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Digitizing Geometric Ornaments of the Bandung Grand Mosque for Cultural Preservation

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Abstract

This research explores the preservation of decorative motifs in the Bandung Grand Mosque through digitization as an effort to safeguard Islamic and Sundanese cultural heritage. Although the mosque has been widely discussed in architectural studies, systematic documentation of its ornaments is still limited. This study addresses that gap by digitizing geometric motifs and analyzing their structural complexity. A qualitative approach with a comparative strategy was applied, involving literature review, field observation, and digitization using CorelDRAW software. The findings show that geometric ornamentation dominates the mosque with varying levels of complexity depending on its line intersections and the number of geometric repetitions or tessellations. The study produces a publicly accessible digital catalog that preserves the accuracy of ornamental forms and supports their reuse in education, design, and cultural conservation. The results demonstrate that digitization is an effective method for documenting traditional ornaments while opening new possibilities for contemporary motif development.

Keywords: *bandung; cultural preservation; digitization; grand mosque; ornament outlines*

Introduction

A mosque is a building that represents the Muslim community at a specific place and time. It consists of architectural elements such as domes, minarets, pulpits, and mezzanines. These elements are decorated with ornaments that function as embellishments.

The ornaments of a mosque may change due to aging, lack of maintenance, or natural disasters. Such changes often lead to future renovations with new designs that reflect the culture of their time. Digital technology today plays a crucial role in cultural preservation, dissemination, and innovation (Zeng et al., 2023). Without preservation efforts through digital documentation, there is a risk of losing cultural continuity in the digital era.

Digital preservation initiatives for mosques have been carried out by various parties, such as the website patterninislamicart.com by David Wade. The website presents motifs from historic mosques worldwide, including Egypt,

India, Iran, Morocco, Spain, Syria, Central Asia, Turkey, and France. The documents displayed take the form of a catalog containing catalog numbers, regions, cities, buildings, eras, types, functions, materials, and the individuals who documented them. The catalog is also supplemented with photos and vector images. This information serves as a valuable reference for research and Islamic design development.

However, previous digital documentation projects tend to focus on historic mosques in the Middle East and Europe, while documentation of Southeast Asian mosques, especially in Indonesia, remains limited. The Bandung Grand Mosque, as one of the major cultural landmarks in West Java, has not yet been systematically digitized or analyzed in terms of its geometric ornamentation. Therefore, this study fills the gap by focusing on the digital preservation of mosque ornamentation in Indonesia through vector-based documentation and cataloging. It offers both a cultural record and a design resource for future academic and creative work.

The first objective of this study is to create digital vector images of the ornaments in the Bandung Grand Mosque. The second objective is to compile a digital catalog of these ornaments, making them easily accessible for designers and academics.

Theoretically, this research is grounded in the Islamic art theory of geometric ornamentation as aesthetic expression (Burckhardt, 2009) and in digital heritage preservation theory (Zeng et al., 2023). It contributes to the body of knowledge in design and culture by integrating traditional Islamic visual principles with modern digital documentation practices. Practically, it serves as a reference and shortcut for designers in developing ornaments and applying them to creative industries such as fashion, interior design, and architecture. Practically, it serves as a reference and shortcut for designers in developing ornaments and applying them to creative industries such as fashion, interior design, and architecture.

Literature Review

1. History of the Bandung Grand Mosque

The Bandung Grand Mosque is one of the historical buildings in Bandung City. It was built in the 19th century between 1811 and 1812 in the area near the Cikapundung River (Asri, 2024). The mosque is located in the city center at Jalan Dalem Kaum No.14, Balonggede Subdistrict, Regol District, Bandung City, West Java 40251.

Initially, the Bandung Grand Mosque had a simple design constructed by local residents. The materials used were local wood and bamboo, and the decorations consisted of traditional ornaments inspired by relics of the Mataram Kingdom.

During the Dutch colonial period, the mosque's design was transformed into a more modern and grand structure, adopting colonial styles. Located on the west side of the town square, the mosque served as a central religious and cultural landmark (Widyaevan, 2015). The layout was expanded to accommodate more worshippers and to facilitate community activities.

Figure 1. Bandung Grand Mosque During the Colonial Period
Source: (Kunto in Windyaevan, 2015)

After Indonesia's independence, the Bandung Grand Mosque underwent significant changes by adopting Middle Eastern architectural styles, particularly in its domes and minarets. The mosque complex was also expanded, adding a second floor and a basement area designated for ablution facilities (Asri, 2024).

Figure 2. Bandung Grand Mosque with Middle Eastern Style
Source: (Windyaevan, 2015)

The Bandung Grand Mosque has undergone 14 renovations (Rustandi et al., 2019). Today, it serves not only as a place of worship but also as a tourist destination in West Java and an iconic landmark of Bandung City. The mosque is open to the public every day.

Figure 3. Bandung Grand Mosque After the Last Renovation
Source: (Asri, 2024)

2. The Landscape of the Bandung Grand Mosque

The Bandung Grand Mosque currently occupies a land area of 23,448 square meters with a building area of 8,575 square meters, designed by Ir. H. Keulman, Ir. H. Arie Atmadibrata, Ir. H. Nu'man, and Prof. Dr. Slamet Wirasonjaya (Rustandi et al., 2019). The mosque's exterior includes the main building, minarets, gardens, and domes, while its interior consists of doors, stairs, ceilings, walls, the mihrab, and lighting, accommodating up to 10,000 worshippers.

The mosque's exterior is a monumental work combining local and Middle Eastern styles. The main building stands 25 meters tall, symbolizing the 25 prophets Muslims are required to know. The minarets were originally planned to reach 99 meters, representing the Asmaul Husna (the 99 names of Allah), but were reduced to 81 meters to ensure aviation safety over the mosque area. In front of the mosque lies a garden with synthetic grass, serving as an open space for public gatherings. The mosque features three domes, with the main dome measuring 30 meters in diameter, while the two others measure 25 meters each.

The interior of the Bandung Grand Mosque is dominated by marble materials to help cool the building's temperature. The decorations combine Islamic and Sundanese ornaments, crafted from teak wood and engraved glass. Certain parts of the mosque, such as the mihrab, are adorned with calligraphy.

3. Islamic Ornamentation

Mosques represent the culture of local communities through the application of visual elements (Kartika et al., 2020). One of these visual elements is ornamentation in the form of ornaments and motifs. Ornaments are visual elements consisting of decorative forms, either organic or geometric (Senoprabowo et al., 2022). A collection of ornaments composed into a unified design is referred to as a motif (Mesra et al., 2022).

