ARGENTINIAN MAIZE INTERNATIONAL TRADE

SUMMARY

The graphs have been made using Plotly library and have some dynamic components, to see them please open the notebook in a tool outside of GitHub. Just in case, those figures are contained also as images

Open in Colab

INTRODUCTION:

Argentine is a South American country with an important impact on Cereals in its International Commodities Trade where Maize reached the third position among the top export commodities from 2019 to 2022 and the country itself has been among the top exporters of the commodity during the last years *[1]*.

The data used for analyzing the market was obtained from the United Nations Stats and other open sources, the information and insights in the present document can't be used with commercial purposes keeping each data source with their original licences.

OBJECTIVE:
The present document has been developed as a descriptive resource to analyze the Argentinian Exports of Maize patterns, which will be defined by the following objective:

- Identify patterns among trade partners' behaviour.
- Identify topics or inquiries for a future diagnostic analysis development.

[1] (Department of Economic and Social Affairs, United Nations International Trade Statistics Yearbook 2021).

00.00. RESOURCES AND WORK ENVIRONMENT SETTING

For a better final user reading and comprehension, the code for the object creation (graphs and tables) is contained in a custom-made local library called "prpSummaryFunct".

00.01. LIBRARIES AND WD

In [1]:
```
##-- LIBRARIES
import os

##-- WORK DIRECTORY
wd = 'C:/Users/jrab9/OneDrive/08.Github/2023.HS10-ARG.Clustering/01.Data/'

os.chdir(wd)

##-- CUSTOM BUILD FUNCTIONS
import prpSummaryFunct as exSum
```

01. ANNUAL VALUES

2022 is the last year of data in the dataset analyzed, for this year the total exports of the country reached 86.627,2 USD Millions and Maize esports reached 8.311,6 USD Millions, 8.7% less than 2021. In 2020 the world faced a global crisis due to the COVID-19 pandemic (declared as a Public Health Emergency of International Concern by the World Health Organization in January 2020 and as a Pandemic on March 2020) *[2]* , the same year a particular phenomenon occurred with the International Trade Values of Argentine, the total exports decreased an 18.9% but the cereals (including Maize) has increased over 48%, an unusual value among its other closer years.

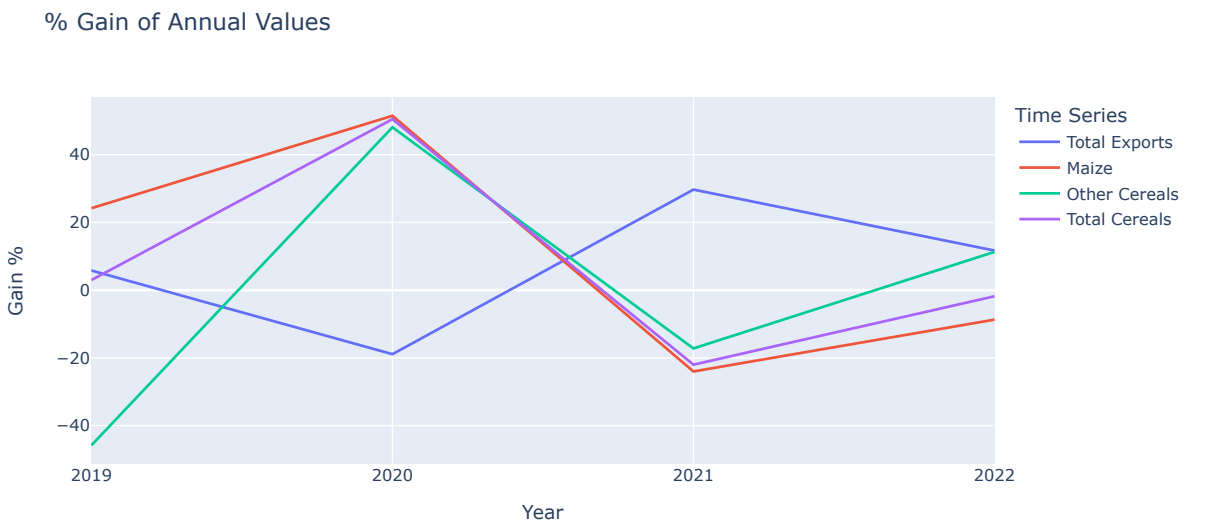
In [2]:
```
exSum.valOfArgExportsInMUSD()
```

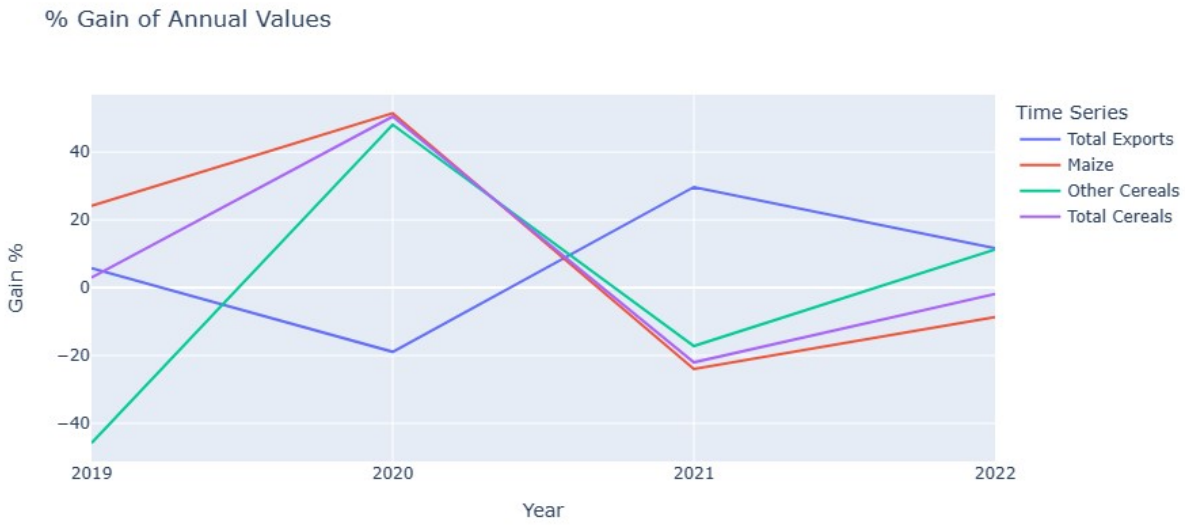
Out[2]:

	Year	Total Exports	Cereals Exports	Maize Exports
0	2018	60271.8	7570.9	4124.4
1	2019	63984.5	7802.5	5438.7
2	2020	53794.9	15765.5	11208.8
3	2021	76486.9	12922.7	9036.0
4	2022	86627.2	12694.7	8311.6

After 2020 the values of total exports have a positive trend but with cereals the opposite happened, for total cereals, the difference between 2020 and 2022 values is -19.5% but Maize decreased by over 25% in the same period, with no signs of recovery during the last year (2022), the opposite happened with other cereals, in 2022 gained 11.3% which is a close value of the total exports gain in 2022 (11.7%).

