Journal of Rural and Community Development

Using Data Envelopment Analysis to Measure and Benchmark the Efficiency of Small-scale Tourism Farms in South Korea

Authors: Hyungsuk Choo, Young-Hyo Ahn, & Duk-Byeong Park

Citation:
Choo, H., Ahn, Y.-H., & Park, D.-B. (2018) Using data envelopment analysis to measure and benchmark the efficiency of small-scale tourism farms in South Korea. *The Journal of Rural and Community Development*, *13*(2), 1–15.

Publisher:
Rural Development Institute, Brandon University.

Editor:
Dr. Doug Ramsey

ISSN: 1712-8277 © Journal of Rural and Community Development
www.jrcd.ca

Using the Data Envelopment Analysis to Measure and Benchmark the Efficiency of Small-scale Tourism Farms in South Korea

Hyungsuk Choo
Bowling Green State University
Bowling Green, OH, USA
hchoo@bgsu.edu

Young-Hyo Ahn
Incheon National University
Incheaon, South Korea
yhahn@incheon.ac.kr

Duk-Byeong Park
Kongju National University
Gongju, South Korea
parkdb84@kongju.ac.kr

Abstract

Although economic viability and low productivity of small-scale tourism farms have been a major concern, there is no information on the economic analysis, including efficiency, of this sector. This exploratory case study aims to demonstrate the value of Data Envelopment Analysis for assessing and benchmarking the efficiency of small-scale tourism farms. Using the case study of 196 small-scale tourism farms in South Korea, the result of analysis indicates that the technical efficiency score is equal to 39.3% and the mean output increase amounting to 60.7%. Most tourism farms (76.0%, 149) were found to be inefficient, indicating an efficiency score lower than .5. The dominant source of inefficiency was found to result from pure technical efficiency involving managerial skills while the scale efficiency of Korean tourism farms has reached a certain level. Implications for farm tourism operators and researchers and directions for future research are discussed.

Keywords: tourism farms; agritourism; efficiency; data envelopment analysis (DEA)

1.0 Introduction

As more and more small-scale farms struggle to remain in their primary farming practice due to decreased farm income, diversification into additional economic activities has been common locally and globally. Among these, tourism is one of the most frequently adopted strategies that many farmers have chosen (Lane & Kastenholz, 2015). Tourism on the farm has been considered a viable means of achieving economic and social re-development due to the unique benefits to tourists and consumers, including enjoyment of farming nature, learning agricultural practice and food, and purchase of locally grown products (Arroyo, Barbieri, & Rich, 2013). Over the past few decades, this type of tourism, called farm tourism (Capriello, Mason, Davis, & Crotts, 2013), farm-based tourism (Park, Doh, & Kim, 2014), agricultural tourism (Veeck, Hallett, Che, & Veeck, 2016), or agritourism (Arroyo et al., 2013)—hereafter farm tourism—has dramatically increased in numbers in many rural regions of the world. Farm tourism generally hosts a small number of tourists for tourism activities and farming nature and culture are primary resources for tourism activities on the farm which do not require extensive development of infrastructure. For these reasons, farm tourism has received attention with respect to its sustainability potential (Choo & Jamal, 2009).

Despite the support received from both supply and demand sides and their sustainability potential, tourism farms (Meraner, Heijman, Kuhlman, & Finger, 2015; Park et al., 2014; Võsu & Kaaristo, 2009) are often vulnerable to market failure (Busby & Rendle, 2000). They are generally characterized by small and/or family-operated businesses in a relatively remote location, a low capital base, and functions with low-level skills and little experience. Accordingly, the challenge of how to sustain the operation and competition exists among small-scale tourism farms. While it is evident that the primary goal of diversification into tourism can be found in the economic outcomes, there is lack of information on those, including the efficiency of tourism farms. The efficiency of tourism farms is considered to be a critical component that can assist them in their strategies to become economically successful. Benchmarking tourism farms for efficiency is also valuable for farmers who plan to launch tourism activities on their farms.

The purpose of this exploratory case study is to propose Data Envelopment Analysis (hereafter DEA) as an effective tool to measure the efficiency of small-scale tourism farms and to identify the causes of inefficiency. By identifying the efficient small-scale tourism farm in a sample, the slacks in inputs and outputs of inefficient farm tourism and the peer group of efficient farm tourism, the DEA stands out as one of the most promising techniques to aid the decision making of efficiency. Benchmarking has not received much attention in farm tourism literature because of lack of appropriate methodological tools to aid the benchmarking process. This paper intends to fill this gap in research and suggests a rigorous quantitative approach to benchmarking the efficiency of farm tourism sector. Drawing on the survey data from a case study of small-scale tourism farms in South Korea, the result of analysis shows that DEA was found to be useful in evaluating the efficiency of the farm tourism sector in South Korea where small-scale operations are predominant. DEA successfully aids in evaluating the relative efficiency scores of 196 tourism farms collectively and individually as well as in providing the best performing units to be benchmarked against.