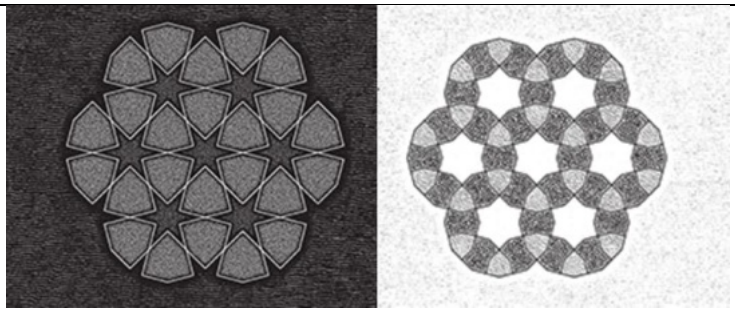
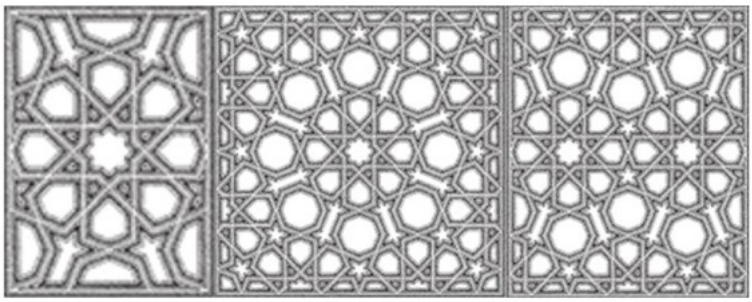
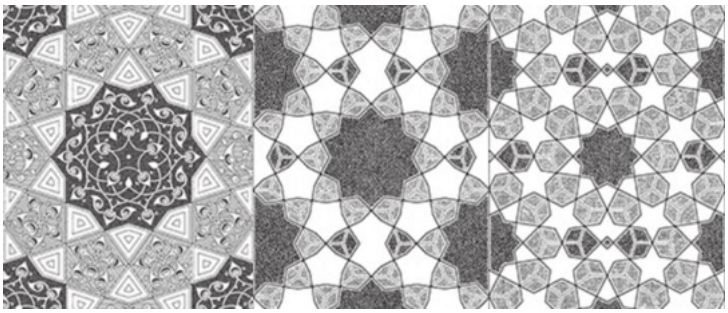
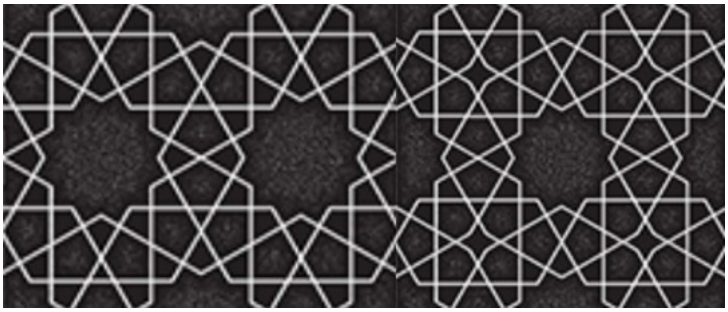
In addition to serving as a representation of culture, ornamentation also functions to create a beautiful atmosphere for those who are inside it. Putri (2016) explains that according to Destiarmand (2013), Islamic ornamentation avoids depicting

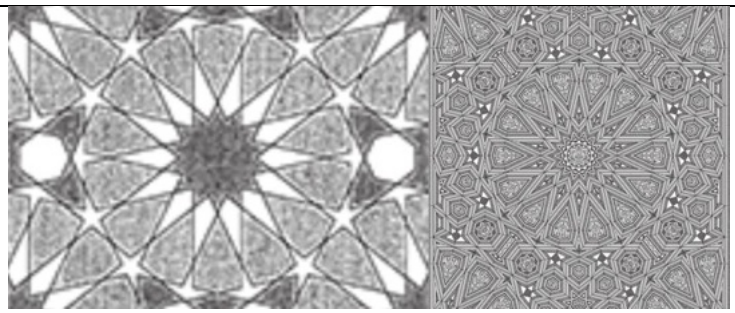
living beings such as humans and animals. Islamic ornamentation is divided into four types: calligraphy, floral, geometric, and muqarnas (Putri, 2016).

Burckhardt (2009) in Bordbari (2018) explains that geometric ornamentation in Islamic art carries the meaning of God clearly and divine union. This concept correlates with its creative process, which begins with the construction of a circle. From this circular form, various other geometric shapes such as the hexagon, octagon, decagon, and dodecagon can be derived. These shapes can then be developed into infinity patterns, which are commonly applied as decorative elements in mosques.

Geometric ornaments in Islamic art carry symbolic meanings derived from their underlying base shapes (Sutton, 2018). Hexagonal forms are associated with the Qur'anic six days of creation, the Seal of Solomon, the compasses, and divine unity. Octagonal structures symbolize the four elements (earth, water, air, and fire) and are often interpreted as archetypal crystalline flowers. Decagonal shapes represent the mother of patterns and various knot-like configurations. Dodecagonal forms convey meanings related to the unseen, the subtle, and the abundant. Meanwhile, tetradecagonal shapes are linked to the concepts of divine light and the full moon.

Table 1. Islamic Ornament Designs and Their Symbolic Meanings

Basic Form	Ornament Design	Symbolic Meanings
Hexagon		1. Quranic six days of creation 2. The Seal of Solomon 3. Compasses 4. Devine unity
Octagon		1. The four elements (earth, water, air, and fire) 2. Archetypal crystalline flower
Decagon		1. The mother of patterns 2. Knots
Dodecagon		1. Unseen 2. Subtle 3. Abundant

Tetra-decagon		1. Devine Light 2. Full Moon

Source: (Sutton, 2018)

There are also various styles of Islamic geometric ornamentation inspired by Islamic Empires such as Ummayyad, Abbasid, Tulunid, Almoravid, Ottoman, Safavids, and Mughal (Eldien, 2025). Each empire possesses its own visual characteristics influenced by regional, temporal, and cultural interactions with other empires or communities.

The geometric ornamentation of the Umayyad style is an adaptation of Byzantine mosaic craftsmanship (Bonner et al., 2017). This ornament replaces depictions of living beings with star-shaped forms. There is also stone-carving craftsmanship featuring interweaving circular ornaments based on geometric patterns inspired by Hellenistic art. Such ornaments can be found on the windows of the Great Mosque of Damascus, which was built between 706 and 715 CE (Schibille et al., 2022).

Figure 4. Geometric Ornamentation in the Great Mosque of Damascus Window
Source: (Bonner et al., 2017)

The Abbasid period (750-1258 CE) represents the era of the Islamic Golden Age. Islamic knowledge and scholarship flourished during this time, as did the arts. The development of Islamic art in this era was influenced by the diversity of materials and techniques used in ornament production. Among these techniques were stucco work, woodwork, and brickwork, which evolved in regions under the rule of the Abbasid Empire. The variety of ornamental types also expanded through the application of mathematics and geometric construction, resulting in more precise geometric ornamentation (Bonner et al., 2017).

