



**NEW PRODUCT DEVELOPMENT PROCESS THROUGH DESIGN
COMPETENCIES APPROACH FOR MALAYSIA BUMIPUTERA FURNITURE
MANUFACTURERS**

By

NOR HAYATI BINTI MANSOR

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Doctor of Philosophy**

June 2020

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirement for the degree of Doctor of Philosophy

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June 2020

Chairman : Professor Hjh. Rahinah Ibrahim, PhD
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Despite of strong government support, Bumiputera SME Furniture Manufacturers face some export barriers due to lack of design originality, nil standard NPD process and non-export product quality. Many complex businesses have problems to attract skilled workers also to retain the experienced one. The crisis requires innovative solutions such as accelerated skill application in the whole value chain of product development cycle. This mixed-method study expedites learning process for younger talents and strategy to alleviate knowledge transfer by experienced workers. It contributes to Malaysia Human Capital Development that supports Malaysia Vision 2020. Data was gathered from Bumiputera SME furniture designers with techniques how to mitigate shortage of skilled workers and brain drain issues. The purpose of this research is to study on how can Bumiputera designers' competencies able to enhance organization capability development which improves product development among Bumiputera SME furniture manufacturers in Malaysia. This study uses literature review to document designers' competencies, personal traits in Bumiputera SME furniture manufacturing companies during Product Development Cycle. Results of the study includes, recommending key enablers to improve and support process and methods that improve designer's capabilities. Additionally, the study proposed an operational framework for improving designer competencies where personal competencies development framework and judgment will be enhanced. It included compilation of designer best practices and proposals on how SME furniture manufacturers can accelerate their process in order to move up the value chain. The study thus contributes in enhancing designer capability development. It is expected to accelerate product development, quality and economic benefits in furniture industry in Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PEMBANGUNAN PRODUK BARU MELALUI KOMPETENSI REKABENTUK UNTUK PENGUSAHA PERABOT SME BUMIPUTERA DI MALAYSIA

Oleh

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Pihak kerajaan memberi sokongan kepada pengilang perabot bertaraf Perusahaan Kecil dan Sederhana (PKS) Bumiputera namun terdapat masalah untuk mengeksport di sebabkan permasalahan rekabentuk, tiada standard proses untuk pembanguna produk baharu dan tiada kualiti . Permasalahan ini memerlukan penyelesaian inovatif seperti meningkatkan aplikasi kemahiran dalam rantai nilai kitaran pembangunan produk. Ia menyumbang kepada Pembangunan Modal Insan Malaysia yang menyokong Wawasan 2020. Tujuan kajian ini adalah untuk mengkaji kecekapan pereka Bumiputera dapat meningkatkan pembangunan keupayaan organisasi dan meningkatkan pembangunan produk dan kualiti di kalangan pengilang perabot PKS Bumiputera di Malaysia. Kajian ini menggunakan kajian literatur untuk mendokumentasikan kecekapan pereka, ciri peribadi dalam syarikat pembuatan perabot PKS Bumiputera semasa kitaran pembangunan produk. Kemudian, ia menggunakan kaedah kajian campuran method untuk meneroka dan mengesyorkan bagaimana pereka dalam syarikat perkilangan perabot PKS dapat meningkatkan keupayaan mereka dalam kitaran pembangunan produk. Keputusan kajian mengesyorkan pemboleh utama untuk memperbaiki proses dan kaedah yang meningkatkan keupayaan pereka. Di samping itu, kajian itu mencadangkan rangka kerja operasi untuk meningkatkan kecekapan pereka di mana rangka kerja dan penghasilan pembangunan keupayaan dan kecekapan akan dipertingkatkan. Ia termasuk penyusunan amalan terbaik pereka dan cadangan bagaimana pengeluar perabot PKS dapat mempercepat proses rekaan bagi meningkatkan rantai nilai. Kajian ini menyumbang dalam meningkatkan pembangunan keupayaan pereka. Ia dijangka mempercepatkan pembangunan produk, kualiti dan faedah ekonomi dalam industri perabot di Malaysia.

