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EVALUATION PROCESS OF RUBBER REPLANTING AID IN EASTERN AND NORTHWESTERN THAILAND.

Banpot Wiroonratch*

Graduate School of Commerce, Burapha University, Chon Buri 20131, Thailand.

ABSTRACT

The objectives of this research were to analyze the confirmatory factors of process evaluation on rubber replanting aid of the Office of the Rubber Replanting Aid Fund (ORRAF) according to the perception of rubber farmers participating in the projects, which the investigation on the accord of process evaluation model of rubber replanting aid with the empirical data was included, and finally to test the invariance of process evaluation model of rubber replanting aid between two groups of rubber farmers participating in two projects including farmers who had never owned a rubber plantation and those participated in phase 2 of the project supporting rubber tree planting during 1997 – 2001. The samples were 1,107 rubber farmers obtained by means of stratified random sampling. The instrument used for data collection was the rubber replanting process evaluation form of the ORRAF evaluated by the rubber farmers in the projects. The data analysis was conducted using Confirmatory Factor Analysis (CFA) and Model Invariance Test by means of Multiple-group models analysis.

The research revealed that the process evaluation factors on rubber replanting aid of the ORRAF evaluated by the rubber farmers participating in the projects consisted of three factors, i.e., training, plantation management knowledge, and plantation tendance knowledge. The model of process evaluation on rubber planting aid fitted the empirical data at a good level. The model of process evaluation of rubber replanting aid between rubber farmers in the two projects – aiding farmers, which never owned a rubber plantation and supporting rubber tree planting in new areas in phase 2 during 1997 – 2001 had an invariance form, but had variance in the coefficient of the second-order factors.

Keywords: Process evaluation, rubber, farmers.

*Corresponding author. E-mail address: banpot.buu@gmail.com

INTRODUCTION

Rubber is an economic plant, which has been used worldwide as raw material in the production of scientific, transportation, communication, automobile, and household products. As there is no other plant which provides much milky fluid used in the production of goods as rubber, the use of it has increased from 43.3% in 2006 to 44.6% in 2009 (International Rubber Study Group, cited in Rubber Research Center, 2010). In addition, there is lower risk for farmers in rubber planting as it can be tapped all seasons for approximately 20 years. As a result, rubber farming is considered as a secure occupation which more people are interested in this business. Although the weather in Thailand is considered as suitable for rubber planting, the quantity of liquid gained may be differing among areas caused by land characteristics, management, and experiences, especially in soil development, and weather. In order to support the business, the Office of the Rubber Replanting Aid Fund (ORRAF) was conducted. The Office of the Rubber Replanting Aid Fund is a non-profit state enterprise under the Ministry of Agriculture and Cooperatives that helps strengthening the stability of the society. It was established according to the Rubber Replanting Aid Fund Act with the purposes to help increasing rubber farmers' income by encouraging replanting good breed of rubber trees in place of old rubber trees with less productivity, or by planting other perennial plants significant to economy. Additionally, the ORRAF provides farmers who have never owned a rubber plantation with an alternative to have a sustainable occupation in rubber tree planting (Office of the Rubber Replanting Aid Fund, 2011). The mission of the ORRAF is to follow the Sixth Para Rubber Development Strategy (B.E. 2554-2559), which aims to increase the production quality, to develop skills of rubber farmers, to develop local rubber marketing systems, to increase the cooperation of sustainable rubber management, and to develop the management of rubber organization (Office of Agricultural Economics, 2007). In addition, the ORRAF provides guidance and on the job training regarding rubber innovation continuously.

Process evaluation is considered as an alternative leading to the project's success. Since organizations and institutes in the community are involved in projects and activities occurred within, the evaluation of the project needs to be based on the fact and it needs to be concerned about the effects that might occur to people being involved. Additionally, the suitable techniques should be employed. The factors analysis is a statistical method used to measure the process of rubber management. To ensure that the rubber management of the ORRAF meets the objectives, such monitoring and evaluating using different indicators will provide the answers to whether the projects can reach the goal and objectives as set, to which extent the goal is fulfilled, or to how the projects are adjusted or improved in order to reach the goals and objectives (Kitpreedaborisoot, 1992).

