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Effects of Some Management Proxies and Sociological Factors on Productivity of Rubber Smallholdings in Malaysia*

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It has been widely appreciated that management ability is difficult to define and measure. This is especially so in the field of agricultural economics. Although management is crucial in the allocation and utilization of the (farm business) resources, Thomas (1962, cited in Krause and Schultz, 1968) has claimed that no research in this field has measured managerial abilities of farmers. Similarly, Johnson (1956: 16) suggests that economists have experienced great difficulty in explaining and understanding the role of management in determining resource productivity. This is mainly due to the lack of units for its direct measurement (Mundlak, 1961: 44). In emphasising this difficulty, Krause and Schultz (1968) have pointed out that, although it is widely recognised that management ability is important, discussion of management faces difficulty as soon as it turns to what management is and what factors are important in the successful management of a farm business.

How do we measure good and poor management ability? Do we measure it in terms of man-hours worked or productivity? If we measure it in terms of man-hours worked, this may not necessarily evaluate the achievement of a manager, which depends upon his ability rather than the number of hours he works. Ability again varies from person to person and it may depend upon the constraints a person is faced with. These constraints may include land-tenure and credit institutions responsible for the allocation of land and capital.

Some researchers have used financial measures such as net worth, labour income and management returns as proxies for management abilities. According to Reiss (1949) these measures are unsatisfactory for various reasons. They are *ex-post* measures and thus knowledge of historical experience is required before any prediction can be made. Financial measures reflect profits as well as losses due to factors beyond the control of managers, and these factors are not corrected for the value framework and planning horizons. Other shortcomings include lack of available records, lack of knowledge, poor recall and divergent ul-

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terior motives in response to personal interviews (Krause and Schultz, 1968: 9). It must also be emphasised that one who is successful in managing a farm of a certain size may not be equally successful in managing a farm of another size.

There are economists who totally reject the idea of management ability as a variable in production function analysis. They argue that apart from random variation in production caused by the uncontrollable factors, the same amount and combination of production factors under the same physical condition would produce the same output.[1] According to this view, it is not possible for nature to produce one result at one time and another result at another time under otherwise identical conditions simply because of differences in some "ghost" input called management (Upton, 1976: 325). The weakness of this view, as pointed out by Upton (1976) is that it disregards numerous decisions which are left to the farmer's judgment. Differences among individual farmers' ability to make decisions are reflected in the yield.

In relation to rubber smallholdings, Upton's argument is pertinent. For example, although all smallholders may have decided to apply the same quality and quantity of fertilizer to their farms, given a *ceteris paribus* condition, the individual smallholder's decisions as to when and how to apply the fertilizer would affect their rubber yield.

1) See Johnson, G. L. (1964). "A note on non-conventional inputs and conventional production functions," in *Agriculture in Economic Development* (ed. C. Either and L. Witt), McGraw-Hill, New York.

Due to conceptual and measurement difficulties, many studies have ended up attempting to measure factors affecting management ability. Most of these studies seemed to follow the Nielson management model which postulates that ability is one of the antecedents which, through the management process, determines management outcomes (Nielson, 1962, cited in Justus and Headley, 1968: 6). This model describes the manager as possessing a biography (V_1) of past experiences, drives, motivations (V_2) and capabilities (V_3; antecedents) which determine managerial behaviour (P; processes) and, in turn, produce an outcome (0) or result. The model is completed by appropriate "feed back" from the outcomes to the attributes of the manager, where results can be used to influence future decisions and outcomes (Justus and Headley, 1968: 5).[2]

Objectives

This paper attempts to investigate the influence of some selected management proxies and sociological factors on rubber productivity of 185 unassisted (independent) and 149 fully government-assisted Felda (Federal Land Development Authority)[3] smallholders (those who farm areas of less than 40 hectares), in the state of Melaka, Peninsular Malaysia. Here four management proxies and twelve sociological and

2) For more description of Nielson's model, see Wirth, M. E. (1964). "Pattern-Analytics: A Method of Classifying Manager Types," *Michigan Quarterly Bulletin*, Vol. 47, No. 2.

3) Felda was created by the government to resettle "landless" and low-income rural families in newly created land settlement schemes.

other[4] factors were chosen. The four management proxies include scores of holding maintenance referred to as management index (M_1), estimated management index (M_2), (estimated by regressing M_1, as a function of Z_1 to Z_{12} and obtaining the estimated M_2) percentage of trees surviving in the holding as against the number planted (M_3), and percentage of surviving trees actually in tapping (percentage in tapping; M_4). This final measure takes note of the number of trees not being tapped because of disease or damage. The twelve sociological factors selected are:

technical knowledge	(Z_1)
number of children	(Z_2)
smallholder's age	(Z_3)
spouse's age	(Z_4)
number of extension visits received per year	(Z_5)
smallholder's years of schooling	(Z_6)
spouse's years of schooling	(Z_7)
smallholder's tapping experience (years)	(Z_8)
spouse's tapping experience (years)	(Z_9)
children's education index	(Z_{10})
distance of house to holding (kilometers)	(Z_{11})
status or roles within community (number of positions held)	(Z_{12})

Analytical Framework

The main analytical technique employed here is the Pearson Correlation obtained in the SPSS (Statistical Package for Social Sciences) which tests for significant association between the various factors and rubber yield (output per hectare). Three correlation matrices are obtained, one each for the pooled, independent and Felda data sets.

The data used in the analysis was collected in 1976. All smallholders selected were those who farmed similar rubber varieties in areas of minimum variation in soil types and environmental conditions. This selection minimises their productivity differences with respect to these factors, thus allowing for better comparison in other respects. Each smallholder category was selected from three localities, with independent smallholders from Jasin, Alor Gajah and Melaka Tengah districts, and, Felda smallholders from Hutan Percha, Machap and Kemendore land settlement schemes.

Results and Discussions

Results of the analysis are discussed under two sections, management proxies and sociological factors.

Management Proxies

Tables 1, 2 and 3 show the matrix correlations of yield, management proxies, and the various sociological factors for the pooled data, Felda smallholders and independent smallholders, respectively. For the pooled data analyses, management is positively related to yield, technical knowledge, spouse's experience, status, percentage of trees surviving in the holding and the percentage of trees in tapping at, at least 5 per cent significant level (Table 1). The results suggest that smallholders with a high standard of holding management tended to obtain high yield. This is mainly

4) Other factors here refer to distance from a smallholder's house to his holding, which is not really a sociological factor, but is included under sociological factors for simplicity.

Table 1 Correlation Matrix of Yield, Management, Sociological and Other Factors for All Smalholders (N=334)

