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ABSTRACTION OF TRADITIONAL CRAFTS INTO EXPRESSIVE SUSTAINABLE ARCHITECTURE

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Abstract:

Socio-cultural aspects of craft, along with aesthetic and creativity, are expressed in the products of craft practices. Craft activities of weaving may be deeply imbued with unique cultural values and expressive of cultural identities. The paper concerns how traditional Malay craft is abstracted onto a real-life project which has to deal with the problem of modularity and buildability. The focus is on the food covers or better known as *tudung saji* pattern, woven using a specific technique called triaxial or hexagonal weave, where the strands are plaited in three directions. Understanding and making explicit, formalizing and computing the craft patterns provide new insights into its cultural dynamics as well as creative and generative possibilities. The paper summarizes the design process from craft to meaning and philosophy to variations of modern abstraction. The concepts were integrated into an innovative cladding design of a passive cooling system. The design and development process of water-wall design includes the production of digital three-dimensional model. The efforts to merge craft sensibilities and practices with new making technologies and computational strategies have uncovered several interesting viewpoints. The implication of the study is to inculcate the symbolic application of cultural values in craft goods towards design. Future work towards sustainability in craft is part of revival. Traditional Malay craft need abstraction and reinvention in a contemporary way, to create an expressive connection and foster cultural identity within time and space.

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Keywords:

Cladding Design, Cultural Values, Passive Cooling System, Traditional Malay Craft, Tudung Saji

Introduction

Sustainable architecture in passive mechanisms is seen as cost-effective and value-engineering principles that contribute to sustainability. Study on the environmental characteristics of Islamic heritage structures to gauge the climatic performance, architectural and ecological wisdom is frequently studied in the field of passive low energy architecture. Theoretically, it combines both a socio-psychological benefit and an energy-environmental benefit at the same time. Water has been part of both outdoors and indoors environment of architecture, and the analysis of indoor and outdoor impact require different tools and computational resources that governed by different equations. Water provides psychological, visual, auditory, and tactile effects, which are primarily perceived by the senses, and affects human psychologically rather than merely visually and physically (Booth, 1989). Hence in terms of aesthetic dimensions, water elements are primarily perceived by the senses as a 'visual element'. Except for the directive effect, water elements give relaxing effects such as visual, acoustic, and provide concentration with tactile integration on the human.

This research highlights the abstraction of geometric pattern applied on 'chilled water wall' as an energy-saving technique to complement the demented and open-air approach of the spatial food testing laboratory design. The sense of regional identity in buildings is inspired from Malay cultural forms such as the Malay house and traditional food cover known as *'tudung saji'*. Based on the overall Energy efficient and My Crest guidelines applied by the Public Works Department of Malaysia, the overall strategy is to control energy use in air-conditioned areas and optimize air flow ventilation. The layout of lab is following the multidirectional nature of wind regime. The passive approach to the lobby and hallway areas is to 'break' the form into fragmentation and improve ventilation by increasing greenery and linear-type patios and hallways. Gross (2017) emphasizes that water bodies must work with airflow and natural convection and wind ventilation which must be integrated with the planning of building complexes to optimize the evaporation of water by the means of latent heat loss. M.Kamal (2020) unpublished thesis highlights the significant impact on the waterwall design as an internal cooling strategy. The study found that the Muslim civilization of the past were indigenous in combining the simultaneous impact of thermal mass coupled with water elements. The thesis tends to stresses its success in terms of thermal performance. Using computational fluid dynamics (CFD) simulation tool, it allows analysis to be done to verify its impact, its success in terms of thermal performance were discussed.

Although there is a lack of studies in water due to the difficulty of modelling and testing water bodies which are placed inside a building, the National Centre for Food Safety in Sepang (NCFS) project present otherwise. Environmental analysis was observed on the coupling of the waterwall with thermal mass system located at the main lobby. A fieldwork measurement was conducted and acquired for the Computational Fluid Dynamics (CFD) ANSYS Fluent simulation process. The coupling of waterwall with thermal mass result in 4˚C to 8˚C reduction to the indoor temperature under hot humid climate conditions when the outdoor temperature

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rises to 31˚C. The results also demonstrated that the exploitation of low mean airspeed provides ample time for the evaporative cooling of the indoor environment to become more efficacious and cooled air to circulate within the premise boundary. Due to the size of the overall lobby, a hybrid technique was devised to increase the cooling conditions of the lobby areas. This combine the strategy of chilled water wall and blowers in order to couple passive measures with daylighting through skylights. This research features on the chilled water wall design aspects and process.

