

Article

Assessing Managerial Efficiency of Educational Tourism in Agriculture: Case of Dairy Farms in Japan

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Abstract: Many rural areas face difficulty in how to motivate farmers to embark on diversified activities, such as tourism, while raising managerial efficiency. Thus, this paper conceptually and empirically evaluated how a farmer's identity correlates with managerial efficiency since the connection between the two has not been explored fully. We have addressed this issue through examining farmers' efforts in providing an emerging new educational tourism service by focusing on the Educational Dairy Farms in Japan. Conceptually, this paper classified farmers' identity into two types: traditional identity as a simple farm producer offering an educational service as a volunteer, and, enlarged identity, which is oriented toward viability of a new service activity. Empirically, data envelopment analysis revealed that those with the enlarged identity realized a higher managerial efficiency although there was much room for improvement in overall managerial efficiency. Consequently, support measures with a wider perspective that include identity issues should be designed for capacity building of farmers who are conducting tourism.

Keywords: educational tourism in agriculture; identity; data envelopment analysis (DEA); technical efficiency; Educational Dairy Farm

1. Introduction

Engaging in rural/agri-tourism is now a widely known means of diversification and development of farm and rural economies (Sidali et al. [1]). Nevertheless, since tourism is a relatively new domain of farm activity, it is not easy for farmers to actually launch efficient tourism activities. To address the obstacles impeding success in the realm of rural tourism, this paper sheds light on the relationship between a farmer's identity and managerial efficiency in activities that include relatively new educational-tourism service activities in agriculture. This is because the author assumes that the formation of a farmer's identity in relation to tourism is a crucial factor for the successful development of such a new activity. This issue cannot be addressed solely from the perspective of technical skills because identity is an issue of mind set. This is firstly because the conventional management skills specified in physical farm production cannot address service production issues properly (Brandth and Haugen [2]). Secondly, even if new technical skills for tourism are acquired, unless the appropriate identity is formed in relation to the new activity, these skills will not be efficiently utilized.

Identity factors of operators have not been fully addressed from the economic perspectives in connection with rural tourism, despite the pioneering work by Akerlof and Kranton [3] that clarified the significance of identity for a better understanding of economic behaviour. A scientific understanding of how identity relates to managerial efficiency is vital for designing effective assistance measures for farm diversification through tourism activity.

Based on Akerlof and Kranton [4], identity is defined here as a social norm that determines behaviour whereby people try to behave in accordance with their own identity. If the attempted activity suits a farmer's identity, managerial efficiency will increase; per contra, if the attempted activity does

not suit one's identity, efficiency will decrease or inefficiency will increase. Therefore, tourism activity should be consistent with an individual's identity; otherwise, the result will not be a viable business. This is the hypothesis to be verified, and this paper aims at testing this hypothesis empirically.

In the field of rural tourism, educational tourism in agriculture is already institutionalized in industrialized countries where agrarian and urban populations live far apart; examples are the FACE (farming and countryside education) program in UK (Graham [5]), Ferme Pédagogique in France, Fattorie Didattiche in Emilia-Romagna (Canavari et al. [6]), Italy, and Educational Dairy Farms, EDFs hereafter, in Japan (Ohe [7–9]). Visitors who have no direct agrarian background can learn how food is produced, about their agrarian heritage, rural life, and the rural environment. Especially, in the case of EDFs, the educational impact on children is supposed to be higher than that of farms that only produce crops. Touching and watching livestock can foster an understanding of the close relationship between food and life. For example, allowing a child to observe the delivery of a calf offers a profound and long lasting lesson on the value of life even without words. However, the recognition of the value of the educational activity does not always automatically ensure its economic viability.

The structure of this paper is as follows: after a literature review, conceptual considerations are presented that enables an evaluation of how differences in identity are related to managerial efficiency. Then, 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 differences in identity would cause significant differences in overall managerial efficiency. As noted in the literature review, DEA has been quite widely employed in measurements of efficiency, including that in the field of tourism economics, e.g., Barros [10,11]. Finally, the author presents policy recommendations in taking into account identity formation toward the establishment of economically viable rural tourism services by farmers.

