

A study of Economic complexity of Indian Exports Vis-à-vis China: A Review Paper based on Atlas of Economic Complexity theory

Purvi Pujari, Anuj Kumar, Srilalitha Sagi, Sachin Napate

Abstract

As the world tries to grapple with the aftermath of the COVID-19 pandemic, there are concerns about the revivals of economies across the globe. The world is also trying to make sense of global restructuring trade, which is expected in the post-COVID-19 world. This paper attempts to analyze the emerging trade scenario between India and China. Atlas of Economic Complexity theory (ACE) by Ricardo Hausmann, Cesar A. Hidalgo has been taken as a base for this research. This study propagates that the countries with products that require more know-how have more potential to grow. Taking the Atlas map giving details of Indian exports as a base, the researchers have compared the data from the last two years. The purpose is to identify whether the complexity of Indian exports is increasing or not. A particular case study has been done on Indian exports to China. There has been little progress in this field as India is exporting more complex products slightly to China. There is an urgent need to formulate a strategy to enhance the complexity of Indian exports. The policymakers need to give impetus to the industries which have a cross-cultural demand in China and leverage this opportunity. This will open the path for consolidating India's position in the global trade as well as improving its strategic position vis-a-vis China.

Keywords: Atlas of Economic Complexity (ACE), Product Complexity Index, Exports, India, China, trade

JEL Codes: F1, F4

1. Introduction

Forecasting the growth of a country is a fascinating and tempting phenomenon. Traditionally forecasting economic growth has been based on the Gross Domestic Product (GDP) of a nation. Forecasting growth potential for any country has many significant benefits for international trade.

The macroeconomic parameters like GDP, per capita income, and employment which has been traditionally used to predict growth, have their limitations. These parameters, though they are a perfect mirror of the current position of the economy, are usually unable to show a clear picture of the future. Understanding the potential of a country to grow regarding what it produces and what is demanded by the world from the government in question is very important. The economic complexity of exports of a country is an excellent robust predictor of its growth. (Hidalgo, et al., 2009). Hence, exports have always been a better reflection of industrial development and the growth potential of any economy. Growth prospects are more in the countries which export complex products (Felipe, et al., 2012). For an emerging economy like India, it is essential to understand and analyze its exports and predict their growth. These

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parameters, though they are a perfect mirror of the current position of the economy, are usually unable to show a clear picture of the future. Understanding the potential of a country to grow regarding what it produces and what is demanded by the world from the government in question is very important. The economic complexity of exports of a country is an excellent robust predictor of its growth. (Hidalgo, et al., 2009). Hence, exports have always been a better reflection of industrial development and the growth potential of any economy. Growth prospects are more in the countries which export complex products (Felipe, et al., 2012). For an emerging economy like India, it is essential to understand and analyze its exports and predict their growth. These predictions can be crucial policy decision-making tools for the long-term vision of a nation. Surprisingly, not much work has been done in this regard, especially on the aspect of the growth potential of India vis-a-vis its manufacturing and export products. Very little literature is available in this regard.

Out of all the export partners of the Indian economy, China holds a significant place. The reasons are China's geopolitical and diplomatic significance, the economic dependence of India on China's imports as well as an export partner, China's investments in India's startups and technology firms. China's technological advancement etc. has made it a strong player in global international trade. Both the countries are the fastest-growing economies that are emerging as leaders in the global trade map. The trade relationship between these two neighbors dates back to history and increasing prominence in the present international economics too. Good relations between India and China cannot boost the Indian economy unless the trade imbalance in exports and imports of the two countries is recovered. COVID-19 pandemic has affected the Indo-Chinese relationships in a negative manner. The repercussions of the pandemic are still felt by the globe. The exponentially increasing cases and loss of life due to the pandemic have been really alarming. (Kumar, et al., 2021). The pandemic has taken a significant toll on lives and hampered the way of life for a considerable number too. (Pujari, 2021). Similar issues were reflected among these two neighbors too.

The tension between the borders of the two countries is clearly visible. Whether the tension between India and China has affected the exports and imports trade between two countries. There is no such significant reduction in exports and imports observed. Both countries understand that they are essential to each other, and they are the pillars of the South Asian region.