The architectural value of NCFS describes a relation between the practice of Malay food cover weaving and design expressions. The art of plaiting is one of the major national art heritages that present since the early time of Malay Peninsula. This interesting design has a range of variety in its interpretation. The practises follow the use of colours that make various kind of plaiting product looks more appealing. The art of plaiting cannot be parted from the traditional way of life in Nusantara communities. During the old days, local village dweller would create numbers of plaiting products in daily basis. The product ranges from praying mat, plate mat and food cover or *'tudung saji'*, The process of making *tudung saji* is woven using a specific technique called triaxial or hexagonal weave. Where the strands are plaited in three directions, its tessellated parallelograms form an illusion of three-dimensional cubes that are found pleasing in motif studies of symmetrical patterns (Adam, 2011). 'Tudung saji' weaving begun by making a cone shaped latticework of triaxial weave. The latticework, which functions as a framework, is started by plaiting 5 strands together to form a pentagonal opening. This is followed by interlacing another 5 strands at the vertices of the pentagon to form 5 hexagonal openings. The approach of adding 5 strands at a time is repeated in order to expand the structure, which begins to take on a conical shape as more strands are added. Starting at the edge of the cone, coloured strands are interlaced upward and across in between the voids on the framework, resulting in a hexagonal tessellation that sometimes resembles three-dimensional cubes (Zamri, et.al, 2014).

The inspired 'tudung saji' as a food cover which was mostly used by the Malays carries a symbolic meaning to the building context. Food-cover weaving, a cultural practice that was unfamiliar to the modern people, suggest an aesthetic value and became the main design feature of the vertical water walls. While always a fundamental part of the design world, traditional Malay craft activities of weaving have only recently become more integrated into a real-life project. In another study, the researcher highlights the overall analysis attribute of geometric motif can be distinguished into the use of material, design meaning, technique of use, combination with other motif and its use for repetitive component (Baniyamin et.al, 2019). In particular, this kind of exploration gives the product an authentic quality rooted in traditional craft history. Contemporary designs created with traditional quality intend to evoke feelings of familiarity through their cultural values and expressive of cultural identities. Hence, it is to create a product that has an emotional element connected to something recognizable from the past. These feelings are communicated innovatively through form, material, texture, palette, and pattern.

The research inquiry develops and evaluates a design process that fuses traditional craft techniques of weaving with contemporary innovative cladding design. The water-wall design created through the production of a digital three-dimensional model design process consists of items intended to deal with the problem of modularity and buildability. During this

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investigation, a design process was developed that fused traditional craft techniques weave of ‘tudung saji’ pattern, where the strands are plaited in three directions. Additionally, inclusive design theory and craft theory informed the design process. Based on these ideas, this research sought to create a product that fits within the design goal of creating an innovative cladding design of a passive cooling system.

Literature Review

Lu (2020) proposed an intriguing theory of architecture as a sort of spatial socio storytelling, arguing that all forms of ornamentation reflect the tale of the civilisation and its proclivities. The history of architecture, according to Semper, begins with the history of practical art, which begins with “motifs simultaneously embodying function, techniques and ritual action (Hvattum, 2004, p. 10).” Semper stated in his ground-breaking treatise on "The Four Elements of Architecture" in the mid-nineteenth century that the threading, twisting, and knotting of linear threads were among the most primitive of human arts, from which all else, including both building and textiles, was derived. ‘The commencement of building coincides with the birth of textiles,' he asserted. Semper's investigation of the preconditions of style, a lavishly illustrated overview of the technical arts (textiles, pottery, carpentry, masonry), forever changed the interpretative environment for aesthetics, architecture, and art history. Semper felt that style should be guided by historical function, cultural affinities, creative free will, and the innate properties of each medium. After his observation of the primary elements of architecture, namely the hearth, mound, roof, and wall—, Semper indicated that each of these elements “corresponds to a particular technique of making, developed both in a ritual and a functional sense in the practical arts (p. 14).” The hearth has its origins in the firing of clay, which has led to the development of ceramic processes. The mound was built with stonework, while the roof was built with carpentry. Weaving methods were related with the enclosure that started in the wickerwork of walls. The wall motif was a major component in Semper's development map of primary architectural features. As Semper contended, the original enclosure, “was not the solid wall or wood, but rather the primitive fence woven by branches and grass.” For Semper:

> *Wickerwork, as the original space divider, retained the full importance of earlier meaning, actually or ideally, when later the light mat walls were transformed into clay tile, brick, or stone walls. Wickerwork was the essence of the wall.*
>
> *(Semper, 1989, p. 103)*

Consider the carpenter's trade next. Informally, referred to as a joiner. He combines pieces of wood to create a variety of objects like as boats, buildings, and furniture. As the work progressed, the cutting, shaving, and drillings were fashioned to fit, and so only became pieces as the work progressed. Joinery and knotting have a close relationship. The carpenter weaves with his woody materials in the same way that the basket maker does, and the form of the construction develops from the weave. The Latin term *texere*, which means "to weave" (hence text and textile), is derived from the Sanskrit words *tasha*, which means "axe," and *tashan*, which means "carpenter." The old joiners were also known as world-weavers.

Inclusive Design Theory

Understanding craft theory and history serves as a basis for understanding and creating “nostalgic” design (Adamson, 2007). Nostalgic design is defined as an interest in using the past and memory as an inspiration for design but reinventing these references in a new and often

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technologically innovative way, fusing traditional and contemporary. The focus of the nostalgic design is the adaptation of something familiar while emphasizing a strong emotional connection to the past. In the fast-paced digital world of the 21st century, this transition toward superficial connections often creates a yearning for meaningful emotional connections with people and places. Designing in a way that addresses inclusiveness and diversity serves as a reminder that the built environment is a cultural artefact that should strive to embrace everyone. This design investigation is centred on nostalgic design ideals, creating objects with a traditional craft component but formulated in a 21st century way. The goal of the research is to understand and making explicit, formalizing and computing the craft patterns. This provides new insights into cultural dynamics as well as creative and generative possibilities. This research stemmed from several theory bases. The study began with literature relating to inclusive design theory and from here the research extended into craft theory.

Craft Theory

In addition to uncovering the theories of inclusive design, it is necessary to review the history, definition, and current trends of the craft world. For the research, the craft can be defined and narrowed as a process of creating objects mainly relating to weaving. In the past, the handiwork of the women in the family often stemmed from basic human necessities: food, clothing, shelter, and warmth. They used functional crafts as a form of creative self-expression. In addition to its creative aspect, craft goods were social objects that assume importance beyond household utility; they signified and legitimized social roles and group membership. Ananda Coomaraswamy writes that "the human value of anything made is determined by the coincidence in it of beauty and utility." Craft is defined by its past. Each craft discipline has a rich history associated with it and by nature, the craft looks backwards to that history. Craft looks to the past for techniques, visual cues, meanings, and ideas. Crafts derive meaning from their traditional heritage. Craft perches in the middle of many different topics, uniting people over various backgrounds, genders, and ethnicities as well as linking history with modernity. The reason for craft's continuing history is due in part to the fact that craft inspires comfort. Typically craft products are accessible and fit easily within a normal life, neither challenging nor intimidating. The familiarity of craft forms perfectly complements the individuality of handcraft. Craft objects also engage the senses, especially their appeal of touch. Weavers and textile makers are conscious of the feel of different fabrics, how different densities have various tactile qualities.

Design Process Theory

To aid in answering the research questions the designer used articles by Nigel Cross, 'Designerly Ways of Knowing (2007) and *Visualizing Research* as the basis for the design process methodology. The article lays out an argument for and challenges our thinking about a neglected third area of education: Design. In general, the two dominant cultures of education are the sciences and the arts, broadly defined. The development of design research has led to the establishment of design as a discipline of study in its own right. Cross' article highlights several issues that remain highly relevant today.

