



The Influence of Agricultural Production Information on the Agricultural Management Scale in Rural Areas of Cambodia

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Abstract The main object of this study was to quantitatively grasp the relevance among local farmers to analyze the characteristics of local farming and agricultural production information to build stable and sustainable farming needed by farmers. The research site was ten districts in Kampong Cham Province, Cambodia. The results of the analysis are summarized as follows: 1) It was confirmed that the index of agricultural production information varies depending on the districts; 2) Based on the Canonical Correlation Analysis results, cultivated land and annual income from agricultural activity, which are regarded to be the results of agricultural management, have relevance among factors such as attributions, crops, and agricultural production information was clarified. The cultivated land is affected by the index, which is aimed at expanding the scale of rice production. In addition, annual income from agricultural activity is affected by an index aimed at high-quality crop production based on new technology information, information about organic fertilizer and training. According to the results of the analysis, agricultural productivity expansions in Cambodia depends on providing information that can be adaptable to the intention of agricultural management of the local farmers.

Keywords Cambodia, canonical correlation analysis, multiple farming

INTRODUCTION

In Cambodia, per capita income has increased along with economic development. Consequently, a demand for various agricultural products in addition to rice has increased resulting in increased production of various agricultural products including vegetables. Currently, in rural areas, many local farmers intend to produce rice as usual, while many farmers produce vegetables and fruits using multiple farming. In order to mitigate poverty in rural areas, it is necessary to produce a variety of crops, centering on rice production, which is expected to expand in the future. The building of stable and sustainable agricultural management is essential. According to this background, the main object of this study was to quantitatively grasp the relevance among local farmers in different districts to analyze the characteristics of local farming and agricultural production information to build stable and sustainable farming needed by the farmers. In addition, this study focuses on multiple farming in Cambodia.

OBJECTIVE

The main object of this study was to quantitatively grasp the relevance among local farmers in different districts to analyze the characteristics of local farming and agricultural production information to build stable and sustainable farming needed by the farmers. The specific analysis of this study has the following two issues: 1) the index of agricultural production information required by local farmers per district; 2) the Canonical Correlation Analysis applies to attributions, crops and agricultural production information are associated with scale of cultivated land and annual income from agricultural activity considered to be a result of farm management. The Canonical Correlation Analysis is used in quantitative analysis of the relation between the agricultural management scale acreage allotment and regional structure (Ohtake and Aoyagi, 1988; Matsumoto, 1998).

METHODOLOGY

The research site was in Kampong Cham Province. Kampong Cham Province is located northeast of Phnom Penh, and southeast of Siem Reap. During the French colonial period, in Kampong Cham Province, the hilly terrain was developed as a rubber plantation zone. The population of Kampong Cham province is approximately 1.75 million and much of the population is engaged in agriculture. The target area of the questionnaire survey consisted of the following ten districts: Batheay district: 45 respondents (10.3% of the total respondents); Chamkar Leu district: 50 (11.4%); Chueng Prey district: 36 (8.2%); Kaoh Sotin district: 46 (10.5%); Kampong Siem district: 38 (8.7%); Krong Kampong Cham district: 48 (11.0%); Kang Meas district: 44 (10.1%); Prey Chhor district: 36 (8.2%); Srei Santhor district: 50 (11.4%); and Stung Trang district: 44 (10.1%). The total number of respondents is 471, and the number of valid respondents is 437. In Kampong Cham Province, vegetables and fruit trees are widely produced while their main production is rice. As for the vegetables, cabbage and cucumber are often planted and produced throughout the year. Also, various vegetables and fruits including luffa, bitter melon, winter melon, Chinese spinach, leaf onion, lemongrass, green beans, papaya, and cashew etc. are produced. Additionally, at this site, the Institute of Environmental Rehabilitation and Conservation (ERECON) carries out a project on Promoting Sustainable Agricultural Conditions for Poverty Reduction in Kampong Cham Province in Cambodia (October/2017-September/2020). This project aims to promote sustainable farming practices to local farmers based on the cyclic use of natural resources.