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My wonderful children
Nur Liyana & Harith Sabri, and

My dear friends Dr Maszura, Dr Noranita and Prof Dr Hjh Rahinah
others for their unconditional support.



This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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- the research conducted and the writing of this thesis was under our supervision;
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CHAPTER 1

INTRODUCTION AND THE CONTEXT OF THE STUDY

1.1 Introduction

This chapter discusses the overall context and background of the research. It explains designer competencies issues in the industry which include professional behavior, new product development improvement, design judgment and product quality in Bumiputera SME furniture manufacturers in Peninsular Malaysia. The statement of the problem and the research objectives are presented in this chapter. It also discusses research justification, scope, limitation, expected contributions, and structure of the thesis.

1.2 Context and Background of Study

The business of making furniture is a lucrative industry. Considering Malaysia has transformed from agriculturally based to manufacturing based economy, with worldwide market, furniture-making business has much to offer. It is a wealth producing sector that contributes RM 9.14 billion to Malaysia export earnings (Malaysia Timber Council, 2016). It indicates that 80% of Malaysia's furniture manufacturers hold an SME status. Hence, attention is needed to this economic contributor in a more magnified approach.

The Malaysian furniture industry started with traditional and small producing business since early 1980's. Today the sector has transformed into a technologically advanced multi-billion-ringgit industry from a traditional, domestic based production in the beginning of 1980s. It is a cross discipline industry that includes technology, materials, chemical, timber, steel, etc. The industry is well supported by Malaysian government agencies and is one of the promising sectors as quoted by MATRADE retrieved 29 December 2018 from <http://www.matrade.gov.my/en/foriegn-buyers-section/69-industry-write-up-products/621-furniture> with RM 7 billion business and 160 export countries. Leveraging on the domestic demand, the potential niche areas to be explored are resorts, spas and other institutional users. In addition, there is also a high growth from Original Equipment Manufacturer (OEM) to premium original design manufacturer (ODM). In the quest to be a developed country, Malaysia's furniture industry has transformed from a backyard operation to machine application. Malaysia was recognized for high quality furniture, with the emergence of rubber wood furniture and strategized towards premium design.

Malaysia furniture industry has much to offer. According to report by MATRADE retrieved 29 December 2018 <http://www.matrade.gov.my/en/about-matrade/media/press-releases/4674-malaysian-furniture-export-performance-shows-growth>, the total furniture exports to the US were valued at RM1.55 billion, registering a double digit growth of 20.8 per cent compared to the same period in 2018. This may be a result of import diversion among the international buyers, as trade war between China and the US; many countries may be shifting their orders to countries in the Southeast Asia. According to the Sunday Daily newspaper article, retrieved 10 August 2018 from <https://www.thesundaily.my/business/us-china-trade-war-augurs-well-for-furniture-exporters-MA1121482>, Malaysia furniture manufacturers benefited from the trade war, although Malaysian furniture component exports to China have declined, potentially buyers will purchase finished furniture products directly from Malaysia. With good quality products and a high potential market, the Malaysian furniture industry is poised to exceed expectations and to continue its exponential growth where Bumiputera furniture manufacturers should leverage on this business-friendly environment.

This thesis seeks to understand the underlying explanation for such situation and ways to accelerate competencies development among designers so that they can design high quality new products for mass production. This empirical research expedites learning process for younger talents and identifies strategies that alleviate knowledge transfer by experienced workers. The thesis conceptualizes the creation, acquisition, transfer and reuse of knowledge in various parts of the value chain. This study uses literature review to explain how designers apply appropriate design practice during New Product Development Cycle. Theories on competencies, knowledge management, human behavior, new product development and product quality will be drawn together to support the concepts, framework and propositions.

