

Multifunctional Cabinet Inspired by Modern Farmhouse for Small Size Housing

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Abstract: The cost of residential property in Malaysia has continued to rise over time, resulting in more and more small apartment buildings being built to ensure that Malaysian citizens in the B40 and M40 income groups can purchase a home. Due to limited space, these are not enough to accommodate all the essential furniture and other daily necessities, especially if they have a large family, leading to the introduction of multipurpose furniture. Therefore, the objectives of this study are to identify design criteria, design and develop a prototype of a multifunctional cabinet influenced by the modern farmhouse. The study began by determining the design criteria by distributing a questionnaire to 50 people in Taiping, Perak. Then, the design and manufacturing of the prototype were carried out according to the identified design criteria. According to the survey, the majority of respondents preferred natural colors, combination of storage types and materials. The multifunctional idea includes a cabinet with storage function, a hidden dressing table and a hanging area. The new multipurpose cabinet inspired by modern farmhouse is designed to provide homeowners with a solution for small apartments without losing the utility or the desire to beautify the living space.

Keywords: Multifunctional Cabinet, Modern Farmhouse, Small-Size Residential, Malaysia Houses, Furniture Design

1. Introduction

Malaysians are classified into three groups based on household income: the top 20% (T20), the middle 40% (M40), and the bottom 40% (B40), which vary by state in Malaysia. According to the 2019 Department of Statistics (DOSM) report, families in the B40 group have a median household income of RM 4,850 or less; the M40 group has a median household income between RM 4,850 and RM 10,959; and the T20 group has a median household income of more than RM 10,959 (Mahidin, 2020). This affects daily spending habits and budgets, as well as the desire to own a home and furniture. As living

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spaces in Malaysia become more compact, there seems to be a greater desire for multifunctional furniture (Begum, 2020).

A multifunctional furniture is a furniture that can perform several functions. It is a piece of furniture that can fit into a small space and meet the needs of several people. For example, a cabinet is a piece of furniture that is used to store or display items; it usually has shelves, drawers, or both. By incorporating other furniture functions into the design, you reduce the amount of furniture needed to furnish the home without compromising the functionality of the combined furniture. According to Kadam (2019), the growing number of small homes has driven the development of multifunctional furniture with additional storage space. It is observed that the use of more living space is increasing. The modular and convertible features of this furniture not only provide functional benefits, but also enhance the decor of the space.

Multifunctional furniture has become more convenient for consumers in recent years, especially for those with limited living space. The design of multifunctional furniture has evolved tremendously, leading to the development of a wide variety of space-saving solutions that are both technologically advanced and aesthetically beautiful. You would have more free space, which would be a great advantage given the limited capacity of an apartment. Many apartment dwellers can save space by using multifunctional furniture while improving their living conditions and making better use of the available space (Research Newster, 2021). Therefore, the aim of this study is to determine the design criteria, design and fabricate a prototype multifunctional cabinet inspired by the modern farmhouse.

2. Literature Review

2.1 Houses in Malaysia

The oversupply of real estate in Malaysia has increased by 40% in recent years, as shown by comparing the first half of 2016 and 2017 with the amount of new unsold housing units. Nonetheless, property values continue to rise. Economic growth has exceeded expectations, affecting the purchasing power of the lower and middle classes as well as other local buyers. According to government initiatives, affordable housing programs include terrace houses and apartments.

The apartment or flat has a size of about 700 square meters (Arshard, 2015; Ju *et al.*, 2014). Apartments have the advantage of being cheaper and safer than houses with minimal maintenance costs. Apartments are either a way to live inexpensively or they simply provide owners with the easiest type of housing. Apartments are often found in four- to five-story buildings. These are essentially low-cost architectural solutions that have no special features.

A terrace house, on the other hand, refers to a landed property that is adjacent to another. Terrace houses are lined up row by row and are often single or double-storey. The good aspect of a terrace house is that it is connected to one lot (land). According to Arshard (2015), the floor area of terrace houses ranges from 48 to 60 m². The price of a terrace house is slightly higher than the price of an apartment. Therefore, it is difficult for the homeowner to furnish their home with all the necessary furnishings for daily life, while ensuring that there is enough free space so as not to feel cramped.

