Decomposing total factor productivity of SMEs in agricultural sector in Aceh, Indonesia

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Abstract. This study measures and decomposes the Total Factor Productivity (TFP) of the SMEs in the agricultural sector across 23 regencies/cities in Aceh province, Indonesia during the 2015-2019 period. Using Data Envelopment Analysis (DEA), the study found a low level of SMEs' productivity during the study period. The SMEs in Aceh province recorded different levels of TFP. Overall, the SMEs' TFP has slightly declined, contributed mainly by an increase in efficiency level and a decline in the technical efficiency change. These findings showed the importance of adopting advanced agricultural-related technologies and implementing good SMEs' governance principles to further improve SMEs' TFP. Finally, the government must prioritize promoting non-productive SMEs across the 23 regencies/districts in the province by offering sufficient financial aids and conducting professional managerial training programs.

1. Introduction
Small and Medium Enterprises (SMEs) play an important role in economic development both in developed and developing countries, including Indonesia. SMEs show a crucial increasing role in Indonesia as it shows a growing trend of contribution to the national economy in the last few decades. In addition to the expansion of job opportunities and employment, as a small-scale business entity, SMEs have been able to reduce income disparity, alleviate poverty, provide foreign exchange income for the country, and at the same time act as a driving force for national economic growth. Based on data from the Ministry of Cooperatives and SMEs, the 61.7 million units of SMEs that existed in 2016 were able to absorb up to 89.2% of the total workforce, contributed 60.34% of the total national GDP, 14.17% of total exports, and contributed 58.18% of the total investment [1]. In 2020, the number of SMEs and their contributions to the national economy showed an increasing trend. In 2020, the number of SMEs reached 64.2 million units with a contribution to the national GDP of 61.07% or
IDR 8,573.89 trillion. The contribution of SMEs to the Indonesian economy includes their ability to absorb 97% of the total workforce and contributed 60.4% to the total investment [2].

Of the nine categories of the SMEs, SMEs in the agricultural, livestock, forestry, and fisheries sector contributed the most (48.85%) to the Indonesian economy in 2014, followed by SMEs in the sectors of trade, hotel, and restaurant (28.83%), transportation and communications (6.88%), processing industry (6.41%), services (4.52%), finance, leasing and corporate services (2.37%), building (1.57%), mining and quarrying (0.53%), and electricity, gas and clean water (0.03%) [3]. In early 2021, the SMEs in the agricultural, livestock, forestry, and fishery sector was recorded as the second most important sector, following the management industry sector in supporting the Indonesian economy. SMEs in the processing industry sector contributed 19.88% to Indonesia's GDP, followed by the agricultural sector at 13.70% [4]. During the 2011-2009 period, the SMEs in the agricultural sector were able to absorb the highest workforce with an average of 32.21% compared to other sectors which were less than 19% during the same period. Even the agricultural sector is a sector that experiences continuous growth of 2.59% during the Covid-19 pandemic outbreak when national economic growth contracted by -2.07% [5]. The agricultural sector is projected to grow by 3.30% to 4.27% in the next few years [6]. This shows that the agricultural sector is one of the mainstay economic sectors of the Indonesian economy.

The increasing contribution of SMEs to the Indonesian economy cannot be isolated from an increase in labor productivity. For example, during 2014-2018, labor productivity in the agricultural sector increased by 20.35%, from IDR 23.29 million per labor in 2014 to IDR 28.03 million per labor in 2018, with an average increase of 4.79% per year. However, the overall productivity of SMEs in the agricultural sector has been relatively low due to the lack of innovation and utilization of modern biotech agricultural technology, precision agriculture, upstream-downstream integrated value chains, the marketplace for access, and price stability [7]. The importance of putting efforts to increase the productivity of SMEs in the agricultural sector has prompted this research to measure the SMEs' productivity and its sources in depth.

Many previous studies have assessed SMEs' productivity and their determinants both in developed and developing economies [8]. For example, the previous found the importance of the workforce, technology, and training to enhance the SMEs' productivity in India [9]. Product innovation through research and development contributed to the productivity of SMEs in Italy [10]. Financial support, skilled labor, and technological progress determined the SMEs' productivity in the Arab region [11], while infrastructure access and business competitiveness determined the studies' productivity in Africa [12]. A study on SMEs' productivity in Canada found an insignificant influence of credit constraints on their productivity [13].

