

3D Design Driven Innovation (DDI) Form and Structure Studies Strategy for Modern Sofa Commercialization

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ABSTRACT

This study explores and analyzes recent design-driven innovation (DDI) practices in the SME furniture industries. The study was conducted in: an in-depth literature review and an analysis of the selected companies' in form and structure strategies for modern sofa commercialization where the findings present that Bumiputera SMEs furniture manufacturer is unable to continue their business sustainability due to increase competition or weakness from various aspect of entrepreneurship and digitalization where it is important to continue the survival of Bumiputera furniture manufacturer in the Digital Transformation 4.0.

Keywords: 3D Design Driven Innovation; Design Strategy; Sofa; Commercialization

INTRODUCTION

The furniture business in Malaysia is under a manufacturing sector of small and medium enterprises (SMEs). The Malaysian furniture industry comprises 85% of SMEs (Akbar, et al., 2017). SMEs in the furniture industry offer significant potential and contribute greatly to the economic development of any country. According to the Malaysian International Furniture Fair. (n.d.), the growth is expected to be high as ranked amongst the top 10 largest exporters of furniture in the world, Malaysia exports around 80% of its production. With large markets in the US, Japan and Australia, Malaysia has a strong position in the global furniture industry. Under the National Timber Industry Policy, the furniture industry is targeted to contribute RM12 billion in exports. The furniture industry has long been a vital manufacturing sector, significantly bolstered by the emergence of numerous SMEs. However, to remain relevant, it must continually adapt to the large-scale needs of its audience. The furniture industry in Malaysia will continue to grow and more demands of the products will exist. In order to sustain the position of the Malaysian furniture industry within the market, the understanding of the industry is essential to assess the export competitiveness and identify the potential of export markets of furniture products of Malaysia (Haque, 2013).

The fusion of innovation and form plays a pivotal role in creating competitive, high-value furniture primed for success in the global market. Malaysian furniture manufacturers need to bolster their competitiveness and expand their international footprint by prioritizing these aspects. As emphasized by Epede and Wang (2022), innovation is the cornerstone of competitiveness in today's dynamic economic and technological landscape, underscoring its universal significance across industries worldwide. For Malaysian furniture manufacturers, embracing design-driven innovation is key to enhancing their export potential and successful commercialization. By differentiating their products, understanding and meeting diverse consumer preferences, and focusing on sustainable and user-centric designs, they can build a strong international presence. Design-driven innovation not only adds value to their products but also shapes the future of the industry, ensuring long-term competitiveness and growth in the global market. DDI sees design as a contribution to innovation through creating meaning, such as other drivers like technology or market (Verganti et al., 2013).

In our exploration of the furniture industry, we recognize the pivotal role of innovation and form in crafting competitive, high-value products, particularly sofas, destined for success in the global market. As highlighted by Epede and Wang (2022), innovation is crucial in navigating today's dynamic economic and technological landscape, underlining its universal significance across industries worldwide. Sofas, as fundamental pieces of upholstered furniture, serve a multitude of functions in households worldwide. Whether for relaxation, socializing, or even sleeping, sofas must withstand various loads and offer comfort and style. Understanding this, manufacturers must prioritize the form and design of sofas, considering factors such as cushioning, back support, armrests, and leg structures. As highlighted by Lin (1997) and Li (2022), the composition and design elements of sofas greatly influence their functionality and aesthetic appeal, ultimately impacting their competitiveness in the global market.

This study thoroughly examines the intricacies of form and structure strategies, investigating their impact on the overall appeal, functionality, and marketability of modern sofas. By integrating insights from market analysis, and technological advancements, we aim to offer actionable recommendations to furniture manufacturers seeking to capitalize on 3D design-driven innovation for success in the competitive global market. This research endeavor seeks to enrich the ongoing discourse on design-driven innovation in the furniture industry, providing valuable insights and practical strategies to enhance the commercialization of modern sofas through innovative form and structure studies.

LITERATURE REVIEW

Bumiputera entrepreneurs and small and medium enterprises (SMEs) face a myriad of challenges, ranging from limited participation in the international market and a shortage of skilled workers to difficulties in marketing products in supermarkets and a lack of raw materials. Moreover, the Malaysian furniture industry grapples with complications like stiff competition, inadequate infrastructure, and hurdles in accessing markets and exporting, as underscored by Akbar et al. (2017).

