CHAPTER 7

Factors Influencing on Farmer's Use of Seasonal Weather Forecast Data in Rice Production Decisions Making

This chapter aims to find out factors influence on farmer's SWF data using in rice production decisions by applying the Theory of planned behavior (TPB). The null hypothesis of theory is that the farmer's attitude, farmer's subjective social norms, and perceived behavior controls have no relationship on rice farmer's seasonal forecast use in rice production decision making. The application of structure equation modelling (SEM) analysis was applied by using AMOS 16.0 (citation) and SPSS 16.0 software packages to estimate the unknown coefficients of the causal relationships among talent variables (farmer's attitude, social norms, perceived behavior controls) and also to indicate clearly how hypothesis is presented by observer variables. There are three main sections presented in this chapter. Firstly, prior to the analysis, the reliability of indicators used to measure the theory planned behavior model was investigated by using Cronbach's alpha coefficient. Secondly, confirmatory factor analysis (CFA) was conducted to test quality and adequacy of the measurement models to confirm the convergent validity and discriminant validity of studied model. Lastly, in order to understand the causal relationship among factors and farmer's SWF use in rice production decision, SEM analysis was conducted to test the hypothesis present in this study.

7.1 Developing the Dependent Variable for Study Model

7.1.1 Indicators of Farmers' SWF Use in Rice Production Decision

In order to find out how farmers used SWFs on farmer decisions making in rice production, a set of questions (8 questions) based on the results obtained from the focus group discussion was formulated. This set of questions was used to interview 180 rice

households who considered SWFs in their rice production decisions. The frequencies of the SWFs' use were scored using 7 Likert scales (Table 7.1).

Table 7.1 The farmer's statement of SWFs use in rice production decisions

Decisions	1	2	3	4	5	6	7
SWFs were use in planting date decision							
SWFs were use seed selection decision for next season							
SWFs were use in seed brewing time decision							
SWFs were use in herbicide application decision							
SWFs were use in pesticide application decision							
SWFs were use in fertilizer application decision							
SWFs were use in irrigation management							
SWFs were use in harvesting date decision							

Note: 1 = not use; 2 = rarely use; 3 = occasionally; 4 = sometimes 5 = frequently; 6 = usually; 7 = every time.

The level of use of SWFs on each decision was scored according to the orientation of questions. The highest score of 7 points denotes that the SWFs were used 'every time' in farmer's decisions, while the lowest score of 1 point means that the farmers did not use of SWFs in their decisions. These eight questions were used as indicators that measured farmer's SWF use in rice production decisions.

Table 7.2 shows percentage of the respondents who reported their use of SWFs in rice production decisions at different degrees. In this table, the 7-point Likert data was divided into four groups. For who answered at 1 score, it was put at separated column at no use of SWF group. Second group is who responded with 2 and 3 scores that were summed in one column as less use of SWF group. Third group is moderate SWF use group who gave 4 to 5 scores. Last group is high SWF use group who put from 6 to 7 scores. This help to simplify the explanation on how farmers used SWFs in their decision-making.

The results indicates that most of farmers used SWFs from "rarely" to "occasionally" in their rice production decisions, while it was really low percentage of farmers used SWFs usually or very frequently. The mean column shows that the average score of SWF use in rice growing decisions was from 1.5 to 3.5. It reflected the low frequency use of SWFs by farmers in their rice production decisions (occasionally to sometimes).

Moreover, the decisions on planting and harvesting date, pesticide application, and irrigation management obtained high average score; and there was about 50% of farmers reported that SWFs was used rarely to occasionally in their decision-making.

Table 7.2 Farmers reporting the in SWF use in rice production decisions

Rice decisions	**SWF use (%)**				**Mean**
	1	2 - 3	4 - 5	6 - 7	
Planting date	15.6	45.0	28.9	10.6	*3.2*
Rice variety	61.1	38.3	0.6	0.0	*1.5*
Seed brewing time	36.1	49.4	12.2	2.2	*2.2*
Herbicide application	36.1	50.6	12.8	0.6	*2.2*
Pesticide application	16.1	36.7	32.8	14.4	*3.5*
Fertilizer application	28.3	60.6	11.1	0.0	*2.3*
Irrigation management	15.6	49.4	32.8	2.2	*3.0*
Harvesting date	10.6	46.1	27.8	15.6	*3.5*

Source: household questionnaire, 2013 (N=180)

Besides, there was also high percentage of farmers gave very low score on SWFs use for decision relevant to seed variety selection, seed brewing and herbicide application; with low average score from 1.5 to 2.2. It means that, farmers rarely used SWFs in these three rice production decisions.