It is the third-largest export destination for India. The resulting hampering of production and logistics because of the pandemic has impacted international business and the availability of the human resource. (Kumar, et al., 2020). Given the present turbulence in the Post COVID-19 global economy, it is very significant to study the emerging trade scenario between India and China. For this purpose, the ACE has been taken as a base. The goal is to identify whether the complexity of Indian exports with China is increasing or not. If India wants to emerge as a strong trading partner to China, it must improve the complexity of its exports.

Objectives:

The objectives of this paper are as follows:

1. To analyze the Economic Complexity of India's Exports to China
2. To compare and evaluate the product complexity of Indian Exports vis-à-vis Chinese exports
3. To identify the strategic interventions for enhancing the economic complexity of Indian Exports to China

2. Methods

This research is done with an analysis of secondary data taken from the Department of Commerce, Export Import Data Bank. The objectives have been decided after an extensive literature review of the research papers based on the concept of Atlas of Economic Complexity (ACE). To understand the complexity of Indian Exports to China, the export data from the last

two years have been compared. The authors have reviewed the literature of the previous ten years to explore the arguments for Atlas of Economic complexity. They have also worked on the India-China import and export relationship. The concept of Atlas of Economic Complexity is still unexplored. The authors have used an experimental research design for this paper because this topic area is still unknown. Generally, the exploratory research design is conducted for the problem which was not explored before. This topic has been studied but not in much in detail. The authors faced difficulty in finding papers relevant to this topic area, but the data available on export-import of commodities helped in drafting this paper. In this paper, export-import data was used, so writers didn't show a keen interest in collecting primary data from the public. Based on the literature review and data gathered from various secondary resources, the authors reached towards the findings of the paper. The data used in this paper has been taken from the department of commerce.

Literature Review

The researchers have undertaken an extensive literature review on the areas that have been researched in relation to ACE. Following are the few latest research works on the subject from across the globe.

Table 1 Literature Review (Authors' own)

S. No.	Authors	Arguments for Atlas of Economic Complexity (ACE)
1.	Herrera et al. (2020)	This study focused on the complexity of states in Brazil during a period of twenty years. It identifies that EC has a direct relation with the country's productive systems and institutions. The study also determined that for growth to happen, it is essential for a nation to develop its organizations that are partnering in development.
2.	Nguyen et al. (2020)	The impact of complexity on natural rents in this research. It concluded that Economic complexity has a reduced impact on payments made to such resources.
3.	Sørensen et al. (2020)	This working paper tries to identify the areas and fields that can result in more complexity in the Mozambique economy. It identifies demand-side and supply-side factors to enhance the complexity of the economy to initiate a structural transformation. The needs of an economy should be assessed to open the paths of growth.
4.	Estmann Christian et al., (2020)	This study focused on opportunities in front of Tanzania. It concluded that Tanzania has relatively good knowledge accumulation, which generates many diversification possibilities.
5.	Lan Khanh Chu and Dung Phuong Hoang, (2020)	Income inequality and EC connect have been studied in this recent research. It concluded that the quality of education and public expenditure could be enhanced by

		bringing parity in income.
6.	Sciarra et al. (2020)	This study studied the use of the Atlas to analyze the innovation opportunity and connect it to the complexity of the economy. The study used a mathematical model to assist the findings. It tries to connect entrepreneurial creativity with the growth pattern of an economy.
7.	Vu, (2020)	Using a cross-country OLS regression, this study analyzed the complexity and its impact on differences in income in an economy. The study deduced that the countries that have higher complexity products have the benefit of less income inequality.
8.	Ren et al. (2020)	This research is centered on a model which has nested layers representing the international business of a good. It also studies the comparative advantage of a country and growth prospects in the globe to explore the complexity of international trade.
9	Buhari et al. (2020)	This study focused on the relationship between economic complexity, economic progression, and carbon emissions in an economy. The study was concentrated more on developed countries and put the emphasis on the reduction of pollutants which occur with development.
10	Feix et al. (2019)	The progress of agri-business and its connection with economic complexity has been studied in this paper. The researchers tried to find out can the growth of agriculture in Brazil can be termed as high complex production and its impact on labor productivity.
11	Sepehrdoust et al. (2019)	This research studied the impact of the opening of the economic environment on the EC as a result of the policy followed by the economy. It suggested that it is needed to improve foreign trade and trade liberalization to have better complexity.
12	Termeer (2019)	This study explained the theory of ACE and its implications for Bulgaria. The progress path for the country has been analyzed, keeping complexity in perspective.
13	Gala et al. (2018)	This study focuses on the significance of adopting the Atlas to identify the potential of the future scope for an economy. It tries to identify the similarity and differences between developed and developing economies.