In [3]:
```
exSum.AnnualGainInExports()
```





Among all the cereals included in the HS Cereals Classification, for Argentine international trade Maize is the main commodity, Maize represented 9.59% of the total exports in 2022, with a 5.9% average gap of the total market share (in exports) between 2018 and 2022.

Even when the total cereals and maize percentage of total exports values decreased in 2022 to values closer to 2019 than 2020, the other cereals group maintained a similar value in 2021 and 2022 even higher than 2019 tending to go towards the values of 2018 gap.

In [4]:
```
exSum.heatmapOfExports()
```

Out[4]:

	year	% of Total Cereals Exports	% of Maize exports	% of Other Cereals Exports	GAP Between Maize and Other Cereals Exports
0	2018	12.56	6.84	5.72	1.12
1	2019	12.19	8.50	3.69	4.81
2	2020	29.31	20.84	8.47	12.37
3	2021	16.90	11.81	5.09	6.72
4	2022	14.65	9.59	5.06	4.53

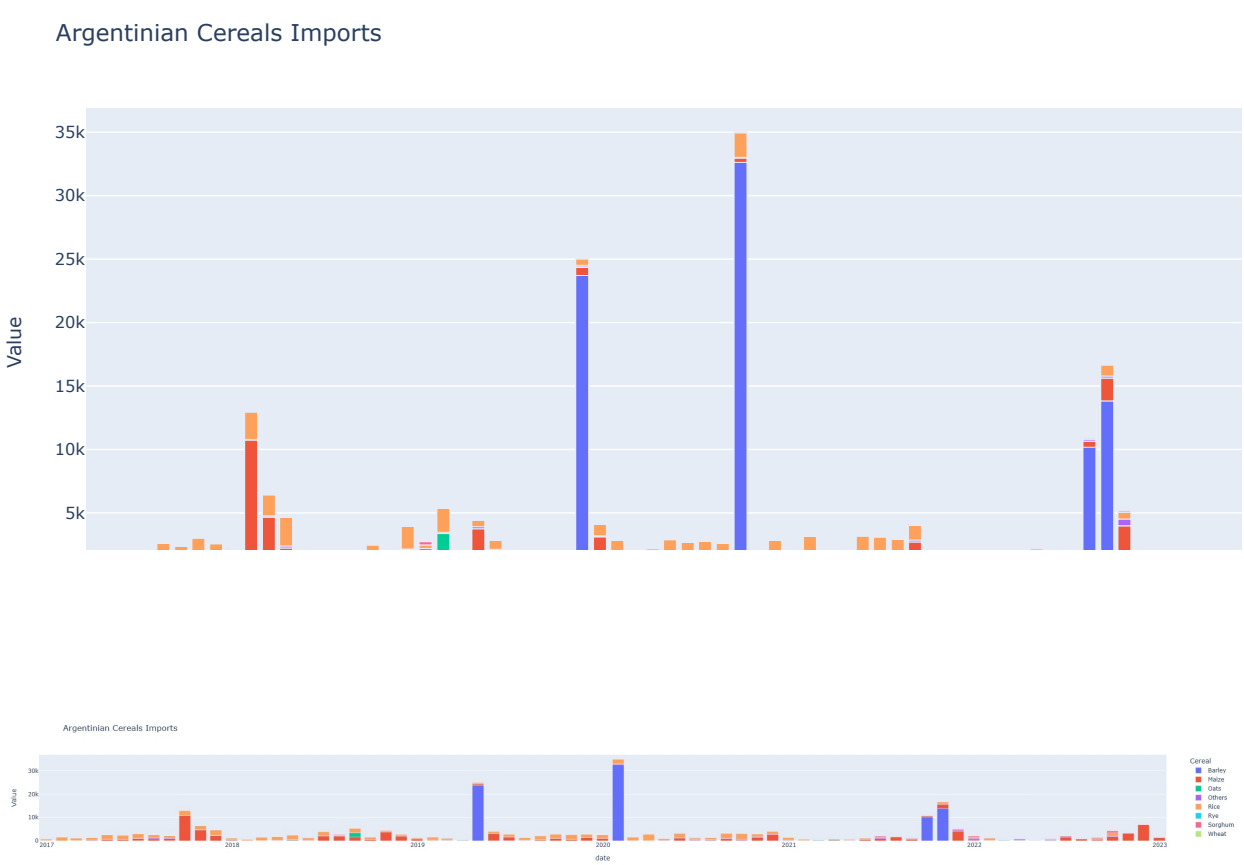
02. MONTHLY TIME SERIES

Considering that maize is an essential resource and that the cost of commodities depends on the international market price and its conformation characteristics, the following series and values will express Tonnes of cereals and won't include any monetary value like the previous section.