7.1.2 Testing the reliability of indicators of farmers' SWF Use

In order to understand whether the set of 8 questions reflected the farmer's SWF use, a Cronbach's Alpha was employed to test the internal consistency of these indicators.

The results in Table 7.3 shows that only 3 measurement indicators including planting date decision, pesticide application decision and harvesting date decision reached reliability to represent for farmer's SWF use in rice production decisions. It is clearly that three indicators in Table 7.3 have corrected item total correlations more than 0.4 and there was no value in Cronbach Alpha if item deleted less than Cronbach alpha value. Moreover, Cronbach alpha value was 0.713 (>0.6). Therefore, there was internal consistency for those measurement indicators. Whereas the other indicators such as seed variety selection, seed brewing time decision, fertilizer application, irrigation

management were deleted because their Cronbach Alpha values were higher than Cronbach alpha value of all measurements.

Table 7.3 Validity of indicators of farmer's SWF data use

Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha value
Planting date	0.569	0.576	***0.713***
Rice variety[a]	-	-	
Seed brewing time[a]	-	-	
Herbicide application[a]	-	-	
Pesticide application	0.497	0.667	
Fertilizer application[a]	-	-	
Irrigation management[a]	-	-	
Harvesting date	0.530	0.625	

[a]*Deleted indicator*

As results of Cronbach Alpha testing, three main indicators represented for farmer's SWF use in rice production decisions are planting date, pesticide application, and harvesting date. These indicators will be applied as the dependent variables in TPB and then analyzed using structure equation model in the later section.

7.2 Farmers' Attitude Factor that Influencing on SWF Use

7.2.1 Developing the Indicators of Farmers' Attitude

A set of 10 questions was formulated from the focus group discussion conducted earlier about the expectancy of farmer in SWF use in rice production, to interview the rice farmers on how they belief that SWFs could benefit their decisions making on rice production in growing season.. These were considered as ten indicators of farmer's attitude about benefit of SWF use in rice production decisions (Table 7.4). Expected respond on each question was an estimation of farmer's attitude on their knowledge of both negative and positive on SWF use. A 7-point Likert was applied in each question range from "1" as "extremely unlikely" to "7" as "extremely likely" for measuring

farmer's attitude. For instance, if farmer perceives that SWFs were useful in assist them selecting the right seed variety for next season weather condition, so their attitude on SWFs will be high positive.

Table 7.4 Farmers' attitude about benefit of SWF use in rice production

No	Attitude to the SWF use	1	2	3	4	5	6	7
1	Good for setting the best planting date							
2	Good for selecting the suit seed variety for next season							
3	Help to save costs in rice production							
4	Useful in pest management							
5	Useful for irrigation management							
6	Good for selecting the best harvesting date							
7	Useful for getting higher rice yield							
8	Useful in rice postharvest operation							
9	Help to avoid extreme weather events							
10	Help to ensure food security							

Note: 1 = extremely unlikely; 2 = Unlikely; 3 = somewhat unlikely; 4 = neutral 5 = somewhat likely; 6 = likely; 7 = extremely likely

Table 7.5 explains farmer's attitude about affecting of SWFs on specific rice production decisions. Farmers attitude measurement is divided into three main levels as negative attitude ranged from1 point (extremely unlikely) to 3 points (somewhat unlikely); 4 point as neutral attitude (neither negative or positive); positive attitudes ranged from 5 points (somewhat likely) to 7 points (extremely likely) on each outcome of SWF use. The last column shows the mean of farmer's attitude measurement of each rice production decision.

The results point out that above 65% of respondents had negative attitude (<4) which means the SWF use can benefit them in rice production. There were 90%, 88.3% and 82.2% farmer showed bad attitude on the SWF use such as selecting the suitable seed variety, getting higher yield and ensuring food security accordingly. Whereas, percentage of farmer who had positive attitude about SWFs in producing rice production benefit was low at 1.1 % to 20%, in which pest management and setting good planting date were two SWF outcomes that took the highest percentages of positive attitude of respondents (>4) at 20% and 16.7% respectively.

