

Impact Analysis of Lockdown in COVID-19 on agriculture using Machine Learning Regression model

Ankur Dumka¹, Parag Verma², Parvesh Bansal³, Anil Bisht⁴, R.P.S. Gangwar⁵, Anuj Bhardwaj⁶

¹Associate Professor-Computer Science & Engineering, Women Institute of Technology (Govt.), Dehradun, India

²Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India

³Assistant professor, Govt. Engineering College, Bharatpur, Rajasthan, India

⁴Assistant Professor, Dept. of Computer Science & IT, MJP Rohilkhand University, Bareilly, India

⁵Director, Women Institute of Technology, Dehradun, India

⁶Professor, Computer Science and Engineering, Chandigarh University, Punjab, India

Email: ¹ankurdumka2@gmail.com, ²parag_verma@yahoo.com; ³bansal086@gmail.com,
⁴anil.bisht@mjpru.ac.in, ⁵profrpsgangwar@yahoo.co.in, ⁶anuj2k3@gmail.com

Abstract: COVID-19, which emerged in January 2020, has affected almost all sectors of the economy. Agriculture sector also contributes in controlling the economy on a large scale. Social distancing is the only effective way to prevent the corona virus. In order to implement social distancing, more than 80 countries around the world have implemented the provision of lockdown. The lockdown has affected almost all sectors of the world, such as education, travel and hospitality, and agricultural imports and exports. This paper calculates the impact on the agriculture sector due to the lockdown under COVID-19 using a machine learning regression model. To understand the impact of COVID-19 on agriculture, we took a case study of one of the major agricultural countries, INDIA, and studied the impact using datasets collected from various sources. A significant positive relationship between food inflation, import goods and export commodities has been revealed by the results of data collision. This indicates that the decline in imports and exports of goods has led to a spurt in food inflation.

Keywords: Agriculture, COVID-19, Lockdown, Machine Learning, Regression Model

1. INTRODUCTION:

Since the start of 2020, the outbreak of COVID-19 has shaken the entire economies of the world. As the pandemic spread across the world, many experts feared that global food supplies would begin to shrink, being affected by steps taken by countries around the world, such as social distancing, lockdown, etc., especially if the supply chain has been interrupted due to the lockdown in various counties.

As India is the second largest agricultural economy in the world, the agricultural sector is one of the primary sectors which make a special contribution to the country's economy. The

impact on farmers has a big and direct impact on the economy of any country. The agricultural sector consists of various fields such as farming, fisheries and forestry. Almost all the secondary or tertiary sector of the economy is directly and indirectly dependent on the agricultural sector. The agricultural sector contributes about 6.4% of the total world economic output. The total estimated production of this area is about \$ 5084800 million. In terms of agricultural sector contribution, the major contributing countries are China and then India. China's contribution is 19.49 while India's contribution is 7.39 percent of the total agricultural production, while the United States with the world's largest economy ranks third. Out of a total of 226 countries, the economy of about 9 countries plays a major role in the agricultural sector. In which three countries derive more than 50% of their GDP from the agriculture sector itself.

The agriculture GDP of top 10 countries with the comparison of the share of agriculture in their total GDP is discussed as follow:

S. No.	Country	Overall GDP	Contribution of agriculture in GDP	Share of agriculture in GDP
1	China	1.194	9.91	8.3
2	India	0.2439	3.75	15.4
3	United States	1.936	1.742	0.9
4	Brazil	0.2081	1.29	6.2
5	Indonesia	0.0923	1.283	13.9
6	Nigeria	0.03948	0.852	21.6
7	Russia	0.1469	0.6904	4.7
8	Pakistan	0.02789	0.688	24.7
9	Argentina	0.0619	0.67569	10.9
10	Turkey	0.0841	0.5636	6.7