2. Literature Review

Few economic approaches to identity issues have been undertaken. As pathfinders, Akerlof and Kranton [3,4,12] fully explored this issue by creating the term "Identity Economics" and verified that issues of identity gave new insights into economic approaches. According to Akerlof and Kranton [3], identity is defined as a person's sense of self in the social category to which a person belongs. Thus, identity influences how people behave and their decisions according to norms within their social category or according to their ideals. They also proposed the utility function in that identity is associated with each social category, which is named "identity utility". Identity utility increases when people behave in accordance with their identity, while the identity utility decreases when people do not behave within that identity. Akerlof and Kranton [12] introduced identity into the economics of education and provided insights into the behaviour of high school students rationally. Akerlof and Kranton [4] also applied identity to the economics of organization to raise motivation of employees. They further explored, by incorporating identity, issues between gender and the labour market and race issues related to work and minority poverty. From the perspective of economics and ethics, Sen [13] noted that identity sometimes leads people to narrow-minded behaviour with violence. On the other hand, Sen [13] also argued that norms and identity would mitigate violence if people accept multiplicity of identity, which presents deep insights into not only modern society but also the diversification issues of farm activity. Nevertheless, identity issues have not been extensively studied in relation to agriculture and tourism except for the report by Ohe [14], which was reviewed in this section below.

In agricultural economics, whereas there has been abundant literature on the evaluation of the relationship between managerial capability and efficiency, identity has not been considered as a crucial factor in the evaluation of efficiency (Cramer et al. [15]; Pingali and Evenson [16]; Drummond and Goodwin [17]). Regarding farm management, Olson [18] stated that cultural diversity should be considered in human resource management of labour because of the multi-ethnic character of hired workers, but it did not discuss the identity of farmers.

Identity has not been an uncommon topic in tourism research. Identity issues have been extensively studied primarily in connection with the fields of cultural and heritage tourism (Timothy and Boyd [19]; Baram and Rowan [20]; Richards and Munsters [21]). This is because identity is a crucial element of heritage (Timothy and Boyd [19]). Specifically, various levels of identity have been investigated: national identity (De Beus [22]; Palmer [23,24]), ethnic identity (MacCannell [25]; Kenny [26]), place identity (Uzzell [27]), and regional or local identity (OECD [28]). Further, Pritchard and Morgan [29] argued that destination branding is closely linked with the identity of the local community, which is the backbone of the authenticity of tourism goods and services provided in the local community (Jamal and Hill [30]). Despite this extensive interest in identity issues from cultural and heritage aspects, economic approaches, or management perspectives have not been fully assumed. Luo et al. [31] quantitatively investigated the moderating role of relational identity based on the leader-member exchange theory in the context of China's hotel industry, which did not include rural tourism that is mainly run by farm households.

The focus of the arena of tourism economics, which is a rapidly growing discipline in economics, has been widening as tourism and hospitality businesses grow (Dwyer and Forsyth [32]; Candela and Figini [33]; Stabler et al. [34]; Tribe [35]; Vanhove [36]). Although efficiency issues have been intensively discussed, as mentioned below, the relationship between managerial efficiency and identity is yet to be examined.

In rural tourism and agritourism areas, which have some similarities to cultural and heritage tourism, the rural cultural heritage is quite often discussed in relation to the local identity (Barbič [37]; George et al. [38]; Sznajder et al. [39]; Sidali et al. [1]; Macleod and Gillespie [40]; Kumbhar [41]). Since the rural cultural heritage is an essential factor in rural tourism and agritourism, it is natural that this aspect has been intensively focussed upon, which has contributed to progress of research in these fields. Regarding agritourism as a measure of farm diversification, Nickerson et al. [42] investigated the motivation of farmers from three aspects, social, economic, and external influences, by principal component analysis (PCA) and cluster analysis. Similarly, Ollenburg and Buckely [43] examined farmers' motivation to engage in agritourism in connection with lifestyles of farmers using principal component factor analysis. Nevertheless, none of these studies fully examined the linkage between a farmer's identity and diversification of farm activity toward tourism.