Variables		O	M_1	M_2	M_3	M_4	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8	Z_9	Z_{10}	Z_{11}	Z_{12}
Yield	(O)	1.0000																
Management Index	(M_1)	0.2067$^{\surd}$	1.0000															
Estimated Management Index	(M_2)	-0.0109	0.0198	1.0000														
Percentage of Trees Surviving	(M_3)	0.3288$^{\surd}$	0.1301$^{\surd}$	0.0401	1.0000													
Percentage of Trees in Tapping	(M_4)	0.4050$^{\surd}$	0.2434$^{\surd}$	0.0405	0.8317$^{\surd}$	1.0000												
Technical Knowledge	(Z_1)	-0.0062	0.1579$^{\surd}$	0.0224	0.0785*	0.1041†	1.0000											
No. of Children	(Z_2)	0.0382	-0.0165	-0.0551	-0.0350	-0.0170	0.0943†	1.0000										
Smallholder's Age	(Z_3)	-0.1787$^{\surd}$	-0.0967†	0.0227	-0.0532	-0.0804*	-0.0680*	-0.0493	1.0000									
Spouse's Age	(Z_4)	0.0199	0.0031	-0.0045	0.0695	0.0393	0.0840*	0.1232$^{\surd}$	0.1974$^{\surd}$	1.0000								
Extension Visits	(Z_5)	0.0456	0.0401	0.0913†	0.1162$^{\surd}$	0.1453$^{\surd}$	0.1932$^{\surd}$	-0.0235	0.0170	0.0239	1.0000							
Smallholder's Education	(Z_6)	0.0563	0.0108	0.0136	0.0157	0.0176	0.1773$^{\surd}$	0.0195	-0.1311$^{\surd}$	0.1237$^{\surd}$	0.0146	1.0000						
Spouse's Education	(Z_7)	0.0633	0.0373	-0.0445	-0.0598	-0.0373	-0.0541	-0.1252$^{\surd}$	-0.1890$^{\surd}$	-0.0355	0.0122	0.0471	1.0000					
Smallholder's Experience	(Z_8)	-0.1137†	-0.0635	0.0864*	-0.1759$^{\surd}$	-0.1013†	0.0283	-0.0436	0.3538$^{\surd}$	0.0443	0.1040†	-0.1059	-0.1143†	1.0000				
Spouse's Experience	(Z_9)	-0.0551	0.1070†	0.0252	-0.0085	-0.0347	0.0920†	0.1217$^{\surd}$	0.0925†	0.3487$^{\surd}$	-0.0008	-0.1156†	-0.1280$^{\surd}$	0.2769$^{\surd}$	1.0000			
Children's Education Index	(Z_{10})	-0.0285	-0.0171	0.0029	0.0246	0.0505	0.1655$^{\surd}$	0.4484$^{\surd}$	0.0650	0.1861$^{\surd}$	0.0500	0.1523$^{\surd}$	0.0173	0.0478	0.0576	1.0000		
Distance	(Z_{11})	0.1052†	-0.0048	-0.0417	-0.0332	-0.0415	0.0175	0.1058†	-0.1757$^{\surd}$	-0.0012	-0.0567	0.1292$^{\surd}$	0.0036	-0.0918†	-0.0229	-0.0084	1.0000	
Status	(Z_{12})	0.1120†	0.1186†	0.0816*	0.1277$^{\surd}$	0.1580$^{\surd}$	0.2837$^{\surd}$	0.0601	0.0370	0.0711*	0.0375$^{\surd}$	0.1247$^{\surd}$	-0.0333	0.0664	0.0358	0.1537$^{\surd}$	0.0081	1.0000

Levels of Significance : * 10 %, † 5 % # and $^{\surd}$ 0.5 %

Table 2 Correlation Matrix of Yield, Management, Sociological and Other Factors for Felda Smallholder (N=149)

Variables		O	M_1	M_2	M_3	M_4	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8	Z_9	Z_{10}	Z_{11}	Z_{12}
Yield	(O)	1.0000																
Management Index	(M_1)	0.2567$^{\surd}$	1.0000															
Estimated Management Index	(M_2)	−0.0742*	0.0743	1.0000														
Percentage of Trees Surviving	(M_3)	0.2273$^{\surd}$	0.2065$^{\surd}$	−0.0337	1.0000													
Percentage of Trees in Tapping	(M_4)	0.2965$^{\surd}$	0.3252$^{\surd}$	0.0062	0.7482$^{\surd}$	1.0000												
Technical Knowledge	(Z_1)	0.0102	−0.0273	−0.0191	0.0926	0.1047*	1.0000											
No. of Children	(Z_2)	−0.0618	−0.0857	−0.0483	−0.1086*	−0.0415	0.0994	1.0000										
Smallholder's Age	(Z_3)	−0.0196	−0.0533	0.0378	−0.1259*	−0.0720	0.0335	0.1796$^{\surd}$	1.0000									
Spouse's Age	(Z_4)	−0.0549	−0.0641	0.0021	−0.0597	−0.0397	0.0830	0.2236$^{\surd}$	0.2563$^{\surd}$	1.0000								
Extension Visits	(Z_5)	−	−	−	−	−	−	−	−	−	1.0000							
Smallholder's Education	(Z_6)	0.0132	−0.0852	−0.0536	0.0868	0.0182	0.3188$^{\surd}$	−0.0445	0.0008	0.0350	−	1.0000						
Spouse's Education	(Z_7)	0.1504*	0.0610	−0.1441$^{\surd}$	0.0557	0.0529	0.0285	−0.1989$^{\surd}$	−0.2040$^{\surd}$	−0.0527	−	0.2910$^{\surd}$	1.0000					
Smallholder's Experience	(Z_8)	0.0012	0.0773	0.1400†	0.0211	0.0743	0.1617†	0.0424	0.3473$^{\surd}$	0.1649†	−	0.1502†	0.1458†	1.0000				
Spouse's Experience	(Z_9)	0.0633	0.0990	0.0834	−0.0522	−0.0346	0.0357	0.0586	0.0515	0.3450$^{\surd}$	−	−0.2195$^{\surd}$	−0.1577†	0.4175$^{\surd}$	1.0000			
Children's Education Index	(Z_{10})	−0.0407	−0.0639	0.0598	−0.0712	−0.0161	0.0548	0.3535$^{\surd}$	0.2159$^{\surd}$	0.2859$^{\surd}$	−	−0.0605	−0.0214	0.0490	−0.0082	1.0000		
Distance	(Z_{11})	0.0992	0.0153	−0.0570	−0.1672†	−0.1323†	0.0564	0.0389	−0.1012	0.0491	−	0.1413†	0.1296*	0.0105	0.1129*	0.0392	1.0000	
Status	(Z_{12})	−0.0152	−0.0218	0.0478	0.0547	−0.0125	0.4356$^{\surd}$	0.0857	0.0106	0.0574	−	0.1791$^{\surd}$	−0.0295	−0.0295	−0.0453	0.0761	0.0216	1.0000

Levels of Significance : * 10 %, † 5 % and $^{\surd}$ 0.5 %

Table 3 Correlation Matrix of Yield, Management, Sociological and Other Factors for Independent Smallholders (N=185)

