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# GROWTH, INSTABILITY AND TRENDS IN AREA, PRODUCTION AND PRODUCTIVITY OF COCONUTS IN INDIA

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## ABSTRACT

The present study was carried out to examine the current trends in major coconut producing countries in the world and India from 1990 to 2018. It focuses mainly on the growth performance of coconut area harvested, production and productivity in the top ten countries in the world and estimation of projected trends in coconut crop, especially in India. Growth rate, Instability index, ARIMA and Exponential model were used to examine the data. Production (5.85%), productivity (6.13%) were high in Brazil and the area harvested in Myanmar during the study period. The annual growth rate of production, productivity and area harvested of coconut in India were 1.67%, 0.44% and 1.22%, respectively, during the study period. Globally, area harvested, production and productivity have stabilized in the top 10 coconut producing countries, including India. The coconut production, productivity and area harvested data of India for the period of 1990 to 2018 were analyzed using Autoregressive Integrated Moving Average (ARIMA), and the Exponential smoothing model was used to project trends for the next three years from 2019-2021. After analyzing the data for stationarity, the suitable time-series models were chosen based on various goodness of fit criteria, viz. Akaike's Information Criterion, Mean Absolute Percentage Error (MAPE). Trends in area harvested, production and productivity were analyzed based on time series models using ARIMA. By using the best model, the area harvested, production and productivity were projected for three years. It reveals that there was an increase in productivity and production for the next three years, and a decrease in area harvested were forecasted.

**Keywords:** Growth performance, ARIMA, Coconut, Area harvested, Production, Productivity.

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## INTRODUCTION

The coconut (Cocos nucifera) is the most expedient palm in the world, and it belongs to the palm tree family (Arecaceae). The coconut palm is called "Kalpavriksha", meaning the "Tree of heaven" or "Tree of life" because each and every part of the tree is useful to human life for some purpose. It grows in capricious climatic and soil conditions. Coconut is a source of food, beverage, medicine, natural fiber, fuel, wood and raw materials for units producing a variety of goods. The coconut yields 65 to 70 percent of vegetable oil obtained by drying the coconut kernel. Coconut palm provides food security and livelihood to the large size of population in the world particularly, in Asia Pacific Countries (Chan and Elevitch 2006, Perera, 2012; Shanthini and Radja Ramane, 2018; Kalimuthu and Raghavi, 2019). Coconuts are grown in over 86 countries across the globe, with an average production of 54 billion coconuts every year.

Coconut has about three thousand years of history in India and is hailed as a smallholder's crop. Nearly 10 million people in the country are affianced with coconut farming, processing, marketing and saleable activities (Lathika and Ajith Kumar, 2005). India ranks third among the leading coconut growing of the world, accounting > 21.02 per cent of the total world production of nuts and tender coconut market valued at 4000 million. However, coconut is cultivated in the coastal areas of almost all states in India (Shanthini and Radja Ramane, 2018). The present study seeks to examine the status of coconut crops over the years in terms of area harvested, production and productivity in major coconut producing countries in the world and especially in India.

The specific objectives of the study are

I. To analyze the trends and understand the magnitude of instability in area harvested, production and productivity of coconut crop
II. To project the trends for coconut area harvested, production and productivity.

## 1. MATERIALS AND METHODS

### *1.1. Data base and period of study*

The study is based on annual time series data covering the period of 29 years viz., 1990-91 to 2018-2019. The secondary data on area harvested, production and productivity of coconut in 10 major coconut growing countries in the world viz., Brazil, Philippines, India, Indonesia, Sri Lanka, Mexico, Myanmar, Thailand, Vietnam and Papua New Guinea were collected from FAOSTAT. In view of this, the study period (1990-91 to 2018-19) was divided into three sub-periods to draw meaningful conclusions with reference to the trends in area harvested, production and productivity of coconut crop, as follows:

Period I - 1990-91 to 2000-01
Period II - 2001-02 to 2011-12
Period III - 2012-13 to 2018-19
Period IV (Overall Period)-1990-91 to 2018-19

### *1.2. Methodology*

#### *1.2.1. Growth rate*

Several methods are available to estimate growth rates. In this study, the exponential function was used to estimate compound growth rate by making time as the independent variable

and area harvested/production/productivity as the dependent variable. This exponential trend equation gives a constant rate of increase or decrease per unit of time, and they are termed as Compound Growth Rate. CAGR is computed by fitting an exponential function to the variables viz., area harvested, production and productivity of coconut for the period 1990 to 2018 **(**Gujarati and Sangeetha, 2007; Krishnan et al., 1991; Anandu and Pushpa, 2017).

$$lnY_t = A + Bt + \in$$

Where, $A$ $(= ln[Ao])$ and $B$ $(= ln[1 + r])$ are the parameters to be estimated by ordinary least square regression, $t = time$ in a year. The CAGR is obtained as $r = exp(B) - 1$