Table 1: top 10 countries agriculture contribution in economy

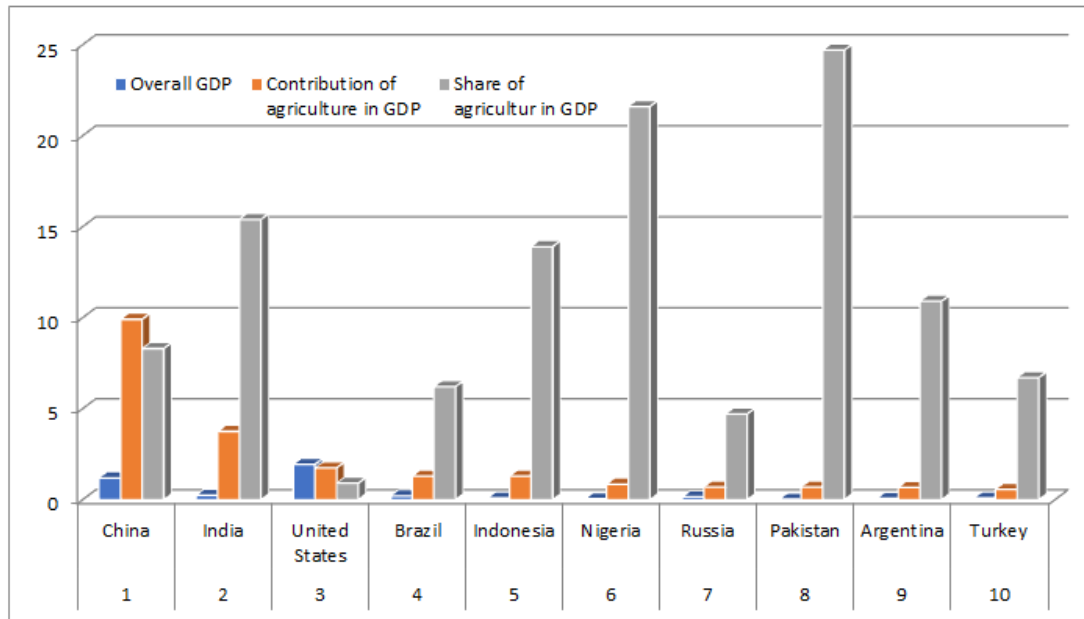


Figure 1: Share of agriculture GDP on GDP of the countries

From figure 1 it is quite clear that China sharing the maximum GDP followed by India, US, Brazil, Indonesia, Nigeria, Russia, Pakistan, Argentina and Turkey. These are top 10 countries contributing maximum agriculture GDP across the world.

Corona virus popularly known as COVID-19 which first reported in china in the month of December 2019 has covered nearly all the countries across the globe. As on 6 June 2020, there are 6,843, 840 number of cases of corona virus with 398071 number of deaths and 3335219 number of recovered cases across the globe. The number of Corona cases across the world taking the top 10 affected countries as per data available on 6 June 2020 are as follows:

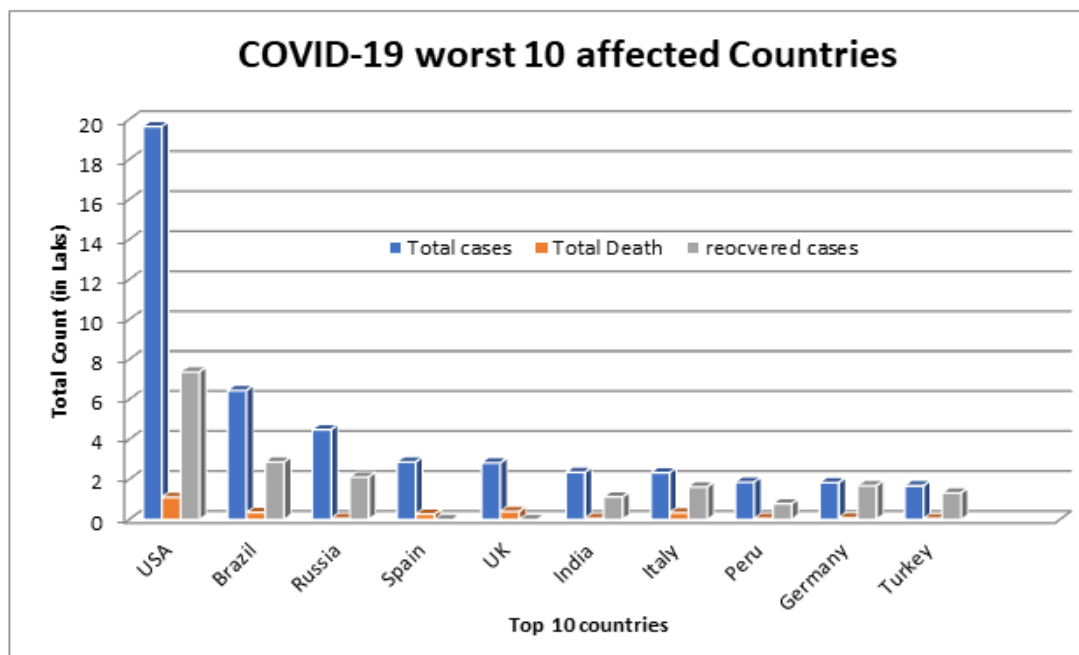


Figure 2: COVID-19 worst affected countries across the world

The scientist across the world are searching for vaccine for the CORONA virus but till date, there is only solution to deal with this virus is by means of physical distancing and different countries has imposed lockdown in order to ensure the social distancing among their citizens on different time periods. But on the other hand, there are other aspects of lockdown is on the economy and other sectors of the countries which had a large impact on different sectors and agriculture is another area which is highly impacted from lockdown. Since China leads in agriculture contribution to GDP but in our case we take the case study of India as India leads second in terms GDP contribution to GDP and also in top 10 countries in terms of number of CORONA cases across the globe which help in getting the good results for our study.

This paper focuses on the impact of CORONA or lockdown on agriculture sector using approach of deep learning. In order to study the impact of COVID-19, we had consider the case study of country India and analyze the impact of COVID-19 and lockdown on agriculture and measures taken to deal with this impact on agriculture.

Review work:

CORONA has impacted different sectors like GDP, education, economy, job, living style etc. There are many researches that focused on impact of CORONA in different fields which are discussed in this section.

Researcher Verma with team (Verma et al. 2020) study the impact of temperature on number of cases in COVID-19. The study was based on the data analyzing the variation of temperature in different countries with respect to the number of cases across different countries.

