DESIGN IDEALS

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REVIVING OF ADAT BERSIRAM TRADITION AND ADAPTIVE REUSE OF MASJID LAMA KAMPUNG TANJUNG BERINGIN, SERI MENANTI, NEGERI SEMBILAN DARUL KHUSUS

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ABSTRACT

Masjid Lama Kampung Tanjung Beringin was built in 1892 by Raja Melewar and the villagers. The mosque is left abandoned for many years without proper care, hence this building has present of defects and missing parts. Restoration an old building with different function has been applied a long time ago with the intention of reviving the building. There are many approaches to revive an old building, such as, adaptive reuse. The aim of this study is to revive the tradition that takes place at Masjid Lama Kampung Tanjung Beringin, Seri Menanti, Negeri Sembilan Darul Khusus through adaptive reuse. The objective of this project is to identify factors causing the functional deterioration of Masjid Lama Kampung Tanjung Beringin, to identify the significance of the mosque in order to revive its function, and to revive the function of the mosque through suitable approach.

This study will discover the right process of adaptive reuse and a documentation on the fabric of the site as well as its previous functions as one of its significant value. Perhaps, this study will be beneficial to the people. Specifically, this study analyses eight methods have been used in analysing the site on its motifs, defects, functions, and the design of the mosque in order to fulfil the objective of the study. This study finds the intricate carvings in the mosque that might have related to the reign of Raja Melewar and also related to the adat bersiram tradition that takes place in the mosque. Lastly, this study suggest that adaptive reuse is the best conservation works in hopes it will bring back from the edge of death of this mosque.

RESEARCH INTRODUCTION

Adaptive reuse means a renovation work and reuse of existing structures for new purposes. This happened often on a religious building, castles, and many more. This can be seen in Osaka Castle, Japan has turned to museum, Carcosa Seri Negara, Kuala Lumpur has become a hotel today and even Malaysia's castles like Istana Lama Seri Menanti, Negeri Sembilan and previous Istana Negara, Kuala Lumpur that has turned to museum to attract more tourist. However, old building that have undergone for adaptive reuse approach are often have conflicts with the user or perhaps with its own identity, especially religious building that have a different function. Usually the conflicts can be related with the sanctity of that building. As we know, religious building is used to perform religious practices which we often see it as a sacred building.

METHODOLOGY

The research using two different methods, which is, primary data and secondary data.

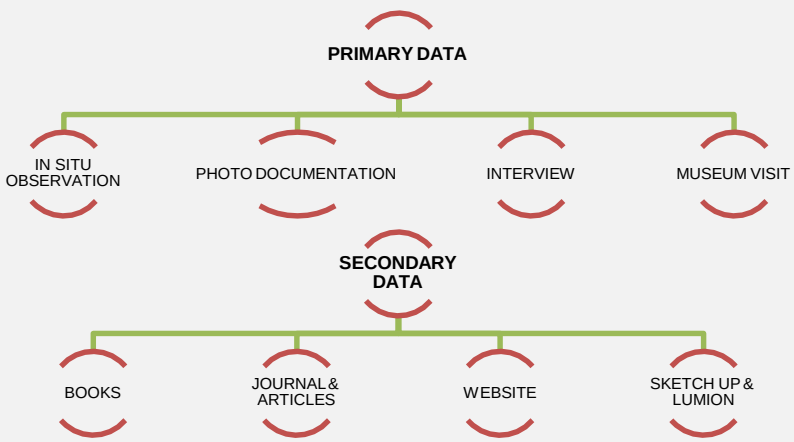


Figure 1: Research Methodology

PROBLEM STATEMENT

1

- The mosque is left abandoned for many years and lack of documentation. It is hard for a researcher to get any information regarding this mosque.

2

- Since the mosque was left without proper care, hence this building has present of defects and missing parts.

3

- There are missing parts in the mosque, which is the ceiling of the mosque are mostly detached missing due to decayed and very old.

4

- The mosque has not been used for about 55 years and perhaps the last ruler used for *adat bersiram* was Tuanku Munawir.

5

- There is no evidence or people who know the exact location of previous site of the mosque.

6

- The detail event of *adat bersiram* that takes place in the mosque also could not be found since the event happened hundred years ago. Only verbal story from the villagers is the reliable sources.

SITE LOCATION

The mosque is located at Lot 2450 in Kampung Tanjung Beringin, Seri Menanti, see Figure 2. Historically, this mosque is the first mosque established around the Pekan Diraja Seri Menanti.

Figure 2: The location of Masjid Lama Kampung Tanjung Beringin
Source: Google Earth (2019)

AIM & OBJECTIVE

OBJECTIVE

- To identify factors causing the functional deterioration of Masjid Lama Kampung Tanjung Beringin
- To identify the significance of Masjid Lama Kampung Tanjung Beringin in order to revive its previous function of *adat bersiram* as part of the coronation process of Negeri Sembilan royalty
- To apply adaptive reuse towards improving the function of Masjid Lama Kampung Tanjung Beringin

AIM

- To revive the *adat bersiram* tradition as part of coronation process and Masjid Lama Kampung Tanjung Beringin, Seri Menanti, Negeri Sembilan Darul Khusus through adaptive reuse.

FINDINGS

From the interview session conducted with Mrs. Rokiah from Jabatan Warisan Negara, Kuala Lumpur. Masjid Lama Kampung Tanjung Beringin was gazette as National Heritage in 2012. Meanwhile, the interview with Mr. Rosiswandy, the Assistant Curator at Muzium Adat Negeri Sembilan, Jelebu, found that there are many names regarding adat bersiram. the names are, *Adat Mandi Berlangir, Mandi Limau, Berlimau Langir, Adat Bersiram Tabal, Adat Mandi Safat, and Istiadat Mandi – Mandian.*

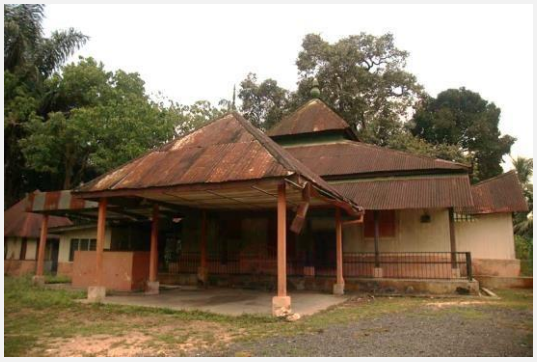
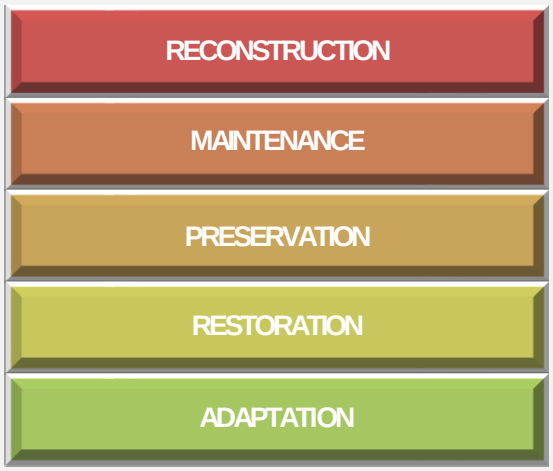


Figure 3: Current condition of the mosque

BUILDING CONSERVATION WORKS

Conservation encompasses all the processes of looking after a place so as to retain its cultural significance. It includes:



CASE STUDY

The uses of a building may change from time to time though, when the main purpose shifted into a new purpose in order to meet the current needs and at the same time preserve its authenticity. In those days, some historical buildings have been reused into a museum or concert hall, library, houses, offices, restaurants (Ariffin, et al., 2017). According to Mine (2013), there are two possible method to adaptive reuse a building, first, to preserve the originality of spatial and volumetric organization of the building which has been applied to Sephardic Synagogue, Amsterdam. Secondly, method of restoration that change the originality of spatial and volumetric organization of the building, can be seen in Carmo Monastery, Lisbon, Portugal & Demirci Mosque, Turkey.

