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WHAT DETERMINES CO-OPERATIVES' PRODUCTIVITY IN INDONESIA? A-TWO STAGE ANALYSIS

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ABSTRACT. This study empirically measures and analyzes determinants of productivity changes of the co-operatives across all 34 provinces in Indonesia over the 2015-2020 period using a-two stage approach. In the first stage, the study measures the productivity of the co-operatives using Data Envelopment Analysis (DEA). Meanwhile, in the second stage, the study utilizes a panel regression model to measure and analyze the determinants of productivity of the co-operatives in Indonesia. The study recorded that the co-operatives in Indonesia have experienced a 9.7% increase in their Total Factor Productivity (TFP), contributed mainly by the technical efficiency progress. Furthermore, the study found that the business volume has contributed to the improvement of the co-operatives' TFP. Meanwhile, the co-operatives' members, liquidity, and indebtedness are found to deteriorate the TFP growth. Profitability, however, is found to have an insignificant effect on TFP growth due to the non-profit orientation of the co-operatives. These findings suggest the need for co-operatives to diversify their business activities, supported by the adoption of relevant advanced technologies, particularly the use of online marketing. In addition, the co-operatives should improve their financial performances to maximize the use of capital by restricting liquidity and indebtedness. Finally, the government support to enhance financial and managerial aspects is essential to realize the co-operatives as the pillar of Indonesia's economy, as mandated by the 1945 Indonesian constitution.

keywords: TFP, malmquist index, dea, co-operative surplus, internal and external capital, business volume, financial performance

Introduction

Co-operatives are pertinent to global social, cultural, and economic development. About 3 million co-operatives existed around the globe in 2020 with more than 1 billion members have offered job opportunities to 280 million of the world population. The top 300 world co-operatives generated a total turnover of USD2,180 billion (Euricse, ICA, 2020). Geographically, the majority of the 300 world's largest cooperatives were located in Europe (55.00%), followed by America (25.67%), Asia-Pacific (19.00%), and Africa (0.33%). Of the 10 top cooperatives globally, 7 of them were located in Europe and Groupe Crédit Agricole (France) appeared to be the largest cooperative in the world with a total turnover of USD114.55 billion and the number of an employee of 142,675 (Euricse, ICA, 2020).

The presence of the Covid-19 pandemic at the end of 2019, has caused a shock to various sectors of world economies, including co-operatives. Although co-operatives have been proven to be more adaptable and resilient in times of economic crises than other non-profit institutions (Darma et al., 2020; Billiet et al., 2021; Tortia & Troisi, 2021), during the COVID-19 pandemic outbreak, the effect of social distancing, closing of the market, and banning gatherings had caused a sudden drop in co-operatives' performance globally (Francesconi et al., 2021). The values and co-operative features that guarantee members' democratic participation based on principles of trust and solidarity and co-operative forward-looking orientation contribute to cooperative resilience (Dongre & Paranjothi, 2020; Billiet et al., 2021; Dave, 2021). To enhance their adaptability and resilience to the turbulent period, co-operatives could still maintain and even improve their performance through cost minimization (Tanjung & Purnamadewi, 2021).

Recently, co-operatives enhanced their actions to contribute to the global sustainable economic growth and quality employment. Many countries across the globe have taken strategic initiatives to promote co-operatives following the world economic development agenda (Imaz & Eizagirre, 2020). For example, large co-operatives in Europe have been pursuing the achievement of the 2030 Agenda of Sustainable Development Goals (SDGs). Co-operatives in Europe focused not only on short-term actions but they revived and thrived on their mid-term and longer-term agendas to rebuild a more inclusive, green, and cooperative economy (Castilla-Polo & Sánchez-Hernández, 2020). Participation and attention to members and a community focus are key points that have guided co-operatives' actions to disseminate a business model that embraces the goals promoted by the 2030 SDGs' Agenda in terms of human rights, fair labor, environmental sustainability, and sustainable growth through global networking enhancement (Kaurova et al., 2022).

The presence of co-operatives in various parts of the world is increasingly important due to their increasing contribution to the global economy, including Indonesia. For example, Article 33 of the 1945 Indonesian Constitution has placed co-operative as a pillar of Indonesia's economy. Since its first establishment in 1896 in Purwokerto, Central Java (Nasution, 1990), co-operative has contributed to increasing the welfare of its members and freeing them from moneylenders. In the last few decades, co-operatives have been showing tremendous progress. In 2016, they had offered 574,451 job opportunities and contributed about 2% to Indonesia's economy (Azhari et al., 2017). At the end of 2019, 23.16 million Indonesian is members of the 204,734 co-operatives nationwide (Ministry of Co-operatives and SMEs, 2019).

The promising progress of co-operatives and their steady contribution to the national economy is not isolated from the government support through the issuance of legal basis to supervise the co-operative, such as the 1945 Constitution and the 1992 Co-operative Act, No. 25. However, out of the total number of co-operatives in the country, 39.90% of them have been inactive nationwide. Similar problems are also faced by many co-operatives across 34

provinces in Indonesia. Lacking capital, unskilled staff, mismanagement, and low level of productivity have contributed to their inactivity (Ministry of Co-operatives and SMEs, 2017).

The co-operatives in Indonesia have, to some extent, promoted the national economy. Nevertheless, the co-operatives' contribution to the national economy is still far from expected due to the larger number of their inactivity. The contribution of co-operatives to promote the development of Indonesia's economy has been smaller compared to the contribution of co-operatives to the national economies of Sweden (13%), Switzerland (16.4%), Finland (21%), New Zealand (22%), and Kenya (45%) (Hasan et al., 2018). The failure of co-operatives in Indonesia to play their crucial role as the backbone of the national economy is primarily caused by their lower productivity (Hasan et al., 2018).

Many previous studies have explored the productivity of co-operatives worldwide. For example, in the developed countries, Ludena (2010) has explored the co-operatives' productivity in America, Doumpos and Zopounidis (2013), and Akinsoyinu (2015) in the European countries. On the other hand, studies of the cases of developing economies have been investigated by Dong and Featherstone (2004) in China and Khan et al. (2010) in Pakistan. Most of these studies documented the low-level productivity of the co-operatives.

