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A Study on the Efficiency of Child-Youth Psychological Support Service in Utilization of the DEA Analysis

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Abstract

The purpose of this study was to examine the efficiency of child-youth psychological support service in utilization of the DEA analysis. The budget and the number of service provider were used as input variables and the number of users was considered as an output variable to find reasons of inefficiency of Decision-Making Units (DMU) by measuring relative efficiency and to suggest improvement strategies. As result, there were 2 regions identified as Constant Return to Scale (CRS), 3 regions identified as Decreasing Return to Scale (DRS), and 2 regions identified as Increasing Return to Scale (IRS). Based on the result, it is suggested that regions identified as DRS should decrease excess supply and regions identified as IRS should increase under supply.

Keywords: *Child-youth psychological support service, Efficiency, Data Envelopment Analysis (DEA)*

1. Introduction

In socio-demographic changes such as aging population, increase women's economic activity, and increase income level, etc., demands for various social services have increased drastically. Social service are defined as services provided in the society to promote welfare of individuals and general society as well as to improve the quality of life in such areas as public administration, social welfare, public health and medication, education, and culture [1]. . The budget for social services provided with vouchers exceeds 1 trillion won per year. As investments into autonomous regional social services have continued expanding rapidly and drastically within a few years from the state subsidy amounting to 77.1 billion won in 2007 to 141.1 billion won in 2013, 190.2 billion in 2015, and to 223.7 billion in 2016. Particularly, the efficiency of community social service investment needs to be improved as a decentralized welfare service project for local governments to develop and plan social services according to each region's characteristics.

While the level of satisfaction with such services has been examined in existing researches to measure the effectiveness of service [2][3][4][5]., there are few studies on the efficiency because of the limitation in assessing the efficiency of inputs and outputs when it comes to public goods. Hence, it is necessary to investigate the efficiency of community social service investment to verify if related public services have been operated efficiently since the initiation. Accordingly, this study seeks to find out ways to secure service efficiency through the DEA analysis.

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2. Theoretical background

2.1. Concept of efficiency and overview of the DEA model

The concept of efficiency is relevant to the analysis of system input and output. In general, efficiency means the extent that a certain organization creates products as much as possible with limited resources in utilization of its production technologies available, and it is expressed with the ratio of input to output [6]. This study seeks to measure relative efficiency by means of a Data Envelopment Analysis (DEA) model that has few limitations in the context of efficiency analysis and that is useful for services leading to a large quantity of inputs and outputs.

The DEA analysis is to measure relative efficiency of organizations that are similar or same to one another. This linear programming is used to assess the relative efficiency among decision making units (DMUs) that consist of inputs and outputs, and this analysis method adopts a non-parametric approach to assess relative efficiency of an activity that aims to product maximum outputs per unit input [7]. While there are various DEA models available, the most commonly utilized models are CCR and BCC models in general.

2.2.1. CCR model

The DEA model assumes constant returns to scale based on the CCR model which stands for Charnes, Cooper, and Rhodes. This is also called the CRS (Constant Return Scale) model [4]. The output-based CCR model is to maximize output elements with the input of DMUs fixed. This model represents the extent of an organization's efficiency.

2.2.2 BCC model

The BCC model has been proposed by Banker, Charnes, and Cooper (1984) to make up for the disadvantages of the CCR model[9]. This model assumes variable returns to scale rather than constant returns to scale assumed in the CCR model, and convexity conditions are added as well to judge whether the level of efficiency estimated base on the CCR model is related solely to technical factors or to scale factors as well. The units presented in the analysis table are units of efficient DMUs that inefficient DMUs refer to for access to an efficient frontier. Relative, inefficient DMUs present efficient DMUs with input and output variables of similar structures. In addition, the number of references indicate the number that inefficient DMUs refer to efficient DMUs. The larger number of references DMUs involve, the more reliable the efficiency scores are [10].

2.2.3. DEA-based previous studies

Because of the advantages of DEA methods, researches on domestic social welfare organizations have been expanded. Two of the most frequently used variables that are referred to as inputs in relative efficiency measurement are budget and manpower [11][12][8]. Common input variables in previous researches are budget and manpower, and common output variables are the number of facilities and that of users.

Table 1-1. Input/ Output variable selection and variables

Variables		Description
Input Variables	Budget	Budget input for regional operation of community social service investment (unit: 1,000 won)
	No. of Workers	Number of workers for of community social service Investment in each region (unit: individual)
Output Variables	No. of Users	Number of community social service Investment users in each region (unit: individual)

3. Research method

This study adopts the DEA analysis with models divided to the output-based CCR model and output-based BCC model. Study subject are Chungcheongbuk-do community social service investment for children (child and youth emotional development support service). The period of data collection was from November 1st to 20th, 2015. The DEA analysis was conducted in reference to the August performance data of the Social Security Information Service and by means of Frontier Analyst 4 Program.

