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Multidimensional Goals of Paddy Farmers in KADA Granary Area, Malaysia: Using Simple Ranking Procedures and Analytic Hierarchy Process

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ABSTRACT

Paddy and rice industry in Malaysia is a strategic industry as it provides the main source of food and livelihood for about 206 400 small scale farmers. Various government programs have been implemented to improve the paddy farmers' living standards through income improvement. However, the farmers' livelihood in terms of income and living standard has not improved significantly. This situation is possibility due to farmers' objective in farming differs from the income maximization goal of the government's programs. This factor has led to the assumption that goals other than profit maximization compete strongly in farmer's decision making. The main objective of this study is to investigate the farmers' multiple goals in paddy production. The study was conducted in the region of Kemubu Agricultural Development Authority (KADA) granary area involving 325 respondents. The Simple Ranking Procedure was used to rank the importance of goals when engaging themselves in farming. Analytic Hierarchy Process was employed to obtain a ratio scale of importance for the multiple goals. Results from the Simple Ranking Procedure (SRP) and Analytic Hierarchy Process (AHP) show that "Welfare of the Family" and "Have Time for Religious Activities" is the most important goals for farmers when engaging in paddy farming activities, respectively. This shows that farmers' preference for being farmer is to maximize utility rather than maximizing profit and income.

Keywords*:* multidimensional goals, paddy farmers, utility, analytic hierarchy process, simple ranking procedure

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INTRODUCTION

Rice cultivation in Malaysia is closely associated with the rural population and traditional farmers. Paddy is produced mainly by small holders with an average farm size of about 1.06 hectares. There are approximately 206,400 paddy farmers of which 116,000 are full time farmers who are depending on paddy cultivation for their livelihood. As the staple food of the nation and being the most important food security crop, the government encourages domestic production of rice. However, the national average yield is low at just over 3.0 tonnes per hectare. Local production can only cater for approximately 72 percent of domestic demands. Hence, the shortfall is supplemented by the imported rice. About 28 percent of annual imported rice is from Thailand and Vietnam. Malaysia imports on average about 960,000 tonnes of rice from various countries.

The choice of KADA as the research location is partly based on the importance, and on the fact that the average yield of paddy in KADA is low. Even though KADA is the second largest planted area among the eight granaries, however the average yield of paddy production is only 3.86 tonne per hectare which is the third lowest among all the granaries. Total number of farm households in KADA is 54,045 farm families with an average family size of 5.35 people. The average age of KADA paddy farmer is 51.4 years old. The average size of farm is 1.43 hectares per household. In terms of land ownership, 43 percent of the farms were rented while 31 percent were owner operated and the rest that is 26 percent were owner-tenants [1].

This research is done based on utility and behavioral theory. Utility is the satisfaction one derives from consuming a good or service or engaging in some activity [2]. The analysis of consumer behavior is greatly facilitated by the use of a utility function which assigns a numerical value or utility level to commodity bundles. Both behavioral theory and utility theory start with the idea of satisfying a decision maker through alternative goals. According to the behavioral theory, individuals have multiple goals and they try to obtain a "satisfactory set" rather than an "optimal set" [3]. On the other hand, utility theory assumes that an individual can select among the alternatives available to him in such a manner that the satisfaction derived from his selection is as large as possible [4]. Both behavioral and utility theory recognizes that an individual is aware of his alternative goals and capable of assessing them (comparing) in a hierarchical sense. Multiple goals approach allow for more accurate assessment of producer's preferences. Thus, better predictions can be made regarding producer's actions when multiple goals are considered [5].