### *1.3. Measure of Instability*

Coefficient of Variation (CV) is the most commonly used index for measuring instability. CV has an interpretation in the context of measuring an overall variation in the data of a variable not showing any trend. But usually, when we have a time-series data of a variable showing some kind of a trend which may be linear or non-linear, CV does not take into any such time trend and over estimates instability. Thus, it is desirable to use an index of instability which should adjust the data for trend and measure instability around the trend (Krishnan et al 1991 and Anandu and Pushpa 2017).

$$CV = \frac{Standard\ deviation}{Mean} \times 100$$

### *1.4. Autoregressive Integrated Moving Average (ARIMA)*

ARIMA time series models (Box and Jenkins 1970; Mandal 2005; Box et al., 2007 and Hyndman and Khandakar, 2008) were used in parametric models. Suitable ARIMA models were fitted after an evaluation of times series data for stationarity based on auto-correlation function (ACF) and partial autocorrelation (PACF). The time-series data is said to be stationary, then its mean and variance remain the same over time. If it changes over time with some trend or pattern, then the time series is non-stationary. There are various methods to test the existence of unit root. Here, the Augmented Dicky- Fuller (ADF) test was used to identify the presence of unit root (Dickey and Fuller, 1979 and Gujarati et al., 2012).

$$\Delta Y_t = \mu + \gamma Y_{t-\theta} + \alpha_i * \sum_{i=0}^{m} \Delta Y_{t-\theta} + \epsilon_t$$

Where m = number of lagged difference terms required so that the error term $\in_t$ is serially independent. The null hypothesis is the same as the DF test, i.e., H0: $\gamma = 0$, implying that $Y_t$ is non-stationarity. The equation mentioned above is called Augmented Dickey-Fuller. This test was applied to the spot time series of coconut to test the null hypothesis that the series has a unit root or non-stationarity. The stationarity of the series was also determined by considering the autocorrelation function (ACF) and partial autocorrelation (PACF). The auto-correlations up to five lags were worked out.

The most suitable time series model was employed based on different goodness of fit criteria, i.e., Mean Percentage Absolute Error and AIC. For measuring the accuracy in fitted models, MAPE value less than 5 per cent is the best model for forecasting, and it is computed by using the formulae given below. The ARIMA model with the lowest AIC value will be more appropriate for forecasting (Akaike 1974 and Lama et al., 2015).

$$\text{MAPE} = \frac{\sum_{.} |y_t - \hat{y}_t|}{n} \times 100$$

Where $y_t = actual\ value, Y = forecasted\ value$ and $n = number\ of\ forecasts$.

## 2. RESULTS AND DISCUSSION

The present study seeks to examine the growth performance, instability and estimation of coconut crops over the years in terms of area harvested, production and productivity in major coconut producing countries in the world and especially in India.

### *2.1. Growth performance of coconut area harvested, production and productivity*

The growth rate of coconut area harvested in the world was high in Myanmar (1.95%) during the period of 1990-91 and 2018-2019 due to the implementation of policies related to the market-oriented economic system, freedom in agricultural production and also the involvement of private sectors in agricultural investment. The next highest growth rate was found in Indonesia (1.30%), followed by India (1.27%), Philippines (0.55%) etc., (Table 1).

**Table 1:** Decadal growth rate of coconut area harvested among the top 10 countries

| Countries | 1990-91 to 2000-01 | 2001-02 to 2011-12 | 2012-13 to 2018-19 | 1990-91 to 2018-19 |
|---|---|---|---|---|
| Brazil | 2.14<br>(5.95) | -0.10<br>(2.40) | -4.24<br>(9.93) | -0.26<br>(10.50) |
| Philippines | 0.10<br>(0.89) | 1.24<br>(4.28) | 0.25<br>(1.29) | 0.55<br>(6.05) |
| India | 1.84<br>(8.35) | 1.19<br>(2.91) | -0.30<br>(2.62) | 1.27<br>(9.57) |
| Indonesia | 1.37<br>(5.47) | 0.49<br>(4.76) | 1.33<br>(3.40) | 1.30<br>(10.08) |
| Sri Lanka | 0.64<br>(2.80) | -1.17<br>(5.73) | 1.48<br>(4.92) | 0.32<br>(5.36) |
| Mexico | -0.08<br>(2.70) | 1.00<br>(5.77) | 0.90<br>(2.26) | 0.28<br>(4.44) |
| Myanmar | 1.71<br>(5.42) | 1.19<br>(10.37) | 0.52<br>(1.15) | 1.95<br>(20.58) |
| Thailand | -0.93<br>(3.02) | -3.34<br>(10.17) | -1.52<br>(4.86) | -2.04<br>(20.84) |
| Vietnam | -4.08<br>(13.14) | -0.76<br>(5.92) | 2.68<br>(5.45) | -1.12<br>(20.09) |
| Papua New Guinea | 0.00<br>(3.52) | 1.26<br>(10.44) | -1.25<br>(3.34) | -0.85<br>(11.92) |

***Source:*** *FAOSTAT.*
***Note:*** *Figures in parenthesis indicates Coefficient of Variation (CV)*

The growth rate of area harvested and production was found to be least in Thailand (-2. 04%) because consumption was more than its production. The coconut area harvested in the world was found to be stable in all the top 10 countries during the study period. Globally, stability has been found in the area harvested among the top 10 countries due to the high demand for coconut in the market because of its multiple uses such as food, fuel, drink, oil and shelter.