Nevertheless, the furniture sector faces problems, such as low production efficiency, and machining accuracy with a low degree of innovation, mainly in enterprises engaged in atypical production (Long, et al., 2020). These issues can hinder competitiveness and sustainability, requiring investments in technology and innovation to address. The main factors that businesses need to address are increasing the product quality and design, form, structure, standardization and mass personalisation of the production, tools and equipment, increasing the productivity and innovation within a smart factory with targeted promotions, environmentally friendly materials, digitisation, 3D design, furniture innovation (Epede, et al., 2022).

Although the furniture industry contributes the largest number in export value, the participation among Bumiputera manufacturers is very small (Ratnasingam, 2018). The study of limited innovation trends in the Malaysian furniture industry has made it a challenge faced by the furniture industry. The industry is driven primarily by comparative advantages derived from low cost factor inputs, which has eroded in recent years due to escalating production cost (Ratnasingam, 2018). Currently the Bumiputera Small and Medium Enterprises (SME) furniture manufacturers are facing obstacles in terms of design fundamentals and manufacturing innovation. Bumiputera entrepreneurs are often said to be left behind in achieving success in economic development (Osman et al, 2022). The industry's struggle is compounded by a lack of R&D processes, such as 3D digital design, 3D sketches, scaling, full-scale mock-ups, prototyping, and testing before commercializing sofa furniture. The lack of innovation can be attributed to the lack of talented local designers in furniture companies (Lean, 2008). This is disrupted as the current Bumiputera furniture SME is incapable, due to the increasing competition or weakness in different aspects of entrepreneurship and other factors, to continue the business sustainability (Osman et al., 2019).

The global shipping and supply chain crisis have heavily impacted the furniture industry, with soaring transportation costs posing significant challenges for sofa manufacturers,

particularly those producing bulky and non-disassemble products, Shan Lin (2023). Addressing concerns about transportation logistics and packaging hazards such as impact, compression, and atmospheric conditions (Fluidadmin, 2021; Hughes, 1996) is crucial for ensuring the safe export of furniture items. Despite these challenges, Malaysian furniture exporters demonstrate resilience and growth, significantly contributing to the nation's economic development and enhancing its global competitiveness.

To address these issues, it is essential to foster a culture of innovation through robust government initiatives and enhanced training programs, thereby driving the Malaysian furniture industry towards sustainable growth and increased global competitiveness. As highlighted by Abu et al. (2019) the furniture companies need support in terms of the absence of a supportive organizational culture, governmental backing, and adequate knowledge or training as barriers to innovation. Despite boasting the highest export value, the low participation of Bumiputera furniture SMEs compared to others persists as a concerning trend (Osman et al., 2019).

METHODOLOGY

The research method implemented in this study was a quantitative approach aimed at producing a comprehensive and detailed analysis to gather all necessary information. A questionnaire survey was conducted to investigate the preferred structure and form of sofas by users of SME furniture companies. This method was chosen to understand the process of designing sofas. The researcher observed how SME furniture companies utilized the 3D design-driven innovation (DDI) form and structure studies strategy to produce sofa furniture for export and commercialization. The area selected for observation was Shah Alam, where data collection was carried out.

Research Framework

The theoretical framework provided served as a guideline for researchers to follow the selected method suitable for the research. The research utilized both primary and secondary data to collect and gather relevant information and resources, ensuring the chosen research method was executed accurately.