2.0 Literature Review

2.1 Development of Farm Tourism in South Korea

Korean agriculture has experienced a decline of traditional agriculture resulting from socio-economic problems such as loss of farming income, aging and decreased rural population, increase of farming cost, and so on (Park & Yoon, 2009). In response, traditional agriculture economy has been increasingly replaced by the multifunctional economy where additional land use creates goods that are co-produced as by-products of agricultural production (Jongeneel, Polman, & Slangen, 2008). Agriculture in the multifunctional land use paradigm has been shown to contribute to various functions of land use, such as an ecological function, cultural heritage presentation–preservation, rural settlement, food security, and a recreation function (Sakamoto, Choi, & Burmeister, 2007). Tourism activity on the farm has also been commonly recognized particularly for its potential for achieving multiple functions among those listed above. Meanwhile, higher incomes (Barbieri, 2013), more free time, and greater mobility (Reynolds, 2007) in the consumer market have increased demand for wildlife, landscape, leisure, and outdoor recreation in the rural farming area. As in many rural farming areas adopting tourism, there is a wide and innovative set of agricultural and rural products and services available to the traveling public in Korea. Examples include various activity–experience programs (e.g., pick-your-own program), farm stay, food–restaurant, agricultural festivals & special events, the celebration of historic and heritage sites, agricultural travel routes that feature themes, and so on.

Since the development of the first 12 government-supported groups of farm tourism communities in 1984, the number of farms with tourism has been expanded into more than 1,700 groups of communities as of 2012 (Park, Kim, Kwon, & Ryu, 2012), most of which are now independent with no government support. Rural farming areas have become popular destinations mostly among Koreans, but also increasingly among international tourists. While farm tourism is still only a minority tourism market, almost one fourth of the Korean population has now experienced this type of tourism (Hwang & Lee, 2015). Different from a slight decline in the domestic travel market size in the last decade, both travel miles and frequency of rural travel have been constantly increased between 2002 and 2011. A recent report about agritourism in South Korea (Agritourism Trend, Policy, and Future direction, 2013) shows that more than one half of tourists visit rural farms for one night stay. Average travel party was 4.2 persons per group and its spending was 310,346 Korean Won per trip except the transportation cost. As the market revenue of this sector has reached up to 3,000 billion Korean Won in 2012, a majority of tourism farms have also reported increases in revenue and their number of visitors. With the positive growth of market size and demand, the competition among tourism farms has also been intensified. In the early years of farm tourism business, the main objective was to be well known and sold; however, recent increased competition has recognized the importance of efficiency of the operation to be competitive in the market (Veeck, Che, & Veeck, 2006).

Tourism farms often hold their own uniqueness and distinctiveness in the type of their tourism activities. In addition to a diversity of tourism activities offered at each tourism farm, the size, number of employees, and so on, although mostly small, are also dissimilar. The operational information should thus be a vital component of their management (Andersen & Petersen, 1993) to achieve operational improvement or adopt the best-practice approach.

2.2 The Importance of Efficiency and Data Envelopment Analysis (DEA)

Efficiency, along with effectiveness, is a central term in assessing and measuring performance, which is a necessary condition for the competitive advantage of organizations. Operations scholars generally suggest performance be defined as an appropriate combination of efficiency and effectiveness. Although there seems to be inconsistency in the use of these two terms in the literature (Keh, Chu, & Xu, 2006), they are mutually exclusive. While the concept of efficiency fundamentally deals with the allocation of resources across alternative uses, effectiveness assesses the ability of an organization to attain its pre-determined goal. Drucker (1977) keenly distinguishes efficiency and effectiveness by associating efficiency with 'doing things right' and effectiveness with 'doing the right things'. In his terminology, a measure of efficiency assesses the ability of an organization to attain the output(s) with the minimum level of inputs. It is not a measure of a success in the marketplace but a measure of operational excellence in the resource utilization process. Efficiency can be accordingly used as the reference in decision-making, basis of any improvement, and benchmark of the resource allocation.

Some efficiency scholars adopt DEA as an appropriate method for measuring service efficiency in the tourism–hospitality industry (Barros, 2005b; Wöber, 2007). DEA, as introduced by Charnes, Cooper, and Rhodes (1978) and expanded by Banker, Charnes, and Cooper (1984), is a nonparametric, linear programming procedure to envelop observed input–output vectors which can measure the efficiency of decision making units. It builds an efficient frontier that represents the minimum resources necessary for an organization to achieve at a given level of output, or the maximum output expansion at a given level of input resource. DEA allows multiple inputs–outputs to be considered at the same time without any assumption on data distribution. In each case, efficiency is measured in terms of a proportional change in inputs or outputs, meaning that efficiency of decision making units is subject to analysis in relation to each other. DEA provides some conceptual and practical advantages in that it overcomes the complexity arising from the lack of a common scale of measurement. DEA also avoids the analysis from subjective estimates due to the objective estimates stemming from weighting variables during the optimization procedure (Assaf, Barros, & Josiassen, 2010). Therefore, DEA has been widely recognized as an effective technique for measuring the relative efficiency of a set of decision making units. Among different versions of DEA models, Charnes et al., (1978) originally proposed that the efficiency of decision making units can be obtained as the maximum of the ratio of outputs to inputs. It is called the CCR model after its developers. The result of CCR model analysis is an integrated efficiency valued called technical efficiency (TE). The envelopment in CCR is constant returns to scale, meaning that a proportional increase in inputs results in a proportionate increase in outputs. The formula of efficiency score in the CCR can be found:

$$\text{Max} \frac{\sum_{r=1}^{n} (u_{rb})(y_{rb})}{\sum_{k=1}^{m} (v_{kb})(x_{kb})}$$

