



Research Article

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Green Economy: Community Pottery Development Process from Kradong Volcanic Rock Powder for the Sustainable Development of Communities in Thailand

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Abstract

The aim of this research is to establish a pottery production process from volcanic rock powder in Ban Kruat District, Thailand under the concept of the green economy operation by using research tools such as structured interviews as well as Exploratory Factor Analysis (EFA) and Multiple Regression Analysis. Moreover, it was found that the mixing ratios of pumice powder at 50%, local soil at 20% and kaolin at 30% with a shrinkage rate of 14%, water absorption of 1.88%, and a hardness of 304.75 kg/cm², having been fired at a temperature of 1,190 °C is considered a suitable ratio. In the same way, when transferring the production process of new pottery to the community in Ban Kruat District for production and distribution with the evaluation of consumer satisfaction, it can be summarized that there are six factors that affect consumer satisfaction: 1) Local Identity, 2) Uniqueness of the Materials, 3) Identity from Khmer Art Influence, 4) Factors in Lifestyle and Local Beliefs, 5) Functional Factors that Correspond to the Era, and 6) Factors of Current Market Conditions. Thus, these six factors have a predictive value of 61.365 (KMO =.533), and the results are as follows: $F = 88.808$, $P = 0.000$, $R = 0.858$, $R_2 = 0.736$, $Adj R_2 = 0.728$, $SEE = 0.320$, $Durbin-Watson = 1.919$. Therefore, the regression equation is defined as $\hat{y} = -2.528 + .345(X_1) + .277(X_2) + .287(X_3) + .354(X_4) + .373(X_5) + .392(X_6)$, and it was concluded that all six factors affect consumer satisfaction towards pottery made from new types of volcanic rock powder with statistical significance at .01.

Keywords: Green Economy, Pottery, Community, Sustainable, Kradong Volcanic Rock

1. Introduction

The knowledge of pottery production in the northeastern region of Thailand began to appear from the 8th century onwards. Moreover, it was influenced by the ancient Khmer civilization that spread its administrative and cultural influences throughout Southeast Asia to more than 80% of the region

(Prachachit, 2021). Therefore, there is evidence of the existence of ancient people for a long period of time in the area of what is now Buriram Province, Thailand, which appears to be a small community that settled in the area around the end of the Neolithic period (Carter et al., 2022). Subsequently, an accumulation of wisdom occurred over a long time at Ban Kruat District regarding production of pottery that was produced for sale to the ancient Khmer empire centered in what is now Cambodia. Additionally, it has been discovered that there was a continuous exchange of wisdom and culture in the Northeast of Thailand with evidence of the cultural influence and beliefs of Brahmanism, Hinduism and Buddhism (Sa-ard-iama et al., 2021). Thus, it was religion that brought the community the inspiration to produce a unique type pottery with distinctive patterns showing the beliefs and ways of life of the local people. However, during the past seven hundred years, there have been political and administrative changes that led to the disappearance of this ancient pottery along with the collapse of the ancient Khmer empire. As a result, the wisdom of producing this pottery from volcanic soil was lost.

Regarding the ancient Khmer wares or kiln wares, they were produced in the area that is currently Ban Kruat District in Buriram Province of Thailand, and this pottery that was first excavated in the year of 1922 is a unique pottery created from the dark black clay that was used to sculpt, which is a clay soil mixed with the ashes of the Kradong volcano that erupted 900,000 years ago, resulting in the soil in Buriram province having a dark black color. Thus, the clay when baked is stronger than clay from other areas. According to archaeological excavations, many kilns appeared, and the earthenware featured beautiful shapes and patterns, which made this specialty uniquely different from the pottery produced by other communities in Thailand. Therefore, the pottery containers found in Ban Kruat are similar to the art of Chinese, Vietnamese, Japanese and Indian wares due to the combination of a variety of art styles with the local art of Northeast Thailand as the highly unique potteries.

At present, the Thai government is focused on creating sustainable development by relying on local cultural and natural resources. Thus, it is applying the local potential for creating sustainable development in the 21st century for communities to learn about their own local wisdom. Moreover, it can build on the potential of many local resources in terms of culture, wisdom and skills and other aspects by applying all of them to create increased economic value. Furthermore, the existing local values have helped to develop community products that are suitable for the global situation in the future by focusing on adding value and promoting competitiveness in the community products of Thailand (Palapleevalya et al., 2021). Therefore, the government supports the development of community products by using the existing raw materials, labor and skills in local areas, and it is considered a sustainable economic driver occurring in rural areas of Thailand where the average income per person is low. In this way, this sustainable economic development will promote strength in society, ways of life, wisdom, resources, the environment and economy, thereby conforming with Thailand's future development strategy, which is related to the national agenda policies to drive the country's development with a creative economy. In this case, the aim of the Bio-Circular-Green Economy (BCG) is to develop the potential of rural communities in Thailand with a creative economy that encourages people in the community to become entrepreneurs. Similarly, the production labor has created an economic system in the community that is appropriate by linking local wisdom culture and resources for conducting sustainable development for communities in rural areas, and a balance of environmental, economic, social and cultural aspects that help create positive development with a balance between society, humans and nature for developing a response to future variability needs to be created (Roslan et al., 2021). In addition, the Thai government's objective is to use the BCG to enhance the strengths of Thailand with the diversity of natural resources, and biodiversity is used to create economic growth for Thailand (Usapein et al., 2022). Therefore, an emphasis is placed on encouraging small communities across the country to unite people in the communities to produce products that are developed from the potential of local people and friendly to the environment. As the result, it can demonstrate the uniqueness of the local area based on the combination of arts and culture to drive the economy of rural localities for sustainable development

with economic growth at the most fundamental level.

