Personal Competency and Behaviour Effect on Design Judgement Among Designers in Furniture Manufacturing

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ABSTRACT

Malaysia furniture manufacturing is a lucrative industry with the majority are Small and Medium Enterprises (SME). Moving the SMEs from Original Equipment Manufacturer (OEM) to Original Design Manufacturer (ODM) is encouraged by the government in pursuit of global competitiveness. One aspect of transformation is hiring design personnel into the manufacturing organization especially among the Bumiputra SMEs who are lagging behind the other manufacturer. The purpose of this study is to identify the qualities of designers who could improve design judgement for New Product Development (NPD) of furniture in their current operating context. This article is part of a series of studies in improving Bumiputra SMEs global competitiveness. This study in particular looks into aspects of the designer's competencies and behavior that will affect design judgment. A survey was conducted on 33 designers who are employed from among 106 manufacturers registered with the Bumiputera furniture manufacturer organization of Malaysia. Statistical analyses including factor analysis, descriptive analysis, t-test, were employed to test relationships between dependent and independent variables. The study found personal skill, knowledge, ability, and experience representing designer's personal competencies; and value, attitude, and trait representing designer's personal behavior are critical in making appropriate design judgement. The results are expected to contribute to the development of a Designer Personal Competency Model for the furniture NPD process to help Bumiputra furniture SME manufacturers transform their OEM practice to ODM. This study is significant in supporting Malaysia economic growth specifically among Bumiputra SME manufacturers.

Keywords: *Design Competency, Original Design Manufacturer, New Product Development, Furniture Industry, Bumiputra SME*

INTRODUCTION

As the furniture industry is a highly competitive business, the Malaysian furniture industry has transformed into a technologically advanced multi-billion-ringgit industry from traditional, domestic-based production at the beginning of the 1980s (Nor H Mansor et al., 2015). Malaysia External Trade Development Corporation (MATRADE) reported that the furniture industry is generating RM 4.14 billion business in

2019. Malaysia is recognized for high-quality furniture, with the emergence of rubberwood furniture and strategized towards premium design. In addition, Osman et al. (2018) highlights there is also a high growth from Original Equipment Manufacturer (OEM) to premium original design manufacturer (ODM). Despite the impressive growth, 62.1% of the SMEs employed workers with insufficient knowledge and skills (SME Malaysia, 2018) which may direct the study to agree with Osman et al., 2018 why participation by Malaysia Bumiputera furniture manufacturers is still low and less competitive in the export market.

The study found that the furniture business is highly competitive and low-cost basis (Bumgardner & Nicholls, 2020) with its inherent nature of having a short life cycle (Balaram & Chennakeshava, 2018). It is often perceived as labour intensive, dominated by suppliers and retailers, and with low-wage professions, unskilled workers, and uncomfortable working conditions (Ng & K., 2012). Osman et al. (2018) highlighted design expertise as one of the key elements still lacking among Bumiputera SME businesses. This study agrees with the author which may explain the limitations for exporting among the Bumiputera companies. Hence, the purpose of this study is to identify the qualities of designers who could improve design judgement for New Product Development (NPD) of furniture in their current operating context. This study tested selected hypotheses in relations to the influence of Design Judgment in SME furniture manufacturing. This study is limited to Bumiputra SME furniture manufacturers and is significant in supporting Malaysia economic growth specifically among furniture producers.

LITERATURE REVIEW

In an attempt to elevate the performance of Bumiputera SME furniture manufacturer, the aim of this study explaining the benefits of hiring qualified designers by focusing on the distinct effects of designers' competency and behavioural characteristics on design judgement during new furniture product development. The locally-owned furniture manufacturers SMEs are dominating the market which similar strategy applied in Italy, Taiwan, and Denmark. However, the involvement of Bumiputera in this industry still small (Ratnasingam, 2017). A study by Roper et al. (2016) indicates that the designer's role shall embed in the organizational process as the design is recognized as a functional specialism in the perspective of collaboration between designer with functional teams. Therefore, a good designer able to think in new terms, challenge assumptions, also accelerate innovation (Minder & Lassen, 2018). It is important to understand that competent designers should be able to see problems and evaluate potential solutions. This section introduces the notion competencies can be evaluated in tangible ways instead of articulating the technical skills. The study also found gaps in the industry where the incompetent and lack of experience designers serve the Bumiputera SME furniture manufacturers.