2.2 Cabinet

A cabinet is a small piece of furniture used to store valuable items. Later, it was a piece of furniture consisting of a network of small drawers enclosed by a pair of doors. Cabinets were first used in the late Italian Renaissance. The cabinet is the most opulent piece of furniture in Europe, with many carvings, inlays, gilding and marquetry. It is a work of art used to store porcelain, coins, shells and antiques. Today, due to the division of functional areas in the apartment, the cabinets perform different functions in different rooms.

There are various types of cabinets that fall under the category of furniture in the home, including an entrance cabinet, wardrobe, sideboard cabinet, TV cabinet, wine cabinet, bookshelf, bathroom cabinet, dressing cabinet, and a utility cabinet (Luo et al., 2019). Nowadays, the emergence of multifunctional furniture leads to the combination of more than one furniture function in a hybrid furniture.

Multifunctional furniture allows multitasking while adapting to the style of the home to produce one-of-a-kind furniture. Furniture design has evolved over time and become more and more inventive, allowing it to multitask and fit into smaller living spaces. For this reason, they have become a popular choice for small spaces and incorporate several groundbreaking innovations. Aside from residents of tiny one-bedroom apartments, versatile furniture suitable for large single-family homes to constantly maximize available space. Multifunctional refers to a single object with multiple purposes that makes better use of available space. Multifunctional furniture is divided into three types: convertible furniture, space-saving furniture, and combination furniture. The three types of multifunctional furniture are presented in Figure 1.



Figure 1: Multifunctional furniture; (a) convertible furniture, (b) space-saving furniture, and (c) combination furniture

Material plays an important role in the furniture industry. The choice of material for furniture has a direct impact on the quality and durability of the furniture. Generally, furniture is judged by its functionality, beauty, ease of cleaning, durability, design and other characteristics. There are several materials that can be used to fabricate furniture. Wood, metal, glass and plastic materials are usually used for furniture production.

2.3 Modern Farmhouse

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The modern farmhouse concept combines trendy modern design with cozy farmhouse aesthetics or classic country style, giving a distinctive and new inspiration to rural living (Figure 2). Modern farmhouse design is characterized by its pleasant and clean appearance. According to Sims Hilditch Interior founder, while consumers appreciate the grandeur of country-style homes, they still want their homes to be functional and meet their needs. Natural textures and materials, such as wood and metal, characterize modern farmhouse design. Texture plays an important role in creating the feeling of a modern farmhouse (Babington-Stitt, 2020). Therefore, elements of modern farmhouse design, such as natural textures and warm simplicity, are incorporated into the design concepts in this study.



Figure 2: Interior of modern farmhouse

3. Research Methodology

This study used the same methodology that has been published elsewhere (Ramli *et al.*, 2018). First, a design survey approach was used with a questionnaire as the instrument to determine the design criteria. In this study, the questionnaires were distributed to 50 respondents aged 21 years and older through Google Form and WhatsApp in Taiping, Perak. The questionnaire was divided into two sections: demographic information and design criteria. Meanwhile, a visual survey was conducted to gain insight into the existing design of multifunctional cabinets, focusing on the criteria obtained from the questionnaire.

Thumbnails were then quickly sketched on A3 drawing paper without modification, incorporating one or more aspects of the design criteria from the questionnaire and visual survey. The selected thumbnails were then used to create ideation drawings. A total of five ideation sketches were produced, only some of which were used in the idea development process. Rather than teaching readers what they already know, the idea development process highlights material that readers may not know or have forgotten. In this study, the idea development sketches were more detailed than the ideation sketches, and efforts were made to meet all of the previously identified design criteria. After the idea development sketches were completed, a total of three idea development sketches were selected as finalists for the final design survey. To decide on the final design, a simple questionnaire survey was conducted. Information and explanations about the concepts of each sketch were provided in footnotes to help respondents vote. The design with the most votes was selected as the final design for this study.

The next step is prototyping, which begins with the development of a mockup. In this study, a 1:4 ratio mockup was created. This mockup was used to assess the appearance and ways to improve the design and aesthetic value of the prototype. Mounting board (PVC, black and white), cardboard, craft paper, acrylic mirror film, PVC, brass rod, white thread, and bamboo stick were used for the mockup. In addition, the technical drawing of the final design was created using AutoCAD software. As a visual style, the drawing was drawn in a 2D wireframe with multiple viewpoints. A bill of materials (BOM) was also created, listing the materials, parts, and instructions needed to fabricate or assemble the prototype. During the prototype manufacturing phase, a full-scale prototype was developed. This process includes the conversion of the technical drawing into an actual product using the specified materials, parts, and components. The material recommended in the questionnaire was used to manufacture the prototype.