4. Results

4.1. General characteristics of analysis subject

For the DEA analysis, this study examines the child and youth psychological support service that is available nationwide among 2015 Chungcheongbuk-do community social service investment project for children.

Table 1-2. The service for DEA analysis subject

Service Title	DMU (Region, No.	Budget (1,000 Won)	Workers (No.)	Users (No.)
Child and Youth Psychological Support Service	7	681,686	262	896

4.2 Analysis of child and youth psychological support service efficiency

The child/youth psychological support service is a nationwide standardized project. As of 2015, psychological counselling, play, language, cognition, and art programs are provided depending on children's conditions in 7 regions of Chungcheongbuk-do. The service fee is 160,000 won for 4 times a month.

The result of assessing the relative efficiency of the child and youth psychological support service is compared with the result of analyzing the CCR model efficiency to propose a BCC model. the average technical efficiency (CCR) of the child and youth psychological support service is 88.67%, the average pure technical efficiency (BCC) 98.06%, and the average scale efficiency (SE) 0.90 respectively, which indicates that the difference in efficiency among regional DMUs is insignificant (Table 1-3).

While the assessment of A region, C region, and E region by means of the CCR model was inefficient, that by means of the BCC model was viewed as efficient. This is because the relative efficiency was evaluated as low 'due to the scale' when the CCR model was utilized

among local governments while and the difference in scale among local governments decreased in the latter case[13].

B region where the service was assessed as inefficient needs to benchmark A region and E region. F region too needs to benchmark C region, D region, and G region in order to improve the efficiency.

Among 7 assessed regions, it turned out that D region and G region were subject to CRS (Constant Return to Scale) while A region, B region, and E region were subject to DRS (Decreasing Return to Scale). C region and F region were subject to IRS (Increasing Return to Scale). The number of references was 3 in G region, which is the largest, and 2 in A region, B region, and D region, and then 1 in C region and E region. While city regions were subject to DRS (Decreasing Return to Scale), county regions were subject to IRS (Increasing Return to Scale) except E region.

Regions subject to DRS (Decreasing Return to Scale) need to improve the efficiency of operation by reducing inputs while regions subject to IRS (Increasing Return to Scale) need to establish efficiency plans of upscale.

Table 1-3. The efficiency analysis result of the child/youth psychological support service

DMU		CCR (%)	BCC (%)	SE	Reference Group	Number of Reference	Reason for inefficiency
City	Region A	78.1	100	0.78		2	DRS
	Region B	73.2	98.9	0.73	#1,#5	2	DRS
County	Region C	96.6	100	0.96		1	IRS
	Region D	100	100	1		2	CRS
	Region E	86.8	100	0.86		1	DRS
	Region F	86.0	87.5	0.98	#3,#4,#7	0	IRS
	Region G	100	100	1		3	CRS
Mean Efficiency		88.67	98.06	0.90			

5. Conclusions and suggestions

This study attempts to measure the efficiency of community social service investment by local governments objectively by means of the variable returns to scale and Constant Returns to Scale (CRS), and additionally, the information of input/output inefficiency is provided.

Based on the findings of this study, policy proposals and limitations of this study are presented as follows:

It needs to be noted that when a certain service is evaluated as efficient, it cannot be an absolute indicator of efficiency because the evaluation is based on the relative efficiency of DMUs on the assumption that the value of the reference group of inefficient DMUs inside the efficiency frontier is 100%. In addition, the efficiency was explored based on input/output factors, but the relative efficiency might be different depending on service and group classifications. Besides, it was unable to control all the various environmental factors that might affect the local government's efficiency, which is another limitation of this study.

Based on the findings of this study, the following suggestions are presented:

First, each city/county local governments need to come up with their own specific plans to improve the efficiency of service operation. According to the DEA analysis result, the cause of inefficiency in the child and youth psychological support service among city regions was

DRS (Decreasing Return to Scale) while that in country regions except one was IRS (Increasing Return to Scale). This indicates the imbalance between city and county local governments since resources and budgets are concentrated on city regions. Thus, it is vital to establish plans to allot input factors efficiently for balanced development of regions, to control excess inputs into services that are subject to DRS (Decreasing Return to Scale), and to improve the operational efficiency.

Second, it is necessary to improve the basic system for better accountability, connectivity, and efficiency in project operation and to appoint a general manager for investment into autonomous regional social service as a way to overcome the limitation of comprehensive supplementary projects. Accordingly, a service evaluation system needs to be established in cooperation among the general manager, responsible men in each city/county local government, and community social service support groups so that they can discuss ways to adjust and operate service budgets efficiently.

Third, constant monitoring is essential for successful operation of projects. The results of onsite visits, meetings, and monitoring need to be reflected in developing project manuals and plans so that problems in project operation can be addressed substantially.

The future study needs to find out more various factors that contribute to efficiency improvement with the score of user satisfaction added to output factors.

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