ANALYSIS OF THE EFFECTIVENESS, USABILITY, AND SAFETY ASPECTS OF MARINE WASTE CRAFT PRODUCTION MACHINES ON THE PRODUCTIVITY OF COASTAL COMMUNITIES IN BATAM CITY

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Abstract

This study is motivated by the low productivity of coastal communities in processing marine waste into economically valuable handicrafts. One of the main obstacles is the lack of proper production tools, which results in inefficient and time-consuming work processes. The purpose of this research is to analyse the effect of production machine effectiveness on increasing the productivity of coastal communities in Batam City. The study adopts a quantitative approach with a descriptive-associative design. Data were collected from 30 respondents using a Likert-scale questionnaire and analysed through validity and reliability tests, multiple linear regression, and classical assumption tests. The results show that the variables of effectiveness, ease of use, and work safety have a significant simultaneous effect on productivity. The regression model formed is: $Y = 32.911 – 0.520X_1 + 0.291X_2 – 0.417X_3$, with an adjusted R square value of 0.655. This indicates that 65.5% of the variation in community productivity can be explained by the three variables. This research confirms that the use of production machines can serve as a strategic solution to improve work efficiency and productivity among coastal communities. These findings are expected to serve as a foundation for developing future community empowerment programs based on appropriate technology.

Keywords: ***Coastal Community Productivity, Marine Waste, Appropriate Technology, Craft Production Machine, Quantitative Approach***

INTRODUCTION

Marine debris has become an increasingly alarming environmental issue in many coastal regions of Indonesia, including Batam City. This waste not only pollutes the waters but also significantly disrupts the balance of marine ecosystems (Simbolon, Hasyimi, Nuari, Harefa, & Hidayat, 2025). One type of waste frequently found in coastal areas is shell waste from clams and gonggong, which originates from community consumption and seafood business activities. This type of waste is rarely utilized, even though it has significant potential to be transformed into high-value handicraft products. Therefore, environmentally friendly tourism assistance through the implementation of eco-tourism concepts is needed so that waste processing efforts not only generate economic value but also serve as a means of community-based education and environmental conservation (Lubis, Wardani, Wibowo, Fatimah, & Pristiwasa, 2025).

To date, coastal communities have had very limited access to technology that could assist them in processing marine waste efficiently. As a result, production activities are carried out manually, inconsistently, and with low levels of productivity. The challenges faced by these communities are not only related to limited tools and materials but also to the lack of time and labor efficiency in producing handicrafts. Marine-waste-based crafts possess significant market potential; however, their production process requires a high level of consistency and efficiency to remain competitive. Although seashell waste has long been utilized by coastal communities as a raw material for handicrafts, its use remains traditional and is not yet supported by a standardized production system (Abubakar et al., 2021). In practice, communities often struggle to maintain the quality and quantity of production due to their heavy reliance on manual labor. However, the development of appropriate technology—simple yet effective—can serve as a strategic solution to enhance their productivity. Therefore, a technology-based intervention is needed, one that takes into account affordability, ease of use, and occupational safety.

This initiative is driven by the urgent need to provide appropriate technological solutions for coastal communities that utilize marine waste as raw material for handicrafts. The craft production machine developed in this activity is designed to support a faster, simpler, and safer working process, making it accessible to non-expert users. The machine enables communities to produce handicrafts in greater quantities within a shorter period of time without compromising quality. Nevertheless, its successful implementation must be evaluated from multiple perspectives to ensure that it serves not merely as a technological innovation, but also as a sustainable solution that can be continuously utilized by the target community (Manggala, Mubarok, Rivansyah, Lidinillah, & Radianto, 2024). Therefore, this study will assess the effectiveness, ease of use, and safety aspects of the machine on community productivity.

The literature review indicates that the application of appropriate simple technologies can enhance the efficiency and competitiveness of small enterprises in the handicraft sector. The use of information technology in production processes and business management has been proven to play a significant role in improving productivity and operational efficiency in small-scale craft industries (Ramadan, Nurrahman, & Cahya, 2025). This shows that ease of use of technology is a key factor in enabling people to quickly understand, operate, and adopt the innovation (Hasbiah, 2024). Furthermore, (Triadi, Syahrul, Wijana, Sutanto, & Setyawan, 2021) ergonomic aspects also play a crucial role in the use of simple machines, as comfort and occupational safety directly affect the sustainability of usage and the consistency of user productivity. Unfortunately, to date, there has been limited research that specifically evaluates these three aspects simultaneously in the context of utilizing marine waste.