4. Results and Discussion

4.1 Design Criteria Survey

The total number of respondents who answered the questionnaire in this study was 60. Table 1 summarizes the main results of the survey. According to the demographic data, 61.7% were female, 56.7% were between 21 and 30 years old, 76.7% were Chinese, and 43.3% were employed. Furthermore, 66.7% were in the B40 income category, earning less than RM 4,850 per month in total, and 61.7% reside in terrace house.

Table 1: Summary of questionnaire findings

Section	Percentage (%)	Description
Demographic information	61.7	Female respondents
	56.7	Ages between 21 and 30
	76.7	Chinese respondents
	43.3	Employed
	66.7	Household income group: B40 (RM 4,850 and below)
	61.7	Live in terrace house
Design criteria	90.0	Own at least one cabinet
	53.3	Place the cabinet in the bedroom
	53.3	Own a traditional cabinet (1 function)
	90.0	Prefer cabinet with hidden desk
	68.3	Had no idea about modern farmhouse design until now
	60.0	Prefer a combination storage (open and closed)
	51.7	Prefer a table with legs only
	51.7	Prefer a cabinet with natural color
46.7	Prefer a cabinet made of combined materials	

The design criteria section shows that 90% of respondents own at least one cabinet, 53.3% of respondents place their cabinet in the bedroom and 30.0% in the living room, and 53.3% of respondents own only one traditional cabinet (only 1 function). In addition, 90.0% of respondents prefer a cabinet with a hidden desk. 68.3% of respondents had no idea about the modern farmhouse concept until now (before reading the information in the questionnaire). As for the storage options of the cabinet, only 60% of the respondents prefer combined storage options, 25.0% prefer only closed storage options and the rest choose open storage options. On top of that, 51.7% of respondents prefer simple cabinet legs (without casters) and cabinets in natural colors. Meanwhile, 46.7% of respondents prefer cabinets made of combined material, followed by wood (33.3%), polymer (15.0) and metal (5.0%). Therefore, the criteria that emerged from the design criteria survey are: (i) cabinet with hidden desk, (ii) combined storage, (iii) combined materials, (iv) table with legs only, and (v) natural color finish.

Meanwhile, in this study, a total of four visual research was conducted, focusing on four elements: cabinet with additional function (visual research 1), natural color (visual research 2), combined storage (visual research 3) and combined material (visual research 4), as shown in Figure 3. From visual research 1, it appears that the cabinet can be equipped with additional functions, such as a bench, sink, dressing table, dining table, and kitchen island. This visual research will help the researcher in the design process.

4.2 Design Process

The design process begins with thumbnail sketches. The thumbnail of the multifunctional cabinet is shown in Figure 4. A total of 36 thumbnails were drawn by hand on 2 pieces of A3 drawing paper. The thumbnails marked with a red box were selected for the next process, ideation. The selection was

based on the results collected from the respondents (see Table 2), i.e., a multifunctional cabinet with combined materials.