In the context of Indonesia, there have also been several studies that measured and analyzed the productivity of the co-operatives in specific economic sectors and cities. For instances, Sulikah (2010) measured efficiency of the co-operatives in Klaten, Yogyakarta, Wirnato (2011) in Pekalongan, Central Java, Syamni and Majid (2016), Majid et al. (2021, 2022) in Aceh, Indonesia. These studies recorded that co-operatives in the selected sectors in Indonesian provinces had a lower level of productivity. Since these studies focused their analysis on the co-operatives in the specific sectors and districts, thus they could not offer extensive evidence of the co-operatives' performance province-wide.

In addition, previous studies have explored the determinants of co-operative productivity. According to the Indonesian Co-operative Law No. 25 of 1992, the success of co-operatives is determined both by financial and non-financial factors. Previous studies have documented the number of members, internal management, business units (Colombijn & Morbidini, 2017; Majid et al., 2020), capital intensity, size (Singh et al., 2019), spatial factor, location, interaction among peer co-operatives (Martínez-Victoria et al., 2018), co-operative structure, government support (Karami & Rezaei-Moghaddam, 2005), economic policy uncertainty (Singh et al., 2019), financial stability (Wassie, 2020), and other socio-economic factors (Cheng'ole et al., 2003; Maulida & Fianto, 2019) are among the non-financial factors that determine the co-operative productivity. Meanwhile, many other studies have also found financial factors include liquidity, profitability, indebtedness (Martínez-Victoria et al., 2018; Singh et al., 2019), financing structure, and non-performing financing (Maulida & Fianto, 2019) as the crucial factors determining co-operative productivity.

Unlike previous studies that focused only on either the effects of non-financial or financial factors separately on co-operative productivity, this present study explores both non-financial and financial factors determining the productivity of co-operatives across all 34 provinces in Indonesia. Even though co-operatives have good financial performance, but without the support of good non-financial factors, co-operatives will certainly fail to enhance their productivity and it, in turn, leads to bankruptcy (Syamni & Majid, 2016). Thus, exploring both financial and non-financial factors determining the productivity of co-operatives would offer a comprehensive source of co-operative's productivity that could be further used as a reference for formulating a holistic strategy for the purpose of co-operative productivity improvement.

Besides, the previous studies focusing on co-operatives in Indonesia only measured their efficiency level (Sulikah, 2010; Wirnato, 2011; Syamni & Majid, 2016; Majid et al., 2021; Majid et al., 2022). Thus, this present study intends to fill the gaps of the existing

studies by assessing the productivity of co-operatives across 34 provinces in Indonesia using Data Envelopment Analysis (DEA), in the first step. It also attempts to explore the determinants of co-operatives' Total Factor Productivity (TFP) using a panel multiple regression analysis, in the second stage. These determinants include co-operative business volume, number of members, liquidity, profitability, and indebtedness. The results of the study are expected to offer references for the co-operatives and regulators in designing policies to promote the productivity of co-operatives and their contribution to the national economy.

The remaining parts of the research are structured in the following manner. Section 2 reviews the selected previous studies on co-operative productivity and efficiency. Section 3 highlights the data and empirical model. Section 4 presents and discusses the findings and their implications. Finally, the conclusion is provided in the last Section 5.

1. Literature review

Co-operatives are established mainly to improve the welfare of their members in particular and society at large. Co-operatives are established based on values of self-help, self-responsibility, democracy, equality, equity, and solidarity (International Co-operative Alliance, 1995). Thus, a co-operative is an entity that reflects human values. Humans are creatures who need each other. A co-operative is a unique business entity, where members are both owners and beneficiaries of the services provided by a co-operative (Marwa & Aziakpono, 2014). The dual concept of co-operatives was first introduced by Draheim (1952), which was later further developed by many other scholars (Henzler, 1957, 1960; Bonus, 1986; Zamagni & Zamagni, 2010; Puusa et al., 2013) to have a dual function as a business and social ventures.

In its operation, co-operative develops economic businesses for the sake of the welfare of its members. The profits or co-operative surplus generation should be distributed to its members or be saved for use as future capital (Royer & Smith, 2007). Securing the surplus for co-operatives is essential to ensure their survival and continuity. According to the Indonesian Co-operative Law (1992), No. 25 Article 45, Paragraph 1 of 1992, the co-operative surplus is defined as an income earned within a fiscal year minus costs, depreciation, tax, and other liabilities. Co-operative income is highly reliant on both financial and non-financial aspects (Indonesian Co-operative Law, No. 25, 1992).

The presence of co-operative is not only meant for empowering the economic welfare of the members, but it also plays a crucial role in social and psychological aspects (Laurinkari, 2004). Differently put, co-operative does not solely aim at seeking profit, but it also aspires to realize mutual prosperity. However, co-operatives give more priority to strengthening membership welfare rather than capital strength (Henzler, 1957). Thus, a co-operative is a membership organization that determines its business (Michelsen, 1994). A co-operative is owned and run by its members, who are at the same time the users of services provided by the co-operatives. Although the co-operatives are not entirely a business-oriented entity, however, to provide a higher contribution to its members and national economy, the co-operatives should be operated productively. Thus, identifying the determinants of co-operatives' productivity is timely and crucial for managers, governments, and policy-makers to realize the co-operatives as the backbone of the national economy.

Both financial and non-financial aspects determine the productivity of the co-operatives. The co-operative shall enhance its internal financing sources from voluntary savings, mandatory savings, reserves, and grants. Co-operatives can also seek funding from external sources, such as borrowing from other co-operatives, banks, financial institutions, issuing bonds, and securities. However, the performance of co-operatives is also influenced

by non-financial factors. These include the number of members, business units, and the number of employees. Thus, even though the co-operative has strong financial support, however, without being supported by good non-financial factors, the co-operative will certainly not be able to fulfill its purpose of maximizing co-operative surplus. Consequently, if this problem continuously persists, it causes the co-operative to bankrupt (Syamni & Majid, 2016).

Many previous studies have investigated the co-operative productivity and performance in various sectors, cities, and countries worldwide. For example, for the cases of developed countries, Gwayi and Karanja (2014) examined the financial performance of co-operatives in Kenya. Previous studies have also assessed the performance of co-operatives in Slovakia (Fandel, 2003), the US (Ariyaratne et al., 2006), Germany, France, Italy, Spain, and Austria (Doumpos & Zopounidis, 2013), Turkey (Candemir et al., 2011), Latin America, and the Caribbean (Ludena, 2010). These studies found a low level of co-operatives. Meanwhile, the performance of co-operative in Asia has been explored by Jayamaha and Mula (2010) in Sri Lanka, Khan (2010) in Pakistan, Singh et al. (2010) in India, Dong and Featherstone (2004) in China, and Lavado (2004) in the Philippines. Resembling the findings in the developed countries, the co-operatives in Asia also showed relatively low productivity levels.