Designer Personal Competencies (DPC)

Skill

When defining the concept, designers apply all their experience and skills based on the available knowledge and information concerning design and manufacture (Ward & Clarkson, 2004). Then, following a systematic design process helps to develop strategy and finish deliverables based on customers' requirements. Like other SMEs, furniture manufacturers have limited resources and the designers cum owner apply design thinking that is best suited for open-ended problems and epitomizes the company with skills needed. The reason is Malaysian furniture manufacturing business is still trapped under the Original Equipment Manufacturer (OEM) phase without much effort to move towards Original Design Manufacturer (ODM) (Ratnasingam et al., 2018). The reason identified in this matter is the lack of skill enhancement and creativity even though Malaysia is resource-rich. What Malaysian designers may need to strive for is to be involved from product development until the marketing and delivering stage. Hence, the author agreed with Cash (2018) that design skills and manufacturing skills (Thomas et al., 2016) build on each other which

assist to speed up time to market, therefore, helping to remain resilience and sustainable in more complex environment.

Knowledge

The furniture business is a design-intensive industry, thus, relevant knowledge is experience-based which is very dynamic, distributed, and heavily tacit and gained from everyday work in the industry (Ng, 2011). The designer will make a better decision when important information is easily available (Matthews & Wrigley, 2017) ; however, lack of data and knowledge creates Knowledge Loss (K-Loss), Ibrahim (2006). This is a large and growing concern that many furniture Bumiputera SMEs fail to address. Knowledge with high tacitness is likely to be distinctive. This situation tends to create problems in companies that are highly dependent on workers with high tacit knowledge as it does not flow well in the organization and tends to stick (Ibrahim et al., 2008) which occurs in the furniture industry.

Ability

Even though design ability is poorly understood, according to (Cross, 1990) design ability has to do with intelligence with an ability to resolve conflicts and problems. Nobre & Walker (2011) identifies ability as the representation of development, coordination, and deployment of operational capabilities as well as willingness to learn, change and adapt in the complex environment. For designers, the visual ability is a non-verbal intelligence where one can process information about visual information and the appearance of an object with other pictorial properties and as cognitive (Nazidizaji et al., 2015).

Experience

Lattorff & Moritz (2013) have shown that individual experience can also affect the dynamics of task specialization which also can speed up the project progress (Grierson, 2013). In this study, the extent of designer experience, competencies, and practice within the company is expected to influence the designer's judgment during the new product development cycle. It is unfortunate that some designers are unable to produce original designs due to various constraints and limit function to design (Kamarudin et al., 2016). Hence, in this study, it is individual's knowledge, experience, capabilities, and skills as a form of competencies for the company to develop its business (Tragel & Shemilina, 2015) in Bumiputera SME furniture manufacturers need to highlight.

Designer Personal Behavior (DPB)

The emphasis on behavior during design is a contribution to design knowledge that may affect forms and functions. Design activities involve cognitive activities including thinking, visualizing, and decision- making (Hu et al., 2019). In addition to technical competencies, Parks-leduc et al. (2015) suggested that personality traits be included in the integrative model of understanding a person. Personality is a person's situation, self-chosen and manipulated by a situation (Matthews & Wrigley, 2017). It influences judgment (Gamliel et al., 2014) and those who can collaborate with others tend to be considerate, friendly, generous, helpful, and add value to others. Many personality studies focus on emotional impact as highlighted by Górnik-durose & Pilch (2016); and Gamliel et al. (2014).

Design Judgment (DJ)

Among the conclusions suggested by Rizzuti & De Napoli (2016) is that designers use decision-making value theory to synthesize design and judgment in making quality products. Judgment in design is similar to other judgments made in other disciplines. However, the distinct difference is designers have to judge based on things that are not yet built. Designers in a way have to deal with highly real-life complex, multi-

dimensional and interactive design problems. Schiin (1988); D. A. Schon (1984), D. A. Schon & Wiggins (1992) and Vickers (1983) develop an appreciative theory that views human activities act as a system. An appreciation in judgment can be best understood in the context of knowledge and built around expertise and experience. Some judgment is based on critics by others. Therefore, the study proposes that designers explore concrete integration of knowledge, behavior, and product with a more pragmatic approach and more human-centered practice rather than focused on science or mathematics.