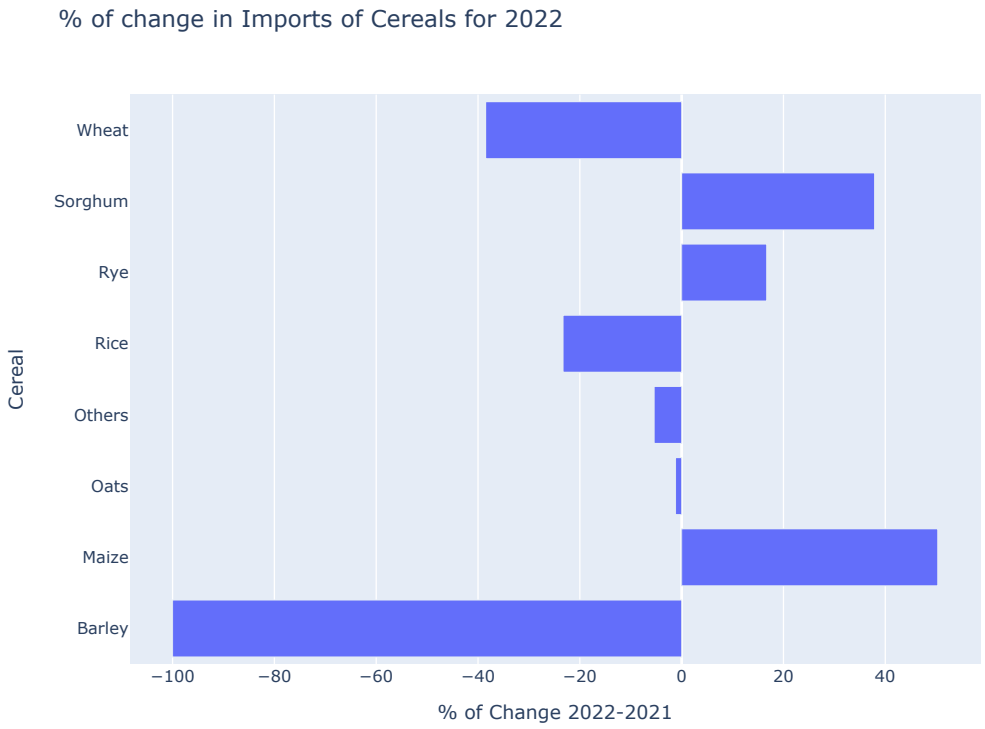
CEREALS IMPORT FLOW

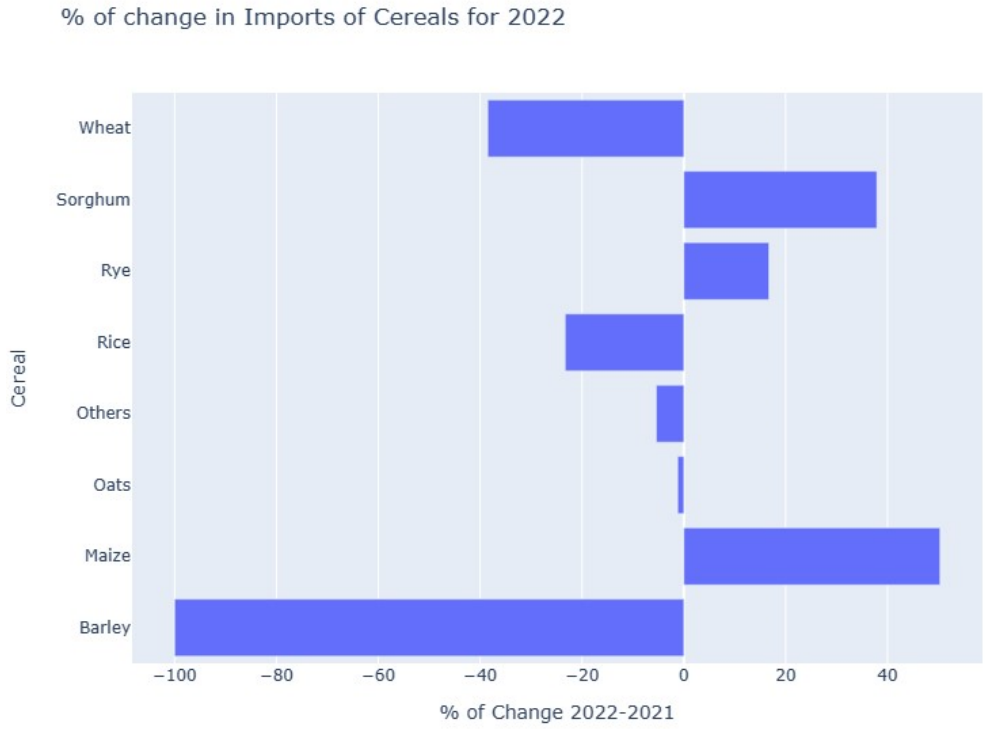
Imports of cereals have a seasonal behaviour and are not as important as exports in terms of magnitude or tonnes, but in 2022 the total tonnes of maize imported reached 50% which can be an issue to consider in a future analysis.

