

Technical Efficiency of Nursery Swine Production of VPF Group (1973) Co., Ltd. Chiang Mai Province

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Abstract

The study aimed to analyze technical efficiency of nursery swine production and factors affecting the technical efficiency of nursery swine production. Data in the study were secondary data obtained from operational performance of 26 piggeries that were collected during 2016 to 2019 to serve an analysis of a tendency of changes of the studied data. Data collection was determined within the 1 cycle of nursery swine production during October to December of every year in which the studied was conducted. Data were analyzed using the Malmquist Productivity Index and Tobit model. The findings from the study revealed that during 2019-2019, the technical efficiency of nursery swine production decreased while changes in productivity increased due to an increase in technological change. As for factors affecting the technical efficiency of nursery swine production, piggeries were divided into 26 piggeries, NU1 to NU26. It found that factors affecting the technical efficiency of nursery swine production were age of swine entering the nursery, average weight of swine at the early stage of raising and experience of those who raise swine.

Keywords: Technical Efficiency of Nursery Swine Production, Nursery, Swine Nursery, Sustainable Agriculture, Sustainable Technical Efficiency, Technical Efficiency, Sustainable Swine Production, Sustainable Production

1. Introduction

Swine are considered significant economic animals that stay with Thailand for such a long time. Nowadays, swine farming is most likely for consumption and domestic sale. Competitiveness in swine production has been seen to ensure positive efficiency, contributing to a lower cost of production. Swine farming in Thailand has been developed in terms of swine breeds, swine feed, management and sanitation to be equivalent to those of foreign countries. As for domestic swine farming, swine farmers need to gain knowledge about how to raise swine correctly in order to develop their own swine farming efficiently for generating their revenue. Therefore, technical efficiency of nursery swine production and fattening pig

raising is an important thing that farmers should appropriately apply to their farms in order to increase their production efficiency of nursery swine to have the maximum growth rate which is another method that helps lessen a cost of production. The high growth rate of swine gives rise to bigger size of swine and good weight. If swine are big in size and have good weight, it will help reduce a growth interruption problem during the first week of raising fattening pigs. Nursery swine with high growth rate will help fattening pigs to be sold faster, causing a decrease in a cost of swine production. According to the information about nursery swine production, the growth rate standard (ADG) of 10-week-old nursery swine is 500 grams/ swine/ day and feed conversion ratio (FCR) is 1.60 (Table 1).

Table 1 Nursery Pig Growth Rate

Age (Week)	Average Daily Gain (ADG) (Gram/Head/Day)	Feed Conversion Rate (FCR)
6	150	-

9	330	1.50
10	500	1.60

Sources: Samart (2012)

The study on technical efficiency of nursery swine production of VPF Group (1973) Company Limited Chiang Mai province aimed to analyze technical efficiency of nursery swine production and factors affecting technical efficiency of nursery swine production. Data in the study were secondary data obtained from operational performance of 26 piggeries that were collected during 2016 to 2019, 4 years, to serve an analysis of a tendency of changes of the studied data. Data collection was determined within the 1 cycle of nursery swine production during October to December of every year in which the studied was conducted. The study results will be used as a guideline for developing the operations to achieve more efficiency and potential of nursery swine production.

2. Material and method

The study relied on secondary data obtained from operational performance of 26 piggeries that were collected during 2016 to 2019, 4 years, to serve an analysis of a tendency of changes of the studied data. Data collection was determined within the 1 cycle of nursery swine production during October to December of every year in which the studied was conducted. Data analysis was divided into 2 parts as

2.1 Technical efficiency analysis of nursery swine production using the Malmquist Productivity Index in order to analyze changes in operational efficiency of nursery swine production during 2016 – 2019. Data envelopment analysis technique (DEA) that focuses on changes in production efficiency (output-oriented) was used under the assumption of variables returns to scale (VRS). The value measured was the value of productivity change obtained from technical efficiency change and technological change.

