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Digital community readiness assessment for cocoa agroindustry in Lampung

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ABSTRACT

The Cocoa agroindustry requires future changes based on information technology that provide significant value benefits for organizations/companies (digital transformation). The experience during the pandemic required us to transform digitally. Cocoa agroindustry stakeholders such as cocoa farmers, farmer facilitators, and regulators have not been responsive to this, and the industry does not know what to do. The urgency of assessing the readiness for technology adoption in the cocoa agroindustry in Indonesia is urgently needed so that all stakeholders can feel the implementation of 4.0-based technology. What are the benefits of digital transformation to increase productivity, value creation, and social welfare in the industry? This study aims to investigate and identify profiling of technology-based adoption, develop quantitative and qualitative models of TRI 2.0 and validate the assessment results. In this work, we take the case of agroindustry in Lampung province by involving cocoa agroindustry stakeholders. The technology readiness index 2.0 methodology provides a comprehensive framework with the result that the value of the Optimism variable is 1.05, the Innovativeness variable is 1.01, the Discomfort variable is 0.6, and the Insecurity variable is 0.75. The results of calculating the TRI 3.5 value, including the Intermediate Technology Readiness Index (Medium). The TRI value can be interpreted as Lampung cocoa agroindustry stakeholders in this case have have information and communications technology (ICT) potential and are not resistant to using new technology. Hopefully this will become a milestone for establishing a cocoa agroindustry community within the framework

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INTRODUCTION

Technology readiness can be defined as an organization's ability to adopt, use and utilize information on technology (Ruikar et al. 2006). Assessment refers to a series of actions related to the collection and interpretation of information about the level of achievement of objectives (Yambi 2020) from a cocoa agro-industrial community. The information needed in this study is a performance appraisal (Tai et al. 2018) related to readiness for digital technology.

The Covid-19 pandemic that hit the world has affected economic growth, and the industrial sector has experienced a decline. On the one hand, digital transformation is accelerating at all levels of society, where everyone is forced to face digital technology due to social distancing policies and lockdown procedures.

Cocoa production centers, one of which is in the province of Lampung. The Lampung cocoa industry has supplier cooperation partners with farmers to fulfill their raw material stock. Lampung Province has a unique supply chain, where the raw materials come from cocoa farmers' plantations in various areas in Lampung, which have a considerable distance from the industry. Communication and information systems in the Lampung cocoa agroindustry are still manual. The data documentation system needs to be improved, making tracing difficult.

The development of information technology has changed documentation from paper-based to digital (Muhidin et al. 2016). The digital-based documentation process can build information documentation appropriately and effectively, so an improvement in the digital business ecosystem (DBE)-based traceability system is urgently needed (Zimmermann et al. 2020).

DBE is a representation of a business ecosystem where businesspeople interact in a digital environment (Nachira et al. 2007) and monitor trends in that environment (Cheng and Jin 2021) using an Information and Communication Technology (ICT) network. The interaction of all information systems, such as social media, mobile applications, and computer applications that facilitate and help business interactions encourage digital transformation. (Zimmermann et al. 2018).

After the pandemic, the export-based cocoa industry underwent an inevitable digital transformation. However, in this case, Indonesia was slow to anticipate the changes. The experience of 3 years during the pandemic required us to transform digitally. Stakeholders related to the cocoa agroindustry, such as cocoa farmers, farmer facilitators, and regulators, have yet to be responsive to this, and the industry needs to figure out what to do. Farmers' digital literacy still needs to improve regarding the use of technology (Fharaz et al. 2022).

So those who benefit from the digital business of the cocoa agroindustry ecosystem are not internal players but other parties who anticipate better. Cocoa agroindustry actors are only objects that are not ready to transform. So that the roles that internal players should carry out are taken over, this is the basis that must be revealed. At which level are you not ready to face this? This gap in the form of differences in the ability to technological readiness of several cocoa agroindustry actors is the background for assessing digital technology readiness. Transformation in a digital community adopts technology to increase productivity, value creation, and social welfare in the industry (Hadiono and Santi 2020) in that community. Literacy related to digital transformation in micro businesses has been carried out (Mandviwalla and Flanagan 2021);(Sharma and Prasad 1999).