Moreover, the mean column also ranked at low points from 2.21 to 3.08 for each outcome. It means that farmers had negative attitude on the SWF in providing them benefit in rice production. The lowest average points were on better rice quality, getting high yield, ensuring food security. It means that the SWF use in rice production decisions unlikely benefited these outcomes.

Table 7.5 Percentage of farmer's attitude about SWF use benefits

Benefits of SWF use	Farmer's attitude			Mean
	Negative (<4)	Neutral (=4)	Positive (>4)	
Setting best plating date	65.0	18.3	16.7	*2.78*
Suitable seed variety	90.0	8.9	1.1	*2.68*
Cost saving	75.6	10.6	13.9	*2.68*
Pest management	70.6	16.1	13.3	*3.01*
Irrigation management	67.8	18.9	13.3	*3.02*
Selecting best harvesting date	62.8	17.2	20.0	*3.08*
Getting higher yield	88.3	7.8	3.9	*2.29*
Pest postharvest operation	73.3	18.3	8.3	*2.88*
Better rice quality	76.1	16.1	7.8	*2.21*
Avoid extremely weather event	74.4	12.8	12.8	*2.76*
Ensuring food security	82.2	13.3	4.4	*2.33*

Source: Household questionnaire, 2013 (N=180)

The low attitude results of farmers about SWF benefits for anticipated outcomes presents in Table 7.5 is consistent with the low use of SWF rice production decisions in Table 7.2.

7.2.2 Testing the Reliability of indicators of Farmers' Attitude

There were 11 indicators presented for farmer's attitude about SWF use in rice production decisions are shown in Table 7.6. Cronbach's Alpha was used to test the reliability of those attitude measurements before conducting further analysis. The Cronbach Alpha of each indicator and all structures is shown in Table 7.6.

Table 7.6 reveal eight statements reflected farmer's attitude about SWF benefits that were setting the best planting date, cost saving, pest and irrigation management, selecting the best harvesting date, getting higher yield, avoid extremely weather events, and ensuring food security. These indicators had internal consistency because Cronbach Alpha value of those indicators was high at 0.852 (>0.6).

Table 7.6 Validity farmer's attitude indicators

Items	Corrected item-total correlation	Cronbach's alpha if item deleted	Cronbach's alpha value
Setting the best plating date	0.637	0.830	
Suitable seed variety	0.490	0.845	
Cost saving	0.580	0.836	
Pest management	0.486	0.845	
Irrigation management	0.493	0.845	
Selecting best harvesting date	0.681	0.825	***0.852***
Getting higher yield	0.618	0.833	
Pest postharvest operation[a]	-	-	
Better rice quality[a]	-	-	
Avoid extremely weather events	0.575	0.837	
Ensuring food security	0.600	0.834	

[a]*Deleted indicator*

Moreover, there was no value in corrected item total correlation lower than 0.4 and those Cronbach's alpha value if item deleted were high above 0.8, so these eight indicators are good to reflect farmer's attitude to do next analysis.

7.3 Subjective Social Norm Factor Influencing on Farmers' SWF Use

7.3.1 Developing indicators of Subjective Social Norm

Individual or organizers whose views had influence on farmers are considered as farmer's subjective social norms. There were many SWF sources that farmers accessed

for their rice production discussed in chapter 6. Three specific social groups might have influence in farmer's decision making as emotional relationship people (spouse, children, relative), sharing information and experience in their farming people (neighbor), experts or crop consultants (woman union, local officers, extension officers) and media communication information as television and radio. It is clear that farmers are likely influenced by SWFs in their decision making if subjective social norms has strongly encourage on using them.