According to Table 2, the growth rate of coconut production in the world was high in Brazil (5.85%) because it is an important center of production for the crop, mainly due to some factors such as its edaphoclimatic conditions that are favourable for the plant development,

the availability of rural credit and the presence of business groups with expertise on the activity and agro-industrial processing. The results show that increasing coconut production was higher and rising in Myanmar and Papua New Guinea after Brazil during the study period. Coconut production was stable in the top 10 countries across the world because the CV was less than 100 percent. The variation was not found in the production of coconut among the top 10 countries due to better management of practices and favourable climatic conditions.

**Table 2:** Decadal growth rate of coconut production (%) among the top 10 countries

| Countries | 1990-91 to 2000-01 | 2001-02 to 2011-12 | 2012-13 to 2018-19 | 1990-91 to 2018-19 |
|---|---|---|---|---|
| Brazil | 15.12<br>(26.70) | 3.28<br>(9.82) | -3.64<br>(10.81) | 5.85<br>(33.90) |
| Philippines | 0.85<br>(6.22) | 1.49<br>(5.00) | -1.23<br>(4.76) | 0.75<br>(10.51) |
| India | 1.45<br>(9.75) | 1.72<br>(10.36) | 1.73<br>(3.94) | 1.74<br>(13.30) |
| Indonesia | 2.32<br>(5.64) | 1.02<br>(7.70) | -0.74<br>(4.72) | 1.53<br>(13.98) |
| Sri Lanka | 2.03<br>(10.88) | -0.23<br>(8.05) | 2.78<br>(10.12) | 1.11<br>(16.26) |
| Mexico | 0.49<br>(6.25) | 0.07<br>(5.59) | 0.60<br>(1.49) | 0.31<br>(5.07) |
| Myanmar | 2.10<br>(10.81) | 3.83<br>(15.72) | 2.14<br>(4.40) | 4.06<br>(36.81) |
| Thailand | 2.33<br>(8.30) | -5.88<br>(21.11) | -2.90<br>(7.35) | -1.69<br>(26.52) |
| Vietnam | -0.11<br>(11.93) | 3.02<br>(10.70) | 3.58<br>(7.58) | 2.03<br>(17.26) |
| Papua New Guinea | 4.83<br>(17.98) | 4.87<br>(35.43) | 0.16<br>(1.65) | 2.31<br>(27.37) |

***Source:*** *FAOSTAT.*
***Note:*** *Figures in parenthesis indicates Coefficient of Variation (CV)*

The growth rate of coconut productivity in the world was high in Brazil (6.13%) during the study period, followed by Vietnam (3.19%), Papua New Guinea (3.18%), and Myanmar (2.07%) (Table 3). A high growth rate was observed in Brazil due to better management of the following factors viz., management practices, soil factors and water availability on coconut growth, dry mass production, nut yields, crop nitrogen uptake etc. The least growth rate was observed in Mexico due to a reduction in the planted area, losing space, throughout the years mainly by reduction of area harvested. The coconut productivity in the world was found to be stable in all top 10 countries as the coefficient of variation was less than 100. The results also indicated that the productivity of coconut in Brazil was higher, followed by Vietnam and Papua New Guinea during 1990-91 to 2018-19. There was no variation regarding coconut productivity in the top 10 countries during the study period because of an increase in awareness among farmers by smearing innovative technologies.

**Table 3:** Decadal growth rate of coconut productivity (%) among the top 10 countries

| Countries | 1990-91 to 2000-01 | 2001-02 to 2011-12 | 2012-13 to 2018-19 | 1990-91 to 2018-19 |
|---|---|---|---|---|
| Brazil | 12.71<br>(23.42) | 3.39<br>(8.81) | 0.63<br>(3.63) | 6.13<br>(29.53) |
| Philippines | 0.75<br>(5.85) | 0.25<br>(2.87) | -1.48<br>(5.09) | 0.20<br>(6.98) |
| India | -0.38<br>(6.33) | 0.52<br>(10.30) | 2.04<br>(4.26) | 0.46<br>(7.96) |
| Indonesia | 0.93<br>(3.83) | 0.52<br>(6.19) | -2.04<br>(5.46) | 0.23<br>(7.12) |
| Sri Lanka | 1.38<br>(9.60) | 0.95<br>(10.80) | 1.29<br>(9.47) | 0.79<br>(15.74) |
| Mexico | 0.57<br>(7.39) | -0.92<br>(4.24) | -0.30<br>(2.43) | 0.02<br>(5.51) |
| Myanmar | 0.38<br>(8.60) | 2.60<br>(9.62) | 1.61<br>(3.48) | 2.07<br>(19.40) |
| Thailand | 3.29<br>(10.74) | -2.62<br>(13.89) | -1.40<br>(2.76) | 0.36<br>(22.93) |
| Vietnam | 4.14<br>(14.74) | 3.81<br>(10.97) | 0.87<br>(2.27) | 3.19<br>(22.41) |
| Papua New Guinea | 4.83<br>(18.99) | 3.57<br>(26.26) | 1.42<br>(3.54) | 3.18<br>(29.15) |

***Source:*** *FAOSTAT.*
***Note:*** *Figures in parenthesis indicates Coefficient of Variation (CV)*

### *2.2. Coconut area harvested, production and productivity of major countries in the world*

Coconut areas harvested during 1990-91 to 2018-19 are plotted in Fig. 1. Among the top 10 countries in the world, the Philippines, Indonesia and India are increasing trends for area harvested under coconut during 1990-2018 compared to other countries. Over the years, the Philippines has shown the highest area harvested under the coconut when compared to other countries, followed by Indonesia and India. It is due to the development of new varieties or improved high yielding varieties.