The readiness of the cocoa agroindustry to adopt digital technology using the TRI Model is an assessment of an individual's tendency to use and exploit new technology (Parasuraman and Colby 2000). The use of TRI in several studies been carried out, including an adaptation of technology to students (Lai 2008); (Ahmad et al. 2021), Arbitration Institutions (Goh and Goh 2021), tourism (Jarrar et al. 2020), halal meat logistics (Masudin et al. 2021) dan and small industry/SME (Ramayah et al. 2004).

Describe the supply chain of the cocoa agroindustry through assessment within the framework of building a digital community using a case study of PT. XYZ's cocoa agroindustry in Lampung province. This study includes an assessment of the existence of these gaps. What are the facts on the ground? Until we can draw up steps to prepare for technology adoption, what needs to be explored according to the facts on the ground, and what policies need to be focused on so that they can fill the gap. The urgency of assessing the readiness for technology adoption in the cocoa agroindustry in Indonesia is urgently needed so that all stakeholders can feel the implementation of 4.0-based technology.

This study aims to investigate and identify technology-based adoption profiling, conduct data validation and reliability tests, and conduct assessments using the TRI 2.0 model. This research will be a milestone for establishing a cocoa agroindustry community within a digital business ecosystem framework.

METHODS

The research's first goal is to investigate and identify system requirements. To describe current conditions, they identify stakeholders, rules, roles, missions, controls, and regulations (Wasson 2017). Defining a system by identifying stakeholders, rules, roles, missions, inputs, and outputs requires a Requirements analysis, which determines system components (Roger S. Pressman, Ph.D. Bruce R. Maxim 2006) Process requirements provide design information about where a system will be used, by whom, and what services will be provided. Also, to determine what compromises can be made if there is a conflict of needs. Research related to agroindustry using the input-output structure has been carried out on rice production (Purwandoko et al. 2019), vegetables (Setiawan et al. 2011), and potatoes (Eka Rahayu, Kartika and Ruwanti 2015).

Identification begins with creating an input-output structure and determining how the process occurs in the cocoa agroindustry (IPO 2006). Then, determine the analysis of needs and entities in system development, such as stakeholders, inputs, outputs, rules, objectives, and roles (Wasson 2017). Limitations, goals, accepted and rejected inputs, accepted and unwanted outputs, resources, rules, roles, and system weaknesses are determined when designing the system. In addition to the input-output structure, profiling identification is clarified using the use case diagram method to describe how the user interacts with the system and how the system provides feedback (Fauzan et al. 2019). The Use Case Diagram simplifies and clarifies the system's main actors and their roles and interactions in the provider's network to make it more straightforward and understandable.

Furthermore, it describes the continuity of processes in business activities that collaborate and interact to reach a goal, Sybase Power Design 16.5(SAP 2013) is used to build a Business Process Model (BPMN). So that in this research, the technology readiness for establishing a digital business ecosystem (DBE) for the community agroindustry of cocoa is described by the BPMN notation, and the BPMN Notation illustrates the representation of business community interaction. Research that has been carried out using BPMN as an illustration of DBE has been carried out by (Dimawarnita et al. 2021) on biodiesel and (Ginantika 2015) on the shrimp industry.

The survey method was conducted to ensure the readiness rate of the cocoa agroindustry using digital technology. The survey was conducted on 95 respondents representing the Lampung cocoa agroindustry. The next stage fulfills the second objective, and this study conducted validity and reliability tests on 95 respondent questionnaire data. The instrument is valid if it shows that it is to measure what should be measured. Validity was carried out to test each questionnaire instrument to see whether the instrument used was appropriate for measuring what it was supposed to measure.

$$\mathrm{r_{ac}} = \frac{\mathrm{n}(\Sigma\mathbf{xy}) - (\Sigma\mathbf{x})(\Sigma\mathbf{y})}{\sqrt{(\mathrm{n}\Sigma\mathbf{x}^2 - (\Sigma\mathbf{x})^2).(\mathrm{n}\Sigma\mathbf{y}^2 - (\Sigma\mathbf{y})^2)}}$$