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \left(\frac{d_0^{t+1}(x^{t+1}, y^{t+1})}{d_0^t(x^t, y^t)} \right) \left[\left(\frac{d_0^t(x^{t+1}, y^{t+1})}{d_0^{t+1}(x^{t+1}, y^{t+1})} \right) \left(\frac{d_0^t(x^t, y^t)}{d_0^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

Determined output factor variable (output) was average daily gain (ADG) – gram/swine/day (Y) while input factor variables were net weight (kilogram/swine), amount of swine feed (kilogram/swine), creep feed formula (kilogram/swine), nursery feed formula 1 (kilogram/swine), nursery feed formula 2 (kilogram/swine), water need for swine (liter/swine) and expense on swine vaccines (baht/swine);

2.2 analysis of factors affecting technical efficiency of nursery swine production using Tobit model by determining a dependent variable, namely, technical efficiency of nursery swine production (Y). Independent variables were age of swine entering the nursery (age/production series) X_1 average weight of swine at the early stage of raising (kilogram/swine/piggery) X_2 time spent in the nursery (number of days in the nursery/production series) X_3 experience of employees who raise swine (year/person) X_4 number of employees who raise swine (number of piggeries/persons) X_5 seasons for raising nursery swine (summer (1)/rainy season (2)/winter (3) X_6

3. Results and discussion

3.1 Technical efficiency of nursery swine production

The analysis result of technical efficiency of nursery swine production found that during 2016-2019 the average technical efficiency of nursery swine production was 0.997 which was at a high level. Most of nursery swine production, 92.31%, had a moderate level of nursery swine production efficiency by 7.69%. During 2017-2018, the average technical efficiency of nursery swine production was 0.967 which was at a high level. Most of nursery swine production, 73.08%, had a high level of nursery swine production efficiency, decreasing from 2016-2017 in 5 piggeries and 26.92% had a moderate level of nursery swine production efficiency, increasing from 2016-2017 in 5 piggeries and during 2018-2019 the average technical efficiency of nursery swine production was 1.003 which was

at an extremely high level, 3.85% had an extremely high level of nursery swine production efficiency, increasing from 2017-2018 in 2 piggeries. 15.38% had a moderate level of nursery swine production, decreasing from 2017-2018 in 3 piggeries (Table 2). However, it was found that during 2016-2019, the average efficiency of nursery swine production tended to change in a better way. It

showed that the overall efficiency of nursery swine production was high, resulting from the operations of nursery swine production that was provided with technical management of nursery swine production and nursery swine production business that did not allow errors, risks or obstacles in the operations, making most of nursery swine production successful.

Table 2 Technical efficiency of Nursery Pig in VPF Group (1973) Co., Ltd between 2016 – 2019.

Ranges of operational efficiency score	2016 - 2017		2017 - 2018		2018 - 2019	
	Number of cooperatives	%	Number of cooperatives	%	Number of cooperatives	%
Very high (1.201 - 1.300)	0	0.00	0	0.00	1	3.85
High (0.901 - 1.200)	24	92.31	19	73.08	21	80.77
Medium (0.601 - 0.900)	2	7.69	7	26.92	4	15.38
Low (0.301 - 0.600)	0	0.00	0	0.00	0	0.00
Very low (0.000 - 0.300)	0	0.00	0	0.00	0	0.00
Total	26	100.00	26	100.00	26	100.00
Technical efficiency average	0.997		0.967		1.003	

As for productivity change in nursery swine production in 2017, there was an increasing change in productivity with the mean equal to 1.733 due to an increasing change in technological efficiency, the mean was equal to 1.738 but there was a decreasing change in technical efficiency, the mean was 0.997. In 2018, there was a decreasing change in productivity, the mean was 1.111 due to a decreasing change in technological efficiency, the mean was 1.14, and a decreasing change in technical efficiency, the mean was 0.967. In 2019, there was an increasing change in productivity, the mean was 1.969 due to an increasing change in technological efficiency, the mean was 1.906, and there was an

increasing change in technical efficiency, the mean was 1.003. Overall during 2016-2019, there was an increasing change in productivity, the mean was 1.559 due to an increasing change in technological efficiency, the mean was 1.561 but there was a decreasing change in technical efficiency, the mean was 0.999. It reflected that efficiency of the operations, management, internal control and business conducting of nursery swine production was better but there was a lack of adopting techniques to help the operations. Therefore, the nursery swine production should be improved and developed by employing techniques to the operations (Table 3).