Researcher Joachim O. with team (Otte et al. 2008) studies the impacts of highly pathogenic avian influenza (HPAI) strain H5N1 and control responses on the livestock sector and associated industries in developing countries.

Researcher Steege A. with team (Steege et al. 2009) study about the influenza pandemic among farm workers. In their research, they find that farm workers are at increased risk of exposure to influenza A virus due to limited resources, immigration status, cultural and communication barriers, substandard housing and discriminations as few reasons. In their research, they collect the recommendation from different peoples like farmworkers associates, state and federal government agencies, migrant clinicians, researchers and industry stakeholders on how to remove these barriers from farm workers, they also include surveillance of livestock farmworkers which include their service organization in planning effort and separation of immigration enforcement from emergency assistance so that they will be less prone to the exposure of influenza A virus.

Researcher Dennis A. with his team (Andrulis et al. 2012) provides a synthesis of research documenting racial and ethnic disparities in morbidity and mortality associated with the 2009-2010 H1N1 pandemic, exploring their underlying root reasons and providing a path forward for integrating diversity and equity into pandemic planning and response.

Researcher Sufiyan A. with his team (Sufiyan 2014) incorporating the vulnerabilities of the marginalized population in each phase of disaster management planning, from mitigation to recovery. In their research, they use correlation and regression analyses to find the association between disaster impacts and different poverty conditions. For their research they focus on 253 countries and find that people living in poverty have a significant positive association with disaster fatalities and property damage, which demonstrates that natural disasters are likely to increase poverty. While the counties with more socially disadvantaged groups are more vulnerable to disaster.

Researcher Trumen B. with his team (Truman et al. 2009) find in their research that immigration and refugees are more vulnerable to influenza pandemic. The reason for their more vulnerability is due to their pre-existing health, living conditions, social disparities and migration history. These vulnerable population and their service providers need information to overcome limited resources, inaccessible health services, limited English proficiency and foreign language barriers, cross-cultural misunderstanding, and inexperience applying recommended guidelines.

Data collection

For this we had collected data from December, 2019 to April, 2020 to simulate our results:

	December	January	February	March	April
Import	39628.22	41147.768	37497.46	31164.59	17120
Trade balance	-12249.159	-15175.347	-9850.2	-9758.2	-6760
Total Export	27379.061	25972.42	27647.26	21406.39	10360
Food Inflation(Cost of food)	13.63	10.81	8.76		
Producer prices	122.9	122.2	121.1		

Table 2: India import/export, food inflation and producer price data variance from December, 2019 to April, 2020.

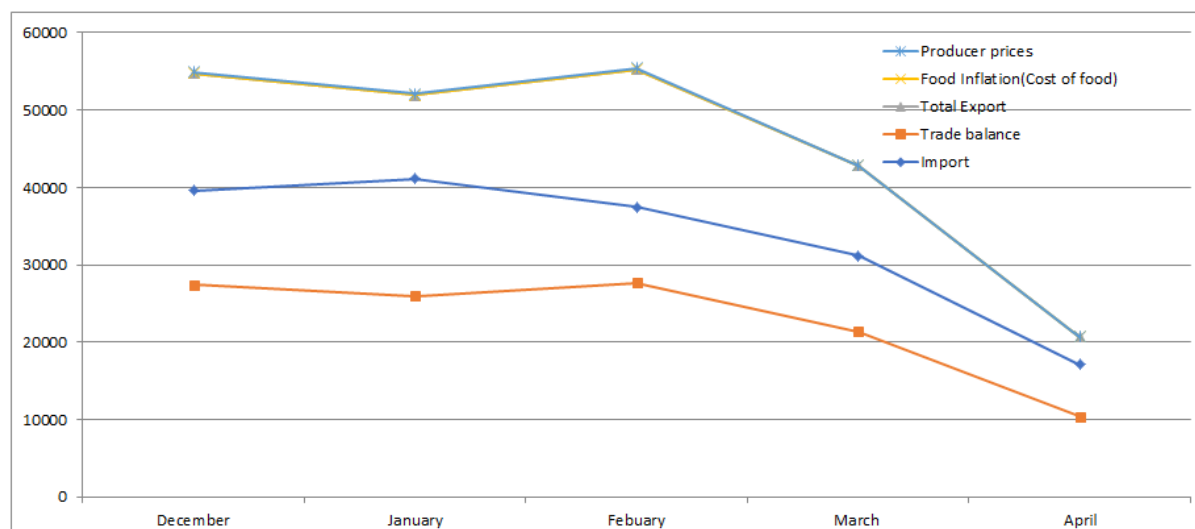


Figure 3: Timeline series analysis of COVID-19 impact on India import/export business

	December	January	February	March	April	May
Beeyu Overseas Ltd.	0.38	0.35	0.34	0.39	0.33	0.31
Bombay Burmah trading	1092.9	1070.8	1118.15	1102.45	716.75	854.5
Diana tea Company	10.7	9.71	10.39	7.33	6.89	9.12
Goodrickle group	195.75	211.7	181.45	159.55	117.95	137.45
Harison malyalam	48.7	64.85	58.05	62.6	56.4	58.3