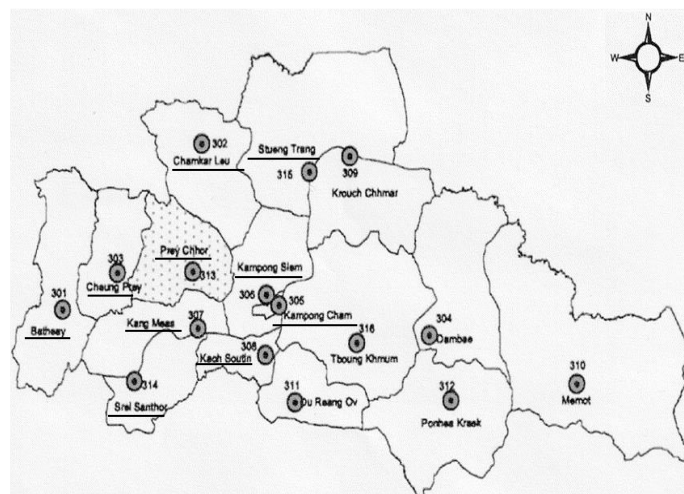


Fig. 1 Location of the study site in Kampong Cham Province

RESULTS AND DISCUSSION

The Index of Agricultural Production Information Required by Local Farmers per District

Table 1 shows the index of the questionnaire survey conducted, which contains categories for gender and age of the respondent, educational background, farm acreage, cropping pattern and farmers' revenues. Table 2 shows segregated results of indicators showing the characteristics of the agricultural production information for each district. In addition, multiple responses are gathered regarding the agricultural production information. For each district, the following characteristics are taken into consideration from the results in Tables 1 and 2.