Variables		O	M_1	M_2	M_3	M_4	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8	Z_9	Z_{10}	Z_{11}	Z_{12}
Yield	(O)	1.0000																
Management Index	(M_1)	0.1802$^{\surd}$	1.0000															
Estimated Management Index	(M_2)	0.0988*	0.2265$^{\surd}$	1.0000														
Percentage of Trees Surviving	(M_3)	0.3607$^{\surd}$	0.1160*	0.1570†	1.0000													
Percentage of Trees in Tapping	(M_4)	0.4541$^{\surd}$	0.2191$^{\surd}$	0.1246*	0.8637$^{\surd}$	1.0000												
Technical Knowledge	(Z_1)	0.0105	0.2384$^{\surd}$	0.0908	0.0770	0.1044*	1.0000											
No. of Children	(Z_2)	0.0052	0.0016	-0.0678	-0.0174	-0.0068	0.1150*	1.0000										
Smallholder's Age	(Z_3)	-0.1586†	-0.0997†	-0.0614	-0.0362	-0.0940†	-0.1586†	-0.1216†	1.0000									
Spouse's Age	(Z_4)	0.0645	0.0429	-0.0285	0.1070*	0.0719	0.0813	0.0860	0.1499†	1.0000								
Extension Visits	(Z_5)	0.1277†	0.0829	0.2268$^{\surd}$	0.1254†	0.1658$^{\surd}$	0.1919$^{\surd}$	0.0235	-0.0806	0.0042	1.0000							
Smallholder's Education	(Z_6)	0.0792	0.0359	0.0809	0.0077	0.0181	0.1559†	0.0460	-0.2125$^{\surd}$	0.1494†	0.0028	1.0000						
Spouse's Education	(Z_7)	0.0793	0.0408	-0.0488	-0.0761	-0.0577	-0.0786	-0.0909	-0.2600$^{\surd}$	-0.0383	-0.0147	0.0154	1.0000					
Smallholder's Experience	(Z_8)	-0.0611	-0.1046*	0.0181	-0.2356$^{\surd}$	-0.1713$^{\surd}$	-0.0395	-0.0081	0.2755$^{\surd}$	-0.0287	0.0633	-0.0017	-0.1478†	1.0000				
Spouse's Experience	(Z_9)	-0.0845	0.1142*	0.0643	0.0019	-0.0347	0.1100*	0.1676$^{\surd}$	0.1132*	0.3496$^{\surd}$	-0.0108	-0.1014*	-0.1285*	0.2222$^{\surd}$	1.0000			
Children's Education Index	(Z_{10})	0.0232	0.0181	-0.1144*	0.0486	0.0756	0.1940$^{\surd}$	0.5626$^{\surd}$	-0.0886	0.1347†	-0.0131	0.1966$^{\surd}$	-0.0331	-0.0054	0.0798	1.0000		
Distance	(Z_{11})	-0.0064	-0.0546	0.0215	0.0004	-0.0046	0.0342	0.0508	-0.0772	-0.0028	0.0186	0.1631$^{\surd}$	0.0078	-0.0107	-0.0811	0.0411	1.0000	
Status	(Z_{12})	0.2239$^{\surd}$	0.2051$^{\surd}$	0.1719$^{\surd}$	0.1549$^{\surd}$	0.2307$^{\surd}$	0.2216$^{\surd}$	0.1001*	0.0278	0.0671	0.3240$^{\surd}$	0.1160*	-0.0674	0.0470	0.0667	0.1594†	0.0914	1.0000

Levels of Significance : * 10 %, † 5 % and $^{\surd}$ 0.5 %

because smallholders with high management tended to have a high percentage of trees surviving in their holdings and a high percentage of trees in tapping which are also suggested by the matrix correlation (Table 1). A smallholder's management standard is also positively influenced by his technical knowledge, spouse's farming experience and leadership ability.

In the separate correlation for Felda smallholders only, however, a smallholder's status within the community, technical knowledge and spouse's experience are not significantly correlated to the management index (Table 2). This was anticipated because of the centralised and regimented management by scheme authorities. Thus the effect of management standard among Felda holdings is not large enough to show up in the analysis.

The analysis also shows that the management standard is significantly, negatively, related to a smallholder's age (Table 1), suggesting that older smallholders have inferior management compared with younger ones. This is probably due to differences in attitudes and energy between younger and older smallholders (Mohd. Noor Ghani, 1977). For Felda holdings, this is not so because, due to strict supervision by Felda management, variation in the management standard between older and younger smallholders is small.

Just as M_1, M_2 (estimated management index) only varies significantly between and within localities of independent holdings, but not between and within Felda schemes, it is interesting to note here that M_2 is not significantly correlated with yield in the analyses which used the pooled and Felda data as does M_1. It is significantly correlated only with independent smallholding yield. Thus the estimated index which has been regarded as a better index than M_1 by some researchers is not particularly useful here.

In using M_3 and M_4 as management proxies, it is assumed that the management standard is positively correlated with the percentage of trees surviving in the holding and the percentage of trees in tapping. As shown in Tables 1, 2 and 3, this is certainly the case: M_3 and M_4 are significantly and positively correlated to management standard. Holdings with better maintenance had less incidence of disease than ones which were poorly maintained, thus they had higher M_3 and M_4.

Sociological Factors

Analyses of sociological and other factors are now discussed.

Technical Knowledge (Z_1)

The importance of knowledge was expressed by Marshall (1890) who said that knowledge is the most powerful engine of production. Hess and Miller (1954, cited from Krause and Schultz, 1968), in their studies, found that farmers' high incomes were related to their high scores in a knowledge test. Farmers may have identical resources in all respects, but with differing levels of technological knowledge will have different levels of production (Wharton, 1963: 9).[5]

The importance of technical knowledge

5) Also see, for example, Huffman (1974), Muggen (1969), Griliches (1964), Hobbs, *et al.* (1964), Cozens (1967), and Chaudhri (1968).

in affecting the incomes of Malaysian rice farmers was investigated by Bhati (1971) who studied rice farmers in the Tanjong Karang irrigation scheme. He concluded that farmers' technical knowledge of various aspects of padi production was one of the determinants of the incomes of padi farmers. Similarly, smallholders who have better technical knowledge are expected to maintain a better standard of holding management and thus obtain higher yield.

However, it must be pointed out that the above is not always true. Having the knowledge does not necessarily imply practice. In the case of rubber smallholders, the acquisition of the technical knowledge may be made through attending group discussions, demonstrations, meetings or visits organised by the extension agents. All these methods represent some sort of social gathering. To practice the knowledge on holdings is more demanding. It requires the application of the smallholders' scarce time and energy.

Rubber smallholders' technical knowledge here refers to their knowledge of agronomic and management practices as recommended by the RRIM [Rubber Research Institute of Malaysia], RISDA [Rubber Smallholders Development Authority] and the Agricultural Department. The independent smallholders' sources of technical knowledge are the extension agents of the RRIM, RISDA, Agricultural Department, their publications, radios, television, village chiefs and friends. On the other hand, the Felda smallholders obtained their technical knowledge mainly through their respective scheme management (although publications of the RRIM and RISDA are also made available to them).

Table 4 shows the number of smallholders scoring different points for various questions asked. It was found that 260 out of 337 (77 per cent) smallholders (three of these were omitted in the subsequent analysis due to their deficiency in other information) could not answer the question (No. 5) related to green budding, one of the latest budgrafting techniques which could reduce the period of rubber immaturity by at least 6 months. In general, all smallholders were well aware of the advantages of planting their holdings with budded rubber, and the benefits of fertilizing their holdings. As expected, more Felda than independent smallholders knew the types of planting materials and fertilizers recommended. However, both independent and Felda smallholders were found to have poor knowledge of rubber diseases, their symptoms, effects and treatment. They also often confused the treatment of one disease for another; for example, most Felda smallholders could not differentiate the treatment of root diseases from mouldy rot, a disease occurring at the tapping panel. The majority of smallholders investigated were totally ignorant of the cause of "brown bast," an important disease which is signified by the drying up of the tapping panels and in severe cases, the trees could die. This disease is caused by tapping the trees too frequently and it is cured by resting the trees. During the investigation, all smallholders were given the correct answers. Special care was taken to inform them about the diseases.

Table 4 Number of Smallholders Obtaining Various Scores for Each Question by Holding Type

Question No.	Independent Scores							Felda Scores							All Scores							Total Sample
	⩾3	2½	2	1½	1	½	0	⩾3	2½	2	1½	1	½	0	⩾3	2½	2	1½	1	½	0	
1	0	0	0	2	163	1	21	0	0	0	0	122	0	28	0	0	0	2	285	1	49	337[a]
2	17	0	33	0	74	0	63	45	0	39	0	46	0	20	62	0	72	0	120	0	83	337
3	1	0	11	4	111	21	39	0	0	10	2	94	13	31	1	0	21	6	205	34	70	337
4	0	0	0	0	119	0	68	0	0	0	0	76	0	74	0	0	0	0	195	0	142	337
5	0	0	0	0	30	6	151	0	0	2	0	26	13	109	0	0	2	0	56	19	260	337
6	0	0	7	5	65	4	106	1	0	3	1	60	5	80	1	0	10	6	125	9	186	337
7	0	0	6	18	140	3	20	0	0	13	0	101	7	29	0	0	19	18	241	10	49	337
8	0	0	0	0	31	83	73	0	0	2	0	54	58	36	0	0	2	0	85	141	109	337
9	0	0	0	0	70	2	115	0	0	0	0	44	3	103	0	0	0	0	114	5	218	337
10	0	0	1	1	25	21	139	0	0	1	0	25	5	119	0	0	2	1	50	23	258	337
11	3	3	18	14	77	7	65	6	1	21	4	70	17	31	9	4	39	18	147	24	96	337
12	0	0	3	11	100	12	61	0	0	3	2	70	14	61	0	0	6	13	170	26	122	337
13	0	0	0	8	92	3	82	0	0	16	1	66	16	51	0	0	18	9	158	19	133	337
14	0	0	0	4	52	1	130	0	0	0	0	22	2	126	0	0	0	4	74	3	256	337
15	1	1	19	8	61	19	78	0	0	0	0	2	1	147	1	1	19	8	63	20	225	337
16	0	0	0	0	130	0	57	0	0	0	0	22	1	127	0	0	0	0	152	1	184	337

[a] This total includes the 3 smallholders who were omitted later due to their deficiency in other information.