The Tulunid Dynasty (868–905 CE) was founded by Ahmad ibn Tulun, the former governor of Egypt and Syria under the Abbasid Caliphate. This led to the spread of Islamic artistic influence in Egypt, including Abbasid-style geometric ornamentation. Such geometric ornaments can be found in the Mosque of Ibn Tulun in Fustat, featuring a hexagonal base form that creates a star-shaped pattern. These geometric shapes were also combined with Samarra-style floral motifs, forming a tessellation pattern. The fusion of these two elements produced an impression that was beautiful, playful, and innovative for its time (Bonner et al., 2017).

Figure 5. Ornaments in Ibn Tulun Mosque
Source: (Bonner et al., 2017)

The most renowned architect of the Ottoman Empire between 1538 and 1588 CE was Mimar Sinan (Güzelci, 2024). He designed numerous structures, including the Selimiye Mosque in Edirne and the Şehzade Mosque in Istanbul. These mosques stand as evidence of the advancement of Ottoman art and technology, which harmoniously combined mathematical aesthetics and geometric rationality.

A distinctive feature of Ottoman mosques is the large central dome, which serves as the focal point of the building. Additionally, smaller domes are found in other parts of the mosque. The interiors of these domes are adorned with geometric motifs, showcasing the intricate artistry of Ottoman architectural design.

Figure 6. Main Dome of Selimiye Mosque in Edirne
Source: (Hassan et al., 2024)

4. Sundanese Ornamentation

Sundanese ornamentation is divided into two types: geometric and floral. There are also combinations of both geometric and floral elements into a single design. Sundanese ornamentation is inspired by natural forms, reflecting the agrarian lifestyle of the Sundanese people (Sunarya, 2018).

The Bandung Grand Mosque is located in West Java, a region predominantly inhabited by Sundanese communities. Examples of Sundanese ornamentation from Bandung inspired by flora include the patrakomala flower, moth orchid, tagetes, and bamboo (Putri et al., 2018).

In the Bandung Grand Mosque, Sundanese geometric ornaments can be found on the mosque's gate walls. These ornaments take the form of fish scales that are repeated to create a patterned motif (Destiarmand et al., 2017). The fish scale shape is based on a geometric circle, arranged by overlapping one-fourth of its form. The fish scale pattern in Sundanese culture is also known as katumbiri or "rainbow." This motif carries the meaning of joyfulness, which is a characteristic of Sundanese society (Hartanti, 2017).

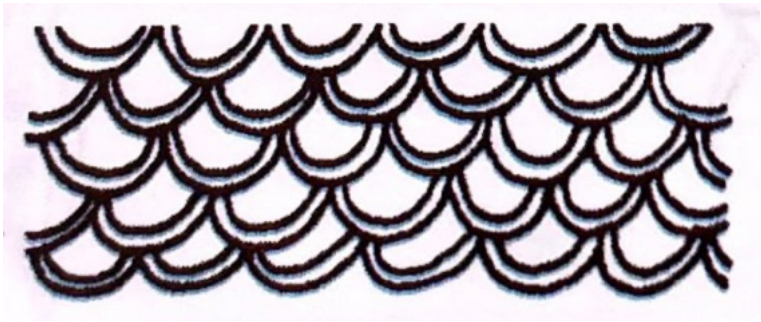


Figure 7. Fish Scale Pattern
Source: (Susanto, 2018)

5. Preservation of Traditional Ornaments

The documentation of mosque architecture has shifted from the exotic to the technical since the nineteenth to the early twentieth century, as architectural drawings became increasingly precise with the aid of technological advancements (Jamaleddine, 2024). The use of technology is often assumed to eliminate traditional culture; however, with creativity, technology can be highly beneficial for cultural development, including ornamentation, as part of cultural preservation efforts (Gondoputranto et al., 2022). Reconstructing ornaments with technology is a way to integrate the concepts of technology, economy, and sustainability.

Digitizing ornaments with graphic processing technology is one model of cultural preservation that aims to record the forms of ornaments. In Indonesia, the documentation of ornaments is mostly derived from traditional artifacts. One example of documented batik is Batik Lasem, which was recorded using photographic techniques (Basiroen et al., 2025). There is also documentation of a traditional Batak Toba house using close-range photogrammetry techniques, which was later converted into a realistic 3D model (Hanan et al., 2015). One application that can be used for ornament digitization is CorelDRAW, through which existing ornaments on an artifact are digitally reconstructed. The digitization stages begin with studying the ornament under research, followed by reconstruction, and further development of the reconstructed ornament to create new ornamentation (Andeska et al., 2022).

Methodology

This study applies a qualitative approach with a comparative strategy through four stages. These stages include tracing the history of the building, identifying its architectural components, and comparing those components with others (Deligiorgi et al., 2021). The research stages are complemented by a visual analysis of the digitized ornaments found in the Bandung Grand Mosque.

The first stage is data collection by tracing the history of the Bandung Grand Mosque. The historical data were gathered through literature studies in books and journals on the mosque's design and architecture.

Data collection through literature review was supported by identifying architectural components through field observations at the Bandung Grand Mosque. The identification of mosque components as cultural artifacts included examining techniques, functions, materials, icons, concepts, and shapes (Edward et al., 2022).

From these field observations, representative geometric ornaments were selected for analysis. The selection was based on their visibility, completeness, and variation of geometric patterns across different architectural components such as domes, facades, gates, and windows. The comparative strategy in this study focused on examining similarities and differences among these ornaments in terms of function, technique, material, icon, concept, and shape.

To ensure the comparison of ornaments on each architectural component is documented as part of cultural preservation efforts, the third stage focused on ornament digitization. Digitization can be carried out in both two-dimensional and three-dimensional forms; however, the creation of two-dimensional outlines is considered the foundation for all novelty and ornament development (Audsley, 1881).

Line is one of the essential elements of design. A line is a sequence connecting two points (Hendriyana, 2019). Lines are divided into two types: single lines and outlines. In CorelDRAW, outlines can be created using various tools, including freehand, polyline, 2-point line, Bézier, pen, B-spline, and 3-point curve.

To ensure the accuracy of the ornaments being produced, high-resolution photographic documentation was used as a reference. Based on these photographs, the relative scale between the ornament's lines could be determined. To achieve precision in the geometric ornaments and to facilitate the repetition of motifs, the ornaments were constructed using grid structures.

In the fourth stage, the digitized results were analyzed visually. The visual analysis focused on the outlines of the Bandung Grand Mosque ornaments based on their level of complexity. Complexity is influenced by design elements, one of which is the line (Hendriyana, 2019). The level of complexity was determined through the density of line intersections and the number of geometric repetitions or tessellations. These criteria provided a consistent analytical basis for classifying the ornaments into low, medium, and highly intricate forms. The ornament digitization in this study focused specifically on geometric ornamentation.