Subject to:

$$\frac{\sum_{r=1}^{n} (u_{rb})\left(y_{rj}\right)}{\sum_{k=1}^{m} (v_{kb})\left(x_{kj}\right)} \leq 1 \quad \text{for all } j$$

$$u_{rb}, v_{kb} \geq \varepsilon \ \text{ for all } r, k$$

y_{rj}= the vector of output r produced by unit j

x_{kj}= the vector of output *k* produced by unit *j*
u_r = the weight given to output *r by the base unit b*
v_i = the weight given to input *I by the base unit b*
j = the number of DMUs
r = the number of outputs
k = the number of inputs
ε = a small positive number

On the other hand, Banker et al. (1984) developed the BCC model, also named after its developers, to estimate the pure technical efficiency (PTE) of decision making units, assuming variable returns to scale, under which the production possibility set is the convex combinations of the observed units. The economic scale of a decision making unit can be evaluated in three ways. The decision-making unit can be evaluated as operating at its optimal scale, that is, constant returns to scale (CRS) which suggests its operating scale should remain unchanged. Otherwise, the operating scale should downsize or expand, and these can be identified as declining returns to scale (DRS), and increasing returns to scale (IRS), respectively. The BCC model and its efficiency score are shown in the formula as follows:

$$\underset{u,v,\omega}{\text{Max}}\, \theta_b = \sum_{r=1}^{s} u_r\left(y_{rjb}\right) + \omega$$

Subject to:

$$\sum_{i=1}^{m} v_i\left(x_{ijb}\right) = 1$$

$$\sum_{r=1}^{s} u_r\left(y_{rj}\right) - \sum_{i=1}^{m} v_i\left(x_{ij}\right) + \omega \leq 0$$

$$u_r \geq \varepsilon$$

$$v_i \geq \varepsilon$$

r = 1, 2, 3, …., s,

i = 1, 2, 3, …., m,

j = 1, 2, 3, …., n,

ω = free

It is worth noting the relationship between TE and PTE scores calculated from CCR and BCC models. The CCR model assumes a radial expansion and reduction of all observed decision-making units—and their nonnegative combinations—are possible; while the BCC model only accepts the convex combinations of the decision-making units as the production possibility set. If a decision-making unit is fully (100%) efficient in both the CCR and BCC scores, it is operating at the most productive scale size. If a decision-making unit has the full BCC score, but a low

CCR score, then it is locally efficient but not globally efficient due to its scale size (Sarıca & Or, 2007). Thus, it is reasonable to characterize the scale efficiency (SE) of a decision-making unit, which measures whether a decision-making unit is operating at its optimal size, by the ratio of the two scores (Appa & Yue, 1999). Understanding the relationship among TE, PTE, and SE enables researchers to find whether the cause of inefficiency is from PTE or SE. In essence, TE can never be larger than PTE and SE and is measured by the ratio of efficiency of CCR to efficiency of BCC in the following.

$$SE = \frac{\theta^*_{CCR}}{\theta^*_{BCC}}$$

θ^*_{CCR} is less than or equal to θ^*_{BCC}, so SE is less than 1.

2.3 Empirical Research of Efficiency in the Tourism and Hospitality Literature

We found a relatively limited amount of tourism and hospitality literature on efficiency. Some of earlier studies examined efficiency using yield management (Brotherton & Mooney, 1992; Donaghy, McMahon, & McDowell, 1995), break-even analysis (Wijeyesinghe, 1993) and the performance ratio (Baker & Riley, 1994). According to Anderson et al. (1993) and Morey and Dittman (1995), hotel efficiency scores are higher than those in other industries, such as banking and insurance. In order to consider multiple inputs and outputs, some researchers have applied new methods, including DEA. Hotel efficiency studies adopting DEA have been conducted for different types of hotels in different regions. Some notable examples include: (a) studies of 15 United Kingdom hotel chains (Johns, Howcroft, & Drake, 1997); (b) Taiwanese international tourist hotels (Hwang & Chang, 2003; Tsaur, 2001); (c) small- and medium-sized hotels in Austria (Wober, 2000); (d) hotel Internet strategy in Greece (Sigala, 2003); and (e) Portuguese state-owned, intra-chain hotels (Barros, 2005a). Recently, progress has been made in the methodology of DEA. Huang, Mesak, Hsu, & Qu (2012) introduced a two-stage dynamic approach involving both DEA and Tobit models for Chinese hotels at the national level. Additionally, Assaf et al. (2010) recognized the importance of the meta-frontier which allows assessment of the efficiency of hotel groups under different environments, for example, sizes, locations, ownership and so on.