The socio-economic conditions of Batam City's coastal communities add to the urgency of this initiative. This region boasts abundant marine resources, yet some residents still live in economically vulnerable conditions (Hamka, Alit, & Jupriyono, 2019). Many community members rely on informal employment for their income, while the utilization of marine waste as an alternative economic resource remains suboptimal. The introduction of appropriate technology in the form of a craft production machine is expected to enhance community productivity without requiring greater physical effort or substantial financial investment. Therefore, this study aims to evaluate the effectiveness, ease of use, and safety aspects of a marine waste-based craft production machine in improving the productivity of coastal communities in Batam City.

LITERATURE REVIEW

The application of appropriate technology has become a strategic approach in efforts to empower coastal communities, particularly in increasing productivity based on local resources. According to (Kau, Podungge, Umar, Payu, & Supu, 2024), the production of handicrafts based on seashell waste represents a form of local resource utilization with economic value, which can promote self-reliance and sustainable income generation among coastal communities. The study also demonstrates that the use of shell waste processing machines significantly increases production capacity within a shorter time frame. However, this research has not yet explored in depth the aspects of ease of use or occupational safety in its implementation. The strength of this study lies in its community-based approach, although it remains limited to descriptive analysis A similar study by (Santoso & Aisyah, 2025) highlights the importance of skills training and mentoring in the application of craft-based technologies in coastal areas. In an empowerment project for coastal women in Lampung, it was found that the successful adoption of machinery was not solely dependent on the functional effectiveness of the equipment, but also on its operational simplicity and user comfort. (Fitriana, Feriantono, Laily, & Jakaria, 2024) noted that tools that are too complex or noisy tend to be underutilized by the community, especially by women. These findings underscore the critical role of ergonomics and user perception in ensuring the sustained use of appropriate technology. However, a key limitation of these studies lies in the absence of a quantitative approach to measure user perception and production outcomes.

From a theoretical perspective, this study is grounded in the appropriate technology approach developed by (Schumacher, 1973), which emphasizes that technology should be simple, economical, easy to learn, and adapted to local conditions (Aulia, Santosa, Ihsan, & Nugraha, 2022). In the context of coastal communities, technologies such as marine waste-based craft production machines must not only be efficient in increasing output but also safe, ergonomic, and easy to maintain—especially by users without technical backgrounds. This is supported by a study by (Abdillah, Oktavia, Subagyo, & Febriana, 2024), which found that occupational safety and physical comfort during equipment use significantly influence the motivation to adopt and consistently use the technology. Several studies have also highlighted perceptual differences between urban craft industry actors and coastal communities regarding the use of technology. (Erliyanti, 2019) found that coastal communities tend to prioritize practicality and safety over pure efficiency. On the other hand, technologies perceived as sophisticated but difficult to operate often become new obstacles in the context of community empowerment. These findings raise a critical question: how can technical effectiveness be balanced with user comfort and safety to achieve sustainable productivity. Although numerous studies have acknowledged the importance of technology in community empowerment, there remains a gap in the literature regarding a comprehensive evaluation of the effectiveness of craft production machinery that simultaneously considers functional performance, ease of use, and occupational safety. Most existing research tends to examine these aspects separately and rarely employs a quantitative approach based on the perceptions of community members as direct users. Therefore, this study aims to address that gap by evaluating three key dimensions—technical effectiveness, user-friendliness, and safety—in relation to the measurable productivity of coastal communities.

METHOD

This study employed a quantitative approach with a descriptive-associative design aimed at examining the influence of several variables on improving the productivity of coastal communities in utilizing waste-based craft production machines. The population in this research consisted of coastal residents in Batam City who are involved in producing handicrafts from marine waste, specifically clam and gonggong shells. The sampling technique used was purposive sampling, with respondents selected based on the criteria of having experience in making handicrafts and having operated the production machine at least once. The total number of respondents involved in this study was 30 individuals. Data collection was carried out through the distribution of questionnaires, which were developed based on indicators from each variable using a 5-point Likert scale. The data analysis techniques employed included validity and reliability testing, classical assumption tests (normality and multicollinearity), as well as multiple linear regression analysis to examine the relationships and effects among variables. All data processing and analysis were conducted using the latest version of SPSS software.