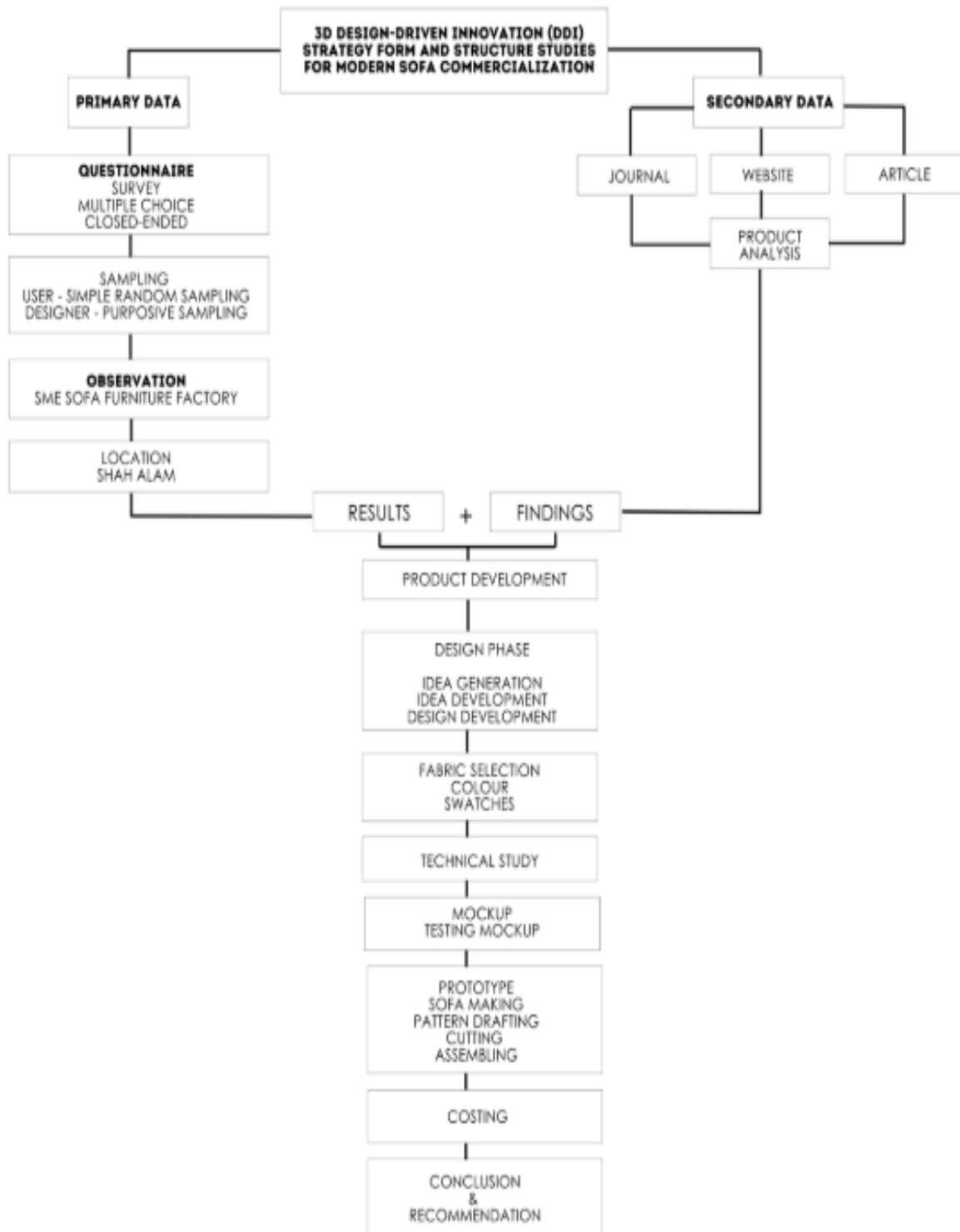


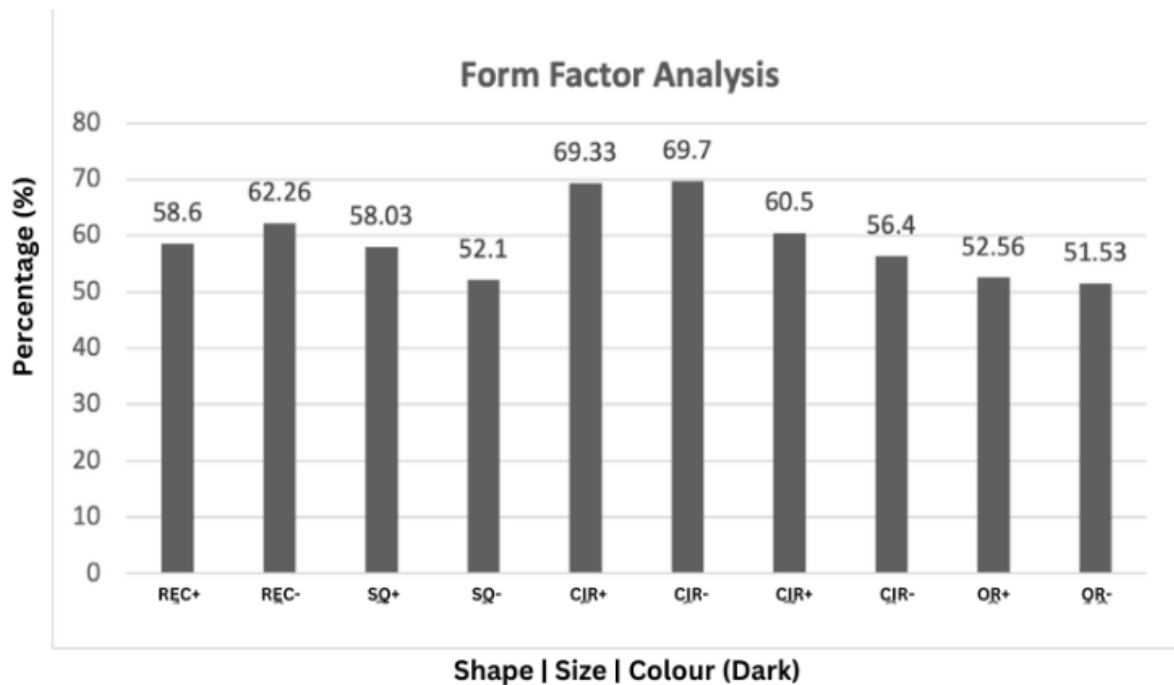
Figure 1. Research Framework

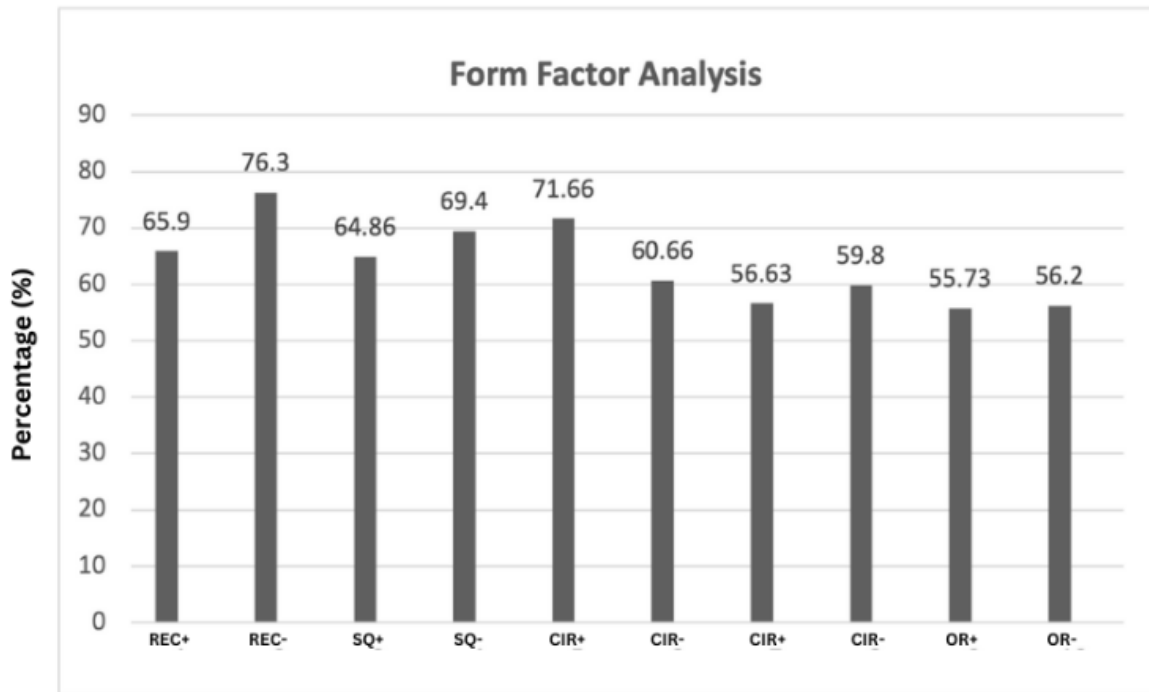
Survey

The researcher explored suitable form designs for modern sofas using basic shapes such as circles, rectangles, squares, and organic forms, aiming to facilitate mass production and commercialization. The analysis incorporated both questionnaire responses and design factors. Upon completing the analysis, the researcher applied practical research on form and materials to develop modern sofa furniture.

A Google Form was created, and questions were prepared to gather feedback from industrial and furniture designers. The researcher collected responses and findings to identify problems and innovative design approaches for sofa commercialization. This knowledge provided insights into SME furniture companies in Malaysia. Designers backgrounds in industrial design participated in assigning specific values to each possible basic form based on design factor analysis. The results gathered ensured that the designers were not biased, and the possible forms and shapes with the highest percentage were further developed.