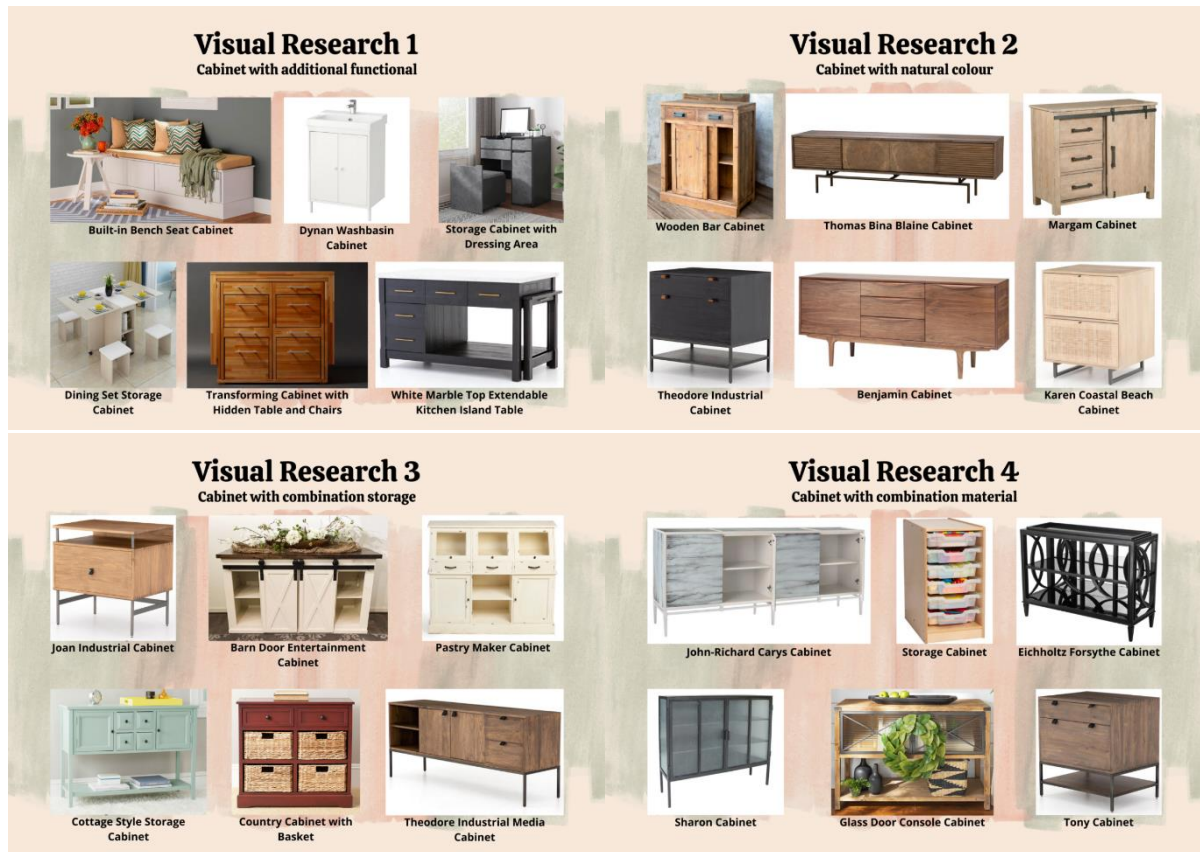


Figure 3: Visual research on cabinet

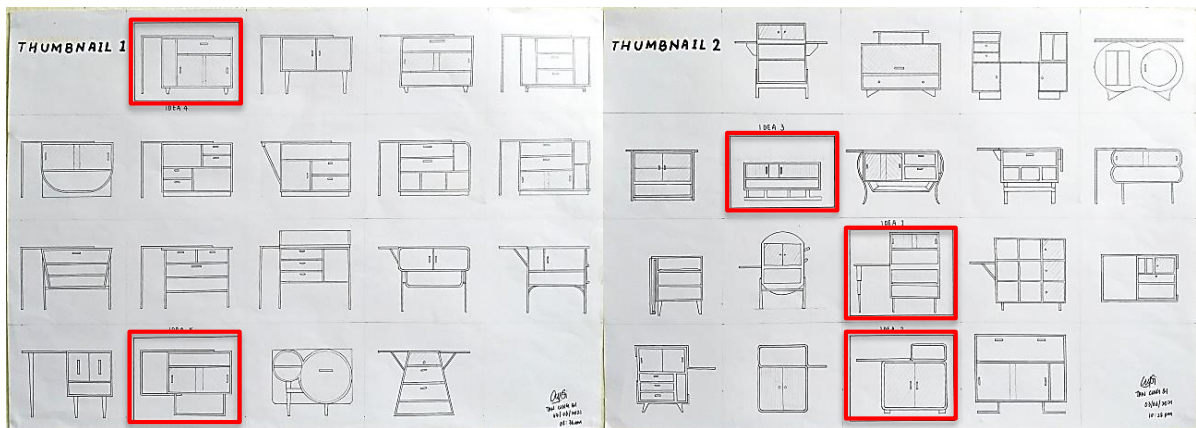


Figure 4: Thumbnail sketches

Next, the ideation for a multifunctional cabinet is shown in Figure 5. Five ideations were generated from the selected thumbnails. Here, compared to the thumbnail sketches, the sketches were more detailed in terms of appearance (3D view), multifunctional elements, layout and design of the cabinet. Ideation 3, 4, and 5 were selected for further development in the idea development process because they have a higher potential to be developed into multifunctional furniture with aesthetic value.

