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Are Board-Managed Cooperatives Efficient? When Monitors become Managers

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ABSTRACT

There is evidence of inefficiencies in cooperatives, but the literature does not adequately address this issue. In contrast to the previous literature on cooperative efficiency, we study the effects of cooperatives that are managed by the board of directors, a situation that is common among cooperatives. This study aims to examine whether board-managed cooperatives (with significant agency costs) are less efficient than other cooperatives. This study estimated the technical efficiency of cooperatives using stochastic frontier analysis on a sample of 378 medium, small and micro cooperatives in Malaysia. The analysis shows that board-managed cooperatives are less efficient than cooperatives with an appointed manager. This result is consistent with the agency-resource dependence perspective (an integration of monitoring and provision of resources). Moreover, the efficiency of a cooperative is related to the number of its charitable funds and members. The appointment of a manager in cooperatives should be encouraged. Although cooperatives lack the resources to appoint a manager, the efficiency that results from such an investment could lead to higher revenues and return to the members.

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ملخص

توجد أدلة على وجود عدم كفاءة في التعاونيات، لكن الأدبيات لا تعالج هذه القضية بشكل كافٍ. بخلاف الأدبيات السابقة حول كفاءة التعاونيات، ندرس آثار التعاونيات التي تُدار بواسطة مجلس الإدارة، وهي حالة شائعة بين التعاونيات. تهدف هذه الدراسة إلى فحص ما إذا كانت التعاونيات التي يديرها مجلس الإدارة (بتكاليف وكالة كبيرة) أقل كفاءة من التعاونيات الأخرى. قدرت هذه الدراسة الكفاءة الفنية للتعاونيات باستخدام تحليل الحدود العشوائية على عينة من 378 تعاونية متوسطة وصغيرة ومتناهية الصغر في ماليزيا. يُظهر التحليل أن التعاونيات المدارة بواسطة مجلس الإدارة أقل كفاءة من التعاونيات التي لديها مدير معين. هذه النتيجة تتسق مع منظور الاعتماد على الوكالة والموارد (تكامل المراقبة وتوفير الموارد). علاوة على ذلك، ترتبط كفاءة التعاونية بعدد صناديقها الخيرية وأعضائها. وينبغي تشجيع تعيين مدير في التعاونيات. على الرغم من أن التعاونيات تفتقر إلى الموارد لتعيين مدير، إلا أن الكفاءة الناتجة عن مثل هذا الاستثمار يمكن أن تؤدي إلى زيادة الإيرادات والعائدات للأعضاء.

RÉSUMÉ

Il existe des preuves de l'inefficacité des coopératives, mais la littérature n'aborde pas cette question de manière adéquate. Contrairement à la littérature précédente sur l'efficacité des coopératives, nous étudions les effets des coopératives gérées par le conseil d'administration, une situation courante dans les coopératives. Cette étude vise à examiner si les coopératives gérées par le conseil d'administration (avec des coûts d'agence significatifs) sont moins efficaces que les autres coopératives. Cette étude a estimé l'efficacité technique des coopératives en utilisant l'analyse des frontières stochastiques sur un échantillon de 378 moyennes, petites et micro coopératives en Malaisie. L'analyse montre que les coopératives gérées par le conseil d'administration sont moins efficaces que les coopératives dont le directeur est nommé. Ce résultat est cohérent avec la perspective de la dépendance à l'égard des ressources (intégration du contrôle et de la fourniture de ressources). En outre, l'efficacité d'une coopérative est liée au nombre de ses fonds caritatifs et de ses membres. La nomination d'un directeur dans les coopératives devrait être encouragée. Bien que les coopératives manquent de ressources pour nommer un directeur, l'efficacité qui résulte d'un tel investissement pourrait conduire à des revenus plus élevés et à une meilleure rentabilité pour les membres.

Keywords:Board, Cooperative, Efficiency, Malaysia, Manager, Stochastic Frontier Analysis, Resource-based View

JEL Classification: C23, R41 (up to 5 codes)

More than 12% of the world's population is a member of a cooperative (World Cooperative Monitor, 2021). As the third sector of the economy, cooperatives' contribution to poverty reduction, employment, and social integration is undeniable (United Nations, 2012). However, the governance of cooperatives has a multitude of problems that can affect their competitiveness vis-à-vis investor-owned firms (IOFs) (Galang et al., 2019). One important aspect that can increase the competitiveness of cooperatives is efficiency. Efficiency is defined as the relative outputs generated versus inputs, such as the invested capital and labor of a cooperative, determined based on a benchmark, that is, the efficient frontier (Guo et al., 2021).

An imbalance in the emphasis on cooperative efficiency and performance can be seen in the literature. For instance, Buang and Abu Samah (2020), Grashuis and Su (2019), Luo et al. (2020), McKillop et al. (2020), and Soero and Dias (2019) conducted a systematic literature review and bibliometric analysis of the literature on various factors related to cooperative performance. However, few studies identified the determinants of cooperative competitiveness and focused on efficiency (except Ahn, Brada & Mendez, 2012; Ariyatne et al., 2000; Galang et al., 2019; Grashuis, 2018; Huang et al., 2013; Krasachat & Chimkul, 2009). Despite the acknowledged importance of the top management team in organizational performance, productivity, and efficiency, a significant gap in the literature remains unaddressed: the impact of not appointing a manager (board-managed) on cooperative efficiency. A recent survey showed that in Malaysia, 56.5% of micro, small, and medium (MSM) cooperatives are run by a board (Jaffar et al., 2023). Thus, this study questions whether the board-managed approach (non-appointment of a manager) will affect the efficiency of a cooperative's accountability to its stakeholders. The findings of this study can be applied to enhance the capability and efficiency of cooperatives, aligning with the goals outlined in the Malaysia's Cooperative Policy 2030, which aims to support Malaysia in achieving a sustainable and inclusive economy (Dasar Koperasi Malaysia, 2023).