1.3 Overview of current furniture design for Bumiputera SME

Like any other businesses, the furniture industry, especially Bumiputera SME furniture manufacturers, faces various issues. This includes both design and non-design related factors that could reduce their competitive edge. Many are sensitive with shortage of workers, materials and other problems. Specific issues faced by Bumiputera furniture manufacturers are as follows:

1.3.1 Design Originality

A true designer creates something that's unique and original. Originality comes with creativity, innovation (Howard et al., 2008) and integrity (INSAG, 2003). While some designers try to be as genuine as possible, some designers copy and imitate from others without realizing it. Designers start to imitate when they are least inspired. Like other industries, it is difficult to curb the copy and imitate

design behavior. Therefore, the attitude becomes a major problem in the industry. Sometimes, clients also force designers to imitate in order to satisfy their request. Access to the latest designs is easy through magazines and internet and there are software allowing designers to imitate design, style and patterns. This will lead designers to neglect some basics like fundamental design theories and principles which (Osman, Aidil, Abd, Rizal, et al., 2018) highlighted that design capability relies on understanding of design and how skill and abilities are used.

1.3.2 Designers Personal Competencies

Research shows that ability to draw does not constitute the level of design competence. Malaysian Bumiputera furniture manufacturers still venture in low-tech and lagging behind others and designers always follow the established steps (T. M. R. T. Hassan et al., 2014). (Osman, Aidil, Abd, Rizal, et al., 2018) identified that most Bumiputera furniture manufacturers are lacking in design capability that disintegrate with business process. The lack of focus in this area results in designers having difficulty in making design judgment as well as slow product development. Thus, Product Development Life Cycle (PLC) may end prematurely.

1.3.3 Quality - High value-added activities

Malaysian furniture is reasonable in quality (Chai, 2012). Customers perceive Malaysian furniture as average value for money products that serve to middle income buyers Star.2018, Fashion and furniture export to grow retrieved Dec 2018 from <https://www.thestar.com.my/business/business-news/2018/11/19/fashion-furniture-exports-to-grow-2-3pc-in-2018>. Furniture manufacturing involves full range activities that combine employees and organization from conception and beyond. In the past, designers' involvement starts mostly near the end of the product development activities. This approach reduces designers' potential for contribution to corporate goals and strategies.

1.3.4 Overview of current SME furniture New Product Development

A well-designed furniture is not just stylish but makes furnishing space easy and meets customer's expectations. Malaysia's furniture industry is still wooden based and segmented predominantly by small and medium-sized (SMEs) <https://www.mida.gov.my/home/wood-&wood-products-and-furniture-&-fixtures/posts/>. Small and medium furniture manufacturers and retailers contribute about 36.6% to Malaysia GDP (Department of Statistics Malaysia, 2017). The industry is categorized as business centered, low-tech and low entry barrier compared to other industries like pharmaceuticals, electronics and electrical, machinery and equipment (Ng & Kanagasundaram, 2011).

Developing successful innovative new products is a must to appeal to new customers. (Osman, Aidil, Abd, Abd, et al., 2018) identified that there are still lack of Bumiputera furniture manufacturers venture into export market. It was found that only five manufacturers registered under Malaysia Timber Industry Board (MTIB) due to many Bumiputera manufactures are interested to supply their products through government contract scheme programs. The author identified that low participation of Bumiputera in this industry due to lack of technological expertise, knowledge in product value chain and lagging in design. Thus, it is essential to see an establishment focused on both design and development of quality products.

1.3.5 Organization Competence

The notion of individual competence is difficult to directly measure against organizational performance. Many previous researches showed that performance and cost of producing furniture varies. The connection between internal individual competence and external environment are even more complex. (Teece & Pisano, 1994) refers to competitive advantage as dynamic capabilities which include key roles in strategic management, internal and external skills, and resources as ways to respond to time-to-market product. Hence, it is not directly measured in this study.