Similar studies on SMEs' productivity have also been conducted in the ASEAN region. For example, the SMEs in Vietnam have experienced an increase in the productivity level due to their ability to possess a globally recognized certificate and to innovate technologically [9]. Tax incentives, utilization of information and communication technology, and product innovation contributed to an increase in the productivity of SMEs in Thailand [14]. Entrepreneurial competencies, professional management, and labor skills, technology, networks, and innovation have been critical to SMEs' productivity [15]. For the case of Indonesia, previous researches documented that human resources [16], training [17], use of proper mix inputs [18], technology, capital [19], business size, educational background [20], and the use of advanced technology [21] determined SMEs' productivity in the country.

The above-reviewed studies have assessed the determinants of SMEs' productivity, but none of them has measured the SMEs' productivity in the agricultural sector in Indonesia. In addition, previous researches have not identified sources of productivity of the SMEs, thus they could no offer a holistic policy recommendation to promote SMEs' performances. Motivated to fill the gaps in the previous studies, the present study aims to assess the total factor productivity of SMEs in the agricultural sector and its sources using the Data Envelopment Analysis (DEA). DEA is able to measure Malmquist Total Factor Productivity (TFP) index and decompose TFP into two sources, namely efficiency and
technical changes. The efficiency change could be further decomposed into pure and scale efficiency changes. Finally, different from previous researches that focused on specific SMEs in a certain region, this study measures the relative productivity and their sources, taking the case of SMEs in the agricultural sector across 23 regencies/cities in Aceh province, Indonesia. The findings of this study are hoped to offer the latest evidence for the SMEs and relevant government authorities in formulating policies to enhance SMEs’ productivity.

2. Materials and methods

2.1. Site and time
This study measures the SMEs’ relative productivity and their sources in the agricultural sector across 23 regencies/cities in Aceh province, Indonesia during the 2015-2019 period. SMEs in this sector involve in various sub-sectors, including food crops, horticulture (vegetables, fruits, and ornamental plants), plantation crops, fisheries, and livestock. Most SMEs in the agriculture sector are engaged in providing food, selling vegetable seeds, flower seeds, fruit seeds, farming corn, vegetables, and ornamental plants in the rural areas in the province.

2.2. Sampling and measurement
Of 4,007 units of SMEs in the agricultural sector in 23 regencies/cities in Aceh province, Indonesia, 138 of them were chosen as the study's sample using a stratified random sampling technique. These consist of six units of SMEs in every 23 regencies/cities. Since the study explores five years, thus this study comprises 690 observations. In measuring the SME’s relative total factor productivity, this research utilizes three inputs (i.e., number of managerial boards, own capital, and external capital, and managerial board) and one output (i.e., profits). The selection of inputs and output is based on the Indonesian Cooperative Act, No. 25 (1992) that states the operational activities of the SMEs are supported by their own, external capital, and managerial members for the sake of gaining profit. The study uses primary data that are collected by distributing questionnaires to the SMEs in 23 regencies/cities in Aceh province, Indonesia.

2.3. Data and analysis
In measuring the productivity of the Decision-Making Units (DMUs), previous researchers have adopted three main approaches, namely traditional, parametric, and non-parametric analyses [8]. A non-parametric approach of DEA has been commonly used to measure the relative productivity of the DMUs due to their superiorities [22]. Apart from its ability to identify the Total Factor Productivity (TFP) sources, DEA is also able to consider the combination of various inputs to produce multiple outputs [23] based on Constant Return to Scale (CRS) and Variable Return to Scale (VRS) assumptions. Different from CRS, the VRS assumes the ratio between changes in inputs and outputs are disproportionate, implying that the additional inputs by x times would not necessarily cause changes in the output by x times [24].