Figure 4: Sephardic Synagogue, Amsterdam

Figure 5: Demirci Mosque, Turkey

Figure 6: Flow of the royal *adat bersiram*

ROYALTY OF NEGERI SEMBILAN

Tuanku Muhriz ibni Almarhum Tuanku Munawir is the 11th Yang di-Pertuan Besar of Negeri Sembilan, Malaysia. Tunku Muhriz is the only son out of six children of the late Tuanku Munawir ibni Almarhum Tuanku Abdul Rahman, the Yang di-Pertuan Besar of Negeri Sembilan from 1960 to 1967.

However, he was bypassed by the Council of Undangs to become Yang di-Pertuan Besar when his father died in 1967 for his uncle, Tuanku Jaafar. Tuanku Jaafar was elected by the Undangs as the 10th Yang di-Pertuan Besar of Negeri Sembilan (Kerajaan Negeri Sembilan, 2019).

Figure 7: The chart of family pedigree of Yang Di – Pertuan Besar Negeri Sembilan
Source: Brendan (2008)

ADAT BERSIRAM

Adat bersiram in Negeri Sembilan Darul Khusus, it started with the placement of Alat Kebesaran Diraja at the lawn of Istana Besar Seri Menanti. Then, they all must wait for the arrival of four Undang. Yang Di – Pertuan Besar and the Tengku Ampuan will sit on a carriage called Maharaja Diraja to drawn by Pegawai 99 to Panca Persada. The carriage will be drawn from the palace's lawn to Panca Persada. When the Yang Di – Pertuan Besar and the Tengku Ampuan sit on Panca Persada, Orang Empat Istana will take the silver tray and bowl and round the king and queen for seven rounds.

After the Orang Empat Istana finished their ritual, the Yang Di – Pertuan Besar and the Tengku Ampuan will dipped their hands into silver tray and bowl that contain lime powder.

Figure 8: Adat bersiram of Yang Di – Pertuan Besar Negeri Sembilan
Source: Warisan Permaisuri (2014)

DESIGN PROPOSAL

The site of Masjid Lama Kampung Tanjung Beringin is in irregular shape. The site is to be use as a place to display a Maharaja Diraja (royal carriage) and Panca Persada (stage for royal *adat bersiram*) as illustrated in Figure 9. These two important replicas in royal adat bersiram is needed in the site to give the image of previous events during the reign of Raja Melewar.

Moving to the interior of the mosque, it will be a museum for adat bersiram Yang Di – Pertuan Besar Negeri Sembilan. This museum will provide an exhibition regarding the event, from the garments, equipment, and tools used during the event as illustrated in Figure 10.