1.4 Statement of Problem

Furniture business is a multi-million business and has transformed from a backyard business to technology-based industry. The furniture sector is labor intensive in nature. Unlike other third world countries where cheap skilled labor is easily available, Malaysia has to struggle between availability and development of this category of resources. In Malaysia, manufacturers, especially Small Medium Enterprises (SMEs) need to operate in cost-effective manner in order to remain competitive. Most Malaysia furniture manufacturers are small in size. Design has become prevalent as customers are more focus on quality with more demanding preferences. Furniture design is important when functions, aesthetic and lifestyle are combined. This is why it is important for furniture manufacturers to employ competent designers to make design judgment in order to deliver the expected results. In Malaysia, there is lack of emphasis in design where copying and imitating are a common practice in order to meet the local expectation (Döngel et al., 2009).

In addition, there are many situations that entrepreneurs take a long time to define criteria of good products. Quality in design is a requirement of a product to meet certain standards for sale. In Malaysia, besides good manufacturing standard, the business owners can choose any requirements that match customers' expectations. Speed of new product development may influence the product quality (Sun et al., 2009).

1.4.1 New Product Development Scenario

As the product gets into the market, it shows that there is a demand for it. As the total market expands, customers expect new designs to come in. If the manufacturers are slow in taking actions, consumer appeal may drift downward. Therefore, new product development once again fights with uncertainties and various unknown. How long the process should take depends on the level of business competitiveness, expected quality and design process (Azouzi, Beauregard & D'Amours, 2009) as explained later in Chapter 2.

1.4.2 Competencies of the Designer

A designer is no longer only expected to draw and design as the roles go beyond the drawing board. Common skills such as design-by-drawing, ergonomic analysis, solid modeling are needed (Green & Bonollo, 2004). Other essential skills are ability to communicate effectively in visual, oral and written form. A good product has a clear sense of design. Understanding the attributes of the products and approach that connect people to the product lie on the understanding of the designer on how it connects the product and people who use it.

1.4.2.1 Design Skill

Effective designers master basic skills and able to make informed decision and become a source for competitive advantage (Małachowski & Korytkowski, 2016). Learning by discovering, seeing and doing (D. a. Schon & Wiggins, 1992) give meaning and test the ability to make judgment. As judgment is subjective, good design relies on skill and expertise with certain principles to make it relevant. Certain skills are inherent; however, with the right application of knowledge, designers can master their respective field. (Osman et al., 2019) identified that Malaysian furniture designers has limited technology management and knowledge acquisition capacity, some with shortage of skills for new business environment.

1.4.2.2 Design Knowledge

Good design manages the ill-structured and open-ended problems. Having a complete knowledge solution based on the design problem require supplementary knowledge in other disciplines. As design becomes more social, knowledge in design helps to make better judgment. (D. a. Schon & Wiggins, 1992) posits that design judgment mostly subjective. In addition, the author claims that design as way to recognize, detect, discover and appreciate. Good designers focus on value-centered design (Knight, 2008). They understand

context and integrate it to others in order to propose a solution. It is challenging to know what specific knowledge is required for designers and its differences from other practitioners. (Osman et al., 2019) identified that many Malaysia Bumiputera furniture designers have lack of knowledge and access to information. Therefore, it is important during the design stage to understand the behavior and constraints of the users especially life cycle issues that can be detailed out during the detailed design.

1.4.2.3 Design Ability

Many researchers identify designers' ability more towards problem solving and generating concept. The researcher identifies that it is important for designers to see the whole design process in order to challenge or to propose exciting proposal. Often, what they do is explore problems and discover but not actually solve the problem. (Cross et al., 1999) covers design problem, design thinking and conceptual development. In this thesis, substantial skill required for designers will be proposed during new product development lifecycle.