The government intervention in rice cultivation began with the objective of poverty alleviation and later the policy direction is toward productivity growth to attain self-sufficiency targets. Since the 1960's the government has invested heavily on massive infrastructure development in the eight granaries. Fertilizer subsidy, guaranteed minimum price and price subsidy are provided to rice farmers to ensure a good yield and, sufficient and consistent income to the farmers. With those government interventions, large amount of money being spent on the programs and subsidy, but farmers remain small holders who generate low productivity. Hence, their income from farming has not substantially increased. The issue, at the same time, is halting the national food security goals, which attaining self sufficiency level of 69 percent in 2020 or granary productivity improvement from currently 4.0 tonnes to 5.0 tonnes per hectare in the same period. Assuming agro-climatic condition and soil fertility are constant, good farm management can alleviate productivity. Nevertheless, farmers' other goals besides profit maximization could contribute to this situation. Farmers are believed to have goals other than production and income maximization when engaging in paddy farming. Hence, the study attempts to identify paddy farmers' multi-dimensional goals and subsequently determine the hierarchy of the goals. Simple Ranking Method and Analytic Hierarchy Process (AHP) were carried out to attain the study's objectives.

This paper is divided into four sections namely Introduction, Methodology, Results and Discussion and Conclusion. Introduction section describe briefly about the general background, literature review, problem statement and objectives of the study. Methodology section discusses the method and the analyses used for the study while in Result and Discussion section will presents and discusses all the findings obtained in this study. Subsequently, in the last section, this paper will converses the conclusion and policy implication.

MATERIALS AND METHODS

Farmer's goals were obtained from the literature review and farmers focus group survey. Nine goals have been identified and the ranking was done by Simple Ranking Method and Analytic Hierarchy Process. The goals were Increase Income, Maintain the Welfare of the Family, Increase Farm Size, Increase Yield by Using New Technologies, Increase Net Worth, To Have Saving, Have Times for Family, Community and Other Activities, Bequeath and To Train Family Members with Paddy Farming and lastly to Have Time For Religious Activities. Data was collected by personal interview with farmers using a standard questionnaire. A total of 325 farmers were interviewed. The study was undertaken in Kemubu Development Authority granary area and this area is one of low productivity paddy producing area. Few analyses have been used in this study that were:

Simple Ranking Procedures (SRP)

The Simple Ranking Method was used to rank the importance of goals by asking the farmers to rank the nine goals from the most to the least important. The most important goal is ranked as "1" and the least important goal as "9".

This procedure did not allow for indifference between goals. The Simple Ranking Method, the n goals are given as follows:

Goal	Ranking
1	
2	
3	
.	
.	
.	
n	

Figure 1: Simple Ranking Procedure for Goal Ranking from 1 to *n* Goal

Analytic Hierarchy Process (AHP)

Analytic Hierarchy Process was used to obtain a ratio scale of importance for n goals. AHP involves pair wise comparisons between two goals. The goals will receive the values between 1 (denoting equal importance) and 9 (denoting absolute importance) depending on the preferences of the producer [6]. A pair of goals was given to the farmer as shown in Figure 2.

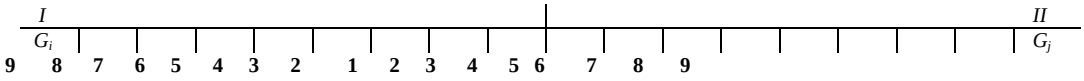

Figure 2: Analytic Hierarchy Process for Making Comparison between Goals, G_i and G_j

The value between 1 and 9 show different degrees of importance from weak to extreme. the relative scale measurement is shown in Table 1.

Table 1: Pair-wise comparison scale for AHP preferences

Numerical Rating	Verbal Judgments of Preferences
9	Extremely Preferred
8	Very Strongly to Extremely
7	Very Strongly Preferred
6	Strongly to Very Strongly
5	Strongly Preferred
4	Moderately to Strongly
3	Moderately Preferred
2	Equally to Moderately
1	Equally Preferred

Source: Saaty, 1980

The AHP has been used by few researchers [7].

