at USD 34.21 billion while the import was valued at USD 8.15 billion. The exports of textiles declined at a rate of (-) 8.74% while imports of textiles registered a growth of 10.33% during 2019-2020. The share of Textiles and apparel in overall export basket of India was 11.34% during 2019-20.



- India's agriculture sector growth rate was estimated to be at 3.9% as compared to the 3.6% in the previous year. The country produces many crops and food grains such as rice, wheat, pulses, oilseeds, coffee, jute, sugarcane, tea, tobacco,

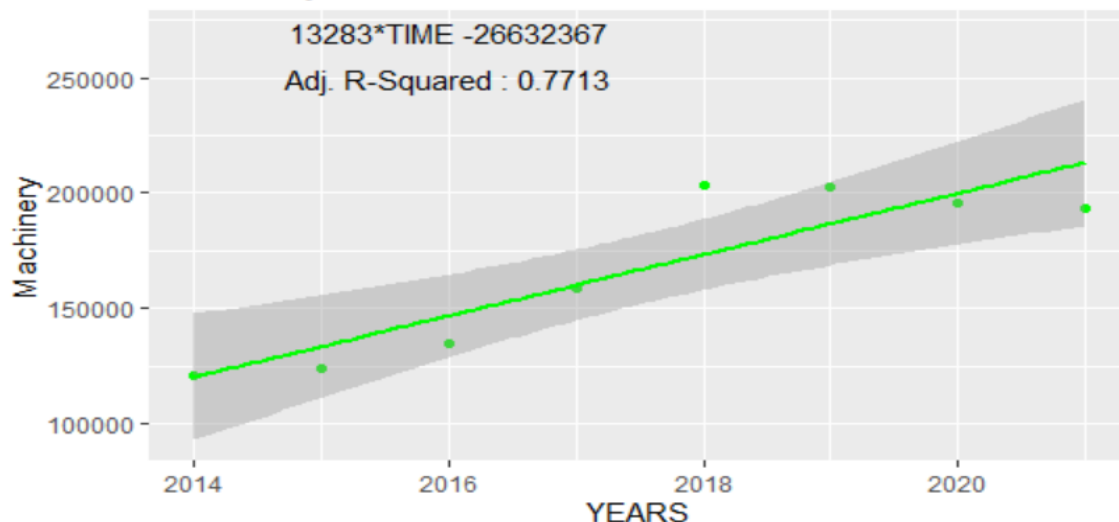
groundnuts, dairy products, fruits, etc. During 2020-21, India's tea production stood at 1,280 million kg. Coffee production during the same period was 354 million kg, a 19% YoY increase. During 2021-22, oilseeds production of India crossed the estimated 37.15 million tonnes while other products such as rice, wheat, maize, pulses, mustard, and sugarcane reached a record high production.

Base Metals VS TIME

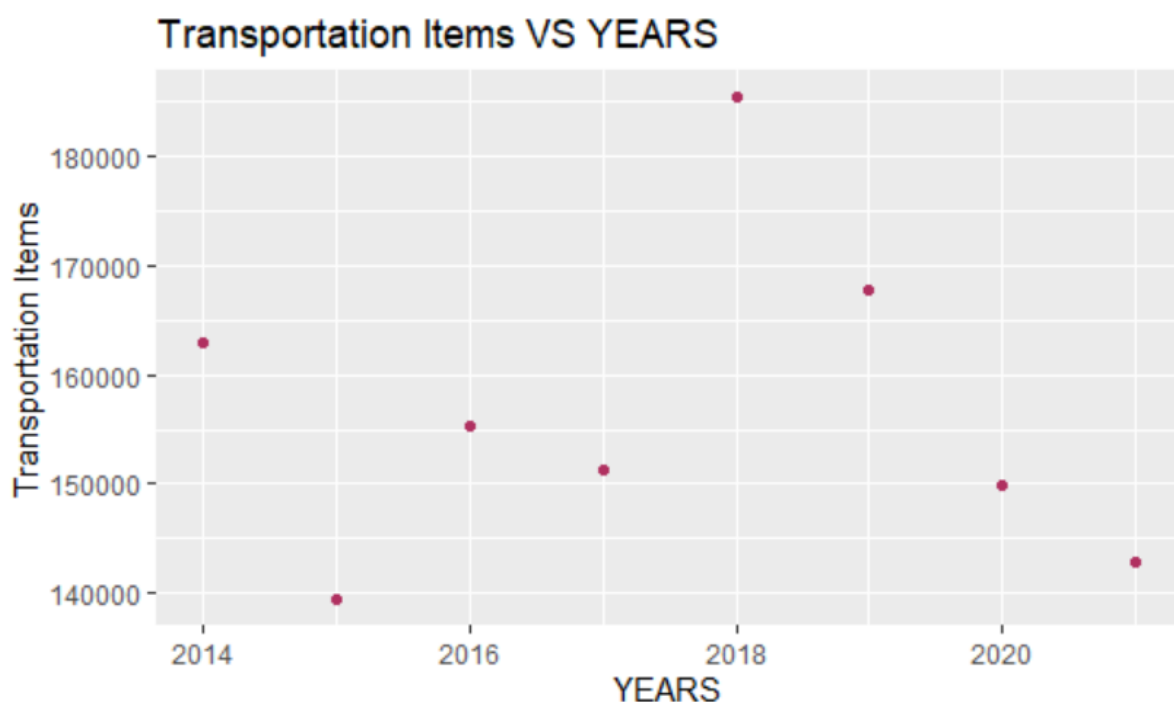


- In 2020, Base metals clad with silver, semi-manufactured were the world's 3911th most traded product, with a total trade of \$121M. Between 2019 and 2020 the exports of Base metals clad with silver, semi-manufactured grew by 8.94%, from \$111M to \$121M. Trade in Base metals clad with silver, semi-manufactured represent 0.00072% of total world trade.