In [5]:
```
exSum.cerealsImpTimeSeries()
```



In [6]:
```
exSum.percentageOfChangeCerealsImp()
```

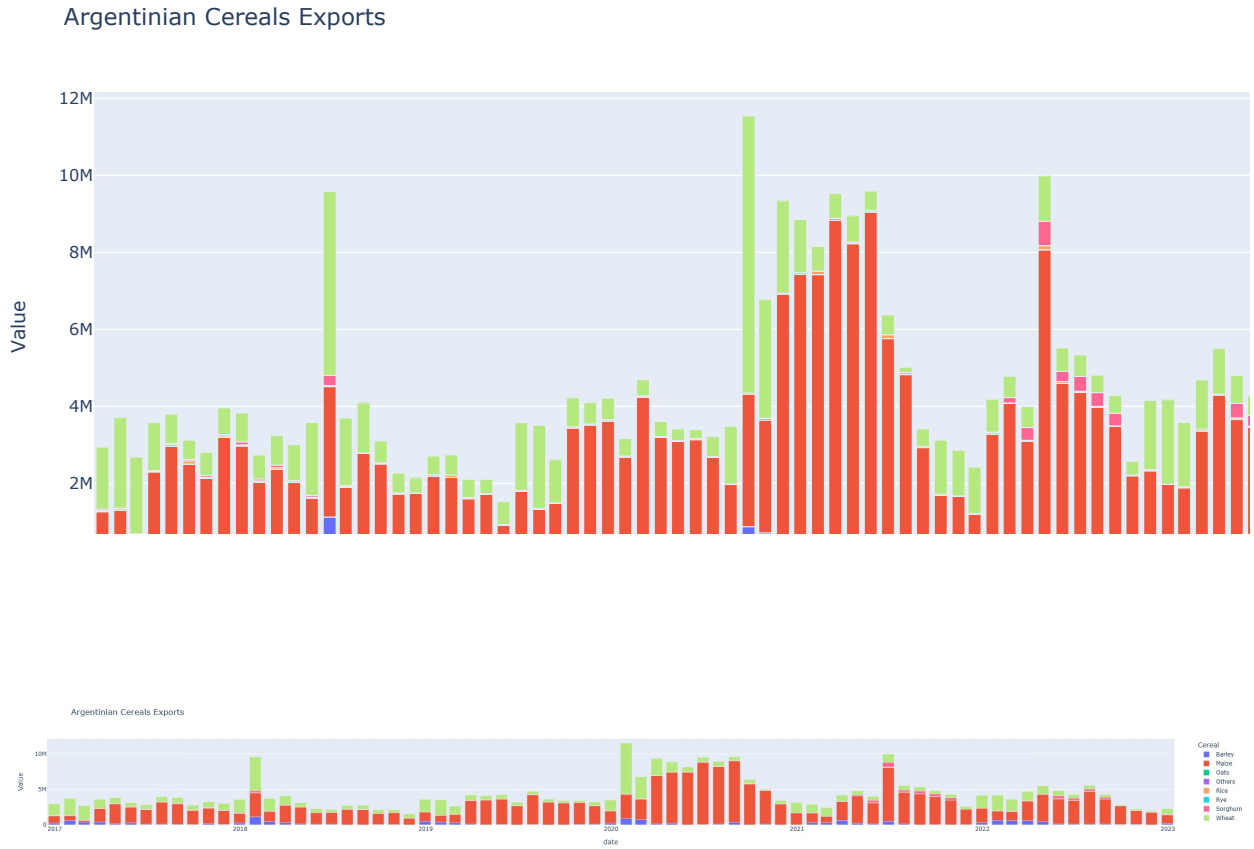




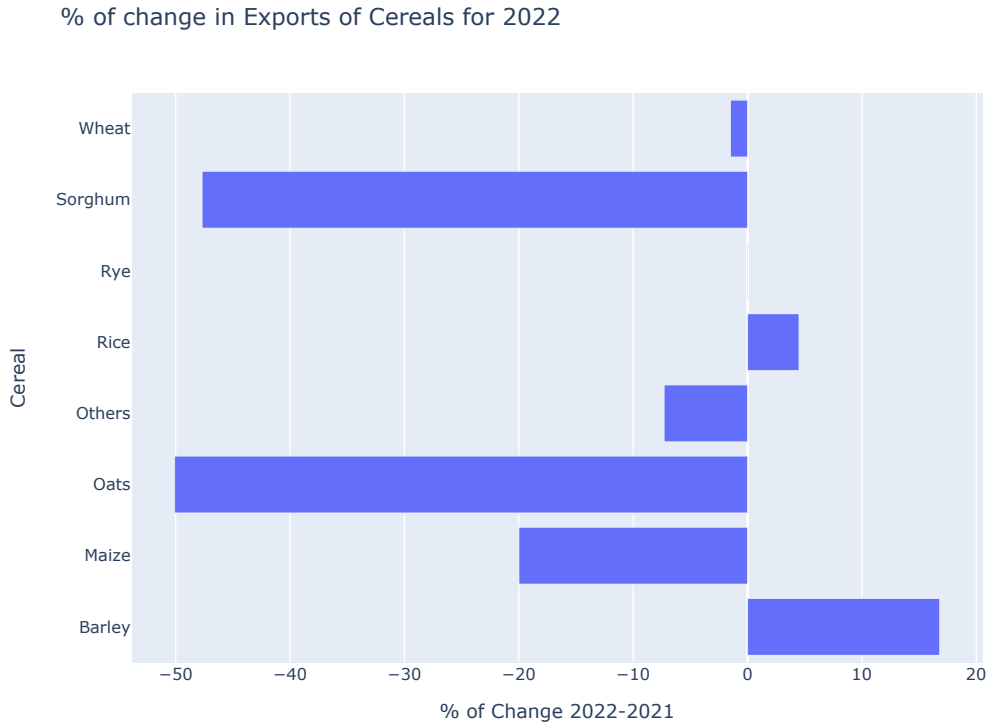
CEREALS EXPORT FLOW

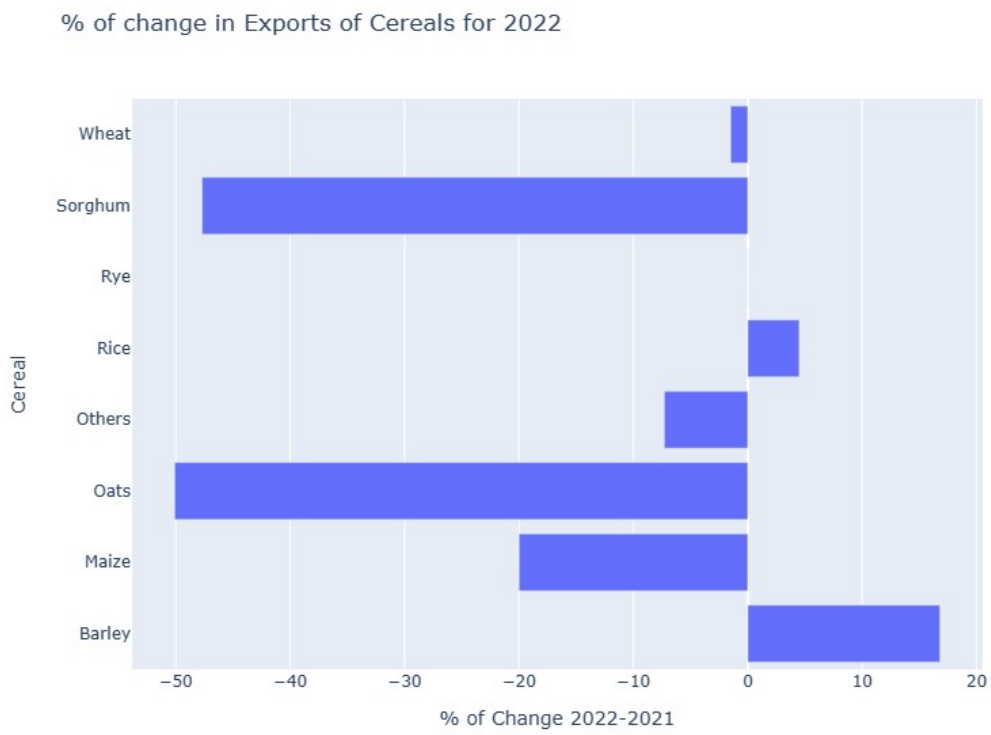
The export flows as the import seems to follow a seasonal pattern, and it's evident that after Maize, Wheat is a cereal with a historic potential to develop. In terms of tonnes, the % of change between 2022 and 2021 is higher than the % of the change in values, reaching in his case -20% with a major difference in the month of June where in 2021 7.5 million tonnes were sold and in 2022 the value was less than a half, 3.5 million tonnes.

