Morphological Forced Connection Method Application in the Development of Plered Ceramic Design

Sheila Andita Putri[1], Muchlis, Yoga Pujiraharjo[2], Rizki Nurfita[3]

[1]School of Creative Industries, Telkom University, Bandung, Indonesia

[2]School of Creative Industries, Telkom University, Bandung, Indonesia

[3]School of Creative Industries, Telkom University, Bandung, Indonesia

chesheila@telkomuniversity.ac.id, yogapujiraharjo@gmail.com, rizkinurfita@gmail.com

Abstrak In Plered, the activity of making clay crafts has been carried out for generations. Located in the southern region of Purwakarta Regency, the pottery industry is located in Anjun Village, Citeko Village and Pamoyanan Village. That said, the activity of making pottery in this region began in 1904. At present, the industrial pattern that applies in Plered is work based on orders from clients in large numbers. Unfortunately, these offline sales have not yet reaped maximum results because of the quiet visitors who come to Plered. Data estimation from various sources indicate that 2020 will be a milestone for significant changes in Indonesia. That means there is a large enough market potential for Plered ceramic craftsmen to market their products in addition to relying on clients' orders. For this reason, the development of Plered ceramic product design is needed to develop the Plered ceramic industry. This study aims to analyze the potential of the Plered ceramics industry to produce alternative ceramic designs through methods that can be applied among craftsmen to develop products that are in line with the target market.

Keywords industrial ceramics, ceramic tiles, product recommendations

1. Introduction

Many efforts have been made from the ceramics industry in this region. Just say starting from collecting raw materials for clay, processing raw materials for clay, ceramic craftsmen, ceramic sellers to sellers of supporting equipment for making ceramics. The products produced are quite diverse, ranging from small pots to decorative pillars. For product distribution, industry players generally sell their products at the Gallery in the same area as the Ceramic production workshop.

However, most of Plered's ceramic industry players rely on their turnover from incoming orders from clients. So far, the design of Plered ceramic products has generally been produced from independent testing and design from clients. Clients who order Plered ceramic products submit the designs they want to be made by craftsmen.

The obstacle that is often encountered is that craftsmen find it difficult to find new design ideas for their ceramic products. So far craftsmen have been helped by references they have found from training and electronic media.

This study aims to analyze the potential of the Plered ceramics industry to penetrate the Indonesian local market so that it can produce a recommendation that can be applied to product development that is in line with the target market. The analysis included product character mapping that could be made by craftsmen and product development ideas. Furthermore, the mapping results are used as a basis for making recommendations on ceramic product designs that can be developed by the ceramics industry craftsmen in Plered.

2. Literature Review

Design in product development acts as a process of gathering something new or arranging existing things in new ways to satisfy known needs from the community (Dieter & Schmidt, 2009). According to Ulrich & Eppinger (1995) product development is a series of activities that begin with the perception of a market opportunity and are ended by the production, sale and delivery of products. Own product development generally starts from an ideation process to find design ideas for design development.

There are various ways and methods that can be done to carry out ideas, one of which is Morphological Forced Connection (MFC). Don Koberg and Jim Bagnall first coined this method in 1974 through the book "The Universal Traveler". This method has been widely used to find new ideas in the development of various fields, ranging from the development of NASA space projects to product design innovations.

Koberg and Bagnall compare the stages of MFC as a Journey where "travel" is divided into "seven universal stages of creative problem solving" (the seven universal stages of creative problem solving). These seven stages do not have to be done linearly. The seven stages are:

1. Accept the situation (commitment)

agreed to accept the problem / case and commit to find a solution to the problem.

2. Analysis (research)

gather enough information, both general and specific information to get a deep understanding of the problem you want to solve.

3. Define (search-purpose)

Breaking down problems becomes issues that are more specific and identifies key issues that will be resolved.

4. Ideas (gathering ideas)

Find possibilities for problem solving to achieve the goals set.

5. Choose (decision-making)

Choosing alternative solutions that can be realized to answer the problem.