The inefficiency of a cooperative will cost consumers (high product and service prices) and its members (less benefits and low financial returns in the short or long run). Therefore, this study aims to test the relationship between board-managed cooperatives and cooperative efficiency.

This study uses the agency-resource dependence perspective (Hillman & Dalziel, 2003) to propose a relationship between board-managed cooperatives and cooperative efficiency. This study expects the role played by board members to manage the cooperative may have negative impacts on the operational efficiency of an organization due to the entrenchment effect and lack of independent monitoring. On the other hand, boards should focus on appropriate supervision and monitoring strategies that can improve cooperative efficiency. Consistent with this perspective, this study also tests the effect of the number of charity funds, cooperative members, female representation on the board, and cooperative age—as potential resources that could enhance monitoring for operational efficiency.

This study contributes to the literature in several ways. First, this study introduces the board-managed model (non-existence of a manager), involvement of women in the board of a cooperative, and the number of charity funds, in addition to other cooperative governance mechanisms from the literature, such as the age of a cooperative and the number of members (Gezahegn et al., 2018). The literature focused mainly on the effect of cooperative governance on cooperative performance. Different from popular measures of cooperative performance, technical efficiency (TE) can be estimated using stochastic frontier analysis (SFA), that is, the maximum output that a cooperative can produce using a given input. Second, though the appointment of a manager can be viewed as a cooperative resource, the costs associated with this type of appointment can be considered as a hindrance, particularly for small and micro-sized cooperatives. Thus, questioning whether the appointment of a manager can provide a competitive advantage to a cooperative is essential. This study extends the application of the resource-based view to the relatively unique context of cooperative efficiency.

This study analyzes the data of a sample of 378 MSM cooperatives in Malaysia to achieve its objective. The context of MSM cooperatives in Malaysia may be a natural laboratory for testing the proposition, as significant variations exist in cooperative governance implementation (Jaffar et al., 2023). The Cooperatives Commission of Malaysia, established under the Cooperatives Act 1993, oversees cooperative movements in Malaysia. The Commission has issued a Guide for the Governance of Cooperatives to be implemented by cooperatives starting in 2015. The guide highlights the principles and practices of good

governance with a "comply or disclose" approach. Second, inactive members of cooperatives in Malaysia, as reported in the literature (Mohd-Saleh & Hamzah, 2017), can serve as an important backdrop to clearly see the effect of a lack of a checks-and-balances mechanism in the board process. In addition, the MSM cooperatives, which constitute 98% of the total number of established cooperatives in Malaysia, contribute only 2% to the total revenue of all the cooperatives in the country. Clearly, the MSM cooperatives in Malaysia are faced with efficiency issues. This study calculates TE using SFA. The results lend support to the argument that the organizational resources used to appoint a manager (board-managed cooperative) in a cooperative will contribute to increasing (decreasing) cooperative TE.

1. Literature Review

Agency theory, as described by Jensen and Meckling (1976; 1979), assumes a manager manages a firm, separated from the owner. It does not represent the situation when the board members who are supposed to monitor the management on behalf of the owner run the business themselves. The theory describes conflicts between the agent who maximizes their utility vis-a-vis the principals who are the capital providers (Jensen & Meckling, 1976). The theory has been extended to describe productivity functions in a labor-managed system and cooperatives (Jensen & Meckling, 1979). While cooperatives are not considered labor-managed organizations, members usually have equal claims on assets and cash flows and suffer from common property and incentive problems (Jensen & Meckling, 1979). However, there are peculiar cooperative characteristics which are further discussed in this section.

Therefore, to investigate this issue further, we use the agency-resource dependence perspective, as suggested by Hillman and Dalziel (2003). The theories imply that the board’s incentives and capital (ability to monitor) influences both monitoring activities and the allocation of resources. Board incentives include board dependence (in this study we use board run) and compensation (both can become moderating variables). While board capital includes expertise, experience, knowledge, reputation, and skills. The main idea emphasizes the ability to create a competitive advantage in the market, that is, to generate more value and lower costs compared with competitors (Peteraf & Barney, 2003; Stoelhorst, 2021).

Studies have examined the relationship between governance as resources (e.g., board competency, diversity, experience, and network) and corporate outcomes in the context of IOFs (for a review, see Khatib et al., 2021; Lu, Ntim, Zhang & Li, 2022; Nguyen et al., 2021). Consistent with the theory, resources are expected to be associated with superior corporate outcomes (competitive advantage, financial and nonfinancial performance, and efficiency). Extant studies on cooperatives have also characterized member participation as a resource (Becchetti, Castriota & Conzo, 2013).

Extending this view, this study uses the agency-resource dependence perspective (Hillman & Dalziel, 2003) to analyze the effect of lack of independence and resources on board-managed cooperatives. In other words, this study underscores the importance of a manager, to a cooperative.

Another research stream focused on the efficiency of cooperatives. Boyd (1988), Brada and King (1993), Carter (1984), and Galang et al. (2019) compared the TE of cooperatives and that of IOFs and found that the TE of cooperatives is lower than that of IOFs. Galang et al. (2019) found that the TE of cooperatives can be negatively affected by certain external factors, such as the political landscape.