2. Objectives

To develop the production process of earthenware from volcanic rock powder together with the local wisdom of Ban Kruat District, Buriram Province, Thailand.

To determine the factors affecting the development of this new pottery in the community.

3. Conceptual Framework

According to the sustainable development concept from the participation of people in the community, it helps to change the social, economic and ecological aspects of the community based on the concept of Integrated Community Sustainability Planning (ICSP) (Ling et al., 2009). Moreover, it raises awareness of sustainable development from the participation of people in the community, which consists of four elements of the concept:

- Integration: Express the common will of the people living within the community to jointly define the development guidelines and common guidelines.
- Define the scope: Study the strengths and weaknesses of the geography to be considered in conjunction with the potential of culture, knowledge, and technology skills and natural resources, etc.
- Sustainability Planning: Determine the development guidelines and desired goals from the development process by setting indicators that are consistent with the culture, knowledge, technology, skills and natural resources which conforms with the community groups in local areas by responding to the needs of people in modern times effectively without affecting the local environment (Valentin et al., 2000).
- Implementation: Depend on the cooperation of the people in the community who jointly decide to develop their own community to be sustainable, with strength and stability.

Development of Ban Kruat Pottery Products in Buriram Province

- The development of pottery clay was studied for the mixture ratio and physical properties of clay pottery from volcanic powder suitable for pottery production, and the experimental method to find the pottery mixture was applied within the clay pottery conceptual framework. Therefore, it was used for the triaxial blend by including three types of raw materials; namely, volcanic rock powder, kaolin and local soil from Ban Kruat District in Buriram Province.
- The testing of the physical properties of the clay for molding consists of these properties: 1) Color After Firing, 2) Shrinkage, 3) Fire Resistance, 4) Strength, 5) Water Absorption, 6) Appropriateness in Forming Clay Water Castings.

4. Research Scope

For the pottery development process of Ban Kruat District, the aim was to study the local potential by determining the development guidelines of the community pottery by using local wisdom as a value for making changes.

- The population are entrepreneurs with commercial registration and product distributors of Ban Kruat community in Buriram Province totaling 55 people.
- The sample group included entrepreneurs and product distributors of the Ban Kruat community with 48 people selected using Krejcie and Morgan's table with simple random sampling.
- The research tool is a structured interview with a 5-level Likert Rating Scale (Cronbach's Alpha = 0.912), and the questionnaire was reliable at an excellent level to apply the

information from the reference sample to the population.

- Analysis was conducted by using mean and standard deviation together with the test of the mixture ratio of raw materials from the Triaxial Diagram (Figure 2).

The Determining Step with the Product Potential Development of Community from Local Wisdom.

The evaluation of satisfaction with new pottery and changes that occur to the community after the new development of pottery was conducted.

- The population includes the people who live in Ban Kruat District of Buriram Province totaling 177,066 people.
- The sample group included the people who live at the ancient kiln site of Ban Kruat District in Buriram Province totaling 198 people (Yamane, 1967), with an error of 10% by using simple random sampling.
- The research tool is a structured interview with a 5-level Likert Rating Scale (Cronbach's Alpha = 0.924), and the questionnaire was reliable at an excellent level to apply the information from the reference sample to the population.
- Exploratory Factor Analysis (EFA) and Multiple Regression Analysis were performed.

5. Results

Step 1: Sharing Opinions on the Ancient Pottery Development of the Community

Opinions were shared by the brainstorming of ideas by the entrepreneurs and distributors of Baan Kruat community products with 55 people, which came to the conclusion regarding the need to develop pottery made from volcanic stone powder with 13 items for the entrepreneurs towards the development of new types of pottery.



Fig. 1: Sharing ideas for the development of new pottery by entrepreneurs in the community.

Source: Author

Table 1: Direction of Pottery Development from Volcanic Powder for Sustainable Development. (n = 48)

Evaluation Criteria		Mean	S.D.	Suitability
Direction of Local Identity Development				
1.1	The structure of the pottery shows the local identity.	4.03	0.18	high level
1.2	The colors and patterns of the pottery show local identity .	3.90	0.60	high level
1.3	Materials used to produce the pottery show local identity.	3.90	0.60	high level
1.4	Pottery represents the local culture.	4.23	0.43	high level
Overall Average of Endemic Identity		4.01	0.45	high level
Development Direction Usability				
2.1	Functional benefits that satisfy consumers.	4.13	0.34	high level
2.2	Consistent with daily life.	4.13	0.34	high level
2.3	Suitable shape for indoor use.	3.76	0.43	high level
2.4	Ease of use.	3.70	0.59	high level
2.5	Strength and durability in use.	4.03	0.31	high level
Overall Average of Utility		3.95	0.41	high level