Table 5 Management, Sociological and Other Factors by Holding Type and Locality

		Independent Smallholders				Felda Smallholders				All	F-Statistics		T-Statistic[a]
		Jasin	Alor Gajah	Melaka Tengah	All	Hutan Percha	Machap	Kemendore	All	Smallholders			
Sample No.		113	40	32	185	54	23	72	149	334	(d.f. 2,182)[b]	(d.f. 2,144)[c]	(d.f. 200<)
Management Index	(M_1)	74.66 (13.16)[d]	86.15 (8.98)	77.13 (9.85)	77.60 (12.65)	78.37 (9.05)	77.80 (11.99)	80.29 (10.45)	79.21 (10.21)	78.32 (11.64)	13.92√	0.79	1.28
Estimated Management Index	(M_2)	77.45 (2.72)	78.82 (2.84)	79.77 (3.93)	78.15 (3.11)	76.14 (15.20)	78.56 (2.37)	78.20 (2.06)	77.51 (9.31)	77.86 (6.63)	8.88√	0.93	0.80
Percentage of Trees Surviving	(M_3)	89.4 (30.4)	91.9 (18.9)	90.1 (17.8)	90.1 (26.3)	86.2 (9.5)	99.2 (9.9)	90.3 (10.5)	90.2 (10.9)	90.1 (20.9)	0.14	13.42√	0.06
Percentage of Trees in Tapping	(M_4)	68.4 (23.8)	65.8 (16.1)	68.9 (16.3)	67.9 (21.1)	63.0 (12.2)	75.8 (14.7)	69.2 (12.8)	68.0 (13.5)	67.9 (18.1)	0.27	8.59√	0.03
Technical Knowledge	(Z_1)	8.91 (4.13)	13.11 (12.04)	11.34 (4.01)	10.24 (6.99)	10.56 (3.67)	10.54 (5.73)	8.38 (3.67)	9.50 (4.16)	9.91 (5.90)	6.14√	5.36√	1.20
No. of Children	(Z_2)	5.53 (3.34)	6.10 (12.78)	4.94 (2.68)	5.55 (3.13)	7.35 (2.28)	6.96 (2.60)	6.18 (3.11)	6.73 (2.79)	6.08 (3.03)	1.24	2.89	3.62↑
Smallholder's Age	(Z_3)	54.94 (11.84)	53.48 (11.22)	52.28 (11.53)	54.16 (11.64)	45.74 (11.40)	46.87 (16.54)	47.42 (11.52)	46.73 (12.31)	50.84 (12.49)	0.74	0.29	5.62↑
Spouse's Age	(Z_4)	39.41 (18.01)	39.60 (14.99)	42.41 (17.28)	39.97 (17.22)	39.57 (11.67)	41.87 (14.97)	36.39 (14.39)	38.39 (13.63)	39.26 (15.72)	0.39	1.74	0.93
Extension Visits	(Z_5)	3.19 (7.52)	6.00 (12.75)	13.88 (20.47)	5.64 (12.45)	-	-	-	-	5.64 (12.45)	7.90√	-	-
Smallholder's Education	(Z_6)	3.97 (2.67)	3.73 (2.37)	7.72 (15.31)	4.57 (6.88)	4.57 (2.27)	4.35 (2.65)	3.93 (2.36)	4.23 (2.37)	4.42 (5.36)	4.22↓	1.17	0.63
Spouse's Education	(Z_7)	2.57 (6.15)	1.98 (2.48)	1.97 (2.65)	2.34 (5.05)	1.69 (2.23)	0.87 (1.55)	1.81 (2.23)	1.62 (2.15)	2.02 (4.04)	0.30	1.71	1.74
Smallholder's Experience	(Z_8)	26.23 (15.27)	22.00 (15.72)	20.38 (14.75)	24.30 (15.45)	13.54 (10.48)	14.78 (12.39)	19.44 (10.53)	16.58 (11.09)	20.86 (14.19)	2.39	5.00↑	5.31↑
Spouse's Experience	(Z_9)	9.89 (12.55)	15.03 (14.23)	9.50 (12.73)	10.91 (13.07)	9.32 (12.73)	8.39 (7.58)	11.56 (10.19)	10.26 (9.49)	10.62 (11.60)	2.59	1.39	0.53
Children's Education Index	(Z_{10})	15.38 (2.58)	15.58 (2.25)	15.41 (2.31)	15.42 (2.46)	14.76 (1.70)	14.74 (1.66)	14.88 (1.78)	14.81 (1.72)	15.15 (2.18)	0.09	0.09	2.68
Distance	(Z_{11})	1.38 (2.13)	1.02 (1.95)	1.70 (1.91)	1.36 (2.06)	3.21 (2.15)	1.96 (2.15)	1.96 (1.81)	2.73 (1.84)	1.97 (2.07)	0.97	4.23*	6.38↑
Status	(Z_{12})	0.59 (0.93)	0.70 (1.07)	1.06 (1.29)	0.70 (1.04)	0.41 (0.81)	0.44 (0.99)	0.35 (0.57)	0.38 (0.81)	0.56 (0.96)	2.59	0.14	3.11↑

a. T-Statistic comparing significant differences between independent and Felda holdings; b. F-Statistic testing variability within and between localities of independent holdings; c. F-Statistic comparing variability within and between Felda holdings; d. Figures within parenthesis are standard deviations.

Levels of Significance: † 5 per cent, ↓ 2.5 per cent, ↑ 1 per cent, √ 0.5 per cent.

The average technical knowledge score obtained by all the smallholders studied is approximately ten (Table 5). There is a big variation in the scores obtained among the smallholders with the co-efficient of variation ranging from approximately 70 per cent among the independent smallholders to approximately 60 per cent within the Felda smallholders. There is no significant difference in the technical knowledge scores obtained by independent and Felda smallholders. However, the scores of technical knowledge obtained by smallholders in the various localities are significantly different at 0.5 per cent probability. The highest scores were obtained by smallholders in Alor Gajah (average thirteen) and the lowest 8.4, at Kemendore Felda Scheme (Table 5).

The pooled data correlation analysis shows that technical knowledge is positively and significantly related to the smallholders' management index, number of children, number of annual extension visits received, years of schooling, spouse's experience, children's education index, status within the community and percentages of trees surviving and in tapping; and it is negatively correlated to the smallholders' age (Table 1). The same results are displayed by the separate correlations for independent and Felda smallholders (Tables 2 and 3). However, technical knowledge is not significantly related to yield.