Result and Discussion

1. Variations of Mosque Ornamentation

The ornamentation of the Bandung Grand Mosque can be found on both the exterior and interior of the building. On the exterior, ornaments appear on the gates, main doors, walls, stair railings, and minarets. On the interior, they are found on the ceilings, doors, windows, walls, carpets, and the inner dome.

Figure 8. Gate of Bandung Grand Mosque
Source: Author

The Bandung Grand Mosque has two grand gates decorated with a combination of four types of geometric ornamentation. The first ornament is a geometric motif with a twelve-pointed star. The second ornament is a geometric star formed by two overlapping squares, one rotated 45 degrees, with an eight-pointed star at its center. The third ornament is a lattice motif composed of quarter-circle geometric shapes, detailed with floral sprout-like decorations. The fourth ornament is a geometric motif of an eight-pointed star. The color combination of these ornaments consists of dark blue, light blue, green, yellow as an accent color, and white for the outlines.

Table 2. Ornament Specifications of the Gates

Design Element	Specification
Function	Gate
Technique	Engraving
Material	Cement
Icon	Geometric and Sundanese
Concept	Islamic
Shape	Star, square, circle, and sprout

Source: Author

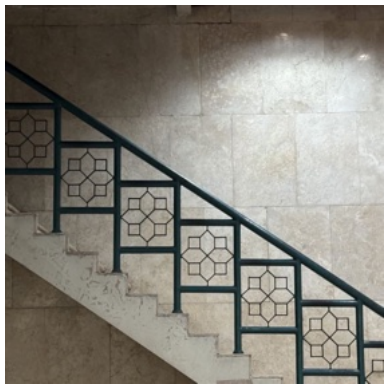


Figure 9. Stair railing of Bandung Grand Mosque
Source: Author

On the side of the mosque, there is a stair railing decorated with geometric ornamentation. This ornament features an eight-pointed star with intersecting lines and four squares filling the field. The ornament is composed using the half-drop technique, following the height of the stairs. The railing is made of metal with a welding technique and painted in dark green.

Table 3. Ornament Specifications of the Stair Railings

Design Element	Specification
Function	Stair railing
Technique	Welding and paint
Material	Metal
Icon	Geometric
Concept	Islamic
Shape	Star and square

Source: Author

Figure 10. Main door of Bandung Grand Mosque
Source: Author

The main door leading to the mosque's interior features ornamentation that combines Islamic and Sundanese artistic styles. The design consists of an eight-pointed star geometric motif, with its fields filled by floral or vine-like ornaments characteristic of Sundanese art. Additionally, Kufic and Thuluth calligraphy adorn the upper part of the door. This ornamentation is crafted from dark brown teak wood using a pierced carving technique. The application of this technique not only serves as decoration but also functions as ventilation and natural lighting.

Table 4. Ornament Specifications of the Main Doors

Design Element	Specification
Function	Main door
Technique	Openwork carving
Material	Teak wood
Icon	Geometric, floral, and calligraphy

Concept	Islamic and Sundanese
Shape	Star, plant, kufic, and thuluth

Source: Author

Figure 11. Minaret of Bandung Grand Mosque
Source: Author

The mosque's minarets feature five types of ornamentation surrounding them. The first is a geometric pattern of eight-pointed stars, composed in a complex yet orderly arrangement. The second is a geometric motif of three-way divisions and triangles. The third is a zigzag line motif, similar to those found in the Nabawi Mosque in Medina. The fourth resembles Nusantara ornamentation; however, due to the viewing distance, it cannot be clearly identified. These four ornaments are crafted from light-colored cement using engraving techniques. The fifth ornament is a geometric motif found on the minaret railings, made from metal with welding techniques and painted dark green.

Table 5. Ornament Specifications of the Minarets

Design Element	Specification
Function	Minaret
Technique	Engraving, welding, and paint
Material	Cement and metal
Icon	Geometric
Concept	Islamic
Shape	Star, square, triangle, zig-zag, and diamond

Source: Author

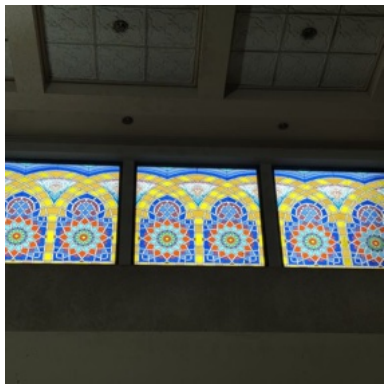


Figure 12. Wall panels of Bandung Grand Mosque
Source: Author

The outer walls of the mosque are adorned with decorative panels featuring various types of ornamentation. Some panels display purely geometric ornaments, while others combine geometric patterns with stylized floral designs or calligraphy. These panels are made of stained glass painted in yellow, green, red, orange, and blue.

Table 6. Ornament Specifications of the Wall Panels

Design Element	Specification
Function	Wall panel
Technique	Stained glass and paint
Material	Glass
Icon	Geometric, floral, and calligraphy
Concept	Islamic
Shape	Star, flower, leaf, and thuluth

Source: Author

Figure 13. Ceiling panel of Bandung Grand Mosque
Source: Author

The mosque ceiling is decorated with geometric ornamentation featuring eight-pointed stars as accents. This ornament is composed using the principle of repetition, arranged as panels affixed to the ceiling. The panels are made of gypsum with engraving techniques. All panels are white, divided by a cream-colored grid.

Table 7. Ornament Specifications of the Ceiling Panels

Design Element	Specification
Function	Ceiling panel
Technique	Engraving
Material	Gypsum
Icon	Geometric
Concept	Islamic
Shape	Star

Source: Author

Figure 14. Stair gate of Bandung Grand Mosque
Source: Author

Inside the mosque, there is a door leading to the basement. This door features geometric ornamentation in the form of squares arranged in a crisscross composition. The railing is made of metal using welding techniques and painted white.

Table 8. Ornament Specifications of the Stair Gate

Design Element	Specification
Function	Stair gate
Technique	Welding and paint
Material	Metal
Icon	Geometric
Concept	Islamic
Shape	Square

Source: Author

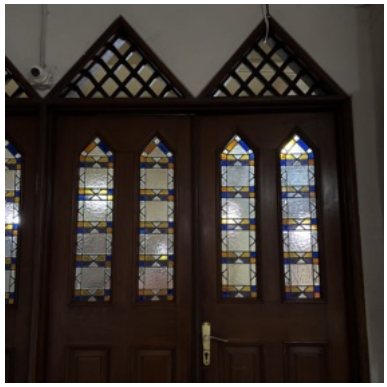


Figure 15. Door panel of Bandung Grand Mosque
Source: Author

The doors leading to the main area are decorated with stained glass ornaments in yellow, blue, and white. The ornament features a geometric motif of square fields arranged like bands, with triangular fields at the ends. In addition to serving as decoration, this ornament also functions as natural lighting.