Studies on the TE of cooperatives investigated demographic factors such as size (Ariyaratne et al., 2000; Schroeder, 1992), leverage (Ariyatne et al., 2000; Krasachat & Chimkul, 2009), cooperative age, output mixes, sector, location (Ahn, Brada & Mendez, 2012; Gezahegn et al., 2020; Krasachat & Chimkul, 2009), accounts receivable policy (Ariyaratne et al., 2000), cost efficiency, and tax advantage (Grashuis, 2018). Meanwhile, other studies found that corporate governance factors are important to increase efficiency, such as board size, training for members, asset ownership, regional development (Huang et al., 2013), board's educational background, chairman's age, members' participation, and compensation for committee members (Gezahegn et al., 2020). However, little effort has been exerted to determine the significance of manager appointment vis-a-vis board-managed cooperatives to cooperative efficiency. This governance set up is popular among MSM cooperatives in emerging economies. Moreover, except for several studies such as Ahn, Brada, and Mendez (2012); Huang et al. (2013); Krasachat and Chimkul (2009); and others, perspectives on cooperatives in emerging economies are few.

Many small and micro-sized cooperatives do not appoint a manager to run their operations owing to limited resources. Thus, such cooperatives are run by the chairman and/or board members. Board-managed cooperatives have costs and benefits. The main benefit of board-managed cooperatives is cost savings, which can entice most small-segment cooperatives to not appoint a manager. Giving returns to members in the form of dividends may have become the main reason for boards to self-run their cooperatives. In this paper, we call such cooperatives "board-managed cooperatives."

Although this approach can avoid the cost of appointing a professional manager, it has several drawbacks. First, in IOFs, the number of owned shares corresponding to the amount of investments, is related to the voting power. Hence, with few exceptions, such as in pyramidal structure situations, the deviation between the control right and cash flow right is minimal. Conversely, cooperatives adhere to a one member-one vote principle (Section 30 (1) Cooperatives Act (1993) [Act 522]), emphasizing democratic governance. Regardless of the extent of a member's financial contribution, including investments in specific projects, only a single vote is permitted. This practice thereby prevents the emergence of dominant controlling or minority shareholders within cooperatives. Control within a cooperative can be exercised when a member assumes a board position, and this control is particularly pronounced when the same individuals manage the business without adequate oversight. In such instances, the disparity between control rights and cash flow rights is heightened, raising the risk of entrenchment. The practice of board managed cooperative is against the principle 3 of good governance as stated in GP27 (para 16 to 19).

Second, in line with the principle of cooperatives (democratically controlled by its members) and Section 42 Cooperatives Act 1993 [Act 522], the appointment of the board of cooperatives must be among its members in the Annual General Meeting. The approach leads to several problems. Depending on the requirement to become a member of certain cooperatives in by-laws (farmers, fishermen, general consumers, teachers, etc.), there is a high chance of appointing directors among those members who do not have appropriate expertise and experience. This practice could lead to inefficiency. In addition, in contrast to good governance practices in investment-owned firms, i.e., at least half of the board must be independent, all appointed board members are non-independent directors

since members are related to cooperatives. Thus, a lack of independent and expert monitoring could harm the internal control systems and heighten the risk of corruption.

Third, board-managed cooperatives have a very basic checks-and-balances mechanism for transactions, which may increase conflicts of interest. The board should perform a supervisory and monitoring role in managing the cooperative on behalf of its stakeholders. Thus, the "mediating hierarchy" in organizations that monitors the balance in stakeholders' interests (Blair & Stout, 1999) is missing in board-managed cooperatives. Theoretically, the situation of board-managed cooperatives is not comparable to that of traditional firms (Alchian & Demsetz, 1972), in which the owner–manager–entrepreneur is the same entity, because not all the members are on the board.

Fourth, although one can argue that alignment of interests between members and managers as agent may be promoted in board-managed cooperatives, without a manager, there is no formal evaluation (self-evaluation) of management efficiency and effectiveness. A failure means re-election of a new board by members in an annual general meeting. The evaluation of former management (board members) is not discussed in detail due to (a) information asymmetry between the members and board (there is no formal paper that evaluates a person based on clear performance indicators for appointment or re-appointment), (b) lack of members' activism, and (c) limited knowledge among members about performance management. This practice could lead to reduced accountability to members.

Fifth, there is a high likelihood of a lack of concentration as the chairman and board members overseeing a cooperative typically hold other full-time positions. In addition, the chairman's and/or board members' voluntary managerial work for the cooperative may reduce the likelihood of implementing an accountability process in annual general meetings. In other words, members will have limited opportunities to ask whether the chairman and/or board members performed their accountability function, as their work is voluntary. In addition, board members generally "sacrifice" their time to perform some of their duties in the day-to-day operation of the cooperative. Thus, the net benefits of board-managed cooperatives may be negative. This problem may be exacerbated by the fact that the members of such cooperatives are generally not well educated

or do not know what to expect or ask during annual general meetings. Thus, inefficiency may be a long-standing situation in such cooperatives. However, the problem may not exist in entities with aligned owner–manager interests, such as in small and medium-sized IOFs. Thus, based on the agency-resource dependence perspective (Hillman & Dalziel, 2003), the above arguments, and using an indicator whether there is an appointed manager as a reverse measure for board-managed cooperatives, the prediction is as follows:

H_1: There is a negative association between an appointed manager and technical inefficiency.

Consistent with the agency-resource perspective (Hillman & Dalziel, 2003), the number of charity funds, female representation on the board, and cooperative age are anticipated to potentially increase monitoring for operational efficiency, with an expected positive (negative) association with technical efficiency (inefficiency). The creation of charity funds, such as those directed towards children's education for members, offering charitable death benefits, and supporting community activities, could align cooperative operations with their initial purpose. In addition, the reserves formed by retaining surplus generated by the cooperative business, which are not immediately disbursed to its members can become additional capital that can be used for short term investment. Different from debt or equity financing, the reserve financing is free from cost of capital.