In [7]:
```
exSum.cerealsExpTimeSeries()
```



In [8]:
```
exSum.percentageOfChangeCerealsExp()
```





03. PARTNERS

Among Argentina's top 10 partners, there are four Asians, three Africans and three South American countries where the % of cereal tonnes exported is over 70% in nine of the ten partners, and more than half have a constant frequency of trade events 12 months a year.

The export of Argentina's market it's very concentrated, the ten top partners hold more than 80% of the Maize exports and over 60% of total cereal tonnes exported from Argentina, even when there were 56 countries of export destinations in 2022.

In [9]:
```
exSum.shareSummaryTop10()
```

Out[9]:

	% SHARE MAIZE	% SHARE CEREALS
0	84.7	64.7

In [10]:
```
exSum.tableTopPartnersWithClusterIdMetrics()
```

Out[10]:

	PARTNER	REGION	MAIZE EXPORTS (TONNES)	% MAIZE IN CEREAL EXPORTS	PARTNER % SHARE IN MAIZE EXPORTS	EXPORTS FREQUENCY (MONTHS) IN A YEAR	PARTNER % SHARE IN CEREALS EXPORTS	METRICS GROUP	SIMILARITY GROUP	TREND GROUP	SEASONAL GROUP	RESIDUAL GROUP
0	Viet Nam	Asia	5224424.0	100.0	16.4	12	11.4	2.0	1.0	2.0	2.0	1.0
1	Rep. of Korea	Asia	4896814.0	100.0	15.4	11	10.6	2.0	1.0	1.0	0.0	0.0
2	Peru	South America	3233667.0	90.0	10.2	12	8.1	5.0	1.0	2.0	1.0	2.0
3	Malaysia	Asia	2823841.0	100.0	8.9	12	6.1	5.0	1.0	2.0	2.0	1.0
4	Algeria	Africa	2535072.9	80.0	8.0	10	7.2	5.0	1.0	2.0	2.0	1.0
5	Egypt	Africa	2418048.6	100.0	7.6	12	5.2	5.0	1.0	2.0	2.0	1.0
6	Saudi Arabia	Asia	2359818.7	100.0	7.4	12	5.1	5.0	1.0	2.0	0.0	0.0
7	Chile	South America	1633542.2	70.0	5.1	12	5.0	0.0	1.0	2.0	0.0	0.0
8	Colombia	South America	960706.1	90.0	3.0	12	2.4	1.0	1.0	1.0	0.0	0.0
9	Morocco	Africa	864765.6	50.0	2.7	9	3.6	1.0	1.0	2.0	2.0	1.0

The top 10 partners share some similar characteristics among them and can be clustered in different ways:

By Business Metrics:

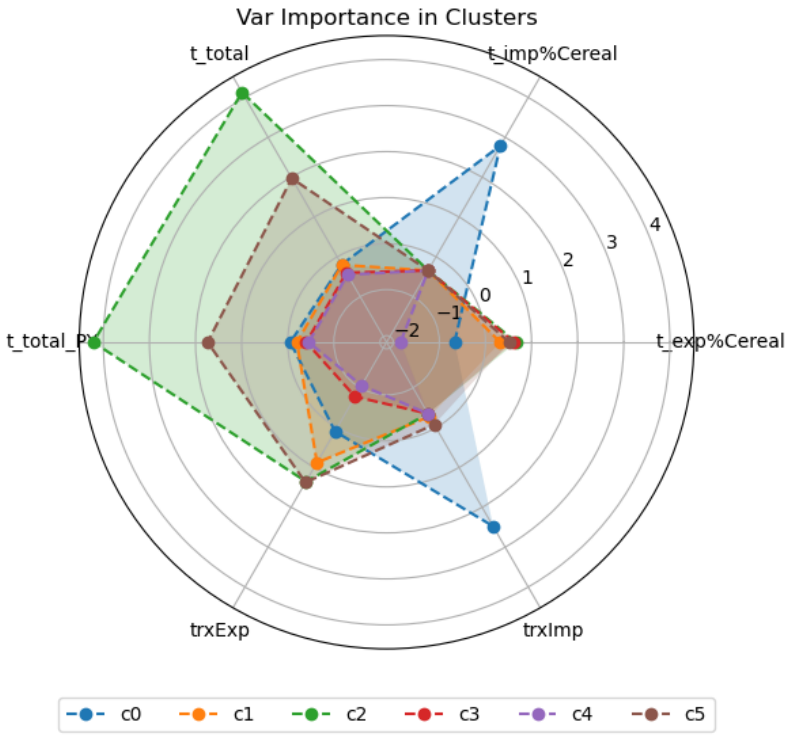
Considering the partners with trade in 2022 there are at least 6 groups of partners if we analyzed the patterns with:

- Total Tonnes Traded with Partner in 2022 (t_total)
- Total Tonnes Traded with Partner in 2021 (t_total_PY)
- Frequency of months with Exports of Maize (trxExp)
- Frequency of months with Imports of Maize (trxImp)
- % of Maize in the Cereals Imports from Partner (t_imp%Cereal)
- % of Maize in the Cereals Exports to Partner (t_exp%Cereal)