Based on the mentioned background and significance, it has led to further investigation on the operation system of the ORRAF regarding the perception of farmers participating in rubber planting projects, i.e., the factors of the operation system of rubber planting aid of the ORRAF, and how the farmers perceived each of the factors. The objectives of this research were aimed to analyze the confirmatory factors of process evaluation on rubber replanting aid of the ORRAF according to the perception of rubber farmers participating in the projects, to investigate the accord of process evaluation model of rubber replanting aid with the empirical data, and to test the invariance of process evaluation model of rubber replanting aid between two groups of rubber farmers participating in two projects, namely, the project aiding farmers having never owned a rubber plantation and the project supporting rubber tree planting in new areas phase II during the years 1997 – 2001. The purpose of the test was to obtain the information to be used as an approach for improving the operation system and providing supports that match the needs and perceptions of rubber farmers in each project.

METHODOLOGY

Population and samples

The population was 37,953 farmers planting rubber trees in rubber replanting aid project of the ORRAF separated into two groups, i.e., 22,901 farmers in rubber replanting who had never owned a rubber plantation classified by the Act of Legislation of the ORRAF, Section 21 bis (B.E. 2538 - 2547), and 15,052 farmers classified by the Act of Legislation of the ORRAF, Section 21 bis, session II (B.E. 2540 - 2544).

The samples were 1,107 farmers selected by Stratified random sampling. During the selection process, the farmers in both projects were classified into stratum and they were randomly picked as samples. The number of samples was 459 farmers from the rubber replanting aid project for farmers who had never owned a rubber plantation and 648 farmers from the rubber tree planting in new areas project (Boomsma, 1983, cited in Wiratchai, 1999, p. 311).

Instrument

The instrument used in this research was a rating scale with five scales being checked for correctness and objectivity by agricultural experts and delegates from the ORRAF who were also supervisors of the research. Next, the instrument was tried out with 30 rubber farmers to check for an understanding of the language used, the clarity of the questions, and the probability of the answers. The reliability of the instrument tested by Alpha's Cronbach Coefficient was between 0.826 and 0.962 and the item discrimination analysis tested was statistically significant (Cronbach, 1990).

Research framework

The factor synthesis was the examination of principles, concepts, or theories relating to evaluation. In this research, it was referred to as the process evaluation of rubber replanting aid of the rubber replanting aid project of farmers participating in the projects on the basis of the information provided by the rubber farmers. This research adopted the context-based factors of operation system of the ORRAF. The delegates did the determination of the probable factors from the ORRAF. The rubber replanting aid project contained three factors of the operation system including organizing training, plantation management knowledge, and plantation tendance knowledge (Division of Funding Promotion, The Office of Rubber Replanting Aid Funding, 2008).

The following figure illustrates the constructed preliminary model:

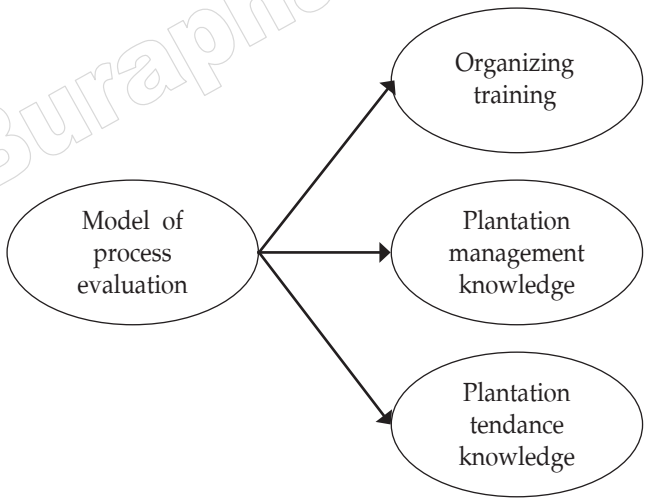


Figure 1. Research conceptual framework: process evaluation model.

With regard to the conceptual framework, the management process of the ORRAF incorporates three main aspects including; organizing training, plantation management knowledge, and plantation tendance knowledge (Division of Funding Promotion, The Office of Rubber Replanting Aid Funding, 2008).

With regard to organizing training aspect, there are eight measured indicators including orientation, rubber tree bud grafting, planting area preparation, cover crop and insert crop planting, maintenance, weed extermination, rubber tapping, and post training.

With regard to plantation management, there are eight measured indicators including planting area preparation, rubber tree planting and maintenance, rubber tree nourishment, and soil nourishment.