3.0 DEA Model Development

3.1 Data Collection

The data for this study were obtained from 357 farms whose tourism businesses were officially supported by the Rural Development Administration under the Ministry of Agriculture, South Korea. After removing 82 farms which had not engaged in tourism more than one year, 275 farms were targeted for the survey. The survey questionnaire was sent to each farm tourism operator via email, followed by site visitation for operators with no email response. Rural Development Administration researchers' relationships with farm tourism operators, preliminary phone calls to each of those, and incentives, including Rural Development Administration rural tourism business guidebooks, were very helpful in achieving a high response rate of 88% of 242 returned questionnaires. Among these, 196 tourism farms were retained for analysis after the removal of 46 having insufficient and missing information required for this study.

3.2 Profile of the Respondents

These farms are located in Gyeonggi Province (46 farms), Kangwon Province (42 farms), Gyeongsangnam Province (34 farms), Junrabuk Province (27 farms), and Gyeongsangbuk Province (19 farms) in Korea (see Table 1 and Figure 1). Four other Provinces in Korea have 28 farms. The primary age group of the respondents was 50–59 (40.8%), followed by 40–49 (35.7%). The respondents aged 20–39 composed of 14.8% of the sample, and 8.7% of the respondents were at least 60 years old. Of the respondents, a majority (57.7%) were male. The average years in agriculture is 12, while operators have engaged in tourism activities for 2.6 years.

Table 1: *Demographic Characteristics of 196 Tourism Farms*

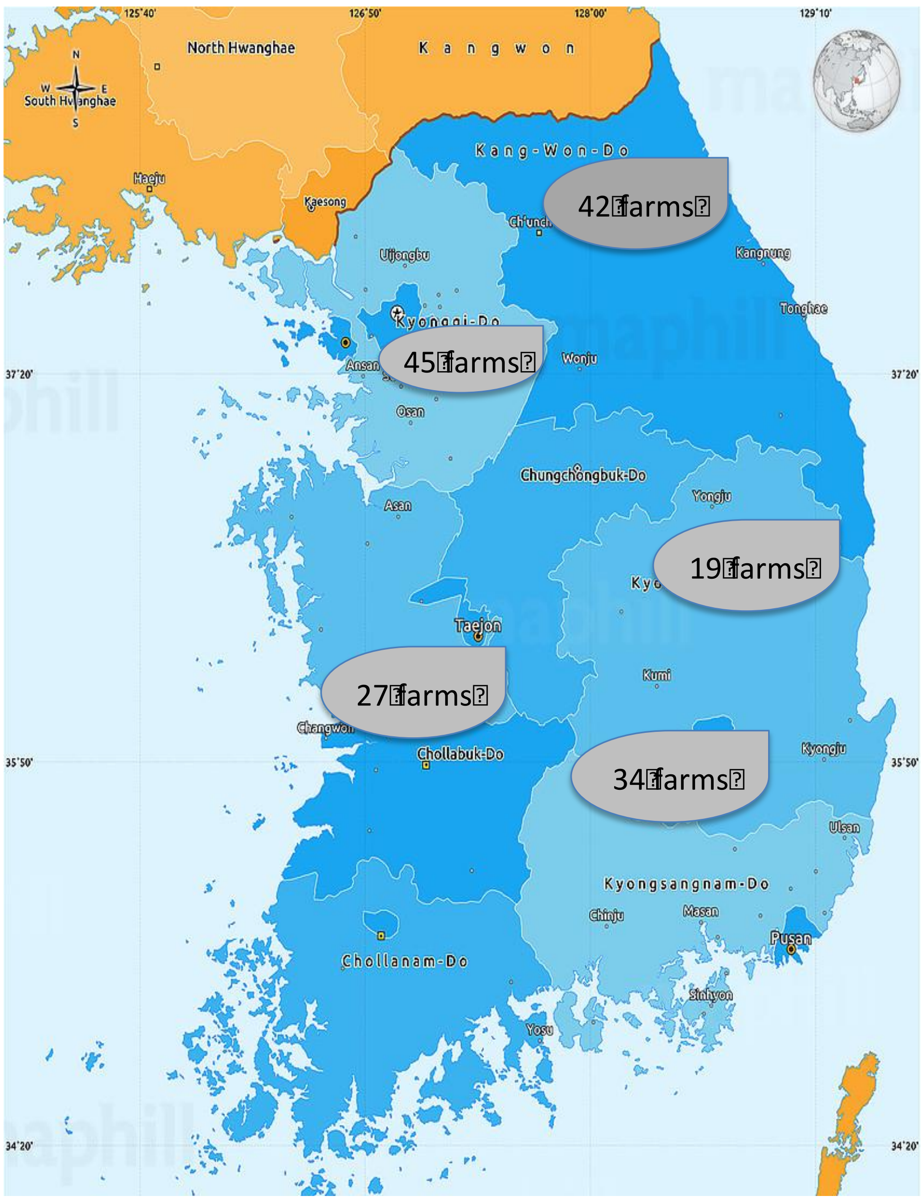
Demographic characteristics		**Frequency (%)**
Gender	Male	113 (57.7)
	Female	83 (42.3)
Education	Elementary	38 (19.4)
	Middle school	61 (31.1)
	High school	70 (35.7)
	College	24 (12.2)
	Post graduate work started/completed	3 (1.5)
Types of Tourism activities	Farm stay	48 (24.4)
	Activity/experience program	50 (25.4)
	Food/restaurant	29 (14.5)
	Farm stand/product sales	54 (27.0)
	Others	12 (6.2)
	No involvement	5 (2.5)
Location (Province)	Gyeonggi-Do	46 (23.5)
	Kangwon-Do	42 (21.4)
	Gyeongsangnam-Do	34 (17.3)
	Junrabuk-Do	27 (13.8)
	Gyeongsangbuk-DO	19 (9.7)
	Others	28 (14.3)
Age	20–29	8 (4.1)
	30–39	21(10.7)
	40–49	70 (35.7)
	50–59	80 (40.8)
	60+	17 (8.7)