Table 3 Productivity change of Nursery Pig in VPF Group (1973) Co., Ltd

Time	Technical efficiency change	Technological change	Productivity change
2017	0.997	1.738	1.733
2018	0.967	1.149	1.111
2019	1.003	1.906	1.969
Average	0.999	1.561	1.559

3.2 Factors affecting technical efficiency of nursery swine production

The analysis result of factors affecting technical efficiency of nursery swine production was based on Tobit model analysis from operational performance of 26 piggeries that were collected during 2016 to 2019, 4 years, data collection was determined within the 1 cycle of nursery swine production during October to December of every year in which the studied was conducted. It was found that factors affecting technical efficiency of nursery swine production comprised 4 variables, namely, (1) age of swine entering the nursery (age/production series) with the statistical significance level of 0.01, the coefficient was 0.3596 which was positive. It means that if the age of swine entering the nursery is older, efficiency of nursery swine production will increase 0.3596; (2) average weight of swine at

the early stage of raising (kilogram/swine/piggery) with the statistical significance level of 0.01, the coefficient was 0.0375 which was positive. It means that if the weight of swine at the early stage of raising is heavier (kilogram/swine/piggery), efficiency of nursery swine production will increase 0.0375; (3) experience of employees who raise swine (year/person) with the statistical significance level of 0.01, the coefficient was 0.0045 which was positive. It means that if employees have more experience, efficiency of nursery swine production will increase 0.0045; (4) seasons for raising nursery swine (October (1)/November (2)/December (3)) with the statistical significance level of 0.01, the coefficient was 0.0105 which was positive. It means that a season for raising swine in each month has an effect on nursery swine production, causing efficiency of nursery swine production to increase 0.0105 (Table 4)

Table 4 Analysis result affecting efficiency of nursery swine production using Tobit Regression.

Variable	Coefficient	p-value
Constant	0.0512	0.0642
X1 (age of swine entering the nursery)	0.3596***	0.0184
X2 (average weight of swine at the early stage of raising)	0.0375***	0.0002
X3 (time spent in raising nursery swine)	0.0127	0.8925
X4 (Experience of employees who raise swine)	0.0045***	0.0030
X5 (Number of employees who raise swine)	0.0004	0.8425
X6 (Seasons for raising nursery swine)	0.0105***	0.0178
Disturbance standard deviation	1.00	0.000
Log likelihood function	4.36	

3.3 Discussion

The study on factors affecting technical efficiency of nursery swine production found the age of swine entering the nursery had an effect on technical efficiency of nursery swine production, consistent with a study conducted by Warunee (2016) on effect of broiler breeders age on hatchability and chick quality as the study found that eggs produced by broiler

breeders aged 30-50 weeks had a better hatchability rate than eggs produced by broiler breeders aged older than 50 weeks. Chick quality, birth weight of chicks and chicks hatched from eggs produced by broiler breeders aged older than 50 weeks were higher than chicks hatched from eggs produced by broiler breeders aged younger than 50 weeks, which is in the same direction of the efficiency of

nursery swine production and average weight of swine at the early stage of raising (kilogram/swine/piggery) that have an effect on the efficiency of nursery swine production. This is consistent with a study conducted by Alongkot (2016) finding that birth weight had an effect on weaning weights of piglets. If newborn piglets are big in size, their weaning weight seems to be good accordingly. Birth weight that increases every 100 grams will enable weaning weight to increase 700 grams, consistent with the direction of efficiency of nursery swine production resulted from adjusting production efficiency that allows swine entering the nursery to have better weights including better experience of employees who raise swine. This is consistent with a study conducted by Udon and others (2017) finding that factors influencing technical inefficiency of fattening pig raising were age of pig farmers, experience in raising pigs and training attendance. A study conducted by Patcharat (2019) found that seasons and weather in each season had a direct effect on milk cows and roughages. Different temperature and humidity in each season could make milk yield and milk component different, consistent with nursery swine production that each season had an effect on nursery swine production. It can be seen that all 4 factors affect efficiency of nursery swine production.

4. Conclusion and Recommendations

Efficiency of nursery swine production was at a high level in 2016, 2017, 2018 and 2019. The means efficiency of nursery swine production were 0.997, 0.967 and 1.033 respectively and the change in productivity was 0.999 on average due to increasing changes in technological efficiency. Therefore, nursery swine production is able to increase efficiency of the operations to ensure the level of efficiency of the operations will reach the highest value at 1.000. There are 4 factors affecting efficiency of nursery swine production, namely, age of swine entering the nursery, average weight of nursery swine, experience of employees who raise swine and season for raising nursery swine.

Based on the study, to increase the efficiency level of nursery swine production on average, factors of production need to be reduced, i.e. time spent on raising nursery swine and the number of employees who raise

swine to be more appropriate. Adjustment should be given to technical efficiency of nursery swine production. The existing technical efficiency should be utilized to its maximum capacity to achieve sustainable the maximum benefit including enhancing the operations in terms of management, internal control and business conducting for nursery swine production.

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