A Comparative Study of Investments in Four Major Perennial Crops

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Abstract in Bahasa Malaysia

Keutamaan getah, kelapa sawit, koko dan kelapa dalam ekonomi Semenanjung Malaysia telah diketahui ramai. Empat jenis tanaman ini sahaja telah memenuhi lebih dari 66% dari seluruh kawasan tanaman yang luasnya adalah kira-kira tiga juta hektar itu. Oleh kerana tempo kemajuan pertanian di negara ini sedemikian laku, sebahagian besar dari tanah yang masih belum diterokai tetapi mempunyai potensi untuk pertanian akan diperuntukkan kepada tanaman-tanaman ini, terutamanya, kelapa sawit dan koko memandangkan keuntungannya pada masa ini sangat memuaskan.

Di Semenanjung Malaysia tanah merupakan satu sumber yang kian sukar diperolehi. Dari seluas 3.4 juta hektar yang tinggal dan belum dibuka untuk pembangunan pertanian, sebahagian darinya jatuh di bawah tanah Kelas IV dan V. Oleh itu, dijangka pada masa-masa akan datang kawasan tanah kelas satu untuk pembangunan pertanian mungkin akan terhad. Malah dalam kawasan-kawasan tanah yang baik untuk pertanian sekalipun akan terdapat keutamaan-keutamaan yang bercanggah dan persaingan untuk tanah dalam pilihan tanaman-tanaman saka ini.

Akibatnya, tanah tidak boleh lagi disifatkan sebagai satu sumber mewah dan jenis-jenis tanaman yang hendak ditanam pada tanah-tanah ini perlu dipilih mengikut satu rancangan yang sistematik dan saintifik. Dalam perkara ini, tidak syak lagi bahawa tanah dan lain-lain faktor agronomi merupakan pertimbangan yang penting. Bagaimanapun keuntungan yang diperolehi masih juga digunakan sebagai faktor penentuan yang muktamad. Oleh yang demikian, kertas ini akan cuba membandingkan keistimewaan peluang pelaburan untuk tanaman-tanaman ini dengan tujuan mengadakan beberapa garis panduan asas supaya keputusan yang rasional dapat dibuat dalam memilih jenis tanaman.

Profil hasil perolehan dihitung pada dasar data sebenar dan data ramalan untuk tanaman-tanaman ini dibawah keadaan-keadaan tanah yang berbeza-beza. Hasil

pendapatan yang diperolehi dibandingkan dengan kos-kos pengeluaran berdasarkan pada beberapa harga yang berpatutan. Keuntungan pula diperiksa dengan berlatar-belakangkan lain-lain faktor sosio-ekonomi. Kriterium-kriterium pelaburan yang selalu digunakan seperti kadar pulangan dalam (KPD), nilai bersih kini (NBK) dan nisbah untung/kos (U/K) digunakan untuk menentukan keuntungan pelaburan.

Berdasarkan kepada kajian-kajian ekonomi, beberapa garis panduan mengenai pilihan tanaman di bawah keadaan-keadaan agronomi yang tertentu pada beberapa paras harga dikemukakan.

Abstract

The importance of rubber, oil palm, cocoa and coconuts in the economy of Peninsular Malaysia is well known. These four crops alone occupy more than 66% of the total cultivated area of about 3 million hectares. The tempo of agricultural development in this country is such that a substantial portion of the remaining potential agricultural land available would be allocated for these crops, particularly oil palm and cocoa because of their current favourable profit margins.

Land in Peninsular Malaysia is itself becoming a scarce resource. Of the remaining 3.4 million hectares available and untapped for agricultural development, a significant portion falls under Classes IV and V land for agricultural development. Therefore, it is anticipated that the amount of Class I land available for future agricultural development may be limiting in the years to come. Even within the available area of good land, conflicting interests and competition for land exist in the choice of these perennial crops.