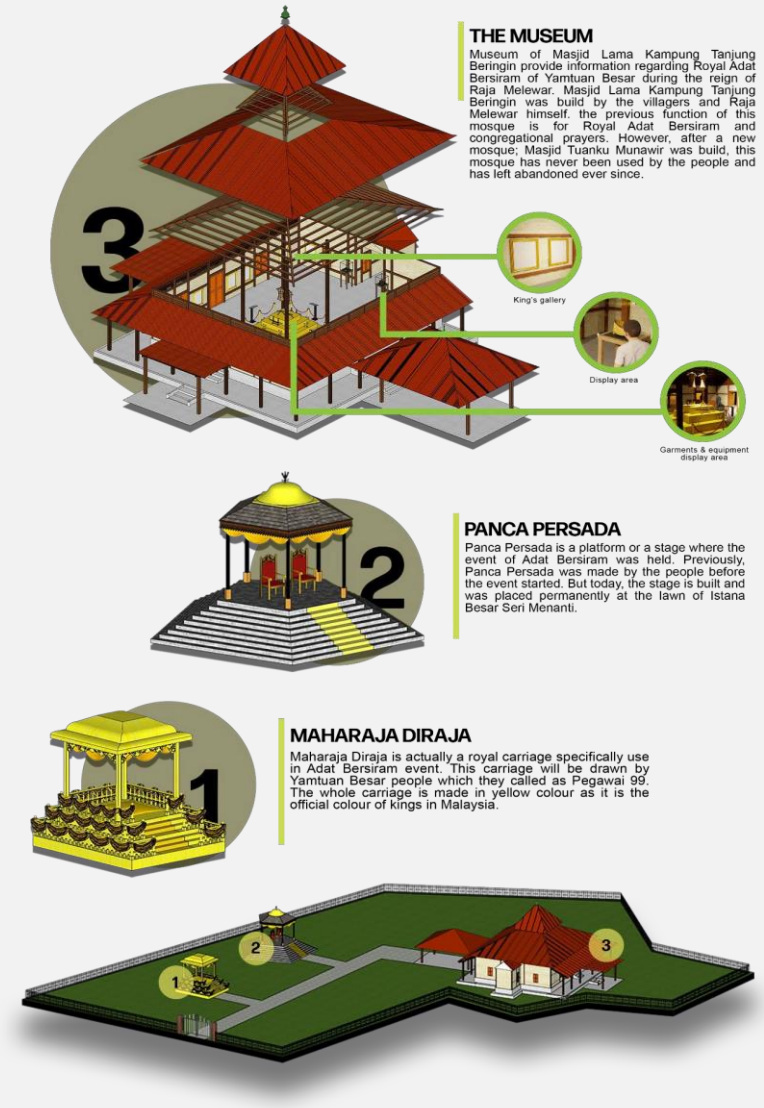


Figure 9: Proposed placement of Panca Persada and Maharaja Diraja on site

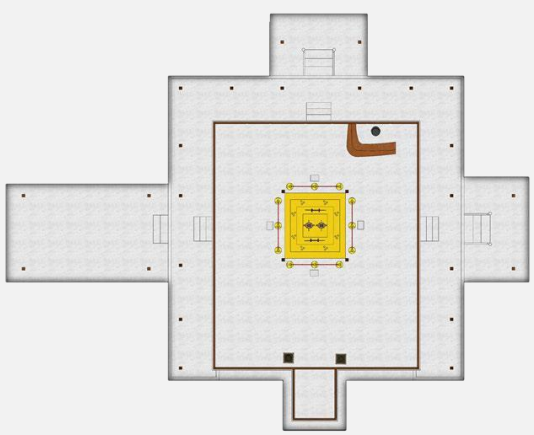


Figure 10: Spatial design of the proposed museum

3D IMAGES

Figure 11: Maharaja Diraja on site

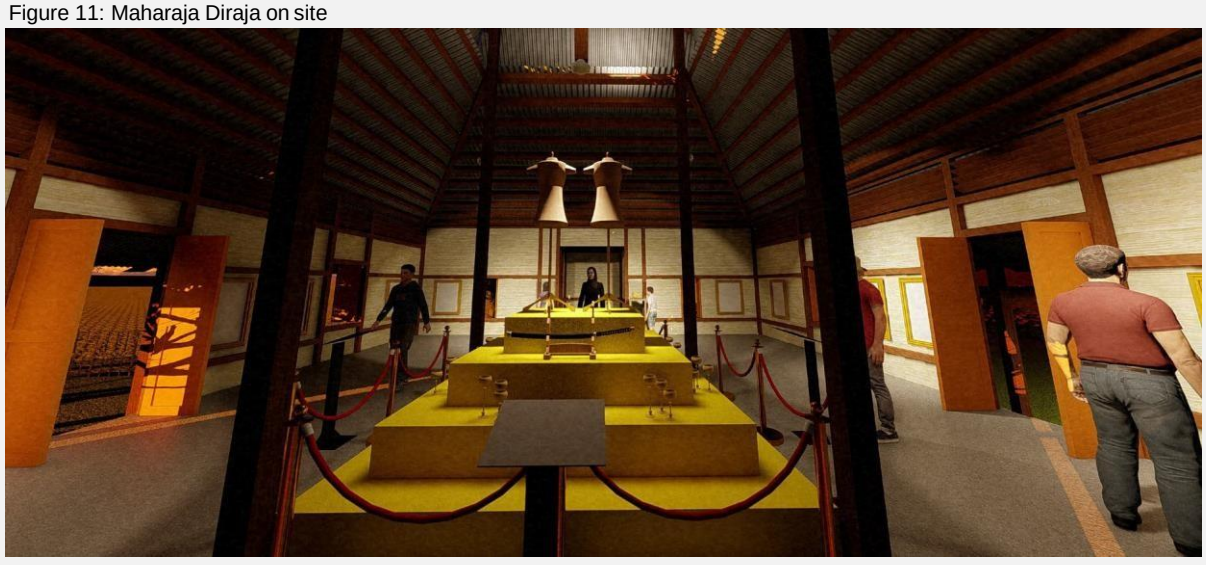
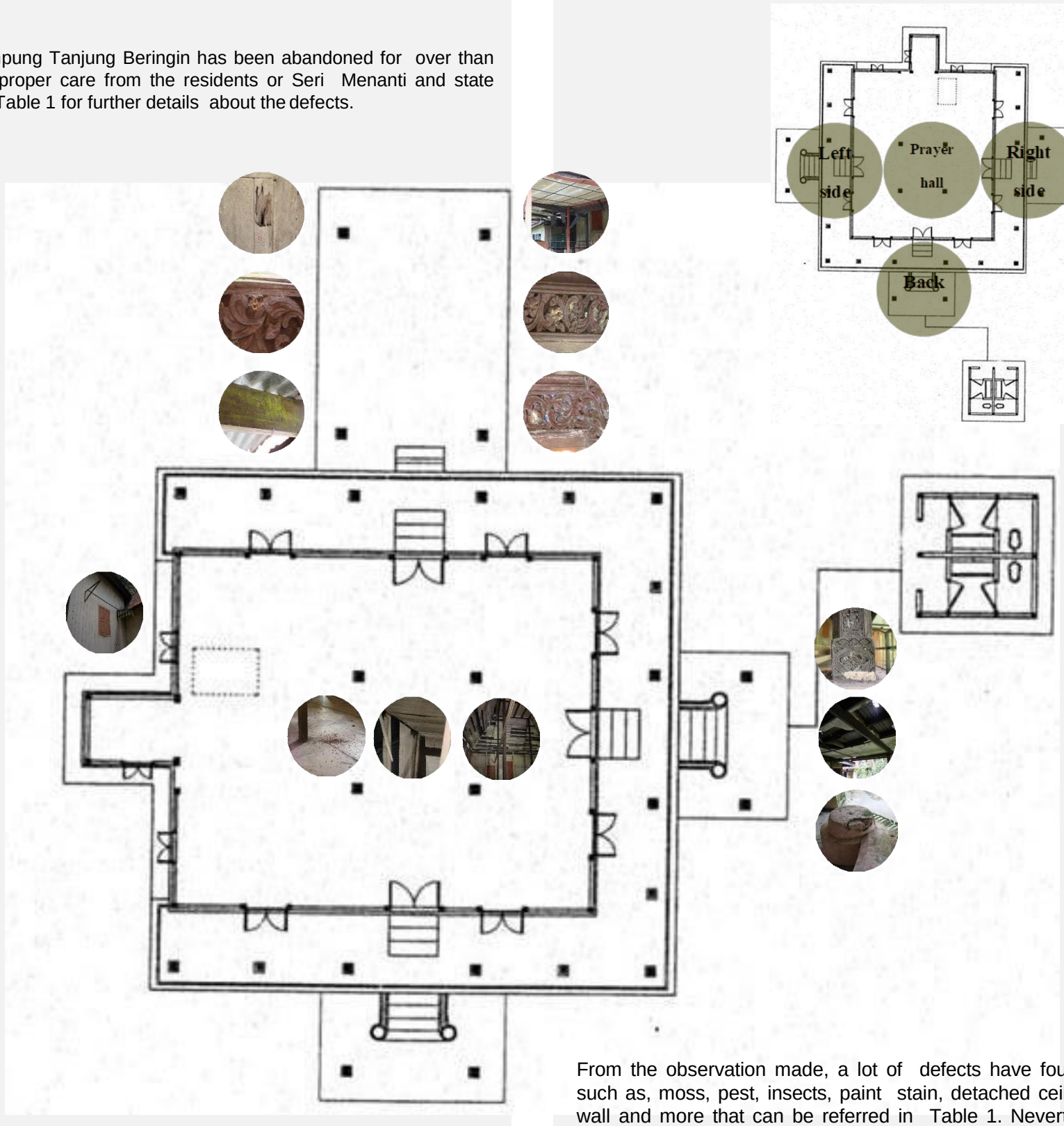


Figure 12: The display area in proposed museum of Masjid Lama Kampung Tanjung Beringin

Figure 13: The display area at mihrab area

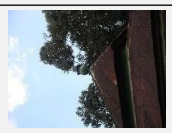
DEFECTS

Masjid Lama Kampung Tanjung Beringin has been abandoned for over than 50 years without proper care from the residents or Seri Menanti and state authorities. Refer Table 1 for further details about the defects.



From the observation made, a lot of defects have found in the building, such as, moss, pest, insects, paint stain, detached ceilings, dirt, decayed wall and more that can be referred in Table 1. Nevertheless, the overall condition of each defect can categorize as moderate. The pillar still stable, and it is believed that the lifespan of the pillar is long.

Table 1: List of defects found in the mosque

No.	Location	Types of Defects	Defects
1.	Roof structure (right side)	Moss	
2.	Entrance pillar (right side)	Pest	
3.	Entrance pillar (right side)	Paint stain	
4.	Entrance pillar (right side)	Pest & insects	
5.	Entrance pillar(back)	Paint stain	
6.	Prayer hall	Bat's waste	
7.	Prayer hall	Bat's nest	
8.	Prayer hall	Detached ceiling	
9.	Mosque's wall (right side)	Decayed wall	
10.	Mosque's wall	Dirt	
11.	Entrance stair (back)	Flaking paint & fragmented stone	
12.	Entrance porch (back)	Detached ceiling	
13.	Entrance stair (left side)	Moss	
14.	Front window	Detached roof	
15.	Mosque's roof	Rusted roof	
16.	Entrance porch (right side)	Decayed ceiling	

CONCLUSION

The first objective of this research is to identify factors causing the functional deterioration of Masjid Lama Kampung Tanjung Beringin, Seri Menanti, Negeri Sembilan Darul Khusus. This can be seen in this mosque. The mosque has been abandoned for quite a long time and never been used ever since. Hence, during the observation it can be seen that the mosque has a lot defects occurs on the fabric of the building.

Secondly, the objective is to identify the significance of Masjid Lama Kampung Tanjung Beringin in order to revive its function. From the observation made, it can be found that a lot of significant value can be found on the site. For example, the motifs and the fabric of the building. The motifs were carved by the villagers and the design of the mosque is basically a traditional mosque design but a bit different since it is quite big for traditional mosque.

The third objective is to revive the function of Masjid Lama Kampung Tanjung Beringin through suitable approach. The intention of this research is to find whether the method of adaptive reuse is suitable for preserving an old building, especially old mosque since it could create criticism among the region.

Preservation through adaptive reuse is seen to be more closed to the one region as it can revive the building into different use. All four case studies have proven that it is not only for house of worship but also can be used as a tourist attraction and a place beneficial for the people, like library in Demirci Mosque, Turkey. Looking at the condition of Masjid Lama Kampung Tanjung Beringin, it is suitable to use this approach as it can help to prevent the building from deteriorate and at least have a proper care.

FUTURE RESEARCH AREA

These are the potential research area that provides a natural guide to future research

1

This research can be deepened more in doing the experiment on the material found on the site to get a specific data like, the exact year of the mosque, alternative material that can replace the original material.

2

More architectural works need to be done, using advanced equipment such as, Building Information Modelling (BIM), 3D building scan, technical drawing, and more. This is to ensure that all the detail information is in one place and easy to access if there is in need to refer in the future.

3

Study on organizations related to the field area is needed to avoid wasting time when the study is conducted. The researcher should know the role of each organization in their respective fields.

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06

SPECIAL AREA PLAN (SAP) FOR BANDAR MAHARANI, JOHOR ROYAL TOWN

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ABSTRACT

This project of Development Action Plan was carried out in a special royal town of Bandar Maharani, Johor. It is a historic town and the capital of Muar District, Johor. Though there are many potentials to be further enhanced, several issues need to be resolved for better environmental quality.

The suggested development approach relates to its physical condition, taking advantage of Sungai Muar that lies in the middle of the town. Thus, the riverfront development is recommended with many improved elements of urban design to elevate the image of the urban heritage of Bandar Maharani. Among the key projects are water taxi, Sungai Bentayan open space and, Muar bridge gateway, and sky pedestrian.

