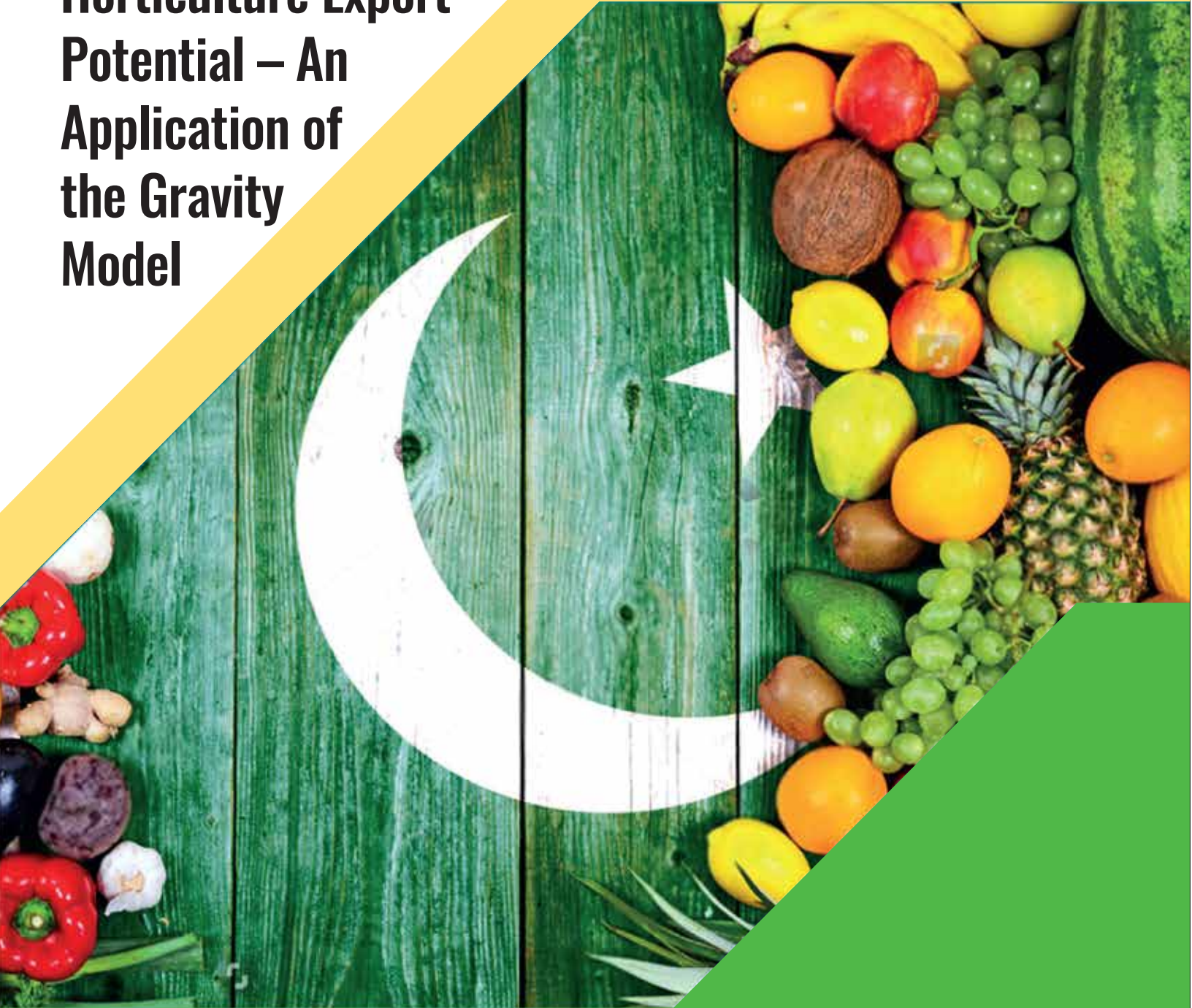


# Evaluation of Pakistan's Horticulture Export Potential – An Application of the Gravity Model



**The Federation of Pakistan  
Chambers of Commerce & Industry**

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## Acknowledgment & Disclaimer

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## Executive Summary

The horticulture sector has a global market of more than USD 251 billion. Pakistan is among the top 35 countries that export horticultural products to the world and possesses the immense potential to remarkably boost its exports. The reason for this high potential is the ranking of Pakistan among the largest horticulture producing countries in the world notably for Citrus, Mangoes, Dates, Chilies, Onions, Potatoes, and others. However, the country's horticultural exports are currently limited to a few commodities with little or no value addition, as a consequence, it earns relatively lower prices than the global average and accounts for a meager share of global exports. Horticultural commodities provide opportunities for export diversification and have immense potential for creating employment, and it can contribute to tackling the declining exports-to-GDP ratio. Lack of foreign exchange, low productivity, and inconsistent trade policies are creating massive economic vulnerabilities.

A switch in the exchange rate regime from fixed to market-determined floating exchange rate regime has enhanced price competitiveness which can be leveraged to enhance exports. Consistent policies, adoption of measures to ensure global compliance to international standards and robust infrastructure are instrumental to expanding the country's agriculture base and fostering export-led growth. The horticulture sector of Pakistan, at its current level of development, offers an overall untapped export potential worth USD 729 million in raw and intermediate horticulture exports in spite of post-harvest losses of up to 35-40 percent, and low yields. These losses are mainly due to flawed supply chain management and insufficient infrastructure. Improvements in supply chain management and mitigation of post-harvest losses could elevate Pakistan's horticulture export potential beyond US\$ 1 billion. Moreover, this basic potential can be enhanced several times through multiple layers of value addition to the current basket of raw and intermediate exports. Another major impediment to horticulture exports is the prevalence of non-tariff barriers. A survey report by ITC highlights that the exporters of fresh agriculture food and processed agriculture food are highly affected by importing countries' NTMs imposition.

The empirical findings of this study reflect that distance between the exporting and importing countries is meaningful in determining the level of horticulture exports. The perishability of these goods, low transportation cost, and high demand in regional countries are the primary reasons of significance for the potential for horticultural exports to countries in proximity. In addition to this, the Asian market also has the untapped potential for Pakistan's horticulture exports worth USD 581 million. Afghanistan, India, China, and Iran can be ranked among potential countries offering the highest export potential. All these countries are densely populated and tend to have similar consumption patterns as Pakistan. Horticultural exports to regional countries allow Pakistan to minimize its trade cost. Europe is Pakistan's second-largest untapped

market for horticultural exports bearing export potential worth US\$ 117 million, however, the European region applies more stringent non-tariff measures than any other region for agriculture imports in the region. In addition, establishing a trade agreement with trading partners is another source of trade cost reduction. Pakistan has fewer trade agreements as well as relatively low coverage of horticulture products in these agreements. Tariff concessions though necessary but are not sufficient for promoting exports until the non-tariff barriers are reduced. Renegotiation of already signed trade agreements as well as the incorporation of horticulture products while signing new trade agreements would help in reviving Pakistan's exports of horticulture.

The value addition of horticulture products in Pakistan also provides opportunities to increase earnings on both domestic and external fronts as it increases the shelf life of products, per unit value it earns, and the product range that can be offered internationally. As with any other major change, the value addition in the horticulture sector should be adopted gradually in Pakistan. Immediate attention needs to be given to the adoption of international standards for production, quality maintenance, and packaging processes. In the second stage, measures to improve processing activities for developing intermediate products with relatively long shelf lives. Modern processing and packaging facilities should be adopted to turn horticulture products into finished goods in the final stage. However, lack of available finances, investment risk and low incentives serve as a major hurdles in such developments. Overcoming these obstacles will not only enhance product competitiveness but also allow harnessing opportunities in sophisticated markets such as Europe where both margins and demand are high, and consumption is increasing.

To bolster the horticulture export base, immunity against unanticipated global supply shocks should be developed and issues such as inadequate standard maintenance practices in production, unavailability of testing labs and the absence of proper certification need to be addressed. Moreover, expansion of the export basket and market diversification for exports may enable Pakistan to participate more in the global value chain.