Studies on entrepreneurship were conducted on agritourism (Ainley [44]), rural tourism (Brooker and Joppe [45]), and nature-based tourism (Lundberg and Fredman [46]). Identity, however, has not been explicitly considered. Farm diversification issues have been studied from rural sociological perspectives; Barbieri and Mahoney [47] by PCA on motivations and Barberieri et al. [48] on the relationship between typology and attributes of farmers by regression analysis. Gil Arroyo et al. [49] examined stakeholders' perceptions of agritourism and Gao et al. [50] studied residents' preferences for the agricultural landscape that would be appealing for agritourism. Rural sociological studies often focussed on the identity of rural females from a gender perspective. Brandth [51] and Brandth and Haugen [52] investigated the identity of rural women from a gender perspective, in connection with farm diversification that included tourism activity. Brandth and Haugen [2] directly focussed upon identity changes among rural women caused by agritourism as a means of farm diversification. Di Domenico and Miller [53] examined self-conceptions of the identity of families, while confronting the need to diversify from traditional agricultural activities to starting a farm-based tourism business. From geographical perspectives, Telfer and Wall [54] pointed out the potential backward linkage on the relationship between agriculture and tourism. Torres and Momsen [55] investigated the synergetic relationships between tourism and agriculture from various international case studies. Nevertheless, these sociological and geographical studies did not address how farmers' different identities were associated with managerial efficiency.

As empirical methodology, data envelopment analysis (DEA) is well recognized in the evaluation of efficiency and productivity (Coelli et al. [56]). In particular, DEA has been quite widely employed for the evaluation of efficiency in various fields (Liu et al. [57]), and also has been extensively

used in tourism economics and agricultural economics. Reynolds [58] indicated that DEA allows for the hospitality industry to assess productivity and provides information on how to enhance it. Barros and colleagues conducted extensive studies on the tourism industry. Barros [10] and Barros and Mascarenhas [59] evaluated the efficiency of hotels in Portugal by DEA. Barros [11] also estimated the Malmquist index to evaluate efficiency of a small Portuguese hotel chain using DEA. Santos et al. [60] measured the efficiency of hotels in Luanda and Angola. Goncalves et al. [61] measured the technical efficiency of Moroccan travel agencies under the condition of *B*-convexity. Ohe and Peypoch [62] evaluated the technical efficiency of Japanese style accommodations (ryokans) with a Window DEA model. DEA has been continuously extended theoretically and applied empirically in the arena of agricultural economics. Chambers et al. [63] developed event-specific DEA. Chavas et al. [64] measured farm household production efficiency in Gambia. Wang et al. [65] and Li et al. [66] focussed on technical efficiency in China. Adhikari and Bjorndal [67] employed DEA and the stochastic distance function to study Nepalese agriculture. As to farm diversification, Davidova and Latruffe [68] estimated the technical efficiency of farms by DEA during a period of transition in the economy in the Czech Republic. Sipiläinen and Huhtala [69] derived shadow values of crop diversity in organic and conventional Finnish farms by DEA. Kim et al. [70] investigated the productivity of specialized and diversified rice farms in Korea, but tourism activity was not included in that analysis. Now, DEA models are applied to the environmental aspects of agriculture. Picazo-Tadeo et al. [71] assessed farming eco-efficiency in Spain, and Skevas et al. [72] measured technical efficiency in handling of pesticide spillovers in Dutch farming. Mendes et al. [73] applied DEA to agriculture mainly in South Europe and included papers that were focussed on rural tourism and dairy farming.

Educational tourism in agriculture has not been extensively addressed except for reports by Ohe [9,74,75]. These studies dealt with dairy farms' diversification toward EDFs from the perspective of internalization of the educational externality, but were not directly focussed on the identity of farmers. Ohe [14] evaluated the technical efficiency of milk production by incorporating the identity of farmers participating in the EDF program with a Stochastic Frontier Production Function. Nevertheless, only milk production was considered in the evaluation and the level of the educational activity was not counted as an output. This paper aims to further the development of research on the area of tourism and agriculture.

