

A Study on International Vegetable Production and Consumption with Special Reference to Select Countries

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Abstract: India is a land of agriculture diversity with 66 percent of its population still dependent on agriculture and contributing about 20 percent to the Indian GDP. Value addition of food products is expected to increase from 8 per cent to 35 per cent by 2025. Fresh Fruit and vegetable processing is also expected to increase from the current level of 2 per cent to 25 per cent of total production by 2025. This study is basically a secondary data analysis on certain international production and consumption of vegetables. The article deals with comparative study of certain select countries with respect to their vegetable production. The analysis shows that there overwhelming evidence in support of the hypothesis that the study regions are significantly different in terms of their vegetable production and consumption.

Keywords: Vegetables market, vegetable production, vegetable consumption, exports

INTRODUCTION

The Vegetables (F&V) sector has been a driving force in stimulating a healthy growth trend in Indian agriculture. Given the rising share of high value commodities in the total value of agricultural output and their growth potential, this segment is likely to drive agricultural growth in the years to come [1]. It plays a unique role in India's economy by improving the income of the rural people. Cultivation of these crops is labor intensive and as such they generate lot of employment opportunities for the rural population. F&V sector is perhaps the most profitable venture of all farming activities as it provides ample employment opportunities and scope to raise the income of the

farming community. It also has tremendous potential to push the overall agriculture growth. India has been bestowed with wide range of climate and physio-geographical conditions and as such is most suitable for growing various kinds of F&V. This has placed India among the foremost countries in F&V production just behind China. F&V together constitute about 92% of the total horticultural production in India [1]. During 2012-13, India's contribution in the world production of F&V was 12.6 % and 14 % respectively [1]. China's share has been highest with 21.2% in world's fruit production and 49.5% in world's vegetables production followed by India and Brazil. The world production and percent share of F&V is shown in Table 1.

Table1: World production and percent share in 2012-13

FRUITS			VEGETABLES		
Country	Production	Share	Country	Production	Share
China	137066750	21.2	China	573935000	49.5
India	81285334	12.6	India	162186567	14
Brazil	38368678	5.9	USA	35947720	3.1
USA	26548859	4.1	Turkey	27818918	2.4
Indonesia	17744411	2.7	Iran	23485675	2
Philippines	16370976	2.5	Egypt	19825388	1.7
Mexico	15917806	2.5	Russian Federation	16084372	1.4
Turkey	14974561	2.3	Mexico	13599497	1.2
Spain	13996447	2.2	Spain	12531000	1.1
Italy	13889219	2.1	Italy	12297645	1.1
OTHERS	270594597	41.8	OTHERS	261467661	22.6

India is a land of agriculture diversity with 2/3 of its population still dependent on agriculture and contributing about 20% to the Indian GDP. Value addition of food products is expected to increase from 8 per cent to 35 per cent by 2025. Fresh Fruit & vegetable processing is also expected to increase from the current level of 2 per cent to 25 per cent of total production by 2025. Development of the vegetable industry is constrained by poor marketing arrangements; there is a large gap between farmers and retail prices. The traditional retailing of vegetables is not very much organized, amounts to 97% of the total market, is extremely localized and highly fragmented with large number of intermediaries.

India's diverse climate ensures availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database published by National Horticulture Board, during 2014-15 India produced 86.602 million metric tonnes of fruits and 169.478 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.110 million hectares while vegetables were cultivated at 9.542 million hectares.

India is the largest producer of ginger and okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, Cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (22.94%), Papayas (44.03%) and Mangoes (including mangosteens, and guavas) (37.57%). The vast production base offers India tremendous opportunities for export. During 2015-16, India exported fruits and vegetables worth Rs. 8,391.41 crores which comprised of fruits worth Rs. 3,524.50 crores and vegetables worth Rs. 4,866.91 crores. Mangoes, Walnuts, Grapes, Bananas, Pomegranates account for larger portion of fruits exported from the country while Onions, Okra, Bitter Gourd, Green Chillies, Mushrooms and Potatoes contribute largely to the vegetable export basket. The major destinations for Indian fruits and vegetables are UAE, Bangladesh, Malaysia, Netherland, Sri Lanka, Nepal, UK, Saudi Arabia, Pakistan and Qatar. Though India's share in the global market is still nearly 1% only, there is increasing acceptance of horticulture produce from the country. This has occurred due to concurrent developments in the areas of state-of-the-art cold chain infrastructure and quality assurance measures. Apart from large investment pumped in by the private sector, public sector has also taken initiatives and with APEDA's assistance several Centers for Perishable Cargoes and integrated post harvest handling facilities have been set up in the country. Capacity building initiatives at the farmers, processors and exporters' levels has also contributed towards this effort.