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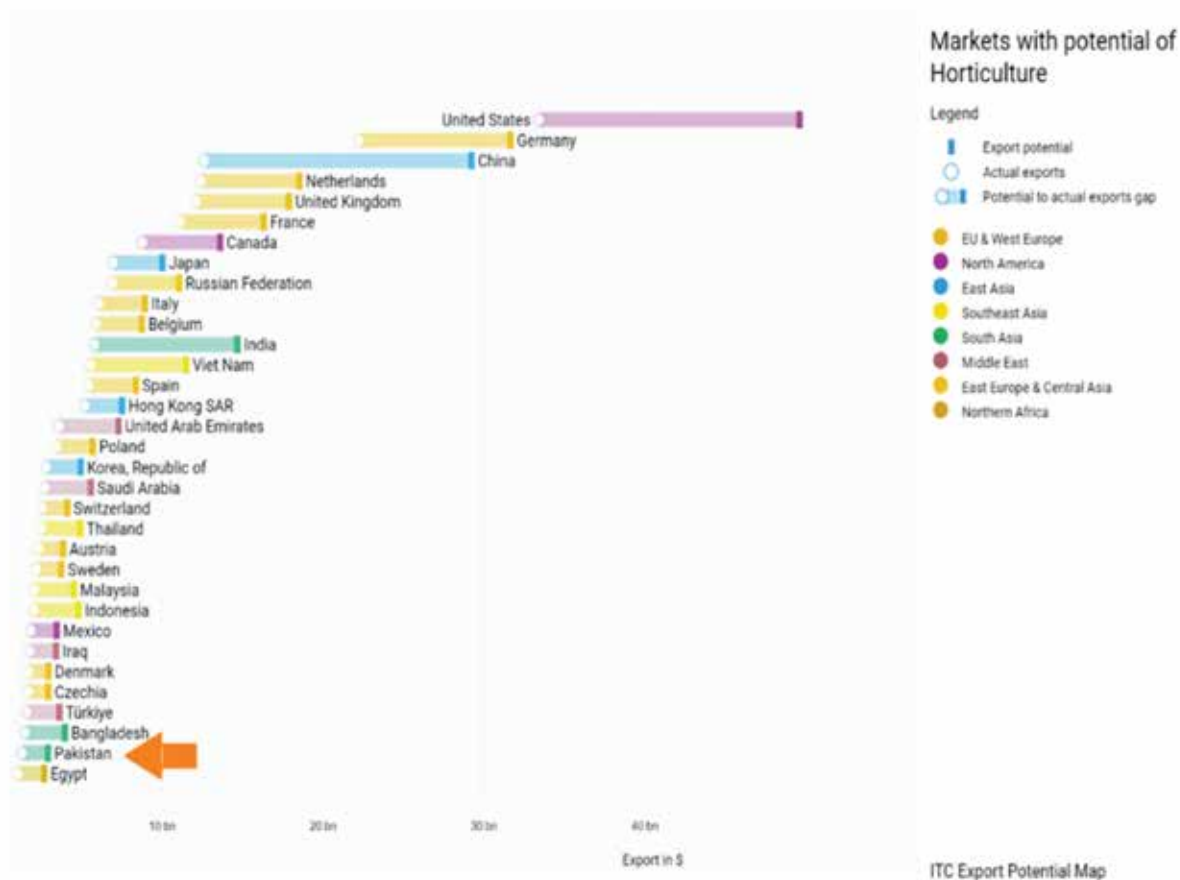
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# 1 Introduction

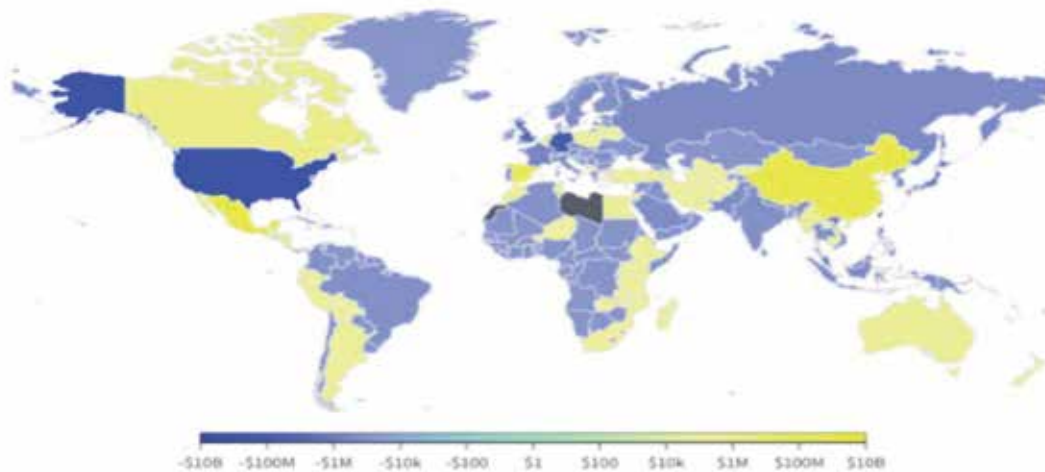
The horticulture sector has a global market worth USD 251 billion and is anticipated to grow further due to the emergence of health-oriented global consumption patterns. The figure below shows the exports and export potential of the top 33 horticulture exporting countries. It reveals that Pakistan's current horticulture export is among the top 33 horticulture exporting countries. However, Pakistan's ranking is well below than that of South Asian economies in the chart including India and Bangladesh.



**Figure 1 Top 33 Countries' Ranking in Horticulture Export**

To get a better understanding of the global demand and supply status, it is crucial to assess the net trade status of countries around the world for Fruits and Vegetables. The map below displays the countries that exports/import Fruits. In 2020, the countries with relatively large exports of Fruits as compared to imports (suppliers) include Spain (USD 7.44 billion), Chile (USD 6.4 billion), Mexico (USD 6.09 billion), Ecuador (USD 3.98 billion), and Peru (USD 3.95 billion). Also, the net importing countries for Fruit (net importers) include Germany (USD 9.21 billion), China (USD 6.95 billion), the United Kingdom (USD 5.35 billion), France (USD 4.21 billion), and Canada (USD 4.21 billion). Moreover, as per this map, in 2020 Pakistan is among the net exporting countries of fruit in the world.

Net Trade (2020)

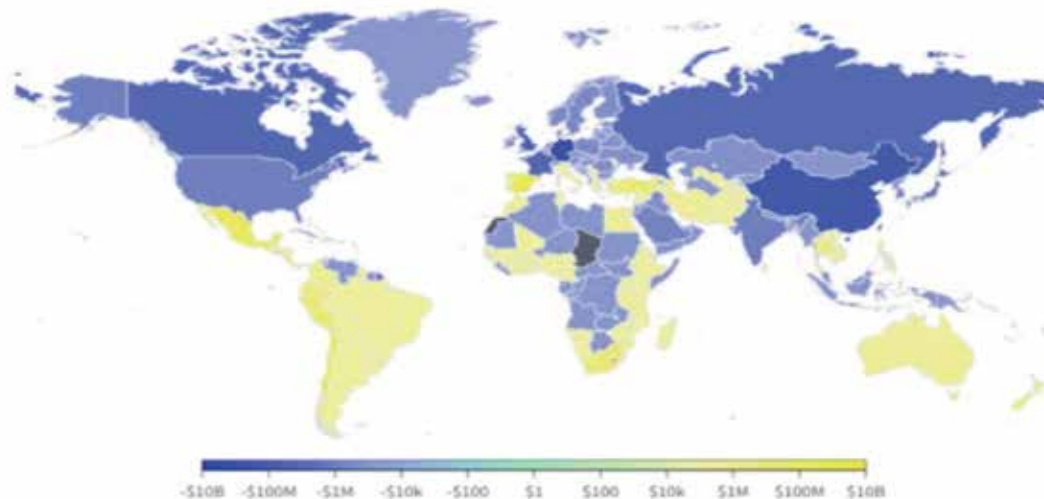


Source: BACI, Observatory of Economic Complexity.

