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# **Evaluating How Operator's Identity Affects Managerial Efficiency of Dairy Farms Conducting Educational Tourism**

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## **Abstract**

Based on an analytical framework, this paper classified farmer's identity into two types: traditional identity that is oriented toward simple farm production and enlarged identity that is oriented toward viability of a new service activity. Second, by data envelopment analysis, the result of managerial efficiency simulation of a two-sector model, that is, the main milk production and the educational activity, revealed that those with the enlarged identity could realize higher managerial efficiency than those with the conventional identity. Thus, it was revealed that a farmer's identity makes a difference in managerial efficiency. The efficiency level, however, was not high, which means that there is much room for improvement in farm resource management. Consequently, when policymakers try to design support measures to develop tourism-related farm diversification, the perspective of the support measures for capacity building should be widened to include identity issues, which helps farmers widen their identity that enable them to be more efficiently acceptable for tourism activity.

**Keywords:** educational tourism in agriculture, identity, data envelopment analysis, technical efficiency

## **1. Introduction**

Tourism conducted by farm people is now widely accepted as a measure of farm diversification that leads to rural revitalization and development not only in developed but also in developing countries. Within the arena of rural tourism, educational tourism in agriculture has been emerging and attracting growing attention because it is differentiated from ordinary rural tourism and allows the majority of visitors who do not have an agrarian background to learn more effectively of the significance of their rural heritage and the environment. This educational role is included in multifunctionality in agriculture. Educational Dairy Farms is an organized framework of farms in Japan that provides educational services regarding agriculture, similar to other such highly organized activities conducted in other parts of the world. The number of visitors to these member farms increased to nearly 900,000 in 2009, which strongly suggests that a new and potentially large market is emerging and that it should be explored as a new income source for farmers.

To realize tourism-oriented diversification, it is essential for farmers themselves to transform their identity as farm resource managers solely based on the traditional production-oriented perspective to a wider one based on a more comprehensive perspective of farm resource management that includes both traditional farm production and tourism activity. This is because the level of diversified farm activity that is undertaken by a farmer is not determined solely by the farmer's individual technical skills and capability, but by the farmer's identity that exists as a norm that is socially nurtured and has persisted for generations. In this context, even if farmers have sufficient capability to conduct diversified activities, those farmers with different identities will undertake specific activities in accordance with a particular identity and realize different degrees of managerial efficiency. Identity factors have been only scantily empirically investigated among economic activities including agriculture, although Akerlof and Kranton (2000; 2002; 2010) state their importance for a better understanding of economic behaviour.

To the author's knowledge, studies on factors related to inefficiency of production activity have been mainly conducted on their direct effect on production, which is exerted by factors within the same activity in tourism economics and agricultural economics. It has not been

clarified yet how a diversified activity such as tourism undertaken by farmers with different identities results in different degrees of managerial efficiency, including those related to a main activity such as milk production, hereafter the identity effect. If we could understand how identity exerts an influence on managerial efficiency, we could expand the scope of farm diversification policies especially focusing on tourism related activities. It is crucially important to clarify this point in seeking a better perspective on the sustainable evolution of farm diversification through educational activity and in providing support measures for that.

Thus, it is necessary to consider not only the conventional technical reasons that cause production inefficiency but also the effect of a farmer's identity when we consider farm diversification in relation to the newly emerging tourism activity. Put differently, it is highly probable that observed technical efficiency includes the mixed effects of conventional technical inefficiency and the identity effect. If the identity effect is not taken into account, the technical efficiency of educational dairy farms might be overestimated.

To approach this aim, by focusing on the designated Educational Dairy Farms in Japan, first this paper presents an analytical framework that enables us to evaluate how the activity of educational services exerts influence on the efficiency of the main activity, milk production. Second, since the educational services are not yet economically viable, this paper conducts a simulation that evaluates managerial efficiency when two outputs, milk production and educational services, are supposed to be maximized by the data envelopment analysis (DEA) model and examines how farmers' different identities would cause significant differences in managerial efficiency. Finally, based on these evaluations this paper presents policy recommendations toward the establishment of economically viable farm diversification by educational services.

## **2. Analytical Framework: Farmers' identity and managerial efficiency**

Here, the researcher considers the relationship between a farmer's identity and the efficiency of diversified activity, i.e. milk production and the educational activity. To simplify the discussion, suppose there are two contrasting types of identity that a farmer could have: traditional identity and enlarged identity. For those with the traditional identity the norm is that their main activity is farm production, so that the educational service is just a voluntary activity offered free of charge. Thus, their aim is to realize efficient milk production to the best possible extent. On the other hand, in those with the enlarged identity the norm is that they should engage in multiple economically viable activities and therefore they will levy service charges for the educational service to achieve its viability. Their aim is, thus, to attain overall managerial efficiency in farm resource allocation among these activities, meaning that those with the enlarged identity have a wider perspective toward farm diversification than those with the traditional identity. In this respect, whether a farmer levies a service charge is an easily observable criterion to indicate which identity a farmer has.