14	Priscila Rubbo et al. (2018)	<p>The connection between a country's Knowledge management practices and ACE was studied in this research. It concluded that India, on account of its knowledge Management practices, has the best growth projection as per substantial productive knowledge, which generates multiple diversification opportunities.</p> <p>Economic complexity and it also concluded that Russia wouldn't be able to achieve much growth as it has the least amount of knowledge management practices.</p>
15	Morrison et al. (2017)	<p>In this study, the researchers study the fitness of nations in relation to the complexity of nations. Also, mention that complex products are those which countries rarely produce. It describes complex economic systems as a network, with nodes representing financial entities.</p>
16	Caria et al. (2017)	<p>This study pointed out the differences between complexity and traditional parameters of growth and development. It studied the export processing zones and the ranking of these countries. The emphasis was on understanding the measures of the progress of an economy and its relation to usual factors considered for development.</p>
17	Hartmann et al. (2017)	<p>The research analyzed the connection between the introduction of products and differences in income. It states that complexity is an essential and negative predictor of income inequality.</p>
18	Gala, Camargo, & Freitas, (2017)	<p>This study concluded that countries with income levels in more significant numbers when measured against their population data usually focus on manufacturing and trading products with more know-how, whereas countries with fewer income levels generally produce and trade goods requiring less technical information.</p>
19	Hausmann et al. (2014)	<p>The connection between the complexity of goods and services traded by a country and the knowledge procurement and growth path possible for a country has been discussed in detail in this research.</p>
20	Cristelli et al. (2013)	<p>The comparative advantage of the nations and the PCI was studied in this extensive research.</p> <p>A model was proposed to assess the growth potential, keeping in mind the measurement of parameters other than income.</p>

The above literature review of the subject shows that ACE has been studied by many researchers around the world. The focus is usually on understanding the correlation between

aspects of the economy like income growth, convergence between poor and rich countries, carbon emission (Buhari, et al., 2020) , etc. The income inequality of a nation can be predicted with the help of ACE (Vu, 2020), (Hartmann, et al., 2017). It can also be of assistance to analyze convergence and divergence among poor and rich countries (Gala, et al., 2018) . The most significant advantage of this tool is to study the growth potential of various countries by considering the demand and supply factors of an economy (Sørensen, et al., 2020). It tells us that countries with better knowledge management practices have the best growth projection. (Priscila Rubbo, 2018). It has also been very crucial in analyzing employment creation vis-à-vis the complexity in the advanced sectors. (Gala, et al., 2018). ACE has also been studied to understand the labor parameter of an economy (Feix, et al., 2019). The impact of ECI and expenditure has also been a part of research on the Atlas. (Nguyen, et al., 2020) The complexity of a nation is also dependent on its institutional set-ups. (Herrera, et al., 2020).

ACE concept of using the complexity of exported products as a reflection of a country's growth potential. It also has a relation with the per capita income of the country. (Gala, et al., 2017). The production capabilities of a nation have a direct impact on its trade competitiveness (Hausmann, 2014). The projection of accumulated capabilities by the economies positively impacts their prospects to develop in the future. The dynamics of growth projection are explained by ACE as per the diversity and ubiquity of its productions. This research connects the acquisition and assimilation of knowledge by an economy to its potential to grow faster.

The tool of ACE has been studied in various aspects connected to any economy. The authors of this paper, after extensive literature review, could not find much of literature where India's growth potential has been analyzed recently. Most of the studies and research are focused on countries other than India. Minimal studies have been focused on the Indian economy's growth potential. However, the book and tool of ACE help in understanding India's growth trajectory vis-à-vis other countries. The other researchers, apart from primary ACE research, have not been based on Indian exports. The product ranking of Indian exports is available in the visualization tool in the ACE study. There has rarely been anything written on the complexity of Indian exports.

The researchers have found a research gap that there is a need to study India's exports as per the Economic Complexity of exports as well analyze the impact of the COVID-19 pandemic on its products offerings. India being an emerging economy, needs to be researched, and its growth path must be analyzed to understand the possibilities of knowledge enhancement and skilling of intellectual capital. The products offered by India for international trade must be high in technology and must be knowledge-intensive.