1.4.2.4 Creativity in Design

From the background study, creativity has many ways to put concept and imagination into context and reality. It is multiple perspectives in nature. As there is no single way to look at things, designers have to use their ability in order to interpret requirements into proposals. The way designers look at the problems and analyze them shouldn't be restricted into single method of doing things. In furniture industry, creativity needs to converge with lifestyle, function and comfort before it creates value to customers. Hence, mental strategy of idea generation applies in the beginning of design process till the end of product development. (Zakaria et al., 2012) believes creativity can be nurtured through various learnable methodologies, be it formal and informal.

1.4.3 Quality and Speed of NPD

As many furniture manufacturers in Malaysia are SMEs, introducing small companies in larger market requires designs to meet a set of quality standard. Speed is crucial in the area where there is pressure to gain advantage in time-sensitive competition. In previous studies, speed to improve product development heavily relies on machine and technology. To date, many manufacturers choose human development as structure of production and growth. Thus, significant efforts to shorten the product life cycle during manufacturing process particularly design and engineering shall be made as well as integration with team members and supplier. For SME manufacturing companies, NPD process is vital to innovate and improve organizational performance. Many successful designs are about applying good design that fits

manufacturing with the intention of optimizing the cost. (Huang & Mak, 1998) posits that integration of process in Design for Manufacturing (DFM) understands how product design integrates with the associated manufacturing processes and systems to achieve simultaneous improvements in both product and process designs.

1.4.4 Design Process

Furniture making process in Malaysia is more than art. Successful manufacturers must operate in less secure environment and with complex manufacturing process (Thomas et al., 2012). Leaner process towards eliminating waste and continuous improvement combines skill related activities and adds values to the product. Appropriate design and non-design process are incremental development. Transformation of functions that include behavior to design process fits as evolution of design process ((Hybs & Gero, 2006). Scenarios are discussed in the literature review on how local designers apply design practices in their daily work activities.

1.4.5 Customer Satisfaction

For long-term business relations, customer satisfaction is essential. Customer expectation changes overtime. In other words, it brings functions and capability direct to the customers. Organizations are no longer competing among business owners. They are now competing on how to fulfill their customer's demand, be it in terms of products or services. Linking customer satisfaction and experience articulate business strategies to what matters most to people. Not only that, it brings the organization together.

1.4.6 Organizational Performance

In general, Bumiputera SME furniture manufacturers gain profit through low price products and high-volume sales. (Azizi & Abdul, 2008) reported that impact on marketing and export performance is still lacking in this industry. Basically, developed countries make their sale more on quality with high standard. Export strategy is usually found as a strong relationship between organization performance and business strategy for SMEs, however research on this area is still limited and not easy to measure (Singh & Mahmood, 2014). In addition, (Pralhad et al., 1990) posits that companies that fail to invest in core competencies fail to invest in emerging market.

1.5 Research Aim and Objectives

The study aims to develop a theoretical framework in enhancing designers' competencies in Malaysia SME furniture manufacturing value chain. The initial design process will be evaluated so that New Product Development can be expedited to meet the accepted quality.

This study aims to better understand the needs of designers in the furniture SME manufacturing companies.

This study is expected to deliver the following objectives:

1. To analyse the operating characteristics of Bumiputera SME furniture manufacturers that develop their internal competencies
2. To evaluate designers' characters, roles and practices during new product development life cycle that support their personal design competencies
3. To analyse how could Bumiputera SME furniture manufacturer support design judgment for improving sustainable new product development
4. To develop a model for designer personal competencies and designer personal behavior to improve product quality during sustainable new product development among Bumiputera SME furniture manufacturers

1.6 Research Questions

The researcher uses the Eagle Research Design Framework (Ibrahim, 2011) technique to rationalize the objectives of the study. It is important to understand the various issues concerning designers' work during the life cycle of furniture manufacturing especially for SME Bumiputera manufacturers. The study seeks to answer the following Research Questions:

How to develop a model for designer personal competencies and designer personal behavior to improve product quality during sustainable new product development among Bumiputera SME furniture manufacturers?