The trends in coconut production across the world among the top ten counties during 1990-2018 was plotted in Fig 2. In the world, coconut production is increasing in Indonesia, followed by the Philippines and India. The rise in production may be attributed to sustainable use of the limited resource achieved with substantial improvements in the management of land, water and inputs usage. It can also be seen that the performance of other countries was positive, though marginal in most cases.

**Figure 1:** Coconut area harvested among the top 10 countries

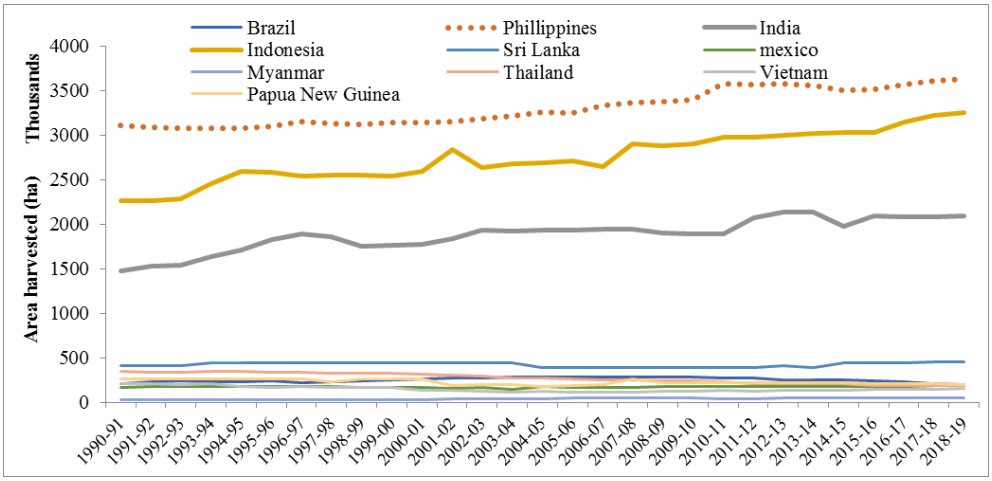
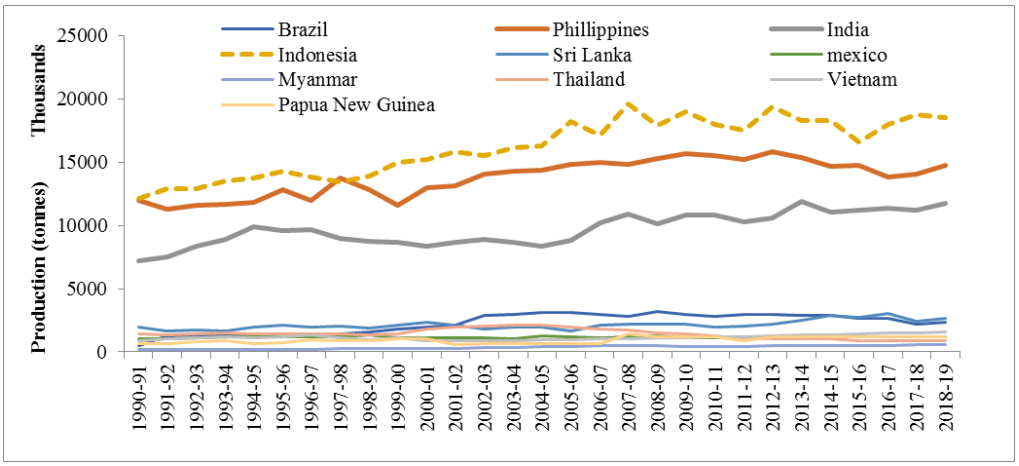
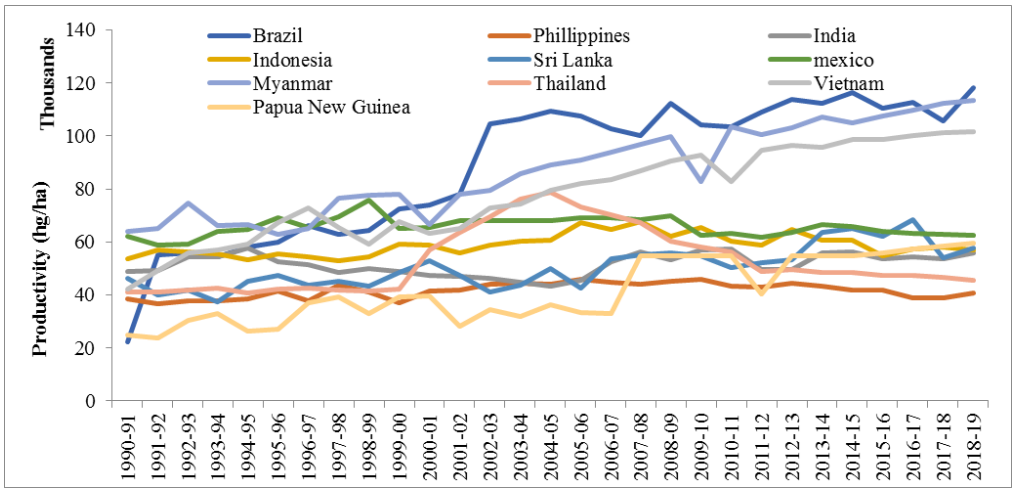