Table 7.7 Subjective social norm indicators

No	Subjective social norms	1 2 3 4 5 6 7
1	Spouses' SWF view is influential on my decisions	
2	Children's SWF view is influential on my decisions	
3	Relative' SWF view is influential on my decisions	
4	Neighbor's SWF view is influential on my decisions	
5	Woman union's SWF view is influential on my decisions	
6	Local officer's SWF view is influential on my decisions	
7	Extension officer's SWF view is influential on my decisions	
8	Television's SWF channels are influential on my decisions	
9	Radio's SWF channels are influential on my decisions	

Note: 1 = not at all influent; 2 = slightly influent; 3 = somewhat influent
4 = moderately influent; 5 = influent; 6 = very influent; 7 = extremely influent

These subjective social norms are presented in Table 7.7 as spouse, children, relative, neighbor, woman union, local officer, extension officer, television and radio. The same general approach was used to measure how farmers valued the different subject norms had influence their SWF use in rice production decision making by using 7-points Likert. The results of subjective social norm measurement provide numeric estimates of this factor in encouraging farmer to use the SWFs in their decisions making.

The survey estimated how rice farmer valued others view about SWF use in rice production decisions making with seven categories of degree from "1" is "not at all influent" to 7" is "extremely influent." Then, these seven points were divided into four groups as "1" at not at all influential, scale 2 - 3 at from slightly to somewhat

influential, scale 4 - 5 from moderately influential to influential and 6-7 at from very to extremely influential. Table 7.8 exhibits percentage of respondents about influence of social groups on farmer's SWF use in rice production decisions.

According to information in Table 7.8, about 70% of respondents rated at scale 2 to 5 (slightly influent to influent), in which scale 2-3 (slightly influential to somewhat influential) ranked highest numbers of answers from 38.3% to 51.1%. In opposite, percentage of farmers who valued the view of social groups at high scale (6-7) was very low, especially relative, neighbor, extension officer, television and radio. Moreover, there was relatively high percentage of farmers reported that these subjective norms were not at all influential on their SWF use in rice production decision, especially, children and radio kept the highest number at 48.9% and 51% for each in this scale group.

Table 7.8 Farmer's view of influence of social groups on farmer's SWF use

Social groups	**Percentage of influence (%)**				**Mean**
	1	**2-3**	**4-5**	**6-7**	
Spouse	11.1	48.3	31.1	9.4	*3.3*
Children	51.7	42.8	5.0	0.6	*1.7*
Relative	17.2	48.3	34.4	0.0	*2.7*
Neighbor	27.8	38.9	33.3	0.0	*2.8*
Woman union	7.8	38.3	51.7	2.2	*3.5*
Local officer	21.7	51.1	23.3	3.9	*2.7*
Extension officer	26.1	43.9	30.0	0.0	*2.8*
Television	25.6	38.9	35.6	0.0	*2.9*
Radio	48.9	43.3	7.8	0.0	*1.9*

Source: Household survey, 2013 (N=180)

The all numbers in mean column in Table 7.8 demonstrates that the view of subjective social norms about SWFs had quite low influence on farmer's SWF use in rice production decisions. Spouse and woman union were rated with quite high with average point of influence at 3.3 and 3.5, experts and crop consultant groups followed by second from 2.7 to 2.9 respectively. Furthermore, television also perceived at quite high

average value at 2.9, while radio and children was considered at less influence on farmer's SWF use in their decisions.

7.3.2 Testing the Reliability of indicators of Subjective Social Norm

Nine measurement indicators of social norms helps to understand the reason why farmers did or did not allow the forecast to influence on their rice decisions making. However, not at all nine indicators was internal consistency to measure for subject norm factor. Therefore, the Cronbach alpha of subjective social norm indicators were displayed in Table 7.9.

Table 7.9 Validity of indicators of subjective norm factor

Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha value
Spouse[a]	-	-	
Children[a]	-	-	
Relative[a]	-	-	
Neighbor	0.742	0.824	
Woman union[a]	-	-	0.869
Local officer[a]	-	-	
Extension officer	0.762	0.807	
Television	0.749	0.818	
Radio[a]	-	-	

[a]Deleted variable

The results in Table 7.9 imply that neighbor, extension officer, and television were three indicators served the reliability for social norms factor. It is obviously that their corrected item total correlation were high at above 0.7 (>0.4). Moreover, Cronbach alpha value of these three measurements was greatly high at 0.869 and no value in Cronbach alpha if item deleted was higher than Cronbach alpha value. It means that those indicators had unidimensional, so they will be representative indicators for subject norm factor to do further analysis.

