INDONESIA AMONG THE COCONUT PRODUCING COUNTRIES

Androecia D. and S. Damanik
Coconut Research Institute

Elna Karmawati
Research Institute for Spices and Medicinal Crops

ABSTRACT

There are 12 primary coconut producing countries in Asia and the Pacific Region, namely : India, Indonesia, Malaysia, Papua New Guinea, The Philippines, Solomon Islands, Sri Lanka, Thailand, Vanuatu, Western Samoa, Federated State of Micronesia and Republic of Palau. In this study assessment of the principal components and cluster analysis were used to evaluate the position of Indonesia among the coconut-producing countries. The variables studied were area, production, exchange rate to one US dollar, contribution from the coconut sector to export earnings, export volume of copra and coconut oil.

Based on the cluster analysis, The Philippines, Indonesia, India and Sri Lanka are the first four groups (one group consists only of one country). Indonesia occupies second place among the top coconut-producing countries.

INTRODUCTION

Coconut is currently produced in a total seventy countries, spread out along the tropical belt. About 90% of the world coconut production comes from the zone between 20° N and 20°S. More than 80% of production is from Asia and the Pacific region. Coconut adapts well to a variety of environments. Among the climatic factors, rainfall and temperature are the most important. The ideal annual rainfall for coconut is 1500-2500 mm while the optimum requirement is about 1800 mm. Optimum temperature is around 27°C with average diurnal variation not to exceed 7°C.

Coconut has two recognized types, the Talls and the Dwarfs. Besides these, coconut hybrids have been introduced only recently in most of the coconut-producing countries.

The world's total production of coconuts in 1986 was about 8.4 million tons copra equivalent or 42.3 billion nuts. The Philippines is the largest producer of coconut followed by Indonesia, India and Sri Lanka. In the Pacific region, Papua New Guinea is the leading producer. In Africa, Mozambique recorded the largest production, while in America, Mexico accounts for about one-third of the total production of that region.

Asian and Pacific Coconut Community (APCC) is a commodity organization consisting of 12 member countries, including India, Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, Sri Lanka, Thailand, Vanuatu, Western Samoa, Federated State

of Micronesia and Republic of Palau. The economics of the community members are predominantly agricultural, but at varying levels of growth and development.

The objective of this study was to evaluate the position of Indonesia among the coconut-producing countries in The Asia-Pacific region by dividing them into several groups based on six variables : area, production of coconut, exchange rate to one US dollar, contribution from the coconut sector to export earnings, export volume of copra and export volume of coconut oil.

MATERIAL AND METHODS

Data source

Secondary data used in this study was taken from the coconut statistical yearbook, Asia and the Pacific Coconut Community (APCC, 1986). 1970-1986 data of several countries : India, Indonesia, Papua New Guinea, Malaysia, the Philippines, Thailand, Western Samoa, Sri Lanka, Solomon and Vanuatu. The variables used in grouping the ten coconut-producing countries are:

X_1 = size of coconut area (1000 ha)
X_2 = production of coconut (million nuts)
X_3 = exchange rate to 1 US dollar
X_4 = contribution from the coconut sector to export earnings (percent)
X_5 = export volume of copra (metric tons)
X_6 = export volume of coconut oil (metric tons)

Statistical Analysis

Since the number variables exceeded three, a statistical procedure was needed to grouping the coconut-producing countries. For this paper, the data collected were preliminary analyzed using Principal Component Analysis. This analysis produced new variables which formed weighted-linear combination of the variables observed.

According to Kleinbaum and Kupper (1978), principal component analysis is a multivariate analysis.It's objective is to choose factors (principal components) which can explain most total variance data by using transformation-factor. It is done by omitting correlations between variables through the transformation of the original variables (X) to new variables (W) which are independent (Morrison, 1976).

The new variable is known as the principal component which comes from the result of the transformation of the original variables, the model in the matrix note is :

$$W = A\underline{X}$$

where $\underline{X}$ is original variable vector, and A is a matrix which transforms the original variables to produce a principal component vector W.

In order to produce the new variables, vector $\underline{X} = (X_1, X_2, \ldots\ldots Xp)$ is assumed to be distributed according to a certain multivariate distribution with mean vector U and with a certain covariance matrix E. Then, covariance matrix E which can be obtained by covariance matrix S gives necessary information for principal component analysis (Morrison, 1976).

In a general way, the principal component -J can be written as : $Wj = a_{1j}X_1 + a_{2j}X_2 + \ldots + a_{pj}X_p = a'_jX$ where a weighted vector a^1_j is obtained by maximizing the variance of the principal component -J, i.e:

$$S^2_J = a'_j S a_j$$

with the assumption :

$$a'_j a_j = 1 \text{ and } a'_i a_j = 0, \quad \text{for } 1 \neq j.$$

Covariance matrix S is used in this problem if all variables observered have the same measurement units, If not, the variables need to be standardized and the principal component obtained from the correlation matrix.