**Figure 2:** Coconut production among the top 10 countries




According to Fig. 3, coconut productivity was positive in the case of all top ten countries in the world. Brazil, followed by Myanmar and Vietnam have recorded positive and increasing productivity rates, with Brazil notching up yields around 11,000 Kgs/ha. The same may be attributed to improved cropping techniques, fertilization and irrigation. The other countries are in the productivity bracket of 4000-6000 Kgs/ha

**Figure 3:** Coconut productivity among the top 10 countries



### 2.3. Growth performance of area harvested, production and productivity of coconut in India

The annual growth rate of area harvested, production and productivity of coconut in India was 1.67%, 0.44% and 1.22%, respectively (Table 4). Globally stability was found in the area harvested, production and productivity of coconut in India. It meant that there was no variation found in the area harvested, production and productivity of coconut in India because the farmers are supported by the government to cultivate coconut by providing a Coconut Palm Insurance Scheme.

**Table 4:** Decade wise growth rate of coconut production, productivity and area harvested in India

| Parameters | 1990-91 to 2000-01 | 2001-02 to 2011-12 | 2012-13 to 2018-19 | 1990-91 to 2018-19 |
|---|---|---|---|---|
| Area harvested | 2.05<br>(7.31) | 1.32<br>(2.91) | -0.29<br>(2.62) | 1.22<br>(9.57) |
| Production | 1.61<br>(9.75) | 1.91<br>(10.36) | 1.73<br>(2.96) | 1.67<br>(13.30) |
| Productivity | -0.42<br>(6.33) | 0.58<br>(10.30) | 2.03<br>(4.26) | 0.44<br>(7.96) |

***Source:*** *FAOSTAT.*
***Note:*** *Figures in parenthesis indicates Coefficient of Variation*

### 2.4. Trends of coconut production, productivity and area harvested in India

It can be seen from Figures 4 (a) and 4(b) that the sixth-degree polynomial gave the best fit to the data of total coconut area harvested and production in India (1990-2018) with $R^2$ values 0.88 and 0.89 respectively and showed an increasing trend. The time-series data on area harvested of coconut in India during the period from 1990 to 2018, as presented in Fig. 4 (a), revealed that the area harvested increased over the years up to 2013-14, i.e., 21.4 lakh hectares and then decreased in 2014-2015 (19.7 lakh hectares). From 2015-2016 (20.8 lakh hectares) the area harvested was maintained steady growth up to 2018-2019 (20.9 lakh hectares). The data of coconut production over the period of 1990-2018 was presented in fig. 4(b) that there was a wide fluctuation in trend. Peak production of coconut was observed in the year 2013-14 (11.9 Mt), which decreased continuously for four years from 2014 to 2017 and then increased in 2018-19. The data of coconut productivity was presented in fig. 4(c) that sixth-degree polynomial gave the best fit with $R^2$ =0.63. The highest productivity was observed during 1994-95 with 57661 hg/ha, and then decreasing trend was observed during the study period due to the exhaustion of nutrients from the soil.

