Analysis of Rice Production in Sri Lanka

S. Abilash *199303L*
Totin W *1999XXXx*
S. P. P. Aravinda *170802E*
M. M. G. U. M. Thialakasiri *199369R*

***Abstract*—Sri Lanka is a country which uses Rice as the main food source. Securing the rice production and balancing the supply and demand is major challenge with the growing population and the shrinking land to agriculture. In order to secure the rice supply for the country, increasing the domestic rice production is a major factor. For that there should be necessary infrastructure for rice cultivation and necessary conditions for increase the yield of the harvest. Securing water resources and supplying necessary amount of water in right time is a major consideration when developing irrigation systems in Sri Lanka. 'Mahaweli Project' is one of the biggest project in recent past of the country and by analyzing we found the it has a positive impact on rice production.**

To maintain the supply and demand balance, it is necessary to import rice when needed. But it is shown that even thogh domestic rice demand can be fulfilled with the domestic production, still rice imports are happening. In this study, we tried to find the patterns of the domestic rice production with rice imports

1. Introduction

Rice is the main food in Sri Lanka. Almost all households in Sri Lanka takes Rice with curries as the main meal. Rice ha become on of the major part of Sri Lankan culture and the roots of that bond runs for around 2000 years back with the written history. Rice is more of a way of the life of the country rather than an economic or agricultural activity.

1.1. Rice Consumption

Since rice is the main food in Sri lanka and the annual Rice consumption per person is approximated as 103 Kg per year by 2009[1]. Rice is on of the good source of energy, carbohydrates, calcium, iron, thiamin, pantothenic acid, folate and vitamin E. It provides 45% total calorie and 40% total protein requirement of an average Sri Lankan[1].

Both locally grown rice as well as imported varieties of rice is consumed. Main types of rice can be fund in the market are Samba, Keeri Samba, Red Nadu, Red Samba, Nadu and Basmathi. Other than as a main food, rice is used to make variety of foods for festival seasons. Rice and rice flow is used to make sweets mainly for Sinhala and Hindu New Year.

1.2. Rice Production in sri Lanka

Rice is one of the major crop in the country which accounts for 34 percent of the total cultivated land area in the Country. By 2018 approximately 1,041,000 ha of lands were cultivated with paddy yearly in 2 major seasons. On average 870,000 ha of land is sown with rice annually. Around 1.8 million farm families are engaged in paddy cultivation island-wide. Most of the farmers sown less than 0.4 ha of lands[2].

There are 2 major seasons where rice cultivated in Sri Lanka. Maha season (wet) starts in October-November and the harvesting happens on February-March On average 560,000 ha of lands are cultivated in Maha season and which accounts for around 70% of the yearly rice production. Yala season (dry) starts in April-May and the harvesting happens on August-September. On average 310,000 ha of lands are cultivated in Yala season and which accounts for around 30% of the yearly rice production. Production of rice is closely linked to both rainfall and surface water resources. The 2 main seasons are purely based on the rain fall which Maha season depends with Northeast monsoon the Yala season depends with Southwest monsoon[2].

Northeast monsoon the Yala season depends with Southwest monsoon. Sri Lanka can be divided into three main agricultural zones based on the annual rainfall and the water resources, which are dry zone, intermediate zone and wet zone. Rice production is concentrated mainly in the two dry zones and which accounts for around 72% of paddy production in the country. Since the paddy production is mainly concentrated around the 2 dry zones water resource management is a most important factor for increased rice production. Sri lanka uses many irrigation systems to supply water for rice producing areas. There are many ancient irrigation systems some even older that 2000 years and still managing water for rice production. Gradual decreasing in rainfall force to have more and more irrigation systems to manage the water and provide water to paddy fields in the right period in time.

Cultivation of rice is highly susceptible to the variations in rainfall, temperature, insects, soil moisture and variation in the intensity and frequency of extreme events. Delayed or weak monsoons or floods or droughts conditions in the areas of rice cultivation area are directly affecting to the yield obtained by the sown quantity.

2. Problem Statement

One of the major challenge is to balance the supply and demand of rice. Therefore from time to time Sri Lanka has to import or export rice in order to keep that supply and demand balance. The one objective of this study is to find the trend of domestic rice production and the import of rice.

Rice is the main food in Sri Lanka. Therefore is has the highest as a primary need for Sri Lankans. Securing the sources which are bound with rice production and supplying rice for the increasing demand with the rising population is a huge challenge for the country. Therefore time to time there are major projects conducted on improving the infrastructure for rice production has been a practice in Sri Lanka for the ancient times. In recent past Mahaweli Project is the biggest project conducted by Sri Lanka on improving and securing the necessary infrastructure, mainly water for rice production. Second of the objective of this study is to identify whether the Mahaweli Project has positive impact on rice production.