6. Carry out (take action)

Realizing alternative solutions in real form.

7. Evaluation (assessment)

Review the process carried out by assessing the suitability of the solution in answering problems and designing future development plans.

As one of the problem solving methods, the peculiarity of the Morphological Forced Connection (MFC) lies in the method of ideation used to explore ideas. In MFC, the ideation process is carried out through a combination of attributes from the specified object. Attributes can be physical structures, forms, and other references resulting from the analysis process. Forced combinations (forced-connection) between these attributes will bring up a combination of potential solutions that need to be explored further to determine the most likely combination to answer the solution.

In the context of design, the basic principle of the combination of morphology in MFC is the idea that a design object that is the topic of a problem can be broken down into several components / attributes. So that if all or some components / attributes are changed, a new design alternative will be created. MFC allows the emergence of design alternatives through a combination of attributes that appear, but not all of the results of the combination can be realized given the components / attributes that cannot work when combined with other components / attributes. The process of combining morphology is done by making a matrix. The matrix contains the components of the decomposition of an object used as a case. Each component is made into a column, where the columns are filled with a list of attributes of the component.

After the column is filled with data, a random combination of the attributes of each component is made. The process is carried out by taking existing attributes randomly and pairing it with other component attributes so that new ideas are created. With this combination of morphology, the more attributes and components are made, the more ideas that can be obtained.

Even so, from a combination of morphology analysis and studies are needed to determine which combinations can be realized and which cannot be realized. Even so, this method is still very possible to continue to be used to find new alternatives based on existing components and attributes.

3. Method Application

The research that will be conducted is qualitative research. Qualitative research is methods for exploring and understanding the meanings that individuals or groups of people think are derived from social or humanitarian problems. This process requires important efforts, such as asking questions collecting specific data from participants, analyzing data inductively and interpreting the meaning of the data obtained. The results of this study are usually flexible (Creswell, 2010: 5).

The research process begins with collecting data on the Plered Ceramics industry. The data will be analyzed along with Indonesian Domestic market statistics and supported by literature studies. The results of the analysis will be used as a basis in the preparation of recommendations for the development of the Plered ceramic industry products, Purwakarta.

In this study, Morphological Forced Connections (MFC) will be applied as a basic method in the process of designing Plered ceramic products. The aim is to get ideas in creating new ceramic design innovations. In addition to the objectives related to the product directly, this research and design are also intended to test the application of the Morphological Forced Connections (MFC) method in the industry.

3.1. *Product Analysis*

Based on the data collected in the field, it was found that the design of the Plered ceramic industrial products can be divided into several variables, namely:

1) ***Dimension Range*.** Plered ceramic products have a wide range of product dimensions. In general, this product range can be categorized into 4 groups, namely:

a. Small ceramic group, are ceramics with a size of 3cm to 15cm. This group is basically a group of ceramic products that are easily grasped. For

example: pots of cactus, ashtrays, tableware (bowls, glasses and mugs), to table vases. This type of ceramic production process is considered the most complicated and time consuming because it requires precision and attention to product details. Because of its small size, this type of ceramics requires craftsmen's special expertise in forming clay.

b. Medium ceramics group, are ceramics with a range of sizes 15.1cm to 40cm. This group is usually in the form of decorative ceramic products placed on a table for display. Examples of ceramic products in this group are usually vessels, decorative bowls, and statues.

c. Large ceramic group. This group consists of ceramics with dimensions ranging from 40.1cm to 80cm. This group is usually in the form of a flower pot for outdoor use and stool.

d. Extra- Large ceramic group. This group is generally in the form of ceramics with a size of more than 80cm and has special functions such as tables, to statues and umbrella stand. Because of its large size, this group is usually placed directly on the floor.