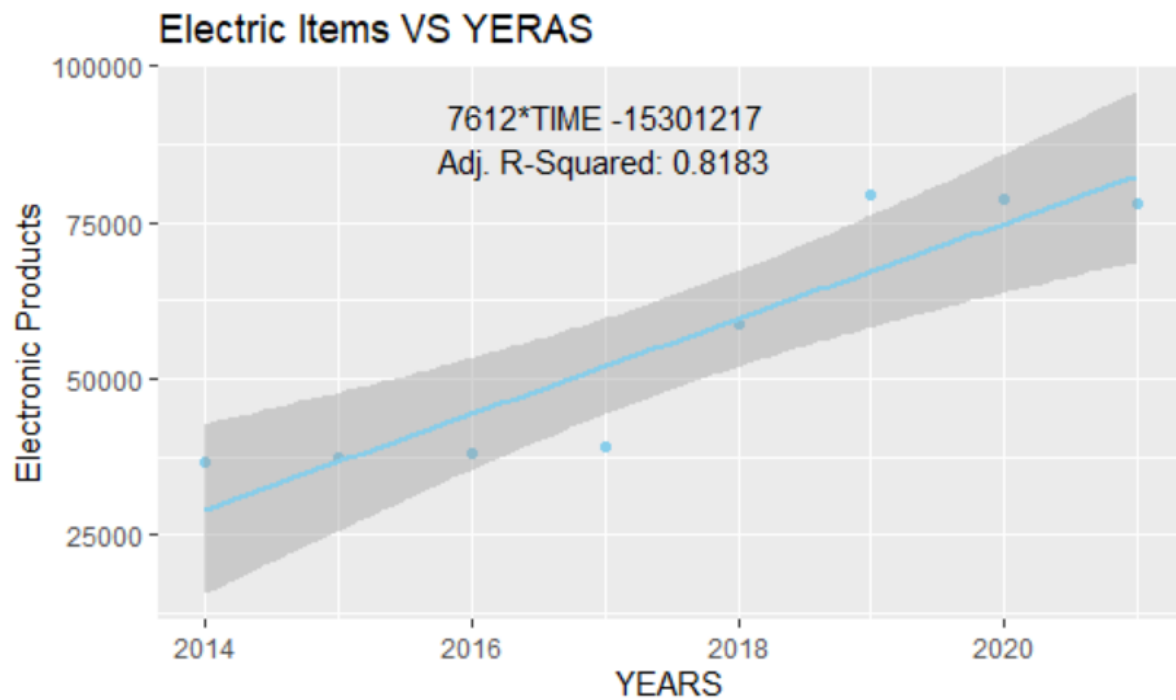
Machinery VS TIME



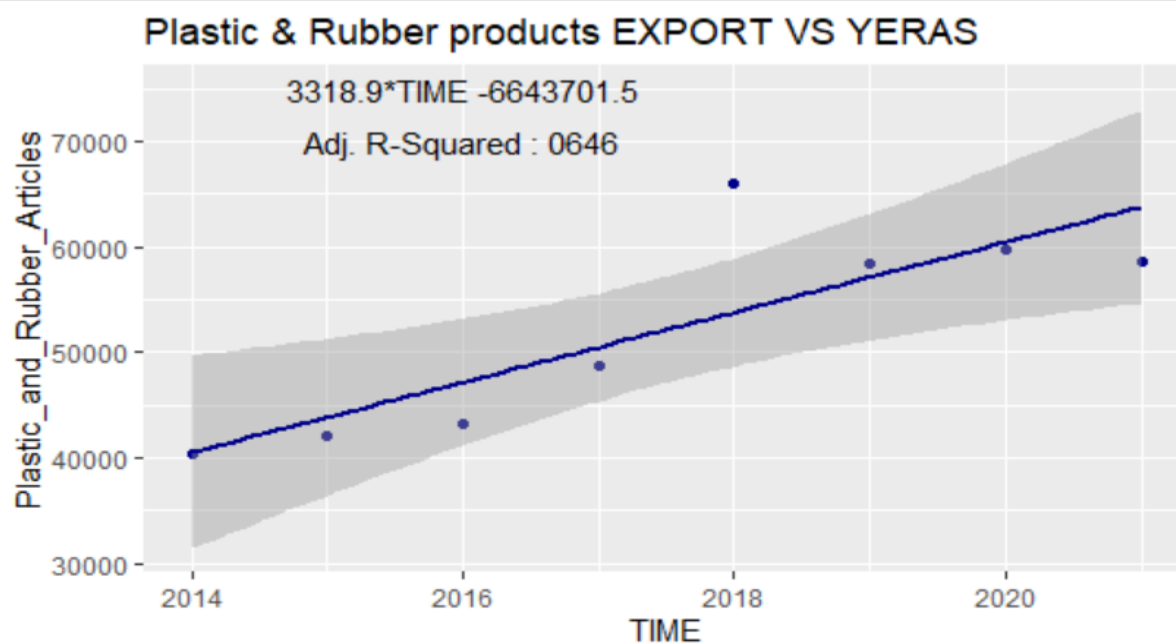
- Machinery is traded all around the world. The data provided on the export analysis shows that there are almost 207 countries and territories, which actively import Machinery from India. The combined value of total export is 828.35 USD million. Therefore, if any exporter wishes to export Machinery then Connect2India offers a complete guide on how to export Machinery from India. From the perspective of the data on Machinery export, India's top 5 trade partners who import Machinery from Indian exporters are USA ,Nigeria ,China,Singapore and Bangladesh. total export value of the top 5 countries is 269.08 USD million which is the 32.48% of the total export value of Machinery.



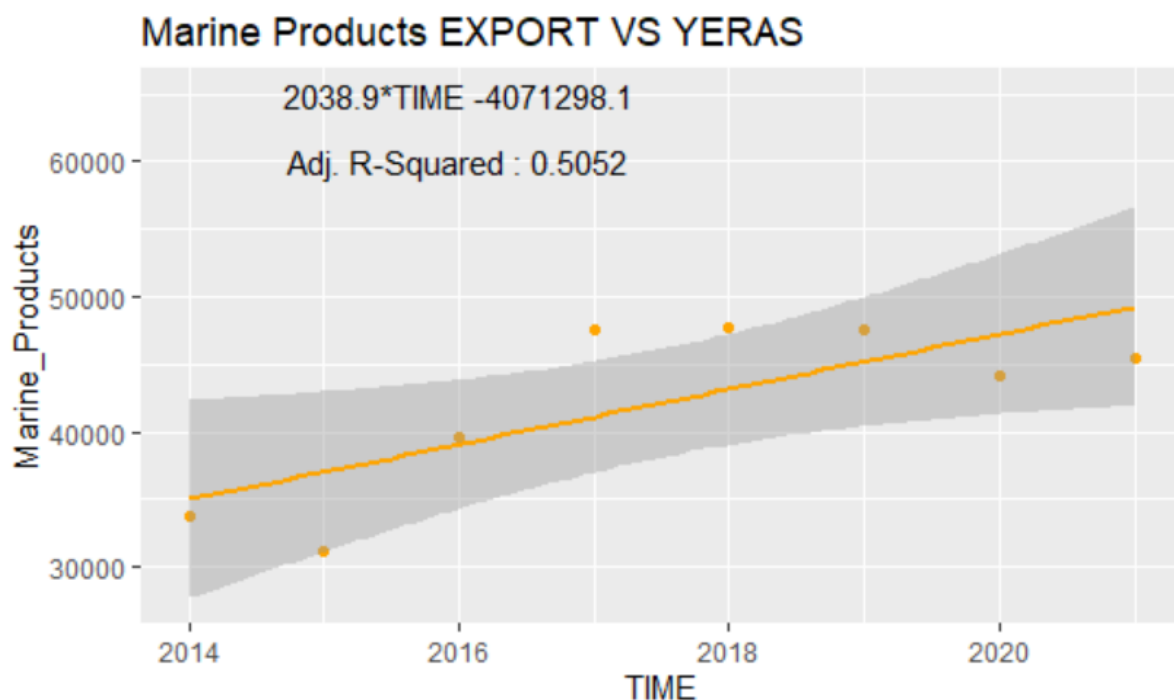
- Transport Of Material is traded all around the world. The data provided on the export analysis shows that there are almost 22 countries and territories, which actively import Transport Of Material from India. The combined value of total export is 0.4 USD million. Therefore, if any exporter wishes to export Transport Of Material then Connect2India offers a complete guide on how to export Transport Of Material from India..



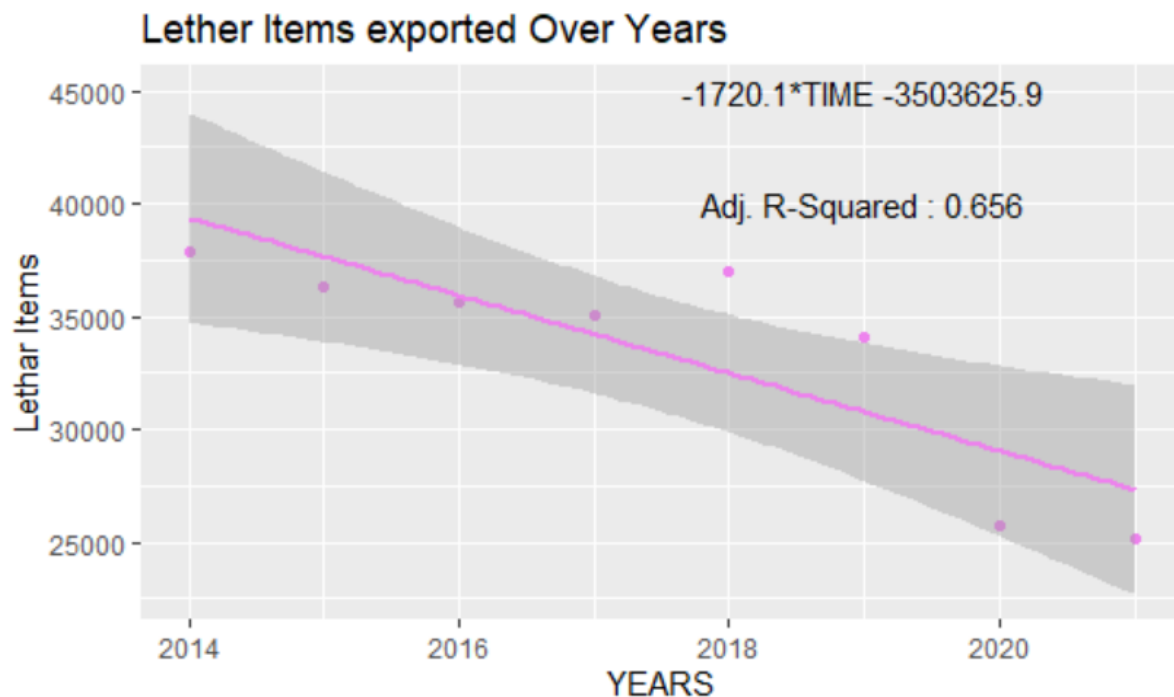
- These include mobile phones, accessories and components, laptops and computers, among others. India's electronic goods exports fetched \$11.11 billion in 2020-21, almost the same as the \$11.7 billion earned in 2019-20. With global demand rallying this year, exporters are hoping for an even better performance in 2021-22. In fact, the Electronics and Computer Software Export Promotion Council says India has the potential to hit \$180 billion in electronic goods exports by 2025 provided it receives long-term policy support from the government.