In the context of Indonesia, there have been few previous studies had investigated co-operative productivity. For example, Lukman (2011), Syamni and Majid (2016), Majid et al. (2021) and Majid et al. (2022) examined the productivity of co-operatives in Aceh Province, Indonesia. Sulikah (2010) explored the efficiency of the co-operatives in Klaten, Yogyakarta, whereas Wirnato (2011) explored the productivity of co-operatives in Pekalongan, Central Java. Overall, these studies found that the co-operative experienced low productivity and performance due to its small-scale entity characteristics.

The above-reviewed study is mainly measured the productivity level of co-operatives in specific sectors and cities. Still, none of them had explored the determinants of co-operative Total Factor Productivity (TFP) growth in entire provinces in Indonesia. This present study intends to fill up these existing gaps by examining the total factor productivity of co-operatives and their determinants in 34 provinces in Indonesia.

In brief, this study intends to probe the following five hypotheses:

H1. Business volume influences the TFP growth of co-operatives in Indonesia.

H2. Number of membership influences the TFP growth of co-operatives in Indonesia.

H3. Liquidity influences the TFP growth of co-operatives in Indonesia.

H4. Profitability influences the TFP growth of co-operatives in Indonesia.

H5. Indebtedness influences the TFP growth of co-operatives in Indonesia.

2. Research methods

This study uses panel data, obtained from the Ministry of Co-operatives and SMEs of the Republic of Indonesia and 34 Provincial Offices of Co-operatives and SMEs nationwide, from the 2015 to 2020 period. Panel data can substantially reduce the problem of omitted variables or ignore relevant variables. Panel data can also address correlations between independent variables to produce accurate regression estimates. This combination also improves the quality and quantity of data, an approach that is not possible provided by the time series or cross-sectional estimation technique. Thus, the panel data examined in this study comprise 204 observations, which are a combination of time-series data (2015-2020) and cross-section data (co-operatives in 34 provinces).

Three methods have been commonly used to measure panel data, namely: pooled least square (PLS), fixed effect (FE), and random effect (RE) approach (Verbeek, 2000). Of these three-panel regression models, the study will select the most suitable panel regression model

to be estimated in this study using a series of statistical tests. The Chow test is performed to determine whether the PLS model or FE model is the most suitable, while the Hausman test is conducted to select the most appropriate model between the RE model and FE model. Finally, the Lagrange test is conducted to find out whether the RE model is more suitable as compared to the PLS model to be adopted in the study.

However, before the panel regression analysis is carried out, the total factor productivity level is first calculated using the Data Envelopment Analysis (DEA). DEA is a non-parametric method that was first introduced by Charnes et al. (1978) within the linear programming framework. DEA analyzes the production boundary mapping function (Ramanathan, 2003; Anderson et al., 2004) and it has been a widely utilized technique for measuring productivity in various disciplines and operational business entities (Cooper et al., 2011).

There have been more than 400 studies have used DEA to measure the productivity of Decision-Making Units (DMUs) around the world in the last decade (Ali & Seiford, 1993). Compared to other techniques, DEA is a superior approach to measuring productivity. Its uses can recognize the input or output of the DMU using as a reference to find sources of inefficiency (Hadad et al., 2013) and is also able to measure multiple inputs and outputs, technological differences, competition, capacity, and demographical aspects.

DEA enables us to compare the efficiency level of a DMU with the best practice (efficient) of the border between the DMUs. In particular, this study uses a generalized output-oriented Malmquist index or the so-called Total Factor Productivity (TFP), proposed by Fare et al. (1989). The index is computed using the DEA program (Coelli, 1996). The choice of the index to compute TFP is due to its desired features' suitability for the study.

Furthermore, DEA requires no input and output prices data in measuring efficiency, making this method approach is more practical in situations where prices are publicly unavailable. It also requires no behavioral assumptions, for example, profit maximization or cost minimization, in cases where the objectives of the DMU are different, not reached, or unknown. Following the studies by Fare et al. (1994) and Majid and Maulana (2012), this study calculates a change in productivity using a Malmquist Index outputs-oriented with the following formula:

$$M_o\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = (a)x(b) \tag{1}$$

where

$$a = \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}; \text{and } a = \frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}; \text{and} \tag{2}$$

where M_0 is the Malmquist Index of TFP, D_o 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. In this context, change in efficiency (EFch) indicates how well the conversion of input to output is between periods, t and $t +1$, whereas technical change (TEch) means technological advances adopted in the production process between periods. Suppose the values of the Malmquist Index are larger than 1.000. In that case, it signifies an increase in efficiency and a level of technical efficiency. In contrast, a decline in levels of efficiency and technical efficiency is characterized by the value of index value of smaller than 1.000.

Utilizing the Malmquist Index permits us to further decompose the TFP component of EFch into two sub-components, i.e., pure technical efficiency change (PEch) and scale efficiency change (SEch). PEch designates how well the DMUs' performances are in translating inputs into outputs. At the same time, SEch points to managerial ability to choose

the best production level capable of attaining the expected output levels. The paramount possible scale is connected to the size of the DMU; if the scale of the DMU is too small or too large, it can cause inefficiency in the DMU. With this in mind, the TFP components of the Malmquist Index can then be rewritten as follows:

$$M_o\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = (a)x(b) = (a)x(cxd) \tag{3}$$

where

$$a = \left[\left(\frac{D_o^{t+1}(x^t, y^t)}{D_o^t(x^t, y^t)}\right)\left(\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^{t+1}, y^{t+1})}\right)\right]^{1/2} \quad ; c = \left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^{t+1}, y^{t+1})}\right); \text{and}$$

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

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).