RESULTS



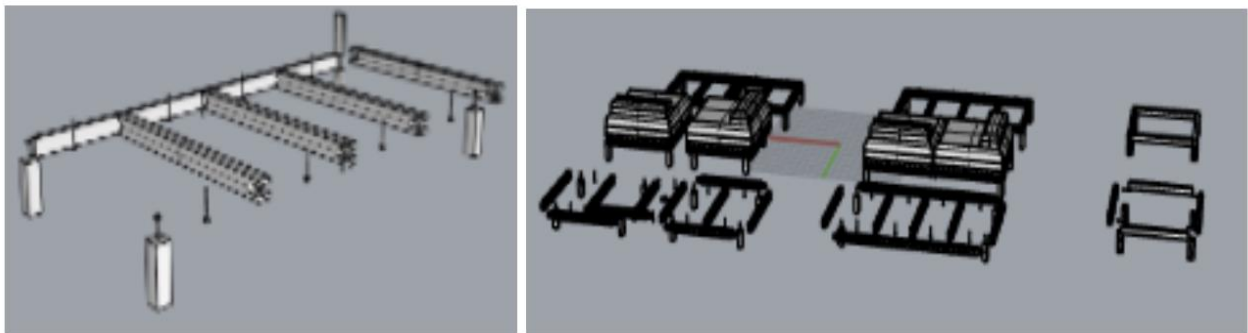


Shape | Size | Colour (Light)

Figure 2. Graph Result of Basic Questionnaire

The researcher depicted the table results through a graph, indicating that light-colored furniture garnered the highest preference among designers for shape, size, and color analysis, surpassing dark-colored options. Notably, the rectangle (REC-) shape received 76.3% of the votes, followed by the circle (CIR+) with 71.66%, and the square (SQ-) with 69.4%. These top three basic forms are slated for further development in the next ideation stage, utilizing 3D software accessible to SME furniture designers.

5.0 Design Process



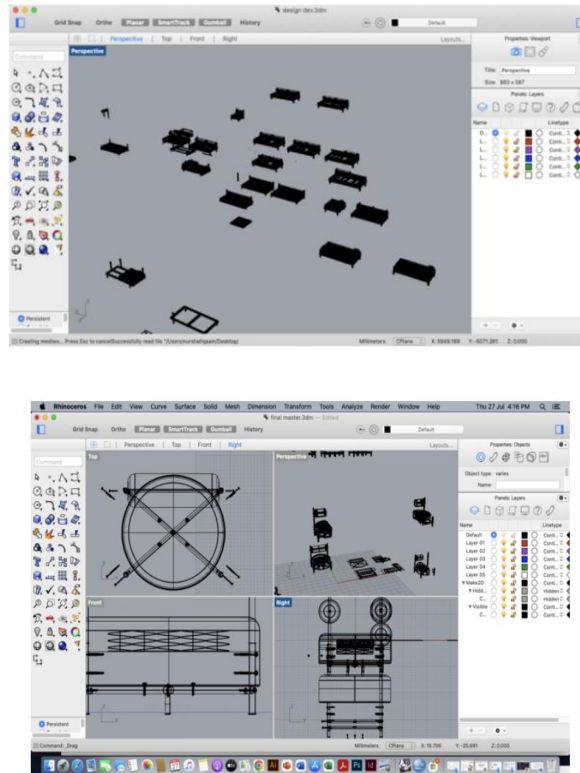


Figure 3. Design Process

DISCUSSION

The researcher conducted an observation of SME furniture companies in Shah Alam to capture the real-life challenges faced by these entities throughout the construction, design process, and export stages.

Form and structure



Figure 4. Survey and Observation From SME Furniture Companies in SNS Furniture, Shah Alam.

The researcher's observation highlighted that many sofa designs in SME furniture companies primarily utilize bulky wood materials, leading to cluttered and impractical structures unsuitable for modern furniture trends. These non-disassemblable sofas present significant transportation challenges due to their bulkiness, consequently

restricting export opportunities. The furniture industry has been greatly affected by the global shipping and supply chain crisis, leading to substantial challenges for sofa manufacturers, especially those creating large and non-disassemblable products, as they grapple with escalating transportation expenses (Audi, et al., 2011). In contrast, the adoption of ready-to-assemble furniture, specifically designed for space-saving during transportation, emerges as a viable solution for enhancing export efficiency and market competitiveness.

Operation



Figure 5. Survey and observation from SME furniture companies in Anggun Sofa & Interior, Shah Alam.

