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# Efficiency Performance of Paddy Farming in East and West Coast of Peninsular Malaysia

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## ABSTRACT

Paddy farming activity is in full swing in both east and west coast of Peninsular Malaysia, this was due to rice is a staple food for Malaysian and national food security. This study examined technical efficiency of paddy farming in east and west coast of Peninsular Malaysia by using data envelopment analysis. Besides, this study also attempted to investigate determinants of inefficiency by using Tobit regression. Information was collected through direct survey interview on a sample of 230 paddy farmers from Peninsular Malaysia. Average efficiency scores of paddy farming for the whole of Peninsular Malaysia, east and west coast had been estimated at 55.6, 51.7 and 63.1%, respectively. The variable tractor had been found positively and significantly affected inefficiency in the east coast of Peninsular Malaysia. On the other hand, inefficiency was found significantly and negatively affected by the variable seminar in the west coast. Efficiency performance of west coast in paddy farming was considered better off than the east coast. In brief, both east coast and west coast of Peninsular Malaysia had indicated relatively low efficiency performance. Encouragement of attending seminar in west coast of Peninsular Malaysia for regularly updating new technology and information should be done by authorities in order to improve efficiency performance of paddy farming.

**Key words:** Malaysia, paddy, efficiency, data envelopment analysis, seminar

## INTRODUCTION

Peninsular Malaysia covers two distinct coastal areas, namely east and west coast of Peninsular Malaysia. East coast of Peninsular Malaysia is facing the South China Sea while west coast of Peninsular Malaysia is facing the Strait of Malacca. Topography, weather, socio-economic, cultures, economic development and other aspects between east and west coast of Peninsular Malaysia vary widely (Wong, 1986). East coast of Peninsular Malaysia consists of the states of Kelantan, Pahang, Terengganu and East Johor. West coast of Peninsular Malaysia consists of the states of Perlis, Kedah, Penang, Perak, Selangor, Negeri Sembilan, Malacca and West Johor (Wong, 1986).

It is believed that the current targeted yield of paddy farming is waiting to be increased. Yield with 5 metric tons per hectare is the new target to be achieved in 2020 (MAAIM, 2011a). However, average paddy yield of these two studied areas were recorded only 3.687 metric ton per hectare and 4.598 metric tons per hectare for east and west coast of Peninsular Malaysia, respectively (MAAIM, 2011b). Therefore, the efficiency performance of paddy farming in both east and west coast of Peninsular Malaysia has become an important horizon to be explored.

Data Envelopment Analysis (DEA) is frequently applied in efficiency study in the world of agriculture. The ultimate goal of achieving efficiency in agricultural production is to prevent waste of agricultural resources (Esmaeili and Omrani, 2007). Efficiency study can be basically categorized into technical efficiency, allocative efficiency and economic efficiency. Output oriented technical efficiency is known as the ability to reach maximum output from a given set of inputs (Laha and Kuri, 2012). Input oriented technical efficiency is known as the ability to minimize inputs used in producing given output (Keramidou *et al*., 2011). Allocative efficiency is known as the ability of input using to achieve optimal proportions with a given technology (Laha and Kuri, 2012). Economic efficiency (which is also known as cost efficiency) attempts to measure the ability to reach cost minimization of an operation without altering production (Ghorbani *et al.,* 2009). It had obviously been found that not all the researchers looked into these three types of efficiency in their studies. Some of the efficiency studies only focused on technical efficiency analysis (Keramidou *et al*., 2011; Bozoglu *et al*., 2006; Gul, 2005). Besides measuring the efficiency scores, researchers were also interested in discovering more information in inefficiency. Various tools had been used in determining the factors affecting inefficiency, like Tobit regression (Koc *et al*., 2011), logistic regression (Armagan, 2008) and even Ordinary Least Squares (OLS) regression (Yusuf and Malomo, 2007).