LITERATURE REVIEW

Vishwanadham N [2] analyses the deficiencies in the Indian supply chain in the food retail. The most important problem associated with the Indian food industry is the inefficient supply chain as a result of which about 20 per cent of the food produce worth Rs. 10,000 crore is wasted. Only through developing an efficient supply chain can India's population have access to affordable superior quality food produce while ensuring remunerative prices to the farmers.

Arvind Singhal [3], The first part of the report lists down the factors contributing to a dynamic economy. The study forecasts the consumption pattern for the year 2014. The food and grocery spending continues to be a major component and it continues to top the categories of consumption. The consumers will shift from 'low-price' platform to 'price-plus' platform. There will be a strong increase in the trend of going shopping as a 'family', the study opines.

The study by Bourlakis, Michael and Bourlakis, Constantine [4] 32 focussed on the integration process of retailer's Information technology strategy with logistics strategy and to find out those aspects of the retailer's distribution and operational performance that are mostly influenced via that integration. The findings show that logistics and information technology strategies are developed and implemented in a parallel way by both local and multinational food retailers. A financial ratio analysis carried out for these firms suggests that multinational firms possess greater operational efficiency at both secondary and instore distribution operations compared to domestic firms. This is largely attributed to the integration of logistics and information technology operations. Multinational firm's superior operational efficiency also contributes for a higher profitability performance.

Leigh Sparks [5] gave a detailed account of the evolution of retail supply chain management in his paper. He discussed a number of changes that are taking place in modern retail supply chain in direct response to the changing demands of consumers. He also explained how these changes prompt a number of implications for the management of the retail supply chains.

Management needs no emphasis. Logistics may be external or internal to the retail outlets. Kotzab [7] shows the importance of logistics in (instore) an outlet. Through his empirical study, Kotzab proves the importance of instore logistics as a key determinant on the success of retail business. In the model, he has included the logistics processes that are carried out within a retail outlet ranging from incoming dock to the

checkout as the in-store logistics. As part of the study, Kotzab interviewed 202 store managers from three different kinds of stores namely supermarkets, small supermarkets and large supermarkets.

Seyed-Mahmoud Aghazadeh [6], in his paper explores ways of improving logistics and distribution supply chains of the food retail industry. The paper explains the concepts of logistics and supply chain as well as the new challenges in the food industry. The paper also discusses the successes and failures of the industry. The results reveal slow progress in accomplishing the goals of leaner supply chains and easier distribution. The study discusses how consumer driven, time-phased planning provides solutions to these challenges such as including the consumer in the supply chain planning process, managing product life cycles, promotional planning, planning for seasonal products, integrating with category management, determining cost-effective supply channels and planning capacities at the store level.

RESEARCH METHODOLOGY

The research is descriptive in nature, which means this study seek to identify certain issues, dilemmas or any ambiguity in the field by merely providing summary of the statistics so collected in support of the objectives. The data sets were obtained from certain international repositories like US Department of Agriculture. The data sets were analysis with the help of certain statistical tests in order to find the uncertainties in the field of agriculture with special reference to vegetables. The original data which have been obtained from the repositories is a data matrix of 6 X196 order. The original data set provides description of vegetable production and export of 196 countries. But for the feasibility only few countries were selected namely India, China, United States of America and United Kingdom. The comparisons were made with the help of Karl Pearson Correlation Coefficient and certain tests like *t test* were done along with *f test* in order to verify if these countries are significantly different with respect to their production and export of vegetables. The data is available only for few vegetables like Asparagus, Broccoli, Cabbage, Onion, Carrot and etc. The details were provided in analysis section of this paper.