Remark:

r_{ac}	=	Product moment correlation coefficient (r count)
x	=	score obtained by the subject of all items
y	=	Total Score obtained for all items
$\Sigma\boldsymbol{x}$	=	Sum of scores in the x distribution
$\Sigma\boldsymbol{y}$	=	sum of scores in the y distribution
$\Sigma\boldsymbol{x}^2$	=	sum of squares in the score distribution x
$\Sigma\boldsymbol{y}^2$	=	sum of squares in the score distribution y

The value of r-count (correlation product moment) is the basis for making decisions with the rules In the validity test. The instrument is valid if the r count value > r table value. The reliability test measures the consistency of measurement of a concept and the consistency of the respondents in answering the questionnaire instrument items. Cronbach's alpha measures reliability test to measure the limit of a measuring tool declared reliable.

$$r_{ac} = \left(\frac{k}{k-1}\right).\left(1 - \frac{\Sigma s_t}{\Sigma s_t}\right)$$

Remark :

r_{ac}	=	Reliability Value
k	=	Number of items
Σs_i	=	Sum of scores in the x distribution
Σs_t	=	sum of scores in the y distribution

The third objective is to assess the readiness of cocoa agroindustry stakeholders to adopt digital technology using the Technology Readiness Index (TRI) research model. With a diverse approach that incorporates optimism, innovation, discomfort, and insecurity (Parasuraman and Colby 2000). the Technology Readiness Index (TRI) 2.0 assessment method assesses an individual's tendency to adapt to digital technology to make life easier (Parasuraman and Colby 2015). TRI 2.0 variable measurement be composed of four (4) variables (4) variables with 16 scale statements (Parasuraman and Colby 2015):

a. Optimism – stakeholders' sense of optimism that technological change can provide better opportunities.
b. Innovative – a person's tendency to be a pioneer in an aspect.
c. Discomfort – feeling uncomfortable in using technology.
d. Insecurity – Feelings of insecurity in the use of technology

The equation shows how to calculate the TRI value of each variable:

$$TRI = \Sigma_{i=1}^{4} A_i + \Sigma_{i=1}^{4} B_i + \Sigma_{i=1}^{4} C_i + \Sigma_{i=1}^{4} D_i$$

A = Optimism Variable
B = Innovative Variable
C = Discomfort Variable
D = Variable Insecurity

The total TRI score is calculated by adding the values of all variables. The TRI value is calculated by multiplying the average of each questionnaire by the weight of each statement. Each variable has a combined weight of 25%. Then divide the total weight by the Number of statements for each variable. The weight of each of the n statements is determined. The next step is multiplying the statements' average value by each statement's weight. Calculations are made to get the total score of each statement. Variable scores are obtained from the cumulative scores of statements on these variables.

Meanwhile, the total score of TRI is calculated based on the sum of the values of all variables (Ahmad et al. 2021). The data collection instrument uses the Technology Readiness Index (Tri) model scale for four constructs: optimism (4 statements), innovation (4 statements), discomfort (4 statements), and insecurity (4 statements). For all 16 statements, a five-point Likert scale was used to measure the scale of agreement: 1 – 5, from strongly disagree to agree strongly.

Then TRI has three categories of assessment, namely:

a. Low – Low user readiness is indicated by TRI value < 2.89.
b. Medium - User readiness is considered sufficient and ready with a TRI value of 2.90 to 3.51.
c. High user readiness and interest is indicated by a TRI value > 3.51.

The research stages in this study can be described in the research framework:

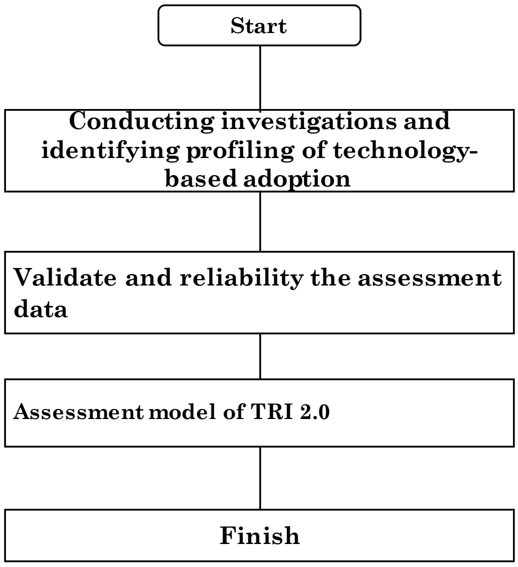

Figure 1 Research Framework

RESULT AND DISCUSSION

Stakeholder Investigation and Profiling of Cocoa Agroindustry

Supply Chain Management of the cocoa agroindustry has two processes (Figure 2). The first is the inbound process of receiving raw materials, storing, and distributing input materials to produce products and services. The second is the outbound process, which distributes finished products to customers. (Anwar et al. 2021). The limitations taken from the cocoa agroindustry established in this article focus on inbound and outbound logistics involving suppliers. This study's primary raw material supplier, manufacturing, and marketing departments were cocoa farmers.

Figure 3 depicts the design of the cocoa agroindustry system entities at all stages of system identification. Inputs in the development of system entities are data on production, suppliers, processing, and consumer data. At the same time, the resulting output is information on technology acceptance decision data and knowing the stages in technology readiness.

Stakeholders involved in this system are procurement providers (large and small supplier communities), business and processing units (cocoa agroindustry community), and finished product vendor providers, which consist of distribution centers and retail communities. Figure 4 depicts the use case.

In addition, the digital business ecosystem (DBE) formation is examined, and business community interaction is depicted using Business Process Model Notation (BPMN) and Modelio 4.1 software. BPMN is a graphical notation describing business activities and processes that collaborate and interact to reach a goal. Business process modeling is designed to help employees communicate with one another and form a shared understanding. Besides that, BPMN is also used to carry instructions on how work should be done and who should do it. Figure 5 describes the BPMN model.