To summarize, to my knowledge, there has not been an exploration of farmers' identity and an evaluation of efficiency by using DEA with regard to farm diversification and rural/agri tourism. It is for this reason that I conducted this study.

3. Analytical Framework: Farm Diversification and a Farmer's Identity

From the hypothesis mentioned earlier, it is supposed that identity matters, especially when a farmer embarks on a new activity rather than continuing to engage in conventional farm activity. This is because when conducting a new activity, a farmer needs to redefine his or her mindset toward the new activities for efficient implementation. For instance, providing tourism services requires different perspectives from those of conventional agricultural production. In this regard, identity will be an effective concept to consider when a new diversified activity is being undertaken if we can verify that the efficiency will differ according to differences in identity.

Empirically, since identity is unobservable per se how can we tell which identity a farmer has? There are two ways to grasp identity: subjectively and objectively. Currently, it is common to ask farmers questions about their perception of themselves through interviews and to receive subjective responses. The advantage of this method is to find out what farmers have in mind under the assumption that their responses are honest. Nevertheless, this could be a disadvantage as well because each individual within the sample population must be questioned and those responses might be based on personal biases; at the very least, the questioner cannot escape from the possibility of such bias. On the other hand, the advantage of an objective grasp of identity is that the outcome of that identity can be easily observed through the individual's behaviour, which is quite observable and without

bias. When this objectively observed behaviour is used as a criterion, identity should be correctly reflected. A disadvantage of this method is that it must be carefully considered whether an observable behaviour is an appropriate reflection of identity, or a single behavior might be a reflection of more than a single identity. In keeping the pluses and minuses in mind, the author has selected the objective method because it is more operational from a policy perspective. Specifically, based on previous studies of EDFs (Ohe [9,14,74]), whether a farmer levies a service charge is an easily observable objective criterion to indicate a farmer's identity. Thus, we can use the behaviour of levying a charge in an empirical evaluation.

Here, to simplify the discussion based on previous studies by the author (Ohe [9,14,74,75]), two contrasting types of identity were pointed out that a farmer participating in the EDF program could have: traditional identity and enlarged identity (Ohe [14]). The author further developed this classification here. These two types are characterized in Table 1. The difference between the two identities is how a farmer treats the educational service. For those with the traditional identity, since the norm is that their main activity is farm production, their aim is to achieve efficient milk production to the best possible extent. With this norm, the educational service is just a voluntary rather than an economic activity. Thus, they offered the educational service without any charge. In contrast, in those with the enlarged identity, since the norm is that they should engage in multiple economically viable activities, it is natural that they ask visitors to pay for the educational service so that it may become a viable activity. Hence, their aim is to achieve overall managerial efficiency in farm resource allocation among multiple activities. This means that those with the enlarged identity will have a wider perspective toward farm diversification than those with the traditional identity. Ohe [75] statistically tested the charging behaviour of EDFs for educational services and found that those EDFs that charged were more diversified than those that did not charge. This fact supports our hypothesis.

Table 1. Farmer's identity and diversified activity.

Farmer's identity	Domain of activity (main activity)	Observable behaviour in the educational service
Traditional identity	Farm production activity	Does as a volunteer
Enlarged identity	Farm production & diversified activities	Levies service charge aiming at a viable service

Note: Author's classification

If the hypothesis is verified empirically, even if a policy framework promotes farm diversification, it is possible to say that efficient farm management will not be achieved unless a farmer's identity has become or is well adapted toward the enlarged identity.

4. Outline of the EDF Program

The history and a description of EDFs were previously reported by Ohe [7,8]; thus, only information on EDFs that is relevant to this study is provided here. The EDF program was established in 2000 by the Japan Dairy Council (JDC), which is a national organization supporting production and marketing by dairy farmers. This program aims at providing correct information on what dairy farms actually do so that the public will gain an understanding of the roles dairy farming play in society. As mentioned earlier, this educational aspect on the close connection between food and life makes livestock farming unique. Since a farmer's role is essential, a farmer is termed a facilitator in this program.