Table 3: Agriculture industry stock analytical data

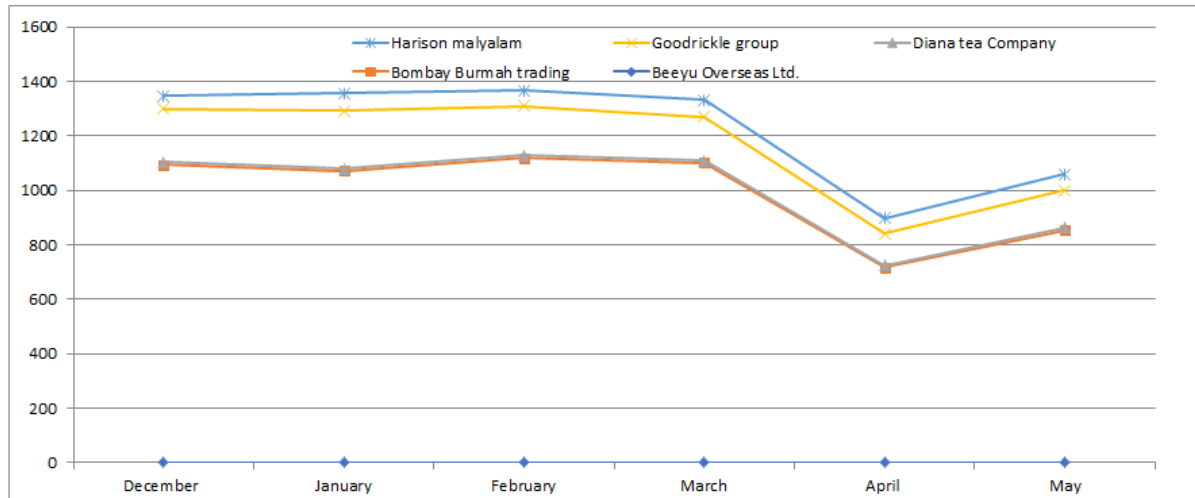


Figure 4: Timeline series analysis of COVID-19 impact on agriculture industry stock

	December	January	February	March	April	May
Apex Frozen Foods Ltd	301.9	403.3	373.85	262.15	229.4	204.75
Avanti Feeds	514.45	603.7	670.05	443.95	283.85	401.45
Coastal Trawlers Ltd	232.55	284.7	281.15	212.15	178	199.9
Waterbase Ltd.	110.8	144.3	148.65	103.95	89.7	88.6
Zeal Aqua Ltd.	89	88	107.7	69.2	50.25	75.6

Table 4: Aquaculture industry stock analytical data

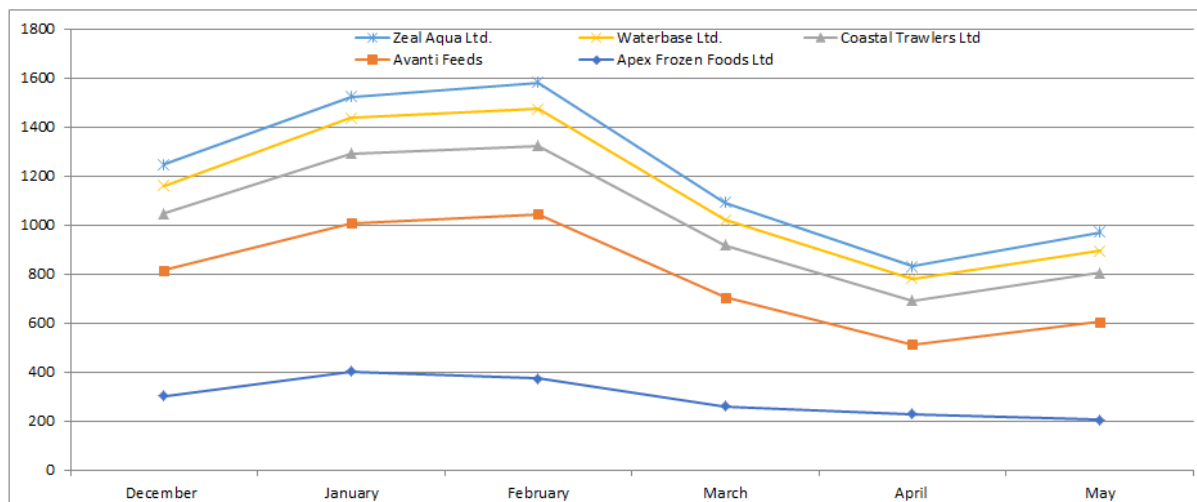


Figure 5: Timeline series analysis of COVID-19 impact on aquaculture industry stock

	December	January	February	March	April	May
Chaman Lal Setia Exports Ltd.	43	51.35	49.5	46.85	39.65	38.5
GRM Overseas Ltd.	189	190	160.3	151	149	150.1
Himalaya Food International Ltd.	5.9	6.83	7.33	7.6	5.43	6.74

Kovilpatti Lakshmi Roller Flour Mills Ltd.	30.25	34.55	37.5	32.05	28.9	27.5
Kohinoor Foods Ltd.	10.1	9.3	8.45	6.8	6.7	8.1