**Figure 4 (a):** Trend in coconut area harvested in India

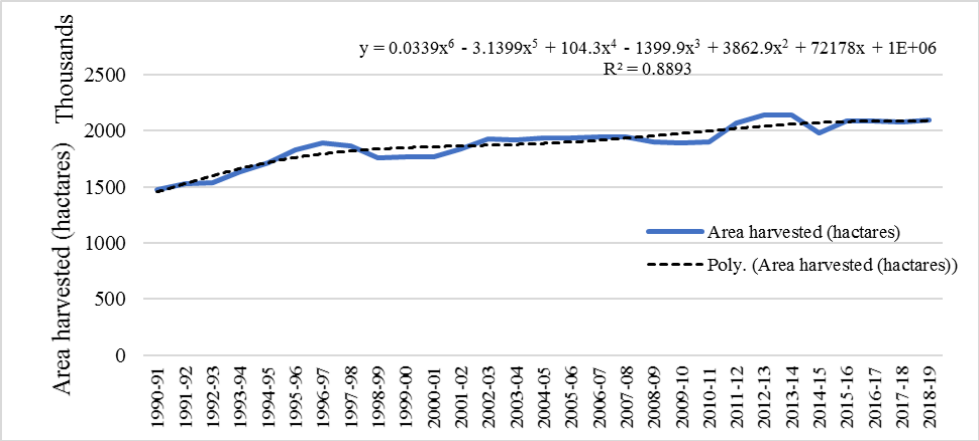


**Figure 4 (b):** Trend in coconut production in India

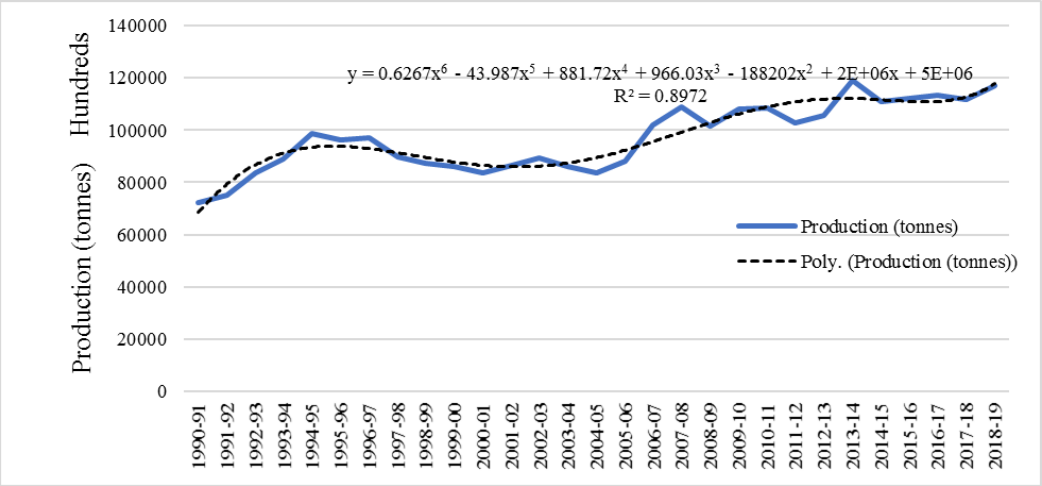
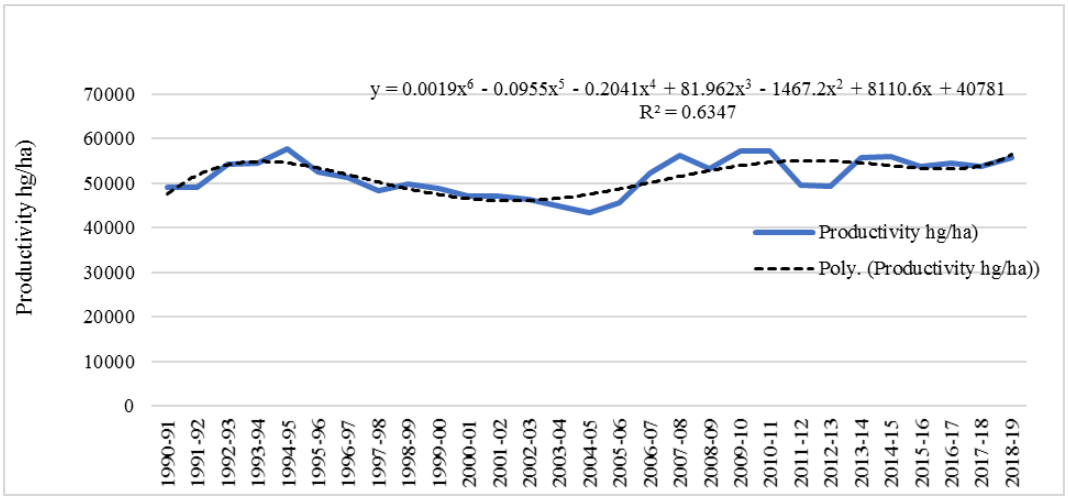



**Figure 4 (c):** Trend in coconut productivity in India




### *2.5. Estimation of projected coconut area harvested, production and productivity.*

Using Augmented Dicky- Fuller (ADF), the stationarity of production and productivity was observed after 2nd differencing ($p<0.01$) and the original area harvested series itself was found to be stationary ($p=0.029$). Based on stationarity, the Autocorrelation Function (ACF) $\gamma_K$ and Partial Autocorrelation Function (PACF) $\phi_{KK}$ were analyzed for choosing MA (Moving Average) and AR (Autoregressive) order, respectively. ACF analysis revealed that the production and productivity were significant at lag 1 and for area harvested lag 1, lag 2 and lag 3 were significant for choosing MA order (Fig.5 and Fig.6). Based on ACF and PACF, the tentative models were chosen (Table 6). AIC was calculated for each model. The model with the least AIC was considered to be the best-suited model. For production and productivity, the best-fitted model was ARIMA (0,2,1) with 801.01 AIC and ARIMA (0,2,1) with 520.21 AIC, respectively. In the case of area harvested, ARIMA (1,0,1) with 738.97 AIC was the best-fitted model.