Yellow=Net Exporter, Blue= Net Importer

**Figure 2 Map of Global Net Fruits Trade**

The map below highlights the net importing and exporting countries of Vegetables. In 2020, the net exporting countries of Vegetables (suppliers) include Mexico (USD 7.96 billion), China (USD 7.46 billion), Spain (USD 6.58 billion), Netherlands (USD 5.02 billion), and Canada (USD 2.22 billion). The net importing countries of Vegetables (demanders) are the United States (USD 8.1 billion), Germany (USD 5.93 billion), United Kingdom (USD 3.52 billion), Japan (USD 2.07 billion), and Hong Kong (USD 1.58 billion). Despite the significant agricultural base, Pakistan is among the net importer of Vegetables.



Source: BACI, Observatory of Economic Complexity.

Yellow=Net Exporter, Blue= Net Importer

**Figure 3 Map of Global Net Vegetable Trade**

## 1.1 Horticulture Sector of Pakistan

The recent depreciation in rupee has made our products more price competitive. It is imperative to focus on areas that require less effort, such as better marketing and standards for exporting goods. There is a large gap between the actual and potential exports of horticulture due to poor standard-maintenance practices in the production process, a lack of clear markets for exports, aggressive marketing and insufficient trade agreements.

### 1.1.1. Pakistan's ranking in Global Horticulture Production

Pakistan has been among the top producer of horticultural products in the world. Table 1 shows the rankings of Pakistan in horticulture production in the world. It ranked 4th in the world for the production of chilies; 6th for producing Dates, Apricots & Mangoes; 9th for Onions; 13th for Citrus Fruits; 17th for Almonds; Carrots & Turnips; and 18th & 19th rank for Brinjals and Potatoes respectively. These production scales can create grounds for exports and value addition.

**Table 1 Production Ranking of Pakistan in Horticulture Products**

Countries	Rankings
Chilies	4th
Dates	6th
Apricot	6th
Mango	6th
Onion	9th
Citrus	13th
Almond	17th
Carrots and Turnip	17th
Brinjal	18th
Potato	19th
Apple	23th
Plum	28th
Tomato	33rd
Cherries	49th
Cucumber	50th

*Source: Planning Commission Pakistan Reports*

## 1.2 Pakistan's Horticulture Sector Exports

Pakistan being a major producer of horticulture products also exports these products to the world. The table below illustrates the annual average growth rate of Pakistan's horticulture exports to the world from 2011 to 2020. The overall horticulture export growth rate has declined in Pakistan by 2.9%. Also, Pakistan's horticulture exports to common border countries have shown an average decline of 12.78% in contrast to the countries i.e., GSP countries (2.8%), Trade Agreements (6.86%), and, Others (4.99%) which have presented the increase in exports during this time.

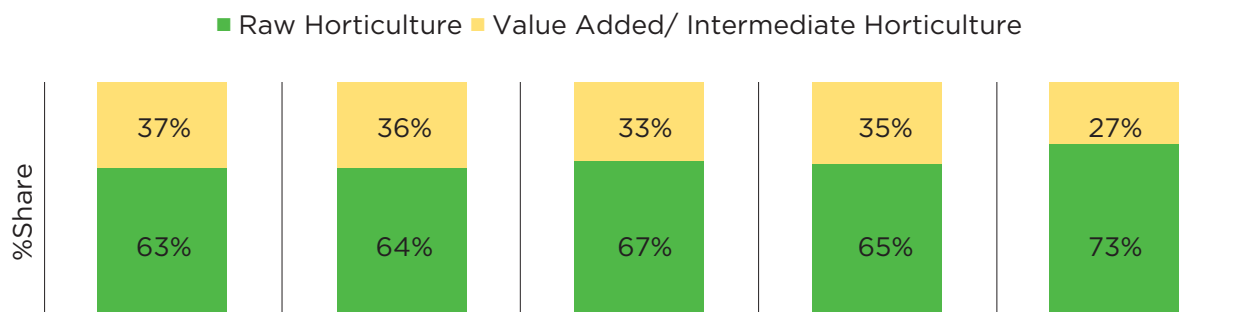
**Table 2 Category-based Horticulture Exports Comparison - 2011 to 2020**

Country Status	CAGR (2011 to 2020)
Total Horticulture Export	-2.90
GSP Countries	2.80
Common Border	-12.78
Trade Agreements	6.86
Others	4.99

Source: ITC Data

Pakistan mostly exports its horticulture in raw form which attracts lower prices despite exporting large quantities. Raw horticulture exports of Pakistan approximately account for 60 to 70% of total horticulture exports. The COVID-19 outbreak has disrupted value addition activities in Pakistan which further enhanced the share of raw horticulture products to 73 percent in 2020. It also indicates that Pakistan has the potential to add value to these raw exports to fetch better prices in the international market.

### Composition of Pakistan's Horticulture Exports



Source: Authors' Estimation

**Figure 4 Composition of Pakistan's Horticulture Export**

#### 1.2.1 Potential Factors Limiting Horticulture Exports

Almost 40% labor force of Pakistan is employed in the agriculture sector. However, due to poor handling skills, lack of technical expertise, & R&D in agriculture production leads to pre and post-harvest losses. This limits the scale of Pakistani horticulture exports in the international market. Another major drawback that raises domestic inefficiency is the presence of multiple middlemen in the supply chain which increases the cost. It also contributes to post-harvest losses due to time and expense incurred in the presence of multiple middlemen across the supply chain as these products have limited shelf life. Pakistan loses approximately 35 to 40% of horticulture products in supply management practices (Jayasuriya et al., 2021). As only 60 to 65% of the product is left for consumption and exports for which a large share of horticulture output is consumed domestically in Pakistan (Kader, 2009). Additionally, Pakistan's horticulture exports are limited mainly due to non-compliance with stiff quality checks and are exposed to severe non-tariff restrictions. For example, Pakistan's exports of chili have been banned by the European Union (EU) because of intolerable aflatoxin levels. Moreover, other exportable horticulture goods are only able to earn almost half of the world's average price.

Table 3 shows that the average export price of Pakistani products is far below the world average. This is a serious concern for Pakistan as export earnings would be low despite exporting large quantities.

**Table 3 Production Ranking of Pakistan in Horticulture products**

Products	World US\$/tones	Pakistan US\$/tones
Potato	319	197
Tomato	585	166
Mango	1227	796
Dates	1042	629
Citrus	765	447
Chili	2355	1792
Apple	804	452
Apricot	1515	1360

Source: Planning Commission (2020)

For Pakistan to get strong standing in the global value chain, the country needs to develop its export base through both product diversification and market penetration. The horticulture sector has emerged as one of the potential areas of Pakistan which can enhance the country's exports. Due to high global demand, these products can fetch better prices in international markets with some value additions. However, this particular sector is bound by high Non-Tariff Measures (NTM) relative to other sectors in international markets. Food safety and health-oriented NTMs are noteworthy in this regard. Lack of compliance with these NTMs has limited the market access and competitiveness for Pakistani exports. It occurs due to inadequate NTMs ensuring facilities and high-cost requirements. According to a survey conducted by ITC to assess the impact of NTMs on Pakistani exporters in different sectors, two sectors related to horticulture sectors turned out to be the most affected sectors by NTMs. These sectors include "Fresh Food and Raw Agro-based Products" and "Processed Food and Agro-based Products". The extent of the impact of NTMs on such exporters is estimated as 63% and 52% respectively.