The above results suggest that younger smallholders who have more education, whose children are more educated, have better technical knowledge than older smallholders who had less education. The results also indicate that smallholders who were frequently visited by extension agents tended to have more technical knowledge. Although one wishes to think that the reason smallholders had more technical knowledge was because they received more extension visits, the reverse could also be equally logical—that extension agents visited them more often because they were educated and had more technical knowledge which facilitated their discussions. More often, extension agents found it difficult to communicate with older and less educated farmers due to communication gap as well as the differences in their ages.

Number of Children (Z_2)

In the areas studied, about 70 per cent of all the smallholders had more than four children, 60 per cent of them having between five and ten children, while about 46 per cent had between five and eight, and only 13 per cent of families had two or fewer children (Table 6). This proportion varies greatly between and within types of smallholders and localities. The average family size on the independent holdings was about 5.6, significantly smaller than 6.7 on Felda holdings (Table 5).

Correlation analysis of the pooled data suggests that the number of children is positively correlated to the smallholder's technical knowledge, spouse's age, spouse's experience, children's education index and distance; and is negatively correlated to the spouse's educational status (Table 1). Separate correlation analysis for the independent smallholders only, shows that the number of children is positively related to the smallholder's technical knowledge,

Table 6 Proportion of Smallholders by Number of Children, Holding Type and Locality

Holding Type/Locality	Number of Children							All
	⩽2	3-4	5-6	7-8	9-10	11-12	13⩽	
Independent:	17.8	23.2	18.9	21.6	11.9	5.9	0.5	100.0 (185)[a]
Jasin	22.1	20.4	17.7	17.7	14.2	7.1	0.9	100.0 (113)
Alor Gajah	7.5	22.5	25.0	27.5	10.0	7.5	0.0	100.0 (40)
Melaka Tengah	15.6	34.4	15.6	28.6	6.3	0.0	0.0	100.0 (32)
Felda:	6.7	14.8	25.5	26.8	18.8	4.7	2.7	100.0 (149)
Hutan Percha	1.9	5.6	29.6	33.3	24.1	3.7	1.9	100.0 (54)
Machap	8.7	8.7	26.1	26.1	21.7	8.7	0.0	100.0 (23)
Kemendore	9.7	23.6	22.2	22.2	13.9	4.2	4.2	100.0 (72)
All	12.8	19.4	21.9	24.0	15.0	5.4	1.5	100.0 (334)

[a] Figures with parenthesis are number of sample.

spouse's experience, children's education index, status, and is negatively related to smallholder's age (Table 3), whereas between the Felda smallholders only, family size is positively related to smallholder's age, spouse's age and children's education index, and is negatively related to spouse's education index (Table 2).

The positive relationship between the number of children and the smallholder's technical knowledge is probably ascribed to the influence of their growing children who, owing to their education, were more modern in their outlook than their parents. The positive relationship between family size and children's education index is expected because it is calculated based on the children's number. Similarly, the positive relationship between age and number of years in school of children in Felda is to be expected because, on average, the farmers are about 8 years younger and many may not have completed their families. Interestingly, however, the wive's ages in the two groups are the same (39 years old; Table 5).

It is also interesting to note the negative relationship between the family size and wive's education, which suggests that more educated wives tended to have less children than the less educated ones. This has an important economic and demographic policy implication and is the more important because of the hint in these tables that the younger wives have more education.

Smallholders' Age (Z_3)

Only 6 per cent of all the smallholders studied were 35 years below and the majority of them were above 45 years, thus the average age of all the smallholders studied was 51 years (Table 5). The proportion of smallholders falling in the various age-groups differs slightly between independent and Felda smallholders. About 27 per cent of the independent smallholders were over 60 years, compared with only 10 per cent on the Felda schemes. Thus, the average age of independent smallholders was approximately 54 years, significantly older than the Felda smallholders, 47 years (Table 5).

Felda smallholders were younger than the independent smallholders because young age (18 to 35 non-military men, 18 to 40 for ex-military men) is one of the criteria for selection into the Felda schemes.[6)]

Correlation matrices of the pooled and the independent smallholders' data indicated that smallholders' age is negatively related to yield, management index, technical knowledge, years of schooling, the percentage of trees in tapping and the percentage of trees surviving in the holding. As expected, it is significantly and positively related to experience (Tables 1, 2 and 3). The results suggest that older smallholders were less educated, had less technical knowledge and their holdings were not as well maintained as those of younger smallholders. Consequently, they have less percentage of trees in tapping and tended to produce less yield.

6) Other criteria include landlessness, health status, education, number of children, experience and skill, and previous occupation. After submission of an application, an applicant is called for an interview with the Felda Selection Committee. During the interview, the applicant is numerically graded, based on the above criteria which carry a maximum of 40 points (27 for the applicant, 13 for his wife).

The same relationship was also found by Bhati (1971) in his study of factors influencing productivity of padi farmers in Malaysia. Older rubber smallholders usually find it hard to keep up with the latest technological developments in rubber farming due to their illiteracy whereas literate smallholders may have direct access to knowledge about planting materials, fertilizers, methods of disease control, new budding techniques, market information and other agronomic practices such as weedicides and pesticides through the various publications which are produced monthly or quarterly by the RRIM and RISDA. Thus, smallholders who have better knowledge will tend to make better farming decisions in order to obtain higher yield (Mohd. Noor Ghani, 1977).

Afifuddin (1973), who investigated commercial farming attitudes of padi farmers in Kedah, Malaysia, found that farmers between 21–30 years were less traditional than the older ones because they were socialised in a more modernised period and environment. He also found that the younger farmers have a higher management ability than the older farmers because of their higher economic aspirations. Age is also related to one's health and fitness and thus one's ability to carry out farming practices. Attitudes towards change and adoption of new technologies are influenced by the farmer's age. Older rubber smallholders in Malaysia are often criticised as reluctant to change and are late adopters of innovation (Mohd. Noor Ghani, 1977).

However, correlation analysis performed only for the Felda smallholders does not suggest any relationship at all between a smallholder's age and his yield, technical knowledge, management index and years of schooling, as previously discussed (Table 2). This is because good maintenance on Felda holdings is a must, and it is supervised by the Felda management, irrespective of the smallholder's age.

Spouse's Age (Z_4)

In family farms, such as the rubber smallholdings where women perform usually as much (if not more) productive work than men, their age is important as it is related to their strength, experience and skill. This is even more so in the case where the smallholder had to work on other jobs, leaving his wife to manage the rubber holding[7] because the holding is too small to provide employment for both partners. A particular case was encountered during the investigation where a smallholder's wife in Hutan Percha Felda scheme had to perform all the productive activities because her husband was reportedly allergic to rubber tapping. He only helped her transport the latex to the collecting station daily, and did the maintenance activities whenever required.

The average age of all the smallholders' wives selected was approximately 39 years, and it varied widely within and between holding types and localities. However, there is no significant difference between the average age of the independent and the Felda smallholders' wives, in contrast to the average of the smallholders' own age. On the independent holdings, it is found

7) For a study of the efficiency of women farm managers, see Moock (1976).

that the spouses' age is positively related to the percentage of trees in tapping (Table 3). This is probably due to their skill and experience in tapping, which caused less losses of trees. On the Felda holding, there is no relationship between the age of spouse and the percentage of trees in tapping. This is because Felda holdings are large enough to provide employment for the couple, and thus the spouse usually does not play a more dominant role in rubber production than her husband as on an independent holding, where the entire farm work is sometimes left to the wife.

Contact with Extension Agents (Z_5)

In the case of independent rubber smallholders, the major extension agents are the extension officers of RISDA who are located at the Mukim and District levels. However, some extension activities are also carried out by officers from other development agencies, such as the Agricultural Department and the RRIM. Felda smallholders receive extension activities from the scheme management which comprises the manager, senior supervisors, supervisors and their field assistants.