**Table 5:** Results of ADF test

| Series | Original Series | | After 1st differencing | | After 2nd differencing | |
|---|---|---|---|---|---|---|
| | ADF statistic | p-value | ADF statistic | p-value | ADF statistic | p-value |
| Production | -2.404 | 0.417 | -3.231 | 0.101 | -4.646 | <0.01 |
| Productivity | -2.026 | 0.562 | -3.164 | 0.127 | -5.017 | <0.01 |
| Area Harvested | -3.866 | 0.0297 | --- | --- | --- | --- |

**Figure 5:** ACF for different series (for choosing MA order)

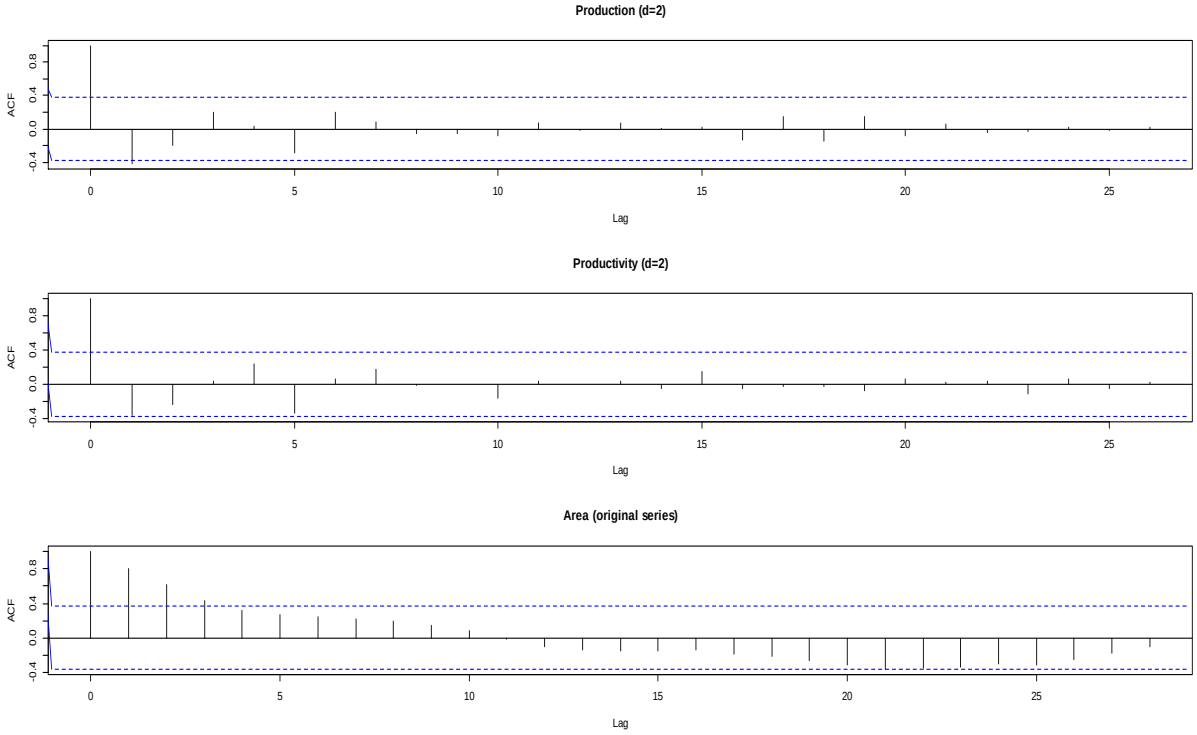



**Figure 6:** PACF for different series (for choosing AR order)

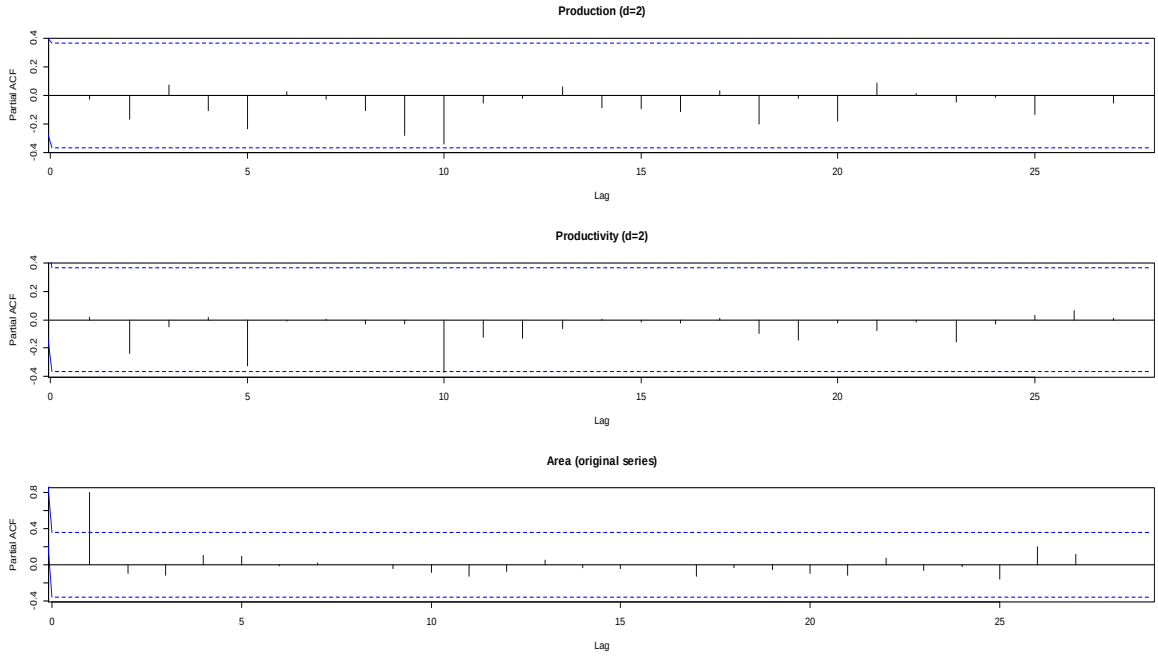


**Table 6:** Tentative models based on ACF and PACF

| Series | Tentative Models | |
|---|---|---|
| | **Model** | **AIC** |
| Area harvested (ha) | **(1,0,1)** | **738.97** |
| | (1,0,2) | 740.16 |
| | (1,0,3) | 742.36 |
| | (1,0,4) | 742.36 |
| Production (tonnes) | (0,2,0) | 815.01 |
| | **(0,2,1)** | **801.23** |
| Productivity (hg/ha) | (0,2,0) | 533.01 |
| | **(0,2,1)** | **520.21** |

Mean Absolute Percentage Errors (MAPE) helps to indicate the best model. The area harvested (2.66%), production (4.45%) and productivity (4.4%) of coconut were having less than 5 per cent. So, it can be deduced that the ARIMA (0,2,1) & ARIMA (1,0,1) models are the best models (Table 7). In the case of Exponential Smoothing, production (5.98%) and productivity (5.51%) were having more than 5 per cent and the area harvested (4.5%) were having less than 5 per cent. So, it can be deduced that the MAPE value was less than 5 percent for production, productivity and area harvested of the ARIMA model, so above mentioned models are considered to be best. But in the case of the Exponential smoothing model, it was observed that MAPE values are greater than 5 percent for production & productivity and less than 5 percent for area harvested.

**Table 7:** Mean absolute percentage errors for the best model

| Series | MAPE (%) |
|---|---|
| Production (tonnes) | 4.457 |
| Productivity (hg/ha) | 4.373 |
| Area harvested (ha) | 2.665 |

**Table 8:** Mean absolute percentage errors of exponential smoothing model

| Series | MAPE (%) |
|---|---|
| Production (tonnes) | 5.986 |
| Productivity (hg/ha) | 5.518 |
| Area harvested (ha) | 4.597 |

For 29 years from 1990-2018, the best-fitted model for Production, Productivity was ARIMA (0,2,1) and for area harvested ARIMA(1,0,1). By including the most recent forecast value, the prediction was made for the next three years ahead using ARIMA (0,2,1) model for Production & Productivity and ARIMA (1,0,1) model for area harvested. The estimated coconut production for the period from 2019 to 2021 is 11.86, 12.02 and 12.18 