Consequently, land cannot be treated as a luxuriant resource anymore and crop choice on its use need to follow a systematic, scientific plan. Land and other agronomic factors are no doubt, important considerations. However, the final arbiter is still the profits derived. Hence, this paper intends to compare the merits of investment opportunities for these crops with a view to evolve some basic guidelines for a rational decision-making in the choice of crop.

Yield profiles are computed on the basis of actual and extrapolated data for the various crops on varying soils conditions. The revenue obtained is compared with the costs of production at reasonable price ranges and the profit margins are examined against a backdrop of other socio-economic factors. Commonly used investment criteria like the internal rate of return (IRR), the net present value (NPV) and the benefit/cost ratio (B/C) are employed to determine the profitability of investments.

Based on the economic investigations, some guidelines on crop choice under certain agronomic conditions at various price ranges are attempted.

In Peninsular Malaysia, out of about 6.4 million hectares considered suitable for agriculture, approximately 3 million hectares are already under cultivation, leaving the remaining 3.4 million hectares as potential agricultural land for future development[1]. A significant portion of the remaining 3.4 million hectares falls within Classes IV and V land for agricultural development. Therefore, it is anticipated that the amount of first class land available for future agricultural development may be limiting in the years to come.

Even within the available area of good land, conflicting interests and competition for land exists in the choice of crops, particularly the important perennial economic crops like rubber, oil palm, cocoa and coconuts.

The importance of rubber, oil palm, cocoa and coconuts in the economy of Peninsular Malaysia needs no emphasis. Lee and Panton[1] showed that in the late 60s, these four crops occupy more than 66% of the total cultivated areas of about 3 million hectares. The tempo of agricultural development in the country is such that a substantial portion of the potential agricultural land available would be allocated for these crops, more particularly with oil palm, cocoa and coconuts because of their current favourable profit margins. Consequently, the proper choice of crops on a specific soil situations becomes of paramount importance in investment decisions[2]. No doubt, the final arbiter is economics itself. Hence, the objective of this study is to examine the profitability of investments in these four important economic crops on favourable soil situations in Peninsular Malaysia, with a view to provide some rationale on decision-making in relation to the choice of these crops; the ultimate objective being to optimally exploit our land reserves.

DATA AND METHODOLOGY

Basic data on yield profiles, input costings and other related information are collected from existing established plantations on identified soil situations of the four major perennial crops. Wherever possible, actual yield and costing figures are used. Where such actual figures are not available, projections are resorted to on the basis of available, published information and sensible estimates according to current industry experience.

The analytical tool used in this study is the technique of benefit-cost analysis involving comparisons of discounted cash flows. The investment criteria employed are the net present value (NPV), the internal rate of return (IRR) and the benefit-cost ratio (B/C ratio). These are used to determine the economic worth of investments made in the four different crops.

BASIC ASSUMPTIONS

As there are many factors involved in yield productivity and marketing operations can be variable, a number of basic assumptions have to be spelt out for the purpose of this study.

The basic premise of this study rests on the assumption that jungle land is assumed to be available for development. Rubber and oil palm are grown separately on blocks of 500 ha each on soils considered 'Class I' suitability for their cultivation. In the case of cocoa and coconuts, both are grown in an integrated system of 500 ha of land where the soils are considered of 'Class I' suitability for their cultivation.

It is further assumed that advanced planting materials are used for rubber planting. Latex is sold as SMR 5, while scrap as SMR 20. On the other hand, the palm oil is sold overseas, and the kernel ex-estate. The cocoa is sold as dried beans and the copra to millers.

No residual values are attached to the crops at the end of the investment period as their relative values or the differences in them would be insignificant.

PLANTATION PRACTICES

Conventional planting procedures are followed for the cases examined on rubber and oil palm.

For rubber, the method of planting with budded stumps is used and the usual field maintenance practices are followed in respect of legume cover establishment, fertiliser inputs in accordance to soils and related features, appropriate horticultural practices and related standard agronomic husbandry.

In the case of oil palm, planting is by polybag seedlings, with the standard crop agronomic husbandry closely adhered to.