There are numerous studies on the benefits of female on board on corporate's (Ramly et al., 2017) and cooperative's efficiency (Hernández-Nicolás et al., 2019). Nevertheless, a counter argument posits that such inclusion may potentially result in organizational inefficiencies. Female directors are found to have more social orientation than male directors (Périlleux & Szafarz, 2015). Cooperatives led by women demonstrate a greater proportion of staffing expenses in relation to operational income, suggesting a stronger emphasis on cooperative principles and values over pure economic gains (Esteban-Salvador et al., 2019). So far, there has been limited research explicitly investigating the impact of female representation on cooperative efficiency.

The enhanced efficiency of a cooperative also related to its years of experience (age from establishment), enabling the acquisition of

advanced technology, investment in employee training, and implementation of other enhancements to optimize business operations.

2. Methodology

2.1.1. Data Analysis

This study employs the concept of TE as a measure of cooperative competitiveness. This study selects technical efficiency as a key measure due to its relevance in assessing the effectiveness of firms in utilizing their resources to generate output. By focusing on technical efficiency, the study aims to measure the extent to which firms optimize their production processes and allocate resources efficiently. Understanding technical efficiency is crucial for assessing competitiveness. TE is the maximum output that a firm can produce with a given input.

To assess the TE of cooperatives, SFA can be conducted to estimate the frontier production function (Aigner, Lovell & Schmidt, 1977; Meeusen & van den Broeck, 1977). In selecting SFM over Data Envelopment Analysis (DEA), several advantages are evident. SFM enables the estimation of technical inefficiencies and basic production boundaries, facilitating the differentiation between inefficiency and random performance fluctuations. Furthermore, SFM provides individual stochastic and heterogeneity errors, which effectively capture the complexity and uncertainty inherent in the cooperative environment. The stochastic frontier production function model is as follows:

$$, \qquad lnY_i = lnf(X_i, \beta)exp^{(V_i - U_i)} \tag{1}$$

where Y_i and X_i indicate the output and input production vectors of the production of cooperative firm i, respectively; β is the unknown parameter coefficient vector to be estimated; $V_i - U_i$ is the error term of the production of firm i; V_i measures the random errors that will determine the statistical noise; V_{jit} is distributed independently and identically to $N(0, \sigma_v^2)$; and U_i is independently and identically distributed and obtained via truncated distribution $N(0, \sigma_u^2)$.

To examine the determinants of TE, U_i is assumed to be a function of the explanatory variables, which can be defined as the technical inefficiency function model, as follows:

$$U_i = \mu_i = \delta_0 + \delta_1 Z_i + \delta_n Z_i + \omega_i, \quad (2)$$

where U_i is the technical inefficiency of firm *i*, Z_i is the vector of the explanatory variables of firm *i*, δ_1 and δ_n is the unknown parameter coefficient vector to be estimated. The parameters of the stochastic frontier function and technical inefficiency model are estimated simultaneously, as proposed by Battese and Coelli (1995). The estimates of the functions are obtained using the maximum likelihood method.

Next, SFA is conducted to evaluate the TE of a firm based on the distance between the firm's output and frontier, and as the distance decreases, the efficiency of the firm increases. A TE value of 1 indicates maximum efficiency. The TE of firm *i* is obtained, as follows:

$$TE_i = \frac{f(X_i,\beta)\, exp(v_i - u_i)}{f(X_i,\beta) exp(v_i)} = exp^{(-u_i)}. \quad (3)$$

The validity of the technical inefficiency term and stochastic frontier production function can be tested by calculating the value of the gamma parameter (γ). The parameter must have a value between 0 and 1 and depends on two variance parameters of the stochastic frontier function. The variance parameters are defined as $\gamma = \sigma_u^2 + \sigma^2$, and $\sigma^2 = \sigma_v^2/\sigma_u^2$. If the value is close to 0, then the deviations of the stochastic frontier function can be ascribed to a random error. Meanwhile, a value close to unity indicates that the deviations are due to technical inefficiency. The hypothesis on the nature of technical inefficiency can be tested using the generalized likelihood ratio (LR) statistic λ given by

$$\lambda = -2\{ln\, ln\, (L(H_0))\, - ln(L(H_1))\}, \quad (4)$$

where $L(H_0)$ and $L(H_1)$ denote the value of the likelihood function under the null and alternative hypotheses, respectively.

3. Data and Empirical Model

In Malaysia, as of the end of 2021, there were 473 medium-sized, 1,343 small-sized, and 6,574 micro-sized cooperatives spread across 14 states. The sample size for this study, totaling 3,804 cooperatives, was determined based on proportional stratified sampling techniques using Krejcie and Morgan's (1970) method. Selection was systematic, in each category of size, and state. An online survey was distributed to board

members of these cooperatives from May 22, 2022, to June 29, 2022. To ensure distribution and timely collection, regional officers of the Cooperative Commission of Malaysia facilitated the survey. A briefing was conducted to explain the survey's purpose and ensure officers' understanding of questionnaire statements. Of the 971 responses collected, 593 responses were excluded due to missing data, outdated financial statements, and questionable financial information. This yielded a final usable sample of 378 cooperatives, representing approximately 9.94% of the identified sample.

While panel data analysis offers advantages in capturing dynamic changes over time, this study opted for a cross-sectional approach due to the data being derived from a cross-sectional survey. Secondly, the aim of this study is to provide a comprehensive snapshot of the current state of inefficiency and efficiency within the chosen context, rather than tracking its evolution over time. The main variables used in the frontier production model are the output and input variables (Table 1). The output variable is total revenue, which refers to the total revenue of the output produced by a firm. The input variable of capital is measured by calculating the value of the total assets. The input variable of number of board members of the cooperative is measured by calculating the number of the board members of the cooperative. The input variable of labor is measured by calculating the number of labor used.