The importance of a principal component Wj is measured with the percentage of the total variances which can be described by component - J devided by the variance of total data. For the principal component obtained from correlation matrix R, this measure is only characteristic-root ratio j divided by matrix-terace R, i.e :

$$\frac{lj}{tr\ R} \times 100\ \%$$

The measurement of relationships between the original variables and the principal component can be determined through the correlation coefficient between the original variables and the principal component.

Correlation coefficients between variable -i and principal component -j are estimated as suggested by Frey and Pimentel (1978) :

$$r_{ij} = a_{ij} (l_j)^{1/2}$$

While the percentage of the variable variance described by each component is a relative effect of a variable on each component.

The percentage of variance of variable -i described by component -J is :

$$S^2ij = (a^2_{ij}\ lj/P) \times 100\ \%$$

while l_j is the highest charateristic-root -j, and p is the number of variables.

Because the relationships between the new variables are orthogonal, cluster analysis is used with distance-Euclidus test.

RESULTS AND DISCUSSION

The principal component analysis produced new variables through a standard weighted linier combination of the original variables. The number of new variables is six, conforming to the number of variables observed, called the principal components. Cooefficients of the selected principal components are shown in Table 1.

Table 1. Two principal component coefficients and their variance

Variable	Principal components	
	1	2
X_1	0.438	- 0.387
X_2	0.441	0.385
X_3	0.408	0.403
X_4	- 0.390	0.457
X_5	- 0.384	0.467
X_6	0.384	0.336
Characteristic root (variance of component)	2.973	1.206
The percentage of total variance	56.100	22.760
Cumulative variance	56.100	78.860

Based on the six components used, only 2 were considered capable of describing the total variance of data. The two principal components explain as much as 78.9% of the total variances. The number of components selected is based on guidelines suggested by Timm (1975), i.e. the number of the principal components is sufficient if total variances is 70 -80%. Karson (1982) explained that if characteristic-root obtained from correlation-matrix, charateristic-roots which are bigger than one is chosen next charateristic-roots. While the last four components are not noticed because they are considered not important.

The first principal component is written :

$$Y_1 = 0.438\ X_1 + 0.441\ X_2 + 0.408\ X_3 - 0,390\ X_4 - 0.384 X_5 + 0.384\ X_6$$

with variance of 2.973 and explained variance as much as 56.10 %. This means that the information obtained from the first principal component is 56.10 %.

Based on correlation coefficients between each variable and the principal component, it was estimated that area, production and exchange rate had a high and positive correlation with the first principal compenent. The first principal component is identified to be the production component.

Table 2. Correlation coefficients between each variable and the principal component

Variable	Principal component	
	1	2
X_1	0.755	- 0.423
X_2	0.760	0.421
X_3	0.703	0.441
X_4	- 0.672	0.500
X_5	- 0.662	0.511
X_6	0.662	0.367

The second principal component can be written :

$$Y_2 = - 0.387X_1 + 0.385X_2 + 0.403X_3 + 0.457X_4 + 0.467X_5 + 0.336X_6$$

with variance of 1.206 and explained variance as much as 22.76%. The correlation between the second principal component and the variable of export contribution and copra export is higher compared to other variables. The second principal component can be understood as export component.

The information gained from the production component is far much higher (56.10 %) compared to the export component (22.76 %) because the variance of copra production in APCC's countries is far higher, varied from the lowest, 70 nuts, to the highest 11 675 nuts (in 1986), compared to the variance of copra export which varied from 1.5 to 136 (thousand metric tons). If compared with the coconut production of other country groups, Africa and South America, have very low variances and coconut average production with a variation of 150 - 834 million nuts. Compared to their coconut production, their copra export is also low.

The first principal component described production, and the second principal component described export; therefore, the relation between the two components can be produced based on component scores of each APCC's coconut producing country which are observed when grouping them. From the relation, cluster analysis is conducted and the results can be seen in Figure 1.

The grouping of the ten countries observed into two or three groups was difficult to conduct because of large differentiation in their production and export rates, except for countries with low production such as the Solomon Islands, Thailand, Vanuatu, Western Samoa and Malaysia. It can be seen on Figure 1 that Philippines is the biggest coconut producing country in area, production, copra export and coconut oil export. However, the rate of coconut contribution to the national income is very low, i.e. 1.95% in 1986. The explanations that the bigger part of the national income comes from fishery, forestry and industry, i.e. 52.87%.