Non-Parametric Analysis

Nonparametric statistics are appropriate tests to check for agreement between farmers' preferences in the ranking of goals (Friedman Test), the degree of agreement (Kendall's W test) and the maximization of the absolute value of the distance between observed and possible rankings (Maximizing disagreement, or the distance function) [8]. Using Freidman's Test, the goals equally important within the block can be determined. The null hypothesis is that, there is no difference in preference over goals among producers, and the alternative is that at least one goal is preferred over the others. The Friedman Test Statistic is defined as:

$$F = \frac{12}{MN(N+1)} \sum_{J=1}^{N} \left[R_J - \frac{M(N+1)}{2} \right]^2$$

The primary objective of Kendall's W is to measure the agreement in rankings in the M block. For the values of 0.1, 0.3, 0.5, 0.7 and 0.9, the agreements are very weak, weak, moderate, strong, and unusually strong, respectively [9]. The statistic can be written as

$$W = \frac{12}{M^2 N(N+1)(N-1)} \sum_{J=1}^{N} \left(R_j - \frac{M(N+1)}{2} \right)^2$$

Spearman Rank Correlation (SRC)

The Spearmen Rank Correlation (SRC) coefficient was used to determine whether there was rank order correlation between Simple Ranking Procedure and Analytic Hierarchy Process ranking. In the simple ranking procedure, the goals take values from 1 to 9. On the other hand, in the Analytic Hierarchy Process, the goals can be ordered from the most important (value=9) and the least important (value=1). The basic formula for SRC can be written as:

$$R = 1 - \frac{6\sum D^2}{n(n^2 - 1)}$$

where *R* is the SRC coefficient, which take the values between -1 and +1, *D* is the difference in ranks and n is the number of observations. In extreme cases, *R* has the following interpretation:

If R = 1, then there is a direct association and perfect agreement
If R = -1, then there is an inverse association and perfect disagreement
If R = 0, then there is no association and, hence, neither agreement nor disagreement

RESULTS AND DISCUSSION

From Table 2, 80.3 percent of respondents are male and the rest of 19.7 percent are female farmers. It shows that most of the farmers involved in paddy farming activities in the surveyed area are male.

For the marital status of the respondents, 91.1 percent of respondent are married, 7.1 percent are widow and only 1.8 percent of them are single. Nearly 40 percent of the respondents had primary education; followed by 33.8 percent with secondary level of education, 26.5 percent never had any formal education while only 0.6 percent graduated from college or university. It can be concluded that most of the farmers possess low level of education. The most predominant age category among the respondent are between 51 to 70 years old. There were 59.4 percent of the total respondents are in the age category, followed by 31 to 50 years old with 26.8 percent respondents. Eleven percent of respondents are categorized in the age group of 71 years old and above while 2.7 percent of respondents represent age group below 30 years old. The average age of respondents is 57 years old, the youngest is 20 years old and the oldest is 87 years old. Since the average age of the respondents is more than 50, it can be concluded that most of the farmers are in the old age bracket. With respect to household size, 61.2 percent of the respondents have a family size of 5 and below ,while the other 34.5 percent of them have 6 to 10 members. A fraction four percent of the respondents have family size of 11 and more. The average household number in a family is five, while smallest is one and the most is 14 people in a family. Since most of the paddy farmers are in old age bracket, the small household number might be due since most of their children are married, working and staying elsewhere. This is a common phenomenon among Malay farmers whose children would get better education and work in a better working environment such in public or private sector. Total income is calculated by adding up the income for both seasons (three months per season) which represent annual farm income. This study found that 57.8 percent of the respondents fell into the lowest income category, earning RM 10,000 and below for both seasons. Twenty three percent of the respondents earned between RM 10,001 to RM 20,000, 7.4 percent, 6.8 percent, 3.7 percent and 1.2 percent of respondents fall into group of income between RM 30,001 to RM 40,000, RM 20,001 to RM 30,000, RM 50,000 and above and between RM 40,001 to RM 50,000, respectively. The average total income is RM 14,000, the lowest total income is RM 300 and the highest is RM 128,000. This indicates that 60 percent of the farmers have a relatively low level of income. Apart of paddy farming, some of these farmers are also having off-farm jobs to gain additional income such as being a tractor driver, coconut climber, livestock farming and vegetable and fruit farming. The income earned from this side jobs called as off-farm income.