For cocoa and coconuts, an integrated system was examined, the summarised details of which are accounted below:

Cocoa/Coconuts Intercropping System

The coconuts and gliricidia shade are established at the same time. The coconut density is reduced to 115 palms per hectare to ensure that the shade provided by the palms at maturity will not be excessive for the cocoa. Further, a 'hedge' planting pattern is adopted with wide inter-row spacings of 11 m and 8 m between palms in the row. The coconut rows are planted in an east-west

direction to maximise the amount of light reaching the cocoa. Four rows of gliricidia 2.5 m apart are planted in each palm inter-row.

The cocoa is planted a year later when adequate shade is achieved by the growth of gliricidia. The cocoa is planted in-between the gliricidia in 3 rows, 2.5 m apart and 3 m within each row, resulting in a density of about 8 647 trees per hectare.

Careful attention is given to selective thinning of the gliricidia to ensure that the palms are not over-shaded and to allow more light penetration as the cocoa develops to maturity.

YIELD PROFILES

In rubber planting, three Class I and widely grown clones are used – RRIM 600, PR 255 and GT 1. The yield profiles of these clones on Class I soil for the first fifteen years are based on commercial records; those for subsequent years are projected *(Table 1)*[3,4,5].

TABLE 1. ESTIMATED YIELD PROFILES OF RUBBER ON CLASS I SOIL (KG/HA)[a]

Year of tapping	RRIM 600	PR 255	GT 1
1	830	1 172	720
2	1 260	1 500	1 000
3	1 560	1 800	1 250
4	1 710	1 925	1 476
5	1 820	2 067	1 600
6	2 120	2 106	1 730
7	2 215	2 188	1 769
8	2 290	2 254	1 890
9	2 620	2 490	1 950
10	2 815	2 700	2 100
11	2 045	2 900	2 250
12	3 845	3 500	3 005
13	3 445	3 200	2 880
14	3 250	2 900	2 500
15	2 850	2 750	2 200
16	3 342	3 076	2 590
17	3 350	3 080	2 593
18	3 338	3 070	2 581
19	3 306	3 044	2 553
20	3 254	3 044	2 511
21	3 183	2 949	2 454
22	3 092	2 878	2 382
23	2 980	2 793	2 192
24	2 849	2 693	2 075
25	2 699	2 578	1 943

[a] Stimulation is assumed after the 10th year of tapping.
Based on Chan and Pushparajah[3], Chan *et al*[4], Rubber Research Institute of Malaysia[5]

In oil palm, the yield profile on Class I soil for the first fourteen years is based on the performance of commercial plantings of D × P planting materials[6,7,8]; yield for subsequent years is projected. The yield profile on Class I soil is shown in *Table 2.*

TABLE 2. ESTIMATED YIELD PROFILE ON OF OIL PALM CLASS I SOIL (TONNES FFB)[a]

Year of harvesting	Yield in tonnes FFB./ha Class I
1	9.0
2	15.8
3	21.3
4	22.6
5	23.9
6	24.6
7	25.1
8	24.4
9	23.9
10	23.9
11	23.3
12	22.6
13	22.1
14	21.6
15	21.1
16	20.6
17	20.1
18	19.6
19	19.1
20	18.6
21	18.1
22	17.6
23	17.3
24	17.1
25	16.8

[a]Based on Ng, S.K.[6], Ng, C.S.[7], Ng. S.K.[8]

In the case of cocoa/coconuts, actual yields are used for the first eleven years, after which, projections are attempted. The yield profiles of cocoa/coconuts over twenty-five years on a soil considered 'Class I' suitability for their cultivation are shown in *Table 3.*

TABLE 3. ESTIMATED YIELD PROFILE OF COCOA/COCONUT ON CLASS I SOILS[a]

Year after planting	Yield of cocoa (dry bean, kg/ha)	Yield of coconuts (kg/ha)
3	280	–
4	504	–
5	672	1 818
6	840	2 280
7	952	2 965
8	1 064	3 427
9	1 120	4 172
10	1 177	3 993
11	1 177	4 396
12[b]	1 230	4 110
13	1 230	4 110
14	1 230	4 110
15	1 230	4 110
16	1 230	4 110
17	1 230	4 110
18	1 230	4 110
19	1 230	4 110
20	1 180	4 110
21	1 060	4 110
22	1 010	4 110
23	950	4 110
24	950	4 110
25	900	4 110

[a]After Chan[9]
[b]Projected yield from 12th year onwards quoted to nearest 10 kg/ha.