7.4 Perceived Control Factor Influencing on Farmer's SWF Use

7.4.1 Developing Indicators of Perceived Control

Perceived controls or obstacles is the third factor effecting farmer's motivation in using SWFs in their rice farming. In this study, perceived controls were classified into two categories as obstacles of farmer's abilities and SWF characteristics. These were considered as restriction factors of farmers to SWF use. It is assumed that if SWF controls are improved, it will increase probability of farmer's SWF use. Regarding to obstacles came from farmers by themselves, there were three indicators including farmer's ability to access to SWFs, ability to understand SWFs, and ability to apply SWFs. It is assumed that improving farmer's abilities to use SWFs appropriately in relevant rice production decisions would enhance farmer's attitude toward SWF use. In term of SWF characteristics, it includes accuracy, timeliness, reliability, availability, understandability, diversity, and localization of forecasts. These limitations undermined farmers from using forecast, so they affected on the farmers' ability to use the forecast. Ten questions in Table 7.10 represents about how farmer perceived these obstacles based on their experience. These questions were measured using 7-points Likert as applied in previous sections.

Table 7.10 Perceived controls indicators to farmer's SWF use

No	**Perceived controls**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	I have ability to access SWFs							
2	I can understand SWFs							
3	I can apply SWFs							
4	SWFs were accuracy							
5	SWFs were timeliness							
6	SWFs were reliability							
7	SWFs were availability							
8	SWFs were easy to understand							
9	SWFs had diversity in communication channels							
10	SWFs was localization							

Note: 1= very low; 2=low; 3= somewhat low; 4= neutral;
5= moderately high; 6= high; 7= extremely high

Table 7.11 shows the percentage farmer about perceived controls factors to their SWF use in rice production decisions. Based on 7-points Likert that farmers raised on each perceived control, the result data was summed and divided into 3 levels. For who answered at 1 to 3 scores, it was put at low perception level. Second level is who responded with 4 points as neutral perception. Last level is high perception farmers who put from 6 to 7 scores.

Table 7.11 Farmers perception on perceived controls in SWF use

Perceived controls	**Percentage (%)**			**Mean**
	< 4	**= 4**	**> 4**	
Access ability	72.2	10.0	17.8	2.7
Understand ability	71.1	18.9	10.0	2.8
Apply ability	72.8	16.7	10.6	2.8
Accuracy	80.6	8.3	11.1	2.5
Reliability	60.6	16.7	22.8	3.1
Timeliness	73.3	16.7	10.0	2.8
Availability	61.1	15.0	23.9	3.3
Understandability	71.7	16.7	11.7	2.7
Diversity in channels	66.1	18.3	15.6	3.0
Localization	72.2	21.7	6.1	2.8

Source: Household survey, 2013 (N=180)

Percentage columns in Table 7.11 demonstrates that around 60% to 80% respondents had low perception (<4) on perceived controls. Moreover, above 70% proportion of farmer assessed their ability to access, understand and apply SWFs in their rice production decisions was low. Besides, forecast accuracy, timeliness, understandability, and localization also took high percentage of answers at low value. In opposite, there were around 6% to 23% of respondents reported high values on perceived controls, in which the highest percentages were rated for SWF availability and reliability. The rest of respondents had neutral perception on these controls, which indicated either low or high.

The mean column reveals that all respondents had low views on SWF controls ranked just only from 2.5 to 3.3, interpreted as low to somewhat low. The SWF accuracy and

understandability were valued at lowest average points, and highest average point was forecast availability.

7.4.2 Testing the Reliability of Indicators of Perceived Control

The Cronbach alpha was used to test the reliability of indicators of perceived control factors influence on farmer's SWFs use for rice production decisions before applying them for another analysis. The results of Cronbach's Alpha testing is exhibited in Table 7-12.