Table 1 (Panel A) shows that the majority of the micro cooperatives (68.1%) is board run (did not appoint a manager). The table also shows that the number of cooperatives with an appointed manager increases as the size of the cooperative increases. Table 1 (Panel B) presents the descriptive statistics of the input, output, and tested inefficiency factors, such as the age of the cooperative since its establishment, proportion of female board members, number of charity funds, and number of members. Board membership ranges from 3 to 18 members; on average, the age of the cooperatives is 26 years; and around 38% of the board members are female. The average number of charity funds created by the cooperatives is around 3, with a maximum of 11 funds.

Table 1: Sample Variables and descriptive statistics of output and inputs of stochastic production frontier

Panel A	Frequency	Percent	Appointed a manager	Board run	Percent with a manager
Micro	226	60.3%	72	154	31.9%
Small	112	29.9%	49	63	43.8%
Medium	40	10.6%	25	12	67.6%
Total	378	100.0%			

Panel B	Variable	Mean	Standard deviation	Minimum	Maximum
Output	Revenue (RM; Y)	413,282	807,620	1,266	6,269,268
Input	Operational expenses (RM; E)	368,329	767,974	100	6,254,902
	Total assets (RM; TA)	1,477,744	4,586,305	461	44,600,000
	Number of cooperative board members (ALK)	12.34	14.60	3.00	18.00
	Number of labor (L)	2.56	4.01	-	30.00
Z	Age	26.59	18.14	3.00	92.00
	Ratio of female members to total number of cooperative board members (RF)	0.38	0.29	-	1.47
	Number of charity funds (T)	2.740	2.547	0	11
	Number of members (MC)	584	894	-	9,364
	Manager (Dummy_M) (Yes = 1, 0 = No)		Yes (229) No (149)		

RM = Malaysian ringgit.

The Cobb–Douglas production function is used in this study for the following reasons: first, the production function form is relatively simple; second, it can be transformed into a linear additive form; and third, it rarely causes problems.[1] The input variable in the production function is

[1] There are two main types of Cobb–Douglas production functions: the original model and the translog model. The Cobb–Douglas model is originally formulated as a linear

directly associated with the production process and is deemed the primary factor influencing the firm's output. Inputs typically constitute a substantial component or factor utilized within the production process. For instance, in manufacturing, common input variables include labor, capital, raw materials, and technology. These are regarded as the principal determinants of production levels (Model 5). In this study, to determine the stochastic effects of operational expenses (E), total assets (TA), number of cooperative board members (ALK), and number of labor (L) on total revenue (Y), the production function model is used, as follows:

$$lnY_i = \beta_0 + \beta_1 lnE_t + \beta_2 lnTA_i + \beta_3 lnALK_{\ i} + \beta_4 lnL_{\ i} + V_i - U_i. \quad (5)$$

The inefficiency variables in the inefficiency function represent factors that can indirectly influence a firm's production but are not integral to the core production process. These variables capture deviations or inefficiencies in production that are not accounted for by the main input variable. Inefficiency variables include factors such as the age of the firm and the quality of management. It is believed that these variables affect the extent to which firms deviate from best practices or the most efficient production processes (Model 6). Therefore, to determine the technical inefficiency effect model, the following equation is used:

$$U_i = \delta_0 + \delta_1 Age_i + \delta_2 RF_i + \delta_3 T_i + \delta_4 MC_i + \delta_5 Dummy\_M_i + \delta_6 G_i + \omega_i, \quad (6)$$

where Age_i represents the number of years since the cooperative's establishment; RF is the ratio of female board members to the total number of board members (Huang et al., 2013); *T* is the number of charity funds; MC is the number of members of the cooperative; Dummy_M is 1 if firm *i* has a manager, and 0 otherwise; δ_1,…, δ_5 denote the estimated parameters of the inefficiency variable; and ω_i denotes a random variable.

The variable of interest is Dummy M, which is predicted to have a negative relationship with inefficiency. Different from prior studies, the present study includes a new variable, that is, number of charity funds (T), in the estimation. Consistent with this study's general argument that

function, whereas the translog model represents a non-linear function. However, after testing, it has been found that the non-linear function does not accurately fit our data.

charity funds (e.g., funds for education of family members or specific activities) are resources that a cooperative can use to generate value efficiently, based on the resource-based view, T is expected to have a negative effect on inefficiency. The literature showed that entities with high CSR are associated with learning and innovation cycles that can improve competitiveness (Kapelko et al., 2021; Vilanova, Lozano & Arenas, 2009). In addition, the increased efficiency from MC, as it is related to the size of a cooperative, may come from economies of scale, improved human resources, and operational processes using technology. Governance (G) consists of six dimensions: cooperative board members' responsibilities, control system and performance, cooperative board competency, internal audit committee efficiency, management efficiency, and multiple cooperative board membership. These dimensions are measured on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 represents "Strongly Agree." These dimensions are then computed to obtain the governance factor.

The literature confirmed that such factors are important to improving TE (He et al., 2022; Mugera et al., 2016; Regma et al., 2021; Pottier, 2011).