Evaluation Criteria		Mean	S.D.	Suitability
Development direction beauty				
3.1	The structures, shapes and forms are beautiful.	4.23	0.43	high level
3.2	The patterns have a local identity.	3.86	0.43	high level
3.3	The colors are unique to the local area.	3.93	0.52	high level
3.4	The pottery conveys the beauty of folk art.	3.93	0.58	high level
Average Overall in Beauty		3.99	0.49	high level
Average of All Aspects		3.98	0.45	high level

Source: Author

Entrepreneurs in the community want to develop pottery from volcanic rock powder with high demand level, (mean = 3.98; S.D. = 0.45). Moreover, when explaining the requirements of community groups as the direction of pottery development from volcanic rock powder, it was found that the first rank is the direction of local uniqueness development with a high level of demand, (mean = 4.01; S.D. = 0.45), followed by the second rank, which is the direction of development in aesthetics with a high level of demand, (mean = 3.99; SD = 0.4 9), and the third rank, which is the direction of development in utility with a high level of demand, (mean = 3.95; SD = 0.41). In addition, pumice powder it required, which is a raw material that is abundant in the community and generates income for the community. Therefore, for the process of developing the new pottery, the researcher applied the needs of community entrepreneurs to the creation of guidelines for the next step of development.

Step 2: Development of Clay Material from Volcanic Rock Powder to Produce Ancient Pattern Pottery from Local Wisdom

The physical ratios of clay were studied before molding into containers. The application of the mixture ratio of raw materials with a triaxial diagram is an analytical table to identify the best mixture ratio of the three types of raw materials; namely, pumice powder, local soil and Ranong clay that was divided into thirty-six mixture ratios.

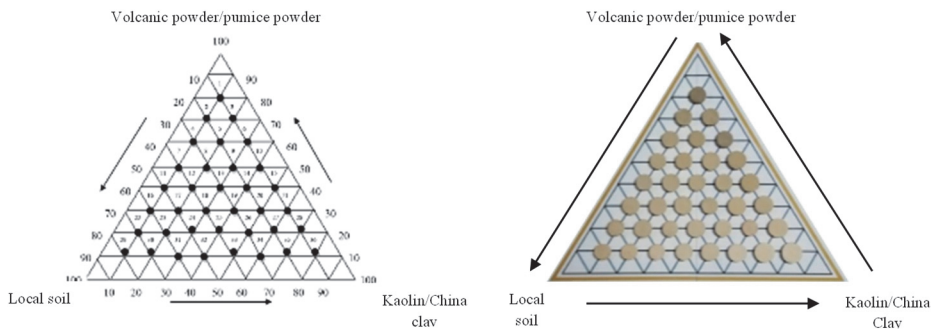


Fig. 2: Analysis of the Mixture Ratio for Three Types of Raw Materials to Develop Clay for Molding; [1] = pumice powder, [2] = local soil, [3] = kaolin/China clay

Source: Author

In this way, the right mixture ratio of raw materials can be found, and the selection criteria from 36 soil mixture ratio formulas was applied to test the soil properties for molding as follows:

1. Physical characteristics that can be observed visually with the color and texture after the firing test must be able to show the uniqueness of the pumice powder.
2. Clay texture for molding must be easily molded, and the clay must have a specific gravity of 1.60-1.80, which results in the clay being able to stabilize and not collapse when molding.

3. The shrinkage of the clay for molding is not more than 15%, and the water absorption is not more than 3%.
4. It can endure heat without melting at a temperature of 1,200 °C.
5. The hardness of the clay after firing is close to 985 kg/cm².

Table 2: Test results of Soil Texture for Molding from Volcanic Rock Powder of Ban Kruat District, Buriram Province.

Test	Mix ratio [1]/[2]/[3]	Strength When dry kg./sq.cm.	Shrinkage (%)		Fire resistance (1200 °C)	Fired color (1,200 °C)	Shrinkage (%)	Water absorption (%)	Strength after firing (kg/sq.cm.)
			before firing	after firing					
1.	80/10/10	-	-	-	pass	dark brown	-	-	-
2.	70/10/20	-	-	-	pass	dark brown	-	-	-
3.	70/20/10	10.24	5	11	pass	brown	11	14.40	97.38
4.	60/10/30	10.10	4	11	pass	brown	11	14.67	269.29
5.	60/20/20	21.40	5	11	pass	brown	11	13.08	286.49
6.	60/30/10	12.60	4	9	pass	brown	9	18.45	171.27
7.	50/10/40	8.60	4	13	pass	brown	13	12.24	243.41
8.	50/20/30	13.80	5	14	pass	dark brown	14	1.88	304.75
9.	50/30/20	19.80	6	12	pass	brown	12	2.24	304.80
10.	50/40/10	23.45	7	13	pass	brown	13	2.28	292.20
11.	40/10/50	12.50	5	14	pass	light brown	14	8.80	290.48
12.	40/20/40	23.90	6	16	pass	light brown	16	7.80	304.75
13.	40/30/30	29.60	7	15	pass	light brown	15	7.76	368.15
14.	40/40/20	29.13	8	16	pass	brown	16	8.97	304.75
15.	40/50/10	36.30	8	15	pass	brown	15	7.29	267.00
16.	30/10/60	15.10	6	14	pass	cream color	14	11.40	304.71
17.	30/20/50	17.20	7	13	pass	light brown	13	3.82	317.91
18.	30/30/40	26.60	9	15	pass	light brown	15	6.42	368.45
19.	30/40/30	31.80	9	18	pass	brown	18	0.67	317.91
20.	30/50/20	35.79	9	18	pass	dark brown	18	0.17	372.36
21.	30/60/10	30.40	10	19	pass	dark brown	19	3.09	295.93
22.	20/10/70	17045	6	16	pass	white	16	9.61	305.45
23.	20/20/60	21.50	7	16	pass	white	16	8.70	330.00
24.	20/30/50	20.00	10	18	pass	light brown	18	3.55	362.78
25.	20/40/40	28.56	10	18	pass	light brown	18	3.06	365.15
26.	20/50/30	23.54	10	19	pass	light brown	19	3.16	365.20
27.	20/60/20	36.00	12	20	pass	brown	20	0.37	364.25
28.	20/70/10	35.50	12	21	pass	brown	21	0.12	315.27
29.	10/10/80	16.30	8	16	pass	white	16	14.64	290.97
30.	10/20/70	15.50	8	17	pass	white	17	10.42	286.79
31.	10/30/60	25.80	10	18	pass	cream color	18	8.59	317.95
32.	10/40/50	24.10	10	19	pass	cream color	19	7.44	336.76
33.	10/50/40	26.20	10	20	pass	light brown	20	4.79	376.58
34.	10/60/30	27.60	11	20	pass	cream color	20	1.20	347.95
35.	10/70/20	40.88	12	21	pass	cream color	21	0.90	412.11
36.	10/80/10	49.40	12	20	pass	light brown	20	0.94	244.02