3.3 Data Envelopment Analysis (DEA) Application

In the DEA models, the input orientation model searches for input minimization from a linear combination of decision making units identifying the output shortfall and the input overconsumption while the output orientation model finds output maximization. Tourism farms generally tend to seek more outputs from current inputs, so analysis of increasing outputs may be more appropriate than that of decreasing the given inputs. Therefore, this study selected the output-oriented model. Both CCR and BCC models were adopted to produce TE, PTE, and SE simultaneously.

As suggested by Anderson and Peterson (1993), identification of the inputs and outputs involved literature reviews and distinction between controllable and uncontrollable factors which resulted in a total of five indicators in the survey study. Investment money, the number of full-/part-time employees, and the number of rooms are used for input indicators, while the number of tourists and annual income from tourism business are two output indicators (see Table 2). The observation and variables used in the analysis ensure that the minimum number of decision making units is greater than three times the number of inputs plus output (196 > 3* (3+2)) (Raab & Lichty, 2002) .

Figure 1. Location of 196 tourism farms.



Source: http://www.maphill.com/korea-south/

Table 2: *Descriptive Statics of Input and Output Indicators Among 196 Tourism Farms*

	Input			**Output**	
	Investment ($)	*# of full-/part-time employees*	*# of rooms*	*# of tourists*	*Annual income ($)*
Max	8,636	75	25	60,000	5,909
Min	14	0	0	7	5
Mean	1,082	3	4	4,553	461
Standard Deviation	1,451	6	3	9,615	859

*Investment and annual income were converted at the exchange rate of $1.00 = 1100 Korean Won.

4.0 Results of Analysis

Table 2 displays the descriptive statistics of input and output indicators. Tourism farms have the average number of 3 full-/part-time employees and 4 rooms. Their average annual sales and the number of tourists are $507 and 4,553, respectively. The high standard deviation of investment, number of tourists, and annual income indicated a substantial variation in the form, size, and performance of each tourism farm.

An output-oriented CCR model was primarily evaluated under the assumption that tourism farms aim to maximize their revenues and the number of tourists. Summary of analysis using 5 indicators identified obtained the efficiency score among 196 tourism farms shown in the Table 3. A tourism farm is output-oriented efficient if it is impossible to increase any of output levels without lowering at least one of the other output levels and/or without increasing at least one of input levels. The mean TE score of 39.3% obtained from CCR model (see Table 3) shows that Korean tourism farms could operate on the average at 39.3% of their current output level and maintain the input level. In other words, tourism farms could increase 60.7% of current output while holding the level of input constant. At the level of individual tourism farms (see Table 4), the interpretation of the efficiency score for each tourism farm, similar to one provided to the collection of tourism farms analyzed, is clear. For example, the score 42.9% for Tourism farm 8 indicates that this tourism farm is 57.1% inefficient. That is, as compared to tourism farms of the efficient reference set, it is possible to increase the output, by at least 57.1% while maintaining the same level input factors. As shown in Table 4, a majority of tourism farms—76.0%, 149 farms—were found to have the TE efficiency score lower than 0.5. In contrast, there were a total of 12 tourism farms obtaining the score of ‘1’ for all of TE, PTE and SE.

The mean TE score, along with 43.7% of PTE mean score in BCC model, was found to be much lower than that of other tourism sectors (Wöber, 2007). The SE score of 90.9% indicates the efficiency of tourism farms has reached a certain scale, correspondingly implying that the dominant source of overall low efficiency resulted from low PTE score. Further analysis was conducted to examine the association between PTE and SE in the quadrant graph of 196 tourism farms. As shown in Figure 2, the highest number of tourism farms were found in the high SE and low PTE quadrant and the second highest number of tourism farms were in the high SE and high PTE quadrant.

Table 4 also exhibits the result of return to scale analysis identified by the BCC model: IRS, CRS, and DRS. A majority of tourism farms—54.6% or 107 tourism farms—were found to have IRS. On the contrary, only 15 (7.7%) of tourism farms are in DRS, so the rest of 74 (37.8%) tourism farms are thus in CRS. This finding suggests that most tourism farms need to increase the overall size of their business because most tourism farms could be able to proportionally increase outputs by increasing inputs.

