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The Productivity of Rajabhat Universities during 2007-2009

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ABSTRACT

The research aims to measure the productivity of Rajabhat Universities during 2007/08-2008/09. Data are randomly collected from 41 Rajabhat Universities in Thailand. The samples are 11 Rajabhat Universities. Malmquist index or Total Factor Productivity (TFP) is employed for calculating the productivity. The result appears that the firs-three Rajabhat Universities which have increased averaged productivity from 2007/08-2008/09 are Sakon Nakon Rajabhat University, Surat Thani Rajabhat University, Uttaradit Rajabhat University. The Rajabhat Universities which have decreased productivity are Phetchabun Rajabhat University, Phetchaburi Rajabhat University, Pibulsongkram Rajabhat University, Buri Ram Rajabhat University, and Rajanagarindra Rajabhat University. The most of the productivity change is come from technological change being greater than efficiency change. Technological progress is the key factor for enhancing the productivity. Therefore, Technological and innovative adoption will promote the productivity. In addition, the regressed productivity group could learn from the progressed productivity group.

JEL Classification: D24.

Keywords: Productivity, Efficiency Change, Technological Change, Rajabhat Universities

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1. INTRODUCTION

Education provision for the quality needs administrative and managerial principles for the entire cyclical functioning. It has been well recognized that evaluation is indeed an essential step for feedback information, which provides us with the basis for assessing the extent of target achievement. It also enables us to identify weaknesses or problems for which remedial measures are needed to facilitate subsequent planning and actions required to achieve the goals effectively and efficiently.

It is hence crucial that the importance of education be recognized, particularly quality assessment by external assessors. Such mechanism will provide meaningful assessment. It also gives all agencies responsible for the education provision - from those at the national level to the smallest – i.e. educational instructions and classrooms, the incentives for self-evaluation so that the quality of education will be continuously enhanced.

As stipulated in Section 81 of the 1997 constitution of the Kingdom of Thailand, a national education law is required; hence the drafting of the 1999 National Education Act, which became effective on August 20, 1999. Chapter 6 of the Act on Education Standards and Quality Assurance mandates the establishment of the Office for National Education Standards and Quality Assessment (ONESQA), enjoying the status of a public organization. The goals of the public organization are to develop the criterion, methods for external assessment and assessment of educational instructions at each level of education as stipulated in the national education law, and it must appraise every school at least once every 5-year cycle – from the last assessment and then report to the public and the involved state agencies.

The quality assessment is considered to be controlling, monitoring and assessment. Administrative and managerial of all organizations will be in good practice and affected more output by using the same amount of inputs or the same amount of outputs but become the lower amount of inputs. Higher educational system change; that is evaluated by the public organization and conforms to the 1999 National Education Act emphasizes the importance of quality assurance and national education standards. Since 1999 up to now, it's 10 years. So, there is a question to be asked about the law change and adjustment of Thai university in that period of time; especially, how is the productivity of Rajabhat university change. The productivity of Rajabhat University being focused is that they have been Rajabhat Institute (originally formed the teachers college system) since 1995 and then in the year 2004 they has been renamed as Rajabhat University and manage under Rajabhat Act. They are independent to manage without all government controls and governed by university council. Because a big change since 1999 and 2004 is questioned that how the productivity of them is. The contributions of the productivity index helps us to anticipate and monitoring about their productivity, explore the causes of decreasing or increasing in productivity, address the target group for supporting, and evaluate the performance of university.

2. LITERATURE REVIEW

2.1 Total Factor Productivity (TFP)

The concept of this study as shown in Figure 1 following the idea of Färe (1990, 1993) Hjalmarsson and Veiderpass (1992), Berg (1992) and Price and Weyman-Jones (1996). Figure 1 shows the frontier curve at the efficiency level (y) which is produced by specific input (x) and assume that the frontier curve can be varied over time as shown by the frontier curve at the time t and t+1 respectively. To assume the inefficiency exists; the overtime relative movement of any produced unit is up to the original and new frontier curve. Consequently, it is changeable in technical efficiency and technological change. If inefficiency is expelled, so the growth of productivity is achieved from the shift of frontier curve or it can be affected only from technological change.