3. Analysis of Rice Production in Sri Lanka

Food and Agriculture Organization of the United Nations has identified and discussed regarding some common factors that can be affected for rice production specifically for wetlands. According to them, the factors are:

- Geographic Factors
- Climatic Factors (Solar radiation, Day-length, Winds and relative humidity)
- Land and Soil Factors (Level of soil fertility)
- Water Supply Factors
- Farming Practices (Good, clean and healthy seeds, Land preparation)
- Socio-economic Factors

More specifically in water supply factors, they have identified key sub-factors such as Water deficiency, flooding with consequent crop submergence, sources of water and irrigation and drainage infrastructures [3] Main focus of this section is to identify whether there is a high or positive impact on paddy production of Sri Lanka with the irrigation projects.

3.1. Mahaweli Project

Mahaweli development program is known as the biggest river basin development project in Sri Lanka. Under this program, several dams are constructed such as Victoria, Randenigala, Rantambe and etc [3] One of the key objectives of this projects is to provide an efficient water management plan within the country while productively using as a resource for power generation [2] The first phase of the project was initiated in 1961 and completed in 1976. Major projects that have completed during this time period are Bowatenne and Polgolla dams.

4. Analysis of Data

For teh study we have mainl used 3 datasets available in Sri Lankan government 'opendata' portal. Datasets of 'Paddy Production In Yala Season 1952 - 2012', 'Paddy Production In Maha Season 1952 - 2012' and 'Paddy Production In 1952 - 2012' are used. Missing data form 2013-2018 was found in government statistics web site and updated the 3 datasets.

4.1. Effect of Mahaweli Project

Figure 1 displays the data for paddy production in Bushels per year before completion of the first stage of the Mahaweli project (Time duration: 1952-1976).

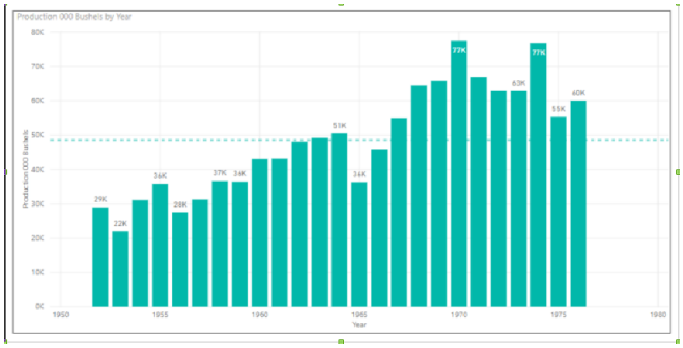

Figure 1. Production '000 Bushels per year (1952-1976)

According to the dataset which has released by the Sri Lankan government, Figure 1 displays that before completion of the project the government had nearly 50k average of paddy production.

The second stage of the project was initiated in 1977 and completed in 1995. Projects that carried out during this time period are Kotmale, Maduru Oya, Randenigala, Rantambe and Victoria dam. Figure 2 illustrates the paddy production per year for the time period between 1976 to 2006.

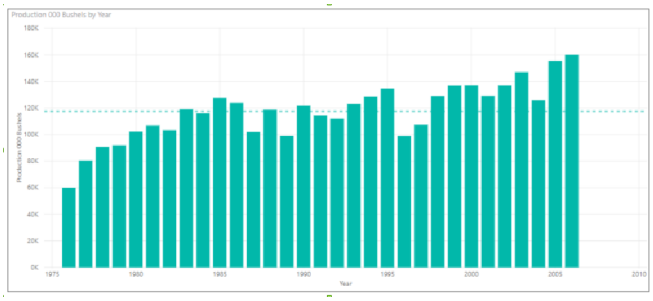

Figure 2. Production '000 Bushels per year (1977-1995)

Compare and contrasting Figure 1 and Figure 2 clearly indicates that massive irrigation projects like Mahaweli have positively affected Sri Lankan agriculture, more specifically for paddy, in order to increase the production. Figure 2 indicates that the average paddy production has increased

from 50k to 120k within the thirty years of time while the second phase of the project was undergoing. Figure 3 illustrates the paddy production from 1960 to 2010 and it indicates the growth of the production that has happened.