Following previous studies measuring co-operatives' productivity, this study considers labor and capital as the basic input variables (Guzmán & Arcas, 2008; Soboh et al., 2012; Martínez-Victoria et al., 2018) and co-operative surplus as the main output (Hasan et al., 2018). This is also in line with the Indonesian Co-operative Act, No. 25 (1992), which describes that, in its operation, the managerial committee uses capital to generate a co-operative surplus. Labor input is measured by labor costs, while capital input is represented by total capital (Martínez-Victoria et al., 2018). Meanwhile, the output component of the co-operative surplus is the net business earnings or so-called "*sisa hasil usaha*" in Indonesia (Hasan et al., 2018).

In the next step, the study measures the determinants of productivity of co-operatives in 34 provinces in Indonesia. Specifically, this study empirically assesses the contribution of co-operative characteristics (Galdeano-Gómez, 2008) and financial performances (Soboh et al., 2009; Martínez-Victoria et al., 2018) to the co-operative TFP. Co-operative characteristics include business volume and number of members, while financial performances include liquidity, profitability, and indebtedness. These factors are examined in the study due to their potential determination to co-operative productivity and data availability.

Theoretically, the business volume reflects the size of co-operatives and their market structure that determines co-operatives' performance. As co-operatives' business volume enlarges, they tend to experience economies of scale through cost minimization (Darma et al., 2020), which, consequently contributes towards an improved productivity level (Galdeano-Gómez, 2008). Likewise, the co-operative members that enjoy benefit only in proportion to their capital contribution (Barton, 2004) would exercise their residual right to control co-operative assets that are not assigned to other parties or attenuated by law (Chaddad & Cook, 2004) for the sake of ensuring a good co-operatives' management. Through the annual general meeting, the co-operative members could voice out their rights for the betterment of co-operative governance and performance (Huang et al., 2015; Darma et al., 2020).

Furthermore, the financial performances of liquidity, profitability, and indebtedness are also contributed to cooperative productivity. The ability of co-operative to fulfill its financial obligation, maintain its indebtedness level, and generate profit would, in turn, determine its productivity level. Following previous studies, thus the study examine liquidity (Hardesty & Salgia, 2004; Notta & Vlachvei, 2007; McKee, 2007); profitability (Brester & Boland, 2004; Barton, 2004; Hardesty & Salgia, 2004; McKee, 2007; Notta & Vlachvei, 2007), and indebtedness (Hardesty & Salgia, 2004; Barton, 2004; Martínez-Victoria et al.,

2018) in our proposed model. Additionally, these factors are crucial in determining co-operative productivity in the Indonesian context based on the Indonesian Co-operative Law, No. 25 of 1992.

Thus, the study estimates the following panel regression to identify the determinants of co-operatives' productivity in 34 provinces in Indonesia.

$$TFP_{it} = \alpha + \beta_1 BUV_{it} + \beta_2 MMB_{it} + \beta_3 LIQ_{it} + \beta_4 PRF_{it} + \beta_5 IDT_{it} + \varepsilon_{it} \quad (4)$$

where *TFP* is the total factor productivity of a co-operative, *BUV* is the business volume, *MMB* is the number of co-operative membership, *LIQ* is the liquidity ratio, *PRF* is the profitability ratio, and *IDT* is the indebtedness ratio. Meanwhile, α is a constant term, β_1, β_2, β_3, β_4, and β_5 are the estimated regressors, ε is the error term, *i* is the co-operatives in province *i* in Indonesia, and *t* is the year *t*.

In this study, TFP is calculated using the Malmquist Index-DEA method. Business volume is measured by the turnover of the co-operative, while the number of co-operative membership is calculated based on the total number of registered co-operative members (Majid et al., 2020). Following Martínez-Victoria et al. (2018), liquidity is measured by the financial ratio of current assets to current liabilities, profitability is calculated as earnings before interest and taxes on total assets, while indebtedness is measured by the financial ratio of total liabilities over total assets.

Table 1 reports the descriptive statistics of the investigated variables of 34 co-operatives in Indonesia over the 2015-2020 period.

Table 1. Descriptive statistics (204 observations)

Descriptive Statistics	Mean	Median	Std. Deviation	Minimum	Maximum
Output:					
Co-operative Surplus (IDR million)	5.198	2.197	0.798	-0.264	6.756
Inputs:					
Labor Costs (IDR million)	2,076.132	1,124.065	305.075	818.071	6,097.764
Capital (IDR million)	42,526.607	1,252.876	9,376.979	13,419.460	16,526.347
Determinants:					
TFP (Index)	1.097	1.074	0.173	0.754	1.497
Business Volume (IDR million)	40.415	10.597	10.064	3.291	103.904
Membership (Person)	1,033,201	505,989	1,688,244	45,184	7,808,978
Liquidity (Ratio)	1.593	1.507	1.522	0.017	8.897
Profitability (Ratio)	0.016	0.013	0.072	-0.193	0.426
Indebtedness (Ratio)	0.491	0.434	0.271	0.169	0.949

Source: Research data, 2020 (processed).

As observed from Table 1, the co-operative surplus in 34 provinces in Indonesia ranges from IDR-0.264 million to IDR6.756 million with an average value of IDR5.198 million. Meanwhile, the co-operatives accumulated capital between IDR13.419 billion and IDR16.526 million with an average value of IDR45.527 billion. In terms of labor costs, the co-operatives spent from IDR818.071 million to 6.098 billion with an average value of 2.076 billion. On average, the co-operative in 34 provinces in Indonesia experienced an increase in Total Factor Productivity (TFP) by only 9.7%. The most remarkable improvement in TFP is recorded by the co-operatives in the East Nusa Tenggara Province by 49.7%. In comparison, the lowest TFP change is recorded by the co-operative in the Bangka Belitung Province by -24.6%. Co-operatives in the Maluku Province recorded the lowest business volume by

IDR3.291 million. In contrast, the highest value is recorded by the co-operatives in the East Java Province by IDR103.904.

In view of business volume, the co-operatives recorded an average value of IDR40.415 million, varying from IDR3.291 million to IDR103.904 million. Meanwhile, on average, the co-operatives possessed 1,033,201 memberships nationwide. The co-operative from the province of East Java recorded the largest number of members (7,808,978 people), whereas the lowest membership is recorded by the co-operative in West Papua by 45,184 people. The liquidity ratio was ranging from 0.017 to 8.897 with an average value of 1.593. Finally, the co-operatives recorded average ratios of profitability and indebtedness by 0.016 and 0.491, respectively. The co-operative from Bangka Belitung Province recorded the lowest liquidity ratio by -0193, while the co-operative from East Java Province recorded the highest liquidity by 0.426. Meanwhile, the co-operative from Maluku Province earned the highest indebtedness, while the co-operative from East Nusa Tenggara recorded the lowest indebtedness by 0.169.