The following are sub research questions to be addressed:

- 1.6.1 What are the Bumiputera SME furniture manufacturers operating characteristics that adopted design competencies in their firms?

- 1.6.2 What is the existing design practice affect designer personal competencies and behaviour which impacting design judgment in Bumiputera SME furniture manufacturers?
- 1.6.3 How could Bumiputera SME furniture manufacturer support design judgment for improving sustainable new product development?
- 1.6.4 How to develop a model for designer personal competencies and designer personal behavior to improve product quality during sustainable new product development among Bumiputera SME furniture manufacturers?

1.7 Research Method - Mixed Method Study

The study aims to understand designers' role and contributions that may affect the design style or trendiest decision in SME furniture manufacturing activities. This research adopts explanatory sequential mixed methods design (Ivanka & Stick, 2007) and divided into two phases. The study starts with Eagle research design framework by Ibrahim, R. (2011) and Creswell (2011) mixed-method research methodology.

The case is developed from the Research Question which explores the current state of designers' behavior, work process and ways to improve the new product quality i.e. How to develop a model for designer personal competencies and designer personal behavior to improve product quality during sustainable new product development among Bumiputera SME furniture manufacturers?

Theories from literature are combined for crafting instruments and protocols. Previous manufacturing research also use qualitative method (Quesada-Pineda & Gazo, 2007) and descriptive theory to support the phenomenon or story (Zainal, 2007). The researcher views mixed-method is a useful method of inquiry to understand the design practice, competencies and behavior during new product development process.

A small number of SME Bumiputera Manufacturers can give insight to large population of the industry players. The selected companies are enough for randomization that fairly represent the overall population (Gerring, 2007). As designer is the unit of analysis, purposive with theory guided sampling as recommended by (Palys, 2008), (Tongco, 2007), (Berends et al., 2011) is used in this thesis. Another study by (Seawright & Gerring, 2008) proposes purposive sampling as a technique to study domain relating to knowledgeable experts.

As such, purposive sampling targeted population is furniture designers based on list given by Persatuan Pengusaha Kayu Kayan & Perabot Bumiputera (PEKA). The idea of using pattern matching to investigate phenomena is a pragmatic approach in order to gain rich understanding.

The study aims to understand deeply designers' behavior and actions which impacting design judgment. Personal Competencies and Expertise (Cross, 2004), discontinuity in organizations that affect the organizations affecting knowledge flows in Product Life Cycle (Ibrahim & Paulson, 2008) and dimension of quality (Garvin, 1987) theories are main references in this thesis in order to understand designers' complex real life situation.

1.8 Expected Findings

The main finding of this thesis is based on the current practice of furniture designers in Bumiputera SME furniture manufacturing companies. In Malaysia, large furniture companies are dominating the industry as well as customers' lifestyle. SME Bumiputera furniture manufacturers will gain benefits by joining the bandwagon through improving the ways they do things especially in design. The study is expected to propose theories, competencies framework, and recommendations for integrating design competencies during furniture new product development for improving product quality. Coupled with good business strategies, the researcher hopes the study contributes to the adaptation of organization's best practices.

At the end of the study, the researcher is expected to complete the following:

- Theories on designer competencies that relate to new product development and product quality.
- Documentation of knowledge and competencies management practices in SME furniture manufacturing companies
- Documentation of NPD life cycle
- Identification of key enablers for enhancing NPD for furniture design improvement
- List of identified sectors and respective SME furniture manufacturers in Malaysia

1.9 Justification of the Study

With the available tools and applications in the market plus some experience, everyone is considered to be able to do design job. Even though there are not

many SME Bumiputera players, the industry remains competitive. With this, some conventional approaches may need improvement.

