proceedings International
publish August 2024
https://prosiding.idipri.or.id/index.php/PWI

INTERNATIONAL EDUCATION WEBINARS
20 Juli 2024

EDITION
"Building The Future of Global Education Through Innovation and Collaboration"

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THE IMPACT OF TECHNOLOGY AND GLOBALIZATION IN INDUSTRIAL REVOLUTION 4.0 IN ORDER TO EDUCATE FARMERS TO IMPROVE THE PERFORMANCE AND SUSTAINABILITY OF COFFEE FARMER COOPERATIVES IN WEST JAVA

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Abstrak; The application of information technology in the agricultural sector makes farmers smarter and plays a vital role in creating a more sustainable and efficient farming system. Along with the development of automation, cyber-physical systems, and IoT, coffee cooperatives must be ready and adapt to the industrial revolution 4.0 era to capture opportunities for market demand, value chains, and added value of coffee agribusiness. The presence of ICT has the potential to improve coffee farmers' performance and institutional sustainability in rural areas, including cooperatives. Performance is a description of the achievement of organizational tasks to realize the goals, objectives, mission and vision of the organization and its business. Quantitative descriptive methods with Linear Regression analysis were used to determine the influence of cooperative capabilities on cooperative performance and sustainability in several coffee cooperatives in West Java. The research results found that performance significantly affected the sustainability of the Coffee Cooperative. This study recommends improving the performance of cooperatives in terms of membership, management, and business models to become sustainable cooperatives based on information technology and achieve added value from market-driven coffee products.

Keywords: Capability, Coffee, Cooperative, Performance, Sustainability

Introduction

The coffee plants cultivated in Bandung Regency are Arabica and Robusta coffee. This is driven by the geographical conditions of coffee plantations in Bandung Regency, which are at an altitude of 1200 m above sea level, where this height already meets the criteria for cultivating Arabica coffee commodities.

Farmers in West Java, which has a narrow arable area, find it difficult to strengthen their bargaining position because the results they obtain are also small. Therefore, efforts to improve coffee farmers' position must lead to the formation of farmer institutions, meaning that farmers need to be consolidated in a group collaboration forum or other collaboration institution. Institutions are not only limited to organizations but also include the rules of the game between coffee business actors to form a healthy partnership.

Institutions that can support strengthening or improving the bargaining position of coffee farmers are institutions that can provide services to farmers' interests. Institutions that suit the above demands are cooperatives. According to Helmberger & Hoos, as quoted by Knutson (1966) in Karmana (2009), cooperatives are organized by their members to provide services whose costs must be taken into account (service and operation at cost) by maximizing the acceptance of cooperative members for the products they produce. For this reason, it is felt that there is a need

for a coffee cooperative which can become an organization that accommodates coffee farmers so that they can maximize their production results. Coffee cooperatives can play a role in providing services to their members so that they can easily obtain the goods they need from economically strong producers (shops, wholesalers, agents, etc.), both goods for production purposes and goods necessities of life, at reasonable prices that can be afforded by the members of the cooperative concerned. This coffee cooperative also provides services so that the coffee produced by its members can be marketed in an integrated manner at a reasonable price, which satisfies the farmers, commensurate with all their hard work. The establishment of a coffee cooperative has the potential to significantly improve the livelihoods of coffee farmers in Bandung Regency, providing them with a stable income and access to necessary resources.

In the era of industrial revolution 4.0, internet and computer technology began to be utilized by coffee cooperatives in West Java. Information technology is crucial in increasing coffee production, as rapid information dissemination through Internet media significantly enhances farmers' knowledge and capabilities. The key task at hand is to empower farmers by educating them about the use of information technology, thereby boosting their productivity and fostering a tech-savvy mindset. The application of information technology in the agricultural sector not only enhances farmers' skills, but also plays a pivotal role in creating a more sustainable and efficient agricultural system. With the evolution of automation, cyber-physical systems, and IoT, coffee cooperatives need to be prepared to adapt to the era of Industrial Revolution 4.0, seizing opportunities in market demand, value chains, and added value of coffee agribusiness. The presence of ICT has the potential to significantly improve the performance and institutional sustainability of coffee farmers in rural areas, including cooperatives.