Finally, prior to the estimation of Equation (4), the study conducts the classical assumption tests of normality, multicollinearity, heteroscedasticity, and autocorrelation to arrive at robust findings. To ensure data normality, a Jarque-Bera (JB) test is utilized. The data is said to be normally distributed if the p-value of the JB test is greater than a 5% significant level. The Variance Inflation Factor (VIF) is calculated to check for multicollinearity. The data are free of the multicollinearity problem if the VIF is less than 10. The Durbin-Watson (DW) test is used to check for autocorrelation, and if the D-W value is less than 2, the data is said to be free of autocorrelation. Finally, the heteroscedasticity is tested using the Breusch-Pagan (PG) test. The data are free of heteroscedasticity (homoscedastic) if the Chi-squared p-value is greater than the 5% level.

3. Findings and discussion

3.1. Brief overview of co-operatives in Indonesia

This study measures and analyzes the productivity of co-operatives in 34 provinces in Indonesia and its determinants. Figure 1 shows the distribution of 34 provinces within 7 islands (i.e., Sumatera, Java, Kalimantan, Sulawesi, Papua, Maluku, and Nusa Tenggara) nationwide. 10 provinces were located in Sumatera Island, followed by 6 provinces, respectively, in Java and Sulawesi Islands, 5 provinces in Kalimantan Island, 3 provinces in Nusa Tenggara Island, and 2 provinces respectively in Papua and Maluku Islands.

As reported by BPS – Statistics Indonesia (2021), during the year 2020, there were 127.124 units of co-operatives across 34 provinces in Indonesia. By provinces, the largest number of co-operatives were located in East Java Province by 22.464 units (17.67%), followed by the West Java Province by 14.706 units (11.57%), and Central Java Province by 12.190 units (9.59%). Meanwhile, the smallest number of co-operatives of 558 units (0.44%) was located in the North Kalimantan, the youngest province in Indonesia that was officiated on 25th October 2012.

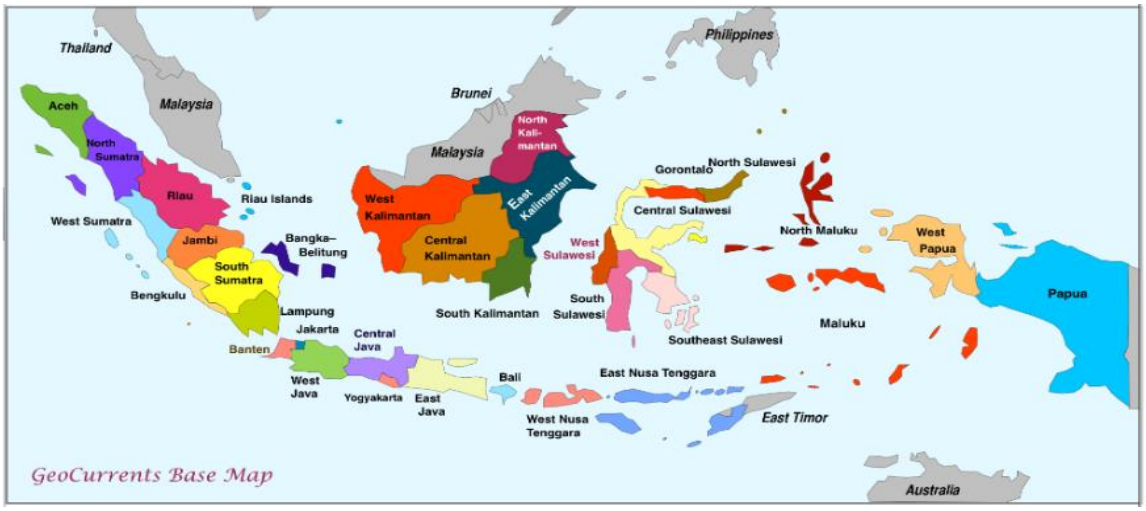

Figure 1. Map of Indonesia

Viewed from the Island perspective, in general, the majority of co-operatives (46.71%) was located in 5 provinces of the Java Island (i.e., East Java, West Java, Central Java, Jakarta Special Capital Region, and Banten; followed by 23.37% was located in 10 provinces of Sumatera Island (i.e., Aceh, North Sumatera, West Sumatera, Riau, Jambi, South Sumatera, Bengkulu, Lampung, Bangka Belitung Island, and Riau Island); 11.82% was located in 6 provinces of Sulawesi Island (i.e., North Sulawesi, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Gorontalo, and West Sulawesi); 8.62% located in 5 provinces in Kalimantan Island (i.e., West Kalimantan, Central Kalimantan, South Kalimantan, East Kalimantan, North Kalimantan); 7.46% was located in 3 provinces of Nusa Tenggara Island (i.e., Bali, West Nusa Tenggara, East Nusa Tenggara), 2.70% was located in 2 provinces in Maluku Island (i.e., Maluku and North Maluku); and 2.33% was located in 2 provinces of Papua Island (i.e., Papua and West Papua). These facts showed that the co-operatives in the country were not proportionately distributed according to Islands and provinces.

3.2. Productivity of co-operatives in Indonesia

In the first stage, the study measured and analyzed the co-operatives' productivity using Data Envelopment Analysis (DEA) where its findings are reported in Table 2. Table 2 illustrates the changes in Total Factor Productivity (TFPch) of the co-operatives in 34 provinces in Indonesia from 2015 to 2020 and its decompositions. The TFP index of smaller than 1.000 implies a deterioration in the productivity level, the index of equal to 1.000 signifies no changes in productivity level, and the index of bigger than 1.000 shows an improvement in the productivity level of the co-operatives.