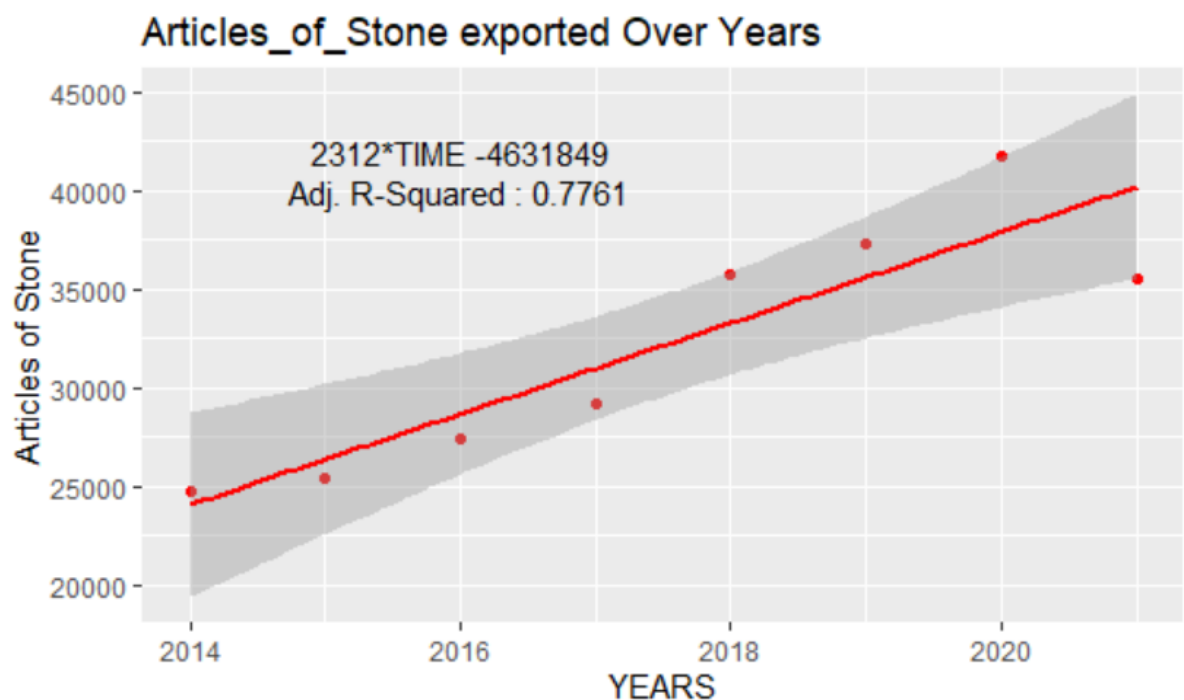
- Rubber And Plastic Products is traded all around the world. The data provided on the export analysis shows that there are almost 63 countries and territories, which actively import Rubber And Plastic Products from India. The combined value of total export is 1.71 USD million. Therefore, if any exporter wishes to export Rubber And Plastic Products then Connect2India offers a complete guide on how to export Rubber And Plastic Products from India



- India's main seafood exports are frozen shrimp and frozen fish. The US is the largest importer of Indian marine products, followed by China, the European Union, and Japan. In the past two years, the pandemic has severely tested Indian exporters of marine products. Exports fell 10.88 percent in 2020-21 from the previous financial year as demand went flat. This year too, exports suffered as China suspended seafood imports from India, citing the presence of coronavirus traces in packaging. It also blacklisted six Indian seafood exporters. In September 2021, China started online inspections of marine products at multiple processing-cum-export units in several Indian states. This, coupled with a resurgence in demand in the US and a good shrimp harvest, has given hope to exporters that they will be able to meet the government's target of \$7.8 billion in seafood exports for this financial year.

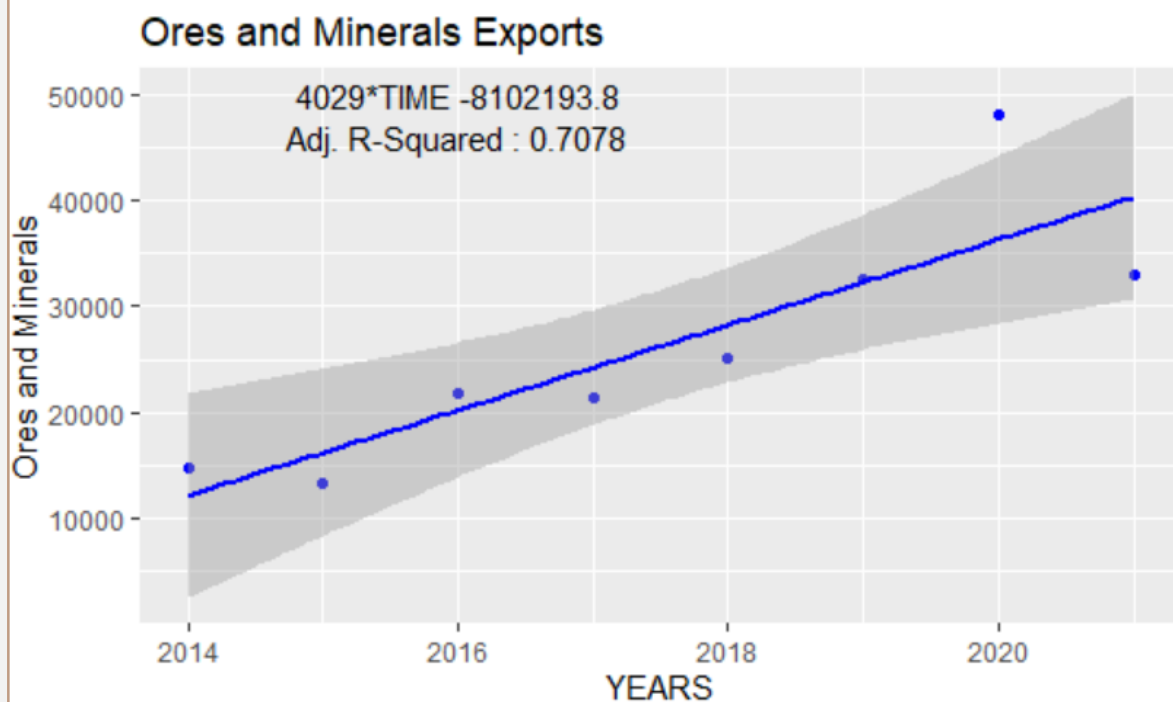


- India is the second exporter of leather garments and third largest exporter of saddlery & harness. The country is also the fourth largest exporter of leather goods in the world. During 2021-22, India exported total leather and leather products of value US\$ 4.87 billion, a 32% increase from the previous year. In March 2022, the leather and leather products exports in the country were valued at US\$ 471.39 million, a 7% increase from February 2022.