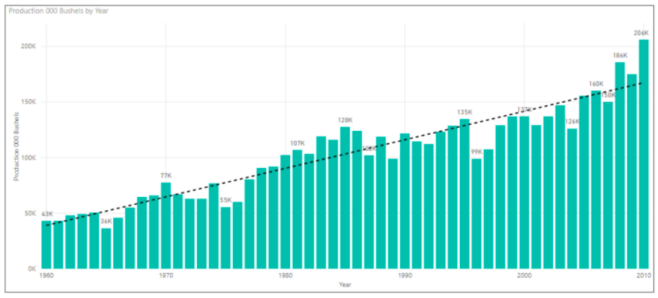

Figure 3. Production '000 Bushels per year (1960-2010)

4.2. Analysis on Rice consumption and Imports

From the dataset it is obvious that the average yield shows an upward trend with the year[figure 4], it was very low around 2000 kg/hectare in the 1960s , but has rapidly grown and in the second decade of 21st centuary it revolves around 4000 kg/hectare, hence with research,effort and technology paddy yield obtained from an unit land has incraesed with year.

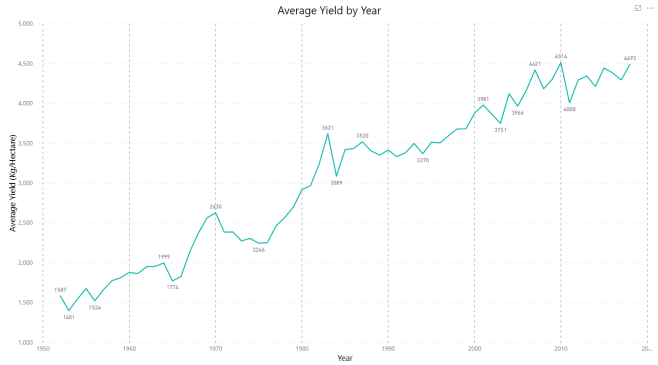

Figure 4. Average Yield by Year

Since average yield has increased the total domestic rice produced for consumption has significantly improved and the yearly rice requirement has been totally covered by the domestic rice produced, it can be visualized with the help of data available from department of census and statistics Sri Lanka [2], the details are available for the years from 2005 to 2015, there is only a single year 2007, where the domestic production has not sufficied the requirement [figure 5], this is due to the drought and floods affecting various parts of the Island in different seasons in 2006 -2007.[6]

Eventhough the rice requirement in Sri Lanka has been mostly satisfied by the domestic production, the data about the imports of rice shows a different picture, Sri Lanka has always been importing rice[6][7].

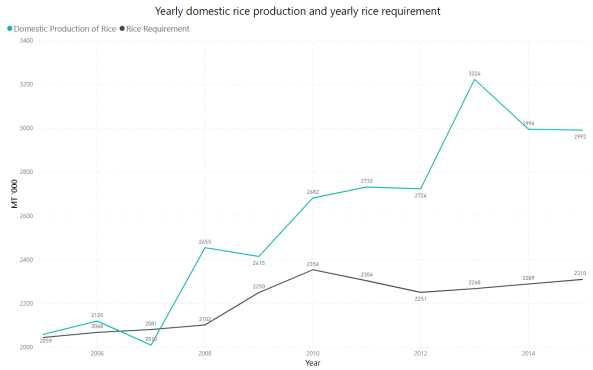

Figure 5. Yearly Domestic Rice Production and Yearly Domestic Rice Requirement

The data from year 1998 to 2017 has been visualized in figure 6, where the mode of the imports is 68 000 metric Tonns, mode of the data is used since the import quantity of rice varies significantly in certain years, the years 1999, 2004, 2007 , 2014 and 2016 has shown very high imports due to natural hazards [6], excluding those years still there is a high amount of imports, if the doemestic rice production satisfies the requirement then what is the need of importing more rice? The answer is the need of long grain aromatic rice, the delicious Basmati rice, Basmati rice cultivation is done in foothills of himalaya in India and Pakistan and its requirement in Sri lanka accounts for the higher rice imports.

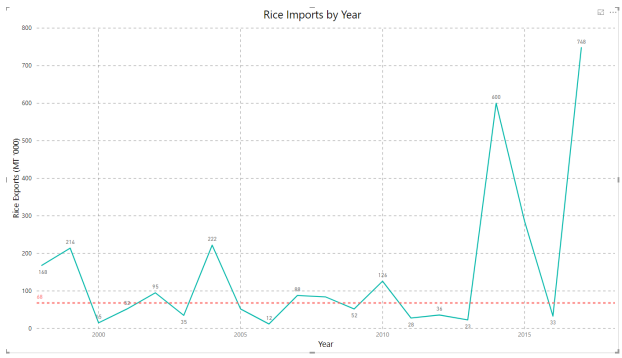

Figure 6. Rice Imports by Year

5. Results and Discussion

5.1. Results and Discussion on Mahaweli Project

Above mentioned findings do not emphasise that the government projects such as Mahaweli are the only reasons for the production increase. Even though there are other factors [5], irrigation projects have a high impact since projects like Mahaweli has not only focused on constructing irrigation facilities but also in the settlement of unemployed and landless families in Mahaweli water supply area in order to encourage them in farming. Therefore, the Mahaweli project becomes a factor which has a significant contribution

to the development of paddy production in Sri Lanka. Moreover, Figure 3 indicates that the production growth has not happened immediately, but some time period has taken. This research does not focus on finding the obstacles that were there which made the time gap but the correlation between the production growth and passive irrigation projects.