Table 7.12 Validity of indicators of perceived control factors

Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha value (N=180)
Access ability	0.635	0.822	0.848
Understand ability	0.622	0.825	
Apply ability[a]	-	-	
Accuracy	0.694	0.812	
Timeliness[a]	-	-	
Reliability	0.604	0.828	
Availability	0.549	0.841	
Understandability	0.709	0.808	
Diversity in channel[a]	-	-	
Localization[a]	-	-	

[a]Deleted variable

The Table 7.12 reveals that four indicators of perceived control factors which are ability of farmers, forecast timeliness, diversity in channel and localization; were deleted because they were not unidimensional with other indicator to reflect measured factor (perceived controls). In contrast, the other six measurement indicators had internal consistency because their corrected item total correlation was higher than 0.4 and Cronbach alpha of value of six items was really great at 0.848. Therefore, six indicator including farmer's access ability, understandability, forecasts accuracy, reliability, availability and understandability will be

used as representation variables for perceived control factor influence on farmer's SWF use in structure estimate model next section.

7.5 Testing of the Measurement Model by Confirmatory Factor Analysis (CFA)

After testing the validity of indicators for each main variable in study model by Cronbach's Alpha, the measurement model is constructed. The extracted indicators in measurement model is present in Table 7.13.

Table 7.13 Indications of measurement model

Construct	Indicator	Measurement
Farmer's attitude	Food security Avoid weather events Higher yield Best harvesting date Irrigation management Best pest management Cost saving Suit seed variety Good planting date	1-7 points Extremely unlikely – extremely likely
Subjective social norms	Extension officer Neighbor Television	1-7 points Not at all influent –very influent
Perceived controls	Understandability Reliability Accuracy Available Access ability Understand ability	1-7 points Very low- extremely high
SWF use	Planting date selecting Pest management Harvesting date selecting	1-7 points Not use – use every time

Assessing the measurement model validity helps to compare the theory model with actual research model at representative data in order to test the fitness of theoretical model with the research data. In this case, confirmatory factor analysis (CFA) is a crucial technique, which a measurement model is fit simultaneously to data. The results provide a test of measurement invariance, or of whether a set of indicators has the same measurement properties across the groups (Kline, 2011). Specifically, all measures were assessed for unidimensionality, reliability, convergent validity and discriminant validity. The unidimensionality and reliability of measures was test by using Cronbach alpha in section 7.1 above. The results of CFA are summarized in Table 7.14 to Table 7.16.

7.5.1 The Goodness of Fit Indices of Measurement Model

The result of CFA shows that the goodness of fit indices of measurement model at Chi-square value for this measurement model was 273.129 with degree of 191 freedom at statistical significant 0.01%. Moreover, the ratio of chi-square to degree of freedom was 1.43 (<2), RMSA< 0.8 and CFI, TLI >0.9, so the goodness of fit model and the overall statistics both achieved the standards of model fitting. It means that the measurement model fitted perfectly.

Table 7.14 The goodness of fit indices of the measurement model

Fit indices	Suggested value[a]	Study model
Chi-square χ^2		273.129
p-value	≤ 0.1	0.00
df		191
χ^2/df	≤ 2 ≥ 5	1.43
RMSEA	≤ 0.08	0.049
CFI	≥ 0.9	0.947
TLI	≥ 0.9	0.942

[a] Suggested value were based on Hair et al. (1998)

Note: *TLI: Tucker-Lewis Coefficient; CFI: Comparative Fit Index*

RMSEA: Root Mean Square Error of Approximation

7.5.2 Convergent Validity of Model

All the indicators that represent farmer's decisions, attitudes, subjective social norms and perceived controls should cover or share a high proportion of variance, so this is

called convergent validity. The estimation of convergent validity among measurement indicators is shown by their factor in table 7.15.

Table 7.15 Validity of measurement model

Construct	Indicators	Standardized factor loading	Cronbach alpha value
Farmer's attitude	Food security	0.665***	0.852
	Avoid weather events	0.628***	
	Higher yield	0.659***	
	Best harvesting date	0.762***	
	Irrigation management	0.511***	
	Best pest management	0.491***	
	Cost saving	0.613***	
	Suit seed variety	0.501***	
	Good planting date	0.747***	
Subjective social norms	Extension officer	0.851***	0.869
	Neighbor	0.821***	
	Television	0.819***	
Perceived controls	Understandability	0.754***	0.848
	Reliability	0.680***	
	Accuracy	0.785***	
	Available	0.626***	
	Access ability	0.684***	
	Understand ability	0.689***	
Decisions	Planting date selecting	0.696***	0.713
	Pest management	0.656***	
	Harvesting date selecting	0.675***	

*** Significant at 0.01 level

A good rule of thumb is that standardized loading estimates should be 0.5 or higher, and ideally 0.7 and Cronbach alpha is higher than 0.7 (Hair et al., 2006). The results in

Table 7.15 show that almost measurement indicators has factor loading more than 0.5 and Cronbach alpha value of each structure was higher than 0.7, then the convergent validity of study structures was achieved. Best management item had loading factor at 0.491 <0.5, but it will be not excluded out of model because this item was statistical significant at 0.01 level. In additional, pest management attitude had directly relationship with the SWF use in pest management decision, so this is important indicators that should be kept in model.