For robust analysis, this study calculates total factor productivity (TFP) using the following equation:

$$TFP = \frac{Y}{(E^{\widehat{\beta_1}} * TA^{\widehat{\beta_2}} * ALK^{\widehat{\beta_3}} * L^{\widehat{\beta_4}})} \quad (7)$$

Where $\hat{\beta}_1$-$\hat{\beta}_4$ are coefficients that represent the elasticities of the respective inputs. Thereafter, to determine the TFP model using ordinary least square (OLS), the following equation is used:

$$TFP_i = \gamma_0 + \gamma_1 Age_i + \gamma_2 RF_i + \gamma_3 T_i + \gamma_4 MC_i + \gamma_5 Dummy\_M_i + \gamma_6 G_i + \varepsilon_i \quad (8)$$

4. Results And Discussion

4.1.1. Correlation matrix

Table 2 presents the Pearson correlation matrix for the key variables utilized in the analysis. The correlation coefficients between the dependent variable and independent variables generally align with the expected signs. Notably, two independent variables (E=Operational

expenses and TA=Total assets) exhibit high correlations with the dependent variable (Y=Revenue). Additionally, significant correlations at the 1% significance level are observed between Revenue and three independent variables (E=Operational expenses, TA=Total assets, and L=Number of labor). Conversely, only ALK (Number of cooperative board members) demonstrates noteworthy correlations at the 1% significance level. Furthermore, the coefficients among the independent variables show low correlations (<0.85), indicating minimal collinearity issues.

4.1.2. Generalized (LR) Tests

The value of the generalized LR statistic for the parameters of the stochastic production function for total revenue is shown in Table 3. The null hypothesis stating that no technical inefficiency effect exists in the model is significantly rejected based on the LR value of 43.87. This result implies that the inefficiency effect is present in the model.

Table 2: Correlation matrix

Variable	Y	E	TA	ALK	L	Age	RF	T	MC	Manager	G
Y	1.000										
E	0.960*	1.000									
TA	0.705*	0.638*	1.000								
ALK	0.064	0.056	0.058	1.000							
L	0.477*	0.495*	0.354*	-0.201*	1.000						
Age	0.225*	0.169*	0.490*	0.042	-0.061	1.000					
RF	-0.036	-0.014	-0.258*	0.233*	-0.132	-0.265*	1.000				
T	0.182*	0.152*	0.110	0.169*	-0.076	0.018	0.372*	1.000			
MC	0.346*	0.335*	0.318*	0.155*	0.190*	0.194*	0.104	0.166*	1.000		
Manager	0.235*	0.242*	0.137*	-0.118	0.276*	-0.085	-0.059	-0.035	0.024	1.000	
G	0.099	0.088	0.075	-0.055	0.065	0.062	0.038	0.106	0.025	0.047	1.000

*Significance level of 1%

Table 3: Generalized LR test of null hypothesis for parameters of stochastic frontier production function for total revenue

Null hypothesis, H_0	LR value	Critical value*	Decision
(No inefficiency effect)	46.62	12.592	Rejected
$\gamma = \delta_0 + \delta_1 + \delta_2 + \delta_3 + \delta_4 + \delta_5 + \delta_6 = 0$			

4.1.3. Production Function

The results of the analysis of the estimated model indicate that the coefficients of operational expenses are positive and statistically significant at the 1% level. The positive relationship between operational expenses and total revenue suggests that a 1% increase in the operational expenses would lead to a 0.770% increase in the total revenue. This result suggests that revenue can be increased by increasing operational expenses.

Moreover, the analysis of the estimated model indicates that the coefficient of total assets is positive and statistically significant at the 1% level. The positive relationship between total assets and total revenue suggests that a 1% increase in the total assets would lead to a 0.148% increase in the total revenue. This finding shows that the total assets is an important factor for generating revenue in MSM cooperatives. Meanwhile, the number of cooperative board members and number of labor are not statistically significant. This result reveals that both variables do not play an important role in generating revenue from production in MSM cooperatives.

Furthermore, the estimated value of gamma (γ) is obtained with a truncated normal model. Gamma (γ) is the variance ratio explaining the total variation in the output at the frontier level to the output attributed to TE. The estimated value of gamma (γ) refers to the ratio of the variance in the output due to TE for all the production functions. The statistic also indicates that the variance parameters of all the production functions differ significantly. The estimated value of gamma (γ) is 0.125, which indicates that the error terms are due to the technical inefficiency effect, which are under the control of each firm's production function. Thus, the estimates indicate the presence of technical inefficiency components in the error terms.

4.1.4. Technical Inefficiency Function

The variables influencing inefficiency are specified as those related to the characteristics of MSM cooperatives. The analysis of the technical inefficiency model shows that the sign and significance of the estimated coefficients have important implications on the technical inefficiency of the small and medium-sized cooperatives in Table 4.

The parameter estimates indicate that the coefficients of number of charity funds, number of cooperative members, and appointment of a manager have a negative and significant impact on technical inefficiency. Specifically, the coefficient of number of charity funds is negative and significant at the 1% probability level, which shows that the variable has a negative influence on technical inefficiency. This result means that increasing the number of charity funds will increase TE. This result is consistent with the argument that a high CSR is associated with high learning and innovation cycles that can improve competitiveness (Kapelko et al., 2021; Vilanova, Lozano & Arenas, 2009).

Moreover, the number of members of the cooperative is negative and has a significant effect on technical inefficiency. The negative sign of number of members of the cooperative indicates that an increase in the number of members of a cooperative will increase its revenue. This result may come from the improved selection of human resources to be involved in the operation from a large pool of members, as resources. The knowledge spillover effect from the talent flow may enhance innovation, technology, and organization processes that can improve efficiency. The result may also be caused by economies of scale, that is, the compliance costs of regulatory requirements and minimum operational structure can be widely distributed to an increased number of members (He et al., 2022). The literature confirmed that such factors are important to improving TE (Mugera et al., 2016; Regma et al., 2021; Pottier, 2011).