Although identity can change with time, once it is established, in general, it is hard to change and it can be passed down through generations. Even if a policy framework promotes farm diversification, efficient farm management will not be achieved unless a farmer's identity changes toward the enlarged one. Although this does not mean that those who conduct diversified activities as a volunteer do not engage in efficient farm resource management, those with the enlarged identity regard farm resource management more as economic behaviour than those with the traditional identity. Within each identity, the clearer the identity a farmer possesses, whether it is the traditional identity or the enlarged identity, the better able that

farmer is to perform farm resource management. On the other hand, the farmer cannot realize efficient farm resource management if the activity is conducted beyond the scope of that farmer's own identity.

This process is not always undertaken consciously by farmers, which is different from regular inputs. The hypothesis here to be empirically examined is whether a farmer takes different maximization behaviours according to identity; in the case of a traditional identity one-sector efficiency maximization is taken, and in the case of enlarged identity the maximization of over-all managerial efficiency composed of milk production and the educational service, is taken.

<b>Table 1.</b> Combinations of efficiency in milk production and overall managerial efficiency		
Case	Efficiency in milk production	Overall managerial efficiency
1	YES	YES
2	NO	YES
3	YES	NO
4	NO	NO
<i>Notes</i> : YES= efficiency of those farms that levy service charge > that of those farms that do not. NO = vice versa.		

Based on the above consideration, I explore the inter-activity effect (cross effect) between a diversified activity, such as an educational activity, and the main activity of milk production taking into account the identity aspect. It is considered as that the identity effect works similar to a technical bias on efficiency. In reality, the identity effect is likely to be combined with conventional technical factors that affect efficiency.

For empirical examination of the identity effect, there could be four cases caused by differences in farmer's identity in terms of efficient resource allocation in milk production and overall farm management, including the educational service activity. As shown in Table 1, Case 1 is an instance whereby those with an enlarged identity attain higher efficiency both in the milk production sector and overall managerial efficiency as well than those do not levy a service charge who are supposed to have the traditional identity. In Case 2 higher managerial efficiency in total is solely attained while that of milk production is not. In both Cases 3 and 4 higher managerial efficiency in total is not attained. In these two cases, there is no rationale to continue with farm diversification although that could happen logically. Thus, Cases 1 and 2 are suitable for an empirical evaluation, and in those cases it can be considered that technical and identity factors are reflected differently. In Case 2 it is supposed that farmers are oriented more toward farm diversification.

The next question to be empirically clarified is to identify how managerial efficiency is attained when the identity effect is considered.

### **3. Outline of the program of the Educational Dairy Farms**

The program of the Educational Dairy Farms was established in 2000 by the Japan Dairy Council, which is a national organization for dairy farmers. The purpose of this program is to provide accurate information on what dairy farms do to enable the public to understand the roles dairy farming play in society. The aim of Educational Dairy Farms is not only to promote an open-door policy of the farmyard to the outside but also to enhance the educational value of dairy farming through teaching where milk comes from and showing the life of milk cows on the farm. For instance, when visitors have a milking experience, they learn that warm white milk comes out of the udder of the cow, which is a simple concept, but is quite different from the daily experience of drinking milk kept in a milk carton in the refrigerator. If visitors are lucky enough, they can see the birth of a calf, which makes a lifetime impression on children or even adults by evoking the meaning of life. People learn what food is and the close connection between food and life from these experiences. In this respect, a farmer's role is crucial and thus a farmer is called a facilitator in this program.

To be a facilitator for the Educational Dairy Farms, a farmer or a farm employee must attend a course on principles, safety, hygiene, and communication skills as well as a presentation of a case study provided by the Council. The Council administers certification for recognition as an Educational Dairy Farm and presents various capacity building courses for those with farms certified as an Educational Dairy Farm as well as dairy farmers at large in Japan. There were 257 Educational Dairy Farms as of 2009 when the survey was conducted.

The number of visitors has increased yearly and reached nearly 880 thousand visitors in 2009, which is a 3.89-fold increase from 2003. This increase was far more rapid than the increase in the number of Educational Dairy Farms, which was only 1.5-fold in the same period. The average number of visitors per farm increased from 1,353 to 3,421, a 2.53-fold increase. These facts suggest that the demand for farm experience has steadily grown to form a certain level of market or at least its potential. I assume that this mounting demand indicates a new social role that dairy farmers can play in society (Ohe, 2011; 2012).