To specify produced unit at the time t, shows the mixture of output and input z (t). The measurement of input-orientated efficiency derives from proportion of horizontal distance which is equal to OB/OF. That is the input can be reduced in order to increase the efficiency at the time t. To compare with the period of time t+1 find that efficiency is equal to OE/OD which is greater than 1. Even though, there is no technical efficiency when comparing with the frontier lines at t+1.

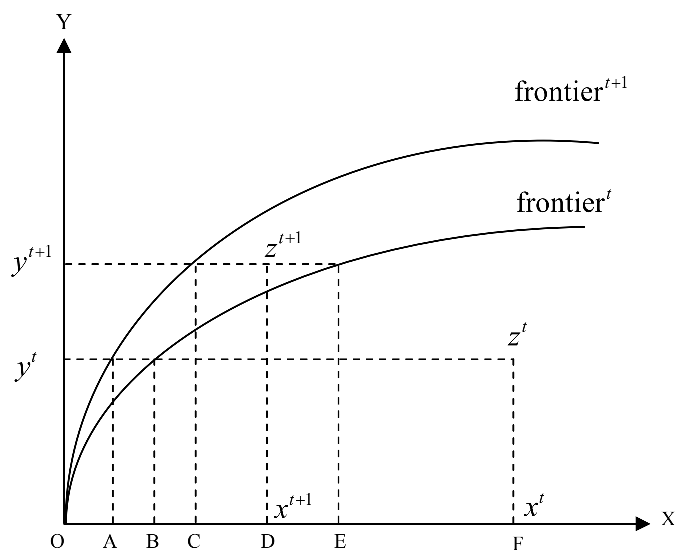

Figure 1
Measuring productivity, efficiency change and technological change

To calculate the productivity index, namely, Malmquist input-orientated productivity, it can be classified productivity between 2 periods-technological change and technical efficiency change. The input-orientated efficiency is to emphasize the decrease of input proportionally by the given output. Therefore, input-orientated Malmquist productivity change index is found by equation 1 as follows:

$$M_I^{t+1}(y^{t+1},x^{t+1},y^t,x^t)=\sqrt{\left[\frac{D_I^t(y^{t+1},x^{t+1})}{D_I^t(y^t,x^t)}\cdot\frac{D_I^{t+1}(y^{t+1},x^{t+1})}{D_I^{t+1}(y^t,x^t)}\right]} \tag{1}$$

The subscript *I* shows the orientated-input productivity. M is productivity of production in the period of t+1 (y^{t+1},x^{t+1}) compare with the time $t(y^t,x^t)$. D is a distance function. In the first term inside the square root, technology in the period t is used as reference technology and in the second term inside the square root technology of the period t+1 is used as reference technology.

If M is greater than 1, the growth of productivity is positive. Following Färe et al. (1993), this index can be decomposed into two components as follows:

$$M_I^{t+1}(y^{t+1},x^{t+1},y^t,x^t)=\frac{D_I^{t+1}(y^{t+1},x^{t+1})}{D_I^t(y^t,x^t)}\cdot\sqrt{\left[\frac{D_I^t(y^{t+1},x^{t+1})}{D_I^{t+1}(y^t,x^t)}\cdot\frac{D_I^t(y^t,x^t)}{D_I^{t+1}(y^t,x^t)}\right]} \tag{2}$$

Or $M = E\cdot P$ (3)

$$E=\frac{D_I^{t+1}(y^{t+1},x^{t+1})}{D_I^t(y^t,x^t)} \text{ and } P=\sqrt{\left[\frac{D_I^t(y^{t+1},x^{t+1})}{D_I^{t+1}(y^t,x^t)}\cdot\frac{D_I^t(y^t,x^t)}{D_I^{t+1}(y^t,x^t)}\right]} \tag{4}$$