In this study, the number of extension visits received by independent smallholders per year is used in the analysis. This measure is not adopted for the Felda smallholders because they are being supervised and are in contact with the Felda staff daily.

Out of the 185 independent smallholders selected, approximately 25 per cent of them knew of and were in contact with extension agents and this proportion varies with locality (Table 7). Among the extension agencies known to them, RISDA (Rubber Industry Smallholders Development Authority) was the most popular and the RRIM (Rubber Research Institute of Malaysia) next popular.

The average number of visits made by extension agents per smallholder selected, varies widely within and between localities. It ranged from three in Jasin to fourteen in Melaka Tengah, giving an overall average of six times per year (Table 7). However, the average number of visits made to those visited is high, ranging from 16 in Jasin to 34 in Melaka Tengah, averaging about 23 times per year. This indicates that extension agents had not spread their visits to as many smallholders as possible, but confined them to only a small number of smallholders.

The main function of extension agents is to disseminate the latest research results to the smallholders. They provide the smallholders with information on planting and processing techniques, pest and disease control and prices of inputs and outputs. Of those smallholders who received extension adivce, all except 4 per cent of them reported that the advice was useful (Table 7). Thus, about 89 per cent of those smallholders who received the advice reported that they practised what they learnt from the extension agents on their holdings (Table 7). Reasons given by those who did not practice the advice include inadequate funds to purchase chemicals and fertilizers, unavailability of time, holdings being too much affected by disease and advice given not being satisfactory.

The relationship between extension visits,

Table 7 Extension Visits by Locality

	Jasin	Alor Gajah	Melaka Tengah	All	F-Statistics[a]
Sample No.	113	40	32	185	
Proportion of smallholders who received advice from extension agents (%)	20.3	22.5	43.8	24.8	
Average number of visits per year made by extension agents per smallholder selected	3.19 (7.52)[b]	6.00 (12.75)	13.88 (20.47)	5.64 (12.45)	10.12√ (d.f. 2, 182)
Average number of visits per year received by smallholders who were visited	16.36 (8.72)	26.67 (13.12)	34.15 (18.23)	23.23 (14.98)	7.90√ (d.f. 243)
Proportion of smallholders receiving extension agents' advice who regard it as:					
very useful (%)	50.0	88.9	78.6	66.7	
useful (%)	45.5	11.1	14.3	28.9	
not useful (%)	0.5	0.0	7.1	4.4	
Total	100.0	100.0	100.0	100.0	
Proportion of smallholders receiving extension agents' advice who react to the advice by:					
practising it immediately on their holdings (%)	77.3	88.9	92.9	84.4	
practising it after seeing others' success (%)	9.1	0.0	0.0	4.4	
not parctising it at all (%)	13.6	0.0	7.1	8.9	
Total	100.0	88.9[c]	100.0	97.7[d]	

[a] F-Statistics of analysis of variance for differences between and within localities.
[b] Figures within brackets are standard deviations.
[c] This does not total 100.0 per cent because a respondent who received advice did not reply to question regarding his reaction to extension advice.
[d] This discrepancy in the total is caused by situation in c.
√ Significant at 0.5 per cent level.

yield, management, and sociological factors, is shown in Table 3. It is positively related to yield, estimated management index, percentage of trees in tapping, percentage of trees surviving, technical knowledge and status. Although this is so, it is quite difficult, at this stage, to establish the direction of causation: whether the more yield, percentage of trees in tapping, etc., was due to the more visits the farmers received from the extension agents, or whether extension agents just visit better farmers. The same applied to the positive relationship between the smallholder's status and the number of extension visits. If the former proposition were the case, then extension agents play an important role in the smallholding development, and important policy implications are suggested by the above results.

Despite the above, it must be emphasised that the effectiveness of extension agents does not only depend on the frequency of their visits but also on the smallholders' attitude and receptivity. Hopcraft (1974) found that extension activities significantly explained productivity of innovative farmers who adopted hybrid corn, whilst negligible effects were recorded on the effects of extension activities on productivity of the less innovative farmers who planted the traditional maize varieties. Hopcraft suggested that this might be due to either the extension agents having nothing to offer in their subsequent visits, or the farmers not being interested. As the number of extension visits increases, the marginal contribution of the visits may decline sharply. Hopcraft (1974: 215) has shown that the recipients of the large number of visits do not seem to be better off, and are often worse off, than those who receive a more moderate number of visits. These might be because the subsequent visits were just social calls and more general subjects were discussed rather than topics relevant to agricultural practices.

Farmers' Education (Z_6)

The effects of formal education on farming productivity have been discussed widely. Schwart (1958) analysed the effects of formal education on the success of farmers. He found that formal education influenced farmers' success as well as their method and ability in making decisions. Farmers with more formal education displayed better understanding of analytical methods and used a more definite and precise method to arrive at price expectations. They also used more direct information (Shaudys and Nodland, 1968: 15).

Welch (1970) has suggested that the contribution of education to production is in the form of "allocative," and "worker" effects. The former refers to the human's ability to acquire, decode and sort market and technical information efficiently,[8] while the latter refers to the ability of a more educated farmer to produce more output from a given set of inputs. These arguments assumed that schooling augments

8) Chaudhri (1968), who analysed the contribution of education in Indian agriculture, was the first to distinguish clearly between the worker and allocative effects of education. However, Nelson and Phelps (1966) had earlier contended that education enhances innovative ability, one dimension of allocative ability (Huffman, 1974: 85).

skill which, in turn, facilitates the gathering, processing, and interpreting of information, thereby enhancing allocative ability, reducing uncertainty, and contributing to efficient decision making (Huffman, 1974: 85).

Schultz (1972) emphasises the importance of allocative ability under dynamic conditions of economic growth. He proposes the allocative ability is revealed in the rates that individuals are capable of adjusting their activities under conditions of disequilibria.

Hopcraft (1974) has offered two reasons to substantiate the claim of Nelson and Phelps (1966), that one of the functions of educative factors is to enhance farmers' ability to use non-traditional factors and inputs. First, the relevant information concerning these factors might originate from formal education channels. Second, these education channels might provide the source to obtain the necessary information, to evaluate and to decode it. The importance of formal education in production is also supported by Schultz (1968: 189) who suggested that where technically superior factors of production are a principal source of agricultural growth, schooling counts.[9] Hopcraft (1974: 115) translated this Schultzian aphorism as follows:

> ...a farmer who has been given appropriate advice by an extension agent might have learned how to use improved seed and fertilizer more successfully, and a farmer who has been to school might be better able to understand, evaluate, and act upon the advice. Inherent in this discussion is the notion that, when it comes to new, unfamiliar, and more technologically advanced factors of production, three conditions apply: the first is that the knowledge, skill and information relating to these factors is useful, that it enhances productivity in the use of new inputs. The second is that such knowledge is not a part of the farmers' existing stock of human capital, it has not yet reached 'state of the arts' dimensions in the population. The third is that applied and useful knowledge acquired by the educational experience.

Nelson and Phelps (1966) contend that education is especially important for those functions requiring adaptation to change or learning (Huffman, 1974: 85). The above argument is relevant to the rubber smallholding situation where technological change in rubber husbandry is rapid as regards both embodied and disembodied changes. Thus, high educational status is one of the necessary conditions for good holding management since it enables farmers to adopt the advice offered.

In this study, smallholders' educational status is measured by the number of years of formal schooling they completed. On average, all smallholders investigated spent about four years in school. It differs significantly within and between localities of independent holdings but not within and between Felda schemes (Table 5). However, there is no significant difference between the educational status of independent and Felda smallholders (Table 5).