Referring to Table 2, the weighted mean of the co-operatives' TFP in the country was 1.097. This indicates that the productivity of the co-operatives experienced an increasing trend by 9.7%. The co-operatives in the Bangka Belitung Province recorded the worst TFP regress by -24.6%, while the co-operatives in the East Nusa Tenggara Province are found as the uppermost performer by 49.7% in TFP progress. The co-operatives from five provinces experienced a decline in their TFP values, indicating worsening performances throughout the study. The co-operatives from 19 provinces recorded the TFP indices lower than the national average, while the co-operatives from the other 14 provinces recorded the TFP changes higher than the average of co-operative nationwide. Only co-operative from the Bangka Belitung Province experienced a negative trend of TFP and its all sub-components, while the five co-

operatives experienced positive trends of TFP and its all components. Different nature of co-operative governance, labor skills, amount of funds, government supports, and macroeconomic policies at the provincial level are believed to contribute to a different level of co-operatives' TFP nationwide (Karami & Rezaei-Moghaddam, 2005; Singh et al., 2019; Wassie, 2020).

As for the efficiency change (EFch), the co-operatives from the Central Java Province were found to be the worst efficiency regress by -29.8%, while the co-operatives from the West Papua Province experienced the highest efficiency progress by 36.1%. Overall, the co-operatives experienced a decline in their efficiency level by an average of -5.4%. This implies the deterioration of efficiency of the co-operatives nationwide. This could be partially due to improper use of inputs' combination by co-operatives to produce optimal outputs in efficient manner (Maulida & Fianto, 2019). About 67% of the co-operatives experienced declining efficiency levels. In 22 provinces, the co-operatives recorded a decline in their EFch. Only in the Jakarta Special Capital Region, the co-operatives experienced no changes in their efficiency level.

Table 2. Total factor productivity index of co-operatives in 34 provinces in Indonesia

No.	Province	TFPch	EFch	Tech	PEch	SEch
1.	Aceh	1.023	0.875	1.167	0.901	0.969
2.	North Sumatra	1.213	1.056	1.146	1.082	0.974
3.	West Sumatra	1.045	0.853	1.223	0.857	0.994
4.	Riau Islands	1.074	0.993	1.079	1.002	0.989
5.	Jambi	1.105	1.010	1.092	1.016	0.992
6.	South Sumatra	1.317	1.187	1.107	1.186	1.000
7.	Bengkulu	1.117	0.987	1.130	0.970	1.016
8.	Lampung	1.494	1.225	1.217	1.217	1.005
9.	Bangka Belitung	0.754	0.852	0.883	1.000	0.852
10.	Riau Islands	1.332	1.061	1.253	1.026	1.032
11.	Jakarta Special Capital Region	1.302	1.000	1.302	1.000	1.000
12.	West Java	1.101	0.844	1.302	0.797	1.056
13.	Central Java	1.061	0.698	1.516	0.643	1.084
14.	Special Region of Yogyakarta	1.105	0.924	1.193	1.000	0.948
15.	East Java	1.308	1.045	1.249	0.998	1.045
16.	Banten	1.064	0.932	1.140	0.924	1.006
17.	Bali	0.986	0.813	1.209	0.813	1.000
18.	West Nusa Tenggara	1.077	1.014	1.060	1.028	0.984
19.	East Nusa Tenggara	1.497	1.206	1.239	1.214	0.992
20.	West Kalimantan	1.044	0.853	1.221	0.867	0.982
21.	Central Kalimantan	0.818	0.708	1.153	0.710	0.995
22.	South Kalimantan	1.071	0.941	1.136	0.950	0.989
23.	East Kalimantan	1.093	1.040	1.049	1.035	1.002
24.	North Kalimantan	0.909	0.901	1.034	0.946	0.940
25.	North Sulawesi	1.064	0.959	1.107	1.005	0.952
26.	Central Sulawesi	1.030	0.926	1.110	0.925	0.999
27.	South Sulawesi	1.123	0.961	1.167	0.961	0.997
28.	Southeast Sulawesi	0.818	0.744	1.096	0.763	0.974
29.	Gorontalo	0.928	0.927	0.999	0.976	0.948
30.	West Sulawesi	1.038	0.853	1.214	1.000	0.853
31.	Maluku	1.154	0.938	1.229	0.973	0.962
32.	North Maluku	1.064	0.922	1.152	0.960	0.959
33.	Papua	1.019	0.836	1.216	0.868	0.961
34.	West Papua	1.393	1.361	1.021	1.345	1.010
	Geometric Mean	1.097	0.946	1.158	0.959	0.984

Source: Research data, 2020 (processed).

In comparison, in the other 10 provinces, the co-operatives recorded positive changes in their efficiency levels. Of the 34 provinces, only co-operatives in 15 provinces enjoyed e greater efficiency changes compared to the entire co-operatives in Indonesia. Meanwhile, in the other 19 provinces, the co-operatives experienced a decline in their efficiency of being smaller than the entire co-operatives countrywide.

Table 2 further illustrates the two sub-components of EFch, i.e., pure efficiency change (PEch) and scale efficiency change (SEch). Both PEch and SEch are found to deteriorate the EFch of the co-operatives in the country, respectively, by -4.1% and -1.6%. The incapability of the co-operatives' managers to combine the right inputs to generate maximum surplus has worsened their efficiency levels. The findings also show that the co-operatives had exercised diseconomies of scale. Thus, merging a few co-operatives entities into a larger scale could minimize their operational costs (Hasan et al., 2018; Majid et al., 2020). Overall, the co-operatives from 12 provinces performed poorer than the national average of the co-operatives. Meanwhile, in the other 21 provinces, the co-operatives performed better than the average of PEch of co-operative nationwide.

Next, the co-operatives in Indonesia also experienced deterioration in their SEch with the average -1.6%. Co-operatives in the Bangka Belitung Province are found to record the largest scale inefficiency decline by (-14.8%, whereas the co-operatives from the province of Central Java experienced the highest scale efficiency improvement by 8.4%. In 20 provinces, the co-operatives experienced a decline in their SEch, the SEch of co-operatives in three provinces were unchanged, and in the rest 10 provinces, the co-operatives enjoyed an improvement in their SEch.

Finally, on average, the technical efficiency changes (TEch) of the co-operatives nationwide are found to experience technical progress by 16.0%. This signifies the technical progress as the main contributor to the 9.7% improvement in the co-operatives' TFP countrywide. Implementation of advanced technological facilities, such as e-sales, e-marketing, e-planning, and e-transaction has improved the co-operatives' TFP. In Industrial Revolution 4.0 era, digital technologies play a pivotal role towards enhanced co-operative technical efficiency. The co-operatives in the Bangka Belitung Province are documented to record the worst technical regress by -11.7%, while the co-operatives in the Central Java Province are found to experience the largest technological improvement by 51.6%. By and large, except for co-operatives from the province of Bangka Belitung that experienced a decline in their TEch, all co-operatives in the other 31 provinces had enjoyed an increase in their TE. Besides, in 17 provinces, the co-operatives experienced a lower increase (15.8%) in their TE, while in the other 16 provinces, the co-operatives enjoyed a greater increase in their TE compared to the average increase in TE of co-operatives countrywide.