#### **4. Data**

In keeping the analytical model on the cross identity effect in mind, DEA is used for a simulation of how technical efficiency will vary when these farms maximize the two outputs by whether or not farmers levy charges for educational services. From these results, factors to be considered in designing support measures toward viable educational services will be discussed.

Data were collected by a questionnaire survey to the entire group of 257 farms designated as Educational Dairy Farms by the Japan Dairy Council jointly conducted by the author and the Japan Dairy Council from October to December in 2009 by surface mail (response rate 79.4%, 204 farms). The author conducted a supplementary survey by telephone. Sample size used for this study was 123 family farms to maintain homogeneity of the sample because there are various types of ranches designated as Educational Dairy Farms, such as publicly owned ranches, ranches run by educational institutions or cooperatives, etc., which are not necessarily oriented toward maximizing the profitability of milk production.

##### **4.1. Variables for DEA model**

First, as the input variables, the number of milk cows and acreage in feed production in 2009 were based on data from the survey mentioned above and supplemented by additional telephone interviews. Likewise, also based on the survey and telephone interview, the labour

input variables were calibrated as real term labour input by taking into account the contribution of labour inputs for milk production and educational activity, respectively; full-time and main responsibility equals unity, full time and sub-responsibility equals 0.5 part-time and main responsibility 0.5, and part-time sub-responsibility 0.25.

As output data, the amount of annual milk production was used based also on the survey and supplementary telephone interview and data provided by the Japan Dairy Council for 2009. Data used for estimation are summarized in Tables 2.

<b>Table 2.</b> Variables used for SFPF and DEA model estimations					
Type	Variables	Mean	Standard Deviation	Min. value	Max. value
Input	Labour input for milk production (real term)	3.07	1.83	0.50	13.50
Input	No. milk cows	93.0	68.8	8.0	450.0
Input	Acreage of feed production (ha)	21.8	24.9	0.1	160.0
input	Levying service charge (yes=1, no=0)	0.48	-	0	1
Input	Labour input for educational services (real term)	2.07	1.25	1.00	11.50
Output	Amount of milk production in 2009 milk year (t)	472.6	362.8	1.9	2247.0
Output	No. visitors in 2009 fiscal year	1127.1	4277.0	0	35389
Output	Estimated revenue according to the minimum price (thousand yen)	830.3	5124.8	0	55,700
Output	Estimated revenue according to the maximum price (thousand yen)	2397.7	17,000.0	0	186,000
<p><i>Source</i> : Questionnaire survey to the Educational Dairy Farms jointly conducted by the author and the Japan Dairy Council from October to December in 2009. Response rate was 79.4% (204/248). Only family farms (123 samples) were used for the evaluation. The data on milk production and the number of visitors were obtained from the Japan Dairy Council.</p> <p><i>Note</i> : Refer to the text about the calibration methods of milk production and real term labour input.</p>					

## 4.2. Simulation of managerial efficiency by DEA

DEA is applied because this method, as a non-parametric method, is suitable for simulation of managerial efficiency. The author evaluates managerial efficiency when farmers are assumed to maximize two outputs with four inputs: milk production as the main sector and the educational service as another sector. Inputs are labour, acreage of feed production as land input, and the number of milk cows as capital input. With regard to labour, two labour inputs for milk production and the educational service were calibrated based on the method mentioned earlier. Three different output variables of the educational services were used because the educational service was not yet firmly established as a viable economic service. These are the number of visitors in 2009, 'maximum price evaluated revenue', which was the calibrated revenue by the maximum price level at each farm, and 'minimum price evaluated revenue', which was the calibrated revenue by the minimum price level at each farm. The maximum and minimum prices are the highest and lowest service prices at each farm obtained from the survey results.

Free of charge service was treated as zero price. The revenue was calibrated according to the number of visitors by that price. The first case, i.e. the number of visitors, is to see non-monetary output, meaning that only the educational externality is generated without any compensation for the service. The second case, maximum price evaluated revenue, is to see the potential revenue from the educational service. This case corresponds to a case whereby services are offered as a set menu. The third case, minimum price evaluated revenue, is to see the case between the two extreme cases. This case corresponds to a case of offering an individual menu.

**Table 3.** Evaluation results of the overall managerial efficiency of Educational Dairy Farms (DEA)

Model	Output1	Output2	Levies charge for educational services					
			Efficiency score			Efficiency rank		
			Yes (59)	No (64)	Test result	Yes (59)	No (64)	Test result
SBM	Milk production	No. visitors for educational services	0.3766	0.3129	nsE	3260	4366	**
SBM	Milk production	Estimated revenue according to the maximum price	0.3907	0.2864	+E	3005	4621	***
SBM	Milk production	Estimated revenue according to the maximum price	0.2974	0.1609	*E	2778	4848	***

Source : Same as for Table 2.