Atlas of Economic Complexity (ACE)

The ACE is a 2011 economics book by Ricardo Hausmann, Cesar A. Hidalgo, Sebastián Bustos, Michele Coscia, Sarah Chung, Juan Jimenez, Alexander Simoes and Muhammed A. Yıldırım. A revised 2014 edition is published by the MIT Press (Hausmann, 2014). The researchers have ranked a vast number of products, approximately 6000 based on the knowledge required to produce them, and ranked them in an index called Product Complexity Index (PCI). The authors of the book have worked for years to identify the technical knowledge required for the manufacturing of products, right from primary products to the highly sophisticated technical ones. They have then gone ahead and ranked all these products as per the tactical information required to manufacture them. The rank of any product exported by a country can be used to understand the complexity of its exports and, in turn, the growth potential of the country. The Atlas provides a tool for understanding the development prospects of a country by analyzing the types of exports made to the other countries. If the exports made by the government require know-how and knowledge, the exports are said to be of complex nature. The theory states that the countries having more complex products will have more growth potential. This concept has been widely used by researchers across the world to understand the growth potential of various countries by analyzing their export baskets. This tool has explained the phenomenon of expansion and shrinking of economies over the last few decades by

decoding their know-how accumulation. It provides beautiful insights into the development trajectory of an economy.

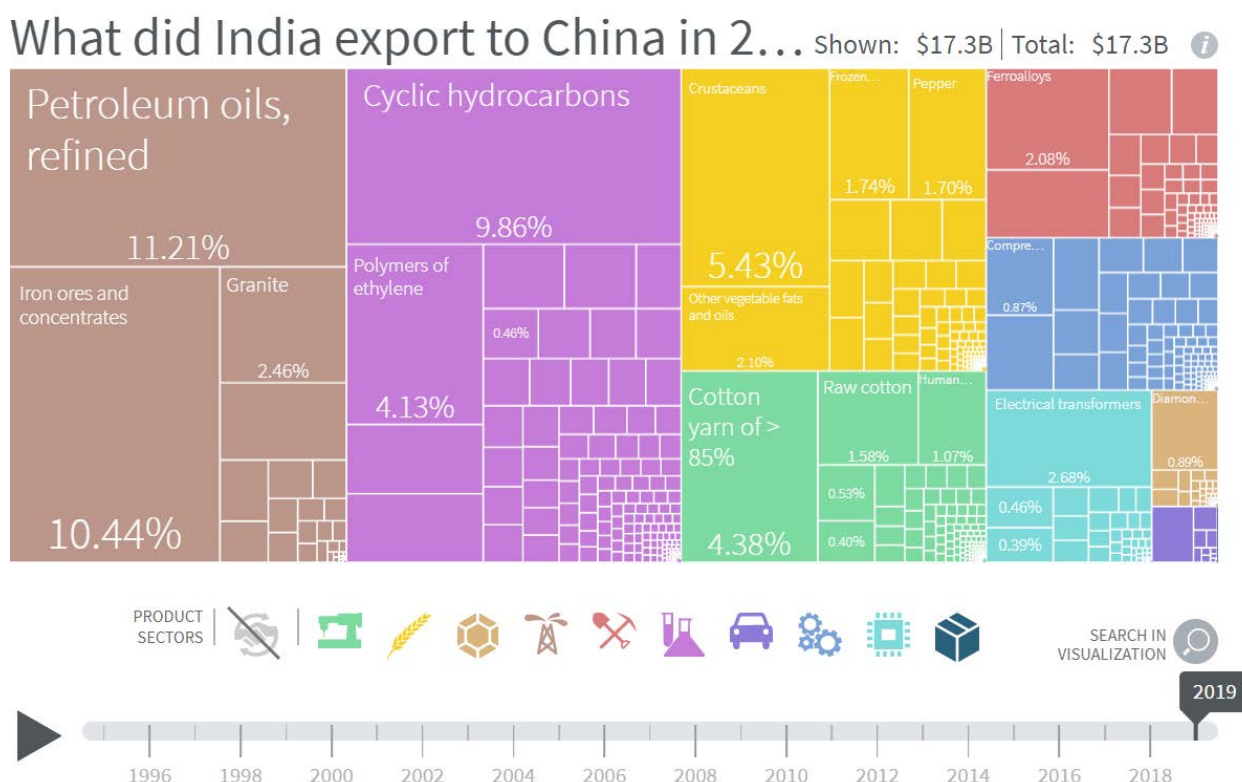
India's exports to China

Suppose we analyze India's significant exports to China in 2018, as per ACE Map (Fig. 1). We see that India is exporting a few complex products to China. The growth can be seen in the field of Electronics, Machinery, and Chemicals which are complex products. But the majority of exports still have low complexity in general.