SUPPLY/DEMAND AND PRICE OF RUBBER, OIL PALM, COCOA AND COCONUTS

Two important factors affecting the choice of crops to be cultivat[illegible] are [illegible]ted demand and price. In the past, commodity prices had fluctuat[illegible]y, and therefore forecasts of future demand and prices are difficult.

Supply/Demand

Rubber. Since World War Two, natural rubber production has been unable to meet world requirements and has to be supplemented by synthetic rubber.

Prior to 1973, world natural rubber consumption increased steadily at an average annual rate of 4%, compared with 7% for synthetic rubber. Total rubber consumption declined in 1974 and 1975 due to adverse conditions. This arrested the decline of natural rubber's share in the total elastomer market. The position of natural rubber was no better in 1976 when demand fell short by approximately 10 000 tonnes[10]. On the other hand, there was an over-supply of 150 000 tonnes of synthetic rubber.

Based on market share projections, Ani Arope[11], Allen *et al.*[12] and Ariffin[13] predicted that the world total rubber demand will be 7% per annum and that of the synthetic isoprenic type 4%. On these considerations, it is estimated that by 1985, the total world requirements would be about 15.0 million tonnes annually. The natural rubber target share of the market would theoretically be approximately 40% or 6.0 million tonnes annually.

Palm Oil. Palm oil together with palm kernel oil is one of the most important oils in the world. Up to 1966, supply and demand showed very little change and its price usually followed the average tendency in the food sector. However, in 1967, there was a sharp decline in supply followed by an upturn in both world production and market supply.

World output of fats and oils in 1975 was estimated at 36.0 million tonnes. The average annual expansion in production over the last decade was 3%. The IBRD forecast a production of 46.9 million tonnes by 1980. Palm oil's share in the total fats and oils production is around 6% and this is expected to increase t 8% by 1980, with an output of 4.5 million tonnes, half of which would be from Malaysia. In terms of export, palm oil's share of the total oils and fats market should increase from the level of 11% in 1974 to 14% in 1980, 70% of which would come from Malaysia.

A cursory look at the world market situation shows that there is a demand for these two commodities. What is more important is that the potential for larger markets exists. Therefore, it is only logical that production should be stepped up.

Cocoa. World cocoa production has remained at between 1.3 and 1.5 million tonnes dry beans for over a decade[14]. The estimated production for 1978/79 is 1.5 million tonnes. Ghana, far long the leading producer has now been superceded by the Ivory Coast which produced 320 000 tonnes in 1978/79 compared to 262 000 tonnes for Ghana. The other major producers are Nigeria (138 000 tonnes), Cameroon (107 000 tonnes) and Brazil (294 000 tonnes)[14]. Malaysia's contribution for the same period is expected to be 26 000 tonnes.

Although world production is expected to increase annually with new areas and new high-yielding hybrids being planted, the forecast of 2.4 million tonnes by 1984 made by the International Cocoa Organisation[15], seems unlikely to be

attained. In fact, the past five years have not seen any increased output worldwide as social and political constraints have adversely affected efforts to increase production.

Coconuts. The world net export of lauric oil has shown a steady decline in recent years. Exports totalled the equivalent of 1.7 million tonnes in 1976, 1.5 million tonnes in 1978[16] and indications point to a further 18% decline in 1979 over 1978[17]. Factors contributing to this situation are the increasing domestic demand with population growth in producing countries coupled with stagnant production levels. Thus, Indonesia is now an importer of coconut oil while Malaysia's and Sri Lanka's contributions to world exports are insignificant.