Plantation tendance knowledge consists of four measured indicators including insect and rubber blight prevention, criterion tendance, fertilizer mixing for rubber trees, and die-hard weed extermination. The Hypothesis was drawn up as the process evaluation of the ORRAF consisted of three factors, namely, organizing training, plantation management knowledge, and plantation tendance knowledge. The process evaluation model of rubber replanting aid of the ORRAF between two groups of participants was invariant.

RESULTS

The analysis of second-order confirmatory factors the model of process evaluation on rubber replanting aid

From factor synthesis under the principles and concepts of operation system of rubber replanting aid of the ORRAF, it was apparent that the operation system of rubber replanting aid consisted of three factors and 16 variables adopted to construct the model of process evaluation on rubber replanting aid of farmers participating in the projects. Before analyzing the operation system factors of rubber replanting aid of these farmers, the researcher inspected the correlation matrix of the variables by examining the index value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy, the index used to measure the appropriateness of sample data being analyzed using factor analysis (Wanitpunya, 2005). The inspection indicated different correlation coefficient between variables in the correlation matrix, which should be over 0.50 and approach 1.0. The result of the analysis of the value index of Kaiser-Meyer-Olkin revealed the value index was at 0.96. Therefore, it can be concluded that factor analysis was appropriate for analyzing the existing data. Then, the Bartlett's test of sphericity was combined into the analysis to illustrate that the correlation matrix between variables was significantly different from the identity matrix. The result of the analysis showed that the value of Bartlett's test of sphericity was 16,220.78 ($p < 0.000$), indicating that the relationship between variables was highly appropriate to be used to analyze the confirmatory factors.

The results of the second-order confirmatory factor analysis of the process evaluation model of rubber replanting aid revealed that the first-order latent variables consisted of three factors, namely, organizing training, plantation management knowledge, and plantation tendance knowledge. Evidence used to illustrate model fit between the model and empirical data was fit indices, the value of factor loading in standard score (beta: β) displaying validity of measurement (Bollen, 1989, p. 199), and reliability (R^2). The result of the data analysis showed that the Chi-square (χ^2) of the model of process evaluation of rubber replanting aid was 1,334.10, which was significantly different from zero. This result suggested that process evaluation of rubber replanting aid did not fit the empirical data. Thus, the researcher adjusted the model using Joreskog and Sorbom's modification indices (1989, p. 21) by allowing the relationship of the errors of observed variables and by considering the p- value, GFI value, which should be over 0.01, 0.90 respectively, and the RMSEA value which should be under 0.05.

The result of the model adjustment analysis is shown in Table 1 and Figure 2. χ^2 of the process evaluation model of the rubber replanting aid was 54.46 which was not statistically significant different from zero, the GFI and RMSEA values were 0.99 and 0.01, respectively. These values indicated that this model met the criteria of being fit. Therefore, it could be concluded that this model was well fitted the empirical data.

When considering the second – order factor loading of latent variables used to explain the importance of the model, it was found that factor

loading of the evaluation of the three variables was positive. Specifically stated, the perception of rubber plantation management knowledge of the rubber farmers participating in the rubber replanting aid project was at the highest level (β = 0.96), the perception of the training was almost as high as the first perception with β = 0.95, while the perception of the rubber plantation tendance knowledge was at the lowest level (β = 0.88). Factor loading of these three variables could significantly explain the importance of the process evaluation of rubber planting aid at a 0.05 level of statistical significance.