- Stone Articles is traded all around the world. The data provided on the export analysis shows that there are almost 139 countries and territories,

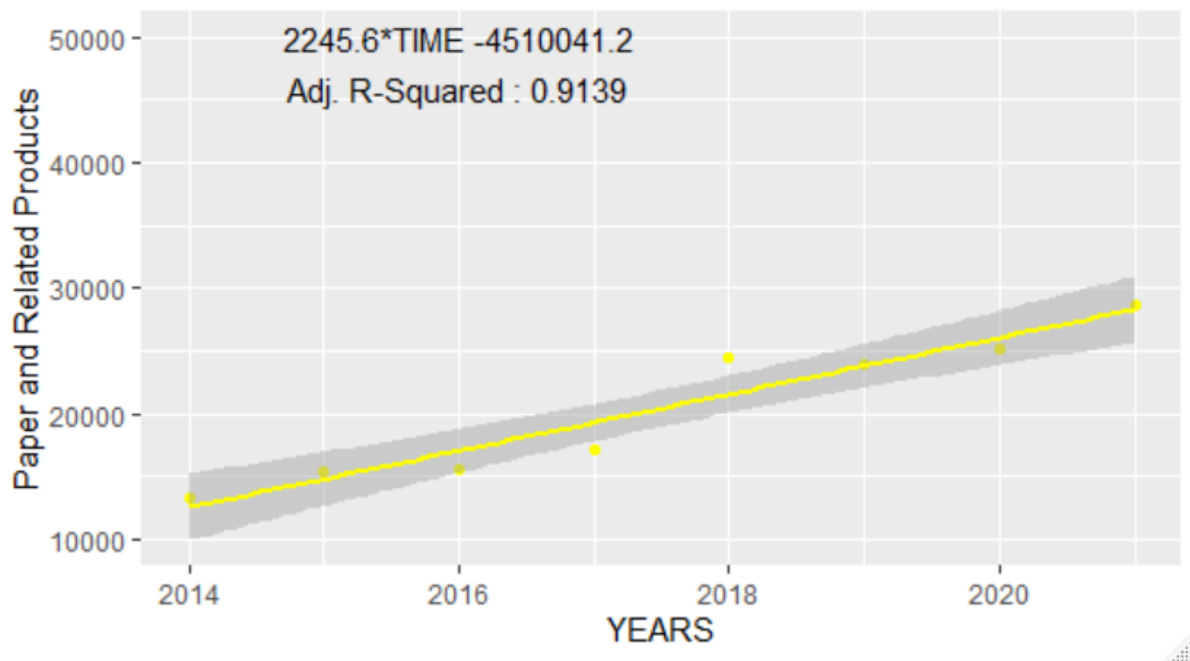
which actively import Stone Articles from India. The combined value of total export is 23.3 USD million. the total export value of the top 5 countries is 16.11 USD million which is the 69.14% of the total export value of Stone Articles. the total export value of the top 5 countries is 16.11 USD million which is the 69.14% of the total export value of Stone Articles.



- it would be seen that Diamond (mostly cut) (77.58%), Iron ore (8.57%), Granite (4.64%), Precious & semi precious stones (2.12%), Alumina (1.57%) and Chromite (0.81%) account for about (95%) of total export trade in ores and minerals.

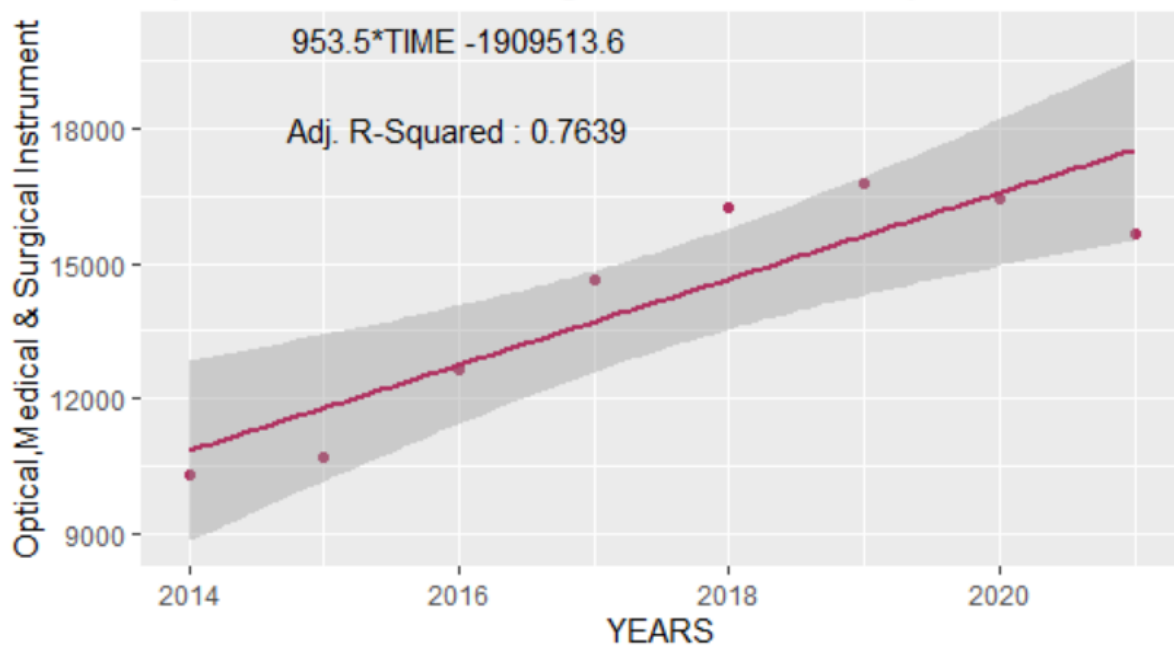
In fiscal year 2021, the export value of mineral ores and processed minerals from India amounted to more than 279 billion Indian rupees. This was a decrease from the previous financial year. India exported principal commodities worth over 21 trillion rupees in financial year 2021.

Paper and Related Products Exports



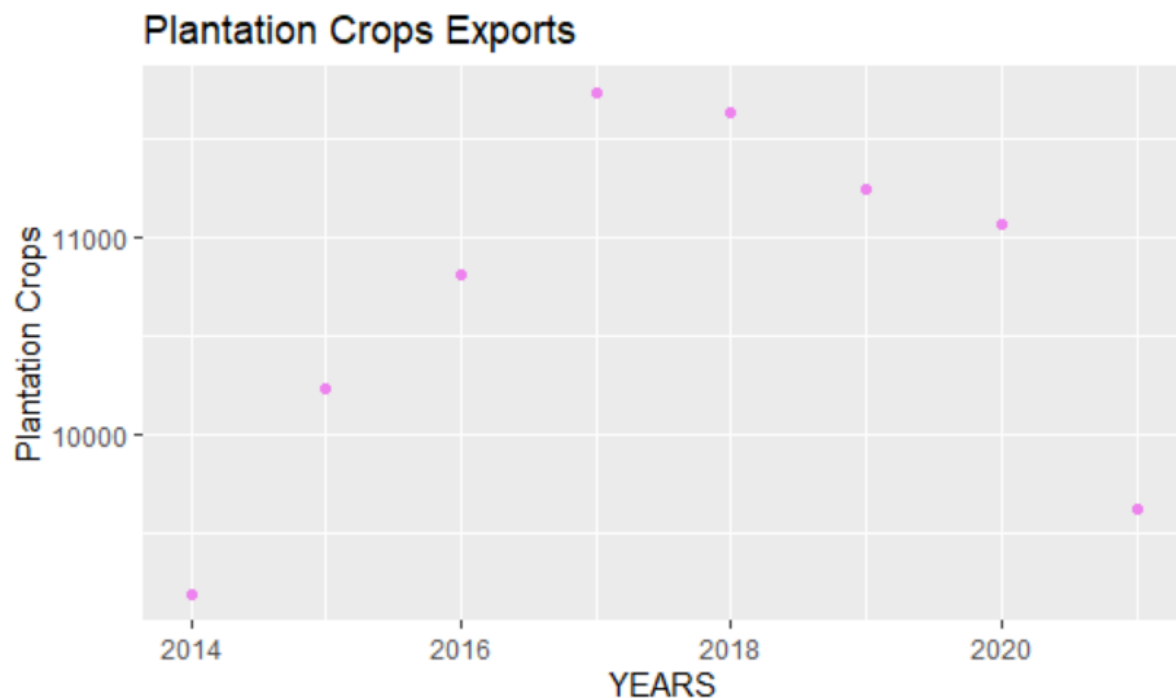
- Within the market of paper and its products, India exported paper and paper board products at the highest value in fiscal year 2021. This amounted to almost two billion U.S. dollars.