Furthermore, appointment of a manager is negatively related to technical inefficiency. The negative sign of appointment of a manager indicates that if a cooperative uses a manager for its production, then its inefficiency can be reduced by 49.6%. In other words, board-managed cooperatives are less efficient than manager-run cooperatives. The result suggests that in cooperatives, the benefits associated with the appointment of a manager outweigh managerial costs. MSM cooperatives should consider appointing a manager to improve their efficiency and thus generate increased revenue, dividends, and long-term benefits for their members. By contrast, board-managed cooperatives are inefficient by the same magnitude in terms of revenue generation. Therefore, the ability of board-managed cooperatives to pay dividend in the long run is questionable.

The results imply that the board's supervisory and monitoring role in the cooperative, balancing stakeholders' interests, maintaining checks and balances, and being responsible and accountable to the members in annual general meetings can be performed better if cooperative is run by a manager. The board of a cooperative is focused on supervisory and monitoring work, whereas managers perform managerial and operational duties. This is consistent with the board's ability to monitor and provision of resources as suggested by the agency-resource dependence perspective (Hillman & Dalziel, 2003). In cooperatives with an appointed manager, the key performance indicators will likely be related to compensation (incentive mechanism). In such cooperatives, managerial and operational tasks are not performed voluntarily and thus will be more likely subjected to detailed scrutiny.

Table 4: Results of maximum likelihood estimates for stochastic production frontier of null hypothesis for parameters of stochastic frontier

Ln (Revenue)	**Coefficient**	**Standard error**	**Z score**	**Significance level**	**95% confidence interval**	
Ln (Operational expenses)	0.773	0.017	45.870	0.000	0.740	0.806
Ln (Total assets)	0.148	0.015	9.750	0.000	0.118	0.178
Ln (Number of cooperative board members-ALK)	-0.009	0.064	-0.140	0.886	-0.134	0.115
Ln (Number of labor)	0.012	0.029	0.440	0.663	-0.044	0.069
Constant	1.160	0.240	4.830	0.000	0.690	1.630
Inefficiency						
Age	-0.006	0.005	-1.130	0.257	-0.016	0.004
Ratio of female board members to total number of cooperative board members (RF)	-0.301	0.399	-0.750	0.451	-1.083	0.481
Number of charity funds (T)	-0.275	0.108	-2.550	0.011	-0.486	-0.064
Number of cooperative members (MC)	-0.002	0.001	-2.180	0.029	-0.003	0.000
Manager (Yes = 1, 0 = No)	-0.496	0.232	-2.140	0.033	-0.951	-0.041
Governance (G)	-0.121	0.086	-1.410	0.159	-0.290	0.047
Constant	1.264	0.410	3.080	0.002	0.460	2.068
lnsigma2	-1.283	0.141	-9.080	0.000	-1.559	-1.006
ilgtgamma	0.247	0.318	0.780	0.437	-0.376	0.870
lnsigma2	0.277	0.039			0.210	0.366
ilgtgamma	0.561	0.078			0.407	0.705
sigma2	0.156	0.042			0.073	0.238
gamma	0.122	0.011			0.100	0.144
Number of observations	378					
Wald chi2 (4)	4858.19					
Log likelihood	-195.5289					
Prob > chi2	0.0000					

4.1.5. TE Distribution

The results from Table 5 display the frequency distribution of the TE (Technical Efficiency) estimates. The analysis indicates that micro, small, and medium-sized cooperatives operate at an average efficiency level of 85.5%. This suggests that, on average, these cooperatives utilize 85.5% of their potential output given their inputs. However, there exists a TE gap of approximately 14.5% in these cooperatives, signifying room for improvement. By enhancing their technical efficiency, these cooperatives could potentially increase their revenue by 14.5%, either by multiplying output levels or reducing input costs. Therefore, operating more efficiently could lead to a significant revenue increase for these medium, small, and micro-sized cooperatives. This finding implies that the small and medium-sized cooperatives in this study can increase their revenue by 14.5%, on average, by improving their TE. The majority of the small and medium-sized cooperatives belongs to the 0.800–1.000 efficiency level.

The results in Table 5 suggest that, on average, the efficiency of a cooperative will peak when it is between the ages of 81 and 100 years. In the aforementioned age category, cooperative efficiency is also the most stable, with the lowest standard deviation and highest minimum efficiency value (0.8826), compared with the other age categories. The least efficient cooperatives are in the youngest age category, whereas the most efficient cooperatives are in the age category that ranges from 41 to 60 years.

Cooperative efficiency is at the lowest average level in the membership category of less than 1,000 members, and the cooperatives with the lowest efficiency (0.2109) belong to this category. However, the cooperatives with the highest efficiency belong to the membership category with the largest number of members. In addition, the lowest efficiency value (minimum) in this category exceeds the minimum value in the other categories.

Table 5. Distribution of Technical Efficiency

a. Technical Efficiency	**Frequency**	**Percentage (%)**		**c. Age category**	**Mean**	**s.d.**	**Min**	**Max**
<0.199	0	0.00		1-20 years	0.828	0.140	0.220	0.977
0.200–0.299	1	0.26		21-40 years	0.882	0.091	0.529	0.982
0.300–0.399	3	0.79		41-60 years	0.880	0.120	0.312	0.989
0.400–0.499	6	1.59		61-80 years	0.833	0.128	0.579	0.978
0.500–0.599	11	2.91		81-100 years	0.924	0.043	0.893	0.954
0.600–0.699	22	5.82						
0.700–0.799	35	9.26		**d. Membership**				
0.800–0.899	124	32.80		1-1000	0.836	0.126	0.220	0.966
0.900–1.000	176	46.56		1001-4000	0.956	0.015	0.917	0.978
Total	378	100.00		4001-7000	0.982	0.000	0.982	0.982
Mean	0.855			7001-1000	0.989	0.000	0.988	0.989
Standard deviation	0.124							
Minimum	0.220			**e. Charity funds**				
Maximum	0.989			1 to 3	0.816	0.133	0.220	0.989
				4 to 6	0.930	0.027	0.843	0.978
b. Technical efficiency	**Mean**	**s.d.**		7 to 9	0.954	0.014	0.922	0.977
Manager appointed	0.885	0.089		10 to 12	0.960	0.010	0.945	0.971
Board run	0.836	0.140						
				f. Director's diversity				
				Low (<0.33)	0.819	0.137	0.220	0.989
				High (>0.34)	0.893	0.096	0.314	0.982