The application of information technology in the agricultural sector has great potential to educate farmers and increase productivity and efficiency. Here are some ways information technology can be used in the farming sector:

1. Agricultural Information System

Agricultural information systems empower farmers by providing them with up-to-date information about weather, market prices, plant diseases and best agricultural practices. This information, accessible via mobile applications or web platforms designed specifically for farmers, gives them a sense of control and confidence in their decision-making.

2. Sensors and the Internet of Things (IoT)

IoT sensors can be installed in fields to monitor real-time soil conditions, humidity, temperature and plant health. Farmers can access the data collected by these sensors via mobile applications to make better irrigation, fertilization and crop protection decisions.

3. Drones and Satellite Imagery

Drones and satellite imagery are used for aerial monitoring of crops. This technology helps identify areas that require special attention, such as areas affected by disease or nutritional deficiencies. The use of drones can also help in the process of spraying pesticides and fertilizers more efficiently.

4. Agricultural Management Application

This application helps farmers in planning and managing their agricultural activities. From recording crop yields to planning crop rotations, these applications can provide valuable insights that help farmers increase productivity and operational efficiency.

5. E-commerce and Digital Markets

E-commerce platforms allow farmers to sell their products directly to consumers or retailers without intermediaries. This can increase profit margins for farmers and provide more comprehensive market access.

6. Online Training and Education

The online educational platform offers courses and tutorials on various aspects of agriculture. Farmers can learn about new techniques, sustainable practices, and the latest innovations in agriculture without leaving their fields.

7. Data Analysis and Artificial Intelligence (AI)

Data analytics and AI are used to process data collected from various sources. AI algorithms can provide recommendations based on patterns and trends detected in the data, helping farmers make smarter, data-driven decisions.

8. Blockchain for Supply Chain Transparency and Security

Blockchain can be used to trace the origins of agricultural products from the field to the consumer's table. This technology increases transparency and security in the supply chain, increasing consumer confidence in farm products.

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8. Blockchain for Supply Chain Transparency and Security

Blockchain can be used to trace the origins of agricultural products from the field to the consumer's table. This technology increases transparency and security in the supply chain, which in turn increases consumer confidence in agricultural products.

Methods

The researcher took the research location at the Coffee Cooperative in West Java and focused on three districts considered to have many coffee cooperatives that are known to be successful and always try to improve the welfare of their members. The districts taken were Bandung Regency, West Bandung Regency and Garut Regency. This research uses a combination research design (mixed methods). The mixed method is a research step that combines two forms of quantitative and qualitative research (Cresswell, 2010).

The research was analyzed using the Structural Equation Model (SEM). SEM, as described by Dahlan (2014), is a powerful multivariate technique used to test theories about the relationships between multiple variables simultaneously. In this research, SEM was employed to establish causality between independent variables and the dependent variable, and to validate the research model. SEM's path analysis capabilities, represented through schematic diagrams, facilitate a visual understanding of the relationships. The sample size, determined using the Slovin formula, consisted of 222 respondents from a population of 503.

a. Model Testing and Validation

Model testing and validation are carried out in three stages: Evaluation of the measurement model, Evaluation of the structural model and Evaluation of model suitability. (goodness of fit model).

1). Evaluation of measurement models (measurement models)

The Evaluation of a measurement model tests its quality. Based on the evaluation results, whether or not the indicators used are valid (Hair et al., 2010; Hoyle et al., 2012). This activity is called construct validity, which shows the extent to which several measurement indicators used as measuring tools can reflect latent constructs. The construct validity often carried out is convergent validity, which is calculated by looking at the loading factor (LF), variance extracted (VE) and construct reliability. (CR), the ideal lF value is ≥ 0.70, but the minimum LF value is ≥ 0.50. Standardized loading factor values below 0.5 can be removed from the model. The results of the LF square are called commonalities or indicator reliability; in this case, it can be interpreted as the percentage of variance in the indicator that the latent variable can explain. The variance extracted calculation is carried out based on the following:

$$\text{Varians Extracted} = \frac{(\sum \text{Std Loading})^2}{(\sum \text{Std Loading})^2 + \sum \varepsilon_j}$$

The VE value shows the average variation in indicator data that can be completely explained by the latent variable. The standard VE value is 0-1 and is acceptable if the VE value is ≥ 0.50.

