STUDY OF ENERGY-FRIENDLY AND ENERGY-SAVING CONCEPTS IN THE RESIDENTIAL DESIGN OF IAI MALANG

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ABSTRACT
Contemporary architect designed houses tend to be environmentally friendly and energy efficient. An architect-designed residence is not only a place of refuge, a reflection of character, lifestyle and shows existence, but also must be energy efficient and environmentally friendly. This study seeks to describe what are the elements of environmentally friendly architecture and energy efficient architecture in the residential design of IAI Malang. The research design uses a mix method, namely exploring (qualitative) as well as trying to explain (quantitative). The research strategy is hermeneutics. The data collection method is secondary data. Using 3 analytical methods, namely descriptive analysis, thematic analysis and comparative analysis. The output of the research is a diagram of the elements forming sustainable architecture in 10 residential samples by architect IAI Malang.

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INTRODUCTION
The development of architecture today leads to many types of architecture: environmentally friendly architecture, energy-efficient architecture, and archipelago architecture (Manurung, 2014) and/or even combining the three. This discourse also leads to contemporary architecture, which has other terms such as sustainable architecture, ecological architecture, green architecture, bioclimatic architecture (Sutanto, 2020b). This discourse also leads to green architecture which has the following characteristics: providing solutions to climate problems to building science (Karyono, 2010); save energy, reduce emissions, conserve, increase production, minimize expenditure and increase the added value of buildings (Anonymous, 2010); sustainable, environmentally friendly, energy-conscious and culturally intelligent (Nugroho, 2018) and climate-responsive (Kishnani, 2006). Therefore, sustainable architecture related to environmentally friendly and energy efficient is almost always expressed in the language of numbers - coefficient, concentration, efficiency and profit return - which is argued as an optimization in the design process (Kishnani, 2006).

This concept of a residence designed by an architect should not only be a shelter, a reflection of character, lifestyle, and show existence (Febrianto, 2019; Utomo et al., 2019b) but must also be energy-efficient and environmentally friendly. The embodiment of architectural types appears in at least 3 systems, namely: spatial systems, form systems, and stylistic systems (Habraken in (Pangarsa et al., 2012). However, according to the author, there are at least 6 systems to assess architectural embodiment, namely: stylistic systems, spatial system (spatial layout), model system
(shape), display system (material & ornament), outer space system (landscape layout), indoor space system (furniture arrangement) (Utomo et al., 2019a).

This study seeks to fill the research gap, namely to describe what are the elements that make up the architecture with environmentally friendly concepts and energy-saving concepts in the residential designs of IAI Malang. The expected output of the research is in the form of a diagram of the elements forming an environmentally friendly and energy-efficient architecture as well as the types of manifestations that appear in 10 residential samples by architect IAI Malang.

METHODS

Research design

The research design is a mixed method that is trying to explore/explore (qualitative characteristics) as well as trying to connect / explanatory (quantitative characteristics). Exploration efforts, in this case, appear in descriptive analysis. Meanwhile, explanatory efforts appear in thematic analysis and comparative analysis.

Research Strategy

This research strategy is hermeneutics. The research strategy uses a hermeneutic strategy. In this study, the hermeneutic strategy was used as a method of analysis. The definition of hermeneutics is defined as analytical methods to reveal meaning (Pattiasina, 2018); interpretation of reality (Sutanto, 2020a); understanding of the relationship between meanings (Adiyanto, 2014). Hermeneutics can be used as an analytical method for reality (Sutanto, 2020a); text (Adiyanto, 2014); or art products (Pattiasina, 2018), in this case, the residential design products designed by the architect IAI Malang.

Method of collecting data

The data collection method is in the form of secondary data, which is taken from a visual documentation book, namely: 25 Works of IAI Malang Architects (Hindarto, 2017). 10 units of observation will be studied, namely, residential buildings (not public buildings) designed by the architect of IAI Malang with an area of less energy.

Data analysis method

This study uses 3 types of analysis, namely: (1) descriptive analysis, (2) thematic analysis (Boyatzis in (Poerwandari, 2007), and (3) flip-flop analysis (Strauss & Corbin in (Poerwandari, 2007). Descriptive analysis in research This is an effort to explore the forms of energy-saving and environmentally friendly elements The thematic analysis in this research is the process of coding information about the units of observation and the functional categories of energy-saving and environmentally friendly elements. Flip-flop analysis is trying to make a comparison effort. at the opposite pole to determine the position of energy-saving forming elements and environmentally friendly elements are in an early or advanced stage.

RESULT AND DISCUSSION

The result of data collection is descriptively explained by 10 observation units (samples) on the theme of energy-saving and environmentally friendly. Descriptive analysis was carried out by sorting which energy-saving and environmentally friendly elements in the 10 units of observation as showed in Table 1. In this descriptive analysis, we look for the forming elements for energy-saving and environmentally friendly forming elements. Based on the hermeneutic coding results, it is known that the elements forming the two concepts are: (a) roof-canopy; (b) wall-openings; (c) guardrails; (d) terraces; (e) accents; (f) solid-void.