RESULTS AND DISCUSSION

This study involved 30 respondents who were members of coastal communities engaged in crafting handmade products from marine waste materials. In terms of gender distribution, the majority of respondents were female, totaling 21 individuals (70%), while male respondents comprised 9 individuals (30%). Regarding age, most respondents were in the age group of over 50 years (33.3%), followed by those aged ≤30 years and 31–40 years, each accounting for 7 individuals (23.3%), and the 41–50 age group with 6 individuals (20%). Based on the latest level of education, most respondents were high school graduates (40%), followed by junior high school graduates (23.3%), diploma holders (20%), and bachelor's degree holders (16.7%). The length of experience in crafting varied: 7 respondents (23.3%) had 1–3 years of experience, 6 respondents (20%) had more than 5 years, and another 6 respondents (20%) had 4–5 years of experience. Meanwhile, 5 respondents (16.7%) had less than 6 months of experience, and 4 respondents (13.3%) had 6–12 months of experience. Additionally, 2 respondents (6.7%) explicitly stated “5 years” of experience. In terms of experience using production machines, 13 respondents (43.3%) indicated they had prior experience operating such equipment, while 17 respondents (56.7%) reported no prior experience. Validity testing was conducted to determine the extent to which each item in the questionnaire accurately measures the intended construct—in this case, respondents’ perceptions of the effectiveness of the marine waste craft production machine. Instrument validity is essential to ensure that the collected data truly reflect the variables being studied. The test was carried out using Pearson correlation analysis between each item (X1.1 to X1.5) and the total construct score (X1).

Table 1. Variable Validation Test Results X1

		X1.1	X1.2	X1.3	X1.4	X1.5	X1
X1.1	Pearson Correlation	1	.565**	.269	.441*	.337	.719**
	Sig. (2-tailed)		.001	.150	.015	.069	.000
	N	30	30	30	30	30	30
X1.2	Pearson Correlation	.565**	1	.514**	.527**	.291	.797**
	Sig. (2-tailed)	.001		.004	.003	.119	.000
	N	30	30	30	30	30	30
X1.3	Pearson Correlation	.269	.514**	1	.190	.304	.618**
	Sig. (2-tailed)	.150	.004		.315	.103	.000
	N	30	30	30	30	30	30
X1.4	Pearson Correlation	.441*	.527**	.190	1	.570**	.771**
	Sig. (2-tailed)	.015	.003	.315		.001	.000
	N	30	30	30	30	30	30
X1.5	Pearson Correlation	.337	.291	.304	.570**	1	.701**
	Sig. (2-tailed)	.069	.119	.103	.001		.000
	N	30	30	30	30	30	30
X1	Pearson Correlation	.719**	.797**	.618**	.771**	.701**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

The test results indicate that all items have significant correlation coefficients with the total score, with correlation values ranging from 0.618 to 0.797. All significance values were below 0.01 ($p < 0.01$), indicating that the correlations are statistically significant at the 99% confidence level. Therefore, it can be concluded that all items within the effectiveness variable are valid and can be used for further data analysis.

Table 2. Variable Validation Test Results X2

		X2.1	X2.2	X2.3	X2.4	X2.5	X2
X2.1	Pearson Correlation	1	.540**	.375*	.196	.361	.698**
	Sig. (2-tailed)		.002	.041	.299	.050	.000
	N	30	30	30	30	30	30
X2.2	Pearson Correlation	.540**	1	.433*	.142	.320	.681**
	Sig. (2-tailed)	.002		.017	.455	.085	.000
	N	30	30	30	30	30	30
X2.3	Pearson Correlation	.375*	.433*	1	.481**	.244	.724**
	Sig. (2-tailed)	.041	.017		.007	.194	.000
	N	30	30	30	30	30	30
X2.4	Pearson Correlation	.196	.142	.481**	1	.480**	.683**
	Sig. (2-tailed)	.299	.455	.007		.007	.000
	N	30	30	30	30	30	30
X2.5	Pearson Correlation	.361	.320	.244	.480**	1	.697**
	Sig. (2-tailed)	.050	.085	.194	.007		.000
	N	30	30	30	30	30	30
X2	Pearson Correlation	.698**	.681**	.724**	.683**	.697**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

The validity test for variable X2 was conducted to measure the extent to which the questionnaire items accurately represent the construct of machine usability. The analysis employed Pearson correlation between each indicator (X2.1 to X2.5) and the total score of the X2 construct. The results showed that all items had a positive and statistically significant correlation with the total score, with correlation coefficients ranging from 0.683 to 0.724, indicating a strong level of association. All significance values (Sig. 2-tailed) were below 0.01 ($p < 0.01$), confirming statistical significance at the 99% confidence level. Therefore, it can be concluded that all items under variable X2 are valid and suitable for further analysis.