INTRODUCTION

The proposed redevelopment of the riverfront of Sungai Muar is partially taken from the Special Area Plan (SAP) of Bandar Maharani, Johor. It is a historic town and the capital of Muar District, Johor. It is one of the most popular tourist attractions in Malaysia to be visited and explored for historical buildings from the pre-war period. It is declared the royal city of Johor by Sultan Ibrahim Sultan Iskandar and is the fourth largest city in Johor. The study discovered its strengths as its Sungai Muar apart from its valuable heritage covering the delicacy of foods, culture and aesthetic design of colonial buildings such as the famous Masjid Jamek Sultan Ibrahim, Muar High School, and Istana Bandar. Jalan Peteri, Jalan Maharani, Jalan Abdul Rahman, Jalan Arab, and Jalan Bakri are the main road located within the study area. The main obstacles are the street design and transportation aspects. Therefore, some riverfront projects were proposed to improve the overall ambient of Bandar Maharani like water taxi, gateway, and sky pedestrian.

METHODOLOGY

Provision of special area plan (SAP) is based on the provision of the Town and Country Planning Act, 1976 (Act 172), subsection 16B (2). The purpose of the special area plan is to accelerate detailed local character planning for an area that has an interest and specific characters. This project falls in category 2, i.e. for improvement of the heritage area. The study involved primary and secondary data collection on-site. A site investigation was conducted to gather the information, particularly on its strengths and weaknesses. Data for was collection covering the aspects of urban design, land use, transportation, and open space. Secondary data was obtained from Muar Municipal Council and other related technical departments. After the analysis of the site was done, the development concept and strategy was laid out. Following this step, detailed proposals were recommended, hoping to improve the overall image of Bandar Maharani as the royal town.

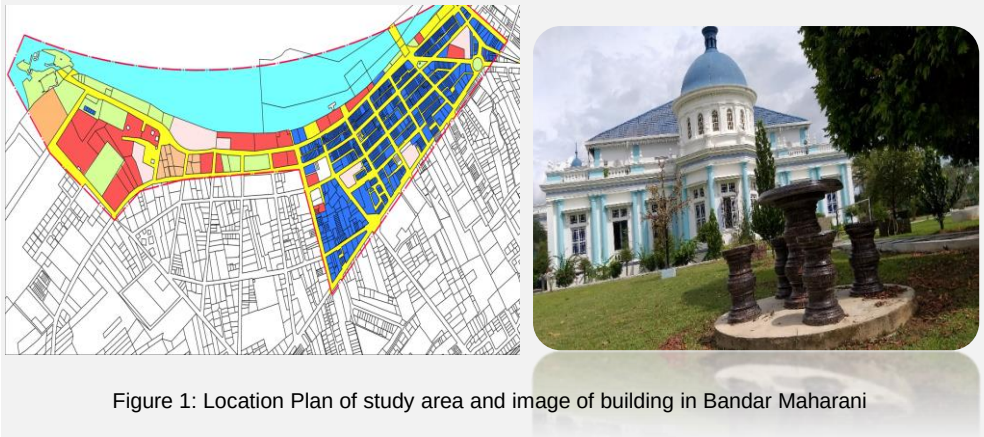


Figure 1: Location Plan of study area and image of building in Bandar Maharani

CONCEPT & STRATEGY

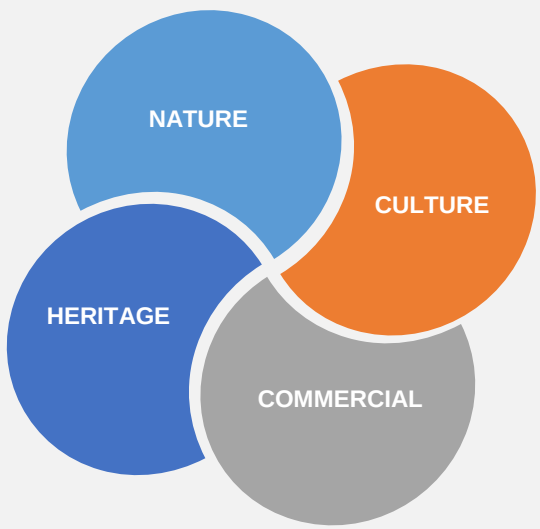


Figure 2: Moving towards the liveable, vibrant, attractive heritage township

PROPOSED PROJECTS

PROJECT ONE
ONE STOP CENTRE

PROJECT TWO
MUAR GATEWAY AND SKY PEDESTRIAN

PROJECT THREE
SUNGAI MUAR WATER TAXI (SMWT)

PROJECT FOUR
SUNGAI BENTAYAN-WATERFRONT OPEN SPACE

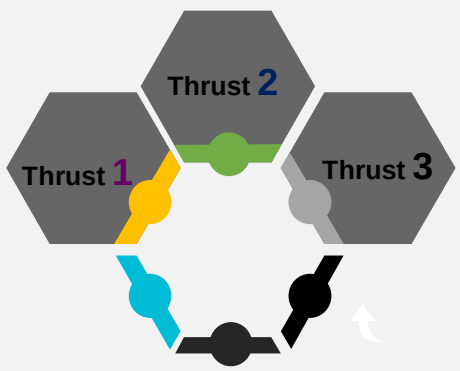
PROJECT FIVE
NEW TOURIST CENTRE

PROJECT SIX
OBSERVATORY PARK & MULTI LEVEL PARKING

DEVELOPMENT THRUST

Enhance accessibility, connectivity, and quality of road and pedestrian network of Bandar Maharani.

Highlight the heritage value of Muar town and improve the image of Bandar Maharani.



Improve and protect the areas that are the potential to promote the uniqueness of the historical royal town.

PROJECT FINDINGS

PROJECT 1: MUAR GATEWAY & SKY PEDESTRIAN

This project improves the image of the welcoming gateway of Sungai Muar by connecting it to the river bank. Six towers will be built, reflecting the royal image. The larger scale of structures supports the skyline and strengthens the overall image along the river. The objectives:

- To enhance the connectivity of the town
- To create a sense of welcoming and enhance the overall image of the town

Figure 3 : Current condition (2018)

Figure 4: Proposed condition (2024)