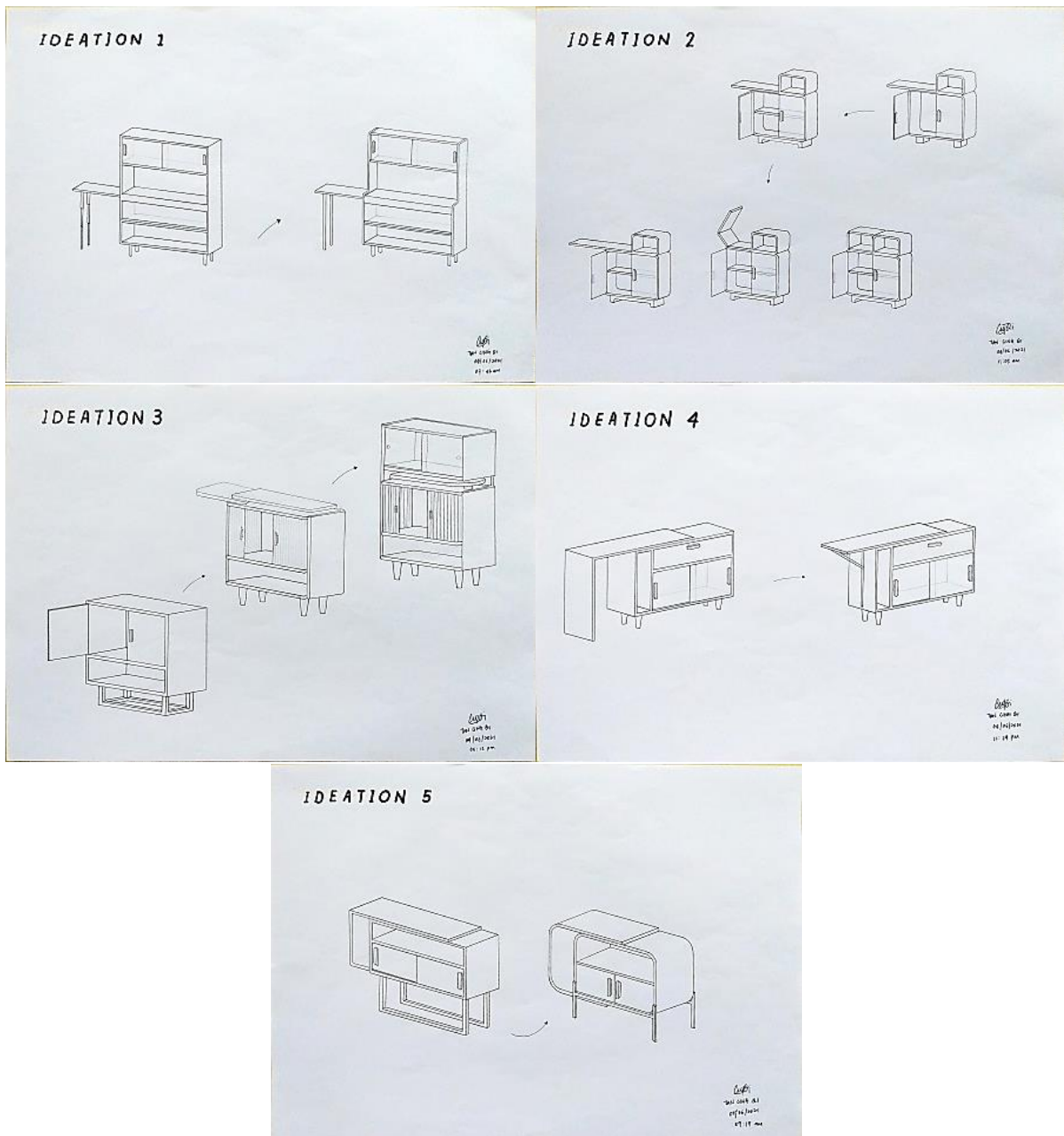


Figure 5: Ideation sketches

Figure 6 shows the idea development of this study. Four set of idea developments were sketched, and the sketches were further detailed in different views to get better information about the design. In this study, idea developments 1B, 1C, 1E, and 3B were selected as candidates for the final design. The reason for selecting these designs is the concept of storage combination and the main criterion that is well designed for multifunctionality.

Before determining the final design, a simple final design survey was conducted to ask potential buyers which design meets market needs and catches their eye the most. Three candidates for the final design are generated from the idea development. The illustration of the final design candidates is shown in Figure 7. Candidate final design 1 is exactly the same as the idea from idea development 1B. It is a detachable cabinet with function that provides a storage function and a small pull-out desk. It can be used as a cabinet or as a coffee table and console table. For candidate final design 2, the idea was generated by combining idea development 1C and 1E. It is a cabinet with storage function that simultaneously provides a small rotating desk, a mirror and a hanging rod. It can be used both as a

cabinet and a dressing table. Minor changes were made for candidate final design 3 and submitted for idea development 3B. It is a removable cabinet with storage function. The upper part can serve as a coffee table or bench and the lower part as a console table.