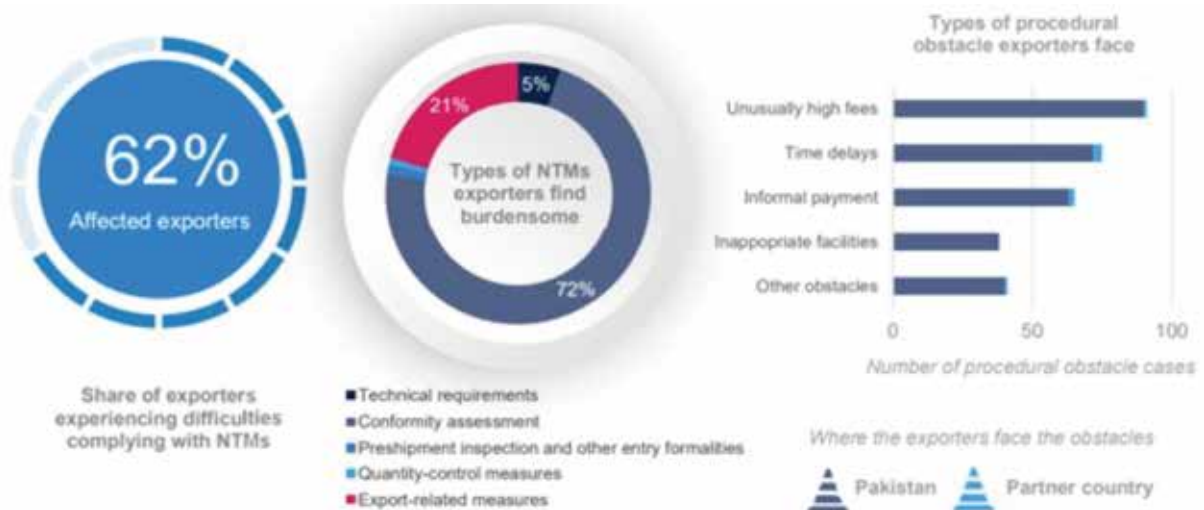
Source: ITC NTM Business Survey in Pakistan, 2019.

**Figure 5 Share of Exporters Affected by NTMs across Sectors**

Non-Tariff Measures are also crucial when considering the trade potential of horticulture products. The data of the ITC survey suggests that the time and monetary cost of NTM testing requirements are high considering the available testing, certification services, and infrastructure in Pakistan. Exporters have reported the procedure of attaining phytosanitary certificates as cumbersome mainly due to the following reasons (ITC, 2020):

- The Department of Plant Protection (DPP) issues phytosanitary certificates after the assessment of product quality via field inspections by its officers. The available numbers of officers who indulge in these are quite low. Field visits are often delayed by several weeks.
- Minimum residue limits testing conducted by the Pakistan Council of Scientific and Industrial Research can take quite some time to issue these certificates which deteriorates the quality of products due to their perishable nature.
- Tests and certifications procedures of NTMs require a large sum of fees which erodes the margins for exporters.
- Restrictions such as inspection of each container after Covid also intensified the cost to export.

The figure below summarizes the major findings of the ITC survey. It highlights that 62% of the fruit and vegetable exporters face difficulties in NTM compliance due to strict SPS testing requirements. It results in costly and time taking certification procedures due to inadequate facilities.



Source: ITC, 2020

**Figure 6 Impact of NTMs on Fresh Fruit and Vegetable Exporters**



## 2 Methodology

This study analyzes the horticulture export pattern of Pakistan to 89 countries from 2011 to 2020 by utilizing the gravity approach. The data on horticulture export is gathered by first identifying the HS codes for all horticulture products in Pakistan (raw & intermediate) and then aggregating it for each year by country.<sup>1</sup>

Revenstein (1885), Isard and Pack (1954), Tinbergen (1962), and Linnemann (1966) are some pioneering studies of gravity model. These notable contributions served as the fundamental ground for the gravity model in explaining trade flows (Bergstrand, 1989). The basic gravity model equation is as follows:

$$IT_{ab} = \frac{GDP_a^{\alpha} GDP_b^{\beta}}{D_{ab}^{\gamma}} \quad (1)$$

Where IT stands for trade among countries 'a' and 'b', GDP<sub>a</sub> indicates the supply ability of exporter 'a', GDP<sub>b</sub> specifies the potential demand by country 'b' and D represents the distance between countries 'a' and 'b'.

A theoretical and empirical examination of the available empirical literature demonstrates that by reviewing the macro-level factors affecting exports in a country through the gravity approach, the export potential of the country can be analyzed. This study contributes to literature in the gravity model-based export potential assessment area by examining the overall horticulture export potential for Pakistan (Abbas, 2015). It further extends the literature in exploring the market identification for overall horticulture export potential. With the application of the log on equation 1, the model takes the following form,

$$\ln Exp_{ijt} = \alpha_1 + \alpha_2 \ln GDP_{e_{jt}} + \alpha_3 \ln GDP_{i_{jt}} + \alpha_4 \ln D_{ijt} + \epsilon_{ijt} \quad (2)$$

This basic model shows the log form of the basic gravity equation, where Exp<sub>ijt</sub> shows the size of exports from the country 'i' to country 'j' in time 't', GDP<sub>e<sub>jt</sub></sub> indicates the GDP of country 'j' in time 't', GDP<sub>i<sub>jt</sub></sub> specifies the GDP of importing country 'j' in time 't', D<sub>ijt</sub> is the distance between country 'i' and 'j' in time 't' and  $\epsilon_{ijt}$  presents the residual term.

Table 4 defines the description of the variable symbols, their respective sources, and the unit they are measured in. Notably, the real exchange rate has been used as a proxy for the relative price variable. Also, 'English' has been taken as the parameter of the common language. Lastly, the dummy takes the value of 1 if the existing trade agreements of Pakistan cover horticulture products otherwise 0. These countries include Malaysia, Mauritius, Indonesia, China and Sri Lanka.

<sup>1</sup>For reference see Table 12

**Table 4 Variables' Source, Unit, and Description**

Description	Variable	Unit	Source
Total Value of Pakistan Horticulture Export	HExp	1000 USD	Trade Map
Gross Domestic Product of Pakistan	GDPe	1000 USD	World Development Indicators
Gross Domestic Product of Importing Countries	GDPi	1000 USD	World Development Indicators
Distance between Capital	D	Kms	indo.com
Relative Prices	RP	Ratios	IMF
Trade Agreement	TA	Dummy Variable	Ministry of Commerce, Pakistan
Common Language	CL	Dummy Variable	Globed
Common Borders	BR	Dummy Variable	World Map

Equation 3 is only effective when the dependent variable is greater than zero and provides inconsistent results when it is equal to zero as the log of zero is undefined. To tackle these issues, studies employed the Poisson Pseudo Maximum Likelihood (PPML) model as it gives more robust estimates (Silva & Tenreyro, 2006; Lateef et al., 2017; Choudhri et al., 2017; Irshad et al., 2018). After incorporating all relevant variables in the equation, the augmented gravity equation with PPML turns out as:

$$HExp_{ijt} = \exp \{ \partial_1 \ln(GDPe_{jt}) + \partial_2 \ln(GDPi_{it}) + \partial_3 \ln(D_{ijt}) + \partial_4 \ln(RP_{ijt}) + \partial_5 BR_{ijt} + \partial_6 CL_{ijt} + \partial_7 TA_{ijt} + \epsilon_{ijt} + \mu_t \} \dots \dots \dots \text{Equation 4}$$

Also, to tackle the endogeneity issue, the estimation of the model has been done with various fixed effects, and additionally, it caters to the effects of the macro fluctuations in the model as suggested by Silva et al (2011) and Irshad et al (2018). The table below elaborates the underlying concepts of terminologies used in this study.

Untapped Horticulture Exports Potential	• Untapped Horticulture Export Potential = Predicted Horticulture Exports - Actual Horticulture Export
Actual Horticulture Exports	• Actual Horticulture Exports = Realized Data Points for Horticulture Exports

**Figure 7 Description of Key Terminologies**

Lastly, in section 6, estimates of possible increases in fruit and vegetable exports are based on assumptions that production will rise with decline in post-harvest losses, while export to production share remains unchanged.

# 3

## Results and Discussion

This section discusses the results of the methodology described in the gravity approach. It defines relevant factors essential for the determination of horticulture exports and their potential in the case of Pakistan.