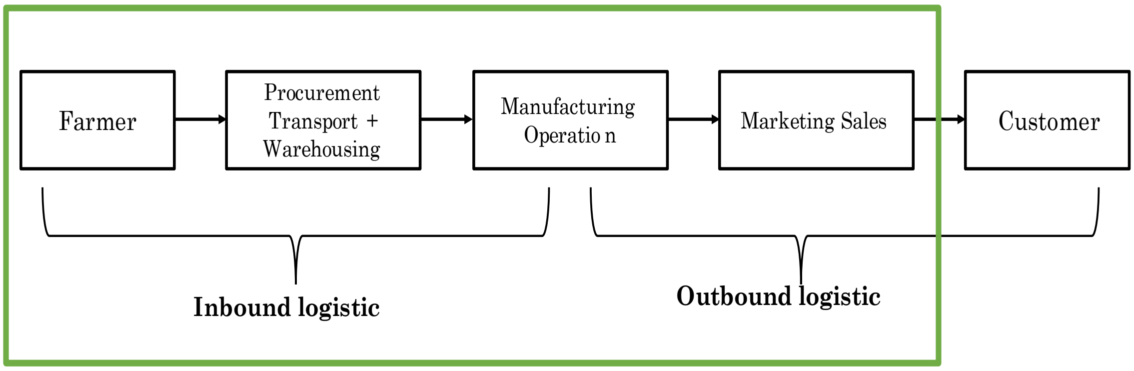

Figure 2 Logistic activities in the agroindustry of cocoa

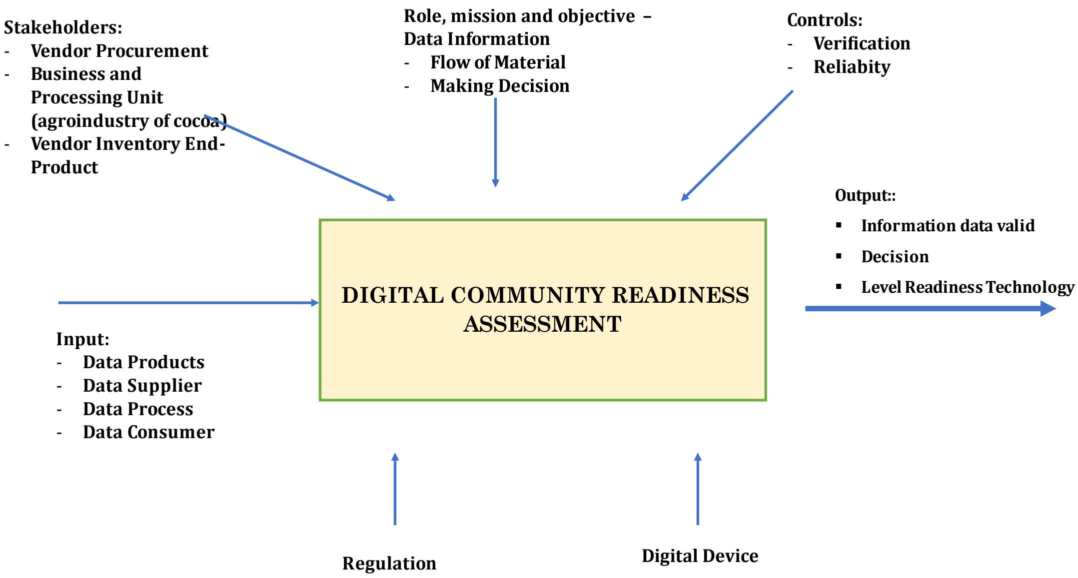

Figure 3 input-output structure

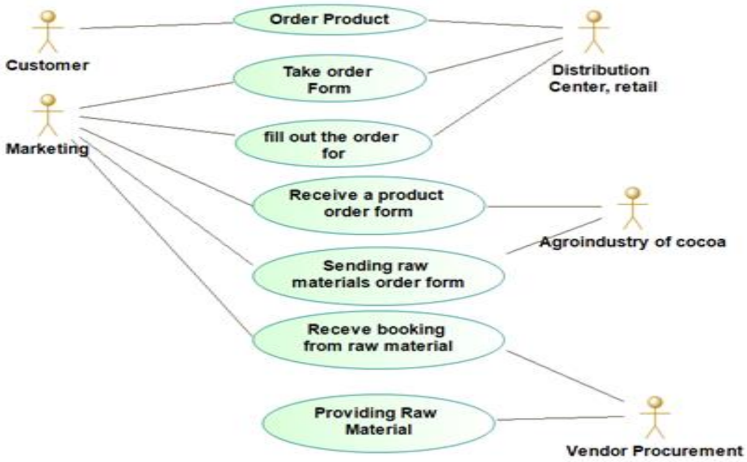

Figure 4 Use case diagram in Supply Chain Management of the cocoa agroindustry

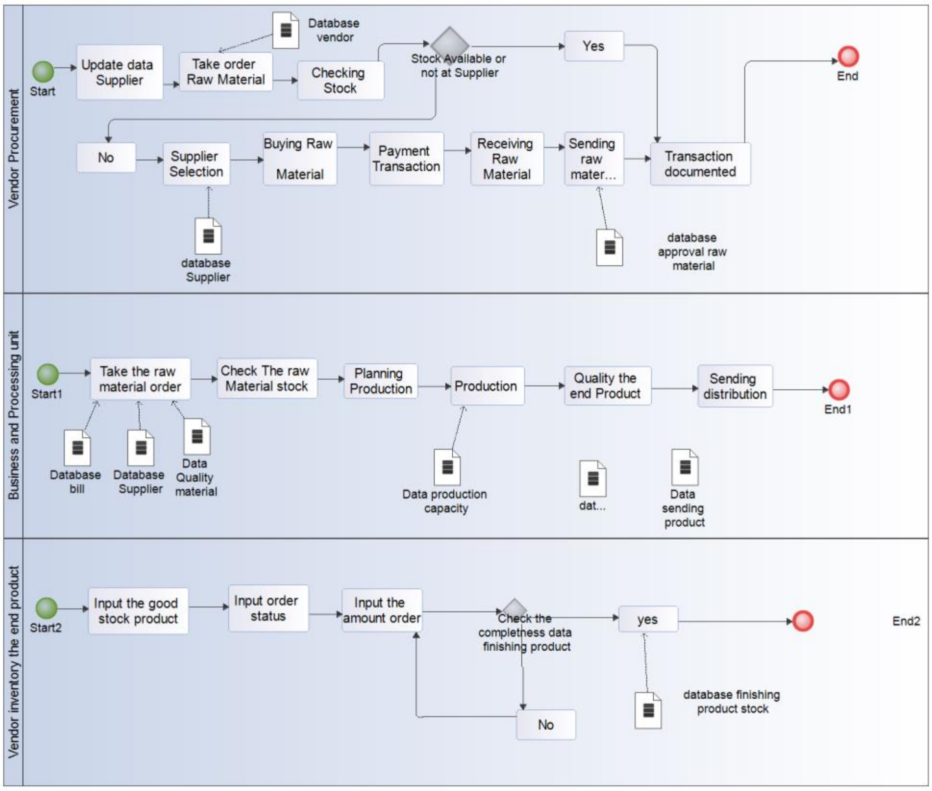

Figure 5 BPMN in the cocoa agroindustry

BPMN in the cocoa agroindustry describes a digital infrastructure-based information system developed to record the necessary data and send information automatically to users. Every business actor in the supply chain must collect the information needed together internally for traceability (recordkeeping) and integrate it to support the improvement of information system traceability. At this stage, the actor is responsible for the process that builds a traceability information system and knows the components that cause the system to run correctly. Digital transformation requires technological innovation that can support the processes of product identification, information collection, data storage, and transformation, as well as system integration. Several studies were conducted to build the structure of information, sending and receiving information from various actors in the system. Collaboration in business is a way for companies to overcome increasing competition in the global market (Ma 2009).

Currently, information and communication technology advances, and many collaborations occur via the Internet, encouraging efficiency and making it easy to get new partners to lead to the establishment of a Digital Business Ecosystem (DBE). The development of information technology has changed documentation from paper-based to digital. The digital-based documentation process can build information documentation appropriately and effectively, so an improvement in the digital business ecosystem (DBE)-based traceability system is urgently needed. The Digital Business Ecosystem (DBE) is a technique of centralizing data and information for each stakeholder in the cocoa agroindustry supply chain to improve performance. When confronted with uncertainty, DBE-based systems enable quick and cost-effective responses. The digital business ecosystem enhances the collaborative environment. DBE provides an interactive software environment that integrates all business entities automatically. The anticipated benefits include increased value and cost-effectiveness for the agroindustry, employees, and consumers (Lee et al. 2010).