Source: Author

In addition, when it was tested by firing at 1,200 °C, it appeared that the clay can be heated to this temperature level with all materials without melting, and the color of the clay is light brown, brown, dark brown, cream, white, etc. Thus, the color will vary according to the amount of pumice powder, local soil and kaolin, which the test results showed as following: 1) with a high level of volcanic stone powder, it is dark brown and brown, 2) with a high level of kaolin, it is light brown to cream color, 3) with a high level a lot of kaolin with local soil, there are many colors, such as very light brown to creamy white, and others.

From the experiment to determine the mixture ratio of clay for molding from all 36 test points, it was found that the standard criteria of soil texture of stoneware that are suitable for developing pottery of the community amount to three test points. The detailed results of each mixture ratio are as follows:

1. Test point 8: Mixing ratio of pumice powder at 50%, local soil at 20%, kaolin at 30% and the molding clay showed a shrinkage of 14% with water absorption of 1.88%, resistance to firing at 1,190 °C, and a strength of 304.75 kg/cm².
2. Test point 9: Mixing ratio of pumice powder at 50%, local clay at 30%, kaolin at 20% with shrinkage of molding clay at 12%, water absorption at 2.24%, resistance to firing at 1,190 °C and apparent strength of 304.80 kg/cm²
3. Test point 10: Mixing ratio of volcanic rock powder at 50%, local clay at 40%, kaolin at 10% with shrinkage at 13%, water absorption at 2.28%, resistance to firing at 1,190°C and apparent strength 292.20 kg/cm²

Step 3: Design of Pottery from Volcanic Powder

This creative idea was inspired by the local history of Ban Kruat District, and there is archaeological evidence of the settlement for community groups approximately 2,500 years ago, and the production of pottery began to appear in the past 1,300 years. Therefore, it is considered as a pottery production source with products that were distributed to nearby areas, and there are more than 120 kilns that could be excavated. Thus, the identity of Ban Kruat pottery was influenced by the ancient wares of the Khmer Empire by applying Khmer arts to combine patterns on pottery as the following: 1) thickness, 2) weight, 3) strength, 4) pattern from the scraping method, brown coating, etc. Hence, these historical stories were applied to create inspiration for the design of pottery from volcanic rock powder with an integrated way of thinking that combines identity, culture, way of life, art and beliefs to create a new style of pottery.

Therefore, the creative process has applied ideas from the culture of the ancient Khmer civilization that expanded its influence beginning in the 8th century in politics, administration, religion, art, etc. Subsequently, there was a period when the ancient Khmer Empire flourished at the peak of civilization in Ban Kruat District that was considered as a pottery production source used as a commodity exchange between communities. In addition, it was an important product that generated income for the ancient Khmer Empire (Khamsiri et al., 2022). In this case, the patterns appear to be influenced by religion and beliefs, and it is the inspiration that the craftsman intended to show his own faith in religion. Thus, the researcher added inspiration arising from historical stories to the development of the forms, including the patterns and colors of the new pottery. As a result, the patterns that appear must reflect the history of the community in Ban Kruat District, especially when testing the actual production to display the results from the production process as real prototypes amounting to three sets.



Fig. 3: Prototypes of Pottery Made from Kradong Volcanic Rock Powder

Source: Author

The prototypes of pottery made from volcanic stone powder have uniqueness as follows: 1) The work

piece with a thin wall edge with strength, 2) The creation of patterns from scraping clay in the containers that leave traces before firing, 3) The coating of containers with reddish brown, dark brown color, etc. Then, the results of the satisfaction from the consumer groups in Ban Kruat District of Buriram province in Thailand were tested. Therefore, the development factors of pottery from volcanic powder for the community in the future with a process of sustainable knowledge for the community were found according to the concept of sustainable development from local wisdom and resources (Bellanger et al., 2021).