Where each cluster presents clear differences in its characteristics:

- **Cluster 0:** High importance of Maize Imports from partners in the trade flow and non-continuous or highly frequent export months with an intermediate relevance in tonnes traded.
- **Cluster 1:** High to intermediate importance of Maize Exports to partners in the trade flow, highly frequent export months with an intermediate relevance in tonnes traded. [INTER]
- **Cluster 2:** High importance of Maize Exports to partners in the trade flow, frequent buyers and High Volume Trade. [TOP]
- **Cluster 3:** Minor partners with high importance of Maize in the trade flow and infrequent buyers.
- **Cluster 4:** Minor partners with almost no cereals trade.
- **Cluster 5:** Second group on average volume and stable partners of high frequency (12/12 months with transactions) and with high importance of Maize in the total exports of cereals. [TOP]

In [11]:
```
exSum.metricsClusterCentroids()
```



By Similarity:

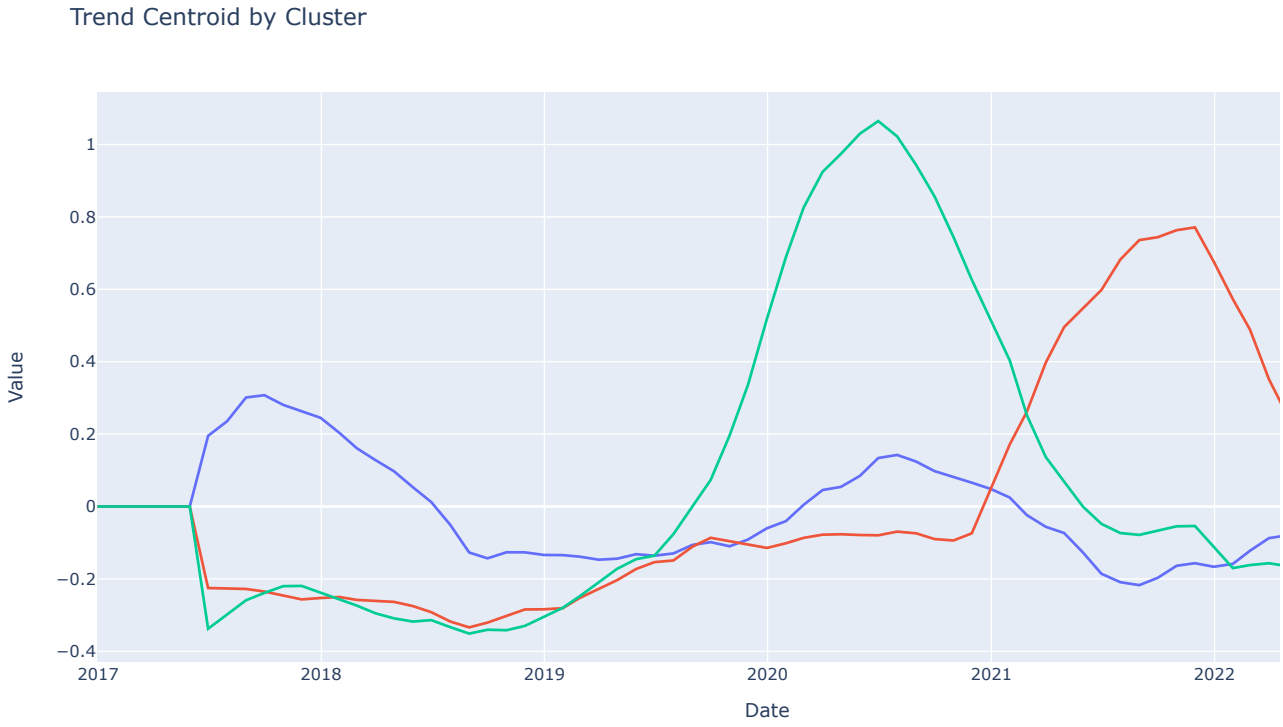
There are different techniques and metrics to measure the similarity level between two Time Series, for this analysis, the Dynamic Time Warping (DTW) measure was used, generating between 2 and 4 groups mostly segmentizing by frequency, in this case, the top partners have the same patter by using the DWT.

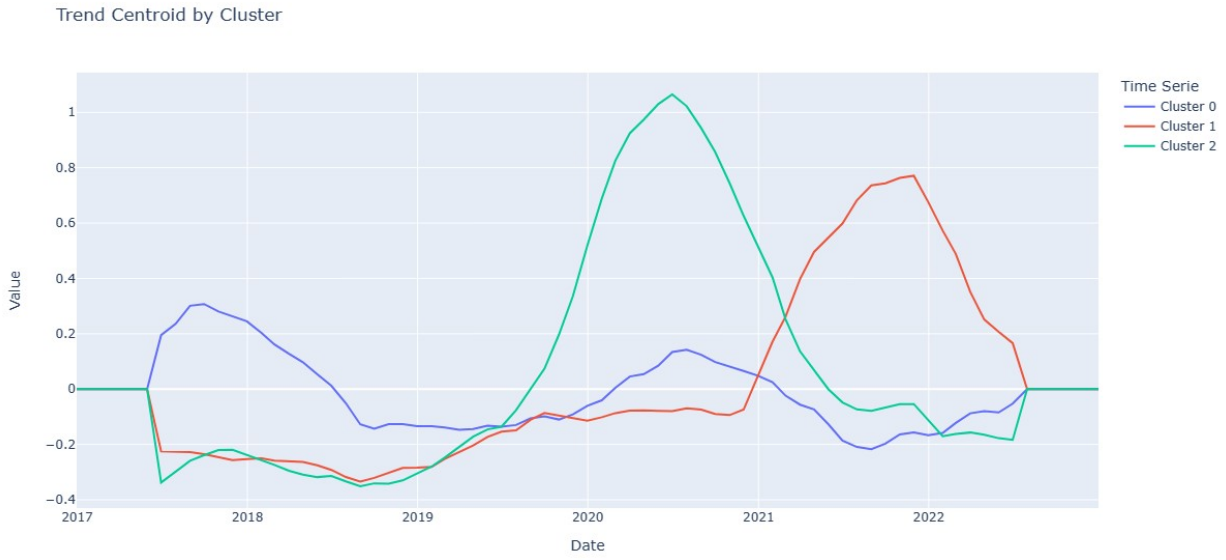
By Trend:

During 2022, two of three (2/3) clusters presented a negative trend, including the top 10 partners clusters, where only cluster 0 has positive values. It is important to note that from the final months of 2018 to 2020 the trend of clusters 1 and 2 was positive. This can be a warning to work with considering that 10 partners can reach 80% of total exports.