Our findings of the low productivity of the co-operatives are supported by many previous studies. For example, Syamni and Majid (2016) found that the changes in the TFP level of co-operative in the city of Lhokseumawe, Indonesia have been mainly caused by technological progress instead of efficiency improvement. The findings of different levels of co-operatives' TFP across the provinces in Indonesia are also in line with many previous studies conducted in various countries worldwide (Fandel, 2003; Lavado, 2004; Dong & Featherstone, 2004; Ariyaratne et al., 2006; Gómez, 2006; Khan et al., 2010; Jayamaha & Mula, 2010; Singh et al., 2010; Candemir et al., 2011; Doumpos & Zopounidis, 2013; Tesfay & Tesfay, 2013; Marwa & Aziakpono, 2014; Asawaruangpipop & Suwunnamek, 2014; Akinsoyinu, 2015; Majid et al., 2021; Majid et al., 2022). These studies documented the different levels of co-operatives productivity in various sectors and demographical areas.

The low productivity level of the co-operatives in Indonesia is not surprising evidence. The small business scale of co-operatives tends to make them more susceptible to financial unrest. Unproductive business traditions and deficient managerial and entrepreneurial

expertise amongst co-operative administrator has slowed down efforts to create co-operatives turn into a dynamic business unit (Ropke, 2000). The compensation plan for the co-operatives' administrative personnel needs to be revised and adjusted to a performance-based reward and attractive promotion packages (Othman et al., 2014). Enhancing the administrative and entrepreneurial competencies of the co-operatives personnel through continuing certified training ought to be recurrently conducted. The co-operatives should further adopt the advanced technological facilities and consider merging their business entity into a bigger scale (Syamni & Majid, 2016; Majid et al., 2021; Majid et al., 2022).

3.3. Determinants of co-operatives' productivity in Indonesia

In the second stage, the study estimates the effects of business volume, the number of members, liquidity, profitability, and indebtedness on the productivity of co-operatives across 34 provinces in Indonesia during the 2015-2020 period using the panel multiple regression techniques. Based on the panel regression models' selection tests, the RE model is found to be the best model to predict the determinants of productivity of co-operatives in Indonesia, as reported in Table 3.

As observed from Table 3, the results of the Chow test indicated the rejection of null-hypothesis, implying the FE model is more suitable than the CE model. The finding of the Hausman test showed the rejection of the alternative hypothesis, indicating the suitability of the RE model that the FE model. Finally, based on the Lagrange test, the RE model is found to be superior to the PLS model. Thus, in the next section, the study reports the determinants of co-operatives' TFP in Indonesia based on the RE model.

Table 3. Testing suitable panel regression model

Panel Regression Model Selection Test		t-Statistics	P-value
Chow test	Cross-section F	5.0413	0.0000
	Cross-section Chi-square	12.0278	0.0000
Hausman test	Cross-section random	1.0750	0.6098
Lagrange test	Cross-section	9.0876	0.0000

Source: Research data, 2020 (processed).

Furthermore, Table 4 presents the findings of the effects of business volume, membership, liquidity, profitability, and indebtedness on the TFP growth of co-operatives in 34 provinces in Indonesia over the period from 2015 to 2020 based on the RE model. As illustrated in Table 4, the business volume is found to positively affect co-operative productivity with the estimated coefficient of 0.1378 at the 5% level. This finding shows that an increase in the business volume by 100% has contributed to a 13.78% increase in the co-operatives, total factor productivity level. This finding shows the importance of business activities to generate co-operatives' surplus that in turn, contribute to the improvement of their productivity. This finding is in line with previous studies (Gwayi & Karanja, 2014; Kinya et al., 2015; Lukman, 2011; Putu et al., 2016; Majid et al., 2020; Majid et al., 2021; Majid et al., 2022). As the co-operatives possess a larger business volume, the higher their chances to generate co-operatives' surplus and improve their productivity level.

Table 4. The determinants of co-operatives' productivity

Variable	Estimated Regressors	t-statistic	P-value
Constant	-1.0296	-0.8631	0.3891
Business volume	0.1378**	2.0577	0.0392
Membership	-0.3408**	-2.1540	0.0269
Liquidity	-0.0187**	-2.1994	0.0385
Profitability	0.0312	0.4521	0.4693
Indebtedness	-0.0582**	-1.9872	0.0421
R^2 = 0.3119; Adj-R^2 = 0.3073; F-Stats = 38.0981***; P-value (F-Stats) = 0.0001; HT (p-value) = 0.168; JB (p-value) = 0.210; VIF = 1.402; BP (p-value) = 0.172; DW=1.910.			

Source: Research data, 2020 (processed).

Note: *** and ** indicate significance at the 1% and 5% levels, respectively. F-Stat is the F-statistics; Adj-R^2 is the adjusted R^2; JB is the Jarque-Bera test for normality; VIF is the variance inflation factor test for multicollinearity; BP is the Breusch-Pagan test for heteroscedasticity; and DW is the Durbin-Watson test for autocorrelation.

On the other hand, the study recorded a negative influence of the number of co-operative members on the productivity of co-operatives with an estimated coefficient of -0.3408, at the 5% level of significance. This shows that an increase in the number of co-operative members by 100% has caused the co-operative productivity to deteriorate by 34.08%. Of the 250 million population of Indonesia, 15% of them are co-operative members (Ministry of Co-operatives and SMEs, 2019). Inactive participation of the members in the co-operative business activities has deteriorated the TFP. A large number of members of co-operatives who were inactive are believed as the main cause for the deterioration of the co-operatives' TFP changes. A large number of members do not necessarily increase the productivity of co-operatives, as they were dominantly inactive. In addition, if most members do not understand the nature of the rights and obligations of the co-operatives due to their lack of awareness to share more capital apart from obligatory membership funds, the performance of co-operatives would have deteriorated. Consequently, this has caused most of the co-operatives in Indonesia to become inactive (Ministry of Co-operatives and SMEs, 2019).