Model TRI 2.0

The Theory of Technology Readiness Index (TRI) measures a person's proclivity to use and benefit from new technologies in the agroindustry of cocoa (Parasuraman and Colby 2000). Application of Technology Readiness in research can identify or understand the user's psychological processes toward acceptance of agro-industrial products or technology-based systems. In this study, users use all digital applications related to transactions in the cocoa agroindustry supply chain, from farmers to product marketing. The case study in this research is PT XYZ, an agroindustry in Lampung that works with cocoa farmers in procuring raw materials—established in 2014. PT XYZ is active in domestic and export trading. The research population consisted of stakeholders who interacted with PT. XYZ in Bandar Lampung, with a sample of 97 respondents whose profiles were (Table 1).

Questionnaires are provided in the Google Forms application. The questionnaire was equipped with questions related to the respondent's profile, age, gender, education level, and location of residence. Based on the questionnaire results, it can be seen that the data obtained was then analyzed using the TRI method.

Validity Test Results

Validity was measured to test whether each questionnaire instrument was appropriate to measure what should be measured. If the calculated r-value is higher than the r-table value, then the instrument is stated valid. Table 2 shows the instrument measurement results.

$$r_{ac} = \left(\frac{16}{16-1}\right) \cdot \left(1 - \frac{19{,}66}{79{,}14}_{t}\right)$$

According to the validity test results in Table 2, all indicators of all variables have a value of r count greater than 0.195, indicating that all indicators of the questionnaire questions are valid.

Reliability test results

The Cronbach alpha method was used to determine the consistency of the data obtained from the collected questionnaires. The reliability test was declared reliable if the Cronbach alpha value was more significant than 0.6. The instrument reliability test calculations in this study have been recapitalized as follows:

According to the results of reliability measurements in Table 3, rac exceeds 0.7. (high level of reliability). If the rac value is more significant than 0.6, the instrument is said to be highly reliable. According to the calculation results, the data has a high level of reliability.