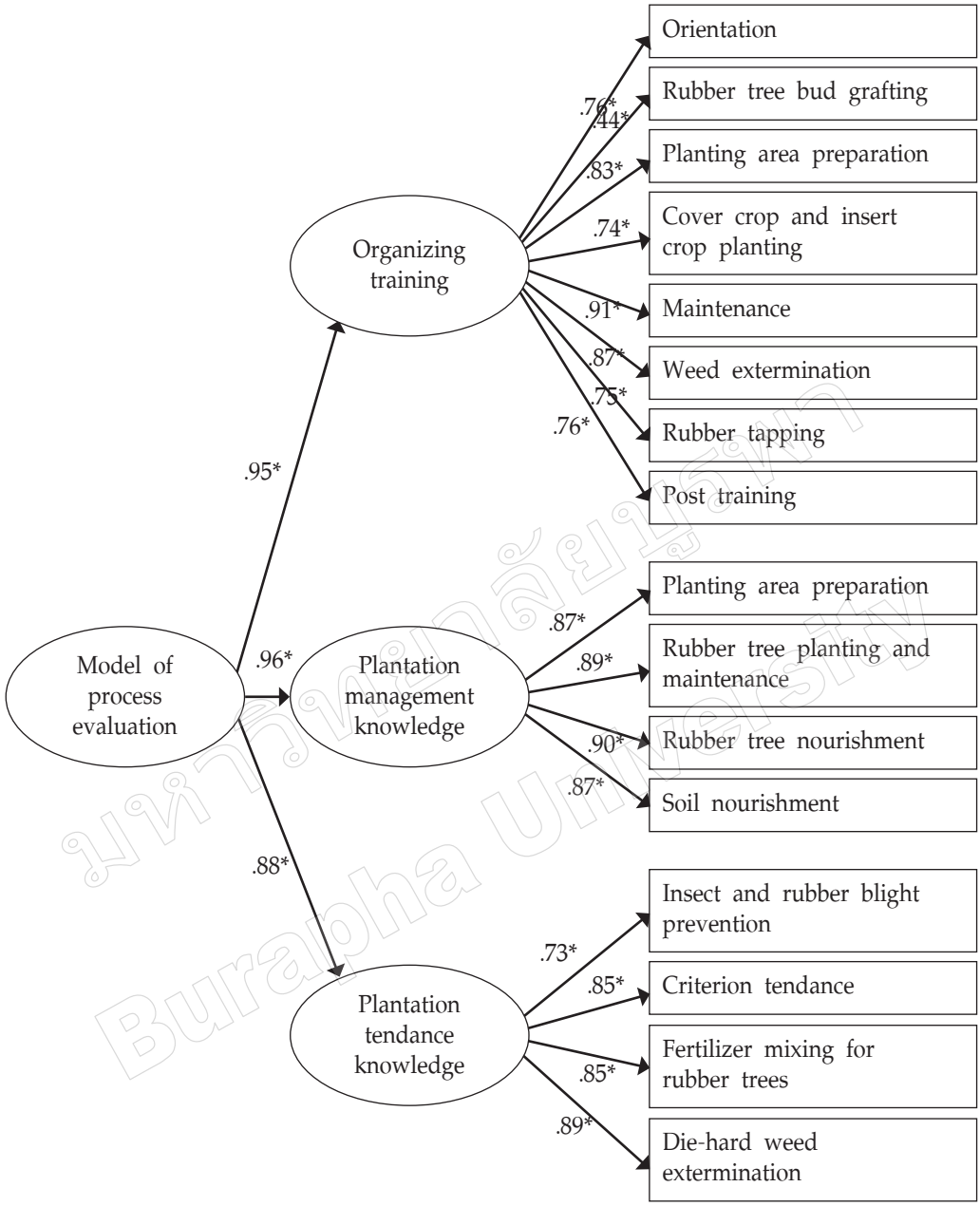
Table 1. Statistical analysis of the second-order confirmatory factors of process evaluation on rubber replanting aid.

Second-order factor	First-order factors	Observed variables	Beta: β	R^2
Model of process evaluation	Organizing training (β = 0.95*)	Orientation	.76*	.58
		Rubber tree bud grafting	.44*	.19
		Planting area preparation	.83*	.69
		Cover crop and insert crop planting	.74*	.54
		Maintenance	.91*	.84
		Weed extermination	.87*	.75
		Rubber tapping	.75*	.56
		Post training	.76*	.58
	Plantation management knowledge (β = 0.96*)	Planting area preparation	.87*	.76
		Rubber tree planting and maintenance	.89*	.79
		Rubber tree nourishment	.90*	.81
		Soil nourishment	.87*	.75
	Plantation tendance knowledge (β = .88*)	Insect and rubber blight prevention	.73*	.53
		Criterion tendance	.85*	.72
		Fertilizer mixing for rubber trees	.85*	.73
		Die-hard weed extermination	.89*	.79
χ^2 = 54.46, df. = 49, p-value = .19, GFI = .99, RMSEA = .01				

*p-value < 0.05

When considering the first – order factor loading of observed variables which explained the importance of latent variables being components of organizing training factor, the results revealed that the rubber farmers joining the project rated their perception of 'training in maintenance' the highest (β = 0.91), 'training in weed extermination' the second highest, and 'training in bud grafting' the lowest with the β = 0.44.