Basically, a co-operative is a force based on the strength of the members, not the strength of capital. Co-operatives prioritize strengthening their members rather than capital (Henzler, 1957, 1960). Besides, suppose the co-operatives have to fund their business from external capital due to lacking capital from internal sources. In that case, the co-operatives have to bear a greater burden in paying the cost of borrowed capital. This phenomenon explained the negative contribution of co-operatives' membership to their productivity regress. However, our findings contradict the results of previous studies conducted by Ayuk et al. (2013) and Sudaryanti (2017). These studies recorded that the number of co-operative members has enhanced the productivity of the co-operatives. They found a positive membership contribution to the productivity improvement of co-operatives, as they only investigated a specific co-operative in a particular region and did not explore all co-operatives nationwide in Indonesia as our study did.

Concerning the effects of co-operatives' financial performance on TFP, the study found that both liquidity and indebtedness have negatively impacted TFP growth with an estimated coefficient of -0.0187 and -0.0582, respectively, at the 5% significance level. These, specifically, show that an increase in liquidity and indebtedness by 1% has caused a decline in TFP growth by 3.12% and 5.82%, respectively. The significant negative effect of liquidity on TFP growth can be justified by the non-profit orientation of co-operatives and their internal management policy decision. The co-operative members might exert pressure in

the co-operatives' internal management with the purpose to maximize the prices of their products and services (Notta & Vlachvei, 2007; Soboh et al., 2014).

This pressure encourages co-operatives to adjust their cash availability as much as possible. This has limited the ability of co-operatives to increase their productivity levels as they have to reduce solvency and limit their current operations. Concerning indebtedness, co-operatives are generally financed by their members who tend to be reluctant to take new investment risks (Soboh et al., 2014). Thus, the financial constraint of co-operatives to increase capital due to disincentives for members to invest in co-operatives has limited their capability to increase productivity (Soboh et al., 2009; Soboh et al., 2012).

Finally, the lack of insignificant relationship between profitability ratio and the TFP growth is very much related to the nature of the cooperative objective, which mainly focuses on maximizing the value of products and services for its members. This practice, according to Notta and Vlachvei (2007), has led to a bias between the rates of return of co-operatives that provide some degree of freedom between profitability and productivity trends.

Overall, our findings showed that the TFP growth of co-operatives in Indonesia is positively influenced by their business volume. An increase in the volume of co-operative business, especially those generated through members has increased the productivity of the co-operative. On the other hand, the financial performances of liquidity and indebtedness negatively impacted the TFP growth. Considering co-operatives as the non-profit orientation business entity, the pressure from members to maximize the prices of their products and services has caused their TFP to decline. Finally, the risk-averse of co-operative members to take new investment risks (Soboh et al., 2014) has constrained co-operatives to enhance their capital, considering a major source of co-operative capital is from their members. The disincentives for members to invest more in co-operatives have limited their capability to improve productivity (Soboh et al., 2012).

Finally, Table 4 also presented the results of classical assumption tests, consisting of normality, multicollinearity, autocorrelation, and heteroscedasticity. The study documented that our estimated data were normally distributed, non-multicollinearity, non-autocorrelation, and heteroscedastic. In addition, all our estimated models were free from misspecification problem, as shown by the significance of the F-statistics. Thus, these showed that our overall empirical findings were robust and could be utilized for further inferences.

Referring to the estimated coefficient of determination, our finding showed that changes in business volume, members, liquidity, profitability, and indebtedness have explained 30.73% variations in TFP changes, as indicated by the estimated value of Adjusted-R^2. This finding further confirmed that co-operative productivity is not only influenced by co-operatives' characteristics as estimated in our study but it is also predicted by many other external factors. The rest 69.27% changes in co-operatives' productivity in Indonesia are explained by many different internal factors, such as governance and technological factors, and external factors, such as regulation, competition, and macroeconomic variables. These findings show the importance of incorporating more other internal and external factors to determine the co-operatives' TFP.

The findings of the low level of productivity of co-operatives in Indonesia has partially caused the failure of co-operatives in the country to play as pillar and backbone of Indonesia's economy as aspired in the 1945 Constitution of Indonesia. More serious and continuous efforts should be made to realize the co-operatives becoming the real pillar and backbone of the national economy, emphasizing both financial and managerial improvement. The government needs to review its policy to enhance the existing co-operatives in all provinces nationwide to be more efficient and profitable. This is meant for improving, enhancing, and increasing the likelihood of co-operatives to success. The private sector of the

economy should be encouraged by the government to work hand in hand with the co-operatives.

4. Conclusions

This study empirically measured the Total Factor Productivity (TFP) of co-operatives in 34 provinces in Indonesia during the 2014-2020 period using Data Envelopment Analysis (DEA). It also attempted to explore the determinants of the co-operatives' TFP using the panel multiple regression technique. Overall, the studied co-operatives have only experienced a 9.7% TFP improvement during the study period. The technical efficiency changes are found to be the main contributor to the co-operatives' TFP progress. Meanwhile, poor business governance has been the main contributor to the high level of co-operatives' efficiency deterioration. Besides, the study documented a positive contribution of business volume to the co-operatives' TFP growth in Indonesia. On the other hand, liquidity and indebtedness have caused the decline in the co-operatives' TFP growth. However, the number of co-operative members and profitability had an insignificant effect on the co-operatives; TFP growth.

Based on these empirical findings, it suggested that to promote the co-operatives to become more productive, the co-operatives should improve their pure efficiency level by implementing good governance principles. The co-operatives should also enhance both scale efficiency and technical efficiency by providing specialized training for their staff, certified management, utilizing advanced technological facilities, and merging several small co-operative entities into a larger scale unit. Diversifying business activities to increase their business volume and improving financial performance by restricting liquidity and indebtedness are among the critical factor for co-operative success.

To offer more enriching empirical findings of the determinants of TFP of the co-operative literature, future studies on this topic might also consider exploring co-operatives' TFP by sectoral economies and their types. Combining both parametric and non-parametric approaches to measure productivity levels of the co-operatives in Indonesia could also provide a comprehensive picture of their productivity measures. Finally, future studies might consider both internal and external factors influencing the TFP of the co-operative nationwide in Indonesia.

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