5.2. Results and Discussion on Rice Imports

During the analysis phase It is found that even though the domestic rice consumption can be satisfied with the domestic rice production, still the rice imports has gone up. It is found that Basmathi rice has causing this increased in rice imports to the country.

5.2.1. Why Basmati Rice?. With a good aroma and taste Basmati has become one of the favorite rice variant around the world, also it has low fat content comparing to other rice varieties, its rich in fiber which helps easy digestion and most importantly with comparison to other rice varieties it has low to mid valued (50-60) GI (Glycemic index) which reduces the exposure to diabetics [9].

5.2.2. Requirements for Basmati rice cultivation?.

- Climate required for Basmati rice farming

Evenly distributed rainfall throughout its growth, and clear sky during day and low night temperatures [10]. Basmati varieties require prolonged sunshine, high humidity and assured water supply. Basmati varieties with superior cooking and eating characteristics can be produced if the crop matures in relatively cooler temperature [10].

- Soil requirement for Basmati rice cultivation

Heavy neutral soils like clay loam, clay and loamy, pH range for the soil for better yield is 5.0 to 8.5, Alkaline or saline soils are not suitable [10]

6. Conclusion

Even though the climatic and soil conditions can be achieved in Sri Lanka, Basmati rice produce low yields because of low resistance to rice diseases and poor adaptability to environmental change [11], with higher cost for harvesting, farmers find it unprofitable and ineffective to cultivate Basmati, hence alternatives must be thought of if we are really going to be self sufficient in rice production. Alternatives may be long grain rice varieties or rice with low GI and good aroma.

One of the way to is to introduce fragrant gene of Basmati into local Sri Lankan rice [11], and other variants like brown rice can be proposed for lower GI and higher fiber content consumption, researches can be carried forward reduce Basmati consumption by producing alternative rice. Cultivating paddy such that the surplus will have a foreign demand increases the opportunity for export and it will help to counter the import expenditure of rice.

7. Suggestion for Future Works

In this study the dataset available in opendata portal of Sri Lanka has used, and the mussing data has filled with the data found on government statistics websites. The dataset available are not very detailed. Therefore as a suggestion use mo detailed dataset and the conduct the study again.

The available data can be use to train a machine learning model and predict some insights. Therefore it will be helpful to build a predictor with the available factore.

Acknowledgments

The authors would like to thank...

References

[1] Ricdpedia - Sri Lanka. Available: http://ricepedia.org/sri-lanka.[Accessed 16 March 2019]

[2] Department of Census and Statistics Sri Lanka, Available: http://www.statistics.gov.lk/.[Accessed 16 March 2019]

[3] "Completed Projects," Mahaweli Authority of Sri Lanka, [Online]. Available: http://mahaweli.gov.lk/en/complete.html. [Accessed 17 March 2019].

[4] "Master Plan," Mahaweli Authority of Sri Lanka, [Online]. Available: http://mahaweli.gov.lk/en/mp.html. [Accessed 17 March 2019].

[5] "Factors affecting wetland rice production and the classification of wetlands for agricultural production," Food and Agriculture Organization of the United Nations, [Online]. Available: http://www.fao.org/3/x6611e/x6611e03c.htm. [Accessed 19 March 2019].

[6] Sri Lanka National Report on Disaster Risk, Poverty and Human Development Relationship 2009, Disaster management center of Sri Lanka.

[7] Economic and Social Statistics of Sri Lanka 2017 by Central Bank of Sri Lanka.

[8] Economic and Social Statistics of Sri Lanka 2018 by Central Bank of Sri Lanka.

[9] The All-In-One Guide To The Health Benefits Of Basmati Rice, Available: https://www.positivehealthwellness.com/diet-nutrition/one-guide-health-benefits-basmati-rice/ [Accessed 17 March 2019].

[10] Basmathi Rice Farming Guide, Available: https://www.agrifarming.in/basmati-rice-farming [Accessed 17 March 2019].

[11] Identification of fragrant gene, fgr, in traditional rice varieties of Sri Lanka N.S. Kottearachchi*, E.G.D. Priyangani D.P.S.T.G. Attanayaka Department of Biotechnology, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (2010) . [Accessed 17 March 2019].