In literature, India and China are viewed as different comparative modes. The growth of China is primarily dependent on manufacturing, while the development of India is dependent on services. Both China and India are deeply integrated into the global economy through trade and FDI inflows. Both countries have a global presence, but China is leading in comparison to India. What is the possible reason for the Chinese economy doing far better than the Indian economy? Both economies are leading powerhouses of Asia now, but India was under British colonial rule for more than 100 years. In comparison, China was never colonized. This is the reason China has had a much better and planned economic model since its inception. Secondly, China has controlled its population to a large extent in comparison to India. China is very much important for India-China global trade because China contributed more than 5% of India's total exports in the financial year 2019-20. China is also donating 14% towards the import. China is one of the critical exporters to India, and India runs a huge trade deficit with China. Different types of products that China is exporting to India include electrical appliances, fertilizers, chemicals, plastics, and engineering goods, etc. India is much dependent on China for bulk drugs imports. India exported more than 14 billion worth of drugs to the USA in 2018-19, but at the same time, India imported two-third part of its medicines from China.

China and India have a significant influence on the world economy, both in good and bad times.

Both India and China have started with meager per capita income in the 1980s. China worked on lowering the trade barriers and attracted more foreign direct investments inside the country. Chinese ability to attract high foreign direct investments made it a front runner. The policy followed by China is classic industrialization in which the government is slowly moving towards manufacturing from agriculture. China is recognized as an export-led economy now focusing on nanotechnology (Paul & Mas, 2016). While India primarily focused on improving the output of the service sector. India can take learning and motivations from the Chinese economy because the Chinese economy expanded more than 10% per year in the last 30 years while the Indian economy expanded only at the rate of 6% during that period (Qureshi & Wan, 2008). The growth of both the Indian and Chinese economies helped in improving the living standard and over the financial position of thousands of hundreds of people. China's export structure is also changing with a sheer focus on skill-intensive and medium to high technology products. There is a broader scope of trade expansion between India and China because some type of moderate complementarity is observed in their export-import structures.

Fig. 1 India's Exports to China in 2019

Source: Atlas of Economic Complexity, Hausmaan Hidalgo et al. (2014)

The analysis of Fig. 1 helps us to identify and analyze the composition of the export basket of India to China as per ACE. As we can remember from the color-coding, the majority of products are primary in nature. These direct products do not require much tactical knowledge to produce and hence are termed as low or medium complex products as per the ACE. For example, cotton yarn is not a high complexity product that is exported from India to China. Though as per ACE, both the countries rank in the top 10 countries as per growth projections. China has witnessed more resilient growth compared to India as per growth predictions from ACE. India has lagged vis-à-vis China due to a lack of diversification in its export basket. The ACE underlines the need to have both ubiquity and diversity in the exports to ensure sustained progress for the economy.

3. Results

To understand the complexity of Indian Exports to China, we need to analyze the data of Indian exports from the last two years. The researchers have taken a base of the products which are exported to China needs to be more complex, i.e., they need to be products requiring more know-how and technical knowledge. If we see the data from 2018-19 and 2019-20, from the Department of Commerce, Government of India, sorted by top 20 export products to China in the year 2019-20, things become clearer. In Table 2., researchers have sorted the top 20 products which have seen maximum growth in the year 2019-20 along with the percentage growth the commodities have seen in one year.