Major replanting or rehabilitation programmes with high yielding hybrids being undertaken by the major producing countries such as the Philippines, Indonesia and Malaysia are not expected to significantly affect the level of supplies until the late 1980s. On the other hand, total production of vegetable oils, particularly palm and soya oils, are expected to increase at an annual rate of 3½% per annum to reach 52.0 million tonnes in 1990[18]. These two oils in 1977 already formed 42% of the world's production of edible oils and 53% of the world exports. Their share of the export market is expected to reach 60% by 1990. Thus, although the demand for coconut oil is likely to exceed supply over the next decade, the interchangeability, in varying degrees, between oils would mean a shift in preference for other cheaper oils. Since palm kernel and coconut oils are close substitutes, the rapid expansion of palm oil production (hence palm kernel oil) expected for the future would have a dampening effect on coconut oil prices, bearing in mind the expected increased supply in the late 1980s from the hybrids.

Prices

Rubber. Natural rubber takes a volatile price situation, therefore, prediction of future prices is hazardous. This is because prices are influenced by many variables among which the force of supply and demand, the excessive production of synthetic rubber and the world industrial activity predominate. Other non-economic forces also exert a considerable influence in determining prices.

Over the years, natural rubber price takes a declining trend, with the exception in 1969, until 1972 when a more favourable direction is being shown by the price arrow. Following the energy crisis in 1973, natural rubber price rose to an average of 180 ct per kilogramme in 1974 and climbed up to 220 ct in 1976. The prospects for steady prices at high levels in the foreseeable future are excellent particularly with the successful conclusion of the International Natural Rubber Agreement on Price Stabilisation at Geneva recently. For the purpose of this study, it is proposed to take prices at three different levels; 180 ct, 240 ct and 300 ct per kilogramme.

Palm oil. The future price of palm oil is influenced by supply and demand and excessive production of other oils among which palm oil and palm kernel oil are only two of at least a dozen major fats and oils. Further, the price of palm oil depends on its price competitiveness in relation to other oils and fats, on new markets and end uses. For this study, it is intended to take palm oil price at three different levels; $500, $900 and $1,300 per tonne.

Cocoa. The volatile nature of cocoa prices is well known. The lowest annual average price recorded in recent years was in 1965 when it plummeted to $580.00 per tonne and escalated to an all-time high of $13 000.00 in 1977. Since then, prices have steadily declined, averaging $9 145.00 in 1978 and $7 700.00 for the first five months of 1979. While the record prices of 1977 are unlikely to be seen again, it is generally agreed that the future market for cocoa remains bright as demand increases with the per capita income of developing countries and possible new markets being found in China and Russia.

Thus, a price range of $2 500 to $5 000 per tonne over the long term would appear realistic and are used in these computations. To allow for greater sensitivity to the analyses, a price level of $7 500 is also assumed in this study.

Coconuts. Copra prices for the past five years have generally been attractive, reaching a high of M$70 per picul. However, considering a future where total vegetable oil production and supply is likely to exceed demand, average prices of M$35 and M$45 per picul copra ex-estate have been selected for this study. The higher price of M$60 is also included for greater applicability.

To sum up this section, it is evident that three price levels are assumed for each crop in the computation of the revenue. The usual deductions of duty and cesses are made, where applicable.

EXPECTED REVENUES AND COSTS

The revenue for a given year for rubber is the product of the latex/scrap and its price. Likewise, the expected revenues of oil palm, cocoa and coconuts are computed. Expected gross revenues for these crops at the lowest price levels used in this study are illustrated in *Tables 4, 5* and *6* respectively.