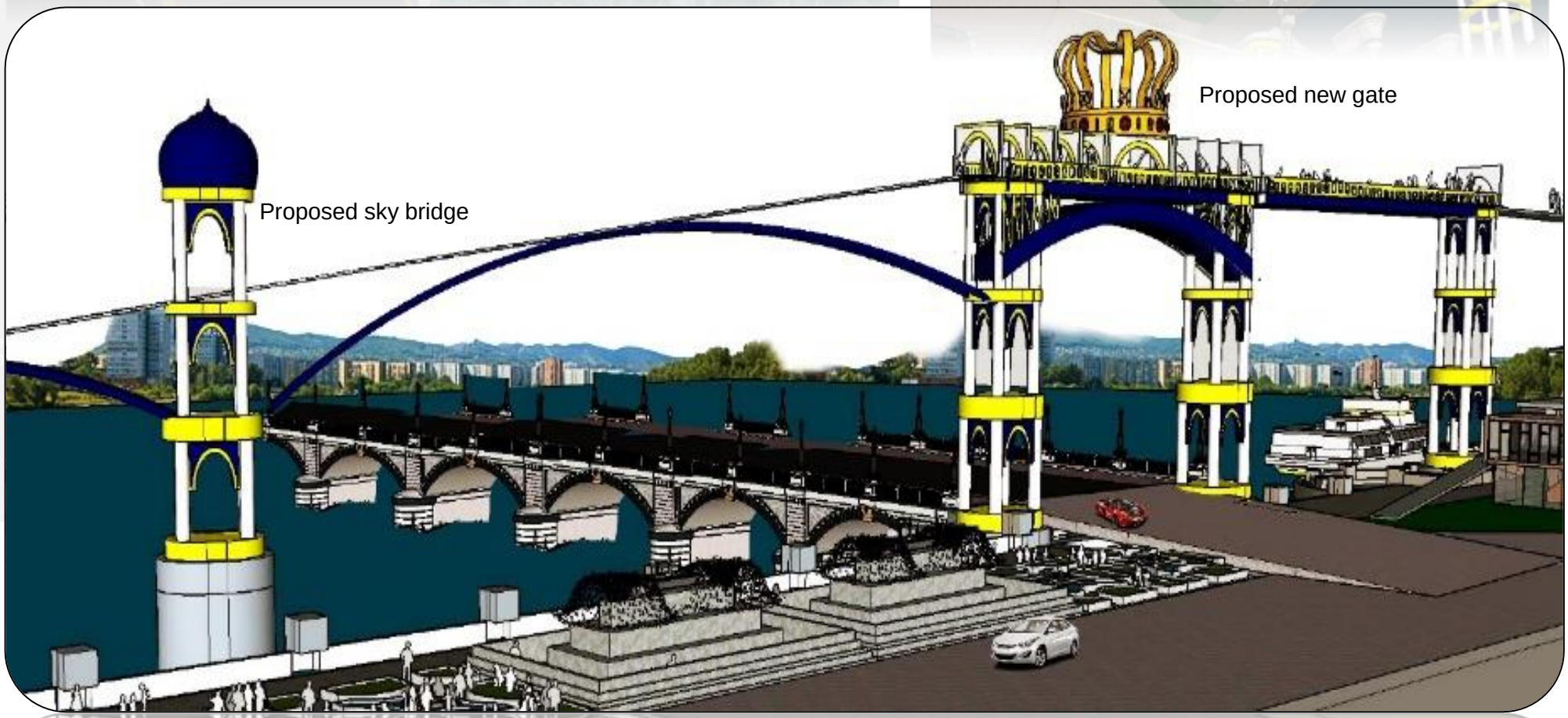


Figure 5: Proposed condition (2024)

PROJECT 2: SUNGAI MUAR WATER TAXI (SMWT)

This project improves the water-based transportation by providing better infrastructure, for instance jetty, and boats as water taxis. The mooring and anchorage sites are provided for convenient operation of the quay. The objectives are:

- To become as a new attraction and means of transportation for Bandar Maharani .
- It can ease the movement of the local people as well as tourists.
- Connects the state of Malacca and Johor to Bandar Maharani.

Figure 6 : Current condition (2018)

Figure 7: Proposed conditions (2025)

PROJECT 3: SG. BENTAYAN WATERFRONT OPEN SPACE

The improvement works at Sungai Bentayan waterfront is essential as it rejuvenates the open spaces to welcome more users. The availability of the present physical infrastructure will become the basis for some adaptive use of spaces, in which the main new components are towers, and overhang pedestrian bridge. The objectives are:

- To offer new place for social gathering and meet up, encourage healthy lifestyle as well as relaxing environment.
- To create connectivity of spaces that encourages the vibrant of activity along the riverbank.

Figure 8 : Current condition (2018)

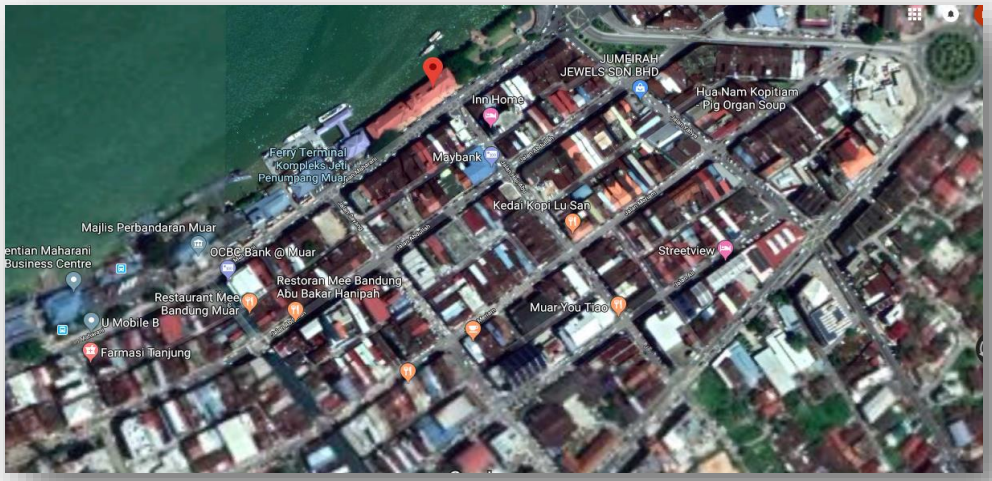


Figure 9 : Current condition (2018)

Figure 10 : Proposed condition (2025)

Figure 11 : Current condition (2018) (Images 1 & 2)

Figure 12 : Proposed condition (2025)

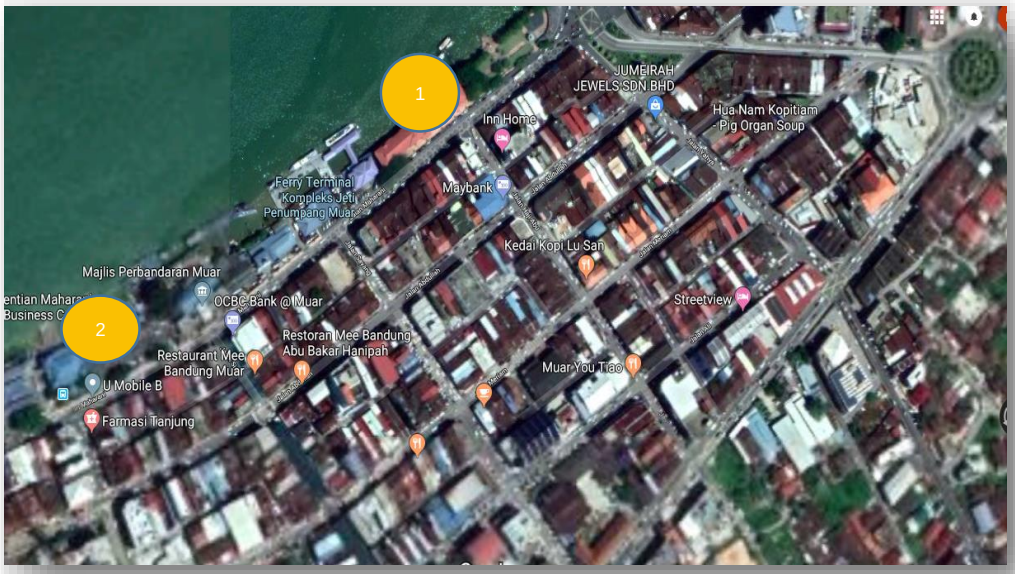


Figure 13 : Proposed condition of the water front (2025)

PROJECT 4: NEW TOURIST CENTRE

The proposed new tourist centre is vital for better operation of tourism activities. The objectives:

- To integrate it with one stop center for access
- To promote the local tourism products.

PROJECT 5: OBSERVATORY PARK AND MULTI-LEVEL PARKING

The proposed observatory park and multi-parking offers facilities of parking spaces and provides open space on its roof top to enjoy the over looking view of Sungai Muar. The objectives:

- To make good use of the existing parking building.
- To utilize the limited space for multi-purpose building.

CONCLUSION

In general, the proposals for waterfront area and Muar town itself reflect the importance of interaction between urban developments and the water. Bandar Maharani is fortunate to have the waterfront area as it is unique and irreplaceable natural resources. Therefore, the project of the Special Area Plan for Bandar Maharani is timely to improve its overall urban design image. It is rich in the abundance of natural, cultural, and historical heritage to be preserved for tourism development as a whole.

Figure 14: Proposed condition of Observatory Park and Multi-Level Parking (2025)

Figure 15: Proposed condition of Multi-Level Parking (2025)

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The authors would like to extend their appreciation to Miss Siti Rukiah Abd. Shukor and her team members from Muar Municipal Council for their help during our site visit in Tanjung Emas, Muar.

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FOSSEAL – A SEALER MECHANISM FOR FOOD WASTE MANAGEMENT

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ABSTRACT

This research aims to identify the behavior of household towards food waste management in the home kitchen and to propose a better way of food waste management method by developing a product. A total of 32 person (24 female and 8 male) were selected for a survey study. Two instruments were developed to collect data; first instrument was photography to show the real situation of waste management in one kitchen and second instrument was a survey questionnaire. The findings indicated that most of the respondents aware of Waste Separate Programme and has tried to separate their home waste.