In the following figure, the cluster centroids are presented (those are the mid-spatial values of each cluster for the Seasonal Component in each timestamp):

In [12]:
```
exSum.centroidTrendTS(partners = False)
```



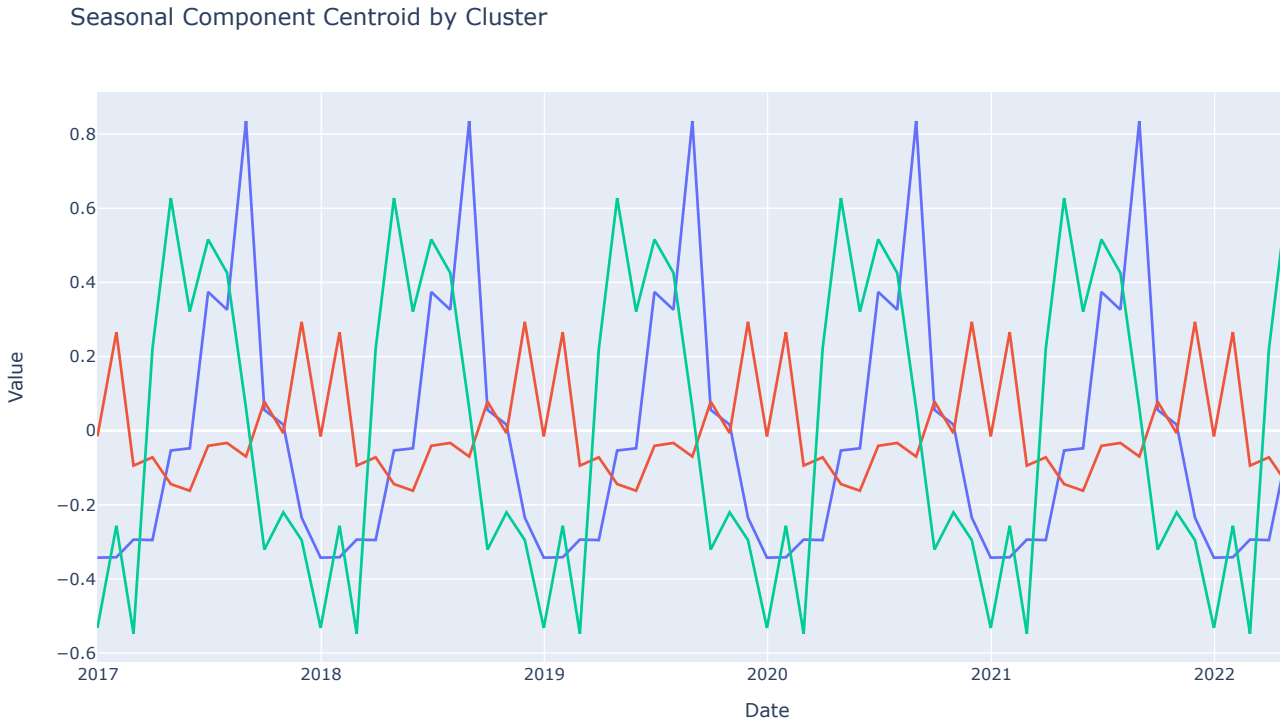


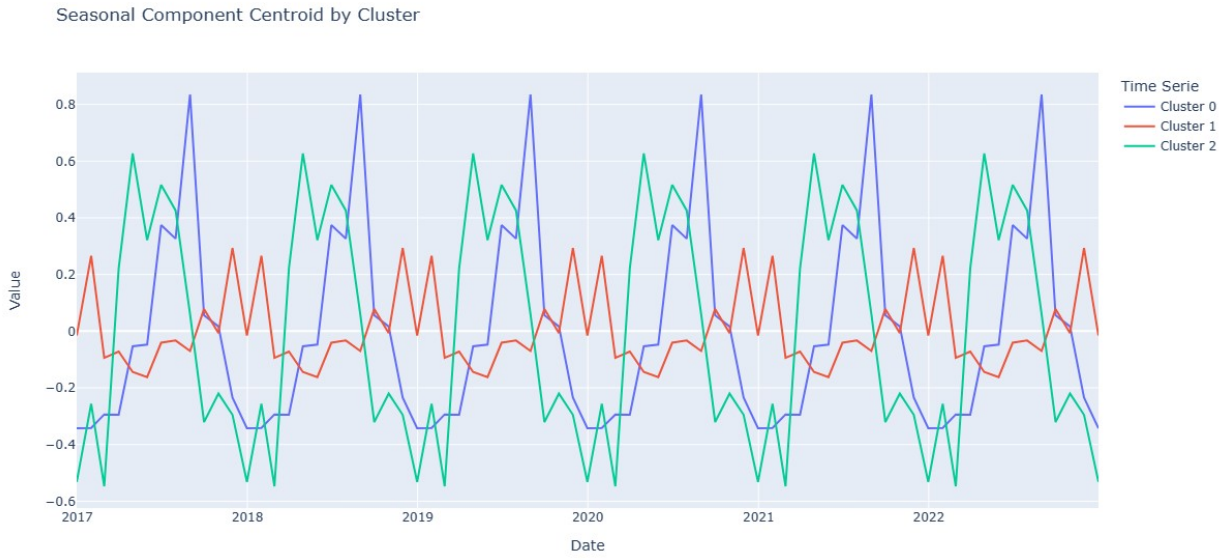
By Seasonal Patterns:

The seasonal patterns are differentiated by the intensity and because of the points of the average start and ending point of each cycle.