Designerly Ways of Knowing traces the development of research interest in articulating and understanding the nature of design cognition, and the concept that designers have particular 'designerly' ways of knowing and thinking. The underlying argument is that there are 'ways of knowing' embedded in the process of design that is different from science; which is they learn

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about the nature of the problem largely as a result of trying out solutions, whereas the scientists set out specifically to study the problem. (Lawson, 1980). Drawing on observations from Lawson's study in How Designers Think, Cross compares the problem-solving strategies of designers to those of scientists. According to these experiments, scientist's problem-solve by analysis, and designer's problem-solve by synthesis. A central theme of design activity is generating a solution quickly rather than focusing on the analysis of the problem (Cross, 2007). An acceptable conclusion for a scientist is 'further research is needed but this is not so for the designer. Additionally, design problems are ill-defined, they are not the same as problems for scientists and scholars. As a result, designers often have to define, redefine, and change the problem to find a solution; designing is a process of pattern synthesis rather than pattern recognition. The value in design is practicality, ingenuity, empathy, and concern for 'appropriateness'.

Design intuition is another facet of the 'designerly ways of knowing.' Design is abductive reasoning, which differs from inductive and deductive reasoning principles. The link between internal mental processes and their exterior expression in sketches and models is crucial to the designer's thought processes. Recognizing the dialogue that takes place between internal and exterior representations is an important component of understanding how design is reflective. A medium, such as sketches or rapid models, is necessary for the designer to convey and reflect on half-formed ideas. "Design is ambiguous," according to Cross (2007). Early on, designers will create. Designers will generate early tentative solutions, but also leave many options open for as long as possible; they are prepared to regard solution concepts as necessary, but imprecise and often inconclusive" (p.54). Sketching and quick model building aid in generating these early solutions, enable a variety of solutions to be considered, and is an integral part of a designers' methodology.

Design Methodology

Visualizing Research

Visualizing Research was used as a template for the design methodology, identifying the main avenues: conceptual process/schematic process and design development leading towards prototype production. This presents a synopsis of each stage of the design process broken down into separate sections. Throughout each of these phases, the design process was evaluated through desk critiques and meetings reviews. The design investigation intended to create a line of products that were inspired by the concept of food covers or better known as tudung saji weaving pattern. The process began with experimentation with a 2-D point, line, and plane. Next, the patterns were generated in 3-D form. SketchUp, a computer program, materialized perspective drawings alongside hand-renderings. The focus remained primarily on 3-D computer modelling with digital representation taking a primary role. The design phases included in this exploration were conceptual or schematic exploration, design development, and analysis.

Findings

Conceptual / Schematic Exploration

The designer generated and documented a design process that was informed by contemporary designers, craft theory, inclusive design theory, and fusing traditional craft techniques and

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Volume 3 Issue 8 (December 2021) PP. 74-86
DOI:1035631/IJCREI.38006

contemporary wall cladding design. The focus remained on 2-D point, line and plane. The reason for this focus was due to the emphasis on handcrafting techniques in this investigation. Geometrical grids are highly useful. They provide a formal linear straight edged pattern with sharp corners which evolve into strong visual repeats, from simple brickwork to basic weaving patterns. This is based on simple regular tiling of triangles and hexagons. The size of these triaxial or hexagonal weaves remained small for purposes of efficiency in producing multiple ideas quickly. The designer documented the process by taking notations/annotations, creating drawings, and taking step-by-step screen captures of any digital work. In Fig.1 Patterns of tudung saji weaving is identified as Flock of Pigeons, Standing, Cape Flower, Bold Head, Sailboats and Five States patterns (Zamri, et al.2014).