The JDC provides a course for those farmers who want to be facilitators for EDFs. Those farmers or farm employees are required to attend a course on principles, safety, hygiene, and communication skills, as well as a presentation of a case study that is provided by the JDC. The JDC issues certification for recognition as an EDF. Every three years, those participating as EDFs must attend a follow-up course to renew the certification and on capacity building. The EDF Promotion Committee is composed

of representatives of EDFs, school teachers, researchers, and dairy cooperatives with secretariat work by the JDC. There were 257 EDFs as of 2009 when we conducted our survey.

Table 2 shows trends of visitors to EDFs. As indicated from the table, the number of visitors has increased faster than the increase in the number of EDFs; a 4.08-fold increase in the number of visitors between 2003 and 2009, while the number of EDFs increased only 1.54 fold. These results indicate that the demand for EDFs has outpaced the supply increase. I assume that that this surging demand demonstrates an emerging business opportunity that dairy farmers can and should explore.

Table 2. Trend of no. of visitors and no. of Educational Dairy Farms (EDFs).

Year	First Period (April–September)	Second Period (October–March)	% Share in First Period	Total	No. EDFs	Average No. Visitors per Farm
2003	162,484	63,392	71.9	225,876	167	1353
2006	421,855	133,285	76.0	555,140	200	2776
2009	662,629	216,600	75.4	879,229	257	3421
2009/2003 ratio	4.08	3.42	1.05	3.89	1.54	2.53

Source: Japan Dairy Council.

5. Data and Variables

In keeping the above consideration on identity in mind, DEA is used for a simulation of how technical efficiency will vary when these farms maximize the two outputs as overall managerial efficiency according to whether or not farmers levy charges for educational services.

To collect data, a questionnaire survey of the entire group of 257 EDFs that existed across the country was jointly conducted by the author and the JDC from October to December in 2009 by postal mail, with a supplementary survey subsequently made by telephone. The response rate was 79.4% (204 farms). Since there are various types of ranches designated as EDFs, we excluded EDFs run by publicly or privately owned ranches, ranches run by educational institutions or cooperatives, etc from the survey. This is because these ranches have different principles and aims; they are not necessarily oriented toward maximizing the profitability of milk production, as are ordinary family farms. For this reason, the sample size actually used for the empirical evaluation was 123 family farms to keep the homogeneity of the sample. These 123 EDFs produce milk and also provide educational services.

6. Educational Service and Pricing

EDFs offer educational services that visitors can only experience in the farm yard, which can be classified into two types: farm operation experiences and food/rural cultural experiences. In a usual case, a facilitator gives a lecture to visitors at the beginning of the visit. The farm operation experiences consist of allowing visitors to perform tasks that are part of ordinary dairy farm operations. The three major experiences of this kind are milking cows, feeding the animals, and giving bottles to calves. Farmers can easily provide these experiences; as to them, they are routine daily chores. Perhaps this ease of provision is why the percentages of those EDFs that levy service charges are not high (Table 3). Farmers do not think that these services are special enough to warrant collecting fees. This attitude is also a reflection of the traditional modest rural mentality regarding monetary issues.

The second category, food/rural cultural experiences, is less popular than the first category. Making butter and ice cream are the two most common programs offered. The reason that this category is less frequently offered by farmers is simply because they must prepare materials for such programs. The percentage of EDFs that levy a charge is higher than in the first category. This is partly because farmers need to recover the cost of materials and this category is more oriented toward leisure activities, which makes farmers' decision to levy charges easier. As individual experience services per se were not sufficiently viable, a combination of these services was often offered, such as the combination of milking and butter making. In that case, the percentage of EDFs levying charges was much higher with much higher prices as indicated in Table 3. Thus, providing combined services is effective in raising the viability of this educational activity and resulting in greater educational effects (Ohe [14]).

Table 3. Offered educational dairy farm services.