Notes : test methods are *t* test for the efficiency score and Kruskal-Wallis test for the efficiency rank. \*\*\*, \*\*, \*, + indicate 1%, 5%, 10%, and 20% (as reference) significance, respectively. E=equal variance and N=not equal variance.

The binary criterion that represents the identity effect, i.e. whether a farmer levies a service charge or not, was used again as in the proceeding estimation. I examine whether this variable causes a difference in managerial efficiency in the two-sector model.

Specifically, the model used here was the slacks-based measure, SBM, which minimizes slacks of each input and output (Cooper et al., 2007; Briec and Peypoch, 2010). This is because farm diversification needs to realize rational utilization and mobilization of farm resources, and it is more useful to have a more realistic approach than an ordinal DEA model (CCR) that has a fixed ratio of input-output relationships, termed as a radial model. This paper, thus, adopts an SBM model as a non-radial model.

The model assumes that the economy of scale is variable with output maximization. Sample size was 123 family farms.

Estimation results are shown in Table 3, which provides efficiency scores as well as efficiency ranks according to differences in the service charge levied and statistical test results. Rank was determined by the Mann-Whitney test and the scores by *t* tests.

The commonly observable fact among these results is that the average efficiency scores are all low because the maximum efficiency score is unity. This is probably because there is a large variance in the number of visitors from one farm to another in reality.

Table 3 also shows results of the three different educational service outputs. Score-wise, although there were statistical differences in the case of evaluated revenue according to the



maximum price (10%), no differences were shown in the other two cases. In contrast, rank-wise, there were statistically significant differences in all three cases (1%). Thus, in the case of evaluated revenue according to the maximum price, both in score and rank, there was a statistical difference between those farms levying and not levying a service charge. In short, if the output of the educational services was measured as maximum price evaluated revenue, farms levying a service charge attain higher managerial efficiency than those farms that do not. Consequently, the importance of levying a service charge should be noted and those with an enlarged identity can attain higher managerial efficiency.

To summarize, from the results of the DEA simulation model it was revealed that those with different identities employ different behaviours to attain managerial efficiency and those with the enlarged identity with a wider perspective will be able to attain higher managerial efficiency. Nevertheless, managerial efficiency of the two outputs in these dairy farms was not high enough because the efficiency scores were all far from the maximum efficiency level, which is unity. Put differently, this lower efficiency indicates that there is much room to improve utilization of management resources. Therefore, it will be possible to enhance managerial efficiency by realization of viable educational services. Further, in this two-output model we could not recognize economy of scale, probably because one output has the nature of service production. Overall, how those who have the enlarged identity behave matched Case 2, which suggests that identity makes a difference in managerial efficiency or maximization behaviour of farm resources with an orientation toward diversification.

As policy recommendations, the results indicate that farmers' identity is an important factor that determines farm resource management and farm managerial efficiency. In this sense, it is important to keep in mind the role of farmers' identity for farm diversification policies and especially identity issues should be included in the arena of capacity building.

## **5. Discussion and Conclusion**

This paper investigated how farmer's identity influences managerial efficiency in emerging diversified farm activity by focusing on Educational Dairy Farms. Main points clarified in the paper are as follows:

(1) This paper considers the identity effect, which means that resource management differs according to differences in farmers' identities. Based on consideration of the relationship between a farmer's identity and diversified activity, it was disclosed that in the case of diversified activity technical efficiency will be overestimated if the identity effect is not taken into account.

(2) The results of simulation of two outputs, milk production and educational service activities, using the DEA model revealed that those farms that implement charging for educational services realized relatively higher managerial efficiency. This result demonstrated that some of the farms attained high managerial efficiency in both milk production and conducting educational services. Thus, it should be noted that those who had the enlarged identity conducted different efficiency-maximization behaviour than those who had the traditional identity.

(3) Nevertheless, the differences in efficiency scores between those farms charging and not charging were not large. Further, the average efficiency scores for both types of farms were not high enough to say that they all attained high managerial efficiency in absolute terms. This

result indicates that there is much room for improvement in farm resource utilization to realize a viable educational tourism farm activity.

(4) Consequently, it will be important to take into account what identity a farmer has toward farm diversification for designing policies for better support measures especially in the field of capability building in farm resource management in multiple sectors including educational service activities. For this aim, first of all, educational services should be properly placed in the dairy farm policy arena.

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