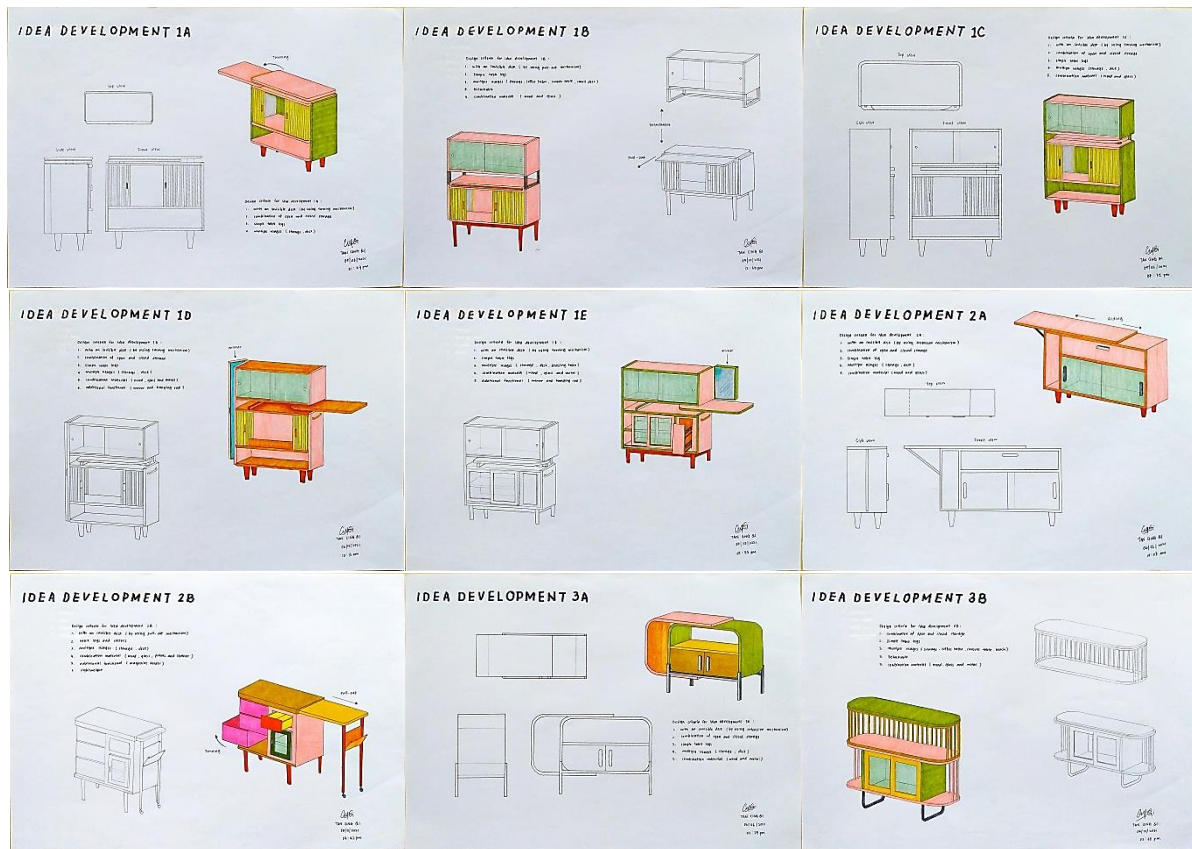


Figure 6: Idea development sketches

The final design survey questionnaire consists of two sections with multiple choice questions and closed questions. Table 2 shows the results of the final design survey. Sixty people participated in the survey. The demographic data shows that 55% of the respondents are female and 56.7% of the respondents are between 21 and 30 years old. In terms of design, 56.7% of respondents prefer design 2. 65% of respondents indicated that the decision was made based on satisfaction with the design and 93.3% of respondents recommend the design without further refinement. For color (wood grain), pine wood and cherry wood have the same percentage, 30% of respondents. Therefore, based on the collected data from the simple survey on the final design, design 2 is selected as the final design for this study (Figure 8).

