Study the application of "green building" on the aspect of the shape and facade LP2M UNNES building

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Abstract. In designing a building, the shape and facade have a very important role. Green building is a high-performance building designed to be responsive to the environment, economically sufficient profit, and as a healthy place to live and work (environmentally responsible, economically profitable, and healthy places to live and work). The concept of 'green' is not just a current trend, but must be treated as a basic principle when we start designing buildings. The characteristics that emerge from the design of the shape and facade of a building will form the image of the building itself. To find out the explanation of the concept of the shape and facade of a building, in this research qualitative research with content analysis method is used, through a study of the main building with a case study of the building of LP2M UNNES Sekaran Gunungpati Campus by applying descriptive analysis content. From the analysis study, it will be known that the building has undergone a transformation in the form of addition and subtraction. In designing environmentally friendly buildings is actually a process. The goal is not to make a perfect building, but rather to create a better building. One of the advantages gained in applying the Green Building concept is efficiency. In terms of the facade of the LP2M UNNES building, it appears that in the processing of the embodiment of the shape of the building, of course it is also influenced by material elements, color, proportion, rhythm, and texture. From these studies it is expected that the facade elements of the appearance of a building will show the identity and character of the building.

1. Introduction
At present, the world of education is experiencing rapid development, especially in higher education, which is marked by various changes in line with developments in technology, communication and world competition. In order to improve the quality of higher education, UNNES continues to carry out campus construction; these changes will certainly significantly affect changes in teaching and learning, education level, university status and so on. The vision of Semarang State University is to become a university with a conservation perspective and with international reputation, which hopes to make UNNES an independent Green Campus. A fairly basic development occurred in the Semarang Teaching and Education Institute in 2000. One of these developments was primarily in the physical construction of infrastructure in the area of the Sekaran Gunungpati campus in Semarang, in order to carry out the teaching and learning process and the administration of education.
UNNES gets a grant for campus construction funds from IDB (Islamic Development Bank). The LP2M UNNES building is certainly one of the buildings for Research and Community Service institutions which is the center of the activities on the UNNES campus, but unfortunately, the new building that has been built is developing for the benefit of each institution and resulting in no visual uniformity of the building facade against vision of UNNES. The LP2M UNNES building is one of the buildings that functions as an administrative place, public services are used by almost all employees, students, lecturers, campus members and the general public, so that public facilities in the LP2M area should meet green building standards that have been regulated nationally.

In designing a building, forms and facades have a very important role. The characteristics that arise from the design of a building will form the image of the building. The formation of this image cannot be separated from the aesthetic appearance contained in the design of the form and facade of a building. Based on the phenomenon of UNNES campus development, careful planning is needed before adding a new building in the UNNES campus area. It is necessary to study in advance the characteristics of the building area as a basic concept in design. With the Green Campus and Green Building approach, of course, it is necessary to analyze various aspects, one of which is the form and facade elements, the physical character of the building. An overview of the form and facade aspects is an effort to provide visual direction for the building that shows the identity of the green campus.

For this reason, it is necessary to conduct an in-depth study of the appearance of the shape and facade of the LP2M building, as well as being a part of the Tri Dharma of Higher Education through research in the realm of architecture. This is due to basically the aesthetic appearance of a building can be perceived differently by everyone who sees it. That's why aesthetics, especially aesthetics in buildings, have subjective values, which is something that is difficult to apply universally. In accordance with this, the processing of the mass and building facades is considered important in a design process to produce a work that has an aesthetic value that can reflect the characteristics of a building.

2. Research Methodology

Data collection was carried out by the observation method to obtain data on the facade and the overall function of the building at the research location on the UNNES campus. From these buildings, the identification of the building will focus on the function of non-academic buildings, namely the building of research institutions and community service. After obtaining some information regarding the LP2M UNNES building, data analysis will then be carried out based on the predetermined research variables. In analyzing the data, the field of observation in the field becomes the focus, namely the visual impression obtained through the views. The method used in the preparation of this research is descriptive analytical method. Analytical descriptive research was carried out by collecting data, processing data, analyzing and concluding.

3. Foundations of The Theory of Forms and Facades

3.1. Form Theory

Form is an inclusive term which has several meanings. Shapes can be attributed to the recognizable external appearance of the building. Forms can be linked to both internal structures and external lines and the principles which give the whole unity. If form is more often meant to mean the meaning of mass or three-dimensional content, then form in particular refers to an important aspect of form which embodies the appearance of a configuration or placement of lines or contours that limit an image or shape. Architectural forms include various elements such as materials, colors, space, textures, and so on, which have special characteristics. This character forms the expression of the building which is the application of the design philosophy and based on certain principles, namely the aesthetic principles. The form consists of 3 (three) types, namely: straight shape, triangle shape, circle shape. While the change in form consists of 3, namely: change in dimensions, change with reduction, change with addition formatting [1, 2].
3.2. Visual Characteristics of Form
The visual characteristic of form is a unity that is contained in a building where each feature has its own role. Some of the visual characteristics of form, namely: form, dimensions, position, orientation, proportion (scale), and color [3].