Separate correlation for the independent

9) See also, Griliches (1964, 1970), Lewis (1961), and Machlup (1970).

smallholders shows that smallholders' educational status is positively correlated to their technical knowledge, children's education and status, but negatively related to their age (Table 3). This is probably because younger smallholders who have better opportunity for better formal education were able to use more direct information and better understand methods of rubber husbandry, than those who had less. However, the above was not so for the Felda smallholders who were strictly supervised by the management. This is reflected by the separate correlation analysis performed only for the Felda smallholders (Table 2).

Spouse's Education (Z_7)

Spouse's education is as important as that of the smallholders's because a more educated wife could understand better about farming activities through her reading of newspapers, ladies' magazines and extension leaflets, and through her listening to the agricultural programs on the radio, than one who is less educated. Thus she could supplement her husband's knowledge in farming.

The wives of all the smallholders interviewed had an average of two years school and this is not significantly different between the two holding types (Table 5). It is interesting to note that on both types of holdings, spouse's education is negatively related to their age and the number of children (Tables 2 and 3). This suggests that older housewives were less educated than the younger ones and this is probably due to their lack of opportunity. This is the same situation as that of the smallholders themselves. The correlation results also suggest that more educated housewives had less children than less educated wives. This is probably because more educated ones tend to be broader in their outlook and were less resistant to the family planning advice given by the local government midwives who were situated in villages (independent) and schemes (Felda).[10] Spouses' education is found to be significantly related to yield on the Felda holdings, indicating its importance in this more modern farming environment.

Smallholders' Experience (Z_8)

The importance of experience in all professions is that it is related to one's ability to execute one's duties. In terms of the Nielson management model, it is said to be accumulated in the primary antecedents, which in turn, causes one to develop a different capability for subsequent actions. Here, experience is referred to as the number of years the smallholders have been rubber smallholders, and it is taken to be synonymous with their experience in tapping because tapping is the most skilled activity in rubber production.

On average, it is found that all smallholders selected had approximately 21 years of experience in rubber farming, and it significantly differs between smallholders of different Felda schemes, and between the two holding types (Table 5).

In the pooled data correlation (Table 1),

10) In addition to the midwives, who are situated at the scheme's Health Centre, wives of Felda smallholders are also advised by the SDA (Smallholder's Development Assistant), on home economics, and health and extra mural activities, and by other various women's organisations including the *Kumpulan Wanita* (Women's Institute).

smallholders' experience is found to be negatively correlated with yield at a high significant level. This is because experience is positively correlated with smallholders' age, which was found, earlier, to be negatively correlated with yield (Table 1). In the same analysis as age, experience is negatively associated with the percentage of trees surviving in the holding and the percentage of trees in tapping. In the analysis of the independent smallholders only, experience is also indicated to have negative association with their management index (Table 3). This is probably because experience as in the case of age is usually associated with more traditional ways of doing things, sometimes to the extent of resistance to change (Hopcraft, 1974: 22). This finding is contrary to that of Wilcox and Pond (1932, cited in Krause and Schultz, 1968) who found that experience was one of the factors related to farmers' earnings.

Ghazali and Rashid (1974) who analysed causes of unsuccessful land development schemes in Trengganu, Malaysia, reported that most of the partially-subsidised land scheme participants, who had previous experience in rubber farming, planted large proportions of their allocated rubber lots, while those without previous experience did not. Also most participants belonging to the former category used the high-yielding budded rubber.

Experience may also be expected to be quite highly correlated with output up to a certain number of years, but after that it may be negatively correlated. This is because as one gains farming experience, one's productivity may increase, but the productivity may decrease as one becomes older. The possibility of this quadratic relationship of output with respect to experience has also been investigated. However, results obtained are not convincing.

Spouse's Experience (Z_9)

It has been found that there is no significant variation in the spouse's age within and between the different localities of independent and Felda smallholdings, and between the two holding-types. As age is significantly related to experience, there is no significant variation between and within localities of both holding types, and also between these holding types (Table 5).

A separate correlation analysis which made use of the pooled, and the independent smallholders' data only, shows a significant and positive relationship between the spouses' experience with management index, technical knowledge, the number of children, smallholder's age, and a significant but negative association between spouses' experience and their, and smallholders', education (Tables 1 and 3). However, a separate correlation analysis, which employed Felda's data only, indicates that similar relationships as above exist only between spouses' experience with their age and education, and with the smallholders' age and education (Table 2).

The positive relationship between spouses' experience and management index again emphasises the importance of women's roles in rubber farming, especially among the independent holdings. The positive relationship between a spouse's experience and the number of children is expected

because the spouse's age is associated with the number of children (Tables 1, 2 and 3). Spouse's experience is negatively related to education because education is also negatively related to age.

Children's Education Index (Z_{10})

Although there is no significant variation between and within localities of both types of holding, the average children's education index[11] of the independent smallholders is significantly higher than that on Felda schemes. This is because independent smallholders are older than Felda smallholders, and probably they may have older children.

The pooled data analysis indicates that children's education index is positively associated with the smallholder's technical knowledge, education and status (Table 1). The children's education could influence the smallholder's technical knowledge because the children might introduce the smallholder to new ideas which they acquired through schools or through reading newspapers and publications supplied by the various extension and research organizations. This could broaden the smallholder's outlook and technical knowledge of rubber farming. The influence of his children's education is especially important where the smallholder himself is illiterate. The positive association between the children's education index and the smallholder's own education and status suggests a tendency for the more educated village leaders to have more educated children than the "ordinary" smallholders who had less education.

Distance to Holding (Z_{11})

Here, distance refers to the number of kilometres the holding is situated from the smallholder's house. The average distance varies greatly within and between holding types and localities, with independent holdings being about 1.4 kilometres away, which is significantly about half the average distance on Felda holdings (Table 5).

The positive association between distance and yield (Table 1) is due to the effects of Felda holdings which are situated further away but produced more yield than independent holdings.

Table 3 shows an interesting negative association between distance and the percentage of trees surviving in the holding and the percentage of trees in tapping. This is probably because the distance from house to holding could affect the smallholder's standard of management of his holding and thus the percentage of trees in tapping and in holding. A holding further from the house requires a longer travelling time for the smallholder. This is especially so if the smallholder has no other means of transport. As maintenance practices are normally done during non-tapping days and in the evenings, a smallholder whose holding is within the vicinity of the house, or whose house is situated on the holding itself, may do maintenance jobs during his leisure hours in the evenings or at any time he is free, without having to walk for half an hour or so to the holding. Also,

11) An index is constructed for each smallholding family's children's education. A point is scored for every child in the family who has been to primary school; two points for secondary (high) school; and three points for attending college or university or both, and for rubber and/or agricultural courses.

a smallholder in this situation is obliged to weed his holding to keep his house surroundings clean, whereas a smallholder whose holding is two or three kilometres away from his house will have to do the maintenance job during non-tapping days. Thus distance to holding may affect a smallholder's capabilities to do these maintenance practices due to time and physical constraints. Often the failure of Fringe and unassisted State Land Development schemes was ascribed mainly to their long distances from the participants' houses.

Roles within the Community

(Status; Z_{12})

As in any other society, within a Malaysian village community there are various persons who are respected because of their roles within the community. These include the village leaders and members of the various village committees. In this study, in addition to the village "sidang" (headman), other positions in the village considered prestigious are the deputy headman, "Iman" (a Muslim priest), "bilal" (a mosque caretaker), "guru" (religious teacher), and the members of the many committees in the village, and these are referred to as "status", here.

To measure status in the community, this study recorded the number of positions the smallholders held. Sometimes a smallholder might hold more than one position, and this signifies his leadership quality and command of respect by the community. A smallholder not having any position may mean that he is just an ordinary smallholder who is either not active or who prefers to be a follower. It must also be pointed out that some positions command more status than others, for example, a *sidang* commands more status than a committee member. However, the persons who command most status in the village usually will have more positions.