Along with the score of TE, PTE, and SE for individual tourism farms, information on relative benchmarks and suggested projections of each input and output indicators are shown in Table 4. We found 17 benchmark tourism farms with 12 of those having the score '1' of both TE and PTE and 5 of those having the score '1' for PTE. Among those, tourism farm 134 was the most frequently referenced tourism farm. In addition to the list of benchmark farms identified for each tourism farm, detailed information can be found from suggested projections of each input and output.

Table 3: *Summary of Efficiency Score*

	CCR	BCC	SE
Mean	0.393	0.437	0.909
SD	0.280	0.301	0.153
MAX	1.000	1.000	1.000
MIN	0.041	0.050	0.200

Figure 2. Relations between PTE and SE.

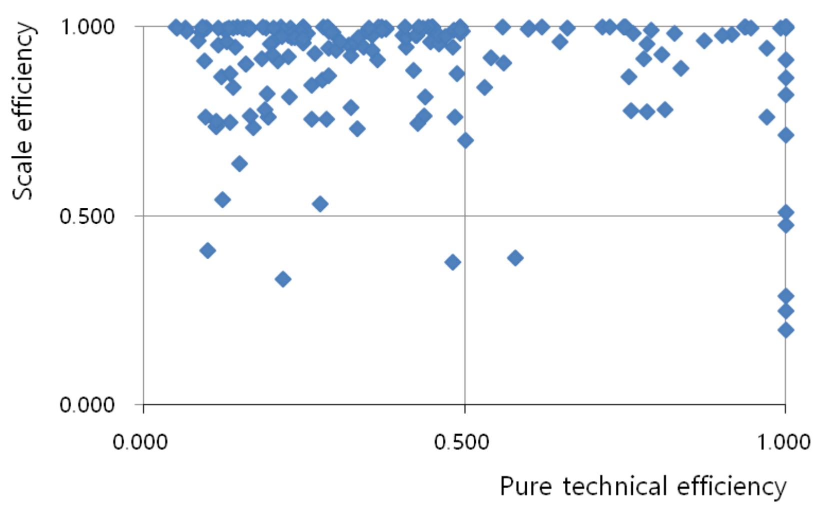


Table 4: *Results of CCR and BCC Models Analysis*

DMU (Farm ID)	**CCR**	**BCC**	**SE**	**RTS***	**Benchmark**	**Suggested projection of input/output (%)**				
						Investment	*Number of full-/part-time employee*	*Number of rooms (%)*	*Number of tourists*	*Annual income*
1	0.998	1.000	0.999	CRS	73, 134, 177	0%	-50%	0%	0%	13%
2	0.097	0.097	1.000	IRS	18, 73, 111, 134	0%	0%	-9%	933%	933%
3	0.272	0.288	0.946	IRS	18, 73, 111, 134	0%	0%	-34%	248%	248%
4	0.305	0.319	0.954	IRS	18, 73, 111, 134	0%	0%	-20%	213%	213%
5	0.387	0.408	0.949	IRS	18, 73, 111, 134	0%	0%	-24%	145%	145%
6	0.344	0.347	0.991	IRS	18, 73, 111, 134	0%	0%	-20%	240%	188%
7	0.316	0.330	0.958	IRS	18, 111, 120, 134	0%	0%	-31%	203%	203%
8	0.429	0.447	0.961	IRS	18, 111, 120, 134	0%	0%	-56%	124%	124%
~**										
134	1.000	1.000	1.000	CRS	134	0%	0%	0%	0%	0%
~**										
189	0.185	0.200	0.927	IRS	18, 120, 133, 134	0%	0%	0%	823%	400%
190	0.593	0.759	0.781	IRS	18, 134, 177, 192	0%	0%	0%	32%	423%
191	0.249	0.267	0.932	IRS	88, 97, 133, 177	0%	0%	0%	275%	275%
192	0.250	1.000	0.250	IRS	192	0%	0%	0%	0%	0%
193	0.371	0.485	0.764	IRS	18, 134, 177, 192	0%	0%	0%	106%	847%
194	0.101	0.135	0.748	IRS	45, 88, 120, 133, 177	0%	0%	0%	643%	643%
195	0.508	0.561	0.905	IRS	18, 134, 177, 192	0%	0%	0%	78%	658%
196	0.074	0.097	0.764	IRS	18, 134, 177, 192	0%	0%	0%	931%	1000%
Analysis of RTS				CRS: 74 farms IRS: 107 farms DRS: 15 farms						
Summary of projections to be efficient based on output-oriented BCC					Mean	-2%	-2%	-22%	391%	402%
					SD	9%	9%	26%	373%	339%

*RTS: Return-to-scale; IRS: increase return to scale; CRS: constant return to scale; and DRS: decreasing return to scale.
** ~ represents data rows that have been omitted due to the length

5.0 Discussion

Although DEA has been adopted in diverse tourism sectors (Wöber, 2007), for example, hotel, travel agency, international airport, and so on, we found no previous research on the application of DEA to tourism farms. The main objectives of this study are to gain an insight into overall efficiency of current tourism farms in South Korea, to understand the cause of inefficiency, and to provide information on the desirable levels of input and output factors for current and new tourism farmers.