Table 5: Food processing industry stock analytical data

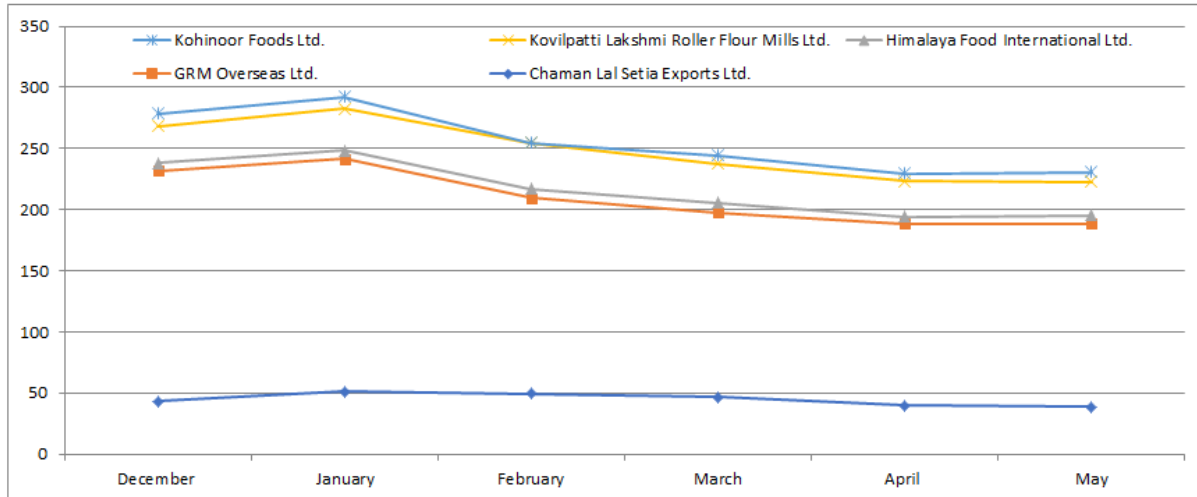


Figure 6: Timeline series analysis of COVID-19 impact on food processing industry stock

	December	January	February	March	April	May
A-1 Acid Ltd.	58.75	54.55	59	59.8	55.5	59
ABans Enterprises Ltd.	189.6	252.1	249.15	282.65	147.75	185
Adani Enterprises Ltd.	207.85	208.3	220.9	225.75	138.15	131.55
Amforge Industries Ltd.	0.87	0.73	0.91	0.71	0.54	0.72

Table 6: Trading company stock analytical data

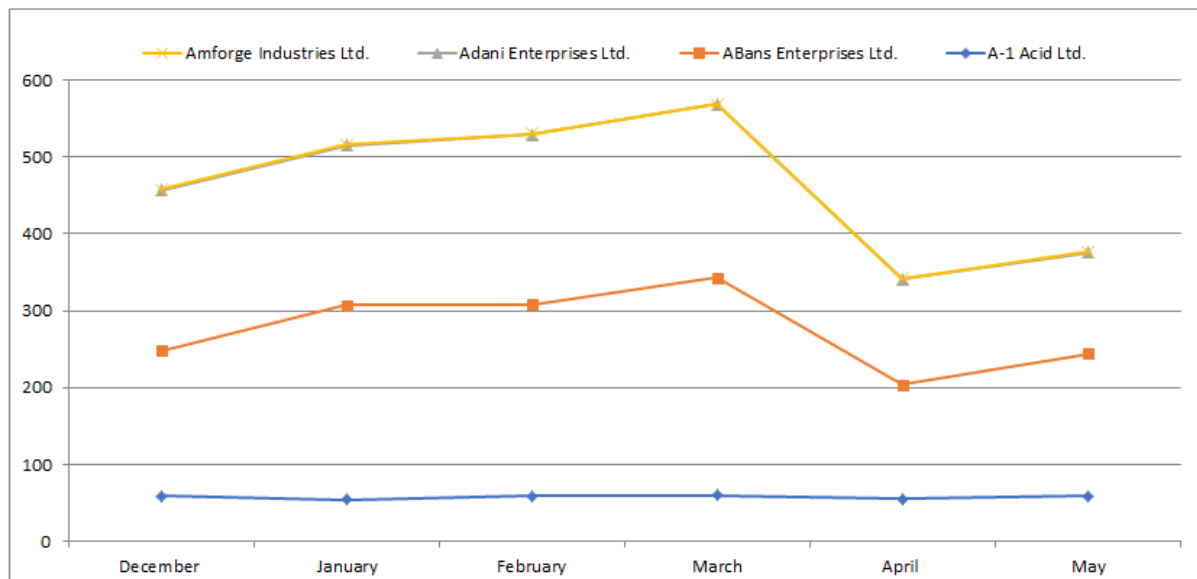


Figure 7: Timeline series analysis of COVID-19 impact on trading company stock

	December	January	February	March	April	May
Chowgule Steamships Ltd.	3.62	2.36	3.55	3.25	2.76	3.24
Essar Shipping Ltd.	7.3	6.55	6.5	5.8	5	7.85
Great Eastern Shipping Company Ltd.	312.75	301.75	300.85	248.95	201.45	226.5
Hariyana Ship Breakers Ltd.	41	41.35	42.95	26.7	24.4	26
Mercator Ltd.	0.95	0.85	1.05	0.7	0.6	0.75