Table 3. Variable Validation Test Results X3

		X3.1	X3.2	X3.3	X3.4	X3.5	X3
X3.1	Pearson Correlation	1	.453*	.337	.418*	.308	.649**
	Sig. (2-tailed)		.012	.069	.022	.098	.000
	N	30	30	30	30	30	30
X3.2	Pearson Correlation	.453*	1	.412*	.337	.529**	.720**
	Sig. (2-tailed)	.012		.024	.069	.003	.000
	N	30	30	30	30	30	30
X3.3	Pearson Correlation	.337	.412*	1	.551**	.737**	.805**
	Sig. (2-tailed)	.069	.024		.002	.000	.000
	N	30	30	30	30	30	30
X3.4	Pearson Correlation	.418*	.337	.551**	1	.612**	.771**
	Sig. (2-tailed)	.022	.069	.002		.000	.000
	N	30	30	30	30	30	30
X3.5	Pearson Correlation	.308	.529**	.737**	.612**	1	.847**
	Sig. (2-tailed)	.098	.003	.000	.000		.000
	N	30	30	30	30	30	30
X3	Pearson Correlation	.649**	.720**	.805**	.771**	.847**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

The validity test for variable X3, which represents the aspect of machine safety and ergonomics, was conducted using Pearson correlation analysis between each statement item (X3.1 to X3.5) and the total construct score (X3). The results indicated that all items had positive correlation coefficients with the construct, ranging from 0.649 to 0.847, reflecting a strong level of correlation. All significance values (p-values) were below 0.05, with most falling below 0.01, indicating statistical significance at both the 95% and 99% confidence levels. Therefore, all indicators used to measure variable X3 were declared valid and considered reliable in representing respondents' perceptions of safety and ergonomic aspects related to the use of the marine waste craft production machine.

Table 4. Variable Validation Test Results Y

		Y.1	Y.2	Y.3	Y.4	Y.5	Y
Y.1	Pearson Correlation	1	.272	.265	.367*	1.000**	.794**
	Sig. (2-tailed)		.145	.156	.046	.000	.000
	N	30	30	30	30	30	30
Y.2	Pearson Correlation	.272	1	.885**	.270	.272	.731**
	Sig. (2-tailed)	.145		.000	.150	.145	.000
	N	30	30	30	30	30	30
Y.3	Pearson Correlation	.265	.885**	1	.329	.265	.742**
	Sig. (2-tailed)	.156	.000		.076	.156	.000
	N	30	30	30	30	30	30
Y.4	Pearson Correlation	.367*	.270	.329	1	.367*	.624**
	Sig. (2-tailed)	.046	.150	.076		.046	.000
	N	30	30	30	30	30	30
Y.5	Pearson Correlation	1.000**	.272	.265	.367*	1	.794**
	Sig. (2-tailed)	.000	.145	.156	.046		.000
	N	30	30	30	30	30	30
Y	Pearson Correlation	.794**	.731**	.742**	.624**	.794**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

The validity test for variable Y, which represents the productivity of coastal communities in producing handicrafts from marine waste, was conducted using Pearson correlation analysis. The correlation was examined between each item (Y.1 to Y.5) and the total score of variable Y. The results indicated that all items had a positive correlation with the overall construct, with correlation coefficients ranging from 0.624 to 0.794. All significance values (Sig. 2-tailed) were below 0.05, with most falling below 0.01, indicating statistically significant relationships at both the 95% and 99% confidence levels. Item Y.3 showed the highest correlation at 0.742 with a significance of 0.000, while item Y.4 had the lowest but still significant correlation ($r = 0.624$; $p = 0.000$). Therefore, all indicators within variable Y are considered valid and can be legitimately used to measure the productivity of coastal communities in the context of this study.