Overall, TE was found to be low while SE was relatively high. Therefore, Korean tourism farms need to increase their business size while maintaining or improving TE. According to the result of CCR and BCC models analysis, only 6% of tourism farms turned out to have the score '1' for TE, PTE and SE, and 24.0% of tourism farms have the efficiency scores higher than .50. The mean PTE score is relatively low. In fact, only 10% of tourism farms are efficient in terms of PTE which is attributed to managerial skills (Barros & Dieke, 2007). The rationale for interpreting BCC as management skills is based on the contrast between CCR and BCC models. Based on the differentiation between TE and SE within the BCC model, assuming efficiency is due to managerial skills and scale effects, the BCC score is interpreted as managerial skills. Thus, a majority of inefficient Korean tourism farms should find the right amount of input and output and the right combination of those. On the other hand, tourism farms identified in the high PTE and high SE are suggested to increase the business size while maintaining the current managerial skills. For those who were in the low PTE and high SE, their farmers–operators should strive to increase TE, while simultaneously increasing their business size.

The efficiency measurement using DEA is not only a useful management tool for each tourism farm but also a critical source of information for the local government agency responsible for rural development or tourism planning (Huang et al., 2012). More and more farms have been diversifying into tourism businesses, but often no guideline is available for input and output considerations of their businesses. In addition to projections of input and output suggested to each tourism farm, benchmarks can help tourism farms identify the best tourism farms in their region where similar processes exist and compare the results and processes of those to their own results and processes. Although information from benchmark farms cannot always be applied to all tourism farms, they can learn how well the target performs and the processes that explain why it is successful.

5.1 Further Research and Limitations

Since this is an exploratory case study of 196 tourism farms that are part of those that the Korean government supported in their tourism development, the intent is not to obtain definitive results for immediate use from tourism farms or for generalization to other tourism farms. Research efforts therefore for the replication, enhancement, and refinement of the DEA methodology, dataset, and its findings can contribute to the body of knowledge in the farm tourism literature. More comprehensive input and output factors relevant to this type of tourism need to be considered. Some input and output factors are not included in the analysis because of an assumption that these factors are constant across the sample. Moreover, the DEA model in farm tourism can allow for restricting weights through linear constraints (Barros, 2005b) because some of factors are likely to be more important than others in the tourism sector. Finally, a further qualitative analysis on a case study is necessary to determine the true source of the (in)efficiency and appropriate actions to be taken by a tourism farm.

References

Agritourism Trend, Policy, and Future Direction. (2013). *In hot issue brief.* Tourism knowledge information system: Korean Culture and Tourism Institute. Retrieved April 3rd, 2018, from http://www.tour.go.kr/FileSystem/UploadTemp/SendNewsLetter/Hot%20Issue%20Brief_20130806.pdf

Andersen, P., & Petersen, N. C. (1993). A procedure for ranking efficient units in data envelopment analysis. *Management Science, 39*(10), 1261–1264.

Appa, G., & Yue, M. (1999). On setting scale efficient targets in DEA. *Journal of the Operational Research Society, 50*(1), 60–69.

Arroyo, C. G., Barbieri, C., & Rich, S. R. (2013). Defining agritourism: A comparative study of stakeholders' perceptions in Missouri and North Carolina. *Tourism Management*, *37,* 39–47.

Assaf, A., Barros, C. P. & Josiassen, A. (2010). Hotel efficiency: A bootstrapped metafrontier approach. *International Journal of Hospitality Management, 29*(3), 468–475.

Baker, M., & Riley, M. (1994). New perspectives on productivity in hotels: Some advances and new directions. *International Journal of Hospitality Management*, *13*(4), 297–311.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, *30*(9), 1078–1092.

Barbieri, C. 2013. Assessing the sustainability of agritourism in the US: A comparison between agritourism and other farm entrepreneurial ventures. *Journal of Sustainable Tourism, 21*(2), 252–270.

Barros, C. P. (2005a). Evaluating the efficiency of a small hotel chain with a Malmquist productivity index. *International Journal of Tourism Research, 7*(3), 173–184.

Barros, C. P. (2005b). Measuring efficiency in the hotel sector. *Annals of Tourism Research, 32*(2), 456–477.

Barros, C. P., & Dieke, P. U. C. (2007). Performance evaluation of Italian airports: A data envelopment analysis. *Journal of Air Transport Management*, *13*(4), 184–191.

Brotherton, B., & Mooney, S. (1992). Yield management—progress and prospects. *International Journal of Hospitality Management*, *11*(1), 23–32.

Busby, G., & Rendle, S. (2000). The transition from tourism on farms to farm tourism. *Tourism Management*, *21*(6), 635–642.