HYPOTHESES DEVELOPMENT

Based on the above literature review, this study hypothesized the relationship of Designer Personal Competencies and Design Judgment as below:

- $H_{1.o}$: Designer with more design competencies will make better design judgment in producing new products

Many scholars agree that proficiency can be developed through training and experience. There is an indication that novices are not proficient in presenting design problems and they are not aware of why certain decisions are made (Verstegen et al., 2009). Based on this, a person who is poor at one process will be poor at all tasks that require it, but not necessarily poor at tasks that do not require it Kavakli et al. (2002).

- $H_{2.o}$: Designers with a more professional attitude can make better design judgment in producing new products

In many start-up companies, designers are both lone designers and owners (Mohd et al., 2016). Decision-making was found heavily relying on tacit knowledge. Like other SMEs, the Bumiputera furniture manufacturing companies have limited resources, and the designers cum owner needs to deal with open-ended problems. Thus, any behavioural and emotional response has a consequences effect on the developed products (Kumar & Noble, 2015). Chai et al. (2015) identified that special knowledge affects behaviour for reasoning with a combination of tasks. Hence, constant application of designers' behaviour in product development over time will result in a certain level of performance and expertise. The lack of competence results in designers having difficulty in making design judgments hence may slow product development thus Product Development Life Cycle (PLC) may end prematurely.

- $H_{3.o}$: Designer Personal Competencies and Designer Personal Behavior have significant impact effect on Design Judgment

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 knowledge and access to information. Therefore, it is important during the design stage to understand the behavior and constraints of the users especially implicit life cycle issues that can be detailed out during the detailed design. Prahalad et al. (1990) posits that companies that fail to invest in core competencies fail to invest in an emerging market.

RESEARCH METHODOLOGY

The study conducted a survey to test the above hypotheses influencing Design Judgment in SME Bumiputera Manufacturers. A similar study has been conducted by (Baraldi & Bocconcelli, 2001) in the furniture industry on how quantitative research being conducted in qualitative phenomena. The author suggested that furniture-based research involved in theoretical frame, methodology, and model to be used for the study of the chosen phenomenon. Inferential statistical methods, including a correlation test, factor analysis was used in testing the main hypotheses. The significant relationship among these variables was

studied with a 0.05 confidence level was considered. Later the strength of each variable was tested using multiple regression since several independent variables were involved. A structured questionnaire was used as primary data collected to investigate designer's competencies and behavior towards design judgment and to identify the most influential variable. Finally, a model was established to illustrate the relationship of each variable.

Population and Sampling

The targeted population is 1,284 SME Bumiputera Furniture Manufacturers operating in Peninsular Malaysia obtained from MATRADE. From that list, the Bumiputra furniture manufacturers were crosschecked against the data available at the Malaysian Timber Industry Board which returned 106 companies who were members of the Persatuan Pengusaha Kayu-Kayan & Industri Perabot Bumiputera (PEKA), a Bumiputera association recognized in the timber and furniture industry and has representatives in Malaysian Timber Industry Board (MTIB). On ground verification was conducted by visiting the companies at the registered address and telephone confirmation for employment of designers eventually ended with 33 Bumiputra SME furniture manufacturing companies. From the samples, 23 had designers with qualifications and 10 had designers without formal design qualification.

The samples were collected based on and categorized as two groups namely Qualified Designer (QD) denotes designers who possess formal higher design education from higher institutions and Non-Qualified Designer (NQD) identified as self-learning designers or practice design without acquiring formal design education. The survey used in this study was conducted by adopting purposive sample representative, as recommended by Berends, Reymen, Stultiëns, & Peutz (2011); and Etikan (2016). In addition, Rizzuti & De Napoli (2016) posit that purposive sampling is the recommended technique to study domain relating to expertise and experience. To avoid sample bias, the respondents were contacted and an appointment was administered to answer the questionnaire. From the survey, differences between QD and NQD categoriesaccording to DPC, DPB and DJ were tested using t-tests at ($p < 0.05$).

