

## INNOVATIVE DESIGN OF KNOCK-DOWN SYSTEM FOR METAL CABINET

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### Abstrak

Di dalam ekonomi global semasa, reka bentuk perabot telah menjadi satu isu utama bagi pengguna. Perkembangan terkini dalam penghasilan perabot telah meningkatkan cara pemasangan yang lebih baik dengan harapan boleh menjimatkan masa yang diambil dalam proses pembuatan. Perabot logam mempunyai beberapa had fabrikasi dan pemasangan dengan memerlukan ruang dan kos yang besar. Oleh itu kaedah perabot *Knock-down* adalah kecekapan yang paling efisien di dalam penjimatan ruang dan kos. Kertas kerja ini mencadangkan kaedah baru perabot *Knock-down* serta perbandingan dengan kaedah pembentukan perabot yang sedia ada. Tugas utama kajian ini adalah untuk mencipta rekabentuk asas sistem *Knock-down* dan rekabentuk tanggam dalam pengeluaran perabot logam tempatan. Kajian ini dijalankan ke atas salah satu pengeluaran perabot logam di pantai barat Malaysia. Dapatan kajian menunjukkan bahawa terdapat beberapa aspek reka bentuk perabot boleh dipenuhi dengan menggunakan kaedah *Knock-down* ini. Kajian juga menunjukkan bahawa reka bentuk semasa pada kabinet logam yang digunakan oleh pengeluaran perabot tempatan boleh diubahsuai untuk mengurangkan masa dan kos pada proses memasang kabinet logam. Kertas ini mencadangkan satu kaedah baru penambahbaikan sistem *Knock-down* dari segi reka bentuk dan garis panduan serta reka bentuk tanggam di dalam rekabentuk kabinet logam.

**Kata Kunci:** *Knock-down*, Rekabentuk, Pemasangan

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## **Abstract**

*In the new global economy, furniture design has become a central issue for the home user. Recent development in furniture constructions have height indicated the need for better ways on assembly activities with expectation to minimize the lead time of manufacturing. Metal furniture has some limitations in fabrication and assembly that requires space and cost. Therefore Knock-down furniture method is the most efficient to save space and cost. This paper proposes the new method of Knock-down furniture with comparativ studies to the existing method of the build up furniture. The main task of this research is to innovate the common design on Knock-down system and interlocking design in local metal furniture manufacturer. The research conducted focuses on one of the metal furniture manufacturers in West coast of Malaysia. The finding shows that a few aspects of the furniture design can be fulfilled by utilizing the Knock-down method. Study also shows that current design on metal cabinet used by local furniture manufacturer can be improvised to reduce time and cost in assembling the metal cabinet. This paper proposes a new method of Knock-down design improvements and guidelines for Knock-down system and interlock design in designing metal cabinet.*

**Keywords:** Knock-Down, Design, Assembly

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## 1.0 Introduction

The past decade has seen the rapid development on organizing documents either in workplace, home or learning institution. Without important documents, there will be confusion. Documents are a solid proof of existence and establishment of something such as existing of people, certain work and project. Business sector would be able to working and function properly without document (Clive D. Edward, 1994). For these reasons business establishments contain some filing cabinet inside their operation building and offices. Build-up cabinet takes too much space for storage, the fulfilment of storage needs might directly influence environmental satisfaction' which neglects the purpose of reducing cost and a quality of the end product (O'Neill, M. J., 1994). Research such as that conducted has highlighted build up cabinet that has disadvantages on storage purpose (Westphal, L.E., 2002). Office furniture is a simple product that does not need much maintenance or repair. (Katrin Besch, 2004) Basically Filing cabinets, specially the lateral cabinets, are very important item of furniture in large companies. Lateral cabinet is the best in preventing these main files to be misplaced and damaged.

Lateral cabinet has several of assemblies' method on making it. This method system is known as a knock-down and build up cabinet. Knock-down is a cabinet usually fabricated in flat parts and designed to be quickly and easily assembled. Moreover, it is also called ready-to-assemble furniture or flat pack furniture. The primary advantage to flat pack furniture is the space efficiency. Furthermore, it saves significant amounts of money for the manufacturer by reducing shipping and storage costs. Consumers are also benefited from this, as they will save money for the furniture assembling.

## 2.0 Material and Method

The research approach is to gain data from one of the metal furniture manufacturers in West coast of Malaysia. The objective of this research is to improvise the knock-down systems in metal cabinet making for local industry and its significance. The research conceptual framework is developed through the literature review and visual observation (Kokuyo Malaysia, 2010). The framework has also been reinforced in gaining more understanding by combining insights from different research field. On this research, the researchers will observe, interview and analyse data to produce prototype. The test also will be carried out to fulfil the finding. According to Figure 1.

<b>Stage 1</b>	Literature Review
<b>Stage 2</b>	Case study <ul style="list-style-type: none"> <li>Research Approaches</li> <li>Preliminary Survey</li> <li>Interview</li> </ul>
<b>Stage 3</b>	Data Collection & Data
<b>Stage 4</b>	Building & Testing Prototyping

Figure 1: Research Process

### 3.0 Results and Discussion

The current study uses a data response from observation and interview on the existing knock-down cabinet will be analyzed. Researchers use a case study method by interviewing in order to conduct a testing on the existing knock-down cabinet and also performing an experiment on a prototype. Mainly the case study is done in 5 stages as indicated in Figure 2.