Table 3: Satisfaction of the Consumers Towards the Newly Developed Volcanic Stoneware Pottery. (n = 198)

Characteristics of the Needs of Entrepreneurs	Mean	S.D.	Extraction	Initial Eigenvalues % of Variance
V1: Colors representing the uniqueness of the pottery	3.700	1.037	.604	13.626
V2: Materials representing the identity of the pottery	3.600	0.885	.677	11.091
V3: It shows the application of the traditions of the community into the design.	3.295	0.861	.570	9.714
V4: It represents the history of the local past.	3.175	1.029	.621	9.503
V5: The pottery is functional and suitable.	3.450	0.855	.653	8.975
V6: The shape of the pottery is appropriate.	3.770	0.900	.522	8.457
V7: The pottery is comfortable to use.	3.000	0.907	.554	6.526
V8: The pottery is strong and durable in use.	3.510	0.935	.653	5.773
V9: The pottery can express the influence of Khmer art with the forms.	4.180	0.685	.699	5.412
V10: The pottery can reflect local identity.	2.860	0.850	.647	4.975
V11: The pottery meets the needs of today's market.	2.940	0.818	.485	4.480
V12: The pottery can meet the needs of consumers.	3.230	0.954	.629	4.272
V13: The design of pottery is consistent with global trends.	2.625	0.817	.715	3.608
V14: The pottery is unique and interesting.	3.995	0.811	.563	3.589

Source: Author

Table 4: KMO and Bartlett's Test of Consumer Groups on Pottery from Newly Developed Pumice Powder

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.533
Bartlett's Test of Sphericity	Approx. Chi-Square	235.725
	df	91
	Sig.	.000

Source: Author

The KMO and Bartlett's Test shows the values that are greater than 0.50, which meets the specified criteria. Moreover, the data can reveal the feelings towards pottery made from newly developed volcanic powder, and it can be used for exploratory factor analysis (Chi-Square = 235.725; Sig. = .000). Thus, fourteen variables and Scree Plot were used to show the Eigenvalue of all fourteen variables that appear in the slope of the graph from the first factor to sixth factor.

Table 5: Analysis of Anti-image Matrices

	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀	V ₁₁	V ₁₂	V ₁₃	V ₁₄
V ₁	.579*	-	-	-	-	-	-	-	-	-	-	-	-	-
V ₂	.068	.484*	-	-	-	-	-	-	-	-	-	-	-	-
V ₃	.090	.041	.584*	-	-	-	-	-	-	-	-	-	-	-
V ₄	.066	.017	.032	.568*	-	-	-	-	-	-	-	-	-	-
V ₅	.142	.195	.042	.013	.491*	-	-	-	-	-	-	-	-	-
V ₆	.043	.054	.073	.166	.198	.575*	-	-	-	-	-	-	-	-
V ₇	.016	.072	.073	.101	.150	.047	.546*	-	-	-	-	-	-	-
V ₈	.117	.183	.080	.058	.018	.028	.227	.557*	-	-	-	-	-	-
V ₉	.254	.058	.102	.085	.046	.088	.090	.036	.532*	-	-	-	-	-
V ₁₀	.227	.038	.064	.204	.056	.112	.072	.042	.061	.541*	-	-	-	-
V ₁₁	.043	.173	.062	.134	.029	.020	.002	.143	.024	.140	.494*	-	-	-
V ₁₂	.184	.191	.071	.100	.078	.138	.074	.134	.118	.073	.047	.481*	-	-
V ₁₃	.124	.115	.183	.060	.003	.033	.012	.074	.239	.230	.057	.047	.490*	-
V ₁₄	.133	.017	.150	.092	.010	.055	.061	.137	.041	.075	.053	.050	.079	.478*

* Measures of Sampling Adequacy: MSA

Source: Author

Table 6: Agglomeration of Six Factors Using the Weight of the Axial Rotation Factor from the Varimax Method

Design Factors for Pottery from Kradong Volcanic Rock	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Factor 1: Local identity [X₁]						
V ₁₀] The pottery reflects the local identity.	.766	-	-	-	-	-
V ₄] It expresses the history of the local past.	.656	-	-	-	-	-
Factor 2: The Uniqueness of the Materials [X₂]						
V ₂] The materials represent the identity of the pottery.	-	.737	-	-	-	-
V ₈] The pottery is strong and durable in use.	-	.621	-	-	-	-
V ₁₂] The pottery meets the needs of consumers.	-	.559	-	-	-	-
Factor 3: The Uniqueness from the Influence of Khmer Art [X₃]						
V ₉] The pottery expresses the influences of Khmer art with its forms.	-	-	.799	-	-	-
V ₁₃] The design of the pottery is consistent with the global trends.	-	-	.664	-	-	-
V ₁] The colors represent the uniqueness of the pottery.	-	-	.500	-	-	-
Factor 4: Local Way of Life and Beliefs [X₄]						
V ₃] It shows the application of the traditions of the community into the design.	-	-	-	.742	-	-
V ₇] The pottery is comfortable to use.	-	-	-	.408	-	-
Factor 5: Functionality that corresponds to the present era [X₅]						
V ₅] The pottery is functional and suitable.	-	-	-	-	.790	-
V ₆] The shape of the pottery is appropriate.	-	-	-	-	.617	-
Factor 6: Current market conditions [X₆]						
V ₁₁] The pottery meets the needs of today's market.	-	-	-	-	-	.676
V ₁₄] The pottery is unique and interesting.	-	-	-	-	-	.517

Source: Author

The summary of factors affecting consumer satisfaction towards pottery from volcanic rocks with the forecast value at the level of 61.365 includes six factors as follows:

- Factor 1 is local identity: It can explain the variance of the data level at 10.660 with the

variables: 1) The pottery reflects the local identity, and 2) The history of the past of the local area is expressed.