Table 2: Summary of final design survey

Section	Percentage (%)	Description
Demographic information	55.5	Female respondents
	56.7	Ages between 21 and 30
Final design selection	56.2	Prefers design 2
	60.0	The decision was made based on satisfaction with the function
	65.0	Decision was made based on satisfaction with design
	93.3	No other design changes required
	30.0	Preferred pine wood
	30.0	Preferred cherry wood.



Figure 7: Final design candidates

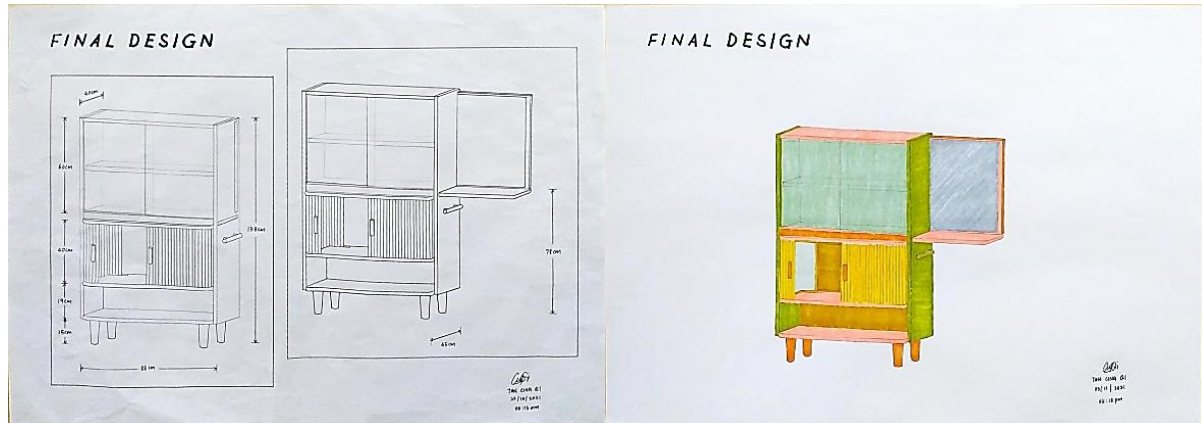


Figure 8: Final design of multifunctional cabinet inspired by modern farmhouse for small size housing

4.3 Prototyping Process

A mock-up is a 1:4 scale model of a real product used for product presentation or demonstration. In this study, the mock-up was made of PVC modeling cardboard (3 mm), craft paper, craft cardboard, black mounting cardboard, white modeling cardboard, acrylic mirror film, PVC film, brass rod, white string, and bamboo stick; hot glue and multipurpose glue were used for gluing. The model for this study is shown in Figure 9. To achieve the best possible reproducibility of the model, the surface representing the wooden panel was thickened to 5 mm using modeling cardboard. The visible surface of the panel was finished using craft paper and modeling cardboard to make it look similar to the wood texture. For the mirror, which is located on the back of the cabinet, acrylic sheet was used. For the moru glass, PVC

film with corrugated texture was used. The brass rod was used as a replacement for the hanging rod. For the tambour door was used bamboo rod and tied together with white string.



Figure 9: Mockup of multifunctional cabinet for small size housing

The technical drawing of the multifunctional cabinet was drawn using AutoCAD software. Figure 10 shows the technical drawing of the multifunctional cabinet with details such as cam bolts, nuts, screws, metal plates, slide rails, pins and dowels. The dimension of the prototype is 88 cm (length) x 40 cm (depth) x 138 cm (height). The height of the table top is 78 cm. Figure 11 shows the BOM and rendered drawing of the multifunctional cabinet.