The first ratio on the left hand side of equation (2) measures the changes in efficiency between t and t + 1. The second term is the measure of technical change. The way the four different distance functions are arranged to allow for a decomposition of productivity changes. The efficiency change component simply compares the distances of the two observations, (y^t,x^t) and (y^{t+1},x^{t+1}), to the corresponding production frontiers, frontier t and frontier t+1. It measures whether production is catching up with or falling behind the production frontier. It is assumed that this component captures diffusion of technology related to differences in knowledge, and institutional settings. The remainder of equation (2) measures technical changes. Particularly, it takes the geometric mean of the changes in technology in time t and t + 1 at input levels x^t and x^{t+1}.

M (Malmquist total factor productivity index) is the product of technical progress (P) which is valuated from the moving up frontier lines of productivity between t+1 and t (Geometry average) with the efficiency change (E) in the same period of time. The calculation of index needs to solve the linear programming equation. It is assumed that the production unit contains N unit and each unit have different input K to produce M. Therefore, the production unit i is shown by vector $x_i y_i$ which is input matrix of X having K x N dimensions and output matrix Y has M x N dimension which is shown the data of the whole production units in the samples. The purpose is to build the frontier curve to cover all data, that is, all various observations lie up and down the frontier curves. The calculation employs the input distance functions; D) for the Malmquist index. It is the reversed idea of Farrell

(1957) which is called input-orientated technical efficiency measures. The index calculation of Malmquist is the same method of Charnes and staff (1978) which is called Data Envelopment Analysis (DEA). The first two linear programming (equation (5) and (6)) show the technology and the observations are evaluated in the same time. The value can be less than or equal to1. The last two linear programming (equation (7) and (8)) show the technology that refers to the data which is evaluated in the period of time. Assume the production is constant returns to scale (CRS), the linear programming in case of input-orientated is shown in equation (5)-(8)

$$\begin{aligned} \left[D_I^t(y_t, x_t)\right]^{-1} &= \min_{\theta,\lambda} \theta \\ s.t. \quad -y_{it} + Y_t\lambda &\geq 0 \\ \theta x_{it} - X_t\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \tag{5}$$

$$\begin{aligned} \left[D_I^{t+1}(y_{t+1}, x_{t+1})\right]^{-1} &= \min_{\theta,\lambda} \theta \\ s.t. \quad -y_{i,t+1} + Y_{t+1}\lambda &\geq 0 \\ \theta x_{i,t+1} - X_{t+1}\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \tag{6}$$

$$\begin{aligned} \left[D_I^{t+1}(y_t, x_t)\right]^{-1} &= \min_{\theta,\lambda} \theta \\ s.t. \quad -y_{it} + Y_{t+1}\lambda &\geq 0 \\ \theta x_{it} - X_{t+1}\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \tag{7}$$

$$\begin{aligned} \left[D_I^t(y_{t+1}, x_{t+1})\right]^{-1} &= \min_{\theta,\lambda} \theta \\ s.t. \quad -y_{i,t+1} + Y_t\lambda &\geq 0 \\ \theta x_{i,t+1} - X_t\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \tag{8}$$

This approach can be further extended by decomposing the constants return to scale technical efficiency into scale efficiency and pure technical efficiency components. This involves the calculation of linear programming where the convexity constraint N1'λ = 1 which is shown in equation (5)-(8). Once again, it appears that the input distance functions as calculate here is the reciprocal of an input-orientated Farrell measure of technical efficiency which is calculated relative to technology satisfying variable return to scale which is contrary of Banker et al. (1984). The calculation of linear programming by the same data under constant returns to scale and variable returns to scale, measurement of overall technical efficiency (E) and pure technical efficiency (PE) are obtained . If overall technical efficiency (E) is divided by pure efficiency (PE), the result is the scale efficiency (S).