Table 9. Ornament Specifications of the Door Panels

Design Element	Specification
Function	Door panel
Technique	Stained glass
Material	Glass
Icon	Geometric
Concept	Islamic
Shape	Square and triangle

Source: Author

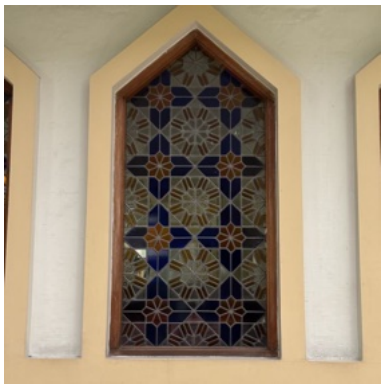


Figure 16. Geometric Wall Panel of Bandung Grand Mosque
Source: Author

There are also fixed windows that serve as partitions within the mosque, decorated with geometric ornamentation. This geometric pattern consists of eight-pointed star ornaments arranged in a square layout. The color combination of this ornament includes white, orange, and dark blue. It is made from transparent glass using stained-glass techniques.

Table 10. Ornament Specifications of the Geometric Wall Panels

Design Element	Specification
Function	Wall panel
Technique	Stained glass
Material	Glass
Icon	Geometric
Concept	Islamic
Shape	Square and star

Source: Author

Figure 17. Calligraphy Wall Panel of Bandung Grand Mosque
Source: Author

The walls of the mosque's main area are decorated with ornamentation featuring Kufic calligraphy arranged within geometric fields. This ornamentation combines light gray tones from engraved marble with dark gray and cream colors from natural stone arranged in a brick-like pattern.

Table 11. Ornament Specifications of the Calligraphy Wall Panels

Design Element	Specification
Function	Wall panel
Technique	Carving
Material	Marble and natural stones
Icon	Calligraphy and pixel
Concept	Islamic
Shape	Kufic and square

Source: Author

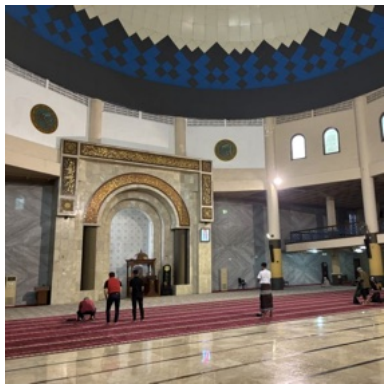


Figure 18. Dome and Mihrab of Bandung Grand Mosque
Source: Author

On the interior of the dome, there is ornamentation with a geometric diamond-shaped motif arranged in a zigzag composition following the dome's curvature. This ornament stands out prominently with black and blue colors set against the dome's cream-colored background.

Table 12. Ornament Specifications of the Dome Decoration

Design Element	Specification
Function	Dome decoration
Technique	Applique
Material	Fabric-covered panels
Icon	Pixel
Concept	Islamic
Shape	Square

Source: Author

In the mosque's mihrab, there is ornamentation in the form of golden calligraphy set against a brown background. The mihrab contains four sections of calligraphy: Thuluth calligraphy of the shahada, ta'awwudz, and shadaqallahul 'azim. There are also inscriptions of the word "Allah" on the right side and "Muhammad" on the left, each surrounded by floral ornaments. In addition, there are Islamic ornaments that combine geometric and floral patterns.

Table 13. Ornament Specifications of the Mihrab

Design Element	Specification
Function	Mihrab
Technique	Carving and painting
Material	Wood
Icon	Geometric, floral, and calligraphy
Concept	Islamic and Sundanese
Shape	Thuluth, plant, and star

Source: Author

Figure 19. Carpet of Bandung Grand Mosque
Source: Author

In certain areas, there are roll carpets featuring a combination of dot and floral motifs created using the tufting technique. The dot motif occupies the largest field, with white dots set against a dark red background. Below the dotted motif, there are floral patterns composed like bands. These floral motifs follow a horizontal repetition principle and are framed by three parallel lines. The colors used in this ornamentation are white, light brown, and dark green for the vines, with a dark red background.

Table 14. Ornament Specifications of the Carpets

Design Element	Specification
Function	Carpet
Technique	Tufting
Material	Synthetic fibers
Icon	Floral
Concept	Islamic
Shape	Plant and dot

Source: Author

Figure 20. Mezzanine Railing of Bandung Grand Mosque
Source: Author

The mezzanine railing in the main prayer hall features geometric ornamentation composed of interlaced square motifs. This ornamentation is made of metal using a welding technique and is painted dark blue.

Table 15. Ornament Specifications of the Mezzanine Railings

Design Element	Specification
Function	Mezzanine railing
Technique	Welding
Material	Metal
Icon	Geometric

Concept	Islamic
Shape	Square

Source: Author

2. Cultural and Symbolic Meaning of Ornaments

The Bandung Grand Mosque features a blend of Islamic and Sundanese decorative traditions. Islamic-style decoration appears in the geometric, floral, and calligraphic ornaments, while Sundanese influences are reflected in certain geometric and floral motifs.

Abbasid-style elements using stucco engraving techniques can be observed on the gate and minaret ornaments. The main door also exhibits woodcarving techniques that combine eight-pointed star geometric motifs with floral patterns, resembling those found in Tulunid Islamic art.

Sundanese aesthetics emerge subtly in the mosque's decoration through the fish-scale motif on the gate. This motif has been a distinctive feature of the Bandung Grand Mosque since the Dutch colonial era and continues to be preserved today.

The geometric fish-scale ornament on the mosque gate is derived from a circular base form. In Islamic art, the circle symbolizes unity, while in Sundanese culture, the motif conveys joyfulness due to its rainbow appearance, which is an attribute that reflects the cheerful character of Sundanese society.

Octagonal-based motifs dominate the mosque's decoration. These forms appear on the gates, main doors, minarets, wall panels, and ceiling panels. Visually, these motifs resemble crystalline flowers. In Islamic art, such forms symbolize the four elements of the natural world: water, earth, air, and fire.

Dodecagon-based motifs can be found in the geometric ornaments on the gate, wall panels, and mihrab. This form carries the meanings of abundance, subtlety, and the unseen. The notion of abundance is represented by the numerous star points generated from the dodecagon. With so many points, the star resembles a flower that appears soft or subtle in its petals. This delicate quality contributes to its symbolic association with the unseen or the hidden.

In addition to ornaments adapted from Islamic and Sundanese traditions, the Bandung Grand Mosque also features distinctive geometric motifs not commonly found in either tradition. These appear on the minaret, stair railing, door panels, mezzanine railing, and stair gate. Such ornaments are characterized by simpler forms based on triangles and quadrilaterals.