Optical Medical and Surgical Instruments Exports

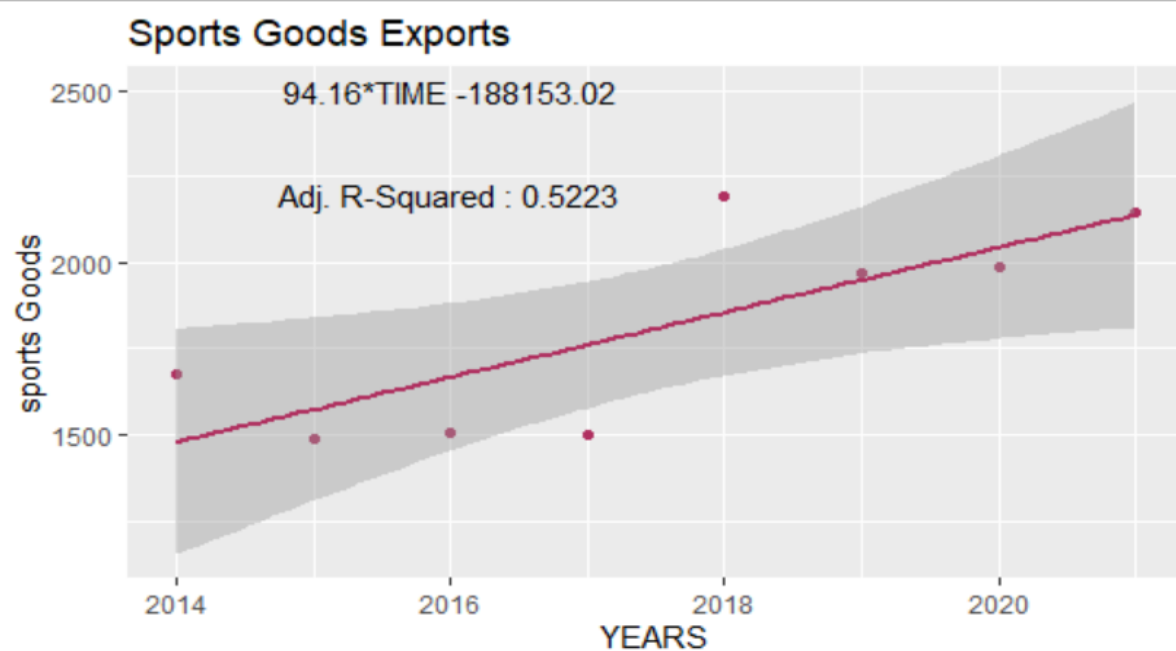


- Surgical Instruments is traded all around the world. The data provided on the export analysis shows that there are almost 153 countries and territories, which actively import Surgical Instruments from India. The combined value of total export is 2.94 USD million. Therefore, if any exporter wishes to export Surgical Instruments then Connect2India

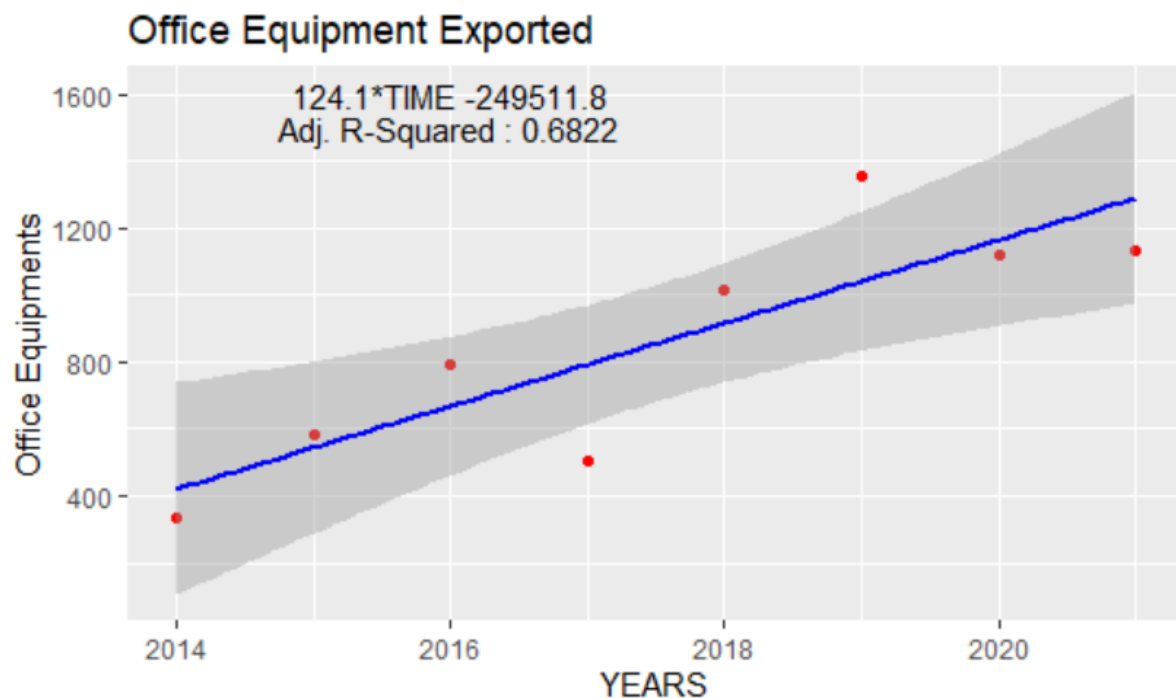
offers a complete guide on how to export Surgical Instruments from India.



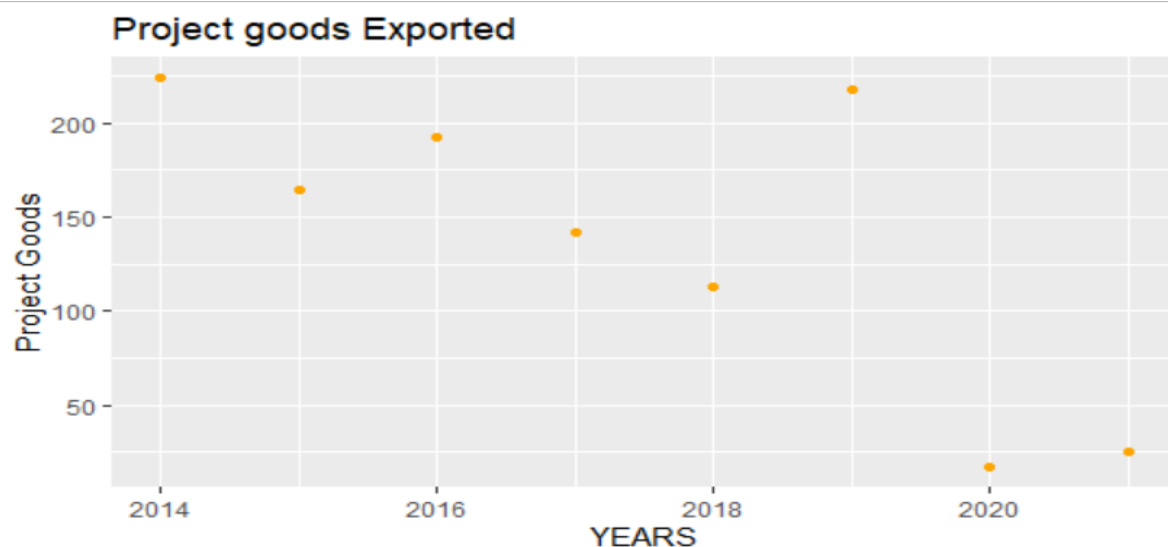
- India exported a wide range of agricultural products valued at over USD 50 billion during 2021-22. Wheat, oil meals, shellac, rice, tea, coffee, cotton, cashew, spices and wheat are some of the main exported agro products. Fresh processed fruits and vegetable exports amount to an estimated USD 400 million. Rice remained a major agro product with almost USD 9.7 bn worth of rice exported in 2021-22.



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- Office Supplies is traded all around the world. The data provided on the export analysis shows that there are almost 153 countries and territories, which actively import Office Supplies from India. The combined value of total export is 12.98 USD million. The total export value of the top 5 countries is 11.02 USD million which is the 84.9% of the total export value of Office Supplies.