The input requirements are based on commercial estate records. The calculation of the wage structure of tappers, harvesters and other field workers is based on the MAPA-NUPW Agreement, 1976. Detailed estimated costs for these crops at the lowest price levels used in this study are illustrated in *Table 7.*

TABLE 4. ESTIMATED REVENUE ($'000) FOR RUBBER ON CLASS I SOIL

Year	Yield (kg/ha)	RSS 1 f.o.b. price (ct/kg)
		180
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	907	776.74
7	1 253	1 073.03
8	1 537	1 316.25
9	1 704	1 459.27
10	1 832	1 568.88
11	1 985	1 699.92
12	2 057	1 761.57
13	2 145	1 836.93
14	2 353	2 015.06
15	2 538	2 173.46
16	2 732	2 339.63
17	3 450	2 954.51
18	3 175	2 718.99
19	2 883	2 468.94
20	2 600	2 226.58
21	3 003	2 571.71
22	3 008	2 575.98
23	2 996	2 565.72
24	2 968	2 541.73
25	2 923	2 503.19
26	2 862	2 450.95
27	2 784	2 384.16
28	2 655	2 273.68
29	2 539	2 174.34
30	2 407	2 061.30
Total revenue		52 492.52

TABLE 5. ESTIMATED REVENUE ($'000) FOR OIL PALM ON CLASS I SOIL

Year	Yield (FFB/ha)	F.o.b. price ($/tonne)
		500
1	–	–
2	–	–
3	–	–
4	–	–
5	9.00	365.77
6	15.00	719.30
7	21.30	1 026.25
8	22.60	1 202.50
9	23.90	1 324.94
10	24.60	1 363.75
11	25.10	1 391.47
12	24.40	1 352.66
13	23.90	1 324.94
14	23.90	1 324.94
15	23.30	1 291.68
16	22.60	1 252.88
17	22.10	1 225.15
18	21.60	1 197.44
19	21.10	1 169.72
20	20.60	1 142.00
21	20.10	1 114.28
22	19.60	1 086.56
23	19.10	1 058.85
24	18.60	1 031.13
25	18.10	1 003.41
26	17.60	975.69
27	17.30	959.06
28	17.10	947.97
29	16.80	931.34
	Total revenue	27 783.73

TABLE 6. ESTIMATED REVENUE ($'000) FOR COCOA/COCONUT ON CLASS I SOIL

Year	Yield		At prices:		
	Dry beans (kg/ha)	Copra (kg/ha)	Cocoa ($2 500 per tonne)	Copra ($30 per picul)	Total
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	280	0	349.88	0	349.88
5	504	1 818	629.85	452.01	1 081.86
6	672	2 280	840.37	611.33	1 451.50
7	840	2 965	1 050.12	737.30	1 787.42
8	952	3 427	1 189.92	852.15	2 042.07
9	1 064	4 172	1 330.10	1 037.40	2 367.50
10	1 120	3 993	1 400.24	992.94	2 393.18
11	1 177	4 396	1 470.02	1 093.00	2 563.02
12	1 177	4 110	1 470.02	1 022.58	2 492.60
13	1 230	4 110	1 540.05	1 022.58	2 562.63
14	1 230	4 110	1 540.05	1 022.58	2 562.63
15	1 230	4 110	1 540.05	1 022.58	2 562.63
16	1 230	4 110	1 540.05	1 022.58	2 562.63
17	1 230	4 110	1 540.05	1 022.58	2 562.63
18	1 230	4 110	1 540.05	1 022.58	2 562.63
19	1 230	4 110	1 540.05	1 022.58	2 562.63
20	1 230	4 110	1 540.05	1 022.58	2 562.63
21	1 180	4 110	1 470.02	1 022.58	2 492.60
22	1 060	4 110	1 330.10	1 022.58	2 352.68
23	1 010	4 110	1 260.07	1 022.58	2 282.65
24	950	4 110	1 189.92	1 022.58	2 212.50
25	950	4 110	1 189.92	1 022.58	2 212.50
	Total				48 583.00

RESULTS AND DISCUSSION

There are several ways of measuring the economic worth of an investment, the most relevant ones being the NPV, IRR and the B/C ratio.