Table 7: Shipping company stock analytical data

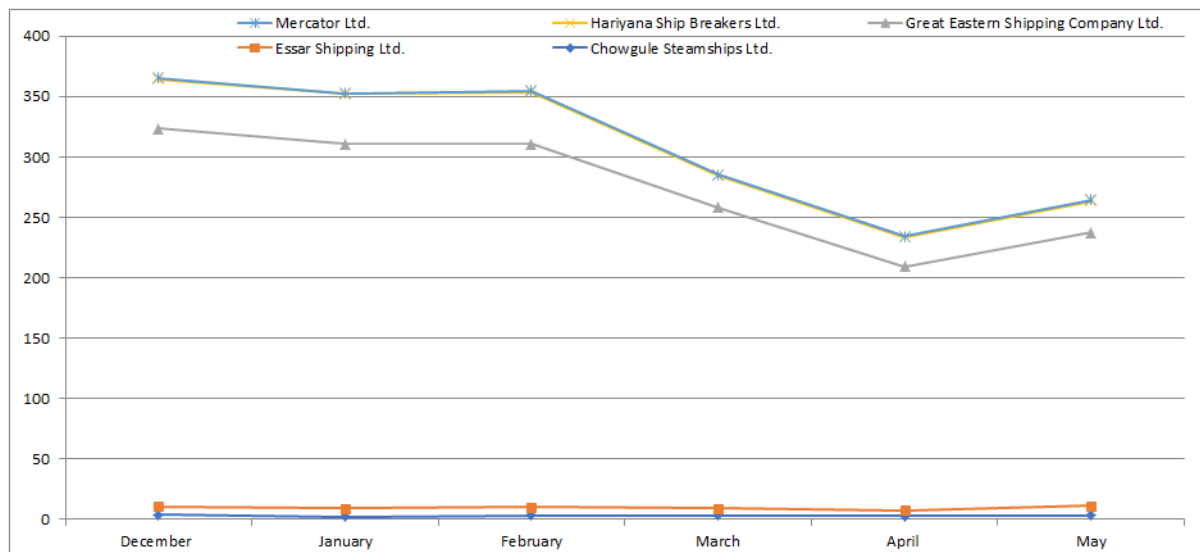


Figure 8: Timeline series analysis of COVID-19 impact on shipping company stock

	December	January	February	March	April	May
ADF Foods Industries Ltd.	306.55	309.85	286.3	257.3	174.6	197.2
Amrit Corporation Ltd.	563.05	601	690	630	631.6	587.9
Bambino Agro Industries Ltd.	116.05	113.75	124.7	92.1	95.65	97.75
Anik Industries Ltd.	8.85	8.3	10	7.35	6.65	9.1
Britannia Industries Ltd.	3048.3	3038.8	3230.1	3026.5	2563.3	3093

Table 8: Consumer food based industry stock analysis

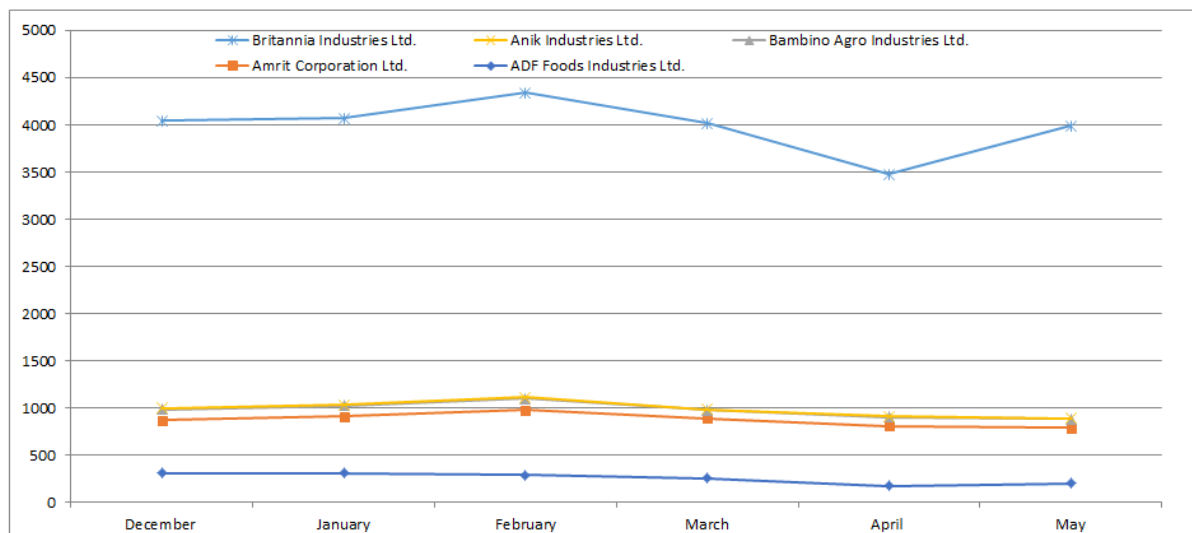


Figure 9: Timeline series analysis of COVID-19 impact on consumer food based industry stock