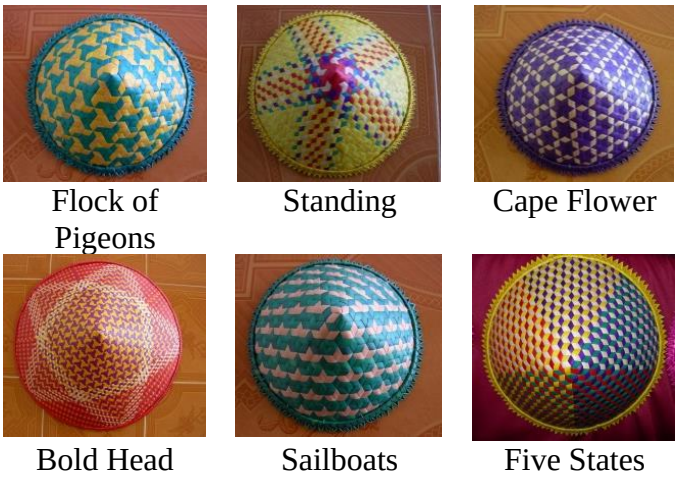

Figure 1: Patterns of Tudung Saji Weaving

Source: Zamri, et al.2014

The conceptual exploration next focus on flock of pigeons motifs. The example of Pati Sekawan (Flock of Pigeons) template is shown in Fig.2. Pigeons have played a major role in human history and symbolism. One significant traits of pigeons are their immense ability to adapt. Pigeons are a symbol of strength, flexibility and victory. Known to be highly social creatures, pigeons are often seen performing graceful and captivating aerial displays with their flock.

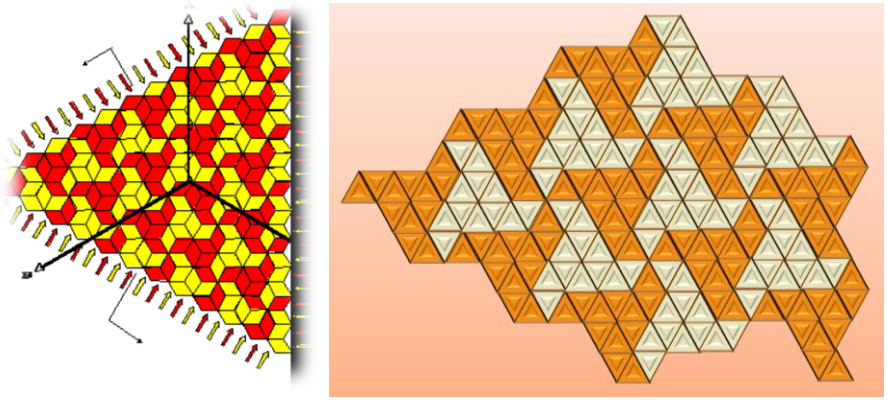

Figure 2: Pati Sekawan (Flock of Pigeons) Template

International Journal of Creative Industries
IJCREI
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Volume 3 Issue 8 (December 2021) PP. 74-86
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Abstraction of the motif is further developed. A significant value of the collage or composition of images, is shown in Fig.3 Mood Board Flock of Pigeons.

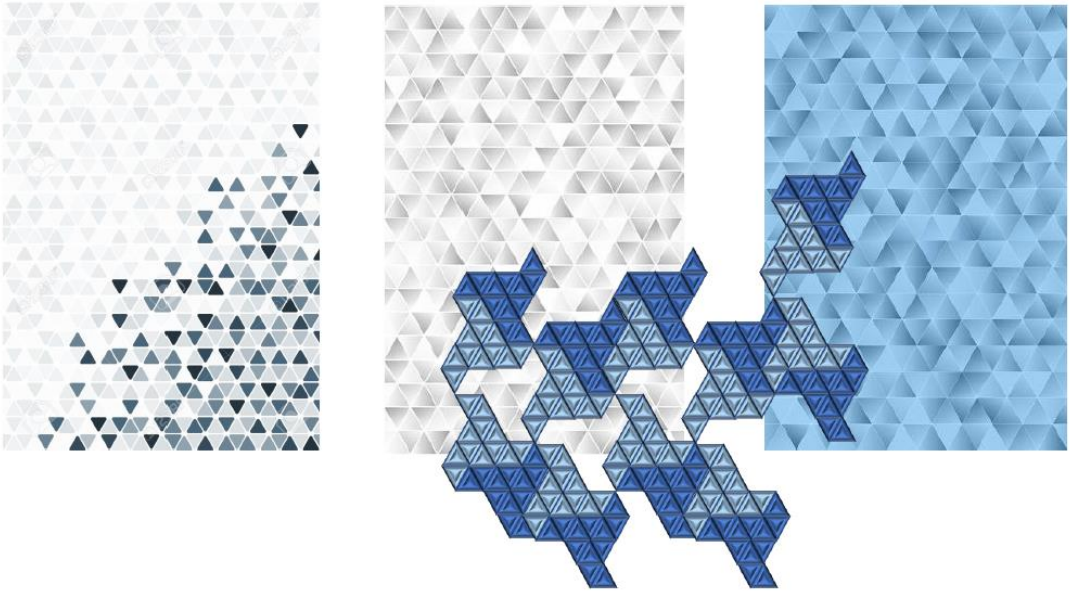

Figure 3: Abstraction Flock of Pigeons

The design exploration continues with integrating the conical shape in vertical planar wall in Fig.4 Shape of Tudung Saji with Flock of Pigeons motifs. In surface design, the emphasize is on the tactile quality of the cladding pattern.