2) **Shapes.** Plered ceramic products have various forms. This diversity can be categorized into 7 groups:

a. Tubes / cylindrical. Has a basic single tube shape with curve shape.

b. Round shape variation. It is the processing of rounded basic shapes into spherical shapes, half balls (commonly seen in pots or bowls), and ovals.

c. Tube combination. It is a development of the cylindrical category with the technique of forming clay which produces 2 or more tubes in one ceramic product.

d. Flat, which is the form of ceramic that tends to be flat and thin. Examples of this type of ceramic products are dinner plates and decorative plates.

e. Boxes (cubes, beams, and other angular geometric shapes). Ceramics in this category have sharp corners (not rounded). Usually made with a slab technique, which combines the clay that has been formed into a flat plate.

f. Abstract. Ceramics in this category are a combination of random forms. Usually in the form of statues or decorative elements that can be attached to other ceramic products. Ceramics in this group are generally made by hand or by mold.

g. Deconstructive. Ceramics in this category are a combination of cylindrical and abstract forms. Usually made for ceramic products with asymmetrical designs.

3) **Function.** In general, Plered ceramic products are divided into functional ceramics and decorative ceramics. Furthermore, both groups of functions can be divided into 4 more specific groups, which are:

a. Decorative Ceramics. Its function is solely as decoration and decorative element.

b. Tableware, are ceramics that have functions in everyday life to be used as eating utensils. Generally small and allows to be reused many times.

c. Storage container., are ceramics that serve to store something like cigarette ash on ashtrays to fruit products on fruit bowl product.

d. Furniture, are ceramics that have a function as household furniture to do something or put things on the surface like a bed and table.

4) **Decoration techniques.** Decoration techniques based on how ceramic products are decorated. In general, the Plered ceramic decoration technique can be divided into:

a. Fiber paint technique. The technique of paint with a dense and random character pattern that resembles plant fibers.

b. Grading paint technique (rainbow pattern). Ceramic painting technique by combining several colors with transition colors to create a smooth gradation effect. At the UPTD Litbang keramik Plered, this technique is known as *teknik corak pelangi.*

c. Swirl technique. Painting technique by pouring various colors of paint over the surface of the water. The paint will float above the surface of the water and stir it with a stick to form a style like a vortex. Plain ceramics are then dipped into the floating paint and to create a vortex motif consisting of various colors of paint.

d. Marble paint technique. The painting technique adopts a distinctive style and color of marble material.

e. Painting technique. Painting technique by painting directly the surface of the ceramic with certain images or patterns.

f. Splatter paint technique. Painting technique by splashing paint onto the ceramic surface to create a distinctive motif.

g. scratch pattern technique. The technique of decorating ceramics by scratching the surface of the ceramic with a certain pattern when the ceramic is still a soft clay (before the ceramic is oven). The result is an ornamental pattern that has depth and texture when touched.

h. Sticking technique (glass material pieces, decorative elements). That is the technique of decorating ceramics by attaching pieces of glass material or decorative elements made from clay when the ceramic is still wet / not yet oven.

5) **Color.** Plered ceramics have a variety of colors that are usually tailored to orders from clients. Clients from Europe and America generally like dark colors with finishing dof while Asian clients tend to like brighter colors with shiny finishing (Bambang Mega, 2018). The diversity of Plered ceramic colors can be divided into 8 (eight) groups, which are:

a. Original color of clay (terracotta). This terracotta color highlights the distinctive character of the reddish Plered clay.

b. Warna tunggal (Single color). That is the type of ceramic painted with 1 color for the entire surface.

c. Kombinasi blok warna kilap (*glossy finish*), is the type of ceramic painted with a combination of 2 or more basic colors with gloss finish.

d. Kombinasi blok warna dof (*matte finish*) is the type of ceramic painted with a combination of 2 or more basic colors with finishing dof (not glossy).

e. Metallic. That is a group of colors that reflect light mimicking the character of metal material.

f. Kombinasi warna tunggal dan metalik (*The combination of single and metallic colors*).

g. Kombinasi warna berpola (pola marmer -pola gurat, dll.) / Patterned color combinations (marble patterns - gurat patterns, etc.) is ceramic color groups that combine 2 or more color patterns in one ceramic product.

h. Pemudaran warna dasar (Basic color fading). That is the color character produced through the process of tarnishing the color of ceramic primer to display an antique, worn, and old-fashioned impression

3.2. Application of the MFC Method

Based on the data above, variables can be changed into codes to facilitate the process of combining morphology. Combinations are made by taking one variable from each column to be combined with one other variable from each column. Merging variables per column can be done randomly. The results of this merger will produce a combination of morphology as an initial idea that can be developed as an alternative design.