When comparing the different agriculture based product approach for finding the impact of COVID-19 on agriculture sector:

	December	January	February	March	April
Food price	13.24	11.51	7.79	4.91	
Vegetable	69.69	52.72	29.97	11.9	
manufacturing	-0.25	0.34	0.42	0.32	
WPI	2.76	3.1	2.26	1	

Table 9: Influence on agriculture based products of COVID-19

Where the data of following item cannot be calculated due to non-availability of manufactured product

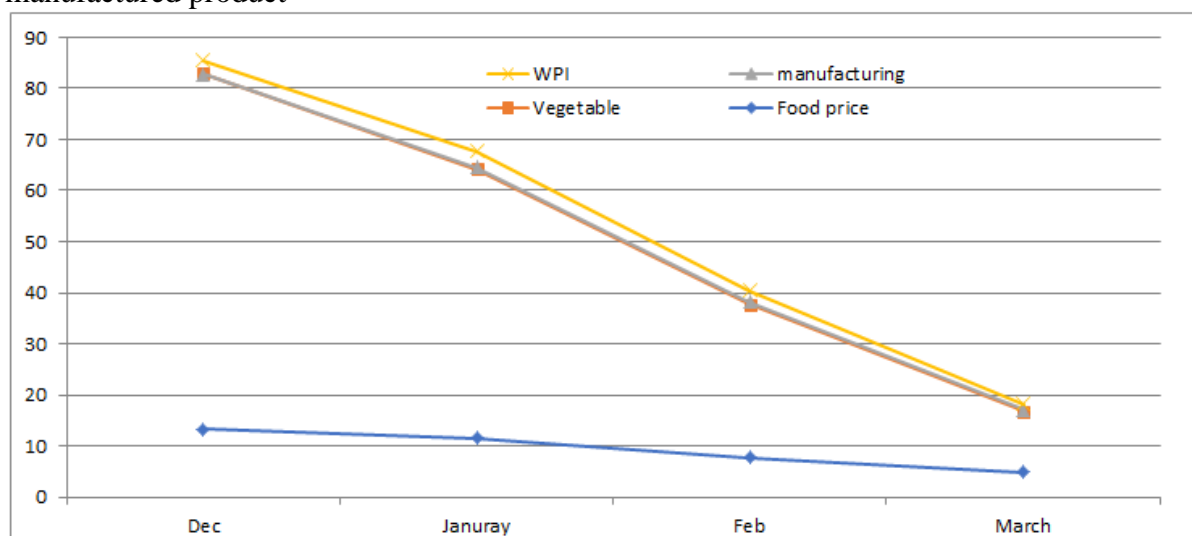


Figure 10: COVID-19 impact analysis of food products

2. METHODOLOGY:

The data analysis of agriculture will help in evaluating two major aspects as significance correlation ship between food inflation rate and import and export business and significance correlation ship between food inflation rate and agriculture industry, food processing, trading companies.

Thus, paper establishes a relationship between agriculture industry, food processing industries and trading companies of import and export businesses. In this approach we have adopted Pearson correlation and multiple regression models to establish a relation between agriculture and associated industries.