On the above bases, therefore, this research measures the relative productivity of the SMEs in the agricultural sector using a generalized output-orientation based on the Malmquist index [23]. Using the DEA program, the study estimates the following equations:

\[
M_0 \left( x^t, y^t, x^{t+1}, y^{t+1} \right) = (a)x(b) \tag{1}
\]

Where,
\[
a = \frac{D_0(x^{t+1}, y^{t+1})}{D_0(x^t, y^t)}; \text{and} \quad a = \frac{D_0(x^{t+1}, y^{t+1})}{D_0(x^t, y^t)}
\]

Where, \(M_0\) is the Malmquist Index of TFP, \(D_0\) is a function of distance, \(x\) and \(y\) relate to the input and output for periods \(t\) and \(t+1\), respectively. \(a\) is a technical change and \(b\) is an efficiency change.
The study decomposes the TFP into two components, namely: efficiency change (EFch) and technical efficiency change (TEch). EFch is further decomposed into two sub-components, namely: pure efficiency change (PEch) and scale efficiency change (SEch). These decompositions are measured using the following equations:

$$M_a(x', y', x^{t+1}, y^{t+1}) = (a)(b) = (a)(x_{ctd})$$

(2)

Where,

$$a = \left( \frac{D_{0c}(x^t, y^t)}{D_{0c}(x^{t+1}, y^{t+1})} \right)$$

and

$$c = \left( \frac{D_{0c}(x^t, y^t)}{D_{0c}(x^{t+1}, y^{t+1})} \right)$$

$$d = \left( \frac{D_{0c}(x^t, y^t) D_{0c}(x^{t+1}, y^{t+1})}{D_{0c}(x^t, y^t) D_{0c}(x^{t+1}, y^{t+1})} \right)^{1/2}$$

Where, a is the technical change (TEch), b is the change in efficiency, c is the change in pure efficiency (PEch), and d is the change in scale efficiency (SEch).

3. Results and discussion

This study measures TFP and its sources of SMEs in the agricultural sector across 23 regencies/cities in Aceh province, Indonesia from the period 2015 to 2019. Table 1 illustrated the relative productivity of the SMEs based on Return to Constant Return to Scale (CSR) and Variable Return to Scale (VRS).

| No. | District           | 2015 CRS | 2015 VRS | 2016 CRS | 2016 VRS | 2017 CRS | 2017 VRS | 2018 CRS | 2018 VRS | 2019 CRS | 2019 VRS |
|-----|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1.  | Banda Aceh        | 0.321    | 0.458    | 0.324    | 0.462    | 0.520    | 1.000    | 0.174    | 1.000    | 0.400    | 1.000    |
| 2.  | Aceh Besar        | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 0.535    | 0.682    | 1.000    | 1.000    |
| 3.  | Pidie             | 0.100    | 0.800    | 0.999    | 1.000    | 0.987    | 0.992    | 0.543    | 0.650    | 0.604    | 0.679    |
| 4.  | Pidie Jaya        | 0.501    | 0.501    | 0.476    | 0.482    | 0.599    | 0.611    | 0.327    | 0.440    | 0.512    | 0.601    |
| 5.  | Bireuen           | 0.558    | 0.571    | 0.623    | 0.638    | 0.781    | 0.781    | 0.175    | 0.237    | 0.816    | 0.824    |
| 6.  | Lhokseumawe       | 0.655    | 0.703    | 0.698    | 0.735    | 0.998    | 1.000    | 0.293    | 0.396    | 0.455    | 0.456    |
| 7.  | North Aceh        | 0.107    | 0.118    | 0.149    | 0.149    | 0.115    | 0.120    | 0.164    | 0.220    | 0.222    | 0.270    |
| 8.  | East Aceh         | 0.837    | 1.000    | 0.934    | 1.000    | 0.629    | 0.709    | 0.207    | 0.265    | 0.878    | 0.950    |
| 9.  | Langsa            | 0.964    | 1.000    | 0.810    | 0.928    | 1.000    | 1.000    | 0.363    | 0.365    | 0.801    | 0.839    |
| 10. | Aceh Tamiang      | 0.223    | 0.229    | 0.249    | 0.255    | 0.244    | 0.247    | 0.160    | 0.161    | 0.366    | 0.401    |
| 11. | Southeast Aceh    | 0.580    | 1.000    | 0.762    | 0.861    | 0.762    | 1.000    | 1.000    | 0.824    | 1.000    | 1.000    |
| 12. | Gayo Lues         | 0.493    | 0.494    | 0.599    | 0.600    | 0.693    | 0.720    | 0.289    | 0.388    | 0.513    | 0.618    |
| 13. | Central Aceh      | 0.264    | 0.301    | 0.398    | 0.398    | 0.403    | 0.411    | 0.253    | 0.325    | 0.274    | 0.345    |
| 14. | Bener Meriah      | 0.785    | 0.803    | 0.876    | 0.903    | 0.866    | 0.872    | 0.293    | 0.398    | 0.951    | 1.000    |
| 15. | Aceh Singkil      | 0.463    | 0.474    | 0.625    | 0.632    | 0.586    | 0.599    | 0.184    | 0.225    | 0.431    | 0.457    |
| 16. | Sabang            | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    |
| 17. | West Aceh         | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 0.392    | 0.460    | 0.718    | 0.733    |
| 18. | Nagan Raya        | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 0.457    | 1.000    | 1.000    | 1.000    |
| 19. | Southwest Aceh    | 0.666    | 0.770    | 0.928    | 0.928    | 1.000    | 1.000    | 0.510    | 0.599    | 0.953    | 0.967    |
| 20. | South Aceh        | 0.743    | 1.000    | 0.881    | 1.000    | 1.000    | 1.000    | 0.918    | 1.000    | 1.000    | 1.000    |
| 21. | Subussalam        | 0.840    | 0.848    | 0.993    | 1.000    | 1.000    | 1.000    | 0.435    | 0.437    | 1.000    | 1.000    |
| 22. | Simeulue          | 0.348    | 0.355    | 0.202    | 0.207    | 0.397    | 0.398    | 0.194    | 0.252    | 0.425    | 0.438    |
| 23. | Aceh Jaya         | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    | 1.000    |