3.3. Definition of Building Facades
Facade is a representation or expression of various aspects that appear and can be observed visually [4,5]. In the architectural context, building facades are not only two-dimensional but three-dimensional which can represent each of these buildings in the public interest or vice versa for that the building facade components observed includes:
   a. Gates and entrances
   b. Ground Floor Zone
   c. Windows and Entrance to Buildings
   d. Guardrail
   e. Roof and Building Finishing
   f. Markers and Ornaments on the facade

3.4. Composition on the Building Facade
The diversity of appearance of building facades is a modification of various design elements which from time to time undergo transformation. According to Ching [6], “The visual apparatus of form which becomes the object of transformation and modification of the shape of the elements on the building facade includes figure, size, color, texture, position, orientation and visual appearance.

To evaluate or conduct studies on facade architecture according to Ching [6]: the visual components that are the object of transformation and modification of the building facade can be observed by making classifications through the principles of formative ideas that emphasize geometry, symmetry, contrast, rhythm, proportion and scale.

3.5. Interpreting Green Buildings
Green Building is a building, either single or multiple in a certain site, which in its construction and utilization must follow sustainability principles in addition to the provisions of the building technical requirements in general. From these two understandings, it can be interpreted that the concept of green architecture is an architectural planning approach that seeks to minimize various harmful effects on human health and the environment. Green building is a high-performance building designed to be responsive to the environment, economically profitable, and as a healthy place to live in and to work (environmentally responsible, economically profitable, and healthy places to work) live and work. The concept of ‘green’ is not just a trend today, but should be treated as a basic principle when we start designing buildings [7]. The principles of sustainable design in the context of environmentally friendly architectural designs include:
   a. Saving natural resources (Economy of Resources), which takes into account the aspects of reducing, reusing and reusing various natural materials used in buildings. Some of the main problems that are considered here include, among others, the problem of saving energy use, conserving water and using building materials. By making these savings the architect will reduce the use of non-renewable natural resources (Non Renewable Resources) both during construction and during the building operation.
   b. Life cycle (Life Cycle Design), which is a methodology to analyze the building process and its impact on the environment. The building process referred to includes all stages from the pre-building phase (Pre-Building Phase), during building (Building Phase) until the building is functionalized (Post Building Phase). The conventional model of a building life cycle is design - construction - operation - demolition. This principle includes an approach that recognizes the
existence of consequences/impacts on the environment in each process in the life cycle model. This approach is basically to reduce negative impacts and increase the life span of building materials. A building material that has expired will be able to change shape as a new material, and thus can always be reused.

c. Humane design (Humane Design), which is a principle that focuses on the interaction between humans and the environment. This principle relates to the adaptation of the design to natural conditions, urban design and site planning, as well as the level of comfort of the building to be achieved. The first two principles relate to efficiency and conservation, while the third principle deals with the harmonious life of all ecosystem constituents: non-organic elements, living organisms and humans. This principle seems to have grown from the philosophy of thought to respect the existence of all objects and living things on earth.

4. Analysis and Discussion

4.1 UNNES as a Conservation University
Semarang State University (UNNES) has declared itself as a Conservation University since March 10, 2010. Formally, there is a Rector Regulation Number 22 of 2009 concerning Conservation University [8] and Rector Regulation Number 27 of 2012 concerning Conservation-Based Campus Management [9]. Conservation has meaning as an effort to protect, protect, preserve and make wise use of natural resources and the natural environment. The declaration of UNNES as a conservation campus is based on various reasons and considerations. Geographically, the UNNES campus is now in the mountains with various topographies. Administratively, Sekaran belongs to the Gunungpati District, Semarang City. This area is a cool area that used to function as a water catchment area to maintain the hydrological cycle and provide water for the life of Semarang City in the lower areas. The development of UNNES can be seen in the master plan for the construction of the UNNES education building below.

Figure 1. MasterPlan UNNES 2005 - 2025
UNNES as a Conservation University has the aim of improving mental attitudes (mind sets), behavior, and participation of all UNNES members in development to support the Nation and character building according to conservation principles. Conservation University is implemented by observing the principles or aspects of conservation, namely sustainable use, preservation, provision, protection, repair and preservation. UNNES as a conservation university means that the vision and mission of UNNES which covers the Tri Dharma of Higher Education is carried out with conservation principles in all aspects of its activities. Especially in the building of the Institute for Research and Community Service (LP2M) as the location for this research can be seen in the image below.