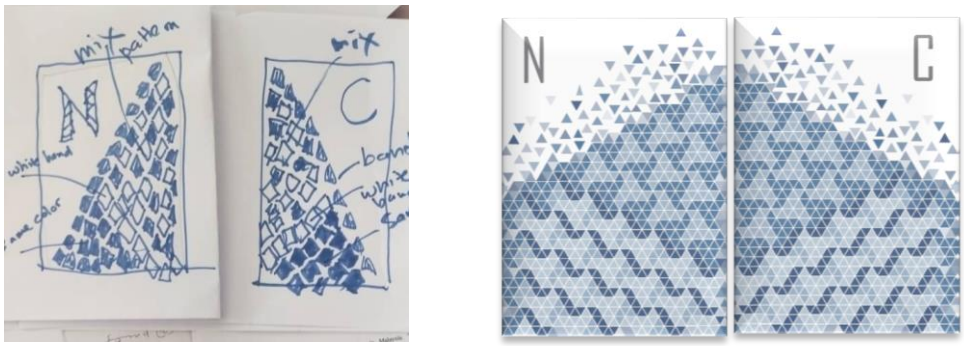

Figure 4: Shape of Tudung Saji with Flock of Pigeons Motifs

Additionally, design ideas were used to provide a purposeful framework for the design process. Reflective note-taking is a useful device to deposit a range of information, which is added to and consulted regularly. This contains activity and development sketches, information about the pace and progress of work, and key points from evaluation and analysis. The notes keep more descriptive and discursive information concerning thoughts and insights from the designer and of how the design process progressed.

International Journal of Creative Industries
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Design Development

Even during the prototype patterns, design development still continued and the designer continued to evaluate and change the design. After the creation of numerous 2-D triaxial or hexagonal patterns, consultant members assisted the designer in selecting the most promising ideas to pursue further. The design that were deemed the most successful were taken to the next level. The designer further refined and developed models in the form of 3-D digital representations. The designer continued to document the process using notations/annotations, creating drawings, and taking screen captures of any digital work. Fig.5 is the axonometric view of the National Centre Food Safety. The main lobby is represented by the conical shape of the 'tudung saji'.

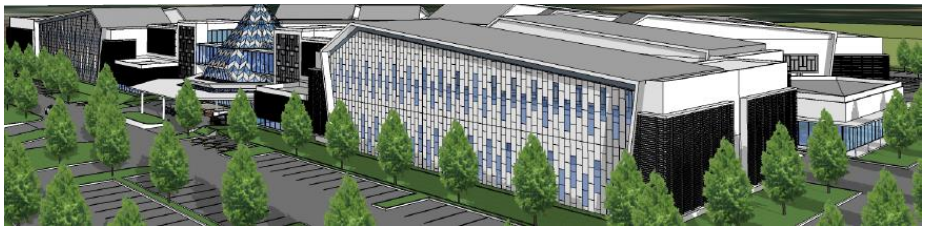

Figure 5: Axonometric View of the National Centre Food Safety

Next, Fig.6 is showing the main Lobby Floor Plan where the chill water wall is placed in the central area. The early design development of the chill water-wall is made of brick and layered in solid void intervals.

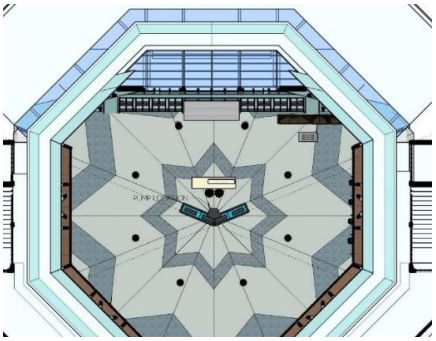

Figure 6: The Main Lobby Floor Plan

Refer Fig.7 Design Proposal 1 Flock of pigeons (brick). The flock of pigeons motifs was proposed as imprinted on the brick surface. The initials NCFS was also integrated as part of the brick wall design.