Source: Primary data processed using the DEA program (2021).

As observed from Table 1, based on the CRS assumption, the study found that SMEs in North Aceh recorded the lowest productivity level (10.7% in 2015), followed by SMEs in the districts of
Aceh Tamiang (16% in 2018), Banda Aceh (17.4% in 2018), Simeuleu (19.4% in 2018), and Central Aceh (25.3% in 2018). On the other hand, the highest relative productivity was recorded by SMEs in Sabang (100% in 2015-2019) and Aceh Jaya (100% in 2015-2019), followed by SMEs in South Aceh (74.3% - 100%), Aceh Besar (53.5% - 100%), Subulussalam (43.5% - 100%), and Nagan Raya (45.7% - 100%). Of the 23 regencies/cities studied, SMEs located in 13 districts/cities recorded a relatively higher level of productivity than the provincial average, ranging between 42.9% (the year 2018) to 76.4% (the year 2016). The rest SMEs located in 10 regencies recorded productivity levels below the provincial average.

Meanwhile, from the VRS perspective, the study found that some SMEs were experiencing full efficiency (100%) during the study period. These SMEs are located in four regencies/cities, namely Sabang, Aceh Jaya, South Aceh, and Nagan Raya. SMEs in two districts recorded relative efficiency scores greater than 90%, namely SMEs in Southeast Aceh (97.2%) and Aceh Besar (93.6%). Meanwhile, the SMEs located in 17 other regencies/cities in the province recorded efficient scores between 10% to 90%. SMEs located in the regency of North Aceh recorded the lowest efficiency level (11.8% in 2015), followed by SMEs in the districts of Aceh Tamiang, Simeuleu, Central Aceh, and Aceh Singkil. Of the 23 regencies/cities studied, SMEs in 14 districts recorded a relatively higher level of productivity than the provincial average, ranging between 54.3% (the year 2018) to 76.4% (the year 2019), and the rest of SMEs located in 9 regencies/cities recorded productivity levels below the provincial average. Overall, the study found an unsteady level of SMEs’ productivity. The SMEs were unable to maintain a continuous improvement of their productivity level from year to year. Their small scale, lack of capital, and traditional mismanagement have caused the low level of SMEs productivity in Aceh province, Indonesia.

Table 2. TFP changes and its decomposition of the SMEs in the agricultural sector, 2015-2019.