Table 2 Top 20 Exports to China from India 2018-19 and 2019-20(sorted taking year 2019-20 as base)

S. No.	Harmonized System (HS) Codes	Approx. Rank (PCI) as per the ACE	Commodity Name	2018-2019 Exports in US\$ Million	2019-2020 Exports in US\$ Million	%Growth
1	29	468	ORGANIC CHEMICALS	3,249.21	2,702.44	-16.83
2	26	799	ORES, SLAG AND ASH.	1,220.22	2,356.97	93.16
3	27	942	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES.	2,855.69	2,128.57	-25.46
4	3	1164	FISH AND CRUSTACEANS, MOLLUSCS AND OTHER AQUATIC INVERTEBRATES.	721.26	1,336.57	85.31
5	85	17	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS.	579.52	862.33	48.8
6	39	342	PLASTIC AND ARTICLES THEREOF.	1,104.52	843.06	-23.67
7	84	122	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF.	830.88	804.31	-3.2

8	52	1211	COTTON.	1,786.77	777.96	-56.46
9	25	1011	SALT; SULPHUR; EARTHS AND STONE; PLASTERING MATERIALS, LIME AND CEMENT.	680.83	614.13	-9.8
10	72	236	IRON AND STEEL	318.9	513.91	61.15
11	9	1144	COFFEE, TEA, MATE AND SPICES.	169.39	472.76	179.09
12	15	1059	ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PRE. EDIBLE FATS; ANIMAL OR VEGETABLE WAXEX.	395.7	394.56	-0.29
13	32	1035	TANNING OR DYEING EXTRACTS; TANNINS AND THEIR DERI. DYES, PIGMENTS AND OTHER COLOURING MATTER; PAINTS AND VER; PUTTY AND OTHER MASTICS; INKS.	238.13	317.07	33.15
14	74	557	COPPER AND ARTICLES THEREOF.	244.06	265.91	8.95
15	67	914	PREPARED FEATHERS AND DOWN AND ARTICLES MADE OF FEATHERS OR OF DOWN; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR.	138.48	180.84	30.59
16	90	173	OPTICAL, PHOTOGRAPHIC CINEMATOGRA PHIC MEASURING, CHECKING PRECISION,	150.33	166.78	10.94

			MEDICAL OR SURGICAL INST. AND APPARATUS PARTS AND ACCESSORIES THEREOF;			
17	38	248	MISCELLANEOUS CHEMICAL PRODUCTS.	142.86	148.68	4.07
18	48	410	PAPER AND PAPERBOARD; ARTICLES OF PAPER PULP, OF PAPER OR OF PAPERBOARD.	117.7	127.37	8.22
19	28	64	INORGANIC CHEMICALS; ORGANIC OR INORGANIC COMPOUNDS OF PRECIOUS METALS, OF RARE-EARTH METALS, OR RADI. ELEM. OR OF ISOTOPES.	63.55	105.42	65.88
20	53	937	OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND WOVEN FABRICS OF PAPER YARN.	102.43	90.54	-11.61

Source: Extracted from Export-Import Data Bank, Department of Commerce

Export: Country-wise all commodities, <https://tradestat.commerce.gov.in/eidb/ecntcom.asp>

Data analysis

The analysis of data in Table 2 suggests that only two products: inorganic chemicals and electrical machinery are in the top 100 ranking in PCI. Only these products have a high ranking as per ACE. The higher rank in ACE denotes that product that have been manufactured using more sophistication and know-how. The rest of the 18 products in the top 20 where Indian exports to China have increased are majorly of low complexity. If a country is exporting products like agricultural products and/or primary products, which can be quickly shipped by multiple countries, its growth potential is limited—the reason being that these exports can easily be provided by other countries. For example, maximum growth has happened in the product – coffee, fish. and ores, slag etc., which are as per ACE low complexity products. India should try to reduce the items like oilseeds and other primary products, which do not require much complex information to manufacture. If the products with the highest growth percentage are not complicated, this can be a very negative reflection of India's export basket.

A comparison of data of exports from 2019-20 as compared to exports in 2018-19, we see a slight shift towards medium complexity products as compared to low complexity products and

services. For e.g., the ratio of Electronics and machinery as well chemicals increased in 2019-20. There has been a growth in the products like explosives, pyrotechnic effects, pyrographic alloys, etc. Explosives, pyrotechnic products; matches; pyrophoric alloys; specific combustible preparations rank high in the Product Complexity Index (PCI). India should attempt to reinforce the manufacturing of these export goods. But we see that there is some restructuring that has happened post-COVID-19. In Table 3, the data of India's exports to China from the Department of Commerce, Government of India, has been sorted for Top 20 exports.