![Figure 2. The building of the Institute for Research and Community Service (LP2M)](image)

### 4.2 Analysis of Building Facade Components

#### a. Entrance

The visual character of the entrance to the function of the LP2M building is dominated by the location of the entrance which is in the middle of the axis of symmetry on the facade, the shape that is pushed outwards with a protective roof in the form of a canopy roof combined with ACP and is visually marked by the presence of prominent columns and ornaments on the roof as protection.
**b. Openings**

The character of the openings in the LP2M building is characterized by a massive composition and balanced openings, the shape of the openings that extend horizontally, the location of the openings that are grouped into the wall plane and bounded by columns, the dominant type of opening is live windows with aluminum frame material, clear glass, iron railing as well as wood jalousie vents. The dominant character of the opening is found in LP2M in a balanced composition between massive and openings, the shape of the opening that extends vertically, the location of the openings grouped in the wall and column plane. The dominant type of opening is to use dead windows. Of the two functions of the building, there is a character of the same opening to the direction it faces. The openings that lead to the southwest, northwest and west are dominated by dead window types with materials that can filter the heat from the sun or live window types with the addition of sun shading. Openings facing in the opposite direction, namely the northeast, east and southeast directions use a type of living window with clear glass material and a massive composition of balanced openings. The use of transparent elements in the form of dead windows has a function as natural lighting in the space in the building. Where in the figure with the function of space in as service units and workspace. The inner space functions as a public space.

**c. The roof of the building**

The roof shape of the LP2M building in general has the same roof characteristics as other buildings. The dominant form of the roof of the building is in the form of a shield or saddle which is broken into
two slopes or combined with other roof forms. Roof with no concrete structure and with iron trusses which functioned as a utility area is the topmost building on the 3rd floor. The slope of the roof is between 30° -60° in accordance with the shape of the tropical roof with the dominant slope used is 30°. Roof material made of zincalume with dark brown or terracotta color.

![Figure 5. The roof of the LP2M Building, Semarang State University](image)

d. Ornaments
Ornaments on the LP2M building are located on the walls on the right and left side, there are some on the front. The characters of the shape, motif and ornament material in both functions have the same characteristics, namely the form of ornament that follows the roof line, the dominant ornament motif in the form of geometry with clear line elements and ornament material made of Aluminum Composite Panel (ACP) and colors that are in harmony with the colors of the sills and the roof.

![Figure 6. Ornament on the front of the Semarang State University LP2M Building](image)
4.3 Analysis of Building Facade Composition

a. Geometry
The geometric characteristics of the LP2M building have the same characteristics, namely the dominant type of geometric area that forms the facade consisting of a horizontal rectangle, a trapezoid arranged vertically in the order from below is a rectangular area as the building body and a rectangular area.

b. Symmetry
The symmetrical characteristics of both the non-academic management and general academic functions have the same characteristic, namely that the axis lines are located in the middle of the field as well as the axis of achievement. Symmetrical balance shows a formal impression in accordance with the function of the building.

c. Rhythm
The rhythmic characteristics of the LP2M building have the same characteristics, namely repetitive elements in the form of columns, openings and ornaments. The dominant type of loop is the loop of shape and size as it approaches the axis. The dominant repeating pattern in columns and openings is a
symmetrical horizontal linear pattern, while the pattern for ornamentation uses a sequential pattern according to the size that adapts to the roof line.

Figure 10. Rhythm Characteristics in the LP2M Building, Semarang State University

d. Scale and Proportion
The characteristic scale and proportion of the LP2M building is the proportion of the roof height and the dominant building is balanced. The results of the analysis of scale indicators and other proportions show the same characteristics of the two functions. The scale adjusts to the dimensions of the average human height in Indonesia, the dominant dimensions of the entrance are 220cm high and 80-100cm wide. The distance from floor to ceiling has a height of between 3.5 - 4m with the number of floors between 1-2 floors. The ratio of building length is greater than the building height. The dimensional equation is seen on the 2 left and right sides of the building.

Figure 11. Scale Characteristics in the LP2M Building, Semarang State University
4.4 Analysis of Building Facade Elements
The dominant color character in the LP2M building is the use of neutral colors outside the circle of colors, namely white, gray and beige, while some buildings use a few contrasting colors as an identity. Building materials that are widely used are the use of clear glass as window filler, aluminum frames, zincalum material on the roof and brick wall material with ACP color paint finishing.

5. Conclusions
The LP2M building has an interesting shape and facade. In terms of the shape of the building and the appearance of its facades, LP2M UNNES is a conceptualist building. LP2M UNNES has a straight basic shape which consists of several rectangular basic shapes and undergoes transformations in the form of changes with additive and subtractive changes. Changes with additives that occur in the LP2M building are in the form of additions and compositions of several basic forms of building mass into a unified form of the LP2M building mass. Meanwhile, subtractive changes are the presence of clashes.
on some parts of the mass of the building without changing the overall shape of the building mass. In terms of the facade, the LP2M building has a facade design that looks twin right and left, like a combination of framed glass blocks on each side which are neatly arranged and straightforwardly shows that this Office and Service building has a transparent building concept with the use of visible transparent glass material. It has a smooth texture in almost all parts of the building with the addition of massive elements with aluminum composite material which appears to have a slightly coarse texture found in some parts of the building mass area which functions as a counterweight to the transparent plane so that the facade of the LP2M building does not appear monoton. The use of decorative ornaments on the transparent plane found on several sides of the facade makes the facade's appearance characteristics stronger and more prominent.

6. References
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