<table>
<thead>
<tr>
<th>No</th>
<th>Identity Building</th>
<th>Energy Efficient Observing Unit</th>
<th>Eco-Friendly Observing Unit</th>
</tr>
</thead>
</table>
| 1  | unit of observation 1 | • Transparent material roof (for top lighting)  
• Breathing walls (for air exchange)  
• vertical openings (for natural lighting and ventilation),  
• void (for air exchange),  
• Top horizontal aperture (for top lighting) | • Recycled wooden walls (recycle concept) and used glass bottles (reused concept)  
• Vertical potted plant fence (reduce concept)  
• Recycled wood veranda (reused concept)  
• Recycled wood accents (recycle concept) |
<table>
<thead>
<tr>
<th>No</th>
<th>Identity Building</th>
<th>Energy Efficient Observing Unit</th>
<th>Eco-Friendly Observing Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Study of Energy-Friendly and Energy Saving …</td>
<td>• Secondary skin wooden barrier (for reducing light and heat) • Terrace (for wind catcher) • back garden green open space (for rainwater catcher)</td>
<td>• Natural stone walls (reduce concept) • Natural stone fence (reduce concept) • Accent wood arrangement (reduce concept)</td>
</tr>
<tr>
<td>2</td>
<td>unit of observation 2</td>
<td>• Transparent canopy material (for top lighting) • Horizontal top aperture (for top lighting) • Vertical wooden secondary skin barrier (for light reduction) • Semi covered terrace (for wind catcher)</td>
<td>• Natural stone walls (reduce concept) • Natural stone floor terrace (reduce concept) • Home bamboo blinds (reduce concept)</td>
</tr>
<tr>
<td>3</td>
<td>unit of observation 3</td>
<td>• Vertical aperture (for natural lighting and ventilation), • void (for air exchange) • side garden green (for rainwater catching)</td>
<td>• Brick wall exposure (reduce) • reused glass bottle wall • Exposed brick fence (reduce)</td>
</tr>
<tr>
<td>4</td>
<td>unit of observation 4</td>
<td>• Used bottle glass material wall (for side lighting); • Vertical aperture (for natural lighting &amp; ventilation); • void (for air exchange) • Semi covered terrace (for wind catcher) • indoor green open space + outer voids + pond (for air exchange and natural conditioning)</td>
<td>• Vertical aperture (for Side Lighting) • Secondary skin barrier made from rooster &amp; perforated steel (for light reduction) • Veranda roof garden (for air exchange and natural conditioning) • Secondary skin accents in the form of perforated steel &amp; roster (for visibility and dust barrier) • Roof garden (for air exchange and green elements)</td>
</tr>
<tr>
<td>5</td>
<td>unit of observation 5</td>
<td>• The wall is covered with secondary skin on the window (for light reduction) • Repeating vertical aperture (for side lighting &amp; cross ventilation) • Secondary skin accent (for excess light reduction) • Rear and side gardens (for air exchange)</td>
<td>• Cubical wall (for light reducer) • Openings covered with secondary skin (for light reducers) • Home coated with secondary skin (for light reducers) • Accent as well as secondary skin (for light reducers)</td>
</tr>
<tr>
<td>6</td>
<td>unit of observation 6</td>
<td>• Breathing walls from used bottles (for air circulation) • blinds from glass type vertical openings (for air circulation) • Terrace (for wind catcher) • roof garden (for green elements) • Wooden wall accents (for heat repellent) • front garden (for air exchange)</td>
<td>• Wood coated canopy (reduce concept) • Used glass bottle wall (reused concept) • Plant fences (reduce concept) • Wooden wall accent (reused concept)</td>
</tr>
<tr>
<td>7</td>
<td>unit of observation 7</td>
<td>• Glassdoor and window openings (side lighting) • Natural stone ply fence (heat repellent) • back garden (additional lighting, air exchange)</td>
<td>• Natural stone layer fence (reduce concept)</td>
</tr>
<tr>
<td>8</td>
<td>unit of observation 8</td>
<td>• Repetitive vertical aperture (side lighting) • top horizontal aperture (top lighting) • The guardrail of secondary skin pillar (light barrier) • Terrace (wind catcher) • grass block (absorb water)</td>
<td>• Natural stone fence (reduce) • brick fence (Reused) • Wooden floor terrace (reduce)</td>
</tr>
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</table>
In observation unit 1, the definition of energy saving is in the following elements: roof (transparent roof material as top lighting); walls (breathing walls for air exchange, vertical openings for natural lighting and ventilation, voids for air exchange); aperture (top horizontal opening for top lighting); barrier (in the form of secondary skin for light reducers); terraces (terraces as wind catchers) and green open spaces (back friends for catching rainwater). Meanwhile, the definition of environmentally friendly in observation unit 1 is found in the elements: wall (recycled wood wall with recycle concept) and wall of used glass bottle with the reused concept); fence (vertical hedge with reducing concept); veranda (recycled wood flooring with the reused concept); accent (recycled wood arrangement with recycle concept).