| District       | 2015-2016 | 2016-2017 |
|---------------|-----------|-----------|
|               | EFch | Tech | PEch | SEch | TFPch | EFch | Tech | PEch | SEch | TFPch |
| 1.            | 1.009 | 0.991 | 1.007 | 1.002 | 1.000 | 1.604 | 0.824 | 2.167 | 0.740 | 1.322 |
| 2.            | 1.000 | 0.968 | 1.000 | 1.000 | 0.968 | 1.000 | 0.976 | 1.000 | 1.000 | 0.976 |
| 3.            | 0.999 | 0.816 | 1.000 | 0.999 | 0.816 | 0.988 | 0.799 | 0.992 | 0.996 | 0.789 |
| 4.            | 0.951 | 0.900 | 0.962 | 0.988 | 0.856 | 1.259 | 0.794 | 1.267 | 0.993 | 1.000 |
| 5.            | 1.116 | 0.896 | 1.117 | 0.999 | 1.000 | 1.254 | 0.806 | 1.224 | 1.025 | 1.011 |
| 6.            | 1.066 | 0.977 | 1.045 | 1.020 | 1.042 | 1.429 | 0.762 | 1.360 | 1.051 | 1.089 |
| 7.            | 1.394 | 0.717 | 1.262 | 1.105 | 1.000 | 0.776 | 0.883 | 0.807 | 0.962 | 0.685 |
| 8.            | 1.116 | 0.896 | 1.000 | 1.116 | 1.000 | 0.674 | 0.882 | 0.709 | 0.949 | 0.594 |
| 9.            | 0.841 | 0.991 | 0.928 | 0.906 | 0.833 | 1.235 | 0.810 | 1.078 | 1.146 | 1.000 |
| 10.           | 1.116 | 0.896 | 1.117 | 0.999 | 1.000 | 0.980 | 0.815 | 0.968 | 1.013 | 0.799 |
| 11.           | 1.315 | 0.749 | 0.861 | 1.527 | 0.985 | 0.999 | 1.067 | 1.161 | 0.860 | 1.066 |
| 12.           | 1.216 | 0.822 | 1.214 | 1.102 | 1.000 | 1.156 | 0.865 | 1.201 | 0.963 | 1.000 |
| 13.           | 1.507 | 0.720 | 1.321 | 1.141 | 1.105 | 1.014 | 0.955 | 1.033 | 0.981 | 0.968 |
| 14.           | 1.116 | 0.896 | 1.125 | 0.992 | 1.000 | 0.989 | 0.886 | 0.966 | 1.024 | 0.876 |
| 15.           | 1.350 | 0.741 | 1.332 | 1.014 | 1.000 | 0.938 | 1.067 | 0.948 | 0.989 | 1.000 |
| 16.           | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 17.           | 1.000 | 0.741 | 1.000 | 1.000 | 0.741 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 18.           | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 19.           | 1.393 | 0.718 | 1.205 | 1.156 | 1.000 | 1.078 | 0.941 | 1.078 | 1.000 | 1.014 |
| 20.           | 1.186 | 0.727 | 1.000 | 1.186 | 0.862 | 1.135 | 0.979 | 1.000 | 1.135 | 1.111 |
| 21.           | 1.183 | 0.740 | 1.179 | 1.003 | 0.875 | 1.007 | 0.893 | 1.000 | 1.007 | 0.899 |
| 22.           | 0.582 | 0.955 | 0.583 | 0.998 | 0.556 | 1.963 | 0.832 | 1.922 | 1.021 | 1.634 |
| 23.           | 1.000 | 0.491 | 1.000 | 1.000 | 0.491 | 1.000 | 1.160 | 1.000 | 1.000 | 1.160 |

Mean 1.087 0.830 1.041 1.044 0.903 1.081 0.905 1.091 0.991 0.978
During the period 2015-2016, the SMEs experienced an increase in SEch by 8.7% and a decline in technical efficiency change (TEch) by 9.5%. Meanwhile, in the period 2017-2018, the SMEs experienced a decline in EFch by 21.0% and a rise in TFP by 2.2%. Finally, in the period 2018-2019, the SMEs again enjoyed an increase in EFch by 8.1% but a decline in their Tech by -9.5%. Overall, the study found that the average TFP of the SMEs in the agricultural sector has declined by -9.7% during the 2015-2016 period, -2.2% during the 2016-2017 period, and -4.4% during 2018-2019. However, during the 2017-2018 period, the SMEs have experienced an increase in TFP by 14.2%. The traditional way of managing a small scale of business entity of the SMEs caused the decline of TFP level. The improper combination of limited inputs to produce the highest outputs have been the main contributors to the decline of TFP level.

Table 2 reports the sources of SMEs’ TFP into efficiency change (EFch) and technical efficiency change (Tech) as well as the sub-components of EFch into scale efficiency change (SEch) and pure efficiency change (PEch). The value of productivity change of greeter than 1.000 shows an increase in the SMEs’ productivity, while the value of less than 1.00 shows a decline in the SMEs’ productivity.