In this study, the paddy farming in the states of Penang, Perak, Selangor, Kelantan and Terengganu were considered as the target of study. According to the report of Ministry of Agriculture and Agro-based Industry Malaysia in 2011, total paddy yield of the states of Penang, Perak, Selangor, Kelantan and Terengganu were accounted 43.68% of annual paddy yield of Peninsular Malaysia or 37.89% of annual paddy yield of Malaysia (MAAIM, 2011b). Objective of this study was to measure efficiency scores of the east and west coast of Peninsular Malaysia by using Data Envelopment Analysis (DEA). Besides, this study also attempted to discover determinants of inefficiency in the studied area by using Tobit regression.

## MATERIALS AND METHODS

Differences between east and west coast of Peninsular Malaysia were considered in this study. Therefore, analysis on these two areas had been done jointly and separately where 140 respondents who represented the west coast of Peninsular Malaysia were randomly selected from the states of Penang, Perak and Selangor. For east coast of Peninsular Malaysia, the sample size was 90 respondents who were randomly selected from the states of Kelantan and Terengganu. This study employed farm management data pertaining to the paddy production in 2010. Data was gathered through face to face interview in a survey of 230 paddy farmers conducted in 2010. Scope of study only covered east and west coast of Peninsular Malaysia. Survey was conducted throughout the year 2010 since the studied areas were quite big.

**Methodology:** This study started the analysis from examining the scores of technical efficiency by using DEA. The approach taken was technical efficiency analysis with application of output oriented variable return to scale (VRS) DEA. Coelli *et al*. (1998) stated that output oriented variable return to scale (VRS) technical efficiency can be formulated as follows:

$$\text{Max}_{\theta,\lambda}\ \theta$$

$$\text{subject to } -\theta y_j + Y\lambda = 0$$

$$x_j - X\lambda = 0$$

$$N1'\lambda = 1$$

$$\lambda = 0$$

where, $\theta$ denotes the score for technical efficiency of the jth paddy farmer compared to others in the sample, $y_j$ denotes yield of jth paddy farmer, $x_j$ is quantity input used by the jth paddy farmer, Y is yield data set for all paddy farmers, $\lambda$ is N×1 vector of constants, X is input data for all paddy farmers and N is total number of paddy farmers. $Y\lambda$ and $X\lambda$ are the efficient estimations on frontier. N1 denotes N×1 vector of ones. $N1' \lambda = 1$ is a constraint that makes comparison only on paddy farmers with similar yield size, by forming a convex hull of intersecting planes, so the data is enveloped more tightly (Coelli *et al.*, 1998). Four inputs were used in this study: size of paddy farm in hectare, expenses on seeds, expenses on fertilizer and finally number of workers. Output yield was measured in metric tons per hectare for yield of paddy farms. All these independent variables and dependent variables were run by DEA to get the scores of technical efficiency.

After getting the scores of technical efficiency of each respondent, the values of inefficiency of each respondent were calculated by: one minus the scores of technical efficiency. Thus, further analysis on examining determinants of inefficiency can be continued. Determinants of inefficiency were investigated by using Tobit regression which introduced by Tobin (1958). A general tobit regression model can be understood:

$$y_i^* = \beta x_j + u_j,\ u_j \sim N(0, \sigma^2)$$

where, $y_j^*$ is a non-negative and unobservable dependent variable for the jth paddy farmer, $\beta$ is a parameter, $x_j$ is independent variable and $u_j$ is a normally distributed error term (McDonald and Moffit, 1980). McDonald and Moffit (1980) stated that the observable variable $y_j$ is identified to be equal to unobservable variable whenever the unobservable variable is above zero and zero otherwise:

$$yj = \begin{cases} y_j^*, & \text{if } y_j^* > 0 \\ 0, & \text{if } y_j^* \leq 0 \end{cases}$$

Determinants were categorized into practice specific and characteristics of farmer's specific. Practice specific included owning of tractor (dummy value 0 and 1) and expenses on pesticide; while characteristics of farmer's specific such as experience of farming (years), education level of paddy farmer (years) and attendance of paddy farmer on seminar (dummy value 0 and 1). These five determinants ($x_j$) and inefficiency scores ($y_j$) were modeled to ascertain the impacts on influencing inefficiency.