Type	Menu	Service Provision % Farms	Levying Service Charge % Farms	Mean Price: Yen
Farm-operation experiences	Lecture by farmer	93.7	33.1	590
	Tour of farmyard	89.9	22.6	416
	Milking	77.8	56.9	681
	Feeding	77.2	39.4	381
	Giving bottle to calves	74.1	43.6	471
	Cleaning barn	58.2	26.1	433
	Brushing animals	48.7	33.9	404
	Field work	36.1	26.3	663
Food/rural cultural experiences	Butter making	62.7	75.8	503
	Ice cream making	23.4	73.1	712
	Cheese making	17.7	75.1	983
	Horseback riding	12.0	63.3	2229
	Ham/sausage making	3.8	100.0	1938
	Cutting sheep wool	5.1	49.0	543
Combined experiences	type 1	47.5	83.8	1370
	type 2	23.6	93.2	1493
	type 3	11.4	93.0	1329
	type 4	2.4	66.7	1033
	type 5	0.8	100.0	1500

Source: 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.

7. Variables for the DEA Model

DEA models need input and output data. As inputs, three input variables were considered as three basic production factors; acreage in feed production as land, the number of milk cows as capital, and labour input as labour, all of which were obtained from the survey. The labour input variables represent real term labour input, which was calibrated by taking into account the contribution of labour inputs for milk production and educational activities, respectively; full-time and main responsibility = 1, full time and sub-responsibility or part-time and main responsibility = 0.5, and part-time sub-responsibility = 0.25.

As an output variable, annual milk production was used based on the survey and on information provided by the JDC for 2009. Nevertheless, since data on 2009 production were missing for 23 farms, the researcher confirmed with local cooperatives that milk production by these farms did not differ in a major way between 2008 and 2009, so the missing 2009 data from 23 farms were replaced by available 2008 data. However, since two-year data were not complete enough to form panel data, we did not use panel data due to the deficiencies of some of the samples. To identify possible bias in this combined data statistically, the author conducted a statistical t test on the differences in milk production according to 2009 data that had been partially supplemented with 2008 data and that with available 2009 data with no such supplementation. No statistically significant difference was found in either result, which allowed the use of 2009 data that were partially supplemented with 2008 data. Descriptive statistics of data used for evaluation are summarized in Table 4. The identity dummy variable, i.e., levying charges = 1, not levying = 0, is shown in Table 5, which shows that those who levy charges and those who do not are roughly equal. Due to data constraints, input data or efforts expended on the educational services were not available and output variables were assumed to have the same quality among EDFs.

Table 4. 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	Labour input for educational services (real term)	2.07	1.25	1.00	11.50
Output1	Amount of milk production in 2009 milk year (t)	472.6	362.8	1.9	2247.0
Output2-1	No. visitors in 2009 fiscal year	1127.1	4277.0	0	35389
Output2-2	Estimated revenue according to the minimum price (thousand yen)	830.3	5124.8	0	55,700
Output2-3	Estimated revenue according to the maximum price (thousand yen)	2397.7	17,000.0	0	186,000

Source: Table 3 and data on milk production and the number of visitors were obtained from the Japan Dairy Council.

Note: Refer to the text about the calibration methods of milk production and real term labour input.

Table 5. Identity dummy variable of levying service charge.

Variables	Yes	No	Total
Levying service charge (yes = 1, no = 0)	59 (48.0)	64 (52.0)	123 (100.0)

Source: Same as in Table 3. Note: Upper figure represents sample size and the lower figure in parentheses is %.

8. Simulation of Managerial Efficiency by DEA

8.1. DEA Model

The DEA model is taken to evaluate the overall managerial efficiency of EDFs. Since the educational service has not become a clearly established market good, DEA as a non-parametric method that is suitable for the 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, either for milk production and educational service, 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.

To simulate a viable economic service, three different output variables of the educational services were used. 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.

A free-of-charge service was treated as having a zero price. The revenue was calculated according to the number of visitors multiplied 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.

The identity variable, i.e., levying a service charge = 1, not levying = 0, was used to examine whether this variable causes a difference in managerial efficiency in this two-sector model. Specifically, the model used here was the slacks-based measure, SBM, which minimizes the slacks of each input and/or output (Cooper et al. [76]; Briec and Peypoch [77]).