In the unit of observation 2, the definition of energy saving is in the elements: canopy (Transparent canopy material for upper lighting); aperture (horizontal top opening for natural lighting); barrier (secondary vertical skin on the core for reducing light); terrace (semi-enclosed space for wind catcher). Meanwhile, the definition of environmentally friendly is in the elements: wall (layer of natural stone); fence (natural stone construction); accent (wooden arrangement).

In observation unit 3, the definition of energy saving is in the elements: openings (vertical & void openings); the existence of green open space (side garden). Meanwhile, the definition of environmentally friendly is in the elements: wall (layer of natural stone); terrace (natural stone floor); veranda (bamboo curtain).

In observation unit 4, the definition of energy saving is in the following elements: wall (glass wall of used bottles); terrace (semi-closed foyer); green open space (inner garden + outer voids + pond). While the definition of environmentally friendly is in the elements: wall (exposed brick wall; used a glass bottle wall).

In the unit of observation 5, the definition of energy saving is in the elements: openings (vertical openings); barrier (secondary skin); veranda (existence of the top garden/roof garden); accent (secondary skin); green open space (existence of the top garden/roof garden). Meanwhile, the definition of environmentally friendly does not exist in this residence.

In the unit of observation 6, the definition of energy saving is on the elements: wall (covered with secondary skin on the 2nd floor); opening (repeated vertical openings); accent (secondary skin); green open space (back and side garden). Meanwhile, the definition of environmentally friendly is in the elements: green open space (back and side gardens).

In the unit of observation 7, the definition of energy saving is in the elements: both wall and canopy (cubical wall); openings on the veranda as well as an accent (secondary skin). Meanwhile, the definition of environmentally friendly is in the element: green open space, green open space (back garden).

In observation unit 8, the definition of energy saving is in the elements: wall (breathing wall of used bottles for air circulation); openings (blinds from glass type vertical openings for side lighting); terrace (wind catcher room); veranda (top garden/roof garden) accents (wooden walls for heat repellent); green open space (front garden for air exchange). Meanwhile, the definition of environmentally friendly is in the elements: canopy (a canopy covered with wood with the reduce concept); walls (reused glass bottles used); fence (green fence concept reduce); veranda (roof garden); accent (reused wooden wall).

In observation unit 9, the definition of energy saving is in the following elements: Openings (predominance of glass doors and windows for side lighting); natural stone plywood fence for heat repellent; green open space (back garden for additional lighting & air exchange). While the definition of environmentally friendly is in the element: fence (natural stone layer with the concept of reducing)

In the unit of observation 10, the definition of energy saving is in the elements: aperture (repetitive vertical opening as side lighting & top horizontal opening as top lighting); barrier (secondary skin in the form of a column as a light reducer); terrace (side terrace for catching wind); green open space (with grass block pavement to absorb water). Meanwhile, the definition of environmentally friendly is in the elements: fence (natural stone fence with reducing & reused concept); terrace (wooden floor terrace with reducing concept); green open space (side park with reducing concept).

Thematic analysis in this study (as showed in Figure 1) is the process of coding information about the unit of observation and the functional category of energy-saving and environmentally friendly elements. Flip-flop analysis is trying to make a comparison effort at the opposite poles to determine the position of energy-saving and environmentally friendly forming elements in an early or advanced stage.
Based on thematic analysis, energy-saving categories can be defined in the unit of observation: (a) roof and canopy (top lighting); (b) walls & openings (breathing walls, side openings, top openings, air circulation); (c) fences & barriers (reducers of excess light); (d) terraces & verandas (wind catcher & passive cooling); (e) ornaments & accents (visibility and dust barriers); (f) green open space (rainwater catcher, air exchange, passive cooling).

Environmentally friendly categories can be defined both in (a) roofs and canopies; (b) walls & openings; (c) fences & barriers; (d) terraces & verandas; (e) ornaments & accents; (f) green open space into 3, namely: reduce; reused; recycle. Based on the flip-flop / comparative analysis, the energy-saving and environmentally friendly forming elements of the residential design of the IAI Malang architect still use the basic level. The advanced level should be in the category: high-performance roofs and canopies; high-performance walls and openings; high-performance fences and barriers; high-performance terraces and verandas; high-performance ornaments and accents; green open space which serves primary.
CONCLUSION
This research concludes that the energy-saving category can be defined in the unit of observation: (a) roof and canopy (top lighting); (b) walls & openings (breathing walls, side openings, top openings, air circulation); (c) fences & barriers (reducers of excess light); (d) terraces & verandas (wind catcher & passive cooling); (e) ornaments & accents (visibility and dust barriers); (f) green open space (rainwater catcher, air exchange, passive cooling). The environmentally friendly and energy-efficient technology features on the 10 observation units still use basic features and have not used advanced features.

REFERENCES