- According to the project export Promotion council exports of india have swung wildly over the past five years. Project exports depend on securing the rights to develop major projects overseas which depends on the volatile nature of global investment Flows, political climate and peace of government contracts. Project exports touched 13.7 billion but then suddenly falls down in 2020 but after the covid period it has started growing again. It is one of the focused exports of government's.

ANALYSIS

We have a dataset of principal commodities exported from Indian from the year 2014 to 2021. We are looking for the trends in each section of the 20 principal commodities, if the trends are of good fitting or bad and the trends are upward or downward and they are lifting the economy up or down.

➤ Trend Analysis :

We have seen the scatter plots and trends of all the 20 principal commodities according to that the summary of trends are given in the below table no. 1:

| COMMODITIES | EQUATIONS | | R-SQUARE | PREDICTION(2025) In US(\$) | Trend Type |
|-------------|--------------------------------|---------------------------|----------|-------------------------------|---------------|
| | Chemicals and Related products | $2257*TIME - 452273192$ | 0.8182 | 439156 | Upward |
| | Base Metals | $14733*TIME - 29548184$ | 0.6972 | 286141 | Upward |
| | Machinery | $13283*TIME - 26632367$ | 0.7713 | 265708 | Upward |
| | Electric items | $7612*TIME - 15301217$ | 0.8183 | 113083 | Upward |
| | Plastics and Rubber Items | $3318.9*TIME - 6643701.5$ | 0.646 | 77071 | Upward |
| | Marine products | $2038.9*Time - 4071298.1$ | 0.5052 | | Upward |
| | Lether Items | $-1720*Time - 3503625.8$ | 0.656 | -3836625.8 | downward |
| | Articals of Stones | $2312*TIME - 4631849$ | 0.7761 | 49951 | Upward |

| | | | | |
|---------------------------------|------------------------|--------|---------|--------|
| Ores and Minarels | 4029*TIME-8102193.8 | 0.7078 | 56531.2 | Upward |
| Paper And Related Products | 2245.6*TIME -4510041.2 | 0.9139 | 37298.8 | Upward |
| Sports Goods | 94.16*TIME -188153.02 | 0.5223 | 2520.98 | Upward |
| Office Goods | 124.1*TIME -249511.8 | 0.6822 | 1790.7 | Upward |
| Optical and Surgical Instrument | 953.5*TIME-1909513.6 | 0.7639 | 21323.9 | Upward |

Interpretation

From the above Table we can observe that observe that we have all total a upward export trend except one. Also the values in \$ predicted for the upcoming Year 2025.

Hence we can conclude that there is an upcoming larger economy for the Upcoming years.

And we need to draw Govt. attention toward the downward Leather Exports to increase the market value.

Highest Growths are expected from Chemicals,Base Metals,Electrical products etc.

ANALYSIS

➤ Parallelity test :

We are to check for the lines of trends are parallel to each other or not i.e we will check the models are changing equally over time or not.

The following table gives all the information regarding the test

Here our test Statistics is F .

TABLE 2

| Trend | Observed F | Tabulated F | Decission |
|------------|------------|-------------|--|
| Increasing | 9.421104 | 2.1278 | Lines are not parallel i.e Upward trends are not changing similarly over time. |

As we have only one decreasing trend Of Leather exports so we cannot check parrallelity there .

CONCLUSION :

So we found a overall growth among the commodities are exported from India. And also got to know for each commodities there are some different causes interfering in exports of them.

In recent years, India exported mostly: pearls, precious and semi-precious stones and jewelry (16 percent of total shipments); mineral fuels, oils and waxes and bituminous substances (12 percent); vehicles, parts and accessories (5 percent); nuclear reactors, boilers, machinery and mechanical appliances (5 percent); pharmaceutical products (5 percent); and organic chemicals (4 percent). India's main export partners are: United States (15 percent of the total exports), United Arab Emirates (11 percent), Hong Kong (5 percent), China (4 percent), Singapore (4 percent) and United Kingdom (3 percent).

the Economic Survey 2022 tabled in the Parliament said that the Indian merchandise exports are expected to grow by 16.5 per cent in 2021-22 surpassing pre-pandemic levels. Similarly, it adds that imports are expected to grow by 29.4 per cent in 2021-22 surpassing corresponding pre-pandemic

levels. However, the survey's first advance estimate of year 2021-2022 showed that imports constitute 23.1 per cent of GDP while exports constitute 20.1 per cent of the total GDP.

The Centre has targeted \$400 billion in merchandise exports for the current fiscal and an ambitious \$1 trillion by 2030.

Impact Of Covid-19 :

But altogether in covid-19 all the exports are suffered mostly as all the borders and ports was seized.

Petroleum products were the most affected commodities in terms of exports from India, with a decline of about 32 percent in January 2021, compared to the same month in the previous year. Other cereals and oil meals witnessed a highly positive change rate.

Global economic impact :

The outbreak of COVID-19 caused a massive economic recession, with six out of the seven largest economies showing a massive GDP loss in the third quarter of 2020. A slump in demand and changing consumption patterns shook international trade worldwide. Since March 2020, lockdowns became a global necessity, and the Indian subcontinent was no exception, announcing its first nation-wide lockdown by the end of March. Aimed at getting hold of the infectious chains, the lockdown resulted in a massive decrease in mobility, but also meant that livelihoods were disproportionately impacted. This was especially true for those with daily or hourly wages across the country.

COVID-19 impact on different sectors

Reduced mobility and the unavailability of resources, due to restricted borders caused significant challenges to traditional retailers. The automotive industry, in particular, emerged as one of the worst impacted industries. Simultaneously, petroleum consumption decreased. Other industries such as healthcare or fast-moving consumer goods, were less effected due to their indispensability and local shopper clientele. E-commerce experienced a long-lasting benefit from the pandemic, as most online purchasers consider e-retail as a post-pandemic option.


What needs to change ??

- **Lack of variation:** India continues to depend on primary commodities – goods available from cultivating raw materials without a manufacturing process (products derived from agriculture, fishing, mining, forestry, etc) – to drive its export growth. Take petroleum products, for example. Experts attribute the growth in petroleum exports in 2021-22 to a rise in oil prices and a revival in mobility rather than higher demand. Data from 2020-21 seems to prove this point – petroleum products exports declined 37.3 percent (by \$15.4 billion) year-on-year in that financial year as the world reeled under lockdowns and mobility restrictions. Warning against over-dependence on commodities that are sensitive to prices, experts say India would do better to diversify its export basket by including more consumer-led commodities, such as manufactured and value-added goods.
- **Missing competitive drive:** India saw its merchandise exports ranking among 15 developing countries slip to Number 8 in 2020 from Number 7 in 2018. Its share of exported goods fell from 3.9 percent to 3.6 percent during that period. Rival China took the top spot and South Korea came in at second. In a year (2020) marred by huge supply chain disruptions and economic distress, only China, Vietnam, and Chinese Taipei saw exports grow among the 15 countries. In the only bit of good news, India took second spot for its services exports, up a spot from 2018.

Various measures taken by Govt. to increase export::

Government is committed for promoting Indian exports in international markets and suitable interventions are done from time to time. The key schemes/interventions taken are:

1. The Foreign Trade Policy has been extended upto 30.09.2021 to provide a stable regime during the Covid-19 pandemic.
2. Schemes such as the Advance Authorization Scheme and the Export Promotion Capital Goods (EPCG) Scheme are being implemented to enable duty free import of raw materials and capital goods for export production.
3. The Interest Equalization Scheme, which provides pre and post shipment Rupee export credit has been extended upto 30.09.2021.
4. Remission of Duties and Taxes on Exported Products (RoDTEP) scheme has been operationalized for exports with effect from 01.01.2021.
5. It has been decided to extend the Rebate of State and Central Levies and Taxes (RoSCTL) Scheme for apparel and made-up exports till March 2024.
6. Transport and Marketing Assistance (TMA) scheme for specified agriculture products provides assistance for the international component of freight and marketing of agricultural produce and to promote brand recognition for Indian agricultural products in the specified overseas markets.
7. A common digital platform for Certificate of Origin (CoO) has been launched to increase Free Trade Agreement (FTA) utilization by exporters.