Separate correlation for the independent smallholders shows that status is positively related to yield, management index, estimated management index, technical knowledge, number of extension visits, smallholders' educational status, children's education index, percentage of trees in the holding, the percentage of trees in tapping, and the number of extension visits received (Table 3). These results, among others, suggest that village leaders within the independent smallholder community tended to have more education, technical knowledge and superior management and obtain more yield than the "ordinary" smallholders. The results also indicate that they received more extension visits than the ordinary smallholders. As mentioned earlier, it is difficult to conclude from this that their superior technical knowledge, holding management and yield were the result of the frequent visits they received from extension agents or whether the extension agents visited them more often because they were knowledgeable village leaders.

The suggestion that community leaders produced more yield than the ordinary smallholders is contrary to the suggestion made by Afifuddin (1973) with respect to padi farmers in Kedah, Malaysia. He indicated that farmers, who were active participants in the various village organisations, made less profit than the non-

participants. Although Afifuddin did not offer explanations for his suggestion, it is suspected that once a farmer is too involved in the various organisations, he is bound by time constraints to have less time on his own farm.

It is also indicated that the village leaders had more educated children than the ordinary smallholders. This is probably due to their higher incomes which permitted them to send their children for further education. It also could be due to them being more educated and thus being more of the value of education than the ordinary smallholders.

With respect to the Felda smallholders, the correlation analysis shows that status is positively and significantly correlated to technical knowledge and educational status (Table 2). In contrast to the case of the independent smallholders, there is no correlation between status and yield and management index because the variation in all these factors was small among Felda smallholders irrespective of their status. This is due to the supervision by the management of all smallholders. Thus, these results confirm that community leaders were those with better education and technical knowledge.

Conclusions

The analysis suggests that there is a positive association between the farmer's technical knowledge and management index, which in turn is significantly, and positively related with rubber yield. It also indicates that the women's education (Felda smallholders' wives) is positively related to yield.

Despite the importance of the smallholder's technical knowledge it is found that many of the independent, as well as Felda smallholders selected had poor knowledge of holding management. Their knowledge was especially poor with respect to identification and treatment of pests and diseases which are of crucial importance to rubber productivity.

Felda smallholders are being supervised daily by their scheme managers and staff. Despite this, it is found that they still have only limited knowledge of holding management. The reason for this situation is somewhat unclear. One possible reason is that Felda staff probably assume only supervisory roles, as do managers and staff of commercial rubber estates, only telling their labourers what must be done, but not why it should be done. They do not fulfil an educational role in addition to their supervisory functions, which tend to be paternalistic and do not encourage the smallholders to develop their own sense of judgment.

On the other hand, it may be argued that in a Felda scheme what matters is that smallholders complete their jobs, irrespective of whether or not they understand the technicalities. If this were the case, then, it is logical that Felda's staff need only perform their supervisory roles. However, smallholders may appreciate their jobs better if they understand more fully what they are doing. Then, in future they will be able to efficiently perform their tasks

with much less supervision.

As technical knowledge and extension visits are significantly and positively related, and assuming that technical knowledge is affected by extension visits, the analysis suggests that the independent smallholders' lack of knowledge on holding management is attributed mainly to their lack of contact with extension agents. Only about one-quarter of the independent smallholders investigated were visited by extension agents.

It has been mentioned earlier that the agency responsible for extension activities of independent smallholders is RISDA, which was created in 1973. Among its many aims is, "... to implement all agricultural innovations, ... and to ensure that the smallholders' sector is modernised in every sense ..." (Mohd. Nor and Chong, 1976: 378). Being new, RISDA lacks staff, especially competent extension personnel at the grass-roots level, that is those who are actually in contact with the smallholders (RISDA is "top-heavy" with "middle" and "upper-middle" level executives based at the Headquarters).

In 1976, RISDA had about 800 extension workers (Mohd. Noor and Chong, 1976: 379). Out of these, however, only 250 were trained and competent in extension work (Yusof Suhaime, 1977: 6). They were those staff who had been transferred from the SHAS. Other extension workers were clerks and field staff of the Rubber Industry (Replanting) Board [RI(R)B] who specialised in the processing of issuing replanting grants (subsidies). They had very limited training in practice of rubber planting and extension techniques. As incompetent extension agents are not effective (Nayan Ariffin, 1977: 11), the effective extension agent to smallholder ratio is high, approximately 1,500–2,000 smallholders per experienced agent.

Apart from the problem of inadequately trained extension agents, the problem of RISDA's extension service is compounded by some of its field staff's unfamiliarity with their working areas. During the survey, some RISDA extension officers we were in contact with could give us very little guidance around the various localities, as they themselves were strangers in the areas. This was partly due to their being new in the areas, and partly due to their habit of visiting the same smallholders over and over again. Some smallholders received as many as three extension visits per month, while others none.

Women's education was shown to have a significant and positive correlation with yield. This is an important result because to date women's education has been sadly neglected. Few serious efforts have been made to educate adult women, especially those in rural areas. On the Felda schemes programs for adult education for women have been organised through the Women's Institute as well as through the efforts of the settler's Development Officer, but typically these are more concerned with household functions or "domestic science" than efforts to improve their knowledge of farming activities.

Women's education was also shown to be significantly and negatively related to family size. This finding may be of partic-

ular interest to those dealing with demographic studies.

On the independent holdings, a smallholder's age was found to be significantly, and negatively related to his technical knowledge, management index and yield, as found by Afifuddin (1973) and Bhati (1971) who both studied rice farmers. The generally low productivity of the older farmers has been attributed mainly to their lack of economic aspiration (Afifuddin, 1973), and also to their late adoption of modern farming practices (Mohd. Noor Ghani, 1977). However, on the Felda holdings there was no significant relationship between a smallholder's age and the above factors.

The analysis also showed that an independent smallholder's status (role) within the community is significantly and positively related to his yield, technical knowledge, management index and education status, but this is not so amongst the Felda smallholders.

The above findings suggest an important policy implication. Where smallholders are given access to similar economic input factors and similar levels of supervision, their age and status within the community may not affect their productivity. These findings to some extent, also indicate the success of Felda in creating smallholdings with very similar productivity irrespective of the age and sociological background of the farmers.

It is also interesting to note here that the estimated management index (M_2), which was based on each smallholder's management index (M_1) as graded during the field inspection of his holding, with subsequent adjustment according to various sociological factors, was found not be as good an indicator of his standard of holding management as M_1. This is probably because a smallholder's sociological background may have nothing to do with the standard of his holding management. Thus it seems clear that the better indicator of standard of holding management is measurement of performance on holdings rather than reference to sociological indicators.

Because of the importance of the smallholders' technical knowledge, Felda and RISDA should increase their extension activities in order to enhance the smallholders' knowledge.

As Felda has no problem of staff shortage it could conduct various short and comprehensive courses for the smallholders, each emphasizing a different aspect of holding management. To do this, Felda's staff themselves must be well informed on the subjects in question. If they are not, some refresher courses would be necessary first. Such courses are readily available from the RRIM.

It has been widely appreciated that RISDA's task in educating the half million rubber smallholders is not an easy one, especially with its present staffing situation. It is inevitable that RISDA needs to increase the number of its competent extension personnel if extension activities are to be performed satisfactorily. Training of the existing staff is necessary in addition to new recruitment.

With its limited number of staff, RISDA should adopt the group activity approach

to extension, in order to maximise their coverage of farmers. Group discussions, demonstrations, slide shows and film shows are examples of group activities which could be adopted. In addition, village leaders and model farmers should be trained so that they may play the role of extension workers in their villages. There should be regular evaluation of extension methods to see whether they are meeting their stated objectives.

Women's adult education programs should be emphasized by the related agencies, not only on Felda schemes but also in rural areas in general.

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