7.5.3 The Discriminant Validity of Measurement Model

Discriminant validity is extent to which a construct is truly distinct from other construct. Hence, high discriminant validity provides evidence that a construct is unique and captures some phenomena other measures do not (Hair, 2006). CFA provides some ways to assess the discriminant validity of measurement model, so this study used the correlation between two any constructs to assess. If correlation of two structures is lower than 0.9, then the discriminant validity is sufficient.

Table 7.16 Correlation between constructs

Constructs			Estimate
Farmer's attitude	<-->	Perceived control	0.839***
Farmer's attitude	<-->	Social norm	0.207***
Farmer's attitude	<-->	SWF use	0.823***
Social norm	<-->	Perceived control	0.288***
Social norm	<-->	SWF use	0.389***
Perceived control	<-->	SWF use	0.753***

*** Significant at 0.01 level

In this study, there were four constructs as attitude, subjective norm, perceived control, and SWF use, so six correlations between them are presented in Table 7.16. The estimation of correlation values of six pair were lower than 0.9 at statistical significant level 0.01. It means that the correlation between any two constructs was not equal to one at 99% significant level, so the constructs in this study achieved discriminant validity.

7.6 Structural Equation Modeling of Final Study Model

After the assessment of the adequacy of measurement model by CFA, structural equation modeling (SEM) was utilized to find the best fitting model and to test causal relationship between variables. SEM is multivariate technique that combines aspects of multiple regression and factor analysis to assess a series of dependent relationship simultaneously, which is not possible using other multivariate technique (multivariate analysis, multiple regression, factor analysis, etc.) (Hair et al., 2006).

Table 7.17 The goodness of fit indices of final model

Fit indices	Suggested value[a]	Study model
Chi-square χ^2		243.257
p-value	≤ 0.1	172
df		0.00
χ^2/df	≤ 2 ≥ 5	1.414
R^2	> 0.5	0.713
RMSEA	≤ 0.08	0.048
CFI	≥ 0.9	0.951
TLI	≥ 0.9	0.946

[a] Suggested value were based on Hair et al. (1998)

Note: TLI: Tucker-Lewis Coefficient

CFI: Comparative Fit Index

RMSEA: Root Mean Square Error of Approximation.

The results of the SEM in Table 7.17 indicate that the model was fit with the representative data. The goodness fit indices of model shown that Chi-square, df, χ^2/df, RMSEA, CFI, TLI achieved the suggested values to be a good fit with the data. Three variables as attitude, subjective norm and perceived control jointly explained approximately 71.3% of total variance in farmer's SWF use in rice production decisions. Overall, the results of model evaluation implied that theory planned behavior model well predicted factors influence on farmer's SWF use decision.

In addition, the Figure 7.1 exhibits the path diagram with standardized coefficients from SEM output. The results of structural equation model reveal that the path coefficients from farmer's attitude (β=0.531, $p<0.01$), subjective norms (β=0.531, $p<0.01$), perceived

controls (β=0.531, p<0.1) were all positive and statistical significant associated with farmer's SWF use in rice production decision. It means that farmer's SWF use was determined by his/her attitude, subjective norms, perceived controls. Farmer's attitude was found to have the greatest direct effect on farmer's use of forecasts and perceived controls followed by second magnitude of influence, whilst subjective norms were the least effect on farmer decisions.