In the following figure, the cluster centroids are presented (those are the mid-spatial values of each cluster for the Seasonal Component in each timestamp):

In [13]:
```
exSum.centroidSeasonalTS(partners = False)
```



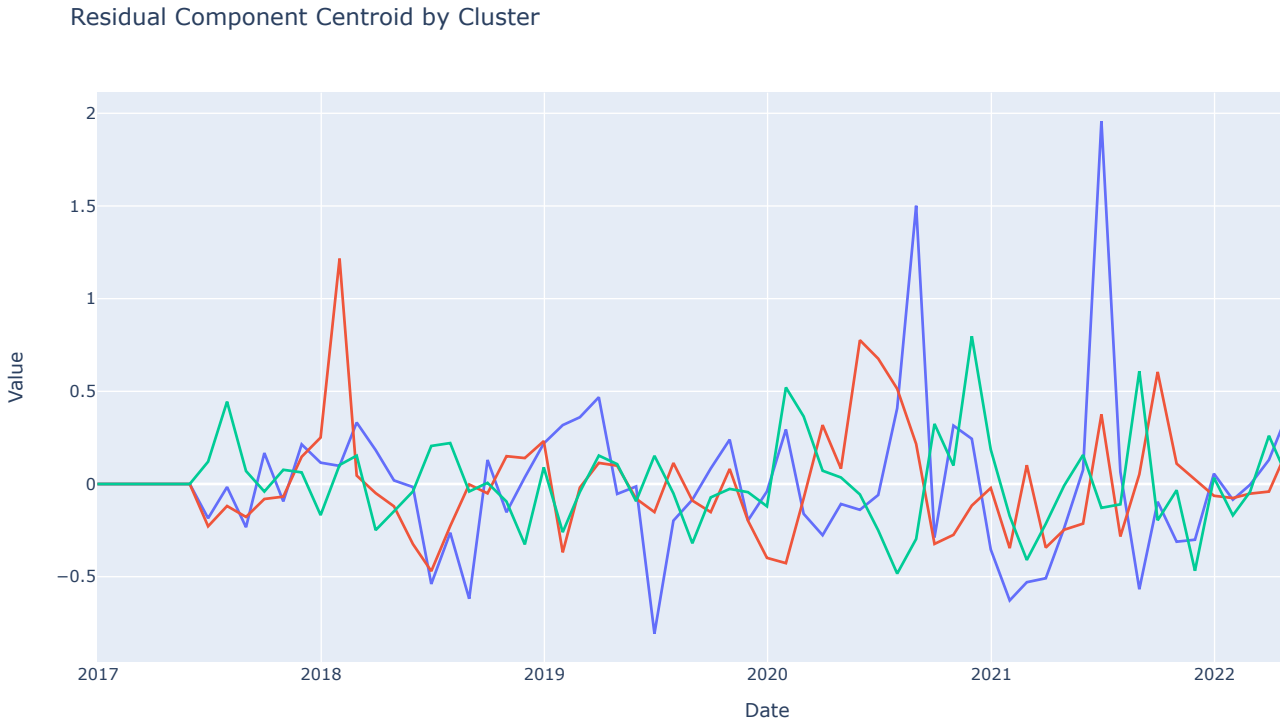


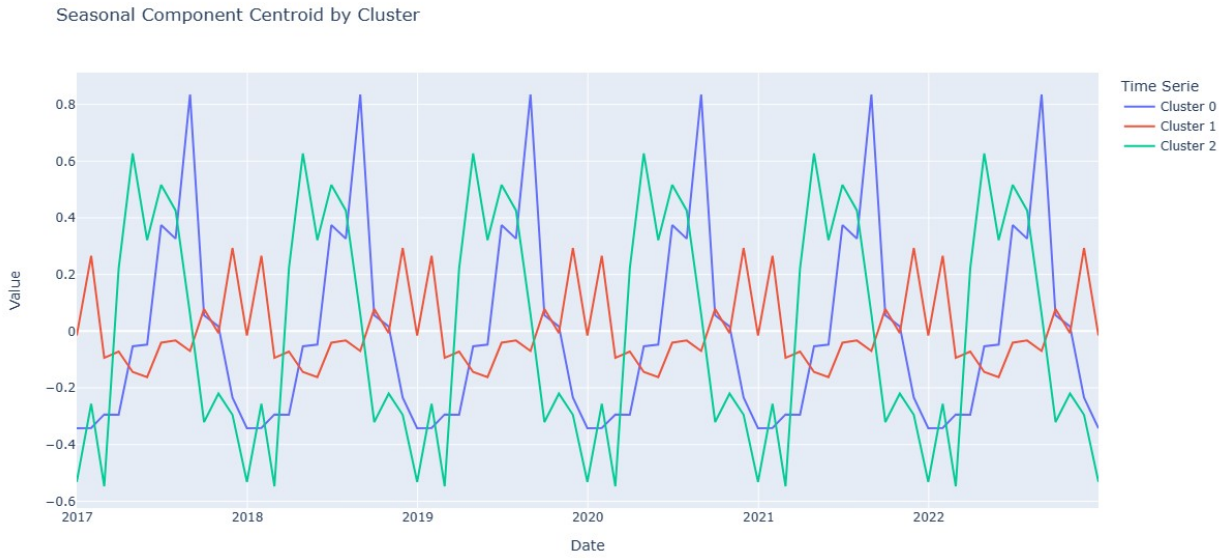
By Random or Residual Patterns:

This pattern groups partners by values outside trend or seasonality, a random phenomenon that impacts the level or value of the Time Series. It's important to note that there are 4 partners sharing seasonal and residual clusters, and those countries have the bigger peaks in the residual component during 2020 and 2021, Korea, Saudi Arabia, Chile and Colombia.

In the following figure, the cluster centroids are presented (those are the mid-spatial values of each cluster for the Seasonal Component in each timestamp):

In [14]:
```
exSum.centroidResidualTS(partners = False)
```





04. FINAL THOUGHTS

Presented in the previous section some descriptives patterns of partners behaviour, there are other inquiries that can drive a diagnostic or predictive analysis such as:

- Are the market values going back to 2018 soon?
- What cereals are helping the other cereals market grow?
- How are these patterns related to the pricing history regarding exports of cereals?
- How is pricing affecting the trade export values and tones?