Table 3 Top 20 Exports to China from India 2019-20 and 2020-2021(sorted taking year 2020-21 as base)

S. No.	Harm onized Syste m (HS) Codes	Commodity Name	2019-2020 Exports in US\$ Million	2020-2021 Exports in US\$ Million
1	26	ORES, SLAG AND ASH.	2,356.97	4,382.42
2	72	IRON AND STEEL	513.91	2,512.55
3	29	ORGANIC CHEMICALS	2,702.44	2,416.35
4	52	COTTON.	777.96	1,277.24
5	27	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES.	2,128.57	1,046.55
6	39	PLASTIC AND ARTICLES THEREOF.	843.06	949.2
7	15	ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PRE.	394.56	875.91

		EDIBLE FATS; ANIMAL OR VEGETABLE WAXEX.		
8	74	COPPER AND ARTICLES THEREOF.	265.91	779.26
9	84	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF.	804.31	750.73
10	85	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS,AND PARTS.	862.33	717.37
11	9	COFFEE, TEA, MATE AND SPICES.	472.76	674.49
12	25	SALT; SULPHUR; EARTHS AND STONE; PLASTERING MATERIALS, LIME AND CEMENT.	614.13	628.72
13	26	ORES, SLAG AND ASH.	2,356.97	4,382.42

14	72	IRON AND STEEL	513.91	2,512.55
15	29	ORGANIC CHEMICALS	2,702.44	2,416.35
16	52	COTTON.	777.96	1,277.24
17	27	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES.	2,128.57	1,046.55
18	39	PLASTIC AND ARTICLES THEREOF.	843.06	949.2
19	15	ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PRE. EDIBLE FATS; ANIMAL OR VEGETABLE WAXEX.	394.56	875.91
20	74	COPPER AND ARTICLES THEREOF.	265.91	779.26

Source: Extracted from Export-Import Data Bank, Department of Commerce

Export: Country-wise all commodities, <https://tradestat.commerce.gov.in/eidb/ecntcom.asp>. Accessed on 10/11/20, 11.00 am

The exports have seen welcome changes from 2019-20 onwards, as per the product complexity is concerned. There are some complex products that have already entered the top 20 exports list.

As per Table No. 3, Electrical Machinery and Equipment and Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers and parts which rank 87 as per Product Complexity Index (PCI), are 10th largest export from India to China. Nuclear Reactors, Boilers, Machinery and Mechanical Appliances; Parts rank is 167, as per Product Complexity Index (PCI), are 9th largest export from India to China. This really shows that India has started exporting more and more complex products to China. Organic Chemical, which is 202nd rank in the Product Complexity Index (PCI), is our third largest export to China. India should try to switch from such low complexity products to high complexity products. Similarly, the sixteenth-highest export is Cotton, which is a primary product. Its rank as per the Product Complexity Index (PCI) is approx.1128, which again denotes low complexity. Ores, Slags and Ash which is our top highest export is a low complexity product based on Product Complexity Index (PCI), its rank is approx. 816. Hence, we can safely conclude that majority of Indian exports to China are of low complexity.

India's total exports to China in 2020-21(Apr-Dec.),were 17,133.84US\$ Million which was a 5.62% share of total exports. In the 2019-20(Apr-Dec) , total exports were \$ 15,264.23, which was 7.58% of total exports. as per statistics from the Department of Commerce, Export Import Data Bank.

Findings and recommendations

A detailed analysis of Indian exports to China suggests that there is a lot to be expected in terms of the complexity of Indian exports to China. Iron and Steel exports to China accounted for 2,512.55 billion dollars, Iron Ore for 4,382.42 billion dollars, and Organic chemicals accounted for 2,416.35 billion dollars for the year 2020-21 All three products are low in complexity. Hence, we can safely conclude that India's exports to China are at low to medium complexity.

There have not been much improvement post-COVID-19 too. India has been lagging behind China in the global rankings. Now, with China facing the threat of hostile relations with the United States of America, this is the perfect time to rethink its export strategies. For India to gain trade competitiveness at the global level, it must enhance the value addition and diversity of its exports. There is an increased need for intervention, given the tactical significance of our neighbor. It is highly imperative that we shift to products that require more technical knowledge and know-how in place of primary products. Also, the priority should be to explore the manufacturing of export-oriented products which are produced by very few countries. In the long –term, India should also shift the focus to other countries, where it commands better economic and political relations. The policymakers need to give impetus to the industries which have a cross-cultural demand in China and leverage this opportunity. This will open the path for consolidating India's position in the global trade as well as improving its strategic position vis-a-vis China.