3. Digitization of Mosque Ornaments

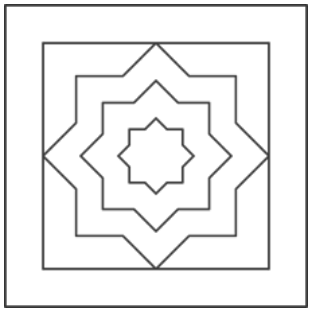
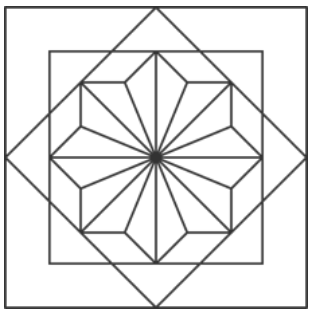
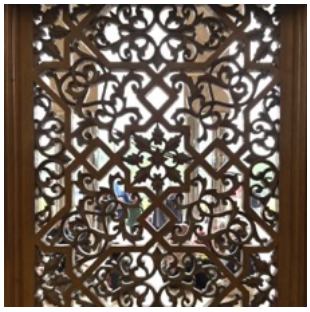
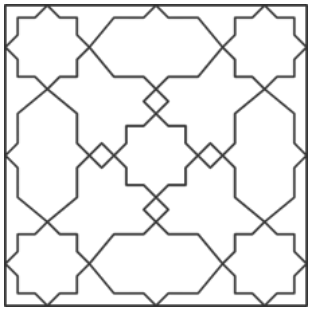
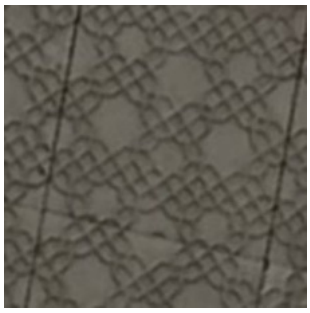
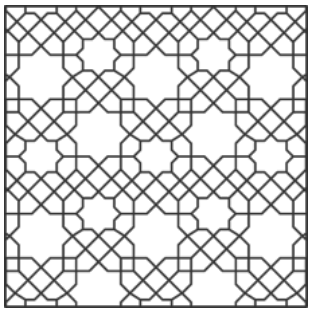
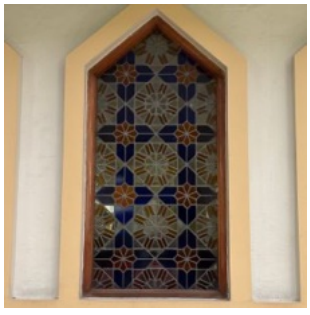
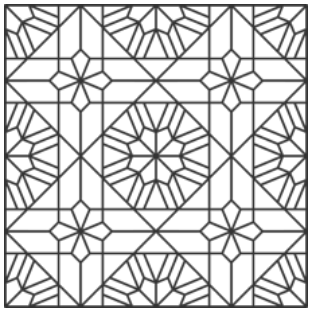
Bandung Grand Mosque features a variety of decorative ornaments. Four types of Islamic design are applied in this mosque: geometric, floral, calligraphic, and pixel. In this study, the digitization focuses on geometric ornaments, including basic forms such as octagon, dodecagon, circle, and other geometric forms.

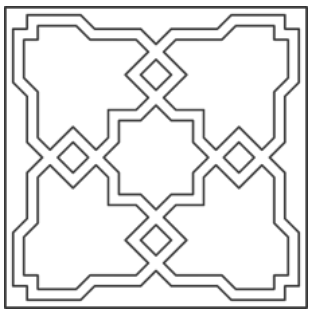
Straight-line ornaments, such as geometric patterns, can be created using the 2-point line tool in CorelDRAW, while curved-line ornaments, such as floral motifs, can be made with the 3-point curve tool. Both tools offer advantages in terms of ease, speed, and precision, which are further enhanced by the use of nodes and control handles to refine line points.

This study employs an outline format in Dark Charcoal (#333333) to create a subtle yet contrasting effect against a transparent or white background. Line thickness is kept consistent at 1.0 pt with straight strokes, rounded corners, and rounded line ends.

The digitization process begins by placing reference images taken during field observation, followed by creating grids as guides for the main shapes. Since most ornaments in the Bandung Grand Mosque follow a radial composition, the process is easier when starting from the center. Once the main forms are drawn, filler ornaments can be added, such as those on the main entrance and exterior walls. For motif creation, simple repetition and compositional patterns are applied. Digital tools significantly simplify the digitization process, especially in repeating ornamental elements to form complete motifs.

Table 16. Islamic Octagon-Based Ornament Outline Digitization of the Bandung Grand Mosque

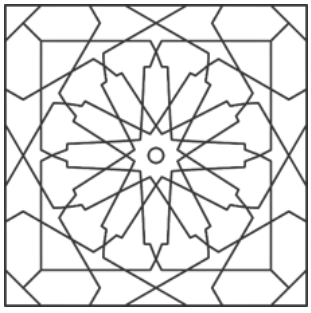
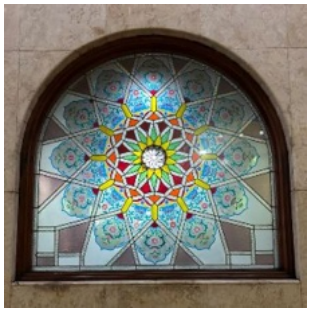
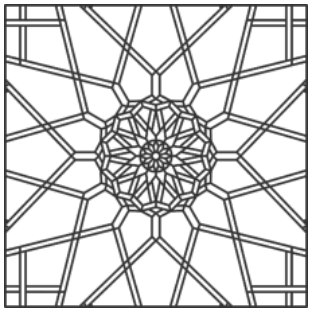
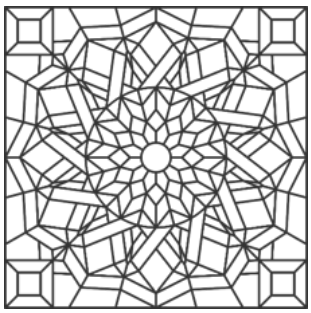
Component	Reference Photo	Outline Digitization
Gate - 01		
Gate - 04		
Main door - 06		
Minaret - 07		
Wall panel - 17		

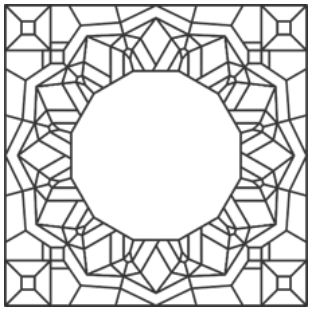
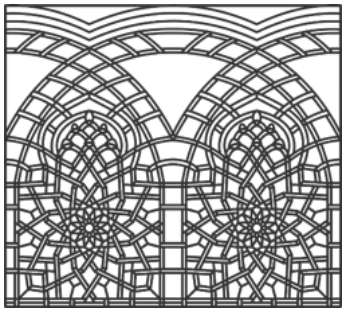
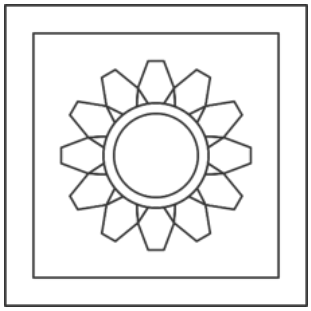
Ceiling panel - 18		

Source: Author

The ornaments above are octagon-based geometric ornaments. Ornaments number 1, 4, 6, and 18 have a low level of complexity. Ornaments 1, 4, and 18 are single ornaments consisting only of outlines without additional details, while ornament 6 is not complex to digitize because it does not involve any floral filling elements. Ornament 17 has a medium level of difficulty due to its simple repetition pattern, whereas ornament 7 is highly complex because it features an intricate repetition structure that forms a complete motif.