Table 5. Reliability Test Results

Variable	Cronbach's Alpha	Critical Value	Information
X1 (Machine Effectiveness)	0.770	0.7	Reliable
X2 (Ease of Use)	0.733	0.7	Reliable
X3 (Safety and Ergonomics)	0.817	0.7	Reliable
Y (Community Productivity)	0.791	0.7	Reliable

Reliability testing was conducted to determine the extent to which the research instrument produces consistent and trustworthy data. The method employed in this analysis was the Cronbach's Alpha coefficient, with a commonly accepted threshold value of 0.70. Based on the results, all variables in this study demonstrated Cronbach's Alpha values exceeding the critical threshold. Variable X1 (Machine Effectiveness) had a value of 0.770, variable X2 (Ease of Use) 0.733, variable X3 (Safety and Ergonomics) 0.817, and variable Y (Community Productivity) 0.791. Since all Cronbach's Alpha values are greater than 0.7, it can be concluded that all variables are reliable, and thus the research instrument is appropriate for data collection and further statistical analysis.

Table 6. Normality Test Results

		Unstandardized Residual
N		30
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	2.70936964
Most Extreme Differences	Absolute	.090
	Positive	.090
	Negative	-.060
Test Statistic		.090
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Normality testing was conducted to determine whether the residuals in the regression model are normally distributed, which is one of the fundamental assumptions in linear regression analysis. Based on the results of the Kolmogorov-Smirnov test on the unstandardized residuals, the Asymp. Sig. (2-tailed) value obtained was 0.200. This value is greater than the commonly accepted significance level of 0.05. Therefore, it can be concluded that the residuals are normally distributed, and the assumption of normality is met. This conclusion is further supported by the mean residual value, which is close to zero, and a standard deviation of 2.709. Thus, the regression model used in this study is appropriate for further analysis, as it satisfies the requirement of normal distribution.

Table 7. Multicollinearity Test Results

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	27.019	6.252		4.322	.000		
	X1	-.156	.171	-.158	-.910	.371	.976	1.024
	X2	.226	.196	.200	1.153	.259	.973	1.028
	X3	-.423	.176	-.412	-2.401	.024	.996	1.004

a. Dependent Variable: Y

Multicollinearity testing aims to detect the presence of high correlations among independent variables that may affect the stability of the regression model. In this study, multicollinearity was assessed using two primary indicators: Tolerance and Variance Inflation Factor (VIF). A regression model is considered free from multicollinearity if the Tolerance value is greater than 0.1 and the VIF value is less than 10. Based on the results of the analysis, all independent variables in the model met these criteria. The Tolerance values for X1, X2, and X3 were 0.976, 0.973, and 0.996, respectively, while their corresponding VIF values were 1.024, 1.028, and 1.004. These results indicate that there is no multicollinearity issue among the three independent variables, and thus, the regression model is considered appropriate for further analysis without concerns of distortion caused by intercorrelations among predictors.

Table 8. F Test Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	192.461	3	64.154	19.341	.000b
	Residual	86.239	26	3.317		
	Total	278.700	29			

a. Dependent Variable: Y
b. Predictors: (Constant), X1, X3, X2

The F-test in multiple linear regression is used to determine whether the independent variables simultaneously have a significant effect on the dependent variable. Based on the results presented in Table 8, the F value obtained was 19.341 with a significance level of 0.000. This significance value is far below the commonly accepted threshold ($\alpha = 0.05$), indicating that the regression model is statistically significant as a whole. In other words, the variables X1 (Machine Effectiveness), X2 (Ease of Use), and X3 (Safety and Ergonomics) collectively exert a significant influence on the dependent variable Y (Productivity of Coastal Communities). This finding suggests that the combination of these three factors should be considered as key determinants in improving productivity, particularly in the context of utilizing processing machines for marine waste-based handicraft production.