DATA COLLECTION

Instruments Survey

Survey design is appropriate in gathering information as recommended by Owens (2007) who used surveys in collecting small sample data from SMEs. The instrument used in this study was a set of questionnaires as proposed by Rowley (2014). The author posited questionnaires are mostly used when the researchers want to profile the sample in terms of numbers with regards to opinion, attitude, experiences, processes, and behavior. There are 31 questions in the questionnaire that were issued to 33 designers who are fully employed by the Bumiputera furniture manufacturers. The answers were rated on scales from 0 to 5. The components were taken on competencies, knowledge, skill, ability, behaviour, information, and design judgement. In the beginning, they were asked about the personal and tertiary background, working experience, numbers of employed and domain activities. The designers participated in the survey by telephone. This is to increase the rate of response compared to other methods.

VALIDITY AND RELIABILITY

In order to test the fitness to measure (Khalid et al., 2012) and indicates internal consistencies of the measurement instruments.

Validity

Validity and reliability are established in an instrument to provide valid and reliable data.

Content Validity: A Pilot test was performed after taking into account all the suggestions from the discussion with the expert which helps to design a reliable questionnaire as recommended by Umar et al. (2017) for small sample size; 20 questionnaires were distributed to designers which are not part of the actual respondents. The potential respondents were considered the appropriate informants in view of their familiarity with issues related to design. Validated and actual questionnaires then were distributed to 33 designers.

Factor Analysis

In this study, in order to reduce dimension of datasets, the factor analysis has been employed to identify underlying factors hidden in a complex system. Exploratory Factor Analysis (EFA) was chosen to identify the factor loading of the variables and has been considered as one of the realiable tool to test the relationship between the observed variables and their underlying constructs (Maskey et al., 2018). The samples and analysis were carried into two variables i.e. Designer Personal Competencies and Designer Personal Behavior. For EFA, principal component analysis Rotation Method: Oblimin with Kaiser was performed. The following is the EFA results conducted in this study.

From the results, the EFA output in Table 1 shows that all factors loading values are all positive which less than 0.7. Any values above this number are considered important to further discussed as suggested by Guimarães et al. (2016).

As, the researcher will not have to deal with any cross-loading items less than 0.5 as suggested by Zulkepli et al. (2017); it has resulted in single factor loading in each of the two variables; Designer Personal Competencies and Designer Personal Behavior that covers 78.703 % of the variance. The results also explained the Kaiser-Meyer-Olkin value of 0.3 which is below 0.5 which shows that 33 manufacturers' sample data is small for factoring as suggested by Maccallum & Widaman (1999) as the minimum desirable N is 250. In addition, samples of less than 100 cases are often classified as untenable by Kelcey (2018).

Table 1.   Results of Exploratory Factor Analysis (EFA)

Section	Sub-Construct	Item	Factors
A	Designer Personal Competencies	Skill	0.316
		Knowledge	0.475
		Ability	0.275
		Experience	0.234
B	Designer Personal Behavior	Attitude	0.553
		Values	0.380
		Traits	0.350

p<0.05

As Factor Analysis is being conducted within the context of Structure Equation Modelling (SEM); hence, both variables fit for model setup in order to understand the pattern of relationship between two variables towards Design Judgment (Zulkepli et al., 2017).

Reliability

In this study, a reliability analysis to assess internal consistency uses Cronbach Alpha to test and scale for each variable as suggested by Tavakol & Dennick (2011). Before performing the analysis, the suitability of the data was assessed through two tests; Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's Test of Sphericity. Generally, 0.70 or higher is considered to be an agreed value for Cronbach's Alpha reliability (Hair et al., 2011). The results are as Table 2 below:

Table 2 - Results of Cronbach's Alpha

Variables	Cronbach's alpha N = 20 (Pilot Test)	Cronbach's alpha N = 33 (Actual Survey)
1. Designer Personal Competencies	.798	.757
2. Designer Personal Behavior	.780	.754
3. Design Judgment	.826	.744

The above Cronbach's Alpha values show that all variables correlate around 0.7. The results show that all three scales were above the value of 0.7 which indicated good internal consistency among the variables. All items appeared to be acceptable and worthy for retention. The removal of any items in the variables would not increase the value of alpha. Therefore, the Cronbach's alpha coefficient has provided evidence for the measurement model for the two variables affecting Design Judgment for Bumiputera SME furniture manufacturers. Comparatively, there is not much difference between the pilot and actual results. Thus, the questionnaires were accepted and used for the data collection.