- Factor 2 is the specificity of the materials: It can explain the variance of the data level at 10.456 with the variables: 1) The materials to represent the identity of the pottery, 2) The pottery is strong and durable in use, and 3) The pottery meet the needs of consumers.
- Factor 3 is the identity from the influence of Khmer art: It is able to explain the variance of the data at the 10.395 level with the variables: 1) The pottery reflects the influences of Khmer art with the forms, 2) The pottery design is consistent with global trends, and 3) The colors represent the uniqueness of the pottery.
- Factor 4 is the way of life and local beliefs. It is able to explain the variance of the data at level 9.955 with the variables: 1) The community traditions are applied to the designs, and 2) The pottery is comfortable to use.
- Factor 5 is utility that corresponds to the era. It is able to explain the variance of the 9.950 level for the data with the variables: 1) The pottery is functional and suitable. and 2)The shape of the pottery is appropriate.
- Factor 6 is the current market situation. It is able to explain the variance of the data at the level of 9.949 with the variables: 1) The pottery meets the current market demand, and 2)The pottery is distinctive and interesting.

Step 4: Evaluation of Consumer Satisfaction Toward the Development of Pottery Made from Newly Developed Volcanic Powder

In this case, the reliance is on the local wisdom of the community in Ban Kruat District, and for when a group of entrepreneurs in the community make an effort to produce a new style of pottery, it was used to assess the satisfaction of consumers in their own locality to determine the correspondence between each variable. In addition, it can classify the factors affecting the creation of pottery from new types of volcanic powder and the level of consumer satisfaction.

Table 7: Pearson Correlation Analysis Between Factors Affecting Satisfaction (n = 180)

Consumer Satisfaction Toward Pottery from Newly Developed Kradong Volcanic Powder					
Factors Affecting Consumer Satisfaction	Mean	S.D.	(r)	Value sig.	Relationship
[X1] Local Identity Aspect	3.017	.586	.374	.000**	Moderate Relationship
[X2] Specificity of the Materials	3.439	.503	.127	.074	Weak Relationship
[X3] Unique Aspect of the Influence of Khmer art	3.501	.446	.301	.000**	Moderate Relationship
[X4] Local Way of Life and Beliefs	3.138	.662	.434	.000**	Moderate Relationship
[X5] Functionality that Corresponds to the Era	3.606	.688	.440	.000**	Moderate Relationship
[X6] Current Market Conditions	3.464	.599	.448	.000**	Moderate Relationship
Consumer Satisfaction Toward New Pottery	4.282	.613	-	-	-
** p > .01, * p > .05					

Source: Author

There were five factors that were moderately related to the satisfaction of local consumers; namely, the local identity, the identity from the influence of Khmer art, the way of life and the local beliefs, the utility that corresponds to the present era, and the current market situation. In addition, it was found that only one factor, the specificity of the material, has a weak relationship with the satisfaction of local consumers.

Thus, it was shown that the level of satisfaction for the consumers towards pottery made from volcanic rock powder was at a high level, (mean = 4.282, S.D. = 0.613). Moreover, it indicates a feeling of satisfaction that resulted in an increase, especially in purchasing opportunities arising from the feeling of satisfaction with the pottery produced with the local wisdom of the community in the future.

Table 8: Relationship Between Six Factors and Consumer Satisfaction

Variable	[X1]	[X2]	[X3]	[X4]	[X5]	[X6]	Satisfaction
[X1]	1.000	-	-	-	-	-	-
[X2]	.057	1.000	-	-	-	-	-
[X3]	.008**	.011*	1.000	-	-	-	-
[X4]	.585	.056	.817	1.000	-	-	-
[X5]	.613	.855	.359	.475	1.000	-	-
[X6]	.016*	.019*	.068	.564	.898	1.000	-
Satisfaction	.000**	.074	.000**	.000**	.000**	.000**	1.000

** p < .01, * p < .05

Source: Author

The results of the multiple regression analysis are as follows: 1) Residual Mean = 0.2, 2) The histogram graph appears as a normal distribution from data under the normal distribution line, and no out-of-bounds values appear in this analysis, and 3) Independent variables and common variables have the linear relationship with each other from the values appearing in the analytical graph that can be connected with a straight line at an angle of 45 degrees, and 4) all variables are assumed to have the equal variance based on observation of the scatterplot, which appears as a band that slopes downward from left to right as a nodular group. Therefore, it can be concluded that the data imported into the analysis is appropriate, and it can be used to forecast regression equations.