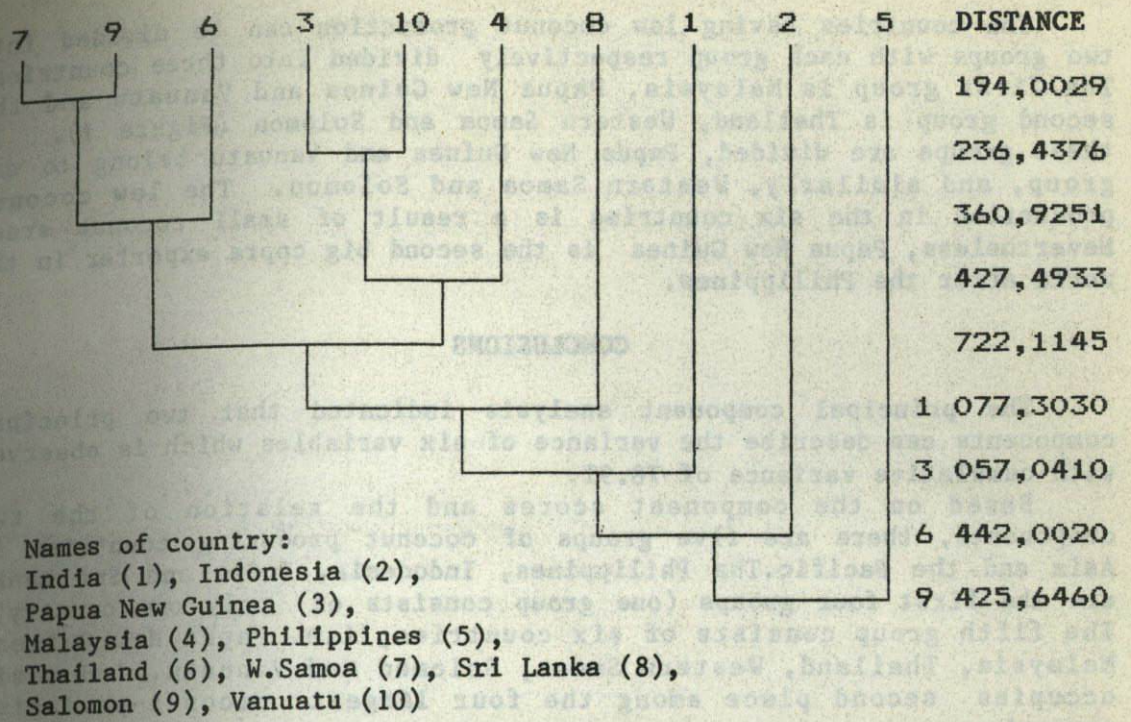

Figure 1. Dendogram of 10 major coconut-producing countries

The second major coconut producer is Indonesia. Actually, the area and coconut production in Indonesia is not much different from that of the Philippines. The estimation of coconut area in Indonesia is 3 182 000 Ha compared with the Philippines 3 262 000 Ha. Most coconut production in Indonesia is consumed for domestic (almost 95%), while the Philippines only consumes about 15% of its coconut production. Most of the Philippines product in is exported in the form of copra, copra-meal, coconut oil, desiccated coconut and shell charcoal.

Due to the increasing domestic demand in Indonesia, most coconut production especially copra and coconut oil, are internally traded. Exports of coconut oil are allowed only after the domestic consumption has been met. Lately, with the availability of palm oil as a substitute, coconut oil is allowed to be exported if international price is favourable. The decline in the coconut oil export was a result of higher domestic prices.

India occupies the third place in coconut production. Its coconut area is 1 209 000 Ha. Like Indonesia, all the coconut production in India is consumed for domestic demand. Domestic demand is higher than the production, so that coconut oil and copra need to be imported. Only Sehusked coconut, coconut protein, coconut honey, coconut flavour and desiccated coconut are exported. But the volumes are insignificant. The coir and coir products are the major coconut products exported from the country.

The countries having low coconut production can be divided into two groups with each group respectively divided into three countries. The first group is Malaysia, Papua New Guinea and Vanuatu and the second group is Thailand, Western Samoa and Solomon (Figure 1). If these groups are divided, Papua New Guinea and Vanuatu belong to one group, and similarly, Western Samoa and Solomon. The low coconut production in the six countries is a result of small coconut area. Nevertheless, Papua New Guinea is the second big copra exporter in the world after the Philippines.

CONCLUSIONS

The principal component analysis indicated that two principal components can describe the variance of six variables which is observed with cumulative variance of 78.9%.

Based on the component scores and the relation of the two components, there are five groups of coconut producing countries in Asia and the Pacific.The Philippines, Indonesia, India and Sri Lanka are the first four groups (one group consists of only one country). The fifth group consists of six countries, i.e. Papua New Guinea, Malaysia, Thailand, Western Samoa, Solomon and Vanuatu. Indonesia occupies second place among the four largest coconut-producing countries.

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