Inspector		stage	Scope
Researcher	Current product	Stage 1	Price comparison
			high cabinet sliding type comparison
			high cabinet swing type comparison
			Anti tilt mechanism design comparison
			Interlocking jointing cabinet comparison
TAC		Stage 2	Test result on cabinet sliding door Structure
Participant			Test result on cabinet swing door Structure
			Time Consume on assembly
Researcher	New Prototype design	Stage 3	1st Sample fabrication
			2nd Sample fabrication:
			3rd Sample fabrication:
Participant			Test result on Assembly 1
Researcher		Stage 4	4th Sample fabrication
			4th Sample fabrication
			4th Sample fabrication
			4th Sample fabrication
TAC		Stage 5	Test result on center lock down
Researcher			4th Sample fabrication
Participant			Test result on Assembly 2
Final Design			

Figure 2: Design methodology for knock-down system



3.1 Experiment on Prototype of Knock-Down Lateral Cabinet

The experiment takes about 6 months to complete from January 2010 to July 2010 (refer figure 3). This sample prototype was supervised by department of research and development in this furniture company, at this company is lateral cabinet is already being designed with build-up design for local market in Malaysia, the Company targets to produce design for lateral cabinet using known-down system. These Experiments have 4 stages. Each stage produces 2 units of lateral cabinet, but in some stage they do not produce full body prototype but change only parts that have problems that do not follow the specification on design criteria.

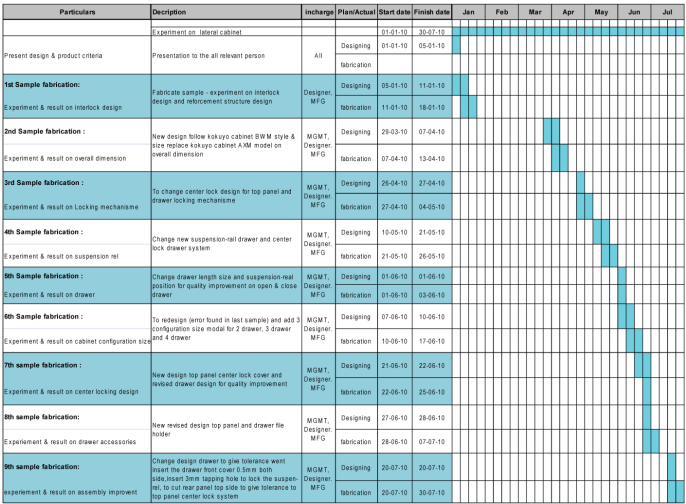


Figure 3: Schedule on lateral cabinet experiment

3.2 Summary Findings

Throughout the result of the information in analysis, those questions arise from the research objective and aim of the study will be achieved. The method of assembly and aesthetic value on the overall appearance are the major concern on this new lateral cabinet design. The summary below is of the data collection that would answer the objective and aim of study:

- The aesthetic value needs to create on the overall appearance of the new lateral cabinet design
- The assembly of new lateral cabinet design can be assembled by only one person
- In new design later will improve the quality of jointing in terms of interlock design

- The new design can save labor cost in terms of assembly
- The anti-tilt mechanism and center lock new design enhances the features and functions on this new lateral cabinet design
- The center lock new design will solve the security manner in the new design

#### 4.0 Discussion

From the information of analysis and research, the new design of lateral cabinet is suggested. This is a new product that will help the company to sell in local market in Malaysia. This lateral cabinet invention is a similar design but more efficient than the existing knock-down lateral cabinet in local market. This product has also a different specification from the existing lateral cabinet.

Results of the observation and interviews conducted in this company are from staffs and some of local manufacturers. They have already assessed the important aspect considered necessary for the knock-down lateral cabinet to be designed for local market in Malaysia. Some of the aspects are as illustrated in Figure 4.

Design Criteria
The interlocking design
Body Structure design
Assembly method
Center lock mechanism
Anti-tilt mechanism
Thickness material on part
The accessories for lateral cabinet

**Figure 4: Design criteria for new lateral cabinet**

## 5.0 Final design

After several experiments and sketches, the researchers decided for the final design to be the interlock design that is mostly designed based on durability and stability of whole structure. This design highlights some of quality control of the company. (Refer Figure 5a and 5b) shows the final design for new knock-down lateral cabinet.



Figure 5a: Final design lateral cabinet



Figure 5b: Final design interlock

## 6.0 Summary

At the end of the research, the study case method achieves the aim of study. Finding of the study shows that, at the preliminary survey, the respondents agree that the existing design of knock-down lateral cabinet in terms of interlocking design has taken much time in the assembly purpose which affected the labor cost.

The responses from the preferred respondents has shown positive view on the new knock-down lateral cabinet. Evidently, the specification on design interlock new has met the respondent requirements in reference to testing on assembly.

However, the aims and objectives of this study have been generally achieved completely. There are some views from respondents who liked the existing design of knock-down lateral cabinet. The reason for this is that the interlocking using rib-bit other than using screw is much cheaper in terms of cost and the design interlocking of some existing cabinet in terms of material thickness of some parts of the cabinet that are more affordable.

Generally, at the end of the study case, the experiments have shown that a new knock-down lateral cabinet can reduce the time in assembling the product. This will help the new knock-down lateral cabinet to sell in local market. It will also assist the company to increase the selling and services in Malaysian environment market.

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