Using these models and the approach of Färe et al. (1994), it's possible to provide four efficiency/productivity indices for each production unit and a measure of technical progress over time. These are: (i) technical efficiency change (E); (ii) technological change (P); (iii) pure technical efficiency change (PE); (iv) scale efficiency (S); and (v) total factor productivity change (M). To state that M is the index to indicate the level of productivity change, if M>1, the productivity increased, and if M<1; productivity losses occur. For the efficiency change; technical efficiency increases (decreases) if and only if E is greater (less) than one. An interpretation of technological change index is that technical progress (regress) has occurred if P is greater than one.

An assessment can also be made of the major sources of productivity gains/losses by comparing the values of E and P. If E > P then productivity gains are largely the result of improvements in efficiency, whereas if E < P productivity gains are primarily the result of technological progress. In addition, an indication of the major source of efficiency change can be obtained by recalling that overall technical efficiency is the product of pure technical efficiency and scale efficiency, such that E = PE x S. Thus, if PE > S then the major source of efficiency change (both increase and decrease) is improvement in pure technical efficiency, whereas if PE < S the major source of efficiency is an improvement in scale efficiency.

2.2 Related Research

The previous research works are employed the method of Malmquist for studying the productivity. The study of productivity in Thai university does not appear. The most research is focused on firm such as bank and state enterprise. For international research paper, there are many researchers aiming study the productivity. The study of productivity has various dimensions which related to the production through the teaching, research, academic service, etc. (Dundar and Lewis, 1998) that is why the measurement of university productivity is quite complicated. The productivity growth can be calculated by Malmquist index. The advantages of this method is that the price of output and input is not required and no assumption about cost or profit maximization (Coelli and Perelman 1999; Uri 2003a, 2003b; Rodríguez-Álvarez et al., 2004; O'Donnell and Coelli, 2005). Malmquist index is applied mostly for service sector such as bank, health care (Ventura, Gonzalez and Carcaba, 2004; Worthington, 2004), financial firms (Mahlberg and Url, 2003; Sturm & Williams, 2004) and universities as the study of Worthington and Lee (2005) and Flegg et al. (2004). The latter two authors apply nonparametric method or Malmquist index to calculate the productivity. Outputs and inputs are comprised of teaching, research and technology transfer. The definition for selecting the input or output is not precise. The limitations appear because of the characteristics of output selected such as in case of teaching which try to measure the learning abilities from the amount of registered students, full-time equivalent students and graduated student.

Research works is difficult to identify the quality. The published papered is also considered as the indicator of quality such as papers from conference proceedings (Sinuany-Stern et al., 1994), the amount of cited articles with impact factor (Sarafoglou and Haynes, 1996), and research budget (Tomkins and Green, 1998).

Inputs are determined variously such as lecturers, officers, student service, library, computers, buildings, etc. these inputs can be measured as expenditure. The amounts of bachelor, master, doctoral students are employed (García-Aracil, 2006). In addition, total expenditure can be used for calculation (Ahn et al., 1988). Expenditure can be decomposed as research and development budget (Ahn, 1987) capital expenses) (Johnes, 2005) library budget, (Rodhes and Southwick 1986) and computer and network budget (Ahn et al., 1988, 1989, 1993)

3. RESARCH METHODOLOGY

3.1 Data Collection

Input and output data are collected from forty-one Rajabhat Universities in Thailand during 2007-2009. The complete data for three years are consisted of eleven Rajabhat universities, in the percentage of 27 from all Rajabhat universities in Thailand, namely: Suan Sunandha Rajabhat University, Suan Dusit Rajabhat University, Chadra Kasem Rajabhat University, Surat Thani Rajabhat University, Phetchaburi Rajabhat University, Rajanagarindra Rajabhat University, Buri Ram Rajabhat University, Sakon Nakhon Rajabhat University, Phetchabun Rajabhat University, Pibulsongkram Rajabhat University, and Uttaradit Rajabhat University.