### 3.1. Evaluation of Pakistan's Horticulture Exports

This study follows the gravity approach and uses the data of Pakistan's horticulture exports to its 89 trading partner countries over the period of 2011 to 2020. Table 5 presents the model results. It is found that a 1% increase in the GDP of an importing country increases horticulture exports by 0.17 %. It reflects the higher demand for horticulture products due to the increase in purchasing power of importing countries. Furthermore, a 1% increase in the distance between Pakistan and the importing countries results in a 1.58 % decrease in Pakistan's horticulture exports. The analysis shows that distance, which represents the trade cost in our analysis, has an even greater impact on horticulture exports because they are perishable in nature. Moreover, the decline in relative prices by 1%, increases horticulture exports by 0.22%. Furthermore, Pakistan exports 143% =  $(e^{0.89}-1) * 100$  more horticulture products to its trading partners having trade agreements regarding horticulture products as compared to other countries. Also, Pakistan is exporting 676% =  $(e^{2.05}-1) * 100$  more horticulture products to its common border countries as compared to other countries. Lastly, sharing the common official language (English) with trade partners is decreasing the possibility of horticulture exports by 48% =  $(e^{-0.67}-1) * 100$  as compared to other importing countries. This particular result is contrary to the expected signs of the common language coefficient. Potentially this coefficient transpires as negative due to the point that proximity is a crucial factor for Pakistan's horticulture export. Alternatively, Pakistan can tap the export potential of geographically distant markets by investing in technical expertise, logistics infrastructure and improving the shelf life of the horticulture products. with the provision and availability of investment and technical expertise in the future. Pakistan exports its horticulture products mostly to the common border and Asian countries and these countries mostly do not have English as their official language. Lastly, the results may be turned out differently if all sectors' exports are considered simultaneously.

**Table 5 Result of PPML model for 10 year period (2011-2020)**

Variables	Coefficients	Std.	P value
GDP of Importing Countries	0.17	0.05	0.00
GDP of Pakistan	-0.71	0.75	0.34
Distance between Capitals	-1.58	0.1	0.00
Relative Prices	0.22	0.03	0.00
Trade Agreements	0.89	0.18	0.00
Common Border	2.05	0.15	0.00
Common Language	-0.67	0.22	0.00
Constant	20.30	0.79	0.00
Country Fixed Effect		Yes	

Source: Author's Estimations

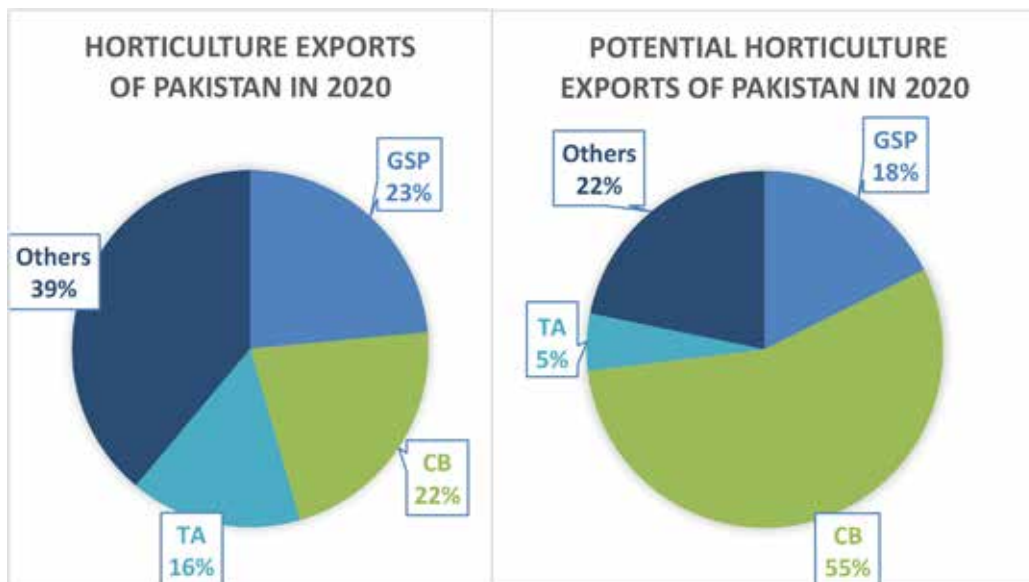
## 4 Assessment of Potential Horticulture Exports of Pakistan

After the determination of factors affecting Pakistan's horticulture exports, this section analyzes the share of different countries in actual horticulture exports as compared to their share in potential and untapped potential exports.

### 4.1 Comparative Analysis of Actual Horticulture Exports and Untapped Horticulture Export Potential

The total raw and intermediate horticulture exports of Pakistan are approximately USD 1.05 billion in 2020. The comparison of horticulture export to untapped potential export for 2020 shows that the 'TA' countries currently have a 16% share in horticulture export of Pakistan and Pakistan has the potential to increase this share by 5% more in untapped potential. Meanwhile, 'GSP' countries overall have 18% of untapped potential as compared to the current share of 23% in Pakistan's horticulture exports. Pakistan's export volume is quite low to 'GSP' countries despite their high demand mainly because of the distance and complex international standard compliance requirements. Moreover, Pakistan has an approximately 55% untapped potential of horticulture exports with 'CB' countries despite the already large contributing share. This large untapped potential has two possible reasons including the relatively less distance cost and underreported trade. However, the share of 'Other' countries is expected to take 22% share of Pakistan's untapped export potential. The 'Other' countries hold the second-highest share in untapped potential.

**Figure 8 Comparative Analysis of Horticulture Exports Share**



Comparing shares of specified categories is a vital form of analysis however, the decline in share does not necessarily indicate the decline in absolute/actual values. As per Table 6, in 2020 there is an untapped potential for horticulture exports in Pakistan. Also, Pakistan has the potential to expand its horticulture export by USD 134 million in 'GSP' countries and, USD 423 million in 'CB' countries. Also, 'TA' countries' untapped potential is almost USD 39 million, and 'Other' countries show USD 166 million untapped potential for Pakistani horticulture exports.

**Table 6 Overall Horticulture Exports Potential**

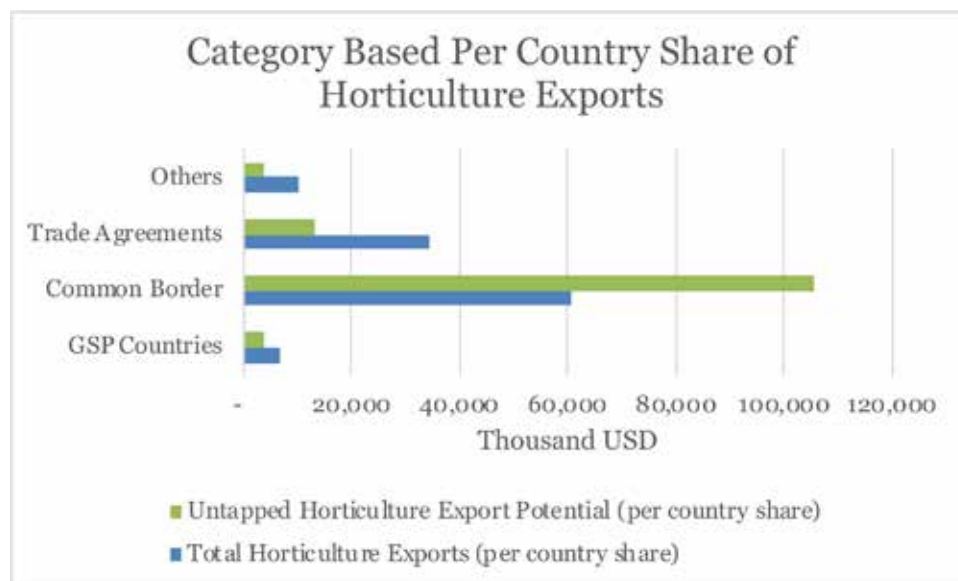
Countries' Status	GSP	CB	TA	NTA	Total
	USD 000	USD 000	USD 000	USD 000	USD 000
Total Horticulture Exports	260,219	243,141	73,417	480,463	1,057,240
Potential	406,429	663,494	82,321	634,322	1,786,566
Untapped Horticulture Export Potential	146,210	420,353	8,904	153,859	729,326

Source: Author's Estimation

Thus, Pakistan has the potential to increase its exports by almost USD 729 million and it could increase more with better supply management practices and value addition activities.