## RESULTS AND DISCUSSION

Average efficiency score of paddy farming in Peninsular Malaysia had been recorded 55.6%. Distribution of efficiency scores of Peninsular Malaysia had been showed in Fig. 1. Despite 89.6% of paddy farmers were found having efficiency score not more than 80%, there was an occasion

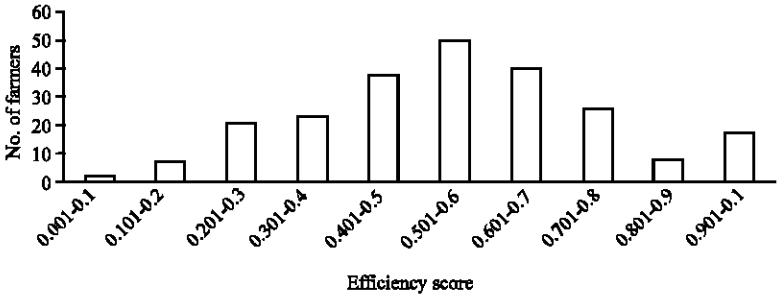


Fig. 1: Frequency distribution of efficiency scores of Peninsular Malaysia


Fig. 2: Frequency distribution of efficiency scores of East Coast of Peninsular Malaysia

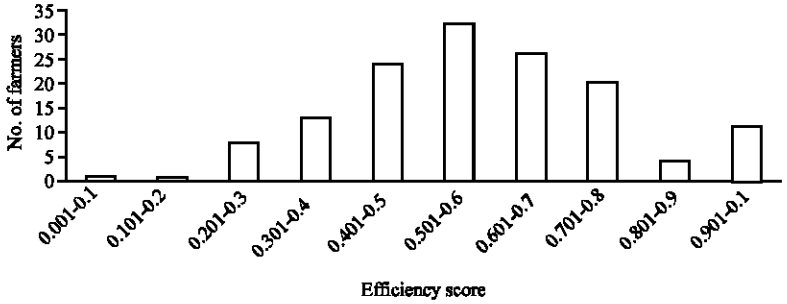


Fig. 3: Frequency distribution of efficiency scores of West Coast of Peninsular Malaysia

where, 7.4% accounted 17 paddy farmers had achieved 100% of technical efficient. This suggested that among the 230 paddy farmers, these 17 paddy farmers had performed very well and they were being the best practice guidance for the rest of paddy farmers.

Distribution of efficiency scores of east coast of Peninsular Malaysia was reported in Fig. 2. It showed that 90% of east coast paddy farmers were found having efficiency score not more than 80%, consistent with the finding of Peninsular Malaysia. Distribution of efficiency scores of west coast of Peninsular Malaysia was reported in Fig. 3. It also showed that 89.3% of west coast paddy farmers were found having efficiency score not more than 80%, similar with finding mentioned above. Besides, east coast of Peninsular Malaysia experienced 51.7% of technical efficient; on the other hand west coast of Peninsular Malaysia reported 63.1% of technical efficient. Among the 17 paddy farmers who performed efficient in paddy farming, 6 paddy farmers were from east coast

of Peninsular Malaysia while 11 of them were from the west coast. It is interesting to note that, despite the average of efficiency scores were different between east (51.7%) and west coast (63.1%), the highest frequency of efficiency scores of these two areas were still belonged to the range of 50.1-60% of efficiency scores (Fig. 2, 3). It was believed that, this had explained the achievement of 55.6% of efficiency score of the paddy farmers in Peninsular Malaysia.

Inefficiency model of Peninsular Malaysia can be observed that variables such as pesticide, experience and seminar were having negative impact on inefficiency (Table 1), suggesting that either an increase in these variables or use of these variables (if dummy value was applied) will lead to decrease in inefficiency, similar with the finding of Ghee-Thean *et al.* (2012), Koc *et al.* (2011) and Ekunwe *et al.* (2008). Yet, the variables like tractor and education were having positive impact on inefficiency effect, suggesting that an increase in these variables or use of these variables (if dummy value was applied) will lead to increase in inefficiency. Unfortunately, there was none of the determinants (tractor, pesticide, experience of farmer, education level of farmer, seminar) had shown significant influence in technical inefficiency model for Peninsular Malaysia. This incident might be caused by different farming behaviors of paddy farmers in the east and west coast of Peninsular Malaysia coupled with other uncontrollable factors. Therefore, this finding had driven the study to being further analyzed more detail by splitting the Peninsular Malaysia into east and west coast.