Table 17. Islamic Dodecagon-Based Ornament Outline Digitization of the Bandung Grand Mosque

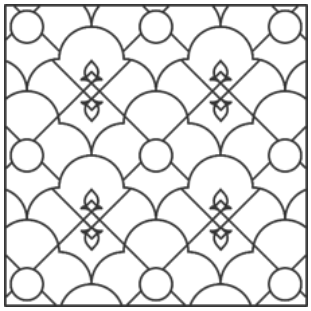
Component	Reference Photo	Outline Digitization
Gate - 02		
Wall panel - 12		
Wall panel - 13		

Wall panel - 14		
Wall panel - 15		
Mihrab - 21		

Source: Author

Dodecagon-based ornaments generally have a higher level of complexity than octagon-based ornaments. However, as long as a geometric ornament does not contain detailed filling elements, the digitization process becomes easier, as in ornament number 21. There are also ornaments with medium complexity, such as ornament number 2, which consists only of outlines but includes more elaborate geometric development. The most complex ornaments are numbers 12, 13, 14, and 15, not only because of their detailed geometric fillers but also because some of them include double outlines.

Table 18. Sundanese Circle-Based Ornament Outline Digitization of the Bandung Grand Mosque

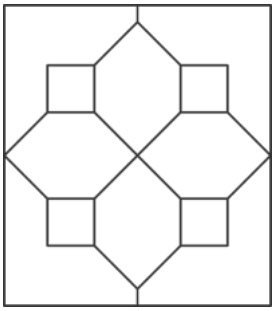
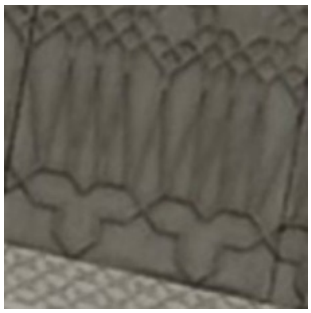
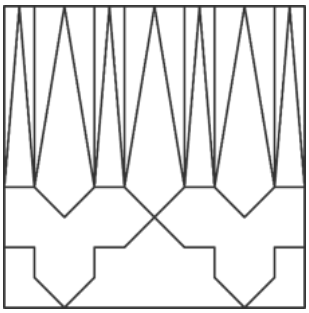
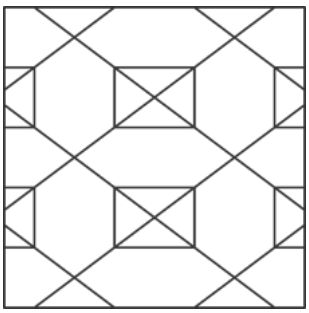
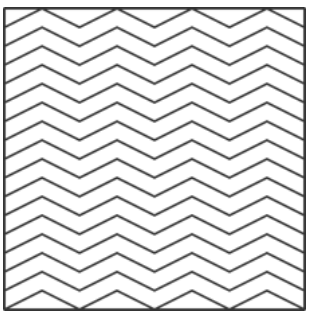
Component	Reference Photo	Outline Digitization
Gate - 03		

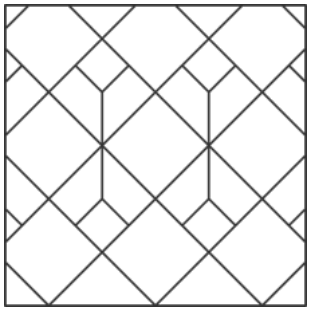
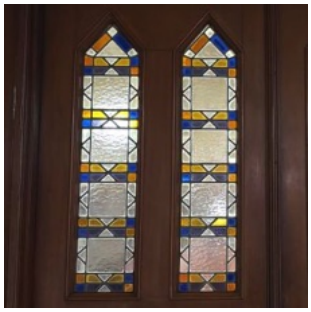
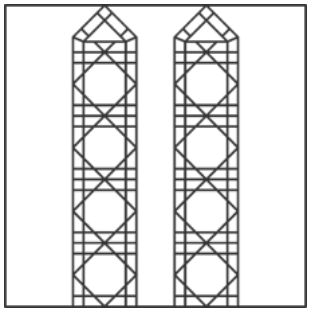
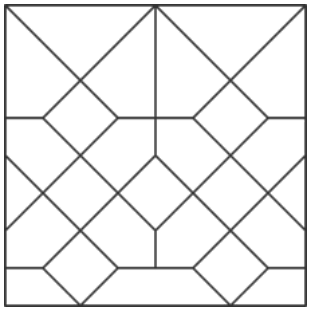
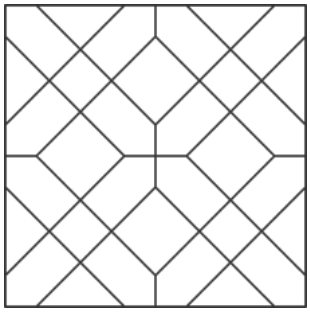
Source: Author

The Bandung Grand Mosque also features Sundanese-style geometric ornamentation based on circular forms,

specifically the fish-scale motif. This ornament has a medium level of difficulty since the process mainly involves adjusting the spacing and portions of the circular shapes to create an accurate repeated motif. The motif has also undergone modifications by combining three circles into one field and adding inner details such as small circles, cross-lines, and floral-like shapes.

Table 19. Other Geometric Ornament Outline Digitization of the Bandung Grand Mosque

Component	Reference Photo	Outline Digitization
Stair railing - 05		
Minaret - 08		
Minaret - 09		
Minaret - 10		

Minaret railing - 11		
Door panel - 16		
Mezzanine railing - 19		
Stair gate - 20		

Source: Author

Ornaments number 5, 8, 9, 10, 11, 19, and 20 are additional geometric motifs that decorate the Bandung Grand Mosque. All of these ornaments have a low level of complexity, although some, such as numbers 8 and 10, are repeated to form larger motifs.