Tabel 1 Variable code

***Case* : the Development of Plered Ceramic Design**				
***RANGE DIMENSI* / DIMENSION RANGE (RD)**	***BENTUK* / SHAPE (B)**	***FUNGSI*/ FUNCTION (F)**	***TEKNIK DEKORASI*/ DECORATING TECHNIQUE (TD)**	***WARNA*/ COLOR (W)**
RD1 Small	B1 cylindrical	F1 Decorative item	TD1 Teknik Cat serat (Fiber paint technique)	W1 Original color of clay (terracotta).
RD2 Medium	B2 Circular variation (round, oval)	F2 diningware	TD2 Grading paint technique (rainbow pattern).	W2 Warna tunggal (Single color).
RD3 Large	B3 Cylindrical combination	F3 Storage & container	TD3 Teknik Cat celup (Swirl technique)	W3 Kombinasi blok warna kilap *(glossy finish)*
RD4 Ekstra Large	B4 Flat	F4 Furniture	TD4 Teknik Cat Marmer (Marble paint technique)	W4 Kombinasi blok warna dof (*matte finish*)
	B5 cubic		TD5 Teknik lukis (Painting technique)	W5 Metallic
	B6 Abstract (statue, ornament)		TD6 Teknik cat cipratan (*splatter*)	W6 *The combination of single and metallic colors*
	B7 Deconstruktive		TD7 Teknik cukil (menggurat pola) scratch pattern technique	W7 Patterned color combinations (marble patterns - gurat patterns, etc)
			TD8 Teknik tempel (Sticking technique)	W8 Basic color fading

Tabel 2 morphological matrix

Variable 1	Variable 2	Variable 3	Variable 4	Variable 5
RD1	B1	F1	TD1	***W1***
RD2	B2	***F2***	TD2	W2
RD3	B3	***F3***	TD3	W3
RD4	***B4***	F4	***TD4***	W4
	B5		TD5	***W5***
	B6		TD6	W6
	B7		***TD7***	W7
			TD8	W8

For more details, the following is an example of MFC application to the variable Plered ceramic products to get product design ideas with a combination of morphology..

Combination 1 (marked with yellow highlights) Medium-sized ceramics with a box shape that serves as a cutlery with terracotta-colored marble-like decoration techniques

a. Possibility: Impossible, the range of dimensions is too large to be categorized as tableware and decorative techniques of marble cannot be realized in terracotta colors.
b. Examples: -

Combination 2 (marked with blue highlights) Small ceramics with flat shapes that function as storage containers with metallic colored decorating techniques.

a. Possibility: Possible, and have never been made before.
b. Examples: Ashtrays, coin containers, coasters / cups.

Through the MFC method, the combination of forms that can be produced is very many and varied. Even so, from the many combinations of morphology produced not all of the results of this combination of morphology can be made (such as the combination example 1). MFC is possible to use as a method of finding new ideas and references in developing solutions to design problems, but the realization of the combination results between variables also requires further analysis.

4. Conclusions

The application of the Morphological Forced Connections (MFC) Method is done by breaking Plered ceramic products into several components. The basis of the MFC method is the idea that if some or all components of an object are changed, it will produce a new design. This component change can be done by creating a new combination of variable products that already existed before.

Through the MFC method, the combination of forms that can be produced is very many and varied. Even so, from the many combinations of morphology that is produced not all the results of this combination of morphology can be realized

MFC can be used as a method of finding new ideas and references in developing solutions to design problems, but the realization of the combination results between variables also requires further analysis.

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