This study also figured out behavior of household on their home food waste management. Most of respondents tie the plastic that contain rubbish before throw it into the Green Bin provided by their authority. The user prefers using small waste bin with a lid to help to prevent from bad smell comes from the waste bin and from insects and other animals. FOSSEAL is a new eco-friendly product that has a potential to improve the waste management at home as well as in formal institution i.e. hospital, school and offices.

RESEARCH INTRODUCTION

Our nation needs to have a new way to improve our waste management system. FOSSEAL is an alternative product to support waste separation campaign as promoted in Malaysia, and it is the best option for food waste management in various kitchens. The combination of sealing system and waste bin itself make it as a new innovation design that can improve hygiene and household behavior towards food waste management. FOSSEAL is a user friendly product, with a simple mechanical concept, which has an application of a sealer on the waste bin [figure 1]. The sealer can be installed easily and it is replaceable.

METHODOLOGY

The study on user awareness has been conducted recently, to enhance the validity of the product research. First, a questionnaire survey on user awareness towards waste separation programme has been done as well. The objective of the survey was to get the users perception towards the waste management and its demands. A total of 30 respondents from housing area near Gombak were selected for the survey. Also, the observation on user daily behavior towards food waste management has been conducted in 3 different house in Kuala Lumpur, Malaysia. At a later stage, an analysis on the product line-up has been done to identify the latest trend, material, dimension, colors and mechanism. FOSSEAL was inspired by the user behavior, who need to tie the plastic waste to ensure the hygiene, tidiness and convenience for the better food waste management.

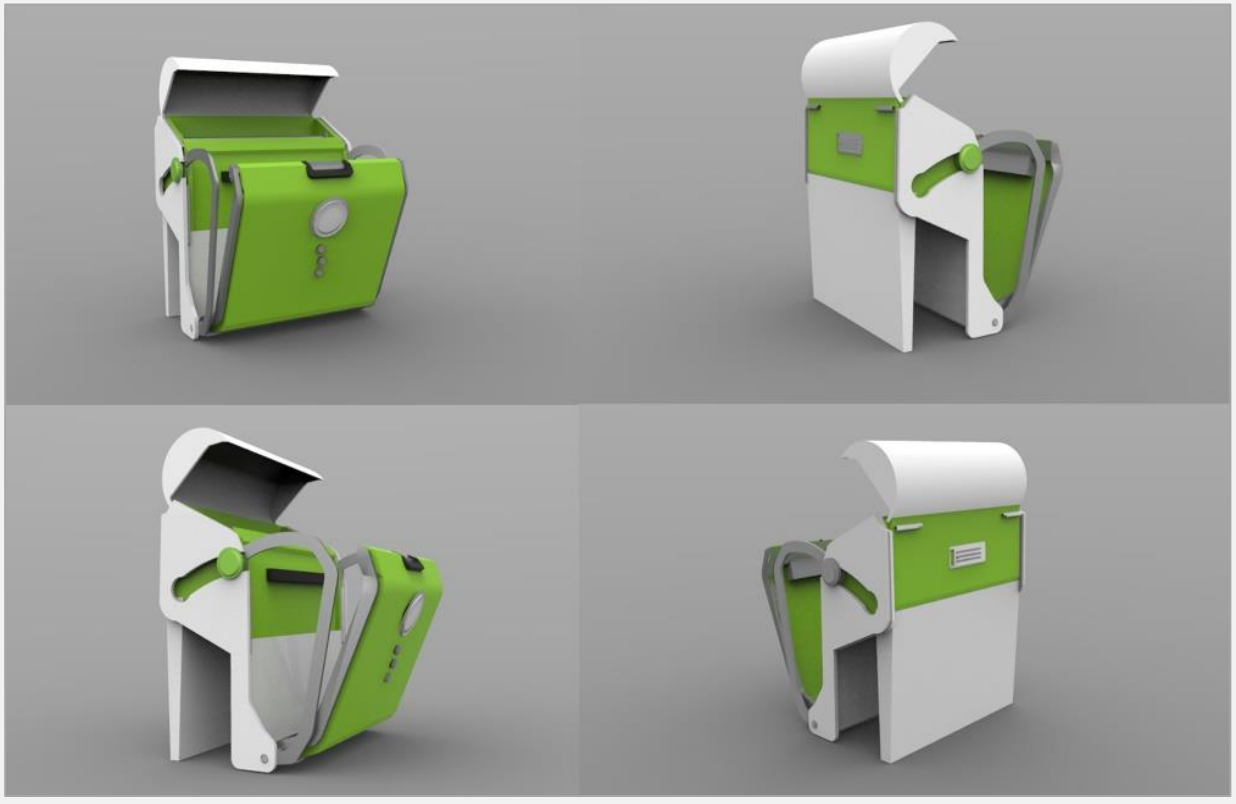


Figure 1: FOSSEAL – A sealer mechanism for food waste management

RESEARCH FINDINGS

LINE UP OF WASTE BIN FOR HOME USE

Many kinds of existing waste bins for home use were produced to provide a waste management system for municipal solid waste including food scrap, papers, bottles, clothing, appliances etc. Most of the design of waste bins are with or without lids, with or without pedal and with or without hook for hanging purposes. Most of the bins design are simple for hygienic purposes. According to Saeed et. al (2009), the municipal solid waste generated in Malaysia house hold is 0.8 – 0.9 kg per house hold in general, with food waste constitution approximately about 60% of the solid waste. Due to Malaysian weather is hot, home waste such as food scrap can be very smelly and watery. Therefore, it is good if innovation of design for waste bin can be developed to create more hygienic and user friendly.

Table 1: Line up analysis for existing waste bin

Design criteria									
DESIGN	Simple without lid and open, half pierced at the above.	Simple without lid and open, using wire for all over the body.	Full covered, comes with lid.	Full covered, come with lid that can be open with pedal. And plastic bucket inside Handy: lid remains open if opened manually, lid closes itself with pedal operation.	Full covered come with lid and pedal. And plastic bucket inside, Motion Control - light pedal operation and the lid closes silently. Handy: lid remains open if opened manually, lid closes itself with pedal operation.	Frame design, come with hook, light and simple, act as plastic holder , handy and frame	Full basket design, come with hook. Handy design, only hook when want to use it	pull-out under counter wastebin has been designed for door front fixing cabinets, and is designed with soft close runners	Door-Mounted, without lid.

FOOD WASTE SEPARATING AWARENESS

A questionnaire survey was done in Klang Valley area on 32 respondents, which 75% of them were females and 25% were male. There were three (3) sections in the survey; Section A : (Demographic), Section B (Awareness on Waste Separation Programme) and Section C (User Behavior Towards Food Waste Management). The result are as in Table 2 – 6.

Table 2: Respondents of Survey – Demographic

The result shows that 81.8% of the respondents alert on the Malaysian Waste Separation Programme. Only 57. 6% respondents having the green waste bin and recycle bin in their housing areas. 84% of them have a knowledge on garbage variation or groups. More than 50% of them had tried to separate their waste.