Among the cooperatives, the medium-sized cooperatives have the highest efficiency value, followed by the small cooperatives. The micro-sized cooperatives exhibit the lowest efficiency value, and the medium-sized cooperatives have the lowest standard deviation value. The cooperatives' efficiency value being proportional to their size is in line with the findings of past studies (Ariyatne et al., 2000) but contradicts those of Huang et al. (2013).

In addition, the greater the number of charity funds of a cooperative, on average, the more efficient the cooperative. The results reveal that the most inefficient cooperatives are those with the least number of welfare funds. This finding can be explained by several factors. First, the pattern is related to the accountability of the members of the cooperative, and the better the implementation of the accountability process, the more efficient the cooperative. Second, a reverse relationship between the two factors is possible, that is, the more efficient the cooperative, the more the funds generated to meet the needs of the members. This explanation can be tested only by using the data of the cooperatives for several years. Third, other factors may be able to explain the relationship. For example, if the number of charity funds is proportional to the size of the cooperative, then the reported increase in efficiency will likely be due to the size of the cooperative rather than to the number of charity funds for the members.

The descriptive statistics also show that, on average, the cooperatives with more female directors on the board have a higher efficiency value than those with fewer female directors. The cooperatives that demonstrate the lowest efficiency are also those in the group with a low proportion of female directors.

Table 6 provides the results of a regression analysis to determine the factors affecting Total Factor Productivity (TFP). The presence of a manager indicates a positive relationship and significant impact on TFP, while other variables show no significant impact. Model diagnostics indicate all VIFs are below 2, suggesting low multicollinearity. The overall model is significant, with an R-squared value indicating that 10.2% of the variability in TFP is explained by the model.

Table 6: Factors Determining Total Factor Productivity

TFP	Coefficient	Standard error	Z score		Significance level	95% confidence interval	VIF
Age	-0.003	0.002	-1.730	0.085	-0.006	0.000	1.17
Ratio of female board members to total number of cooperative board members (RF)	-0.129	0.116	-1.120	0.264	-0.357	0.098	1.29
Number of charity funds (T)	-0.018	0.013	-1.440	0.150	-0.043	0.007	1.21
Number of cooperative members (MC)	0.0005	0.0001	1.550	0.121	0.000	0.000	1.08
Manager (Yes = 1, 0 = No)	0.324	0.061	5.350	0.000	0.205	0.443	1.02
Governance (G)	0.041	0.035	1.160	0.245	-0.028	0.111	1.02
Constant	0.618	0.166	3.730	0.000	0.293	0.944	-
F(6, 371)	7.02						
Prob > F	0.0000						
R-squared	0.1020						
Adj R-squared	0.0875						

VIF=Variance Inflation Factor

5. Conclusion

The governance of MSM cooperatives has inherent problems that can affect their efficiency. Prior studies identified the determinant factors of cooperative efficiency but neglected to investigate the role of manager appointment in increasing cooperative efficiency. Although conventional wisdom suggests that the appointment of a manager can improve the performance of a cooperative, the appointment of a manager in small and micro-sized cooperatives is challenging owing to pressure to maximize their dividends for their members. Thus, the majority of the cooperatives in this category is run by a board of directors. This study aims to prove that board-managed cooperatives are less efficient that cooperatives with an appointed manager. In other words, cooperatives with an appointed manager are expected to be more efficient than board-managed cooperatives and hence will be able to generate higher value for their members after considering the associated costs.

The results suggest that cooperatives with an appointed manager are more efficient than other types of cooperatives. Moreover, the efficiency of a cooperative can be determined by the number of its charity funds and number of its members. The results imply that the efficiency of a cooperative can be explained by its agency and resources, which is consistent with the agency-resource dependence perspective. The absence of a manager negates the board's ability to leverage their incentives (such as compensation) and capital (including expertise, experience, knowledge, reputation, and skills) for effective management oversight. Instead, the operational competence of the appointed board is tested in running the cooperatives.

The obtained results have several practical implications. First, the appointment of a manager should be encouraged for small and micro-sized cooperatives. The original intention of a cooperative to not appoint a manager is to use the extra funds for dividends payment. However, when board-managed cooperatives are inefficient, they may not be able to attain their objectives. The inefficiency of a cooperative run by a board may challenge its survival in the long run. This evidence is valuable for cooperative boards to consider when strategizing how to persuade members to agree on appointing a manager, even if it means sacrificing short-term dividends. Second, as the efficiency of a cooperative is associated with the number of its charity funds and members, the

management and board should consider increasing the charity funds for the members and promoting membership. Such initiatives can increase member participation and cooperatives' efficiency and effectiveness.

However, the effectiveness of a manager in generating revenue and profits depends on their entrepreneurial and managerial skills, which is beyond the scope of this study. Sufficient investment is needed for managers with such skills. Furthermore, the time needed for investments to generate financial and nonfinancial returns for cooperatives remains unknown. Thus, such issues should be examined in future research. Secondly, with only cross-sectional data from a survey, robust testing for endogeneity is limited and often relies heavily on theoretical justification. Future studies could explore the intricate relationship between managerial characteristics and the causal impact of their appointment on cooperative efficiency, utilizing time series data.

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