3.2 Data Analysis

Measurement of productivity is calculated by Malmquist index called Total Factor Productivity (TFP). The outputs and inputs for calculating productivity are follows:

Outputs are consisted of:

The amount of employed graduate and freelance (person)
The amount of research and creative work (project)
The amount of academic services (project)

Inputs are consisted of:

The amount of full time students (person)
The amount of bachelor graduated degree lecturer (person)
The amount of master graduated degree lecturer (person)
The amount of doctoral graduated degree lecturer (person)
The amount of lecturer (person)
The amount of assistant professor (person)
The amount of associate professor (person)
Budget (Baht)

4. EMPIRICAL RESULTS

Table 1 Mean and Standard deviation (S.D.) of output and input for production

Output and Input	2007		2008		2009	
	Mean	S.D.	Mean	S.D.	Mean	S.D.

Input						
Amount of student (person)	10,020.17	4,714.28	12,205.18	4,341.02	13,629.91	8,346.52
Budget (million Baht)	463.43	258.12	649.76	694.38	549.89	290.83
Bachelor degree lecturer (person)	29.45	12.51	29.91	16.15	26.45	17.15
Master degree lecture (person)	242.36	162.98	264.18	154.85	281.36	149.69
Doctoral degree lecturer (person)	40.91	29.04	39.45	24.27	51.82	36.72
Lecture (person)	227.00	155.57	240.73	161.75	260.00	161.80
Assistant professor (person)	81.36	27.05	79.18	23.04	73.64	23.85
Associate professor (person)	13.27	10.68	12.18	9.74	12.36	10.40
Output						
Academic Services (project)	195.73	102.00	181.91	126.25	197.91	145.33
Research and Creative work (theme)	36.36	17.81	54.55	84.27	78.36	70.79
Employed graduate and freelance (person)	1,688.36	1,945.82	2,019.09	1,111.43	1,902.18	1,328.78

As shown in Table 1, it was found that the production input, the amount of Rajabhat University students were 10,000 persons in 2007 and increased up to 13,630 persons in 2009. The budget was from the annual government statement of expenditure and public revenue; 463.43 million baht in 2007, 649.76 million baht in 2008 and decreased to 549.89 million baht in 2009. Most of the lecturers were graduated in the master level. The amount of lecturers and master degree lecture has been increased from 2007-2009. Most of the lecturer didn't have academic positions. The output was found that; academic services were decreased to 182 projects in 2008, and it was increased up to 198 projects in 2009. The amounts of research and creative works were increased in 2007 from 36 up to 78 projects in 2009. The graduates were employed and freelance increased from 1,688 in 2007 up to 2,019 persons in 2008 and slightly down to 1,902 persons.

Table 2 Productivity, Efficiency, Technological Change: During 2007-2009

Name of University	Productivity		Efficiency Change		Technological Change	
	2007/2008	2008/2009	2007/2008	2008/2009	2007/2008	2008/2009
1.Suan Sunandha Rajabhat University	1.151	1.110	1.108	1.000	1.039	1.110
2. Suan Dusit Rajabhat University	1.053	1.460	1.000	1.000	1.053	1.460

3. Chadra Kasem Rajabhat University	1.587	0.935	1.000	1.000	1.587	0.935
4. Surat Thani Rajabhat University	1.615	1.293	1.000	1.000	1.615	1.293
5. Phetchaburi Rajabhat University	0.572	0.621	1.000	0.739	0.572	0.840
6. Rajanagarindra Rajabhat University	1.170	0.845	1.000	1.000	1.170	0.845
7. Buri Ram Rajabhat University	0.822	0.078	1.000	0.852	0.822	0.980
8. Sakon Nakhon Rajabhat University	1.972	1.269	1.325	1.000	1.489	1.269
9. Phetchabun Rajabhat University	0.318	1.077	0.582	0.86	0.546	1.252
10. Pibulsongkram Rajabhat University	0.630	1.037	0.731	0.938	0.861	1.105
11. Uttaradit Rajabhat University	0.978	1.778	1.000	1.000	0.978	1.778
Average	**1.204**	**0.865**	**0.958**	**0.940**	**1.256**	**0.920**