Inefficiency model of east coast of Peninsular Malaysia stated that variables of pesticide and experience were found negatively affected inefficiency (Table 2), in line with results of previous studies (Ghee-Thean *et al.* 2012; Koc *et al.*, 2011; Ekunwe *et al.*, 2008); while, variables of tractor, education and seminar were found positively affected inefficiency. On the other hand, variable of tractor was recognized as the single significant positive effect (0.13) in inefficiency model was unexpected, suggesting that using tractor will lead to increase in inefficiency. This finding proposed that paddy farmers from east coast were less efficient if they owned tractors, compared to the paddy farmers who owned nothing. This could be happened if the paddy farmers who owned tractors did

Table 1: Tobit regression of technical inefficiency model (Peninsular Malaysia)

| Variable | Coefficient | Standard error | p-value |
|---|---|---|---|
| Tobit model | | | |
| Constant | 0.448000 | 0.039000 | 0.0000 |
| Tractor | 0.042000 | 0.031000 | 0.1752 |
| Pesticide | -0.000001 | 0.000009 | 0.8969 |
| Experience | -0.000500 | 0.001000 | 0.6196 |
| Education | 0.001000 | 0.031000 | 0.9658 |
| Seminar | -0.014000 | 0.030000 | 0.6423 |

Table 2: Tobit regression of technical inefficiency model (East coast of Peninsular Malaysia)

| Variable | Coefficient | Standard error | p-value |
|---|---|---|---|
| Tobit model | | | |
| Constant | 0.41200 | 0.06600 | 0.0000 |
| Tractor | 0.13000 | 0.05600 | 0.0213** |
| Pesticide | -0.00003 | 0.00004 | 0.4159 |
| Experience | -0.00007 | 0.00200 | 0.9687 |
| Education | 0.00200 | 0.05500 | 0.9685 |
| Seminar | 0.05900 | 0.05100 | 0.2502 |

**Statistical significant at 0.05 level

Table 3: Tobit regression of technical inefficiency model (West coast of Peninsular Malaysia)

| Variable | Coefficient | Standard error | p-value |
|---|---|---|---|
| Tobit model | | | |
| Constant | 0.391000 | 0.05100 | 0.0000 |
| Tractor | -0.007000 | 0.04000 | 0.8645 |
| Pesticide | 0.000007 | 0.00001 | 0.4877 |
| Experience | 0.000090 | 0.00100 | 0.9467 |
| Education | 0.018000 | 0.03900 | 0.6492 |
| Seminar | -0.075000 | 0.03900 | 0.0526* |

*Statistical significant at 0.1 level

not produce greater yields of paddy to cover the increased in production cost. Comparing with those who owned nothing, these owners of tractor invested more input resources, consequently causing efficiency scores of these owners of tractor to remain at relatively low level. It is believed that the paddy farmers who own tractors might rent their tractors or they might provide plowing services to others, in making some extra income.

Inefficiency model of west coast of Peninsular Malaysia noted that variables of tractor and seminar were found negatively affected inefficiency (Table 3), consistent with the finding of Ghee-Thean *et al.* (2012). However, variables of pesticide, experience and education were found positively affected inefficiency. This finding different with result of east coast of Peninsular Malaysia, variable of seminar showed the single significant negative effect (-0.075) on inefficiency, suggesting that attending seminar will lead to decrease in inefficiency. This result indicated that suppose paddy farmers absent from training in the seminar on paddy farming, they were expected to perform less efficient compared to those who attended the seminar. In Malaysia, seminar on paddy farming is usually held by the government authorities and private companies. Seminar is held for the purpose of improving the knowledge of paddy farmers, exposing latest technology and machinery, enhancing skills of paddy farmers and also introducing new fertilizers, chemicals or seeds. It is believed that having a seminar is also a chance to have the paddy farmers gather for sharing experience and knowledge, and hence, indirectly improving productivity.