Table 1 Average of agricultural management scale for each district

Index		Number of response											
		All	Batheay	Chamkar Leu	Chueng Prey	Kaoh Sotin	Kampong Siem	Krong Kampong Cham	Kang Meas	Prey Chhor	Srei Santhor	Stueng Trang	
		437	45	50	36	46	38	48	44	36	50	44	
		(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	(n) (%)	
Gender	1. Male	282 64.53	32 0.71	42 0.84	16 0.44	26 0.57	19 0.50	25 0.52	34 0.77	20 0.56	36 0.72	32 0.73	
	2. Female	155 35.47	13 0.29	8 0.16	20 0.56	20 0.43	19 0.50	23 0.48	10 0.23	16 0.44	14 0.28	12 0.27	
Age	1. Less than 29 years old	17 3.89	2 0.04	3 0.06	0 0.00	1 0.02	2 0.05	0 0.00	1 0.02	1 0.03	3 0.06	4 0.09	
	2. 30-39years	113 25.86	15 0.33	20 0.40	7 0.19	6 0.13	10 0.26	7 0.15	14 0.32	7 0.19	8 0.16	19 0.43	
	3. 40-49years	140 32.04	21 0.47	15 0.30	9 0.25	20 0.43	12 0.32	15 0.31	17 0.39	9 0.25	10 0.20	12 0.27	
	4. 50-59years	116 26.54	2 0.04	7 0.14	12 0.33	16 0.35	11 0.29	17 0.35	6 0.14	18 0.50	22 0.44	5 0.11	
	5. More than 60 years old	51 11.67	5 0.11	5 0.10	8 0.22	3 0.07	3 0.08	9 0.19	6 0.14	1 0.03	7 0.14	4 0.09	
Educational background	1. Never had been to school	42 9.61	5 0.11	3 0.06	7 0.19	2 0.04	0 0.00	14 0.29	2 0.05	0 0.00	2 0.04	7 0.16	
	2. Primary	228 52.17	24 0.53	34 0.68	21 0.58	20 0.43	22 0.58	17 0.35	20 0.45	18 0.50	25 0.50	27 0.61	
	3. Secondary	133 30.43	14 0.31	11 0.22	5 0.14	19 0.41	13 0.34	14 0.29	14 0.32	17 0.47	20 0.40	6 0.14	
	4. High school	33 7.55	2 0.04	2 0.04	3 0.08	5 0.11	3 0.08	2 0.04	8 0.18	1 0.03	3 0.06	4 0.09	
	5. College/University	1 0.23	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.02	0 0.00	0 0.00	0 0.00	0 0.00	
Total area	1. Less than 0.5 ha	91 20.82	5 0.11	15 0.30	5 0.14	0 0.00	13 0.34	30 0.63	7 0.16	9 0.25	5 0.10	2 0.05	
	2. 0.6-1ha	116 26.54	14 0.31	13 0.26	10 0.28	17 0.37	11 0.29	6 0.13	11 0.25	18 0.50	11 0.22	5 0.11	
	3. 1.1-1.5ha	117 26.77	12 0.27	10 0.20	14 0.39	13 0.28	6 0.16	8 0.17	16 0.36	3 0.08	25 0.50	10 0.23	
	4. 1.6-2ha	40 9.15	8 0.18	3 0.06	1 0.03	7 0.15	7 0.18	0 0.00	5 0.11	1 0.03	3 0.06	5 0.11	
	5. More than 2.1ha	73 16.70	6 0.13	9 0.18	6 0.17	9 0.20	1 0.03	4 0.08	5 0.11	5 0.14	6 0.12	22 0.50	
Cropping pattern	1. Rice	394 0.36	43 0.46	34 0.27	35 0.36	45 0.36	32 0.32	42 0.35	38 0.32	35 0.43	48 0.35	42 0.44	
	2. Vegetables	389 0.36	37 0.40	48 0.39	31 0.32	43 0.35	35 0.35	46 0.38	42 0.36	33 0.41	50 0.37	24 0.25	
	3. Fruit	307 0.28	13 0.14	42 0.34	32 0.33	36 0.29	33 0.33	32 0.27	38 0.32	13 0.16	38 0.28	30 0.31	
farmers' revenues	1. Less than 1,000,000 Riel	30 6.86	0 0.00	1 2.22	8 0.07	3 9.26	7 0.05	2 7.47	0 0.00	6 24.46	3 0.02	0 0.00	
	2. 1,000,000-2,999,999 Riel	169 38.67	9 0.09	16 35.56	18 0.16	23 70.99	15 0.11	25 93.40	17 0.09	14 57.06	24 0.16	8 23.48	
	3. 3,000,000-4,999,999 Riel	122 27.92	12 0.12	12 26.67	7 0.06	11 33.95	11 0.08	12 44.83	18 0.10	10 40.76	15 0.10	14 41.08	
	4. 5,000,000-6,999,999 Riel	57 13.04	5 0.05	13 28.89	2 0.02	6 18.52	1 0.01	5 18.68	6 0.03	3 12.23	4 0.03	12 35.22	
	5. 7,000,000-8,999,999 Riel	32 7.32	10 0.10	4 8.89	1 0.01	2 6.17	4 0.03	1 3.74	2 0.01	1 4.08	2 0.01	5 14.67	
6. More than 9,000,000 Riel	27 6.18	9 0.09	4 8.89	0 0.00	1 3.09	0 0.00	3 11.21	1 0.01	2 8.15	2 0.01	5 14.67		