- Not many researches focus on competencies development for furniture designers. Accordingly, there is a need to undertake the study that expects to establish a theory to enhance designer competencies in NPD. In this study, the researcher oversees factors impacting competencies during Product Life Cycle for New Product Development. Factors namely, skill, knowledge, experience and expertise development, personal behaviors, and judgment were taken into consideration. Understanding of accessibility to the relevant knowledge and learning process and decision making is pertinent to this study. The findings are used to develop a multi-dimensional framework, which is applicable to Malaysia SME furniture manufactures.
- In order to remain focused in this study, among the best practice is to integrate different functions such as competencies, knowledge and quality. The main focus is to test designers' ability to translate customer needs in product development. One of the challenges in design is it may lose its consistency across project and some out of context. One way to prevent this is to deploy multi source knowledge integration so the designer will access the right knowledge and skill in specialized domain.
- An integrated NPD work process will be documented as many previous researches loosely explain about it. Hence, NPD requires efficient strategies to reduce time-to-market as furniture industry is highly competitive business.
- In many cases, furniture business owners produce high production volume and low-price items as a strategy. Business owners need to capture the elements of quality as they are important traits for customers. The researcher examined the relationship between how SME furniture manufacturers define quality and what quality dimensions they consider important to their competitive advantage.

1.10 Scope and limitation of the study

The study is limited to Bumiputera SME furniture designers in Semenanjung Malaysia with small size of population conducted among 33 manufacturers. Verification of the 106 actual population numbers is a real challenge as many of them registered with more than one companies, as a marketing strategy. The study covers designers who are permanently employed by the manufacturers. Designers' personal design competencies and behavior that impacting design judgment were identified and analyzed. Many manufacturers are reluctant to reveal their organization work processes and business strategy. This is due to competition which is the nature of business. This study does not identify designer personal career roadmap and assessment (measurement for current and

expected) competencies at individual and organizational levels.

1.11 Expected Contribution

Most importantly, the study contributes to the theory and practices of designers in Bumiputera SME furniture manufacturing industry. The literature explains the existing practices that need improvement. Results of this research can help designers, owners and the industry to improve new product development and product quality, thus, enable them to expand their business to meet international standards.

1.12 Structure of the Thesis

The thesis has six chapters as follows:

Chapter 1: Introduction

Chapter one introduces the issues and background of the study. It includes statement of problem, main research problems, proposition of the studies and justifications. It presents an outline of the thesis.

Chapter 2: Literature Review

Chapter 2 describes in detail the literature which is divided into three main areas namely: competencies requirement for designers; the theories, strengths and weaknesses; and also the conceptual framework of the study.

Chapter 3: Methodology

Chapter 3 explains the research design, methodology, and strategies for data collection to answer the research questions. The study adopted Eagle research design framework by Ibrahim (2011) and Creswell's (2011) mixed-method research methodology. First, Quantitative approach has six hypotheses to test relationship in Designer Personal Competencies Framework followed by Qualitative approach based on Yin (2011) also explained in this chapter. This method discusses designers in furniture manufacturing companies by gathering in-depth understanding on design practices in Bumiputera SME furniture manufacturers.

Chapter 4: Results and Analysis of Designers' Competencies for Bumiputera SME Furniture Manufacturers

Chapter 4 presents the results and analysis from the mixed-method research methodology. The results are based on theoretical construct constructs i.e. design competencies, designer personal behavior, design judgment, sustainable new product development, and quality new product.

Chapter 5: Results and Analysis of Design Competencies for Furniture Designers

Chapter 5 discusses the main findings with regards to research questions. The strengths and the limitations of the thesis are concluded for three constructs namely, Designer Competencies, New Product Development and Product Quality. This chapter describes the development of the Integrative Design–Enhanced Product Quality Management Model for Sustainable Bumiputera SME Furniture Manufacturers (EPQM) with appropriate recommendations pertaining to designers' competencies and improving design process within the manufacturing process.

Chapter 6: Conclusion and Recommendations

Lastly, Chapter 6 summarizes the findings. It presents the conclusion, knowledge contribution, impact of the study and recommendations for future study. It prioritizes competencies level and highlight knowledge contribution that impacts designer practices in the furniture making industry.

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