#### 4.2. Analysis of Category Based Per Country Share

The determinants of export potential indicate that Pakistan is exporting a relatively large share of its horticulture exports to common border countries including China, India, Iran, and Afghanistan. The country-wise share among each category supports the result. Among all categories analyzed, common border countries have the highest percentage per country (Figure 4). It also captures the highest share in horticulture exports and untapped horticulture export potential. The possible reasons for this high share are various such as considerably low distance, large markets, and also under-reported trade.



Source: Author's Estimation

**Figure 9 Per Country Share by Each Category in Horticulture Exports**

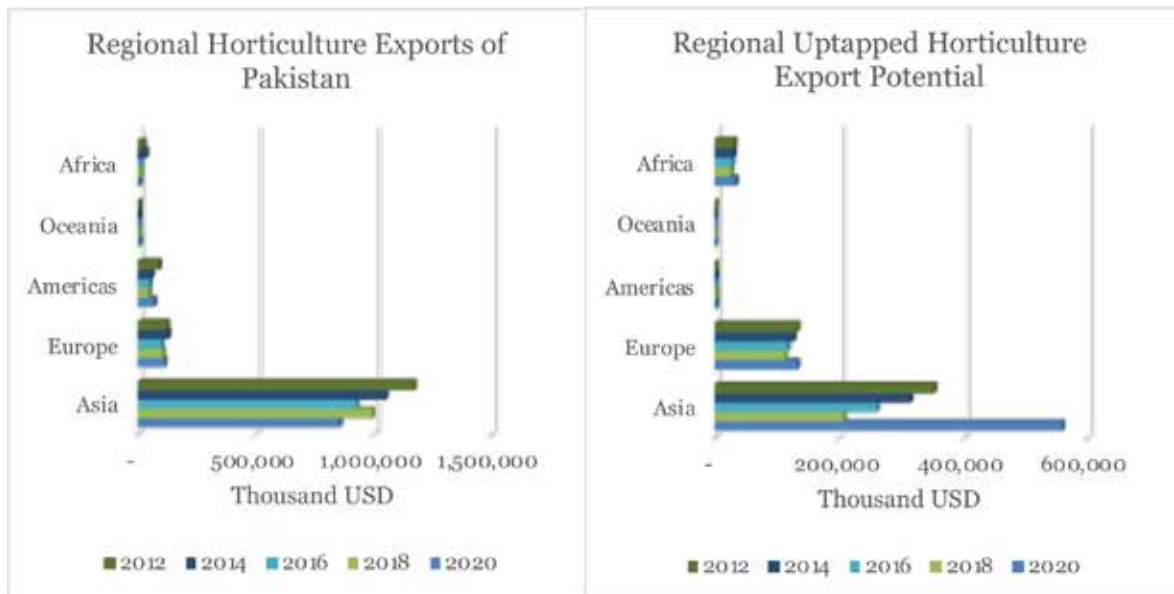
<sup>2</sup>Note: TA and CB both columns contain the actual and potential exports for China.

# 5 Regional Analysis

The following section discusses the regional untapped potential of horticulture exports in Pakistan.

## 5.1 Pakistan's Horticulture Export Potential to Asia

Pakistan exports almost USD 1.05 billion in raw and intermediate horticulture products to Asia, Europe, America, Africa, and Oceania. However, Asia is one of the significant regions in the world for horticulture export of Pakistan due to the proximity. However, the overall trend of Pakistan's actual horticulture exports to Asia is declining in recent past years. Pakistan's exports of horticulture to Asian economies are substantially lower than their potential due to political, strategic complexities, and underreporting of trades. Moreover, Pakistan exports its second largest share of horticulture products to Europe. Also, Pakistan has the most untapped horticulture export potential in Europe after Asia. However, it also has a large number of NTMs which results in low potential with current compliance practices in Pakistan.



Source: Author's Estimation

**Figure 10 Pakistan's Regional Horticulture Exports and Untapped Potential**

The horticulture export of Pakistan to America, Africa, and Oceania is relatively low despite their high demand. There are two crucial reasons for low potential. First, the geographic distance between Pakistan and these regions is massive which drives up the cost of transportation and standard compliance. Second, Pakistan exports almost 70% of its horticulture export in raw form and it limits the exports' ability to capture remote markets. It results in more of Pakistan's horticulture exports to Asia as market accessibility at comparative prices is more feasible there. Also, in the future, the increase in shelf life with the value-addition of Pakistani horticulture export can further open the accessibility of demand in these regions. The table below highlights the top 5 countries in each region with untapped horticulture export potential.

**Table 7 Top Countries with Untapped Export Potential**

**Pakistan's Horticulture Export Potential in 2020 (USD 000)**

Country	Asia	Country	Africa	Country	Europe	Country	America	Country	Oceania
Afghanistan	186,725	Tunisia	7,919	Switzerland	16,737	Trinidad and Tobago	1,005	Fiji	347
India	179,600	Mauritius	4,708	Slovenia	15,325	Mexico	737	New Zealand	297
China	34,878	Seychelles	3,417	Romania	11,595	Brazil	403		
Kyrgyzstan	24,246	Egypt	2,994	Lithuania	10,590	Bahamas	353		
Kuwait	15,412	Morocco	2,108	Latvia	10,188				

*Source: Author's Estimation*

The analysis above provides insights into the relevant factors affecting the horticulture exports of Pakistan. Also, it identifies the markets and their scale to realize the untapped horticulture exports. Moreover, it highlights the region-based factors important for the realization of the export potential.

## 6 Exports Potential of Fruits and Vegetables after Post Harvest Losses Recovery

Pakistan loses almost its 35 to 40% production of fruits and vegetables in post-harvest losses (Siddiq & Basher 2019). To analyze the lost potential associated with these losses, this section examines the potential of Pakistan that remains unrealized in the production and exports of fruits and vegetables due to post-harvest losses and supply management issues.

### 6.1. Estimation of Pakistan's Potential in Fruits Production and Exports after Post Harvest Losses Recovery

Pakistan holds a noticeable ranking in the production of many fruits such as citrus, apple, mango, plum, apricot, and others. However, despite having mass production, the economy lost a significant share of production in post-harvest losses due to inadequate supply infrastructure. Pakistan's total production of fruit is found to be approximately 7 million tons in 2020 and it has earned USD 418 million from the exports of 873 thousand tons of these products.<sup>3</sup> There are two major reasons for these low earnings from fruit export. First, from the side of quantity, every year Pakistan losses almost 35 to 40 % of its production in post-harvest losses and consume nearly 90% of the produced output which as a result leaves very little ground for exports. Second, as mentioned in the above text, Pakistan earns less than the world's average prices for its fruits export, which further lowers the earnings against horticultural exports.

All the above discussion suggests that with the help of corrective measures at the domestic level the quantity sides' shortcomings can be minimized. Also, Table 13 shows the estimates of the potential increase in production and exports of fruits which is possible with a percentage decline in post-harvest losses. In 2020, if Pakistan could recover its post-harvest losses in fruit by 15 to 20, or 30 %, it would increase Pakistan's fruit export earnings to USD 518 million, USD 551 million, and USD 629 million % respectively.

**Table 8 Potential Value of Fruits Exports with Percentage of Post-Harvest Loss Recovery**

Years	Fruits Exports	Share of Fruit Export in Production	Fruits Exports after 15% Production Recovery	Fruits Exports with 20% Production Recovery	Fruits Exports after 30% Production Recovery
Units	000' USD	%	000' USD	000' USD	000' USD
2016	435,232	0.1	566,200	601,587	687,528
2017	354,478	0.09	467,288	496,494	567,421
2018	431,395	0.11	558,439	593,341	678,104
2019	398,771	0.11	515,098	547,291	625,476
2020*	418,597	0.12	518,769	551,192	629,934

Source: Authors' Estimations

<sup>3</sup>Ministry of National Food Security and Research, and ITC.