The following serves as objectives to the study;

1. To know the present condition of production of vegetables with respect to select countries
2. To know about the status of the countries in comparison to each other
3. To find if the countries are different with respect to their production vegetables

4. To find and evaluate the evidence in support of study proposition that the countries are significantly different with respect to their production of vegetables.

As mentioned before, certain statistical techniques like to Karl Pearson Correlation along with T Test of independent samples were chosen to realize the above mentioned objectives. The Karl Person Correlation Coefficient is parametric measure that seek to explain relationship between any two or more variable of the study. Karl Person Correlation Coefficient for population can be expressed as below:

$$\rho_{x,y} = \frac{cov(x,y)}{\sigma_x \sigma_y}$$

And for sample

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

The T Test for independent samples can be defined and expressed as following.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where \bar{x}_1 the mean value of the first is sample and \bar{x}_2 is the mean value of the second sample. s_p is the pooled sample. The hypothesis for the T Test is that the difference between sample statistics is not significant. In other words:

$$H_0: \bar{x}_1 - \bar{x}_2 = 0$$

The alternative hypothesis is that the difference is significant i.e. $H_0: \bar{x}_1 - \bar{x}_2 \neq 0$. Hence, the following could serve as study hypothesis

H_a
= *The differences among sample countries are significant with respect to the sample items (vegetables) of the study.*

The following section provide description to the study analysis.

ANALYSIS

As mentioned in the previous section this article deals with the study of certain select countries with respect to production, export and surplus for consumption. The aim of the study is to find and evaluate the evidence in support of the study proposition that the study regions or countries are significantly different with respect to production, export and consumption of vegetables. The consumption is studied with the respect to surplus available. So this study assumes that the surplus effectively address the consumption of the region willy-nilly of the facts. The following table shows the summary statistics for the study data sets.

Table 2: Vegetable Production (in Metric Tons)

Table of Contents	India	China	USA	UK
Artichoke	0	150	45	0
Asparagus	0	14,503.1	38	5.1
Broccoli and Cauliflower	6,745.0	17,960.3	302	180.6
Cabbage and Other Brassica	7,949.0	64,084.0	960	279.4
Carrots	514.9	32,334.6	1,299	694.1
Corn	21,760.0	3,85,685.2	3,13,949	0.0
Cucumbers	161.0	94,667.8	773	0.0
Eggplant	11,896.0	55,423.4	62	0.0
Garlic	1,057.8	38,390.1	191	0.0
Green Bean	617.9	31,416.6	39	0.0
Lettuce	1,059.9	26,864.5	4,071	0.0
Mushroom	514.9	32,334.6	1,299	694.1
Okra	5,784.0	0.0	8	0.0
Onions	17,511.1	44,064.8	38	300.9
Potatoes	42,339.4	1,76,644.3	38	0.0
Spinach	0.0	1,76,644.3	409	0.0
Squash	4,695.5	13,870.2	814	0.0
Sweet Potato	1,046.6	1,50,929.9	1,223	0.0
Tomato	16,826.0	97,022.9	12,526	0.0
Average	7393.627368	76473.1912	17793.8514	113.3757
Variance	111957940.2	8227320204	4880461017	48449.83
Std Dev	10870.96251	93190.0936	71774.6316	226.1448