Table 2: Socio-demographic profile of farmers

Variables	Frequency (N = 325)	Percentage (%)
Gender		
Male	261	80.3
Female	64	19.7
Marital Status		
Single	6	1.8
Married	296	91.1
Widowed	23	7.1
Educational Level		
No Formal Education	86	26.5
Primary School	127	39.1
Secondary School	110	33.8
College/University	2	0.6
Age (years)		
30 and below	9	2.7
31 to 50	87	26.8
51 to 70	193	59.4
71 and above	36	11.1

Table 2: Socio-demographic profile of farmers (cont'd)

Variables	Frequency (N = 325)	Percentage (%)
Household Number (person)		
5 and below	199	61.2
6 to 10	112	34.5
11 and above	14	4.3
Total Annual Income (RM)		
10,000 and below	188	57.8
10,001 to 20,000	75	23.1
20,001 to 30,000	22	6.8
30,001 to 40,000	24	7.4
40,001 to 50,000	4	1.2
50,001 and above	12	3.7
Off-farm Income		
No	183	56.3
Yes	142	43.7

Source: Survey, 2010

Table 3: Farm characteristics of farmers

Variables	Frequency (N = 325)	Percentage (%)
Total Yield (tonne/ha)		
Below 2.5	258	79.4
2.5 and above	67	20.6
Total Farm Size (hectares)		
4 and below	253	77.8
5 to8	45	13.8
9 to 12	17	5.2
above 12	10	3.1
Owned Farm (hectares)		
No	122	37.5
Yes	203	62.5
2 and below	183	90.1
3 to 4	17	8.4
above 4	3	1.5
Rented Farm (hectares)		
No	82	25.2
Yes	243	74.8
4 and below	180	74.0
5 to8	41	16.9
9 to 12	14	5.8
above 12	8	3.3

Table 3: Farm characteristics of farmers (cont'd)

Variables	Frequency (N = 325)	Percentage (%)
Household Involvement (person)		
1 to 5	323	99.4
6 to 10	2	0.6
Years of Involvement (years)		
20 and below	113	34.8
21 to 40	140	43.1
41 to 60	69	21.2
61 and above	3	0.9
Total Time Spent (hours/week)		
10 and below	4	1.2
11 to 20	16	4.9
21 to 30	93	28.6
31 to 40	70	21.5
41 and above	142	43.7

Source: Survey, 2010

As shown in Table 2, 43.7 percent respondents earned off farm income while the rest of 56.3 percent of them did not engage in other off-farm jobs. This shows that most of the respondents are fulltime farmers whom solely depend on paddy farming income.

Simple Ranking Method and Analytic Hierarchy Process

There are nine goals that have been ranked according to their goals structure preferences. These goals structure will present the priorities of farmers' goals that need to be achieved in order to attain the highest satisfaction by being a paddy farmer. The nine goals are; "Increase Income", "Maintain Welfare of the Family", "Increase Farm Size", "Increase Output with Application of New Technology", "Increase Net Worth", "Have and Increase Saving", "Have Time for Family", "Community and Other Activities", "Bequeath and Train Family Members with the Paddy Farming Activity" and "Have Time for Religious Activities".

The results of simple goals ranking is shown in Table 4. From Table 4, the goal "Welfare of the Family" was selected as the most important goal; indicated by the lowest mean value of 1.58. "Increase Income" was the second most important and the least important goal was "Bequeath and To Train Family Members with Paddy Farming". Other goals namely "Have Saving", "Have Time for Religious Activities", "Increase Net worth", Increase Yield Using New Technologies", "Have Time for Family, Community and Other Activities" and "Increase Farm Size" were ranked third, fourth, fifth, sixth, seventh and eighth, respectively, in terms of importance.