t-test

In the first step, an independent t-test was conducted to determine if there is a significant difference between the means of Qualified and Non-Qualified designers. Qualified designers are skilful designers (Osman et al., 2018) with design certification and Non-Qualified are designers without design certification

The results found that there was a non-significant difference in the scores for Designer Personal Competencies QD (M=3.39, SD=0.32) and NQD (M=3.44, SD=0.22). For Designer Personal Behavior for QD (M=3.28, SD=0.32) and NQD (M=3.17, SD=0.24). For Professional Designer QD (M=3.33, SD=0.27) and NQD (M=3.30, SD=0.20) conditions; t (.903), $p < 0.05$.

There is a very minimal difference between QD and NQD which shows there are no significant impact results from these two groups. As the results are not inclusive, further tests were conducted in order to test the hypothesis.

DESCRIPTIVE STATISTICS

As this study focuses on the designer as the *N,* univariate analysis profile using one variable at a time by understanding their attitude towards behaviour or products, descriptive analysis is suggested by Rowley (2014) is the suitable approach.

The results from the survey of 33 designers employed by Bumiputra SME furniture manufacturers are ***Designer Personal Competencies*** (mean =3.43; SD=0.33) having combined operational variables including *skill* (mean=3.51; SD=0.51)*, knowledge* (mean=3.18; SD=0.63)*, ability* (mean=3.45; SD=0.62)*,* and *experience* (mean=3.64; SD=0.49)*.* The Designer Personal Competencies and its four operational variables are significant. From the same survey, results indicate that ***Designer Personal Behavior*** (mean=3.36; SD=0.32) includes *attitude* (mean=3.33; SD=0.59), *value* (mean=3.15; SD=0.56), *traits* (mean=3.57; SD=0.50). The above-mentioned results are significant at 2-tailed 95 percentile confidence intervals.

The results show strong evidence Designer Personal Competencies and Designer Personal Behavior are positively influence the Design Judgment (mean=3.15; SD=0.62). The scores of variables above mid-point of 3.0 and range between 3.1 and 3.4. The mean values show not much difference and significant impact between the two variables at ($p<0.05$). This may not surprising as many Bumiputera manufacturers are heavily relying on pre-design order and contract manufacturing (Osman et al., 2016). The standard deviations reflected a fairly narrow spread of scores, with a range of 0.2 to 0.3 which close to average which shows that most designers are fairly competent and behave as what as being expected by the company.

FINDINGS

Hypothesis Results

The first step is the theorised causal relationship between variables of Designer Personal Competencies, Designer Personal Behavior with Design Judgment. The results of null hypotheses significance testing, the study has yielded a statistically significant result likewise the hypotheses are truly nonnull and corresponds to the test's positive predictive value. Overall, the results from 33 designers (*N*=33) indicate that there is astrong relationship between each variable. Results are presented in Table 3 below.

Table 3. The Hypotheses Results

Hypotheses	Results
$H_{1.o}$: Designer with more design competencies will make better design judgment in producing new products	(r=0.828, p-Value = 0.000). Since the average score is p<0.01, hypotheses 1 is accepted.
$H_{2.o}$: Designers with more professional attitude can make better design judgment in producing new products	(r=0.842, p-Value = 0.000). Since the average score is p<0.01, hypotheses 1 is accepted.
$H_{3.o}$: Designer Personal Competencies and Designer Personal Behavior has significant impact affect to Design Judgment	(r=0.970, p-Value = 0.000). Since the average score is p<0.01, hypotheses 1 is accepted.

The results of the survey reveal that designers with more design competencies can make better design judgments in producing new products. The degree of a sample representative of the population was addressed by significant testing of the p-value of the hypotheses at 0.05. The p values of these variables, all below 0.05, show that all alternative hypotheses were accepted. Overall, the results indicate that there is a strong relationship between each variable. This means that Designer Personal Competencies contribute 82.8 percent of the variance in design judgment. Designer Personal Behavior has 84.2 percent of variance to design judgment. The combination of both resulted in 97 percent of variance to design judgment. Hence, the data are significant and valid with satisfactory levels of reliability ranging from 0.685 – 0.940.