International Journal of Creative Industries
IJCREI
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Figure 7: Design Proposal 1 Flock of pigeon (Brick)

Next, the alternatives of using 3D hexagon diamond tile was proposed to install the motifs as wall cladding. This is shown in Fig.8 3D Hexagon Diamond tile. However, the most motifs suitable with the hexagon tile is the cape flower (bunga tanjung). It is somewhat different than the early schematic design considering the tile shape availability.

Figure 8: 3D Hexagon Diamond Tile

Refer Fig.9 and Fig.10 Design Proposals Cape flower - front view and aerial view. The design was evaluated again to assess the progress and development of the investigation. This design development stage eventually materialized refined detailing in 3-D models and a full body of work with the addition of detailed specs.

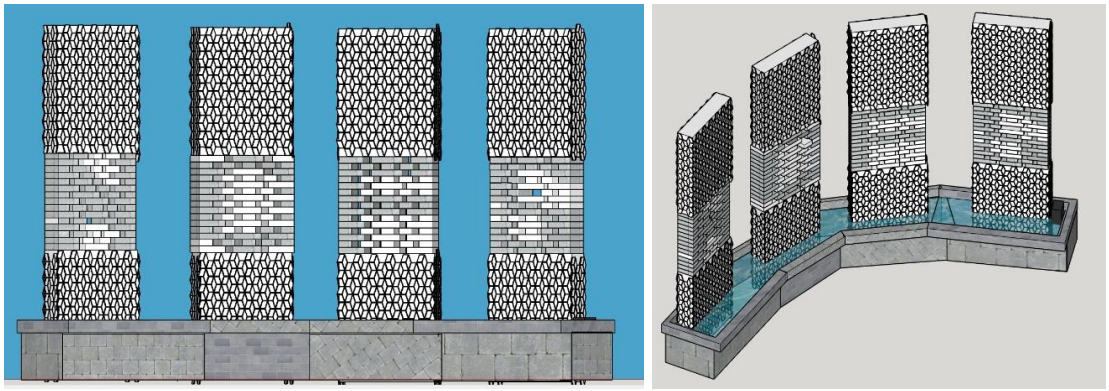

Figure 9: Design Proposal 2 Cape Flower - Front View and Aerial View

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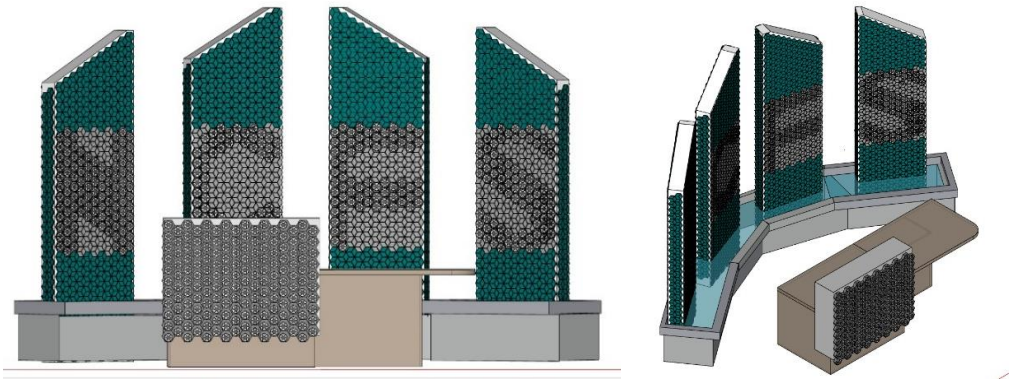


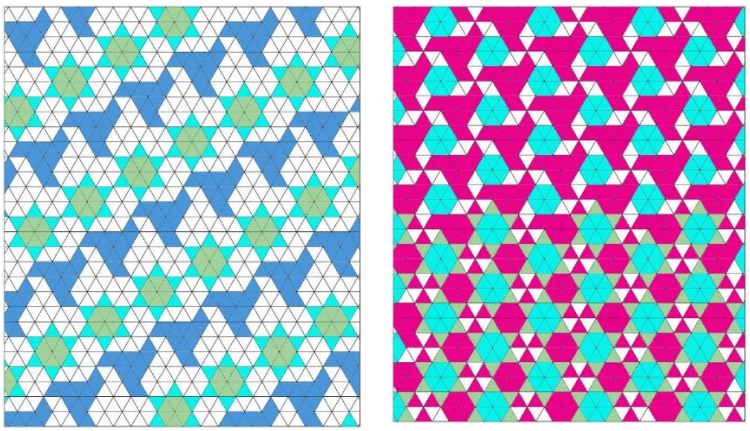
Figure 10: Design Proposal 3 Cape Flower - Front View and Aerial View