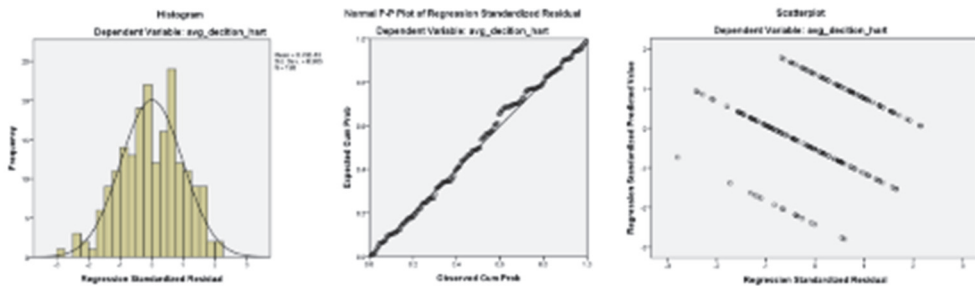


Fig. 4: Histogram, linear relationship, and scatterplot

Source: Author

In this study, the model consisted of six independent variables that influenced the level of satisfaction among consumers with volcanic rock powder pottery, which can predict the dependent variable of 73.6%.

Table 9: The Variance in the Prediction of the Satisfaction of the Consumers Towards the Pottery from Volcanic Powder Created by the Community's Indigenous Knowledge

Model	SS	df	MS	F	P
Regression	54.593	6	9.099	88.808*	.000
Residual	19.569	191	.102	-	-
Total	74.162	197	-	-	-

* p < .05

Source: Author

The variance in the prediction of consumer satisfaction from all six factors is used to create pottery that applies community wisdom to the design as follows: (X1) local identity factor, (X2) uniqueness of materials used, (X3) identity from the influence of Khmer art, (X4) lifestyle and local beliefs, (X5) the utility consistent with the present era, and (X6) factors involving the current market situation. The results showed that all were able to explain the variation in consumer satisfaction at the statistically significant level of 0.05.

Table 10: Stepwise Multiple Regression Correlation Coefficients of the Predictive Variables to Predict the Satisfaction of Consumers of New Pottery (n = 198)

Factors Affecting Pottery Satisfaction from Volcanic Rock	Unstandardized Coefficients		Standardized Coefficients	t	p
	B	Std. Error	Beta		
Constant	-2.528	.338	-	-7.475	.000 *
[X1] Local Identity	.345	.040	.330	8.567	.000 *
[X2] Specificity of the Materials	.277	.047	.227	5.859	.000 *
[X3] Identity of the Influence of Khmer Art	.287	.053	.209	5.412	.000 *
[X4] Local Way of Life and Beliefs	.354	.035	.382	10.144	.000 *
[X5] Functionality that Corresponds to the Present Era	.373	.033	.418	11.187	.000 *
[X6] Current Market Conditions	.392	.039	.383	9.987	.000 *
R = 0.858, R ² = 0.736, Adj R ² = 0.728, SEE = 0.320, Durbin-Watson = 1.919					
* p < .01					

Source: Author

- Regression equation in raw score form

$$\hat{y} = -2.528 + .345(X_1) + .277(X_2) + .287(X_3) + .354(X_4) + .373(X_5) + .392(X_6)$$
- Regression equation in standard score form

$$Z = .330(X_1) + .227(X_2) + .209(X_3) + .382(X_4) + .418(X_5) + .383(X_6)$$

The results of the study indicate that for the factors of local identity ($\beta=0.345$, $t=8.567$, $p\text{-value}=0.000$), specificity of the materials ($\beta=0.277$, $t=5.859$, $p\text{-value}=0.000$), identity from the influence of Khmer art ($\beta=0.287$, $t=5.412$, $p\text{-value}=0.000$), local lifestyle and beliefs ($\beta=0.354$, $t=10.144$, $p\text{-value}=0.000$), the utility corresponds to the present era ($\beta=0.373$, $t=11.187$, $p\text{-value}=0.000$) and the current market conditions ($\beta=0.392$, $t=9.987$, $p\text{-value}=0.000$). Therefore, all factors affect the satisfaction of consumers towards the new style of pottery with statistical significance at .01.

6. Conclusions

The development of pottery made from the volcanic rock powder of Ban Kruat District in Buriram Province, Thailand is located in an ancient community that has continued to live in this area for more than 1,000 years. Therefore, in the local area, there is a large amount of ancient pottery, in the form of cups, plates and bowls that have been excavated from the ancient clay layer. Thus, this is consistent with the idea that a civilization site in Buriram Province was established long ago, and it was influenced by the ancient Khmer civilization, (Rooney, 2005), which has become a unique identity of the community in Northeast Thailand. In this case, it is a source of crockery production from the ancient Khmer art that has been inherited from the ancient Khmer Empire that prospered in art and architecture (Bunthorn, 2022). As a result, the pottery produced from the production source in Ban Kruat District is unique as per these details: 1) religious beliefs, 2) shape, 3) color, 4) properties of raw materials, etc. Additionally, all four elements conform with the concept of immigration of people within the northeast area of Thailand and Cambodia, (Vail, 2007; Egwutvongsa, 2022). As the result, it was through the emergence of art and culture that the pottery used in life was improved and

developed by the local people.