Construct reliability (CR) calculations are carried out based on :

$$\text{Contruct reliability} = \frac{(\sum \text{Std Loading})^2}{(\sum \text{Std Loading})^2 + \sum \varepsilon_j}$$

The CR value can be defined as Conbrach's alpha value in the reliability test. The NR value ranges from 0-1, suitable if CR ≥ 0.7

1. Evaluation of the structural model

Structural model evaluation aims to test the quality of the structural model. The testing process can be carried out in two ways: based on the path coefficient and the R-square value.

2. Evaluation of model suitability (Goodness of fit Model)

The large number of observed variables (which cannot be measured directly) will give rise to more unique values in the covariance matrix than the number of parameters to be estimated.

According to Dachlan (2004), assessing how fit a model is to the data used is necessary, usually called the Goodness of Fit Model (COF).

Analysis of variable relationships is carried out by testing model alignment (goodness-of-fit tests), namely analyzing whether the indicators are elements that can explain each variable. The following are the results of Lisrel's processing of the results of the analysis of the relationship between each indicator and each variable as follows:

Sustainability = 0.45*Performance, Errorvar.= 0.32 , R^2 = 0.68
(0.068) (0.045)
6.59 7.14

The regression coefficient value of cooperative performance is 0.45 with a positive value. Shows that there is a unidirectional relationship between cooperative performance and cooperative sustainability, meaning that if the cooperative's performance increases by one unit, the cooperative's sustainability will increase by 0.45 or 45.0%, and vice versa.

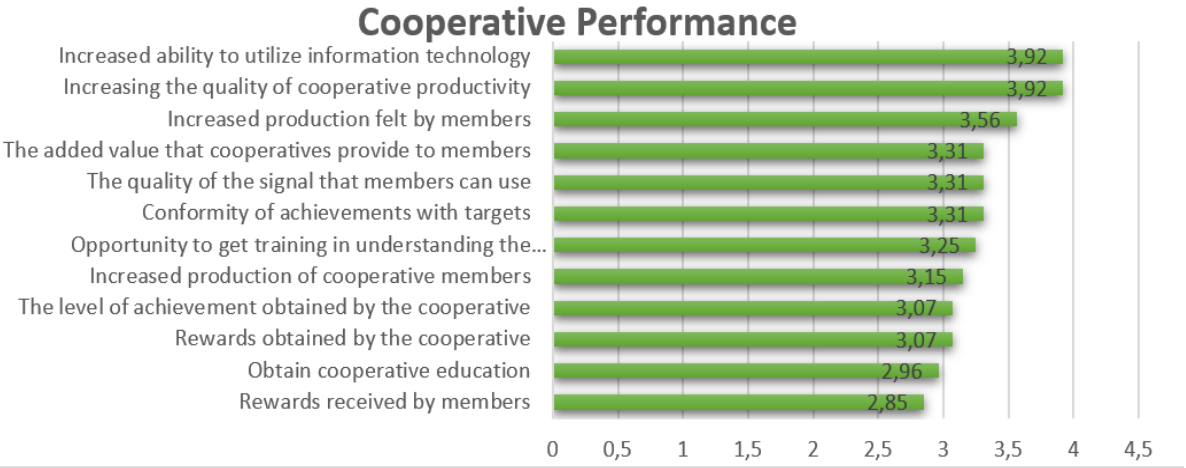

Figure 1. Cumulative Index of respondents' answers to cooperative performance

The research results related to cooperatives' performance in West Java show that performance worth 99% is categorized as having very high performance. Based on the cooperative performance index value, it is known that the average performance is 3.31, meaning it has a high level of performance. In general, of the 12 performance parameters analyzed, almost all of them were categorized as high, especially the productivity dimension in the indicator of increasing ability to utilize information technology (3.92), followed by the productivity dimension in the indicator of increasing the quality of cooperative productivity perceived by members (3.92). This proves that farmers are trying to improve their abilities in utilizing technology, of course, with training provided by cooperatives. The use of this technology was also triggered by the COVID-19 pandemic, which hit the world, including Indonesia, where mobility was limited, so technology became critical in all sectors, including the agricultural sector. Farmers are also trying to use information technology to continue their activities, especially in marketing agricultural products. Cooperatives then use this to educate farmers to be technologically literate and to be able to utilize technology from upstream to downstream.