Regarding the observed variables which explained the importance of the latent variables being components of 'providing rubber plantation management knowledge' factor, the farmers rated their perception of four factors relatively equally. However, the observed variable rated the highest with β = 0.90 was 'rubber tree nourishment'. As for the observed variables which explained the importance of 'providing rubber plantation tendance knowledge' factor, among the four variables, the farmers rated their perception of the provision of 'die-hard weed extermination' knowledge at the first rank (β = 0.89), while rated their perception of the provision of 'insect and rubber blight prevention' knowledge as the least importance (β = 0.73).



χ^2 = 54.46, df = 49, p-value = 0.19, GFI = 0.99, RMSEA = 0.01

Figure 2. Model of process evaluation of rubber replanting aid.

The invariance test of the process evaluation model of rubber replanting aid

The multiple-group analysis of the process evaluation model of rubber replanting aid was conducted to test the invariance of forms and parameters in the model between the farmers in the project aiding farmers who have never owned a rubber plantation and the farmers in the project supporting rubber tree planting in new areas phase II during the years 1997 – 2001. The results of invariance test of forms and parameters of the model of process evaluation on rubber replanting are shown in Tables 2 and 3 and Figures 3A – 3B.

Table 2. The multiple-group analysis of the process evaluation model of rubber replanting aid between the farmers participating in 'aiding farmer having never owned a rubber plantation project' and farmers in 'supporting rubber tree planting in new areas phase II during the years 1997 – 2001 project.

The 2-order CFA: model of process evaluation on rubber replanting aid	Farmer groups in the projects			
	Farmers never owned plantation		Rubber trees planting in new areas phase II	
	β	R^2	β	R^2
Organizing training	.95*	.91	.95*	.88
Plantation management knowledge	.87*	.91	.98*	.83
Plantation tendance knowledge	.82*	.85	1.00*	.85

* $p < .05$

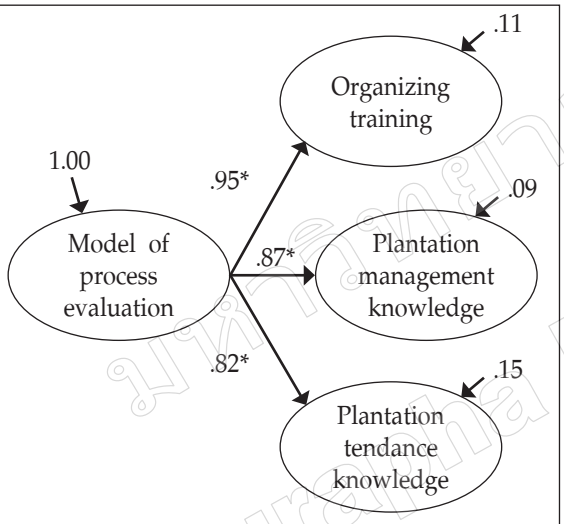


Figure 3 A. Multi-group analysis model of process evaluation on rubber replanting aid of farmers in 'aiding farmer having never raised rubber plantation project'

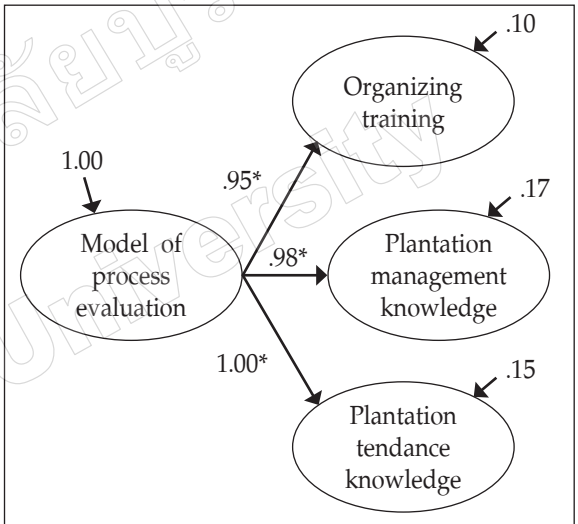


Figure 3 B. Multi-group analysis model of process evaluation on rubber replanting aid of farmers in 'supporting rubber trees planting in new areas in phase II during the years 1997 – 2001 project.