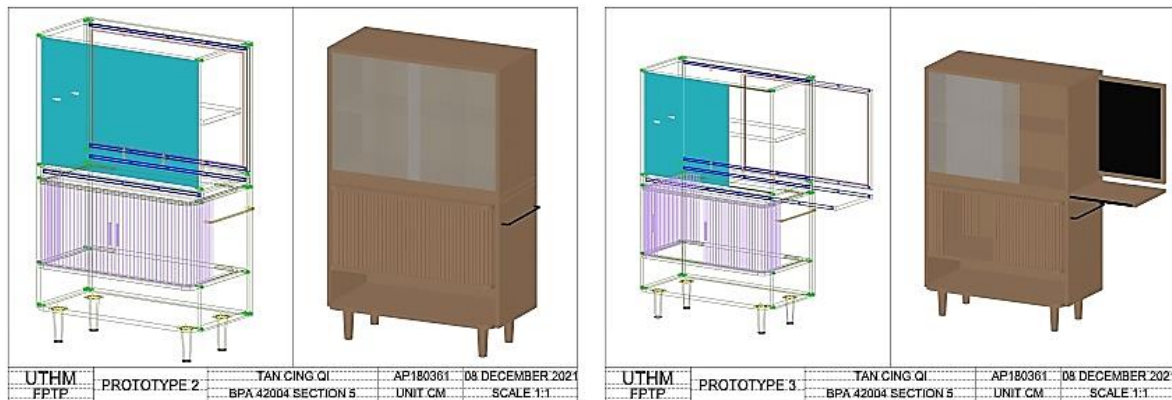


Figure 10: Technical drawing of multifunctional cabinet

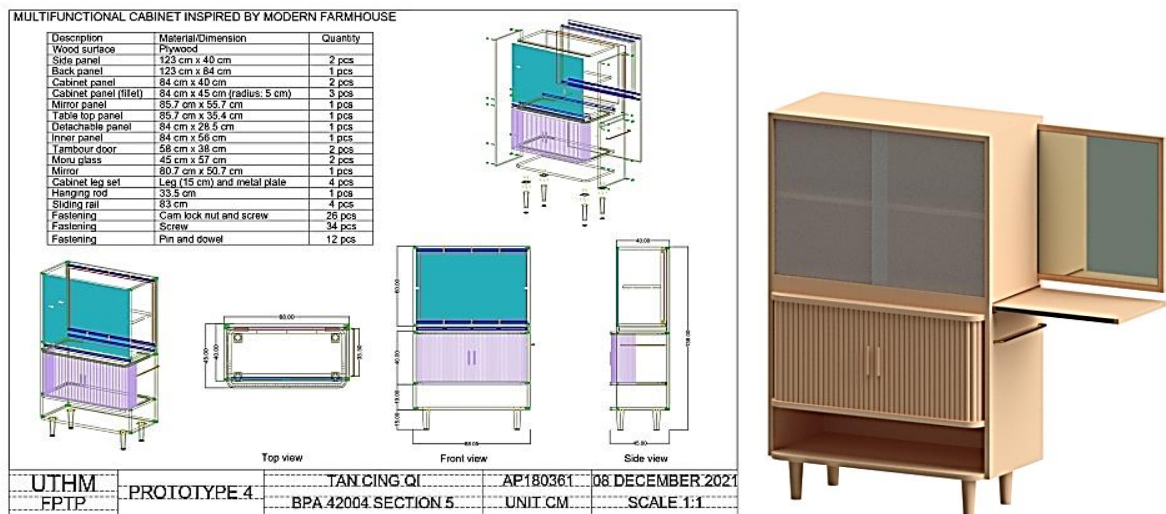


Figure 11: BOM and rendered drawing of multifunctional cabinet

In this phase, a full-size prototype was produced. In the production of the prototype, the cherry wood was replaced by laminated plywood with white Formica (inside). This decision was made because there was not enough cherry wood available from the nearest manufacturers and suppliers. When comparing cherry wood and plywood materials, manufacturers prefer plywood because it is cheaper and can be varied with laminate.

In addition, the tambour door was replaced by a pocket door. The rationale for choosing the pocket door as a replacement is cost, because the tambour door is extremely expensive, which exceeds the expected cost and indirectly increases the selling price of the cabinet. The pocket door is the best alternative, which looks good even in a small cabinet.

Also, the sliding door made of Moru glass was replaced with simple transparent glass. The Moru glass offers a more modern look and a translucent effect that provides more privacy. The reason for replacing the material is that the manufacturer offers only materials that suitable for mass production. The prototype of the multifunctional cabinet, inspired by a modern farmhouse, was completely manufactured (Figure 12).



Figure 12: Prototype of multifunctional cabinet

5. Conclusion

In conclusion, the multifunctional cabinet inspired by a modern farmhouse was designed and manufactured based on a survey of design criteria. The design criteria include a multifunctional cabinet with an invisible desk, natural colors, combined storage and combined materials. The materials used in the production of the prototype were wood, glass and metal. In this study, the term "multifunctional" was used to describe a cabinet with storage function that can also be used as a desk and dressing table. Although some materials intended in the final design were changed during the prototype manufacturing process, the prototype was successfully produced. The multifunctional cabinet was designed to solve the problem for small apartments with limited space.

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