If bulky furniture accumulates within company warehouses, several challenges can arise. Firstly, the limited storage capacity due to the bulky items can lead to overcrowded and disorganized warehouses, making it difficult to locate and access inventory efficiently. This inefficiency can result in delays in fulfilling orders and increased labor costs associated with inventory management. Moreover, the inability to effectively manage inventory space may impact the company's ability to respond to fluctuations in demand or new market opportunities. With limited space for storing new products or raw materials, the company may miss out on potential sales or face delays in introducing innovative designs to the market.

Overall, the accumulation of bulky furniture within company warehouses can have detrimental effects on operational efficiency, productivity, and financial performance. Implementing effective space management strategies and exploring space-saving solutions, such as ready-to-assemble furniture, is crucial for mitigating these challenges and maintaining a competitive edge in the industry.

Commercialisation



Figure 6: Survey and observation from SME furniture companies in SNS Furniture, Shah Alam.

Observing the practices of SME furniture companies, it's evident that the predominant use of nail guns throughout the furniture assembly process results in products that are shipped as a single unit, presenting challenges for transportation and logistics. However, integrating 3D design-driven innovation strategies offers a transformative solution to this issue. By utilizing advanced 3D design technologies, these companies can explore alternative jointing techniques that allow for modular assembly, enabling sofas to be disassembled into smaller, more manageable components for shipping. This approach not only optimizes transportation efficiency but also enhances flexibility in meeting varying customer demands, ultimately bolstering the competitiveness of SME furniture companies in the modern market landscape.

Export



Figure 7: Exporting Process

Ready-to-assemble furniture, with its space-saving design, addresses the logistical challenges posed by the global shipping and supply chain crisis, Hughes (1996). By being easily disassembled and packed into flat packages, it reduces transportation costs and allows for more efficient use of shipping containers, maximizing the number of furniture items that can be exported within a given space.

Moreover, the ongoing trends and demands in the furniture market underscore the importance of continuous innovation in ready-to-assemble furniture by SME companies, Mehtab et al. (2022). By offering customizable and modular designs, SMEs can cater to diverse customer preferences while streamlining production processes and reducing inventory costs. This adaptability not only enhances customer satisfaction but also strengthens the competitiveness of SMEs in both domestic and international markets. The primary objective behind the creation of ready-to-assemble furniture is to minimize

space usage during transportation, facilitating increased export volumes. This furniture can be easily disassembled, packed into flat packages, and transported without the inconvenience of occupying excessive space during transit.

Lack of resources, might prevent from performing digital transformation in SMEs. In order to carry out digital innovation in the manufacturing industry, they should come into prominence which are raising awareness of SMEs about digital transformation, increasing competence of labour power and skills, providing technical and financial support for SMEs about that issue, and strengthening the data communication infrastructure (Ulas. D, 2019). Design outlooks connected to enterprises' role, marketing, and commerce, are essential to enable SMEs to achieve new markets. Apart from that, the lack of knowledge in terms of E- design and E-business that is not applied in SMEs Bumi causes a company to lack expertise in the field of innovation in furniture companies (Osman, 2019).

CONCLUSION

In conclusion, it is evident that the adoption of a design-driven innovation strategy focusing on form and structure is crucial for the successful export and commercialization of furniture. The research findings underscore the challenges faced by Bumiputera SME furniture manufacturers in sustaining their businesses amidst heightened competition and the digitalization landscape of Digital Transformation 4.0. However, amidst these challenges lie opportunities for technological advancements to revolutionize design processes. Moving forward, SME furniture companies must elevate their production standards to meet the demands of the global market. The Malaysian International Furniture Fair's projection of substantial growth indicates promising prospects, particularly as Malaysia ranks among the top 10 largest exporters of furniture globally, with approximately 80% of its production exported. Embracing ready-to-assemble sofa designs presents a viable avenue for SMEs to capitalize on market opportunities.

Moreover, the inadequacy in describing the Design Driven Innovation (DDI) process highlights the need for a paradigm shift, where industrial design should be integral to companies' R&D strategies rather than confined to the concept phase. Innovation efforts should encompass not only R&D directly linked to specific innovations but also broader enhancements in design and manufacturing processes. As advancements in innovation and technology continue to reshape the furniture industry, a holistic approach is imperative to optimize space utilization, enhance customer satisfaction, and improve overall production and manufacturing capacities. By embracing innovation and leveraging technological advancements, both consumers and SME furniture companies stand to benefit, ensuring sustained growth and competitiveness in the dynamic global market landscape.

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