This is because there are still unused farm resources for the educational services, making it necessary to minimize these slacks and to realize rational utilization and mobilization of farm resources for farm diversification. In this respect, 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

(proportional) model. A radial model considers linear production relations, which has both advantages and disadvantages. While the advantage is that it is simple to handle, the disadvantage is that it cannot consider non-zero slack, which often happens in reality. Figure 1 illustrates this issue, which represents an efficiency frontier with two outputs, q_1 and q_2 . On the efficiency frontier, every point attains the maximum efficiency score, which is unity. When a dairy farm is located in P , which is under the frontier, it means that it has output slack (shortage). In a radial model, the output can be expanded on the OP' line up to P' . Nevertheless, there is still output slack $P'A$ because on the segment $P'A$ that farm can increase the output of q_1 without a decrease in output level of q_2 up to A . To overcome this drawback, the SBM model was proposed by Tone [78] as a non-radial model. The author understands that farm diversification is an activity that activates slacks of farm resources, so that the output-oriented SBM model is one of the most suitable methodologies to evaluate the managerial efficiency of diversified dairy farms with educational tourism.

With respect to the return to scale, like radial models, the SBM model has constant returns-to-scale (CRS) and variable returns-to-scale (VRS) models. When there are n Decision Making Units (DMUs), or EDFs in this case, for efficiency evaluation, the output oriented SBM CRS model that evaluates the efficiency of DMU_o ($o = 1, \dots, n$) is given below (Cooper et al. [76]; author revised from p. 105).

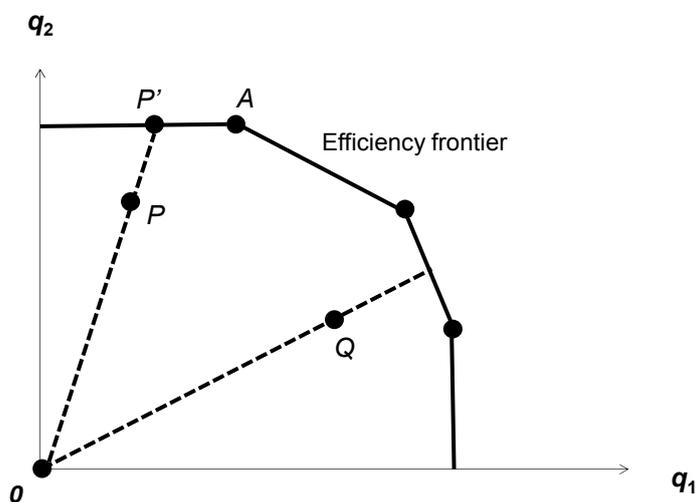


Figure 1. Output Slack (Two-Output Case). Source: Author’s alternation from Coelli et al [56] (p. 181).

$$\rho_o = \min_{\lambda, s^+} \frac{1}{1 + \frac{1}{s} \sum_{\gamma=1}^s s_{\gamma}^+ / y_{\gamma o}} \tag{1}$$

$$\text{subject to } x_o \geq X \lambda \tag{2}$$

$$y_o = Y \lambda - s^+ \tag{3}$$

$$\lambda \geq 0, s^+ \geq 0. \tag{4}$$

The output oriented SBM VRS model imposes another constraint, which is the convexity condition of the efficiency frontier.

$$e \lambda = 1 \tag{5}$$

where,

ρ_o : the efficiency value of DMU_o by the output oriented SBM model

λ : non-negative vector

s^+ : output slack vector meaning output shortfalls

x_o : input vector

y_o : output vector

X : input matrix

Y : output matrix

e : row vector with all elements unity.

If $\rho_o = 1$, then it means there is no output slack, i.e., $s^+ = 0$. Output oriented SBM model aims at minimization of the slacks. SBM models with these two types of return to scale are employed for empirical efficiency evaluation. Sample size was 123 family farms.