- The uniqueness of the pottery produced in the northeastern region of Thailand results from the raw material, which is powdered rock powder from volcanic eruptions that occurred more than one million years ago. As a result, the soil that is molded into community pottery has a unique color, such as dark black, and the containers made from local soil are highly durable. Therefore, it is considered a type of local wisdom that has been passed down since the prehistory of local communities (Welch, 1998; Seviset et al., 2018).
- The Buddhist beliefs that were transported along the trade routes in the 7th-10th centuries resulted in the motifs on ancient pottery combining Hinduism and Buddhism. Moreover, the influence of the religious beliefs of the people that appear in the northeastern region were inserted as well. Thus, it has appeared in the unique patterns that are beautiful and different from other local pottery by including the religious beliefs into community life. In this case, it began in the 1st-6th centuries as seen from excavations in the Mekong Delta archaeological sites, where pottery was buried inside the Phum Snay burial site in the ancient Khmer Empire. (Lapteff, 2013; Egwutvongsa et al., 2021).
- The clay raw materials for the molding of the local pottery is a raw material, and after firing, it has a high strength with a low water absorption rate because the raw material is a stone powder formed by volcanic eruptions. As a result, the clay for molding used to produce pottery has a dark black color which provides the unique identity of the pottery produced in Northeast Thailand. Then, in the 8th century, the wisdom of producing pottery combined with the art from the Khmer Empire was passed on. Additionally, all Southeast Asian areas become a part of this large economy based on the sale of pottery. Thus, the pottery made from clay in Ban Kruat District is highly resistant to heat due to the geological characteristics of the pottery production area (Grave et al., 2021). Regarding this process, the local wisdom of Ban Kruat community was inherited from their ancestors and the community can apply this wisdom and the potential of the local resources to the development of pottery, and Ban Kruat District is considered a source of civilization on the Korat Plateau while the civilization on the Korat Plateau of Thailand was closely related to the civilization on the Kulen plateau of Cambodia. As a result, the wisdom regarding the production of pottery was a link between each of them that continued from the past.

The process of forming pottery using the local wisdom was influenced by the Khmer, and this is considered the production of Angkorian stoneware that disappeared from Thailand more than 500 years ago (Sharon et al., 2021). Moreover, for the physical characteristics of the clay from volcanic rock powder, there are three effective pottery mixing formulas as follows: 1) Formula 1 from test point 8 using pumice powder 50%, local clay 20% and kaolin 30%, 2) Formula 2 from test point 9 using pumice powder 50%, local soil 30% and kaolin 20%, and 3) Formula 3 from test point 10 using pumice powder 50%, local soil 40%, kaolin 10%. When all three soil formulas were used to experiment with the pottery production, it was found that all three formulas were suitable for the community in Ban Kruat District and can be produced with community technology. Furthermore, this is because the new production process requires relatively low skills and production tools. Therefore, it has a positive effect on pottery makers in the community due to the ability to produce pottery from the ancient wisdom of the community (Liping, 2022; Egwutvongsa et al., 2022).

The prediction equation of consumer satisfaction toward pottery produced from volcanic rock powder relied on the local wisdom of the community, and multiple regression analysis was used to identify the factors that affect and have predictive power on consumer satisfaction. Those that have the highest predictive value are the utility corresponding to the present era, the local way of life and beliefs, the current market conditions, the local identity, the uniqueness of the materials used, and the uniqueness from the influence of Khmer art. In addition, when all six factors are combined, consumer satisfaction can be predicted at 73.6%, which is consistent with the idea of creating sustainability in products. Then, the designers must understand the future in terms of predicting consumer

satisfaction that is likely to occur by using the results to determine the product development guidelines or setting the strategies for the community production processes by entrepreneurs (Chien et al., 2010; Giovanni et al., 2019).

Based on the identification of these six factors, consumer satisfaction with the community's newly developed pottery can be predicted. Moreover, it is considered for the development of the competitiveness of communities in rural areas of Thailand so that they are able to compete with the large number of products that are available in the market. Thus, it will help to create opportunities for interested consumers. As a result, it also helps to encourage consumers to make higher purchasing decisions with regard to the community's pottery, which conforms with the concept of sustainable marketing for small entrepreneurs, (Buganza et al., 2009; Egwutvongsa, 2021).

According to the utility factors, 'it corresponds to the present era' has the greatest predictive power. Moreover, with the concept of creating opportunities for success in distributing products to consumers, the products that can meet the lifestyles of consumers can be offered today and, in the future, (Dawid et al., 2017). Subsequently, it presents a new perspective by responding to consumers from the materials that are abundant locally, such as volcanic rock powder, clay, etc. Therefore, it contributes to the creation of a body of knowledge that combines several types of raw materials to increase the economic value for the community. At the same time, it can create a positive attitude toward the local raw materials of the community, which is in accordance with the concept of creating a positive attitude based on local resources (Agbonifoh et al., 1999; Atkinson, 1999). Additionally, the factors 'it shows the identity from the influence of Khmer art' has the least predictive power of the six factors that affect the degree of consumer satisfaction with pottery made from volcanic powder. This is in accordance with the concept of reflecting the story of the product to the consumer by relying on the transmission of stories from the past or local history to inform the consumer group. Finally, this is an element that helps to convey the story of the product being created until it becomes a unique identity of the product that provides appropriately increased economic value (Dell'Era et al., 2007; The Innovation Research Interchange, 2019; Egwutvongsa, 2021; Lertchamchongkul et al., 2022).

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