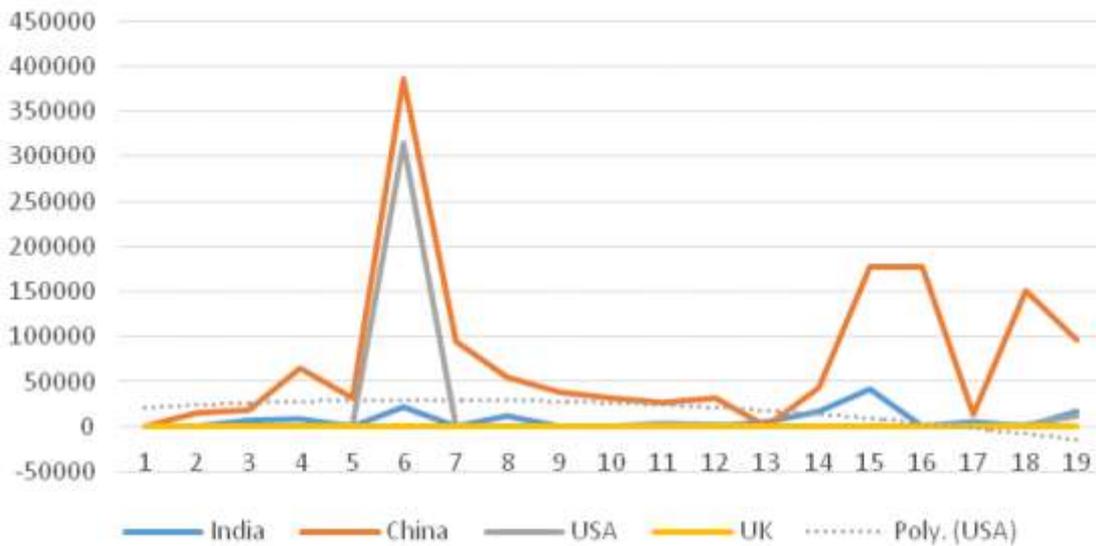


Fig-1: Production status by country

The above table show the summary of the vegetable production. China appears to be top in the list of production followed by USA, India and the least of

which is UK. The following tables shows the details clearly.

Table 3: Vegetable production country wise

Country	Average	Variance	Std Dev	T Stat	P Value
China	76473.19116	111957940	10870.9625	30.66324	2.72368E-17
USA	17793.85142	8227320204	93190.0936	0.832294	0.208074517
India	7393.627368	4880461017	71774.6316	0.449018	0.329389045
UK	113.3756842	48449.833	226.144844	2.185295	0.021164783

China tops the list with an average production of 76 billion tons, which is followed by USA (17 bl), India (7 bl) and UK (0.1 bl). The production in UK appears to be very low. India stands at third in terms of production. The P Value for China and UK are significantly different from the expected value at 5% significance level for the P Values appears to be less than 0.05. So though UK is seems to be poor in terms of

production but production is unusual. USA and India happened to be normal and there nothing any unusual pattern in the production. Fig 1 show the production status of the vegetable by country along with a trend line. However, since the data is not a time bound data the trend line doesn't assume importance. The following table shows the statistical diagnosis for two sample T Test.

Table 4: Statistical diagnosis

Country	China	USA	India	UK
China	NA	0.03632031	0.002796	0.001029943
USA	0.00146352	NA	0.536246	0.290085583
India	0.00279567	0.53624576	NA	0.006028753
UK	0.00102994	0.29008558	0.006029	NA

From the above table China significantly different from rest of the countries in producing vegetables. And shows its outstanding international position in producing vegetables. India is significantly different only when compared to China and UK. But its production with respect to USA has worth nothing. UKs production is significantly different compared to China and India while that with USA appears to be insignificant. Coming USA it show significant differences only with China but not with rest of the countries. The relations appears to be unclear. In the above section China and UK appears to be distinct by being significantly different in terms of their expected values. Whereas, inter-country analysis UK shows distinction with China and India while maintaining *status quo* with USA.

CONCLUSION

Vegetable production in China seems to be unexpectedly high. Though UK production is also unexpectedly high but appears to be normal while compared to USA. USA production is normal except when compared with China. Interestingly, the vegetable production of UK is significantly different from India but not with USA. USA vegetable production is significantly different from China but not from UK and India. This shows that through the details seems to be different globally but a careful statistical diagnosis proves that the countries are different in terms of their vegetable production. So this shows that in terms of vegetable production of India is significantly different from UK and China but not with USA. So the null hypothesis rejected and there is overwhelming evidence in the data in support of study hypothesis. The countries are significantly different from each other in terms of their production and consumption. However, more inquiry is necessary to validate the study results due to the fact that the study is only a secondary data study.

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