8.2. Results of the Evaluation

Results of the evaluation are shown in Table 6, which provides efficiency scores as well as efficiency ranks according to differences in identity, i.e., the service charge levied or not and statistical test results. Rank was statistically tested by the Mann-Whitney test and the scores by t tests.

Table 6. Results of evaluation of overall managerial efficiency of Educational Dairy Farms by data envelopment analysis.

Model	Economy of Scale	Output1	Output2	Levies charge for educational services					
				Efficiency score			Efficiency rank		
				Yes (59)	No (64)	Test result	Yes (59)	No (64)	Test result
SBM	Constant	Milk production	No. visitors for educational services	0.1914	0.1911	nsN	3151	4475	**
SBM	Variable	Milk production	No. visitors for educational services	0.3766	0.3129	nsE	3260	4366	**
SBM	Constant	Milk production	Estimated revenue according to the minimum price	0.2281	0.1719	nsE	2844	4782	***
SBM	Variable	Milk production	Estimated revenue according to the maximum price	0.3907	0.2864	+E	3005	4621	***
SBM	Constant	Milk production	Estimated revenue according to the minimum price	0.1584	0.0677	*E	2556	5070	***
SBM	Variable	Milk production	Estimated revenue according to the maximum price	0.2974	0.1609	*E	2778	4848	***

Source: Same as for Table 3 efficiency rank. ***, **, *, + indicate 1%, 5%, 10%, and 20% (as reference) significance, respectively. E = equal variance and N = not equal variance.

The commonly observable fact among these results is that the average efficiency scores are all low because the maximum efficiency score could be unity if all of the farms attained the highest efficiency. Nevertheless, the maximum efficiency score in the charging case was only 0.3907 and the minimum was 0.1584, which is far below unity. This is probably because in reality there is a large variance in the number of visitors from one farm to another. There was no statistically significant difference between the CRS and VRS models, which means that the existence of economy of scale was not confirmed in this two-output model. This suggests that diversified activity of this kind is not limited to large- or small-scale farms.

Table 6 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 a higher managerial efficiency with no connection with farm size.

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 to be efficient 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 the 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 of the two outputs has the nature of service production. In this context, these results suggest that even small farms can sustain themselves without increases in milk production through viable educational services.

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.

9. Conclusions

This paper investigated how a farmer's identity is associated with managerial efficiency, a relationship that has not been fully investigated despite its importance for the sustainable development of tourism activity in the farm sector. For this purpose, the author focussed on EDFs, which is an emerging educational tourism activity in agriculture. The main points clarified in the paper are as follows:

- (1) This research tested the hypothesis that a farmer's identity is related to different resource management skills and styles in operating diversified dairy farms that conduct educational tourism based on consideration of the relationship between a farmer's identity, either the traditional or enlarged identity, and diversified activity.
- (2) Empirically, we tested this hypothesis by DEA model simulation. The results of the simulation of two outputs, milk production and educational service activities, using the DEA model revealed that those farms that charged for educational services realized relatively higher managerial efficiency regardless of farm size. This result showed 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 exhibited different behaviours to maximize efficiency than those with the traditional identity.
- (3) Nevertheless, the differences in efficiency scores between those farms charging and not charging fees were not large. Further, the average efficiency scores for both types of farms were not sufficiently high 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 before a viable educational tourism farm activity can be realized.
- (4) Consequently, the perspective of the support measures for capacity building should be widened to include identity issues, which would help farmers widen their identity to enable them to more efficiently enter into a new activity such as tourism activity.
- (5) Finally, this study had some limitations. First, the DEA model used physical terms and calculated revenue for output evaluation rather than actual monetary outcomes. Real revenue would be more suitable. Input variables for the educational services also should be considered. Second, further consideration should be given to the possibility of exploring a more appropriate observable indicator. Third, the process of identity formation and factors and experiences that influenced the formation of a particular identity were not addressed. Fourth, causality between

identity and managerial efficiency remains to be clarified. Fifth, the quality of the educational service should be considered. Therefore, further theoretical and empirical investigations are necessary on the relationship between farmer's identity and tourism activity.

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