Table 4: Result of Simple Ranking Analysis

Descriptive Statistics		
Goals	Mean	Std. Deviation
Welfare of The Family	1.58	1.393
Increase Income	2.29	1.246
Have Saving	4.42	1.753
Have Time for Religious Activities	5.27	2.043
Increase Net Worth	5.32	1.834
Increase Yield Using New Technologies	5.63	1.859
Have Time For Family, Community and Other Activities	6.10	1.915
Increase Farm Size	6.78	2.146
Bequeath and To Train Family Members with Paddy Farming	7.56	1.816

Friedman Test Chi-Square: $1.342E^{3***}$
Kendall's W: 0.516

In general, it can be said that farmers' goals were more likely to maintain the livelihood of the family and to be financially secured. The least likely of the farmers' goal is to train and asked their children to inherit their farming activities. Farmers, as the head of a family would like to ensure all basic necessities of the family members are fulfilled such as food and clothes. From the survey interview, farmers also feel that their children should get education up to tertiary level so that their children can secure better jobs. Hence, it can also be said that, farmers'

goals of being a farmers are based on their responsibility as a head of the family and to ensure that the welfare of the family is maintained and to have a better life instead of continuing the life of a farmer.

In the Friedman Test analysis, the probability of the model chi-square ($1.342E^3$) was 0.000, less than the level of significance of 0.05. The null hypothesis that there was no difference in preference over goals among producers was rejected and can be concluded that some goals are preferred over others. On the other hand, the value of Kendall's W is 0.516 shows that the agreement between individuals in the goal ranking is moderate.

Similar to the Simple Ranking Method, the Analytic Hierarchy Process also determines the ranking by looking at the mean value but in reverse order which are the higher the value of the mean of the priority scores, the higher the rank.

Table 5: Result of Analytic Hierarchy Process

Descriptive Statistics		
Goals	Mean	Std. Deviation
Have Time For Religious Activity	0.18862	0.117535
Welfare of The Family	0.18538	0.104274
Increase Income	0.14095	0.081627
Have Saving	0.11185	0.063089
Increase Yield Using New Technologies	0.09531	0.065004
Have Time For Family, Community and Other Activities	0.09058	0.078351
Increase Net Worth	0.07844	0.050095
Bequeath and To Train Family Members with Paddy Farming	0.06201	0.070727
Increase Farm Size	0.05580	0.052022

*Friedman Test Chi-Square: 732.912****
Kendall's W: 0.282

By using AHP, the mean value is obtained by aggregating the goal scores through the number of respondents that chose certain goal according to their preference. The higher frequency of respondent choosing certain goal has contributed to the larger value of mean for the goal. As shown in Table 5, the goal "Have Time for Religious Activity" gave the largest value of mean among the rest, means that it have been chosen as the most important goal and this is followed by for the "Welfare of the Family". However the mean scores for the two goals are very close indicating almost equally important. Other goals in descending order are "Increase Income", "Have Saving", "Increase Yield Using New Technologies", "Have Time for Family, Community and Other Activities", "Increase Net Worth" and "Bequeath and To Train Family Members with Paddy Farming". The goal to "Increase Farm Size" was ranked as the least important goal by the farmers.

From the results discussed above, it can be concluded that majority of the farmers expect to have some quality time to spend for religious activities when engaging themselves in paddy farming activities. Being paddy farmers, they would have ample times to spend for other activities. This is the reason why these farmers felt comfortable with their job with less emphasize to increase farm productivity. Apart of the most preferred goal, this result also indicates that the least number of farmers wanted to expand their farming activities due to most of them are old and comfortable with what they have now. Age is the most influential factor contributed to goals ranking. Under normal situations and conditions, older people would be more inclined towards religious activities and more complacent with what they own. Monetary goal is becoming less important as they have less family members to feed but receives contributions from their children. Nevertheless, income goal which is ranked third does indicate certain level of awareness toward increasing production and the government's programme for production expansion. It is believed that "Income Increase" goal would have high correlation with the family welfare goal as the family welfare will be better off with better income generated.