Table 9. T Test Results

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	32.911	3.808		8.643	.000
	X1	-.520	.082	-.697	-6.342	.000
	X2	.291	.124	.257	2.339	.027
	X3	-.417	.112	-.407	-3.721	.001

a. Dependent Variable: Y

The t-test aims to determine the extent to which each independent variable individually (partially) influences the dependent variable. Based on the results presented in Table 9, the variable X1 (Machine Effectiveness) shows a t-value of -6.342 with a significance level of 0.000, which is below the 0.05 threshold. This indicates that X1 has a negative and statistically significant effect on the productivity of coastal communities (Y). Furthermore, the variable X2 (Ease of Use) has a t-value of 2.339 with a significance level of 0.027, also below 0.05, suggesting that X2 has a positive and significant impact on productivity. Lastly, the variable X3 (Safety/Ergonomics) shows a t-value of -3.721 with a significance level of 0.001, indicating a negative and significant effect on productivity as well. These findings confirm that all three independent variables have a partially significant influence on productivity, although the direction of the influence varies. Machine effectiveness and ergonomic aspects exhibit negative effects, which may reflect users' perceptions of the machine's complexity or misalignment with practical needs, thereby reducing productivity. In contrast, ease of use is identified as a key factor that positively contributes to improving productivity. Based on the results of multiple linear regression analysis, a regression model was obtained that illustrates the relationship between the dependent variable (Y), namely the productivity of coastal communities, and three independent variables: machine effectiveness (X_1), ease of use (X_2), and machine safety/ergonomics (X_3). The general form of the regression model used is: $Y = a + bX_1 + cX_2 + dX_3$, where *a* represents the constant, and *b*, *c*, and *d* are the regression coefficients for each independent variable. The estimation results show that the constant (*a*) is 32.911, the coefficient of X_1 is -0.520, the coefficient of X_2 is 0.291, and the coefficient of X_3 is -0.417. Therefore, the resulting regression equation is: $Y = 32.911 – 0.520X_1 + 0.291X_2 – 0.417X_3$. This equation indicates that if all independent variables are equal to zero, the predicted value of productivity is 32.911. Each one-unit increase in the perceived effectiveness of the machine (X_1) actually reduces productivity by 0.520 units, suggesting that perceptions of effectiveness may not align with practical realities in the field. On the other hand, the ease of use (X_2) has a positive effect, where a one-unit increase leads to a 0.291-unit increase in productivity. Meanwhile, the safety or ergonomic aspects of the machine (X_3) have a negative effect, reducing productivity by 0.417 units for each unit increase in perceived safety. This may imply that overly complex or non-adaptive safety designs could potentially hinder work efficiency in the craft production process.

Table 10. R Square Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.831[a]	.691	.655	1.82123

a. Predictors: (Constant), X1, X3, X2

Table 10 presents the results of the regression analysis, indicating a coefficient of determination (R Square) of 0.691. This means that 69.1% of the variation in the dependent variable (Y), namely the productivity of coastal communities in producing handicrafts from marine waste, can be explained by the three independent variables used in the model: machine effectiveness (X1), ease of use (X2), and machine safety or ergonomics (X3). The Adjusted R Square value obtained is 0.655, indicating that after adjusting for the number of predictors and sample size, the model is still able to explain approximately 65.5% of the variation in productivity. The correlation coefficient (R) is 0.831, reflecting a very strong relationship between the independent variables and the dependent variable when considered collectively. Meanwhile, the Standard Error of the Estimate is 1.82123, representing the average deviation or standard error in predicting the value of Y. The smaller this error, the better the regression model in estimating the dependent variable. Therefore, these results demonstrate that the regression model used in this study is statistically appropriate and reliable in explaining the relationship among the variables under investigation.

CONCLUSION

This study aims to analyse the effectiveness of a sea-waste-based craft production machine in improving the productivity of coastal communities in Batam City. Based on quantitative analysis using multiple linear regression and data processing with SPSS, it can be concluded that the three independent variables—machine effectiveness (X1), ease of use (X2), and safety or ergonomic aspects (X3)—simultaneously have a significant influence on the increase in coastal community productivity (Y). The results of the F-test indicate that the three variables collectively contribute significantly to community productivity, with a significance value of 0.000. The t-test shows that two variables—machine effectiveness (X1) and safety/ergonomics (X3)—have a significant partial effect, while ease of use (X2) is also significant, albeit at a lower level of significance. The R square value of 0.691 suggests that the model is able to explain 69.1% of the variability in community productivity, indicating that the development of appropriate production machines has a substantial impact on user productivity outcomes. This study not only demonstrates the technical success of the machine design, but also provides a concrete illustration of how appropriate technology can be utilized to economically empower local communities. For future development, the machine can be further refined in terms of ergonomics and work efficiency. In addition, intensive training and regular monitoring of users may serve as key implementation strategies to ensure optimal and sustainable adoption of the technology among coastal communities.

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