Analysis

A panel of experts of the design and built consultant members analyzed the design process and its resulting products at regular monthly meetings. Additionally, chronological analysis had been done during this stage to evaluate the overall design process and its products. The growth and development of the designed products have been analyzed over time. In order to provide options, colour alternatives for the tile cladding design on four different chill waterwall was further discussed. Eventually, the base bricks also require a few design options with tile, hollow space or without hollow space. Refer Fig. 11.

Figure 11: Design Options with Tile, Hollow Space or Without Hollow Space

Progressively, options on the layout of colour set was also discussed as highlighted in Fig.12.



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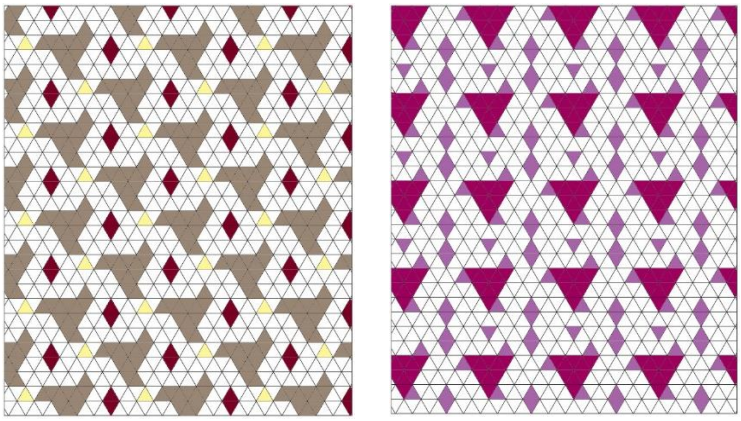

Figure 12: Options on the Layout of Colour Set

Discussion

The literature review of inclusive design theory and craft theory provided the designer with the basis to design a line of innovative cladding design pattern with the purpose of creating a passive cooling system. The design process of water-wall design merged seamlessly with the reinterpretation of traditional crafts. Additionally, the familiarity associated with crafts reinforces the efforts to merge craft sensibilities and practices with new making technologies and computational strategies. The design process focused on the creation of 3-D physical models with reference to tudung saji pattern, woven using a specific technique of triaxial or hexagonal weave, plaited in three directions. The methodology employed by the designer consisted of generating numerous early tentative solutions while leaving many options open before narrowing them down. This recognition that design is reflective and largely intuitive served the designer throughout the process. Gaining feedback from the designer, architectural and sustainability consultants was crucial to the design investigation. Through open-ended discussions throughout the design process, the designer collaborated with the consultants and gathered suggestions for further development of the designs.

Conclusion

Crafts derive meaning from their traditional heritage. Essential to its creative aspect, is the ability of craft goods to be identified as social objects that accept importance beyond its household utility; they signified and legitimized social roles and group belonging. Reviewing current nostalgic trends in architectural design, the designer synthesized these ideas and created a design process that emphasized the traditional craft element. The chilled water-wall design created in this investigation revealed their contemporary side with the concrete, brick and tile cladding portions of their vertical frames while staying true to their traditional side with regards to their meanings behind the pattern. In this fast-paced modern age, crafts represent authenticity and portray a personified element. Crafted objects nourish the mind and soul by manifesting an emotional connection. The rich history associated with craft-making also further reinforces this connection. With the completion of this design investigation, the designer concluded that the prototypes succeed in enhancing design of a functional water-wall, which in turn enriched visual and spatial comfort with the passive cooling system. The implication of the study is to inculcate the symbolic application of cultural values in craft goods towards design. Future work towards sustainability in craft is part of revival. Traditional Malay craft need abstraction and reinvention in a contemporary way, to create an expressive connection and foster cultural identity within time and space.

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