Table 3 Average of productivity, efficiency, technological change for all years

Name of University	Productivity	Efficiency Change	Technological Change
1.Suan Sunandha Rajabhat University	1.131	1.053	1.074
2. Suan Dusit Rajabhat University	1.240	1.000	1.240
3. Chadra Kasem Rajabhat University	1.218	1.000	1.218
4. Surat Thani Rajabhat University	1.445	1.000	1.445
5. Phetchaburi Rajabhat University	0.596	0.860	0.693
6. Rajanagarindra Rajabhat University	0.994	1.000	0.994
7. Buri Ram Rajabhat University	0.865	0.923	0.938
8. Sakon Nakhon Rajabhat University	1.582	1.151	1.375
9. Phetchabun Rajabhat University	0.585	0.707	0.827
10. Pibulsongkram Rajabhat University	0.808	0.828	0.976
11. Uttaradit Rajabhat University	1.318	1.000	1.318

As shown in Table 2, it was found that Rajabhat Universities whose productivity increases in ascending order in 2008; namely: Sakon Nakon Rajabhat University (97.20%), Surat Thani Rajabhat University (61.50%), Chadra Kasem Rajabhat University (58.70%), Rajanagarindra Rajabhat University (17.00%), Suan Sunandha Rajabhat University (15.10%), and Suan Dusit Rajabhat University (5.30%). Descending order productivity are Phetchabun Rajabhat University (68.20%), Phetchaburi Rajabhat University (42.8%), Pibulsongkram Rajabhat University (37.00%), Buri Ram Rajabhat University (17.8%), and Uttaradit Rajabhat University (2.20%). In 2009, regressed productivity was Buri Ram Rajabhat University, Phetchaburi Rajabhat University, Rajanagarindra Rajabhat University, and Chadra

Kasem Rajabhat University, respectively. In average, the productivity of Rajabhat University is regressed. The increases (decreases) of productivity of Rajabhat University were successes (failure) from the technological change. The two-year average of productivity, efficiency and technological change are shown in Table 3. It is found that the increased productivity is Sakon Nakon Rajabhat University, Surat Thani Rajabhat University, Uttaradit Rajabhat University, Suan Dusit Rajabhat University, Chadra Kasem Rajabhat University, and Suan Sunandha Rajabhat University.

5. CONCLUSIONS

The result of research is found that the firs-three Rajabhat Universities which have increased averaged productivity from 2007/08-2008/09 are Sakon Nakon Rajabhat University, Surat Thani Rajabhat University, Uttaradit Rajabhat University. The Rajabhat Universities which have decreased productivity from 2007/08-2008/09 are Phetchabun Rajabhat University, Phetchaburi Rajabhat University, Pibulsongkram Rajabhat University, Buri Ram Rajabhat University, and Rajanagarindra Rajabhat University. In average, the productivity of Rajabhat University is regressed. This situation occurred may be the low performance of management of Rajabhat University. It appears that input such as amount of student, lecturers have been increased continually but the graduate has declined while academic service does not change much and research work increase annually average 20 items.

6. RECOMMENDATIONS

The above findings are found that technological progression is an important factor that increases productivity. Therefore, technology and innovation should be promoted in Rajabhat Universities. Such as technology and innovation in learning, and modern management. The external study should be arranged to visit the successful group of Universities of the higher productivity such as Sakon Nakon Rajabhat University, Surat Thani Rajabhat University, Uttaradit Rajabhat University. In addition, the university admission of the large student should be decrease and emphasize on the good practice for improving student's quality. Finally, the graduates can be offered as the employee or can be the good entrepreneurs.

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