Million tonnes, respectively and estimated productivity for the next three years are 56013.26, 56254.51 and 56495.77 hg/ha, respectively. The increased production could be achieved under the scientific management of coconut through better cultivation practices, increased application of plant nutrients, irrigation, pest control etc., and integration of agrarian practices conducive to gain of production through productivity. The estimated area harvested for the period 2019 to 2021

is 20.8, 20.7 and 20.6 lakh ha, respectively. From the study, it can be deduced that there was an increase in productivity and production for the next three years and a decrease in the area harvested (Table 8).

**Table 8:** Forecasted values for next 3 years from the best models

| Year | Area harvested (ha) | Production (tonnes) | Productivity (hg/ha) |
|---|---|---|---|
| 2019-20 | 2088880 | 11866213 | 56013.26 |
| 2020-21 | 2074367 | 12026083 | 56254.51 |
| 2021-22 | 2060664 | 12185953 | 56495.77 |

***Source**: Computed from secondary data*

## CONCLUSION

The study was conducted to examine the growth performance, instability, trends during the study period and also estimation of projected trends in coconut area harvested, production and productivity for three years from 2019-2021. Growth performance of production, productivity was high in Brazil because it is an important center of production for the coconut crop and also mainly due to some factors viz., edaphoclimatic conditions, better crop management practices, availability of rural credit and the presence of business groups with expertise on the activity and agro-industrial processing. The coconut area harvested was observed high in Myanmar because the implementation of various policies related to agricultural production, market and participation of the private sector. The ARIMA (0,2,1) and ARIMA (1,0,1) were the best models because they are with minimum AIC and less than 5 per cent MAPE values.

In the case of the Exponential Smoothing model, the area harvested had $< 5\, percent$ of MAPE value compared to production and productivity. By using best-fitted models, the coconut area harvested, production and productivity projected for the next three years from 2019-2021, it reveals that there was an increase in productivity, production and decrease in area harvested. The study suggested that increased production could be achieved under the scientific management of coconut through better cultivation practices, increased application of plant nutrients, irrigation, pest control etc., and integration of agrarian practices conducive to gain of production through productivity.

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