## CONCLUSION

This study found that the existing paddy yield of Peninsular Malaysia can be raised by as many as 44.4% without changing any existing technological condition. Specifically, paddy yield of east and west coast of Peninsular Malaysia were having 48.3 and 36.9% of potential to be improved, respectively. Obviously, there is under performance of paddy farming in Peninsular Malaysia. Raising current paddy yield up to the targeted yield requires improvement in farming efficiency. Relevant authorities should give more attention on improving farming efficiency, hence improve the productivity and achieve the targeted paddy yield. In summary, this study strongly encourage conducting more seminars in west coast of Peninsular Malaysia. Nevertheless, further research on east coast of Peninsular Malaysia is recommended because this study was not able to provide a good suggestion in improving farming efficiency and productivity of the east coast of Peninsular Malaysia.

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**REFERENCES**

Armagan, G., 2008. Determining the factors affecting efficiency scores in agriculture. Int. J. Agric. Res., 3: 325-330.

Bozoglu, M., V. Ceyhan, H.A. Cinemre, K. Demiryurek and O. Kilic, 2006. Evaluation of different trout farming systems and some policy issues in the black sea region, Turkey. J. Applied Sci., 6: 2882-2888.

Coelli, T., D.S. Prasada and G.E. Battese, 1998. An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers, Boston, Dordrecht and London.

Ekunwe, P.A., S.I. Orewa and C.O. Emokaro, 2008. Resource-use efficiency in yam production in delta and Kogi States of Nigeria. Asian J. Agric. Res., 2: 61-69.

Esmaeili, A. and M. Omrani, 2007. Efficiency analysis of fishery in hamoon lake: Using DEA approach. J. Applied Sci., 7: 2856-2860.

Ghee-Thean, L., M.M. Ismail and M. Harron, 2012. Measuring technical efficiency of malaysian paddy farming: An application of stochastic production frontier approach. J. Applied Sci., 12: 1602-1607.

Ghorbani, A., S.A. Mirmahdavi and E. Rahimabadi, 2009. Economic efficiency of caspian cattle feedlot farms. Asian J. Anim. Sci., 3: 25-32.

Gul, M., 2005. Technical efficiency and productivity of apple farming in antalya province of Turkey. Pak. J. Biol. Sci., 8: 1533-1540.

Keramidou, I., A. Mimis and E. Pappa, 2011. Estimating technical and scale efficiency of meat products industry: The Greek case. J. Applied Sci., 11: 971-979.

Koc, B., M. Gul and O. Parlakay, 2011. Determination of technical efficiency in second crop maize growing farms in Turkey: A case study for the East Mediterranean in Turkey. Asian J. Anim. Vet. Adv., 6: 488-498.

Laha, A. and P.K. Kuri, 2012. Differences in resource allocation under alternative tenurial contracts and its explanations: Evidence from rural West Bengal, India. Trends Agric. Econ., 5: 13-22.

MAAIM, 2011a. Agrofood statistics 2010. Ministry of Agriculture and Agro-based Industry Malaysia.

MAAIM, 2011b. National Agrofood Policy 2011-2020. Watan Publication, Putrajaya, Kuala Lumpur, ISBN-13: 9789839863390.

McDonald, J.F. and R.A. Moffit, 1980. The uses of tobit analysis. Rev. Econ. Stat., 62: 318-321.

Tobin, J., 1958. Estimation of relationships for limited dependent variables. Econometrica, 26: 24-36.

Wong, P.P., 1986. Tourism development and resorts on the east coast of Peninsular Malaysia. Singapore J. Trop. Geogr., 7: 152-162.

Yusuf, S.A. and O. Malomo, 2007. Technical efficiency of poultry egg production in Ogun state: A Data Envelopment Analysis (DEA) approach. Int. J. Poult. Sci., 6: 622-629.