Table 3: Result of Awareness on Waste Separation Programme

	QUESTIONS	YES	NO
Q1	Malaysia Separation Program alert	81.8%	18.2%
Q2	Housing area provided by green wastebin and recycle bin	57.6%	42.4%
Q3	Garbage group knowledge	84%	15%
Q4	Tried separate garbage	61%	39%

There are 46% respondents who used small plastic bags before threw it to the green waste bin. 28% of them use only a dustbin to throw all rubbish without separating it. 25% of them used several bins and plastics before throwing it into the green bin. This result showed that the users are most of the users are alerts on the waste separation and tried to separate their waste for a better waste management at their home. [Table 4]

Table 4: Result of User Waste Management at Home

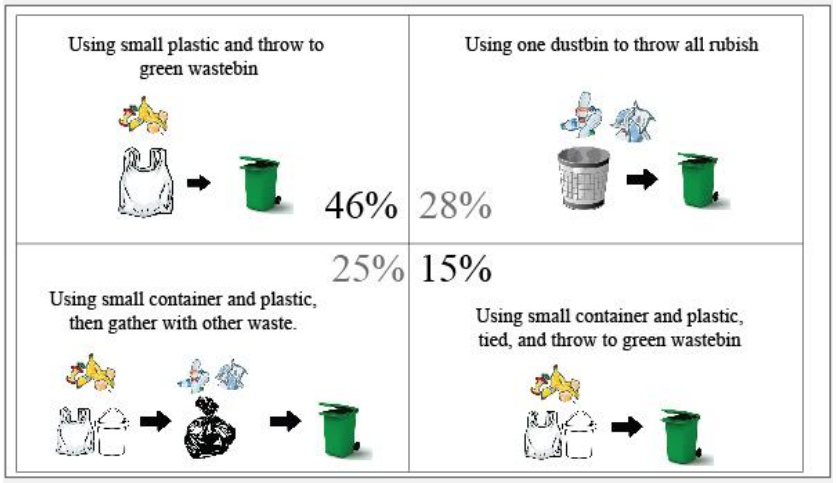


Table 5 shows frequency of throwing waste on weekly basis at home area. 45% of the respondents have a routine of throwing their home waste everyday, while another 45% of the respondents only throw it when their rubbish bin is full. Other respondents throw their rubbish twice and once a week. Table 6 shows several reasons from respondents on why they should tie their plastic bags that contains home wastes. Most of the respondents wanted to keep their home hygiene. 56% of them also wanted to avoid from flies and bad smells of the waste. 21% of them also wanted to avoid the home waste from the cats and dogs. From this result, most of the respondents alert on the clean and hygiene of their home, which they need to throw the waste everyday even though the rubbish bin is not full yet. They need a waste bin that more practical and user friendly.

Table 5: Frequency of Throwing Waste Weekly at Home

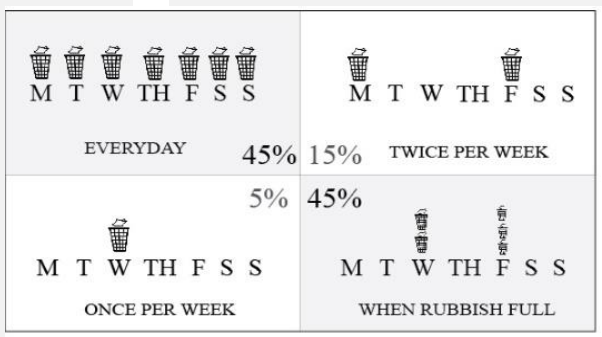


Table 6: Reasons users need to tie home waste plastic bags

Table 7 shows design preference by the respondents. Six (6) kinds of design (A – F) were the selected as the samples. Design A and F obtained the highest preference, which is 24.2% respectively. Design A have a lid to avoid the smell from the rubbish, which is consider as hygiene purposes. Design F is without lid but has a very user-friendly purposes. The least preference are Design B and C, which are less in their practicality.

Table 7: Result of User Preference on Waste Bin Design

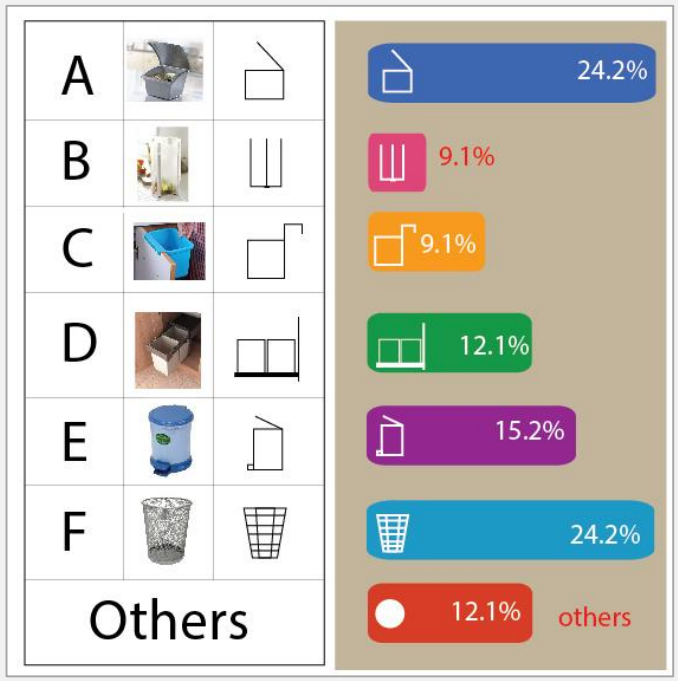
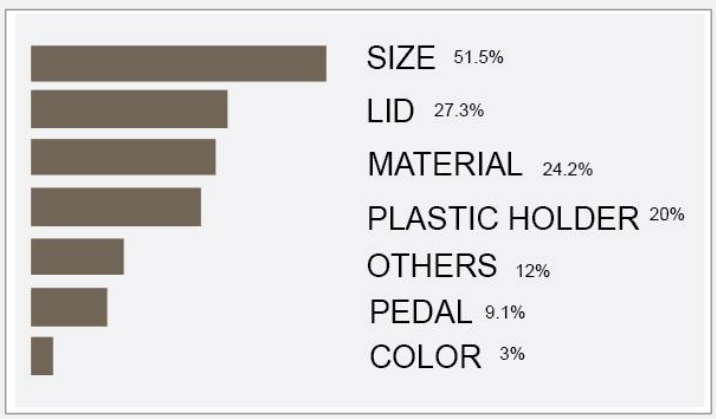


Table 7 shows several reasons of preference on waste bin design. Seven (7) different reasons were asked to the respondents. Respondents selected their design preference mainly based on size (51.5%), lid (27.3%), material (24.2%). It can be said that users consider more on size than the material and color for waste bin design. Waste bin with lid is also one of the consideration while purchasing the waste bin. Lid can help to cover the smells and keep the waste from home flies and other insects.

Table 8: Result of User Waste Management at Home



SKETCHES AND DRAWINGS

In the FOSSEAL design development, there are many stages were conducted which are thumbnail, idea development, proposal and final design. With undergo on all stages, appropriate final design can be gained under the supervision of the designer or expert. The idea development are as in Fig. 2. Design concept of FOSSEAL as in Fig. 3.