Capriello, A., Mason, P. R., Davis, B., & Crotts, J. C. (2013). Farm tourism experiences in travel reviews: A cross-comparison of three alternative methods for data analysis. *Journal of Business Research, 66*(6), 778–785.

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research, 2*(6), 429–444.

Choo, H., & Jamal, T. (2009). Tourism on organic Farms in South Korea: A new form of ecotourism? *Journal of Sustainable Tourism*, *17*(4), 431–454.

Donaghy, K., McMahon, U., & McDowell, D. (1995). Yield management: An overview. *International Journal of Hospitality Management*, *14*(2), 139–150.

Drucker, P. F. (1977). An introductory view of management: Instructor's manual. New York, NY: Harper and Row.

Huang, Y., Mesak, H. I., Hsu, M. K., & Qu, H. (2012). Dynamic efficiency assessment of the Chinese hotel industry. *Journal of Business Research, 65*(1), 59–67.

Hwang, J., & Lee, S. (2015). The effect of the rural tourism policy on non-farm income in South Korea. *Tourism Management*, *46*, 501–513.

Hwang, S.-N., & Chang, T.-Y. (2003). Using data envelopment analysis to measure hotel managerial efficiency change in Taiwan. *Tourism Management*, *24*(4), 357–369.

Johns, N., Howcroft, B., & Drake, L. (1997). The use of data envelopment analysis to monitor hotel productivity. *Progress in Tourism and Hospitality Research, 3*(2), 119–127.

Jongeneel, R. A., Polman, N. B. P., & Slangen, L. H. G. (2008). Why are Dutch farmers going multifunctional? *Land Use Policy, 25*(1), 81–94.

Keh, H. T., Chu, S., and Xu, J. (2006). Efficiency, effectiveness and productivity of marketing in services. *European Journal of Operational Research*, *170*(1), 265–276.

Lane, B., & Kastenholz, E. (2015). Rural tourism: The evolution of practice and research approaches–towards a new generation concept? *Journal of Sustainable Tourism*, *23*(8–9), 1133–1156.

Meraner, M., Heijman, W., Kuhlman, T., & Finger, R. (2015). Determinants of farm diversification in the Netherlands. *Land Use Policy, 42*, 767–780.

Morey, R. C., & Dittman, D. A. (1995). Evaluating a hotel GM's performance: A case study in benchmarking. *Cornell Hospitality Quarterly, 36*(5), 30–35.

Park, D. -B., Doh, K. -R., & Kim, K. -H. (2014). Successful managerial behaviour for farm-based tourism: A functional approach. *Tourism Management, 45*, 201–210.

Park, D. -B., & Yoon Y. -S. (2009). Segmentation by motivation in rural tourism: A Korean case study. *Tourism Management*, *30*(1), 99–108.

Park, S. -H., Kim, Y. -R., Kwon, I. -H., & Ryu, K. -S. (2012). *A New direction and strategy for rural tourism development in Korea.* Cheonnam, Korea: Korea Rural Economic Institute.

Raab, R. L., & Lichty, R. W. (2002). Identifying subareas that comprise a greater metropolitan area: The criterion of county relative efficiency. *Journal of Regional Science, 42*(3), 579–594.

Reynolds, K. A. (2007). *Information channels reaching agricultural and on-farm nature tourism visitors* (UC Small Farm Center Research Brief). Davis, CA: University of California Small Farm Center.

Sakamoto, K., Choi, Y. -J., & Burmeister, L. L. (2007). Framing multifunctionality: Agricultural policy paradigm change in South Korea and Japan? International *Journal for the Sociology of Agriculture and Food*, *15*(1), 24–45.

Sarıca, K., & Or, I. (2007). Efficiency assessment of Turkish power plants using data envelopment analysis. *Energy, 32*(8), 1484–1499.

Sigala, M. (2003). Developing and benchmarking internet marketing strategies in the hotel sector in Greece. *Journal of Hospitality & Tourism Research, 27*(4), 375–401.

Tsaur, S. -H. (2001). The operating efficiency of international tourist hotels in Taiwan. *Asia Pacific Journal of Tourism Research, 6*(1), 73–81.

Veeck, G., Che, D., & Veeck, A. (2006). America's changing farmscape: A study of agricultural tourism in Michigan. *The Professional Geographer, 58*(3), 235–248.

Veeck, G., Hallett, L., Che, D., & Veeck, A. (2016). The economic contributions of agricultural tourism in Michigan. *Geographical Review, 106*(3), 421–440.

Võsu, E., & Kaaristo, M. (2009). An ecological approach to contemporary rural identities: The case of tourism farms in south-east Estonia. *Journal of Ethnology and Folkloristics, 3*(1), 73–94.

Wijeysinghe, B. S. (1993). Breakeven occupancy for a hotel operation. *Management Accounting, 71*, 32–33.

Wober, K. W. (2000). Benchmarking hotel operations on the Internet: A data envelopment analysis approach. *Information Technology & Tourism, 3*(3–4), 195–211.

Wöber, K. W. (2007). Data envelopment analysis. *Journal of Travel & Tourism Marketing, 21*(4), 91–108.