## 6.2. Estimation of Pakistan's Potential in Vegetables Production and Exports after Post Harvest Losses Recovery

Pakistan is also a producer and exporter of vegetables. The production of vegetables in Pakistan is revolving from around 7.1 to 9.3 million in the last five years. Though the figures for the last two years of production are relatively sluggish around 8.3 to 8.4 million tons.<sup>4</sup> Pakistan has earned almost USD 259 million from the exports of 712 thousand tons of vegetables which are almost 8 percent of total vegetable production. The trend of vegetable consumption share shows that Pakistan consumes a relatively higher percentage of its vegetables as compared to fruits. This leaves even less room to export vegetables because there are post-harvest losses of 35 to 40 % in vegetables as well. Table 16 displays that if in 2020 Pakistan recovers its post-harvest losses in vegetables with the percentage of 15, 20, and 30, its vegetable export earnings would raise to USD 326 million, USD 347 million, and USD 396 million respectively.

**Table 9 Potential Value of Vegetable Exports with Percentage of Post-Harvest Loss Recovery**

Years	Vegetable Exports <sup>5</sup>	Vegetables Exports/Vegetable Production	Vegetable Exports after 15% Production Recovery	Vegetable Exports after 20% Production Recovery	Vegetable Exports after 30% Production Recovery
Units	000' USD	%	000' USD	000' USD	000' USD
2016	176,219	0.08	219,722	233,455	266,805
2017	173,339	0.09	234,198	248,835	284,383
2018	246,892	0.12	323,421	343,635	392,725
2019	250,245	0.11	307,478	326,695	373,366
2020*	259,874	0.09	326,540	346,948	396,512

Source: Authors' Estimations

This report has employed two different methods of horticulture export potential estimation, that is, the gravity approach and potential hidden in the recovery of post-harvest losses. The results suggest that in 2020 overall horticulture export potential as per the gravity approach was 729 million USD. Thus, in 2020, if Pakistan could recover post-harvest recovery in fruit and vegetable production combined with 15, 20, and 30%, it would increase the total unrealized potential of horticulture exports by USD 869 million, USD 948 million, and USD 1.07 billion USD, respectively<sup>6</sup>.

**Table 10 Estimated Overall Horticulture Export Potential**

% of Post-Harvest Loss Recovery	15%	20%	30%
Units	'000' USD	'000' USD	'000' USD
Overall Unrealized Potential Due to Post Harvest Losses	166,838	219,670	347,975
Total Unrealized Horticulture Export Potential	896,164	948,996	1,077,301

Source: Authors' Estimations

<sup>4</sup>Ministry of National Food Security and Research, and ITC.

<sup>5</sup>Production of all vegetables including potatoes.

<sup>6</sup>This includes the untapped export potential of horticulture determined through gravity approach and the lost unrealized potential of fruit and vegetable exports due to post harvest losses

# 7

## Conclusion

Pakistan exports approximately USD 1.05 billion worth of raw and intermediate horticulture products to the world. Distance turns out to be a crucial factor in determining horticulture exports of Pakistan due to the perishability of horticulture products. The purchasing power of importing countries which induces demand also has a significant impact on Pakistan's horticulture exports. Relative price level exhibits a positive association with horticulture exports. It shows that the increase in relative prices improves importing countries' relative purchasing power and as a result, increases Pakistan's horticulture exports. Additionally, Pakistan's horticulture exports are likely to increase if a trade partner shares a common border with Pakistan or has a trade agreement with Pakistan.

Pakistan's horticulture sector bears untapped export potential worth USD 729 million. Among all regions, the Asian market remained largely untapped and offers the highest untapped potential for horticulture exports followed by Europe, Africa, Americas, and Oceania regions. Besides similar consumption patterns, the reason for relatively high export potential in Asian economies is lower distance and transportation costs than in other regions. On the other hand, a major limiting factor for Pakistan's horticulture export is the post-harvest losses in fruits and vegetable production up to 30 to 45%. These post-harvest losses are high because of a lack of proper infrastructure and technical expertise. Infrastructure facilities typically include temperature & atmosphere control logistics, packaging houses, cold storage chains, and others. The enhancement of technical expertise calls for specific practices and techniques, backed by focused R&D on potential products, that need to be adopted during the pre and post-harvest periods so that the export quality could be improved, and the wastages could be reduced. According to the estimates in this study, Pakistan's total untapped horticulture export potential would be able to reach USD 869 million, USD 948 million, and USD 1.07 billion approximately, if the post-harvest losses related to fruits and vegetable production could decline by 15, 20, and 30%, respectively.

# 8 Policy Recommendations

This study proposes the following recommendations to help increase horticulture exports:

- **Horticulture Export Promotion**

Government bodies including the Trade Development Authority of Pakistan (TDAP) and Pakistan Horticulture Development & Export Company (PHDEC) should launch aggressive international marketing campaigns with the help of commercial partners for promoting horticulture exports. Horticulture products should be included in the regular trade fairs where participation is made through TDAP. In addition, horticulture-specific trade fairs should also be launched in potential markets.

- **Coordination among tiers of government for the Development of the Horticulture Sector**

Since the passage of the 18th Constitutional Amendment, agriculture has been devolved to provincial governments, however, exports as well as some other functions are still under the purview of the federal government.

It is therefore urged that the coordination between provincial and federal authorities should be improved so that both tiers of government can efficiently play their complementary role in promoting local production, value-addition, and exports of horticulture products.

- **Adequate Development of Cold Storage Chains**

The lack of availability of cold chains in Pakistan is a major reason for substantial pre and post-harvest losses, especially for products with shorter shelf life such as vegetables and fruits.

It is recommended that the Public-Private Partnership model should be adopted to encourage cold storage chains in the country. The strategic locations for cold chains should be the country's exit roots such as ports, borders as well as farms, and markets.

- **Easy Credit Facility to Agri-Tech Businesses**

Easy credit facilities should be provided to Agri-Tech businesses to encourage them in investing in farm-to-market infrastructure and expanding storage facilities to smoothen the supply process.

- **Process for issuance of certificates and services needs to be expedited**

The process of certification of NTMs is performed inefficiently in Pakistan which causes the deterioration of horticulture products with limited shelf life. Functional inefficiencies of the Department of Plant Protection (DPP) certification and services of Minimum Residue Level (MRL) testing due to the limited capacity of DPP result in delays as pointed out by ITC.

It is recommended to enhance the technical resources of the Department of Plant Protection (DPP). Adequate hiring and capacity building should be done in DPP as well as other relevant departments responsible for certification essential for perishable goods exports such as horticulture products. In addition, measures to curtail substantial delays in certification and testing services need to be adopted.

- **Promote Agro-Tech across the supply chain**

Private startups are currently trying to cover the market gap in Pakistan and working on strengthening the farm-to-market supply chains however the number of these startups is very limited. The function of these businesses includes the direct provision of agricultural products from farmers to registered local vendors and a range of businesses.

It is recommended that these businesses should be incentivized via financial schemes so that the availability of these types of business services could be extended.

- **Engage International Research Agencies & Academia**

International funding and research agencies are operating on projects to increase the productive capacities and value addition activities in Pakistan. Similar to the Australian Centre for International Agricultural Research (ACIAR), the government must engage other similar international agencies for technical research and support for upscaling the horticulture sector of Pakistan. In addition, joint projects need to be urged with countries having well-developed horticulture export base. These initiatives must focus on improving labor productivity, enhancing farm yields, adopting modern technology, awareness on digital platforms, and others.

- **Enhance Coverage of Horticulture Products under Trade Agreements**

Horticulture products are not adequately covered under the existing trade agreement despite bearing the tremendous export potential these products.

It is urged that exportable horticulture products identified in this study must be given due weight while negotiating future trade agreements as well as renegotiating existing agreements. While negotiating trade agreements, due diligence must be performed to analyze whether local horticulture producers are complying with Sanitary & Phytosanitary (SPS) as well as their ability to overcome Technical Barriers to Trade (TBT) (such as size, grading, labeling, packaging, etc.) as per the requirement of the partner country.