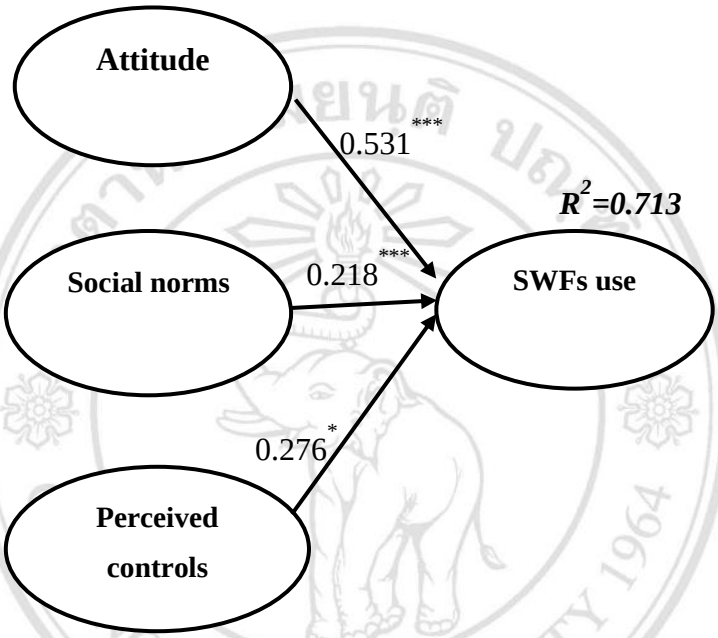

Figure 7.1 The result of SEM analysis of factor influence on farmer's SWF use
****Significant at 0.01 level,* ***Significant at 0.1 level*

However, the question is "how much does each variable actually effect on farmers' use of SWF in rice production decisions?" Regarding to farmer's attitude, it is clear that 1% change in farmer's attitude toward to the forecasts, the probability of farmer's SWF use in rice production decisions will increase 53.1%. Farmer's attitude about using forecast was composed of expectation of selecting the pest planting and harvesting date, ensuring the food, getting higher yield, avoiding extreme weather events, cost saving, suit seed variety, irrigation and pest management that was shown by coefficients in Figure 7.1. While, the increasing 1% in social norm influence will lead to an increasing in probability of SWF data use in rice production decisions by 21.8%. Moreover, farmers view forecast controls as a limiting factor in their decisions making, so when forecast obstacles are improved 1%, the likelihood of farmer's SWF use in rice production decisions will increase by

27.6%. These indicate that it may be easier to increase the influence of forecasts in rice production decisions by further enhancing farmer's attitude on benefits of SWF use.

From the results from the TPB analysis above, it can be concluded that the farmers applied the SWFs data for the three main activities which are planting date, pesticide application and harvesting. The factors that significantly determine the use of SWFs data are those nine, three and six factors represented under the three main factors in the TPB model which are farmers' attitude, subjective social norms and perceived controls respectively (Table 7.15). The most important way is farmer's belief (attitude) enhancing on the outcomes of SWF data use such as ensuring the food security, help to avoiding the extremely weather events, helping to getting the higher yield, selecting the best planting date and harvesting date, help to manage irrigation, disease and pest, saving cost, help to selecting the suitable seed. These beliefs had direct impact on farmer's use of SWF data that was discussed in table 7.6. Secondly, farmer's SWFs can be improved thought perceived control factors which include capacity of farmers (access ability and understand ability) and SWF characteristics (accuracy, reliability, availability, understandability) as shown in table 7.12. The improving in subjective controls factors would contribute in farmer's use of SWFs at 27.6%. The third way to help farmers to make use of SWF data better is improving the influence of different social group on farmers, especially neighbor, extension officers and television as the result of table 7.9.

However, there is a relationship between three factors regarding to farmer's SWF use. It can be discussed that the farmers' attitude (perceived benefits toward rice production that could be obtained from using the SWFs data) are determined by two main factors which are 1) availability and quality of the SWFs data which are closely linked to those sources of data in the social norm; and 2) ability of farmers in using the SWFs data. Therefore, the potential way to improve farmers SWF use is enhancing the interaction of extension officer in term of communication and interpreting SWFs to farmers because extension officers often work and give advisories regarding the rice farming. Therefore, farmers will have better accessing and understanding the SWFs information received from the officers. Moreover, the improving SWF data on television would help farmers in SWF use since almost of the farmer access information through this channel. However, it is necessary to improve the accuracy, reliability and understandability of SWF data from this channel as it directs impact on the farmer's belief.