TABLE 7. ESTIMATED COSTS ($'000) FOR 500 HECTARES RUBBER, OIL PALM, COCOA/COCONUTS

Year	Total costs ($'000)		
	Rubber	Oil palm	Cocoa/coconuts
1	448.56	661.72	1 563.44
2	665.16	460.53	1 134.38
3	945 60	876.26	737.67
4	598 90	1 304.07	868.31
5	485.46	480.32	1 032.90
6	365.54	632.52	1 102.71
7	676.38	753 15	1 191.60
8	453.72	797.50	1 236.95
9	485 80	806.17	1 358.00
10	504.69	786 60	1 368.49
11	527.65	786.02	1 422.00
12	540.49	773.66	1 398.81
13	585.80	783.78	1 419.50
14	596.34	767.61	1 419.50
15	631.37	1 330.95	1 419.50
16	658.15	736.65	1 419.50
17	822.06	711.12	1 419.50
18	737.87	700.54	1 419.50
19	690.81	693.77	1 419.50
20	647.57	685.59	1 419.50
21	710 14	690.80	1 396.89
22	715.97	677.53	1 356.40
23	704.25	649.46	1 335.77
24	687.43	626.43	1 315.26
25	657.53	685.81	1 315.26
26	645.12	737.91	1 315.26
27	631.00	600.57	1 315.26
28	608.09	233.73	1 315.26
29	587.52	226.68	1 315.26
30	565.42	226.68	1 315.26
Total	18 581.39	20 612.45	32 490.84

The above costs are derived based on following price levels:

Rubber	(180 ct per kg)
Palm oil	($500 per tonne)
Cocoa	($2 500 per tonne)
Copra	($30 per picul)

The NPV of an investment is the maximum amount an investor could pay for the opportunity of making the investment without being financially worse off[19]. It emphasises only the time value of money and not its dollar value. The IRR is that discount rate which equates the sum of the net present value of a project to zero. The B/C ratio is the ratio of discounted benefits to discounted costs. The use of a combination of these three criteria provides a better guide towards decision making.

The choice of an appropriate discount rate for a long term investment is highly complex. This difficulty is compounded by the uncertainty of price associated with the resulting product. For the purpose of this study, discount rates of 7½%, 10% and 12% are assumed.

Results

The results of the financial analyses which are expressed in terms of the NPV, IRR and B/C for all the crops are shown in *Table 8*.

At the lowest commodity price levels, rubber and cocoa/coconuts out-perform oil palm. In rubber, all measures of profitability are positive at a discount rate of 7½% only. At other discount rates, all measures are negative except the IRR. Though the IRR is positive, it is below the costs of capital of 10% and 12½%. At these latter discount rates, the return to investments are unsatisfactory.

In cocoa/coconuts combination, the result of the analysis is better than those in rubber. However, at a discount rate of 12½%, the NPV is negative and the B/C ratio is less than unity. But IRR still exceeds the cost of capital of 12½%.

In oil palm, all measures of worth are most unsatisfactory. These demonstrate that at an oil price level of $500 per tonne, the project is technically not feasible and economically not viable.

At other price levels, the returns to investments in all crops are positive, irrespective of the discount rates used. Therefore, the investments are technically and economically feasible on a commercial basis. All measures of profitability are in favour of cocoa/coconuts combination followed by oil palm and rubber. Rubber appears to be less attractive, even though the rate of return on capital invested is higher than the opportunity costs of capital assumed to be 10% and 12½%.

Although this study demonstrates a more favourable position of cocoa/coconuts and oil palm, rubber planting should continue. There are certain situations which we have studied wherein the results reveal a more favourable position for rubber; for example, when commodity prices are "low" or in more "hilly" areas and in areas which have a distinct dry season[20].