Strategies for enhancing economic complexity of Indian Exports to China

There is an urgent need to creatively formulate a plan to improve the sophistication of Indian exports. Following are a few creative strategies identified by the researchers which can be adopted by the government and the policymakers with the objective of getting better leverage against its neighboring country China:

1. The focus of the policymakers should be to make exports to China more complex. If the complexity of the exports is increased, there will be fewer chances of other competing nations overtaking India as an exporter to China. A detailed study of Indian exports to China should be undertaken, and the products of high complexity should be identified. An attempt should be made to increase the exports of such products.
2. The priority should be given to products and services which are less ubiquitous (Hidalgo, et al., 2009). In other words, the products which are produced by only a few

countries should be exported to keep our position as a leading export partner of China. This will require a detailed analysis of India's export basket to China.

3. The preference should be given to products and services which are less dependent on imports. The focus should be to make export self-sustainable. India imports many products from China. Any restriction in imports will adversely impact our exports. It cannot be done without creating an alternative solution. The emphasis should also be on diversifying the country base of its imports too. The use of Artificial Intelligence can also be explored in this matter. AI can be very significant in improving operational and organizational efficiency. (Bhalerao, 2022)
4. There should be an attempt to reduce the proportion of low-tech and high labor-intensive products in the export basket. China already has a sizable labor population. Hence, exporting labor-intensive products to China is not a good strategy in the long term.
5. In general, India should work towards diversifying its exports into the category of more complex products. (Hidalgo, et al., 2009). This will give the economy more leverage against other competing countries and reduce the risk for exports.
6. The basket of exports should be spread across various countries. Given the dynamic diplomatic relations with China, this will be a better long-term strategy. India should also shift the focus to other countries, where it commands better economic and political ties. COVID-19 demands more creativity and innovations from policymakers as well as organizations. (Kumar, 2021)
7. There must be government-initiated drives to invite FDI in goods and services of high complexity. There should be initiatives taken by SMEs and policymakers in bringing more integration as well as diversification, specifically in the export sector (Kumar, 2021).
8. An attempt should be made to reduce the percentage of low complexity products. The efforts should be made to gradually reduce the quantity of low-value export products.
9. An analysis of the domestic demand of China should be done to strategically identify the products which can be targeted in the future.
10. In the post-COVID world, as a new global order is emerging, India should reexamine its export strategy and creatively design its export basket to reemphasize its focus on self-sustenance. Initiatives like Aatamnirbhar Bharat must have the strategic intent to develop entrepreneurial talent in knowledge-intensive industries.
11. To facilitate Indian exports to China, there is an urgent need to foster a bilateral environment of continuous interaction, and the focus should be on promoting trade through positive initiatives. Recent border tension escalation should not have a persisting impact on the trade scenario between the two countries.
12. The obstacles like lack of information to Indian exporters regarding legal processes prevalent in China, local regulations and procedures, imposition of excessive customs duties, the complicated and ever-changing regulatory framework should be modified.

4. Conclusion

The more complex the exports of a country are, the higher are the chances of it having sustainable development. Difficult exports would enable the government to identify more such products which it can manufacture and export. Over the years, not much has been done to increase the complexity of Indian exports vis-à-vis China. As per the latest data from ACE rankings, China is in the eighteenth position, whereas India is at forty-second position in the world country rankings. There is an urgent need for strategic intervention to achieve more complexity in the exports. Higher complexity would open paths for India to have a stable and sustainable growth path. Higher complexity would also ensure the identification of other knowledge-intensive industries which can be identified for boosting exports. Over the last few years, there has been little progress in terms of the complexity of the exports of India to China from 2019 onwards. It has improved more post-COVID-19. India should maintain the same direction and growth of exports as China. As India purposely moves forward with a strategic intent of Aatamnirbhar Bharat and Make in India, such rethinking is very crucial. The

policymakers should identify new productive areas to boost the rapid but sustained growth trajectory. It should attempt to improve the complexity of its exports by focusing on reducing the ubiquity and addressing the need to have sophisticated and specialized capabilities. As the world is still seeing the waves of Anti- China emotions, this is the right time to strategically design the export basket to China and get global leverage. The policymakers need to give impetus to the industries which have a cross-cultural demand in China and leverage this opportunity to progress in the international trade landscape.

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