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8. In order to leverage the full export potential of our vast country, Districts are being promoted as Exports Hubs by identifying products and services with export potential in each district, addressing bottlenecks for exporting these products/services and supporting such local exporters/manufactures through institutional and strategic interventions. District specific export action plans for 478 districts have been prepared.
 9. Exports of services is being supported through negotiating meaningful market access through multilateral, regional and bilateral trade agreements, through participation in and organization of international fairs/exhibitions like the Global Exhibition on Services. An 'Action Plan for Champion Sectors in Services' is being developed to give focused attention to identified Champion Services Sectors through identified nodal Ministries/Departments
 10. Assistance is being extended to exporters under the Market Access Initiative (MAI) scheme for various activities such as export market research & product development, product registration, organizing / participating in fairs, exhibitions and Buyer Seller Meets (BSMs) abroad, Reverse Buyer Seller Meets etc.
 11. In order to have a coordinated and focused attention on development of export infrastructure, a working group on infrastructure up-gradation has been constituted under National Committee on Trade Facilitation (NCTF) and a National Trade Facilitation Action Plan (NTFAP) has been formulated. This includes measures for improving road and rail connectivity to ports and smart gates at sea ports.

APPENDIX :::

DATA AND PLOTS :

- TIME=c(2014,2015,2016,2017,2018,2019,2020,2021)
- Chems_and_Related_products=c(193983.58,210573.06,219810.37,242114.44,306130.69,319029.81,357765.43,308065.37)
- Petroleum_Crude_and_related_products=c(346082.49,199638.27,211509.03,241434.52,325929.13,292339.97,190471.83,344328.26)
- Gems_and_Jewellery=c(252207.68,257415.64,290903.32,267832.85,281408.09,254114.2,191906.08,214772.41)
- Textiles_and_Allied_Products=c(227160.46,235402.42,239898.35,232307.62,257651.84,238928.39,224179.34,229327.88)
- Agriculture_and_Allied_products=c(184316.23,160572.21,164594.79,179070.11,199824.97,185897.53,240190.2,198558.47)
- base_metal=c(151449.34,120845.33,146786.63,181858.26,177767.35,169499.92,204845.69,259100.44)
- machinery=c(120527.23,123890.88,135081.57,158792.42,203532.11,202556.91,195646.44,193363.37)
- Transport_Equipments=c(162901.04,139323.14,155237.24,151383.25,185574.91,167875.27,149953.17,142770.99)
- Electorronics_Items=c(36723.31,37300.41,38144.35,39148.04,58858.07,79567.83,78626.19,77979.07)
- plastic=c(40384.76,42002.58,43172.61,48814.66,59.14,58340.75,59795.62,58537.78)
- marine=c(33688.38,31219.4,39593.78,47646.41,47664.94,47618.1,44176.03,45458.53)
- others=c(34577.94,44748.21,38233.35,34952.96,43676.91,44610.67,44873.99,43077.38)
- Leather_and_Leather_Manufactures=c(37852.93,36325.79,35608.01,35091.46,37049.86,34046.2,25781.74,25132.99)
- articles_of_plaster=c(24701.12,25377.41,27407.68,29136.54,35792.81,37365.86,41805.36,35489.35)
- ores_minarals=c(14731.09,13211.29,21828.45,21308.34,25191.32,32605.4,48058.24,33014.59)
- paper=c(1332868,15353.87,15655.39,17085.42,24420.9,23901.71,25195.94,28663.57)
- Optical_Instruments=c(10310.27,10708.74,12671.4,14657.06,16244.07,16766.74,16460,15662.44)
- Plantation=c(9187.82,10232.39,10804.99,11731.69,11627.59,11242.31,11065.69,9629.9)
- sports_and_goods=c(1674.08,1487.15,1507.58,1500.23,2195.06,1972.39,1987.58,2148.05)
- office_equipment=c(335.54,385.3,791.79,506.85,1013.86,1356.37,1117,1130.53)
- Project_Goods=c(224.44, 164.53,192.86,142.05,112.58,217.84, 16.74,24.91)
- library(ggplot2)
- data.frame(TIME,Chems_and_Related_products)
- summary(lm(Chems_and_Related_products~TIME))

- `ggplot(data.frame(TIME,Chems_and_Related_products),aes(TIME,Chems_and_Related_products))+geom_point(colour="red")+geom_smooth(method="lm")+labs(y="chemicals",x="YEARS")+ggtitle("Export of Chemicals and related Product")+annotate("text",x=2017,y=c(370000,390000),label=c("Adj R-squared: 0.8138", "22574*chemicals - 45273192"))`
- `summary(Petroleum_Crude_and_related_products~TIME)`
- `ggplot(data.frame(TIME,Petroleum_Crude_and_related_products),aes(TIME,Petroleum_Crude_and_related_products))+geom_point(colour="red")+ggtitle("PETROLIUM AND RELATED PRODUCTS VS TIME")+labs(y="Petroleum And products",x="Years")`
- `summary(lm(Gems_and_Jewellery~TIME))`
- `ggplot(data.frame(TIME,Gems_and_Jewellery),aes(TIME,Gems_and_Jewellery))+geom_point(colour="Blue")+ggtitle("Gems and jeellery products VS TIME")+labs(y="Gems & Jewellery",x="Years")`
- `summary(lm(Textiles_and_Allied_Products~TIME))`
- `ggplot(data.frame(TIME,Textiles_and_Allied_Products),aes(TIME,Textiles_and_Allied_Products))+geom_point(colour="orange")+ggtitle("Textiles product VS TIME")+labs(y="Textiles",x="Years")`
- `summary(lm(Agriculture_and_Allied_products~TIME))`
- `ggplot(data.frame(TIME,Agriculture_and_Allied_products),aes(TIME,Agriculture_and_Allied_products))+geom_point(colour="violet")+ggtitle("Agricultural Products VS TIME")+labs(y="Agricultural Products",x="Years")`
- `summary(lm(Base_Metals~TIME))`
- `ggplot(data.frame(TIME,Base_Metals),aes(TIME,Base_Metals))+geom_point(colour="blue")+ggtitle("Base Metals VS TIME")+labs(y="BASE METAL",x="YEARS")+geom_smooth(method="lm")+annotate("text",x=2017,y=c(250000,270000),label=c("Adj. R-Squared : 0.6972", "14733*TIME -29548184"))`
- `summary(lm(Machinery~TIME))`
- `ggplot(data.frame(TIME,Machinery),aes(TIME,Machinery))+geom_point(colour="green")+ggtitle("Machinery VS TIME")+labs(y="Machinery",x="YEARS")+geom_smooth(method="lm",colour="green")+annotate("text",x=2016,y=c(250000,270000),label=c("Adj. R-Squared : 0.7713", "13283*TIME - 26632367"))`
- `summary(lm(Transport_Equipments~TIME))`
- `ggplot(data.frame(TIME,Transport_Equipments),aes(TIME,Transport_Equipments))+geom_point(colour="maroon")+ggtitle("Transportation Items VS YEARS")+labs(y="Transportation Items",x="YEARS")`
- `summary(lm(Electoronics_Items~TIME))`