DISCUSSIONS

The study looked into the classification, contributions, and efforts of furniture SMEs to the Malaysian economy. It was found that initially, Malaysia's furniture industry was wood-based and low-tech; however, the industry has evolved into production from diverse materials with high-value-added manufacturing. There is a need for value-added improvement in Malaysia and it was found that improving designers' competencies is one way to bridge the design gaps and move from OEM to ODM. Employers need to identify designers who fit to change (Leclerc & Horan, 2018) based on consumers' behaviour (Lee et al., 2020). It is important to recognize the path and characteristics of the ODM company. In the case of Malaysia, Bumiputera SME furniture manufacturers need to pay close attention to various aspects like designer personal competencies, personal behavior as core elements for operational improvement.

The development of expertise is required across disciplines and work processes. Designers use their abilities and competencies for personal growth with the support of learning and training. Years of practice enable experts to have a core understanding of their respective areas which enables them to design for the future and have the authority to discuss with the less experienced. There is a need for value-added improvement in Malaysia and it was found that improving designers' competencies is one way to bridge the design gaps. From the study, it is essential that this critical relationship between design competencies and behavior be sustained by allowing designers the flexibility to be creative, original, and honest while they test new ideas throughout the design process. Such freedom in design while upholding certain behavioral values, traits, and attitudes would enable individual designers to be perceived as professionals who can make good design judgments. Such professionalism would sustain the Bumiputera SME furniture business which then could expect repeat customers or good referrals for businesses.

Furniture making has been identified as the new growth area, with the Malaysian government emphasizing the competencies to increase efficiency, effectiveness, and competitiveness. As it is recognized as a rapidly expanding industry with a low entry barrier, the industry needs to be equipped with the appropriate skill sets. Maximizing designer's capabilities together with operating practices give advantages to manufacturing companies (Raduan Che Rose, Naresh Kumar & Graduate, 2008).
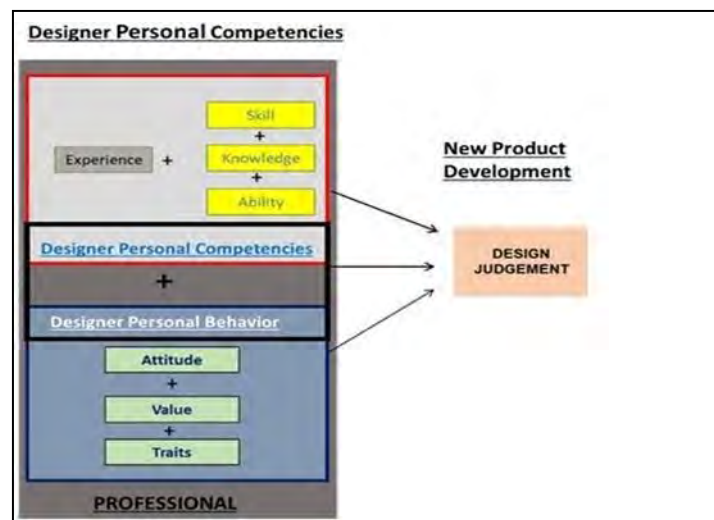

Figure 1: Designer Personal Competencies Model for Sustainable New Product Development

Based on the results of the study, the Bumiputera Furniture Manufacturers require designers with experience, skills, knowledge and ability plus also possess professional behavior with right attitude, value and traits. The study hence developed a Designer Personal Competencies Model (see Figure 1) as an

integrated model in collaborative environment between novice expert designers. Hence, Designer Personal Competencies Model is recommended to serve the importance of designer competencies and professional behaviour which will ultimately become the driver for sustainable innovation in the furniture making industry. As such, the impact of the study gives benefits to the Bumiputera SME furniture manufacturers and the relevant industries.

CONCLUSION

In conclusion, the results show strong evidence Designer Personal Competencies and Designer Personal Behavior are positively influencing the Design Judgment (mean=3.15; SD=0.62). The study's results affirm key furniture designers' core design competencies (such as Experience, Skill, Knowledge and Ability) and Designer Personal Behavior (such as Attitude, Value and Traits) are paramount in order to make effective decision-making during the New Product Development process. The study is significant in leading towards the development of a Designer Personal Competencies Model for Sustainable New Product Development where Designer Competencies and Designer Personal Behavior are influential. Future studies are recommended to extend this study to cover non-Bumiputra furniture companies.

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