Overall, the study found that the average TFP of the SMEs in the agricultural sector has declined by -9.7% during the 2015-2016 period, -2.2% during the 2016-2017 period, and -4.4% during 2018-2019. However, during the 2017-2018 period, the SMEs have experienced an increase in TFP by 14.2%. The traditional way of managing a small scale of business entity of the SMEs caused the decline of TFP level. The improper combination of limited inputs to produce the highest outputs have been the main contributors to the decline of TFP level.

Table 2 reports the sources of SMEs’ TFP into efficiency change (EFch) and technical efficiency change (Tech) as well as the sub-components of EFch into scale efficiency change (SEch) and pure efficiency change (PEch).  The value of productivity change of greater than 1.000 shows an increase in the SMEs’ productivity, while the value of less than 1.00 shows a decline in the SMEs’ productivity.

Overall, the study found that the average TFP of the SMEs in the agricultural sector has declined by -9.7% during the 2015-2016 period, -2.2% during the 2016-2017 period, and -4.4% during 2018-2019. However, during the 2017-2018 period, the SMEs have experienced an increase in TFP by 14.2%. The traditional way of managing a small scale of business entity of the SMEs caused the decline of TFP level. The improper combination of limited inputs to produce the highest outputs have been the main contributors to the decline of TFP level.

In terms of its TFP components, the study found an increase in efficiency change (EFch) by 8.7% and a decline in technical efficiency change (Tech) during the 2015-2016 period. In the 2016-2017 period, the SMEs enjoyed an increase in EFch by 8.1% but a decline in their Tech by -9.5%. Meanwhile, in the period 2017-2018, the SMEs experienced a decline in EFch by -47.3% but a rising in TFP by 21.0%. Finally, in the period 2018-2019, the SMEs again enjoyed a rising in EFch by 80.4%, but a decline in their Tech by -47.0%. Overall, the EFch is found to be the main contributor to the changes in TFP as compared to TEch. These findings showed that the lack of advanced agricultural technologies adopted by the SMEs in the agricultural sector has been detrimental for the SMEs to improve their TFP.

Furthermore, Table 2 reports the sub-components of EFch, namely scale efficiency change (SEch) and pure efficiency change (PEch). During the period 2015-2016, the SMEs experienced an increase in SEch and PEch by 4.4% and 4.1%, respectively. During the period 2016-2017, the SMEs experienced a decline in SEch by -0.9% but an increase in PEch by 9.1%. In 2017-2018, the SMEs
experienced a decline in their SEch (-19.7%) and PEch (-36.0%), whereas in 2018-2019 the SMEs again recorded an increase in their SEch (17.6%) and PEch (53.3%). These findings further show that the small scale of the business entity and the inability of SMEs' managers to combine proper mix inputs to produce the maximum outputs have contributed to the low level of TFP change.

Finally, Table 3 reports the overall TFP changes and its decomposition of the SMEs in the agricultural sector in Aceh province during the 2015-2019 period. As observed from Table 2, on average, the SMEs in the agricultural sector have experienced a decline in their TFP by -0.9% during the study period. The changes in SMEs' TFP have been boosted by EFch (0.23%) but deteriorated by Tech (-3.1%). These findings further confirmed the traditional technology adopted by the SMEs in the agricultural sector has been the main contributor to the decline in the SMEs' TFP. The study also found that the EFch has been sourced from PEch by 2.8% and SEch by -0.4%. The small scale of SMEs' business entity caused the SMEs' inefficiency, thus their TFP. Overall, most of the SMEs in 23 regencies/districts in the province have recorded a decline in their TFP. Of the 23 regencies/districts, the SMEs in 10 regencies/cities have recorded a TFP progress, while SMEs in the rest 12 regencies/districts have experienced a TFP regress.