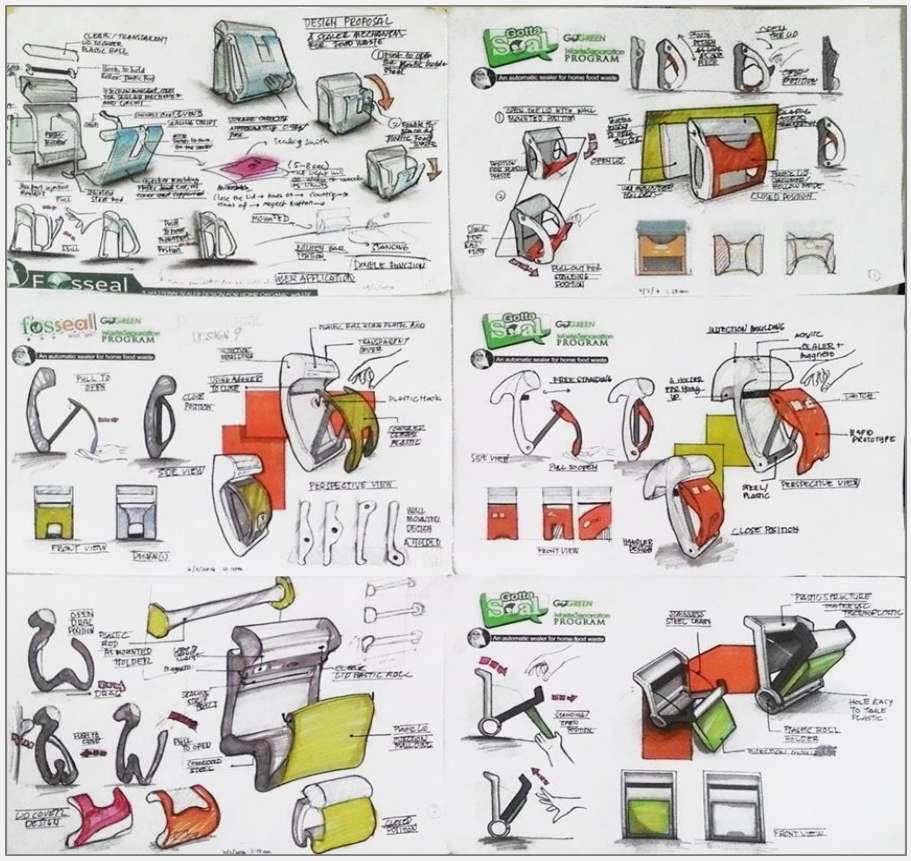


Figure 2: Sketches for FOSSEAL

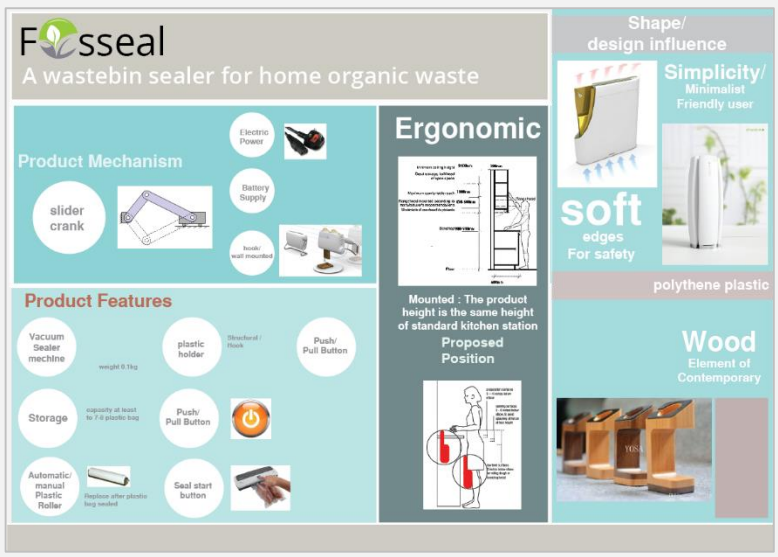


Figure 3: Design Concept for FOSSEAL

MODEL DEVELOPMENT

Table 9: FOSSEAL Model Development

1.Using Laser cut on acrylic 3mm to get the body of product	2. After laser cut body part, then using model board to cover the whole body. Then using poly putty to cover the fault and to make plastic effect.	3. Blow the LID using blower and together with the mold, using ABS board.
		
4. After finished the surface of body, spray with primer coating.	5. Also spray primer on the structure part and white spray for the last resort.	6. Spray white for basic color for coating and layer.
		 
7. In the meantime waiting for spray to dry, blow this acrylic sheet using blower and use the pipe pvc 4' diameter as mold.	8. After the white spray dry, spray LIME GREEN,	9. Put all the detailing like button, holder, rubber sheet, sealer and iron rod, as detailing.
		 
10. Put the laser cut mechanism at the side.	11. Testing the mechanism after glue everything together.	11. Put the plastic cover. And attach it with hinge.
	 	

Mock-up model was developed as initial model development to assess product practicality and its design composition, material application and mechanism. Table 8 shows the mock-up development in stages, while Figure 4 shows the outcome of model development (no 1- 6). Rendering Illustration also has been created by 3DS MAX 3D Software and KEYSHOT 5 to make a realistic look for the product, to show a clear mechanism and material usage, as well as the color of the product.

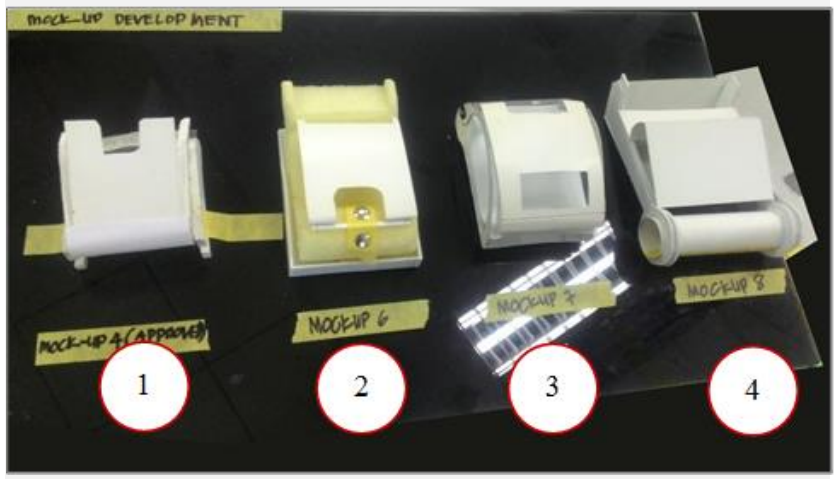


Figure 4: Mock – up Development for FOSSEAL

Figure 5: Rendering Illustration for FOSSEAL

APPLICABILITY

FOSSEAL give the idea of easy-to-seal plastic, which are biodegradable, after they throw the food waste. After sealing the plastic, the food waste can be thrown aster 2-3 days without the bad smells from the rotten waste being exposed. It also can help to prevent the rubbish from insects and other animals. In addition, it will help Alam Flora in their rubbish collection services in terms of managing the separation of waste especially when dealing with the food waste. FOSSEAL also is ideal to be used in the medical institution for example in clinic and hospitals, as well as in general offices. FOSSEAL can be applied in multi-location i.e. at the kitchen cabinet or table top. Several parts of this product can be dismantle for cleaning purposes. [Figure 6]

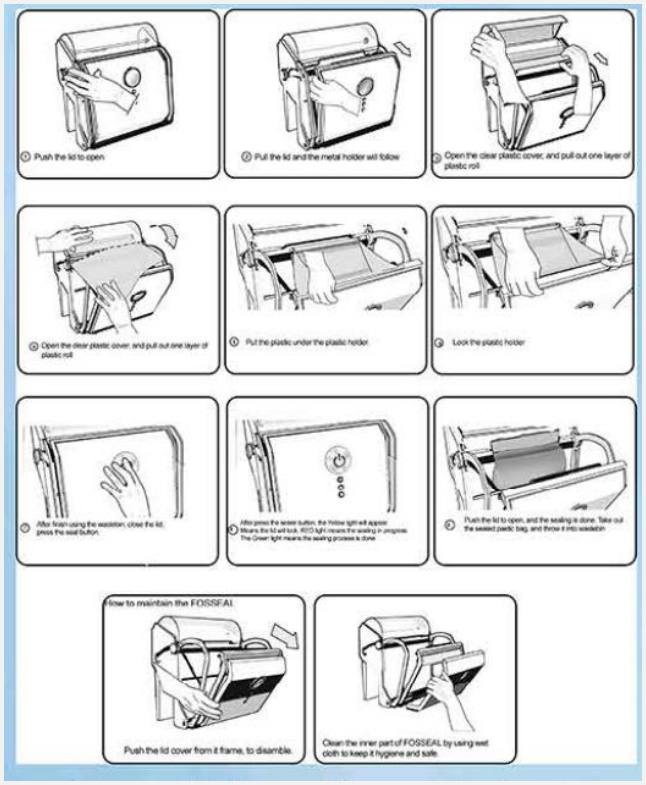


Figure 6: Manual for Product Usage

COMMERCIAL POTENTIALS

FOSSEAL is a handy and stylish product that is needed in the hectic lifestyle for personal or office solid waste management. The cost of this product is reasonable and it comes with several colors line-up such as the lime green, maroon and red. The sealer is maintenance-free, which can be replaced easily. The usage of biodegradable plastic will enhance the commercialization for bio-economic product. The sealer and the biodegradable plastic are proposed to be sold separately at affordable price. The manufacturing processes will use the common techniques including laser cut and injection molding with appropriate material selection. In future, FOSSEAL can be developed more in many potential design variation [Fig.7].

Figure 7: Design Variations

CONCLUSION

FOSSEAL is a potential solution that can encourage people to participate in the waste separation campaign and practice a healthy and green lifestyle. The study found that typical users separates the food waste in the plastic and tie it. Then, the user will dump the plastic with other rubbish together. The study also found that users prefer small size of rubbish bin with lid, which is more practical in their daily life. FOSSEAL is a new eco-friendly product that is potential to solve the household waste management.

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