In the Friedman Test analysis, the probability of the model chi-square (732.912) was 0.000, less than the level of significance of 0.05. The null hypothesis that there was no difference in preference over goals among producers was rejected and can be concluded that some goals are preferred over the others. On the other hand, the value of Kendall's W is 0.282 shows that the agreement between individuals in the goal ranking is between very weak and weak.

Consistency of Goals Ranking

In order to check for consistency between the results of simple ranking and AHP goal scoring methods of farmers, the Spearman Rank Correlation (SRC) coefficient was used. For the SRC, first, the goal scores in the AHP were transform to rankings by giving the value of 1 to the most important goal and 9 for the least important one, and the other respectively. For Simple Ranking, the most important goal will rank as 1 and rank 9 for the least important, and other respectively. Then the difference between the AHP and Simple Ranking were calculated for each observation by subtracting one from other. The SRC test was used to check whether there was rank order correlation between the AHP and simple ranking procedures. The hypothesis for this test is:

H_0 = The AHP ranking and Simple Ranking procedures provides different goal rankings.
H_1= The procedures provide the same ranking

Table 6 shows the goal structure obtained from simple ranking and AHP ranking. Through the Simple Ranking procedure, farmers were more focus on the livelihood of the family and financial stability , where the first three goals that being selected is more to maintain income to ensure the welfare of the family can be maintained, then to increase income and also to have some saving. For them, to train and bequeath the farm and farm job to the next generation was being the last choice among the goals. On the other hand, from the AHP ranking, farmers opted to have time more for religious activities as the highest priority. This is followed by to maintain welfare of the family and to increase their income. The least important goals were to increase farm size.

Table 6: Result of Simple Ranking and AHP Ranking

Goal	Ranking	
	Simple	AHP
Increase Income	2	3
Welfare of The Family	1	2
Increase Farm Size	8	9
Increase Yield Using New Technologies	6	5
Increase Net Worth	5	7
Have Saving	3	4
Have Time For Family, Community and Other Activities	7	6
Bequeath and To Train Family Members with Paddy Farming	9	8
Have Time for Religious Activities	4	1

As shown in the table 7, the result of SRC shows that the significant value of 0.800 is higher than 0.05 showing that it fails to reject the null hypothesis.

Table 7: Result of Spearman Rank Correlation

Correlations			SRP	AHP
Spearman's rho	SRP	Correlation Coefficient	1.000	0.014
		Sig. (2-tailed)		0.800
		N	325	325
	AHP	Correlation Coefficient	0.014	1.000
		Sig. (2-tailed)	0.800	
		N	325	325

This is also for the value of Correlation Coefficient of 0.14, which is below than 0.57, showing that the two rankings procedures are not consistent. Overall, these results provide evidence that the two methods cannot be used interchangeably to elicit goal hierarchies.

CONCLUSION

The preferred goals reflect farmer's way of life. By knowing and understanding farmer's objectives and goal structure will allows researcher to better predict their economic behavior, and suggest avenue the industry could take to achieve greater efficiency. Greater knowledge of goal structure is likely to lead to greater understanding of the potential of an industry to develop. Such understanding would also be useful in predicting the interest of the success and failure of government programs.

Since the current policy is to expand production where productivity improvement is the key success factor, the government needs to formulate appropriate and adequate intervention programs so that productivity can be enhanced. Training and seminars to inculcate entrepreneurial traits and temperament among paddy farmers, especially the younger ones need to be implemented. It is through entrepreneurial approach only productivity and efficiency can be harnessed.

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