| No. | District          | 2015-2019 | EFch | TEdh | PEch | SEch | TFPch |
|-----|------------------|-----------|------|------|------|------|-------|
| 1   | Banda Aceh       | 1.057     | 1.033| 1.215| 0.869| 1.091|
| 2   | Aceh Besar       | 1.000     | 0.964| 1.000| 1.000| 0.964|
| 3   | Pidie            | 0.881     | 0.935| 0.908| 0.971| 0.824|
| 4   | Pidie Jaya       | 1.006     | 0.998| 1.047| 0.961| 1.004|
| 5   | Bireuen          | 1.100     | 0.999| 1.096| 1.004| 1.099|
| 6   | Lhokseumawe      | 0.913     | 0.979| 0.897| 1.017| 0.894|
| 7   | North Aceh       | 1.201     | 0.989| 1.230| 0.976| 1.187|
| 8   | East Aceh        | 1.012     | 0.941| 0.987| 1.025| 0.953|
| 9   | Langsa           | 0.955     | 1.037| 0.957| 0.997| 0.990|
| 10  | Aceh Tamiang     | 1.132     | 0.998| 1.151| 0.984| 1.130|
| 11  | Southeast Aceh   | 1.092     | 0.912| 1.000| 1.092| 0.995|
| 12  | Gayo Lues        | 1.010     | 1.028| 1.058| 0.955| 1.038|
| 13  | Central Aceh     | 1.009     | 0.968| 1.034| 0.976| 0.977|
| 14  | Bener Meriah     | 1.049     | 0.985| 1.056| 0.993| 1.034|
| 15  | Aceh Singkil     | 0.983     | 0.891| 0.991| 0.992| 0.875|
| 16  | Sabang           | 1.000     | 1.083| 1.000| 1.000| 1.083|
| 17  | West Aceh        | 0.921     | 0.944| 0.925| 0.995| 0.869|
| 18  | Nagan Raya       | 1.000     | 0.882| 1.000| 1.000| 0.882|
| 19  | Southwest Aceh   | 1.094     | 0.900| 1.059| 1.033| 0.984|
| 20  | South Aceh       | 1.077     | 0.921| 1.000| 1.077| 0.992|
| 21  | Subussalam       | 1.045     | 0.997| 1.042| 1.003| 1.042|
| 22  | Simulue          | 1.051     | 0.989| 1.054| 0.997| 1.039|
| 23  | Aceh Jaya        | 1.000     | 0.934| 1.000| 1.000| 0.934|

Mean: 1.023 0.969 1.028 0.996 0.991

Source: Primary data processed using the DEA program (2021).

Our findings of the low level of the SMEs' TFP in the agricultural sector are supported by many previous studies [25] and [26]. However, our findings of dissimilar SMEs' TFP contradicted the previous study that found similar SMEs' productivity levels in 29 regions in mainland China [27]. Thus, it is extremely crucial for the government to design proper policies to promote SMEs' TFP levels in all regions to enjoy a similar TFP. These findings show the importance of assistance effort to prioritize promoting SMEs in the areas that experienced low TFP level by providing financial and
management assistances. This policy would create an equal economic development across the regencies. This could be done by, inter alia, by the adoption of advanced agricultural-related technologies. Our findings of different SMEs’ TFP levels across the regions are in harmony with previous researches [10], [14], and [28]. Apart from providing financial aids, the government should provide regular training for the SMEs from the areas that recorded lower TFP levels by benchmarking the SMEs’ best practices. Finally, the SMEs need to enhance their funds’ utilization for productive purposes and properly mix limited inputs to produce the highest outputs.

4. Conclusions
This research has measured and decomposed Total Factor Productivity (TFP) of the SMEs in the agricultural sector across 23 regencies/cities in Aceh province, Indonesia during the 2015-2019 period. Using Data Envelopment Analysis (DEA), the study documented the low SMEs' TFP level during the study period. Overall, the SMEs' TFP has slightly declined, contributed mainly by an increase in efficiency change. On the other hand, the change in technical efficiency has lowered the SMEs' TFP. These findings showed the importance of adopting advanced agricultural-related technologies and implement good governance principles to further improve SMEs' TFP. The SMEs also need to properly utilize funds for productive purposes and combine limited inputs to produce the highest output. Finally, the government must prioritize promoting non-productive SMEs across the 23 regencies/districts in the province by offering sufficient financial aids and conducting professional managerial training programs.

To provide more comprehensive empirical evidence of the SMEs' productivity, future researches are suggested to assess the SMEs’ TFP of the various sectors nationwide to offer a detailed picture of the SMEs’ TFP and their sources. Finally, future studies might utilize a mixed approach of both parametric and non-parametric to enrich the existing empirical findings of SMEs’ TFP.

Acknowledgements
This article is part of the research project funded by Directorate General of Strengthening Research and Development, Ministry of Research, Technology and Higher Education, the Republic of Indonesia, under the scheme of the World Class Research No: 215/SP2H/LT/DPRM/2019.

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