Table 2 and Figures 3A – 3B revealed the invariance of model forms of process evaluation of farmers in both groups, namely, the farmers in the project aiding farmers who had never owned a rubber plantation and those in the project of supporting rubber tree planting in new areas phase 2 (1997 – 2001). The results indicated that the levels of importance and levels of perception of loading scores between the two groups were different. In detail, the farmers in the project aiding farmers having never owned rubber plantation rated their perception of 'training' the highest, 'providing rubber plantation management knowledge' the second highest, and 'providing rubber plantation tendance knowledge' the lowest, with the loading scores of 0.95, 0.87, and 0.82, respectively, being statistically significant at 0.05. However, the farmers in the other group rated their perception of 'providing rubber plantation tendance knowledge' factor the highest, 'providing rubber plantation management knowledge' the second highest, and 'training' the lowest, with the loading scores of 1.00, 0.98,

and 0.95, respectively, and all loading scores were statistically significant at a level of 0.05. Each factor had a covariance with the factors of process evaluation, with a percentage of 85, 83, and 88, respectively.

Table 3. Results of the invariance tests of forms and parameters of the process evaluation model of rubber replanting aid between the farmers participating in 'rubber replanting aid for farmer having never owned a rubber plantation project' and the farmers in 'supporting rubber tree planting in new areas phase II during the years 1997 – 2001 projects.

Hypothesis	χ^2	df	p	CFI	RMSEA (CI)	FO	GFI	
							Never planted	Phase II
H_{form}	1,121.66	186	.00	.98	.095 (.090 - .100)	.85	.92	.94
H_{Γ}	1,176.61	198	.00	.98	.095 (.089 - .100)	.89	.93	.90
	$\triangle\chi^2$	$\triangle df$	p					
H_{Γ} compared with H_{form}	54.95	12	.00					

Results from Table 3 showed that the value of χ^2 was 1,121.66, where df = 186, which was statistical significance at a level of 0.05. It indicated that the model did not fit the empirical data. However, when taking other indices into consideration, it was found that the model well fitted the empirical data with the confirmatory factor indices (CFI), the root mean square error of approximation (RMSEA), and population discrepancy function values (FO) as 0.98, 0.09, and 0.85, respectively. These indices indicated that the structure of the model contained an invariant form; therefore, this model could be used to evaluate the operation system of rubber replanting aid relatively reliably in both projects. The model fitted the empirical data in a good level in both projects, with GFI = 0.92 in the 'aiding farmer having never owned a rubber plantations project' and GFI = 0.94 in the 'supporting rubber tree planting in new areas phase 2 project during the years 1997 – 2001'. The researcher was subsequently tested the invariance of the coefficient of the second-order factors (H_{Γ}) between the two projects by analyzing the coefficient difference of the second-order factors. The analysis revealed the difference of Chi-square value ($\triangle\chi^2$) between the two projects was equal to 54.95, where df = 12, at a 0.05 level of significance. Thus, it could be concluded that the second – order factor coefficients were changed during the process evaluation of rubber replanting aid in both projects.

DISCUSSION

The results of this research reveal that the factors of process evaluation of rubber replanting aid of the Rubber Replanting Aid Fund Office perceived by the farmers participating in the projects consisted of three factors, namely, organizing training, providing rubber plantation management knowledge, and providing rubber plantation tendance knowledge, which were congruent with the first hypothesis. The reason was that the researcher theoretically developed these factors of process evaluation. That is, the researcher synthesized the factors from principles, concepts, or approaches of practical operation process under the actual contexts of the operation system of the ORRAF. In addition, expert delegates from the Office provided information about the operation following the guidelines of the State Enterprise Plan Issue 6 (2011 – 2016). As the operation process of the ORRAF included training, providing rubber plantation management knowledge, and providing rubber plantation tendance knowledge,

it was accountable for the test of fit between the principle model and the empirical data in that the model well fitted the data which is in accordance with the Hypothesis 2. This result of the second hypothesis test is congruent with research studies on factor development in various disciplines, for example, in education, Narkeye (2007) developed the factors of electronic leadership characteristics and factors affecting leadership effectiveness for basic education principals. The result has revealed that this factor development contained six factors as developed earlier. Chuanchard (2010) used factor analysis techniques in nursing to develop factors of work ability of registered nurses in community hospitals in the eastern region of Thailand. Her result has indicated 10 factors of development as developed. In social fields, specifically in the Justice Administration and Society, Ratwittayaporn (2010) employed factor analysis techniques to develop the culpability performs components of juveniles in the Center of Youth Observation and Protection in Chonburi Province, Thailand, and the result showed 12 factors as developed.