Table 1 Profile responders

Sex	Male	72,6%
	female	27,4%
Age	Between 21-30	28,4%
	Between 31-40	25,3%
	Between 41-50	31,6%
	Between 51-60	14,7%
Education	Elementary	21,1%
	Junior High School	24,2%
	Senior High School	46,3%
	Diploma-Master	8.4%

Table 2 Validity test results

Variable	r-calculate	r - table	Decision
Optimism 1	0,271358563	0,202	Valid
Optimism 2	0,265072588	0,202	Valid
Optimism 3	0,395370741	0,202	Valid
Optimism 4	0,258799843	0,202	Valid
Innovative 1	0,326341392	0,202	Valid
Innovative 2	0,255122209	0,202	Valid
Innovative 3	0,25227962	0,202	Valid
Innovative 4	0,24024371	0,202	Valid
Discomfort 1	0,290122737	0,202	Valid
Discomfort 2	0,753749099	0,202	Valid
Discomfort 3	0,712687424	0,202	Valid
Discomfort 4	0,686195451	0,202	Valid
Insecurity 1	0,662806778	0,202	Valid
Insecurity 2	0,551653254	0,202	Valid
Insecurity 3	0,551883163	0,202	Valid
Insecurity 4	0,678032131	0,202	Valid

Table 3 Reliability test results

Variable	Cronbach alpha	Result
Optimism	0,742	Reliable
Innovative	0,883	Reliable
Discomfort	0,755	Reliable
Insecurity	0,849	Reliable

Table 4 TRI Calculation Result Score

Variable	Skor
Optimism Variable	1,06
Innovativeness variable	1,02
Discomfort variable	0,69
Insecurity variable	0.75
Total TRIs	**3,50**

TRI Calculation Results

The score of the TRI calculation results regarding assessing digital technology readiness for the cocoa agroindustry can be seen in Table 4 below.

The study conducted by Jaafar et al. (2007) produced a TRI with a score of 3.3 which stated a neutral value. In this study, the TRI calculation result score was 3.5. The cocoa agroindustry community is categorized as the Medium Technology Readiness Index, which is between 2.40 – 3.51, close to the limit set for the high category. On the Optimism Variable value, the highest score is 1.05 indicating the highest confidence in mastering technology, primarily digital related to procurement and the marketplace. Following research by Napitupulu et al. (2018) in small industries states that the results of the high optimism variable show a positive effect on technology readiness. The Innovativeness variable has a relatively high score of 1.01. The cocoa agroindustry community is innovative in adopting relatively high technology. The Discomfort variable value gets the lowest score, which is 0.6. .75 shows that technology cannot feel so safe in its application in the cocoa agro-industrial community. The Cocoa agroindustry in the medium category, according to (Napitupulu et al. 2018)) includes ICT potential and is not resistant to using new technology.

The strategy that can be applied in this condition is to support the implementation of digital use for layers that are not ready, in this case, farmers. Digital technology literacy is spread more. Support digital technology that is easy to understand and apply (Smolander et al. 2017) by farmers or users with lower education. Support for government policies in terms of HR development (Pomaza-Ponomarenko et al. 2020) which have technological advantages, need to be supported by the cocoa agroindustry at the top level.

CONCLUSION

A relevant issue in the search for new technologies, the cocoa agroindustry must have the resources to ensure smooth, full implementation and people willing to accept and use new technologies. The cocoa agroindustry must create opportunities for interaction and cooperation between internal and external parties who understand information technology. The Technology readiness index 2.0 methodology provides a comprehensive framework with a TRI score 3.5. The cocoa agroindustry community is categorized as the Medium Technology Readiness Index. The value of the Optimism variable is 1.05, the Innovativeness variable is 1.01, the Discomfort variable is 0.6, and the Insecurity variable is 0.75. This assessment will become a milestone for constructing the cocoa agroindustry community within a digital business ecosystem framework. Government authority scope policies are needed to fill the gaps in technology gaps at the lowest layer so that they are ready to face more advanced technologies in the future.

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