source : Survey Date

In Batheay District, the average annual agricultural income was the highest among the 10 districts. In the order of importance, they valued information about training, information about organic fertilizer, and new technology information. For Chamkar Leu District surveys indicated that more vegetables and fruits were produced than rice, based on the local cropping pattern. The farmers, in order of importance, valued information about organic fertilizer, new technology information and information about seeds. In Chueng Prey District, the average agricultural annual income is the lowest among the 10 districts and respondents have the highest average age. They most valued information about seeds, followed by information about training and market. Kaoh Sotin District has the third largest average management area among the 10 districts. The agricultural production information that was answered as important was in the order of information about seeds, information about organic fertilizer and market. In Kampong Siem District, it has the second lowest average management area and annual income out of 10 districts. The agricultural production information that was answered as important was in the order of information about seeds, new technology information and market information. In Krong Kampong Cham, it has the smallest average management area, because it located in an urban area in the province. The agricultural production information that was answered as important was in the order of information about organic fertilizer, information about seeds and planting information. In Kang Meas District, half of the respondents graduated from secondary school and high school. The agricultural production information that was answered as important was in the order of information about chemical fertilizer, information about seeds and planting information. In Prey Chhor District, almost all local farmers produce rice and vegetables, while fruits production is low. The agricultural production information that was answered as important was in the order of planting information, information

about organic fertilizer and seeds. In Srei Santhor District, the farmers have the third lowest average agricultural annual income among the 10 districts. The agricultural production information that was answered as important was in the order of new technology information, market information, and information about seeds. In Stueng Trang District, the farmers had the youngest average age, and the largest average management area. The average agricultural annual income was also high. They ranked agricultural production information as most important followed by, information about organic fertilizer, new technology information and information about seeds. The composite questionnaire answers the index of agricultural production information varies among the districts.

Table 2 Characteristics of agricultural production information for each district

Index	Number of response																					
	All		Bathey		Chamkar Leu		Chueng Prey		Kaoh Sotin		Kampong Siem		Krong Kampong Cham 48		Kang Meas		Prey Chhor		Srei Santhor		Stueng Trang	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Agricultural production information	194	0.44	8	0.18	14	0.28	29	0.81	28	0.61	22	0.58	22	0.46	24	0.55	17	0.47	13	0.26	17	0.39
Information about seeds	26	0.06	0	0.00	0	0.00	5	0.14	1	0.02	8	0.21	2	0.04	4	0.09	1	0.03	2	0.04	3	0.07
Information about machinery	135	0.31	13	0.29	17	0.34	10	0.28	10	0.22	19	0.50	11	0.23	13	0.30	5	0.14	18	0.36	19	0.43
New technology information	32	0.07	1	0.02	4	0.08	4	0.11	3	0.07	8	0.21	6	0.13	1	0.02	4	0.11	1	0.02	0	0.00
Information about chemical fertilizer	199	0.46	18	0.40	18	0.36	13	0.36	24	0.52	15	0.39	30	0.63	30	0.68	18	0.50	12	0.24	21	0.48
Information about organic fertilizer	113	0.26	9	0.20	13	0.26	14	0.39	22	0.48	17	0.45	9	0.19	6	0.14	2	0.06	15	0.30	6	0.14
Market information	117	0.27	24	0.53	2	0.04	19	0.53	5	0.11	15	0.39	8	0.17	9	0.20	9	0.25	10	0.20	16	0.36
Information about training	32	0.07	2	0.04	1	0.02	8	0.22	6	0.13	6	0.16	1	0.02	2	0.05	0	0.00	1	0.02	5	0.11
Price information	15	0.03	0	0.00	0	0.00	4	0.11	2	0.04	4	0.11	1	0.02	0	0.00	0	0.00	0	0.00	4	0.09
Information about harvest	138	0.32	5	0.11	10	0.20	13	0.36	21	0.46	6	0.16	18	0.38	19	0.43	25	0.69	6	0.12	15	0.34
Planting information																						