From the SEM test results, we can create a research results matrix shown in the table below:

Table 1. Research Results Matrix

	Hypothesis	Result	SEM Analysis Results
H_1	There is an influence on the performance of coffee cooperatives on the sustainability of coffee cooperatives in the era of Industrial Revolution 4.0.	Proven and significant	t value = 6.59 accepted

Based on the results of the data analysis that has been carried out, the research results can be explained by the relationship between research variables. Explanation of the results of this research: Cooperative Performance Has a Positive and Significant Influence on the Sustainability of

Coffee Cooperatives in the Industrial Revolution 4.0 Era

The research results show that the cooperative performance variable has a positive and significant influence on the sustainability of Coffee Cooperatives in the Industrial Revolution 4.0 era; this is proven by the t-count value of 6.89. Increasing cooperative performance in terms of 1) productivity, 2) effectiveness, 3) quality and 4) achievement will directly influence the sustainability of coffee cooperatives in the era of the Industrial Revolution 4.0.

Discussion

From the analysis above, it is known that coffee farmers who are members of coffee farmer cooperatives have felt the benefits of technology in the agricultural sector. Among the perceived benefits is increasing productivity, where technology helps farmers maximize harvest yields by optimizing the use of resources and reducing operational costs using automation and better monitoring. It can reduce labour costs and agricultural inputs.

Improving Product Quality through better monitoring and management, improving the quality and safety of agricultural products, expanding market access, where digital platforms open access to broader markets and reduce dependence on intermediaries and finally providing education and training where technology provides access to resources education that can improve farmers' knowledge and skills.

Performance and Sustainability

The collective perspective from Edison (2016) states that performance is the result of a process referred to and measured over a certain period based on previously established provisions and agreements. Furthermore, according to Mangkunegara (2009), the term performance comes from the words job performance or actual performance, namely the quality and quantity of work results a team member achieves in carrying out his duties by the responsibilities given.

According to Stephen P. Robbins, a well-known management expert, performance theory in the management context can be described through four main aspects: (1) productivity, (2) effectiveness, (3) quality, and (4) achievement. Productivity is one of the main aspects of performance related to the extent to which cooperatives or individuals can produce output or results about the amount of resources used. In an individual context, productivity can be measured by measuring the extent to which a person can achieve his goals by utilizing time, energy and other resources efficiently. Effectiveness refers to the ability to achieve a goal or desired result. Quality refers to the level of excellence or standard a product, service, or process produces. In the performance context, quality focuses on the extent to which the results or products produced are of high quality. Sound quality can increase customer satisfaction, improve a company's reputation, and reduce costs due to defects or errors. Achievement is the result of the effort and performance that has been carried out. This can be seen as achieving a goal, a target, or a certain performance level. In an individual context, achievement can be measured by comparing a person's actual performance with established standards or expectations.

It is important to note that these four aspects are interrelated and impact each other. High productivity can increase effectiveness, while good effectiveness can contribute to achieving higher quality. Performance results ultimately reflect how organizations or individuals manage their performance in the context of productivity, effectiveness, and quality. Therefore, understanding these aspects is crucial in managing and improving cooperative performance.

Cooperative sustainability is the ability of a cooperative to maintain performance in its strategic environment through the ability to respond creatively to the dynamics of the environment surrounding it. Sustainability Indicators The concept of sustainable development is multi-disciplinary because many dimensions of development must be considered, including ecological, economic, socio-cultural, legal and institutional dimensions. Indicators are one way to assess and promote the sustainability of a production business. Indicators are also valuable variables that indicate a dimension's implementation level.

In the current era of Industrial Revolution 4.0, cooperatives must adapt to the rapid development of information technology. In the retail sector, for example, our cooperatives and MSME players must also be able to utilize e-commerce platforms or develop marketplace platforms to strengthen market penetration.

Conclusion

From the discussion above, performance significantly influences coffee cooperatives' sustainability in the Industrial Revolution 4.0 era.

From the performance variables analyzed, the use of information technology in the agricultural sector has become very important among coffee farmer cooperatives' members, especially after the COVID-19 pandemic, which hit the world, including Indonesia. During the pandemic, the cooperative educated the farmer members of the cooperative to be technologically literate and able to utilize this technology from upstream to downstream. Moreover, farmers feel the benefits of using this technology, as can be seen from the increased productivity, which improves the performance of the cooperative and, of course, is closely related to the sustainability of the cooperative.

Aknowledgements

Thank you to Allah SWT, all lecturers at Bale University Bandung, all respondents and resource persons who have helped in completing this research.

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