- `ggplot(data.frame(TIME,Electronics_Items),aes(TIME,Electronics_Items))+geom_point(colour="sky blue")+ggtitle("Electric Items VS YERAS")+labs(y="Electronic Products",x="YEARS")+geom_smooth(method="lm",colour="sky blue")+annotate("text",x=2017,y=c(85000,92000),label=c("Adj. R-Squared: 0.8183","7612*TIME -15301217"))`
- `summary(lm(Plastic_and_Rubber_Articles~TIME))`
- `ggplot(data.frame(TIME,Plastic_and_Rubber_Articles),aes(TIME,Plastic_and_Rubber_Articles))+geom_point(colour="dark blue")+ggtitle("Plastic & Rubber products EXPORT VS YERAS")+geom_smooth(method="lm",colour="dark blue")+annotate("text",x=2016,y=c(70000,75000),label=c("Adj. R-Squared : 0.646","3318.9*TIME -6643701.5"))`
- `summary(lm(Marine_Products~TIME))`
- `ggplot(data.frame(TIME,Marine_Products),aes(TIME,Marine_Products))+geom_point(colour="orange")+ggtitle("Marine Products EXPORT VS YERAS")+geom_smooth(method="lm",colour="orange")+annotate("text",x=2016,y=c(60000,65000),label=c("Adj. R-Squared : 0.5052","2038.9*TIME -4071298.1"))`
- `summary(lm(Leather_and_Leather_Manufactures~TIME))`
- `ggplot(data.frame(TIME,Leather_and_Leather_Manufactures),aes(TIME,Leather_and_Leather_Manufactures))+geom_point(colour="violet")+ggtitle("Lether Items exported Over Years")+labs(y="Lethar Items",x="YEARS")+geom_smooth(method="lm",colour="violet")+annotate("text",x=2019,y=c(40000,45000),label=c("Adj. R-Squared : 0.656","-1720.1*TIME -3503625.9"))`
- `summary(lm(Articles_of_Stone~TIME))`
- `ggplot(data.frame(TIME,Articles_of_Stone),aes(TIME,Articles_of_Stone))+geom_point(colour="red")+ggtitle("Articles_of_Stone exported Over Years")+labs(y="Articles of Stone",x="YEARS")+geom_smooth(method="lm",colour="red")+annotate("text",x=2016,y=c(40000,42000),label=c("Adj. R-Squared : 0.7761","2312*TIME -4631849"))`
- `summary(lm(Ores_and_Minerals~TIME))`
- `ggplot(data.frame(TIME,Ores_and_Minerals),aes(TIME,Ores_and_Minerals))+geom_point(colour="blue")+ggtitle("Ores and Minerals Exports")+labs(y="Ores and Minerals",x="YEARS")+geom_smooth(method="lm",colour="blue")+annotate("text",x=2016,y=c(46000,50000),label=c("Adj. R-Squared : 0.7078","4029*TIME -8102193.8"))`
- `summary(lm(Paper_and_Related_Products~TIME))`
- `ggplot(data.frame(TIME,Paper_and_Related_Products),aes(TIME,Paper_and_Related_Products))+geom_point(colour="yellow")+ggtitle("Paper and Related Products Exports")+labs(y="Paper and Related Products",x="YEARS")+geom_smooth(method="lm",colour="yellow")+annotate("text",x=2016,y=c(46000,50000),label=c("Adj. R-Squared : 0.9139","2245.6*TIME -4510041.2"))`
- `summary(lm(Optical_Medical_and_Surgical_Instruments~TIME))`
- `ggplot(data.frame(TIME,Optical_Medical_and_Surgical_Instruments),aes(TIME,Optical_Medical_and_Surgical_Instruments))+geom_point(colour="maroon")+ggtitle("Optical Medical`

```
and Surgical Instruments Exports")+labs(y="Optical,Medical & Surgical
Instrument",x="YEARS")+geom_smooth(method="lm",colour="maroon")+annotate("text",x=
2016,y=c(18000,20000),label=c("Adj. R-Squared : 0.7639", "953.5*TIME -1909513.6"))
```

- summary(lm(Plantation~TIME))
- ggplot(data.frame(TIME,Plantation),aes(TIME,Plantation))+geom_point(colour="violet")+ggtitle("Plantation Crops Exports")+labs(y="Plantation Crops",x="YEARS")
- summary(lm(Sports_Goods~TIME))
- ggplot(data.frame(TIME,Sports_Goods),aes(TIME,Sports_Goods))+geom_point(colour="maroon")+ggtitle("Sports Goods Exports")+labs(y="sports Goods",x="YEARS")+geom_smooth(method="lm",colour="maroon")+annotate("text",x=2016,y=c(2200,2500),label=c("Adj. R-Squared : 0.5223", "94.16*TIME -188153.02"))
- summary(lm(Office_Equipments~TIME))
- ggplot(data.frame(TIME,Office_Equipments),aes(TIME,Office_Equipments))+geom_point(colour="red")+ggtitle("Office Equipment Exported")+labs(y="Office Equipments",x="YEARS")+geom_smooth(method="lm",colour="Blue")+annotate("text",x=2016,y=c(1500,1600),label=c("Adj. R-Squared : 0.6822", "124.1*TIME -249511.8"))
- summary(lm(Project_Goods~TIME))
- ggplot(data.frame(TIME,Project_Goods),aes(TIME,Project_Goods))+geom_point(colour="orange")+ggtitle("Project goods Exported")+labs(y="Project Goods",x="YEARS")

TEST FOR PARRALLELITY :

- library(readxl)
- export_dataset_analysis <- read_excel("Six Sem/data for analysis/export_data/export_dataset_analysis.xlsx",
 - + col_types = c("numeric", "numeric", "numeric",
 - + "numeric", "numeric", "numeric",
 - + "numeric", "numeric", "numeric",
 - + "numeric", "numeric", "numeric",
 - + "numeric", "numeric", "numeric",
 - + "numeric", "numeric", "numeric",
 - + "numeric"))
- View(export_dataset_analysis)
- #increasing graphs
- chems_and_ralated_product=c(193983.6,210573.1,219810.4,242114.4,306130.7,319029.8,357765.4,308065.4)
- base_metal=c(151449.3,120845.3,146786.6,181858.3,177767.4,169499.9,204845.7,259100.4)
- macinary=c(120527.2,123890.9,135081.6,158792.4,203532.1,202556.9,195646.4,193363.4)

```

➤ electronics=c(36723.31,37300.41,38144.35,39148.04,58858.07,79567.83,78626.19,77979.07)
➤ plastic=c(36723.31,37300.41,38144.35,39148.04,58858.07,79567.83,78626.19,77979.07)
➤ marine=c(33688.38,31219.43,39593.78,47646.41,47664.94,47618.1,44176.03,45458.53)
➤
articles_of_plaster_etc=c(24701.12,25377.41,27407.68,29136.54,35792.81,37365.86,41805.36,35489.35)
➤
ores_minerals=c(14731.09,13211.29,21828.45,21308.34,25191.32,32605.4,48058.24,33014.59)
➤ paper=c(1332868,15353.87,15655.39,17085.42,24420.9,23901.71,25195.94,28663.57)
➤ optical=c(10310.27,10708.74,12671.4,14657.06,16244.07,16766.74,16460,15662.44)
➤ sports_and_goods=c(1674.08,1487.15,1507.58,1500.23,2195.06,1972.39,1987.58,2148.05)
➤ office_equipment=c(335.54,385.3,791.79,506.85,1013.86,1356.37,1117,1130.53)
➤
➤
➤ year=seq(2014,2021,1)
➤ t=year-2014
➤ t
➤ x=rbind(t,t,t,t,t,t,t,t,t,t,t)
➤
y=rbind(chems_and_related_product,base_metal,macinary,electronics,plastic,marine,articles_of_plaster_etc,ores_minerals,paper,optical,sports_and_goods,office_equipment)
➤ x
➤ y
➤ k=7
➤ n=rep(0,k)
➤ VY=rep(0,4)
➤ VX=rep(0,4)
➤ CXY=rep(0,4)
➤ A=rep(0,4)
➤ B=rep(0,4)
➤ C=rep(0,4)
➤ beta_hat=rep(0,k)
➤ z=rep(0,k)
➤ for(i in 1:k)
➤ {
➤   n[i]=length(y[i,])
➤   VY[i]=var(y[i,])
➤   VX[i]=var(x[i,])
➤   CXY[i]=cov(x[i,],y[i,])
➤   A[i]=n[i]*VX[i]
➤   B[i]=n[i]*CXY[i]
➤   C[i]=n[i]*VY[i]
➤   beta_hat[i]=B[i]/A[i]
➤   z[i]=beta_hat[i]*B[i]
➤ }

```

-
- $CT = \sum(C)$
- $AT = \sum(A)$
- $BT = \sum(B)$
- $\text{beta_hat_pooled} = BT/AT$
- $F_statistic = ((CT - BT * \text{beta_hat_pooled}) - (CT - \sum(z))) / (CT - \sum(z)) * ((\sum(n) - 2 * k) / (k - 1))$
- $F_statistic$

REFERENCES :::

Methods and Information are taken from :

- FUNDAMENTALS OF STATISTICS
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- connect2india.com
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- <https://www.cogoport.com/>
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