Digitalisasi The geometric ornaments of the Bandung Grand Mosque were analyzed based on their levels of complexity, which are categorized into three groups: low, medium, and high. Ornaments with low complexity include numbers 1, 4, 5, 6, 8, 9, 10, 11, 16, 18, 19, 20, and 21. Ornaments with medium complexity are numbers 2, 3, and 17, while those with high complexity are numbers 7, 12, 13, 14, and 15.

Low-complexity ornaments can be digitalized more quickly and easily, whereas high-complexity ornaments require a longer and more challenging process. The fastest digitalization can be completed within 15 minutes, while high-complexity ornaments may take up to 4 hours.

The process of digitizing decorative motifs requires time, effort, thought, and supporting tools. Precision is essential to ensure that the digital outlines remain faithful to the original forms, although in some motifs, line simplification is necessary for the pattern to be readable. The digitized results are documented as part of the digital catalog on ragamhias.com. The motifs digitized in this study constitute the first collection in this repository. Digitization is not merely a technical process but also a form of visual interpretation that plays a crucial role in cultural preservation.

4. Analytical Discussion of the Digitized Ornaments

The digitization of the Bandung Grand Mosque ornaments shows that geometric structures, particularly those based on octagons and dodecagons, are closely connected to the principles of Islamic art that emphasize order, unity, and harmony. This finding aligns with Burckhardt (2009) in Bordbari (2018) and Sutton (2018), who explain that ornamentation in Islamic tradition is not merely decorative but serves as a visual expression of divine union and God clearly. The radial arrangements, repeated star formations, and circular compositions found throughout the mosque support this interpretation. When these motifs are translated into precise digital outlines, the digitization process not only documents their appearance but also helps preserve the symbolic meaning embedded within them.

The findings indicate that geometric ornaments are the most dominant decorative elements in the mosque. Octagon-based and circular patterns repeatedly appear on gates, main doors, minarets, wall panels, and ceiling panels, while dodecagon forms are used in more decorative and visually emphasized areas such as gates, wall panels, and the mihrab. This consistency shows a strong reliance on symmetry and radial geometry across the building. The ornaments also vary in complexity. The simpler motifs rely on clear geometric bases and minimal line intersections, and the number of geometric repetitions or tessellations. In general, higher-complexity ornaments appear in spaces that hold higher visual or symbolic significance, such as minarets and wall panels.

Digitization plays a meaningful role in cultural preservation. Converting the ornaments into vector-based outlines ensures that the motifs can be archived, studied, and reproduced without risking damage to the physical building. Through the online catalog at ragamhias.com, the digitized motifs can be accessed by researchers, designers, educators, and the general public. Although the outlines are presented in simplified digital form, the proportional accuracy is maintained, allowing the designs to remain faithful to the originals. At the same time, the digital files open opportunities for contemporary design development, educational use, or future restoration work.

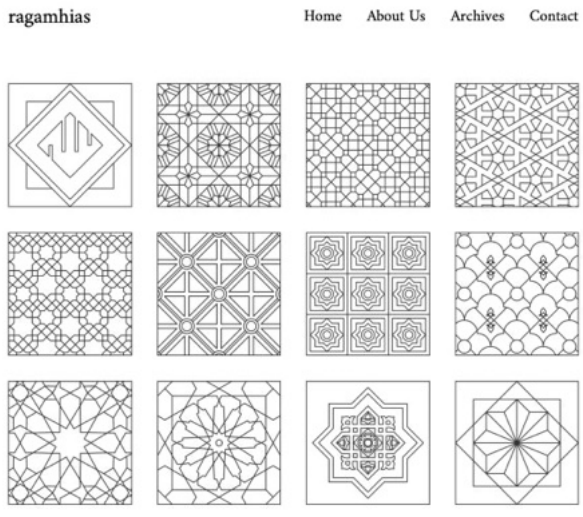


Figure 21. Digital Catalogue of Ornaments on ragamhias.com
Source: Author

The digitized collection produced in this study can support cultural preservation in several practical ways. The motifs serve as reference material for future restoration efforts, should any physical damage occur. Educators and cultural institutions can use these motifs as teaching material for Islamic art, Sundanese ornamentation, or architectural studies. The digital platform also increases public engagement by allowing users to see and understand the artistic heritage of the mosque more easily. In this sense, digitization becomes not only a technical effort but also a form of visual interpretation that strengthens cultural transmission.

This study has several limitations. The digitization focuses on two-dimensional outlines, which do not capture the depth, texture, and material qualities of carved wood, metalwork, or stucco engraving. The manual tracing process also introduces a degree of subjectivity, especially in motifs with unclear or eroded details. Furthermore, the number of ornaments included is limited to those most visible and representative during field observation. Future research may expand the documentation using three-dimensional scanning, examine additional architectural components, or compare this mosque's ornamentation with other examples in Indonesia or across the Islamic world.

Conclusion

This study demonstrates that the Bandung Grand Mosque, as a historical building, is not only significant architecturally and religiously but also rich in Islamic and Sundanese ornamentation, which serve as markers of cultural identity. These ornaments can be found across various interior and exterior elements such as gates, doors, minarets, ceilings, domes, and the mihrab.

Through the digitalization of geometric ornaments using design software, the preservation process can be carried out more systematically. This digitalization facilitates documentation, classification, complexity analysis, and the provision of a digital catalog accessible to both academics and designers. Therefore, ornament preservation not only protects cultural heritage from physical deterioration but also transforms it into a source of inspiration for contemporary innovation.

The theoretical contribution of this research lies in enriching the fields of design, fine arts, and Islamic architecture by documenting the ornaments of the Bandung Grand Mosque. It serves as an academic reference regarding the interrelation between architecture, Sundanese culture, and Islamic aesthetics, while also offering new insights into digitalization methods as a cultural preservation approach in the modern era. Meanwhile, the practical contributions include providing a readily accessible digital catalog of ornaments for designers, architects, and academics; offering a creative shortcut for exploring Islamic and Sundanese designs for the creative industries (fashion, interior, architecture, and crafts); accelerating reconstruction, development, and innovation of motifs into new design forms without losing their historical traces; and supporting cultural preservation efforts through digital media, which are more durable and widely distributable.

Despite its contributions, this study has certain limitations that need to be acknowledged. The digitization process was limited to two-dimensional outlines, which do not capture the depth, texture, and material qualities found in carved wood, metalwork, or engraving stucco. The study also did not include user testing to evaluate how designers, educators, or the public engage with the digital catalog. Furthermore, the analysis was based on a limited set of ornaments that were visually accessible during field observation.

Future research may address these limitations by incorporating three-dimensional digitization techniques, which can provide richer and more detailed documentation of ornamental elements. Collaborative work with heritage institutions may also strengthen preservation efforts, particularly in developing standardized digital archives for long-term accessibility. In addition, future studies may explore user interaction with the digital catalog to assess its effectiveness for educational, cultural, and design applications.

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