This research also indicates that the models of process evaluation of rubber replanting aid of the farmers in both projects – aiding farmers who had never owned a rubber plantation and supporting rubber tree planting in new areas phase II during the year 1997 – 2001 had an invariant form being congruent with result of the third hypothesis test, which indicated that the models of operation process evaluation of rubber replanting aid in both projects were not invariant. This is because the operation mission of the ORRAF is operated following the guidelines of the State Enterprise Plan Issue VI during the year 2011 – 2016, which determine process factors by focusing on program or plan performance. The operation systems of rubber replanting aid in both projects are operated on the basis of three factors, i.e., organizing training, providing rubber plantation management knowledge, and providing rubber plantation tendance knowledge. This result is in accordance with the results of the study on confirmatory factor analysis in different fields. For instance, Intaranarong (2010) has adopted confirmatory factor analysis being used in her education research in order to analyze confirmatory factors of teachers' self – efficacy perceptions. Her result showed that the factor model developed from concepts and theories was well fitted the empirical data. Result of Jureemas and Srisa-ard (2010) study was correlated with the previous study, where the results showed that the factor model developed form concepts and theories fitted the empirical data when conducting research in nursing by using the technique of confirmatory factor analysis to analyze confirmatory factors of work morale of nurses working in community hospitals in Roi-et Province, Thailand.

This study pointed out that the parameters, particularly the second – order factor loadings of the process evaluation model of rubber replanting aid between the two projects – aiding, which never owned a rubber plantation and supporting rubber planting in new areas phase II during the year 1997 – 2001 were different. This result is also congruent with Hypothesis three in detail, based on their perception, the farmers participating in 'aiding farmers who have never owned a rubber plantation project' rated 'training' at the first rank, 'providing rubber plantation management knowledge' at the second, and 'providing rubber plantation tendance knowledge' in the third. It is obvious that these farmers do not have knowledge, understanding, and skills in doing rubber plantation; as a result, these farmers have received training support from the ORRAF as the priority. The training was aimed to provide the knowledge covering all methods of doing rubber plantation. The activities included in the training were orientation, rubber tree bud grafting, planting area preparation, cover crop and insert crop planting, maintenance, weed extermination, rubber tapping, and post training (Rubber Research Institute, 2010).

As for the farmers in supporting rubber tree planting in new areas in phase II during the years 1997 – 2001 project, they rated 'providing rubber plantation tendance knowledge' factor as the most important, 'providing rubber plantation management knowledge' factor as the second important, and 'training' factor as the least important. This reveals that the farmers in this project face the problem

of land conditions; as a consequence, they obtained support from the ORRAF in terms of rubber plantation tendance knowledge. This knowledge covers four techniques, i.e., planting area preparation, rubber tree planting and maintenance, rubber tree nourishment, and soil nourishment.

This research was conducted to evaluate the operation of the Office of Rubber Replanting Aid Fund (ORRAF) in aiding and supporting rubber farmers and its performance following the guidelines of the State Enterprise Plan Issue VI during the years 2011 – 2016, which included continuously providing advice, assigning officers to supervise, and organizing training to introduce new knowledge to the rubber farmers. The results displayed that the ORRAF's project operation reached the goals and objectives as set and definitely met the needs of the rubber farmers.

The recommendation and implementation should be done based on the research results, which point out that the operation system of the rubber replanting aid of the ORRAF perceived by the rubber farmers participating in the projects consists of three factors, i.e., 'organizing training', 'providing rubber plantation management knowledge', and 'providing rubber plantation tendance knowledge. Therefore, in process evaluation of rubber replanting aid, the ORRAF should use the evaluation system consisting of these three factors to evaluate other projects, such as the project of rubber tree planting to raise income and security for rubber farmers in new rubber planting areas phase 1 during 2004 – 2006, the project of plantation groups out of funding and plantation groups under funding, etc.

As the result reveals that rubber farmers participating in the 'aiding farmers having never owned a rubber plantation project' rated 'training' as the most important; as a consequence, the ORRAF should develop farmers who have never planted rubber trees in other projects by providing them with a lot of training.

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