Source : Survey Date

Table 3 Estimation results of canonical correlation analysis

Index	Canonical variables standardized coefficients	
	CV1	CV2
Cultivated land	: Y1 (5 levels)	0.9958 0.3476
Annual income from agricultural activity	: Y2 (5 levels)	0.0129 -1.0547
1 Gender	: X1 (dummy)	0.0467 0.2559
2 Age	: X2 (5 levels)	-0.2296 -0.2613
3 Educational background	: X3 (5 levels)	0.2534 0.0748
4 Rice	: X4 (dummy)	0.698 -0.1882
5 Vegetables	: X5 (dummy)	-0.259 -0.0244
6 Fruit	: X6 (dummy)	0.296 -0.5674
7 Information about seeds	: X7 (dummy)	-0.3184 -0.3051
8 Information about machinery	: X8 (dummy)	0.1119 -0.0629
9 New technology information	: X9 (dummy)	0.1061 0.2414
10 Information about chemical fertilizer	: X10 (dummy)	-0.0442 -0.139
11 Information about organic fertilizer	: X11 (dummy)	0.0296 0.2306
12 Market information	: X12 (dummy)	-0.0133 0.1894
13 Information about training	: X13 (dummy)	0.1343 0.2787
14 Price information	: X14 (dummy)	0.1084 -0.2773
15 Information about harvest	: X15 (dummy)	0.2783 0.0708
16 Planting information	: X16 (dummy)	0.0616 -0.1661

Source Sarvey date

Note Eigenvalue: CV1: 0.19, CV2: 0.13

The Influence of Agricultural Production Information on the Agricultural Management Scale

In this section, Canonical Correlation Analysis reveals that attribute, crop, and agricultural production information are related to annual income from arable land and agricultural activities and are considered a result of farm management. The Canonical Correlation Analysis is used to identify and measure the associations between two sets of variables. The analysis is applicable in the same way as multiple regression analysis, but it is more suitable when there are multiple objective variables. Therefore, the objective variables of Canonical Correlation analysis are Y1: cultivated land and Y2: annual income from agricultural activity. Further, explanatory variables are X1: gender; X2: age; X3: educational background; X4: rice; X5: vegetables; X6: fruits; X7: information about seeds; X8: information about machinery; X9: new technology information; X10: information about chemical fertilizer; X11: information about organic fertilizer; X12: market information; X13:

information about training; X14: price information; X15: information about harvest; and X16: planting information. In Table 3, the results from the estimation of the Canonical Correlation Analysis are shown in the research site.

According to the results of Canonical Correlation analysis, Canonical variate 1 shows cultivated land while Canonical variate 2 shows annual income from agricultural activity. Cultivated land: educational background, rice and fruits are affecting as attributions, and information about harvest is affecting as agricultural production information. Therefore, the cultivated land is affected by the index aiming at expanding the scale of rice production. For annual income from agricultural activity: gender is affecting as attributions, and new technology information, information about organic fertilizer and training are affecting as agricultural production information. Therefore, annual income from agricultural activity is affected by an index of new technology information, information about organic fertilizer and training, all of which are important for high-quality crop production. The results of the analysis suggest that the development of multiple farming in Cambodia is under the condition of expanding rice production and increasing the skills of local farmers in agricultural technology.

CONCLUSION

The main object of this study was to quantitatively grasp the relevance among local farmers to analyze the characteristics of local farming and agricultural production information to build stable and sustainable farming needed by the farmers in Kampong Cham Province, Cambodia. In addition, a Canonical Correlation Analysis applies to attributions, crops and agricultural production information are associated with annual income from agricultural activity and cultivated land that are considered as a result of farm management.

The results of the analysis are summarized as follows. According to the answers from questionnaire, it was confirmed that the index of agricultural production information varies depending on the districts. According to the results of Canonical Correlation analysis, the cultivated land is affected by the index aimed at expanding the scale of rice production. In addition, annual income from agricultural activity is affected by the index aimed at high-quality crop production based on new technology information, information about organic fertilizer and training. As a result of the analysis, it was suggested that for the development of multiple farming in Cambodia, in addition to the premise of expanding rice production, it is necessary to improve the skills necessary for the conversion of high-quality crop production.

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