TABLE 8. RESULTS OF FINANCIAL ANALYSIS

Item	Rubber								
	180ct/kg			240ct/kg			300ct/kg		
	7½%	10%	12½%	7½%	10%	12½%	7½%	10%	12½%
NPV ($'000)	2 564.4	−595.4	−1 041.1	8 719.2	6 872.6	3 714.3	12 416.3	7 448.2	5 381.3
IRR (%)		9.9			16.9			19.8	
B/C	1.2	0.9	0.8	1.5	1.4	1.3	1.7	1.4	1.2
	Oil palm								
	$500/tonne			$900/tonne			$1 300/tonne		
NPV ($'000)	−5 503.7	−648.3	−6 977.2	14 417.5	10 554.1	8 741.6	19 415.1	10 566.9	8 562.2
IRR (%)		1.4			21.5			22.4	
B/C	0.8	0.6	0.5	1.8	1.7	1.6	2.0	1.7	1.4
	Cocoa/coconuts combination								
	Cocoa $2 500/tonne Coconuts $30/picul			Cocoa $5 000/tonne Coconuts $45/picul			Cocoa $7 500/tonne Coconuts $60/picul		
NPV ($'000)	3 643.0	1 877.4	− 150.9	28 519.6	19 941.0	10 417.0	31 449.2	21 416.0	19 516.8
IRR (%)		14.3			25.2			28.4	
B/C	1.2	1.0	0.9	2.1	1.9	1.5	2.3	1.9	1.6

Further, at the assumed levels of production, at the two higher prices and cost employed in these studies, the expected returns to rubber investments are smaller than those of cocoa/coconuts and oil palm, but they are still competitive to other commercial forms of investments like those in property and development, and the hotel industry. These returns are higher than the costs of capital, the interest rate on commercial bank being also considered.

An important point to be stressed at this juncture is the importance of the smallholder sector in the rubber industry. The future increase in rubber production is expected to come principally from this sector. On smallholdings, which use family labour with a low opportunity cost, the absolute levels of return will be higher than those discussed in the above studies.

On the other hand, cocoa/coconuts and oil palm are capital intensive industries. No estates less than 2 000 ha can afford to economically establish their own processing factory. Where estates can sell fruits to a nearby factory, they may be unable to realise a good price for their products, since their buying power is weak. Thus, their returns to investments will be lower than those shown in the computations in this study.

Based on these considerations, it is reasonable to conclude that planting of rubber will continue in the foreseeable future.

CONCLUSIONS

At the lowest commodity price, rubber and cocoa/coconuts combination perform better than oil palm using a discount rate of 7½%. At higher price levels, these three measures of profitability are consistently in favour of cocoa/coconuts followed by oil palm and rubber. Rubber appears to be the least attractive.

In the final analysis, the choice of rubber or oil palm or cocoa/coconuts for investment will necessarily be dependent on several factors such as soil and physio-graphic features. Nevertheless, the most important point is a critical analysis of the basic factors available before decision-making. It is expected that social factors will have strong influence. However, the economic and technical results emanating from the study are basic and primary to any exercise on the choice of any crops for investment purposes.

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DISCUSSION

LIM THIAN TENG (Harrisons and Crosfield (M) Sdn Bhd, Kuala Lumpur)

The first question is on assumption. Price sensitivity test using $500 per tonne appear to be low. The oil palm returns were penalised unnecessarily.

ARIFFIN BIN MOHD NOR

I agree. If Mr Lim remembers that we had three price levels of $500, $900 and $1 003 per tonne and if we do remember again, we had a very low palm oil price some years ago about $500 per tonne and the industry was suffering. In this connection, the price of $500 per tonne does not mean that palm oil price would not move as low as that level.

LIM THIAN TENG

The second question is on yield sensitivity test; would it be more important to relate the terrain, and climatic conditions rather than discounting rates?

ARIFFIN BIN MOHD NOR

I think yield sensitivity test in this study does not arise because we confine our studies only to Class 1 soils. The comparison is based on Class 1 soil for rubber, Class 1 soil for oil palm, Class 1 soil for cocoa and coconuts.

LIM THIAN TENG

The pay back period should be incorporated as it is an important criteria.

ARIFFIN BIN MOHD NOR

I agree that the pay back period is a very important investment criteria. We have actually calculated this but we did not show it on a slide. The directive of the pay back period is of course, shortest for cocoa and coconuts, longest for rubber and intermediate for oil palm.