- **Promotion of Value Addition in the Horticulture Sector**

Pakistan's horticulture products attract relatively low prices in international markets mainly due to a lack of value addition. Following measures are recommended to enhance exports of value-added horticulture products:

- Clusters identified by Planning Commission<sup>7</sup> for horticulture production should include allied industries within each cluster that are relevant to value addition and preservation of horticulture products.
- An effective international marketing strategy focusing on value-added horticulture exports needs to be devised.
- Commercial sections abroad should conduct market research for their respective countries so that consumption patterns of international consumers can be better aligned with domestic production.

- **Adequate Coverage of Horticulture Sector in Trade Agreements**

Existing Trade agreements of Pakistan cover only limited horticulture sectors' products. Also, Pakistan's market access to importing countries for negotiated horticulture products is restricted by the stringent NTM requirements. To enhance the coverage of the horticulture sector in the trade agreement, the following measures are recommended:

- Horticulture sector-related tariff lines should be covered in new and existing trade agreements.
- Non-tariff measures are a major barrier for horticulture exports and must be given due weight while negotiating trade agreements.
- The horticulture sector should be covered in bilateral areas of collaboration to further develop the local horticulture sector and enhance exports.

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<sup>7</sup>Mubarik. (ed.) (2020) Cluster Development Based Agriculture Transformation Plan Vision-2025. Project No. 131(434)PC/AGR/CDBAT-120/2018. Unpublished Report, Planning Commission of Pakistan, Islamabad, Pakistan and Centre for Agriculture and Biosciences International (CABI), Rawalpindi, Pakistan.

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## Appendix

Table 11 Selected Countries by Region

Asia	Africa	America	Europe
India	Algeria	Bahamas	Austria
Nepal	Angola	Brazil	Belgium
Qatar	Benin	Canada	Bulgaria
Kuwait	Botswana	Chile	Croatia
China	Cameroon	Mexico	Czech Republic
Maldives	Djibouti	Trinidad and Tobago	Denmark
Iran	Egypt	United States	Finland Kazakhstan
Kyrgyzstan	Ghana		FranceGhana
France			
Uzbekistan	Kenya		Germany
Bahrain	Madagascar		Greece
Turkey	Malawi		Ireland
Cyprus	Mauritius		Italy
Georgia	Morocco		Latvia
Malaysia	Mozambique		Lithuania
Jordan	Nigeria		Netherlands
Hong Kong, China	Senegal		Norway
Brunei Darussalam	Seychelles		Poland
Thailand	South Africa		Romania
Singapore	Tanzania		Slovenia
Bangladesh	Tunisia		Spain
Azerbaijan			Sweden
Lebanon			Switzerland
Myanmar			Ukraine
Iraq			United Kingdom
Oman			
Viet Nam			
Philippines			
Indonesia			
Japan			
Saudi Arabia			
Sri Lanka			
Russian Federation			
United Arab Emirates			
Afghanistan			



06. Table 12 Main Chapter to Extract Raw & Value-Added Horticulture Category<sup>8</sup>  
Live trees and other plants; bulbs, roots, and the like; cut flowers and ornamental foliage.
07. Edible vegetables and certain roots and tubers.
08. Edible fruit and nuts; peel of citrus fruit or melons.
09. Coffee, tea, mate, and spices.
11. Products of the milling industry; malt; starches; inulin; wheat gluten.
12. Oilseeds and oleaginous fruit; miscellaneous grains, seeds, and fruit; industrial or medicinal plants straw and fodder.
13. Lac; gums, resins, and other vegetable saps and extracts.
14. Vegetable plaiting materials; vegetable products not elsewhere specified or included.
15. Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or veg waxes.
20. Preparations of vegetables, fruit, nuts, or other parts of plants.
21. Miscellaneous edible preparations.
23. Residues and waste from the food industries; prepared animal fodder.
33. Essential oils and resinoids; perfumery, cosmetic or toilet preparations.

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<sup>8</sup>Chapters from which Raw & Intermediate/ Value-Added Horticulture Category is formed on subjective basis.

Table 12 Relevant Studies using Gravity Approach to Determine the Export Determinants

Author	Year	Title	Technique	Period	Dependent Variables	Independent Variables
Daumal et al.	2005	The Border Effects in Brazil	PPML	1991-1999	Exports of Brazil to other Countries in World	GDP imp, GDP exp, Home, Brasil, Distance, Fixed Effects
Rahman	2010	The Factor Affecting Bangladesh's Exports: Evidence from the Gravity Model Analysis	FE	1972-1999	Exports of Bangladesh to other Countries in World	GDP imp, GDP exp, GDP per capita, Inflation, Distance, Exchange Rate, Trade Openness, Total Import & export of exporter, Total Import & export of importer, RTA, Common Border
Zainal Abidin et al.	2013	The Determinants of Exports between Malaysia and the OIC Member Countries: A Gravity Model Approach	RE, FE & Pooled	1997-2009	Exports of Malaysia to OIC countries	GDP imp, GDP exp, GDP per capita, Inflation, Distance, Exchange Rate, Trade Openness, Quality of Institutions
Eita	2016	Estimating Export Potential for A Small Open Economy Using A Gravity Model Approach	Pooled OLS, FE, RE	1998-2012	Exports of Namibia to Trading Partners	GDP imp, GDP exp, GDP per capita, Distance, Exchange Rate, RTA, Common Border
Hippolyte	2016	Determinants of Barbados Exports: Preliminary Analysis using a Gravity Model Approach	OLS, 2SLS	2005	Exports of Barbados's Merchandise to Trading Partner	GDP per capita imp, GDP per capita exp, GDP per capita, Distance, TA, Common Language
Mussa et al.	2018	Impact of Trade Costs on Export Performance of Ethiopia - A PPML Panel Gravity Equation Approach	PPML	2000-2015	Exports of Ethiopia to other Countries in World	GDP imp, GDP exp, GDP per capita, Distance, TA, Common Border, Common Language, Landlocked
Irshad et al.	2018	A Panel Data Analysis of China's Trade Pattern with OPEC Members: Gravity Model Approach	OLS	1990-2016	China's Total Trade to its OPEC Trading Partner	GDP per capita imp, GDP per capita exp, GDP per capita, Distance, WTO member, Exchange Rate, Trade Openness
Irshad et al.	2018	Competitiveness of Pakistani rice in international market and export potential with the global world: A panel gravity approach	PPML	2003-2016	Pakistan's Rice Exports to its Trading Partners	GDP imp, GDP exp, GDP per capita, Distance, TA, WTO member, Common Language

Author	Year	Title	Technique	Period	Dependent Variables	Independent Variables
Rahman et al.	2019	Determinants of Exports: A Gravity Model Analysis of the Bangladeshi textile and Clothing Industries	RE & PPML	1990-2017	Exports of Bangladesh's Textile & Clothing to Trading Partner	GDP imp, GDP exp, GDP per capita, Distance, Exchange Rate, Trade Agreements, WTO membership
Atif et al.	2019	Determinants and efficiency of Pakistan's chemical products' exports: An application of stochastic frontier gravity model		1995-2015	Exports of Bangladesh's Chemical Products to Trading Partner	GDP imp, GDP exp, Distance, Exchange Rate, TA, Common Border, Colonial Links, Import Tariff, Political Disputes
Nguyen	2020	Determinants of Vietnam's rice and coffee exports: using a stochastic frontier gravity model		2000-2018	Exports of Vietnam's Rice & Coffee to Trading Partner	GDP imp, GDP exp, Population, Distance, Exchange Rate, Trade Openness, RTA, Common Border
Salahuddin	2020	Economic & Cultural Distance & Regional Integration: Evidence from Gravity Model Using Disaggregated Data for Pakistan		2000-2015	Pakistan's Total Trade to its Trading Partner	GDP imp, GDP exp, GDP per capita, Inflation, Distance, Exchange Rate, Market Size, Real Factor Endowments, RTA, Common Border, Common Language, Common Colony, Landlocked
Thi Hoang et al.	2020	Determinants of Trade Between Taiwan and ASEAN Countries: A PPML Estimator Approach		2000-2017	Taiwan's Total Trade to its Trading Partner	GDP imp, GDP exp, GDP per capita, Common Language, Distance, Exchange Rate, Culture Difference, Political Power, WTO membership



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