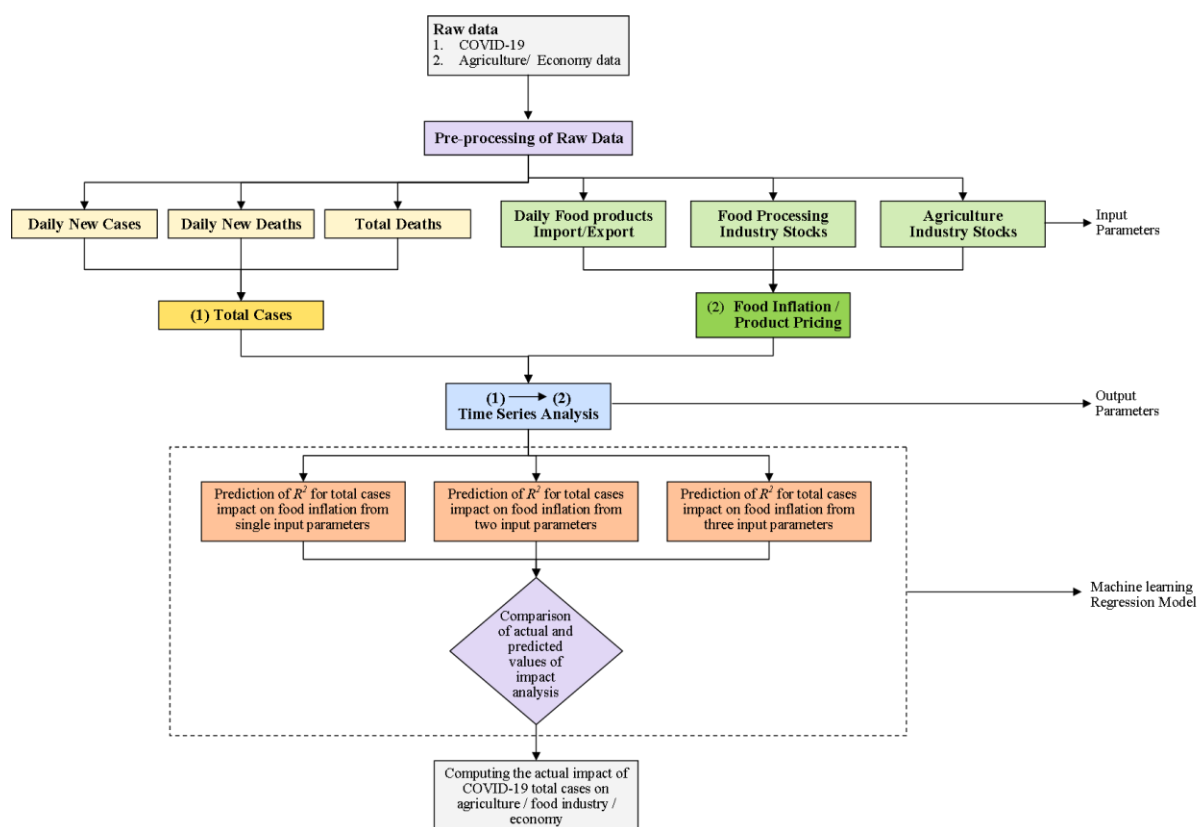


Figure 11: Flow chat of methodology modelling

<i>Regression Statistics</i>	
Multiple R	0.932780498
R Square	0.870079457
Adjusted R Square	0.783465761
Standard Error	1.054844669
Observations	6

Table 10: Regression model Output summary

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	22.35524151	11.17762075	10.04551822	0.0468292
Residual	3	3.338091827	1.112697276		

Total	5	25.69333333			
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Table 11: Regression model ANOVA Outcomes summary

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	2.494542964	5.260238716	0.47422619	0.667718506	-14.2458843	19.23497023	-14.2458843	19.23497023
Food Inflation	-0.191012036	0.240816721	-0.793184274	0.485612458	-0.95739832	0.575374248	-0.95739832	0.575374248
Import	0.666479664	0.170571935	3.907323114	0.029775328	0.12364364	1.209315689	0.12364364	1.209315689

Table 12: Regression model outcomes between food inflation rate and product import during COVID-19 time series

3. RESULT AND DISCUSSION:

The result shows that there is a significant positive relationship between the food inflation, import commodity and export commodity, $r(5) = 0.93$, $p < 0.04$.

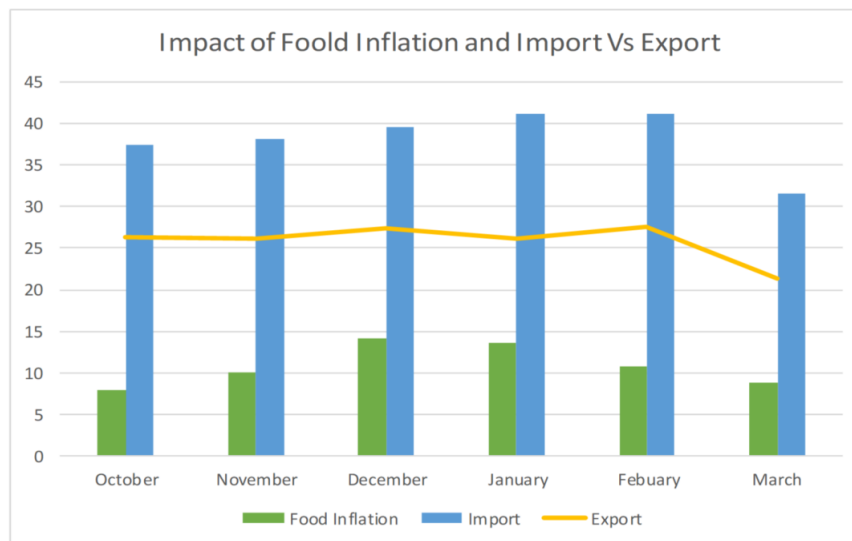
<i>Observation</i>	<i>Predicted Export</i>	<i>Residuals</i>	<i>Standard Residuals</i>
1	25.9138	0.486203	0.59505
2	25.97539	0.124612	0.152509
3	26.19005	1.209952	1.480826
4	27.28336	-1.18336	-1.44828
5	27.82202	-0.22202	-0.27172
6	21.81539	-0.41539	-0.50838

PROBABILITY OUTPUT

<i>Percentile</i>	<i>Export</i>
8.333333	21.4
25	26.1
41.66667	26.1
58.33333	26.4
75	27.4
91.66667	27.6

4. CONCLUSION:

There is a significant positive correlation between food inflation, import commodities and export commodity, $r(5) = 0.93$, $p < 0.04$, during the January 2020 to March 2020 COVID-19 pandemic time period. The increase in total COVID-19 cases is directly proportional to the import/export business of the food industries. Since India is the world's second largest agricultural economy, the rise in COVID-19 cases has a direct bearing on the food industry which is directly linked to agriculture and the country's farmers.



5. REFERENCES

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