RESEARCH ARTICLE

Integrating Design Expert Insights for Achieving Market Success in New Product Development

Mohamad Saiful Sazwan Mohd Rashid[1*], Hassan Alli[1], Ahmad Rizal Abdul Rahman[1], Khairul Manami Kamarudin[1]

[1]Architecture Department, Faculty of Design and Architecture, Universiti Putra Malaysia.

saifulsazwan@rocketmail.com

ABSTRACT

In the competitive landscape of product development, innovation plays a crucial role in creating value and addressing evolving market demands. This study explores the integration of user experience (UX) and knowledge into the product development process, emphasizing their impact on product marketability and success. Drawing on insights from design experts with substantial experience in New Product Development (NPD), the study highlights how understanding user needs, preferences, and experiences informs the creation of market-driven products. By incorporating cognitive, ergonomic factors, and product quality characteristics, designers can enhance product aesthetics and functionality to create a quality product, ultimately increasing purchasing decision. The findings suggest that the collaboration of design experts in the early stages of product development significantly influences product characteristics and improves decision-making. This research demonstrates that leveraging expert knowledge and UX not only drives innovation but also increases the likelihood of creating products that resonate with users and achieve marketability and success.

Keywords: *product development, user experience (UX), user knowledge, product marketability, product success*

Citation:
Mohd Rashid, M. S. S., Alli, H., Abdul Rahman, A. R., & Kamarudin, K. M. (2025). Integrating Design Expert Insights for Achieving Market Success in New Product Development. Alam Cipta, 18(1). https://doi.org/10.47836/AC.18.1.ARTICLE4

Received:
20 December 2023
Accepted:
09 February 2025
Published:
25 April 2025

Introduction

Product designers nowadays continually innovate to meet the diverse demands of users. Innovation is the creation of value by using the transformation of an idea connected with knowledge and resources into a new product, process, practice, or improvement of an existing product (Varadarajan, 2018). Innovation is a crucial driver of value creation, as it involves transforming ideas into tangible outcomes through the strategic use of knowledge and resources. By leveraging these elements, organizations can develop new products, processes, and practices, or enhance existing ones. This process not only fosters continuous improvement but also ensures that companies remain competitive in the market by addressing evolving user needs and market demands. The direction of innovation strategy can increase product performance and productivity, lower production costs, and enhance competition in existing or new products in the market (Marinidarraga & Cuartas-Martin, 2019; Al-Kalouti et al., 2020). Therefore, innovation strategy is also a way for implementation of product innovation whereas the demand of the user becomes an approach to fulfilling the companies' performance goal. However, product innovation must be unique, exceptional, and challenging in order to drive business performance (Majali et al., 2022), as a strategy and the reconfiguration of product innovation elements can create different design solutions.

Many product designers encounter new challenges when developing new products (Falahat et al., 2024). Often, product designers fail to create successful products in the market due to a lack of awareness of users' needs (Pilch, 2024). The

product industry is centered on fulfilling user needs, preferences, and styles while maintaining profitability, aiming to shift user expectations (Marimba et al., 2024). Developing a unique product identity is crucial for shaping public perception and showcasing the quality of product designers, ultimately enhancing user satisfaction (Kim & Heo, 2021). Understanding the user becomes an important driver in creating and providing a fascinating product value proposition (Iheanachor et al., 2021). According to Taha et al., (2012); Alli (2018); Alli & Mohd-Rashid (2019), user and product developer interaction in the product development process is attempted to establish the product character based on needs and requirements, and UX and their knowledge are highly required. Elsya and Indriyani (2020), UX and knowledge can assist product designers in product evaluation so that they can feel the value of the product being consumed and influence the actions to be taken. In addition, it also can help the product developer to become aware of which factors to pursue to fulfil the needs of a new product.

Product designers can quickly innovate a new product by understanding, fulfilling the demand and gaining a viable market. Recognizing UX and their knowledge in shaping product characteristics is crucial for enhancing product marketability and success (Dabić et al., 2023; Wu, 2023; Xu et al., 2023). Critical in the establishment of a new product character in the early stage of the product development process, this study is valuable to explore the good understanding of UX and their knowledge and help product designers generate better product outcomes.

Literature Review

New Product Development (NPD) process has undergone significant transformation over the past 15 years, the adoption of collaborative information has contributed to the increased efficiency and accessibility of the process enabling faster problem-solving and more effective collaboration in design activities (Marion & Fixson, 2021). Product marketability and success appear to be both practical and emotional aspects that must be developed effectively to foster a strong relationship between the product and users. According to Heskett (2017), the key to product design success includes the creative of ideas through their form, functions, ergonomics, manufacturable, and marketability. These factors are harmoniously associated with the user's life, fashion, and response to their needs and wants. Design can make a significant contribution to new product success. However, product designers need to be more innovative and competitive to catch the market needs by providing and applying a strategy to attract new users and increase their satisfaction (Cantele & Zardini, 2018). Product designers also need to establish highly responsive, innovative, and efficient strategies.

User Experience (UX) and Knowledge

A good product emphasis better creation from UX and knowledge, which combines aesthetics and function aspects (Chen, 2020). The agreement amongst numerous related fields, including business management and design fields is imperative to emphasise the importance of considering UX and their knowledge in a NPD process. Users play a critical part in determining the marketability and success of a product as well as the positive impact on the community. The user is expected to provide valuable information which may lead to product requirements. An understanding of users' needs, competitiveness, and market nature is an important factor in new product success (Taha et al., 2012; Cooper, 2018; Alli & Mohd-Rashid, 2019).

User Experience (UX)

UX is essential in NPD, as it plays a crucial role in enhancing the product throughout the development process. By stimulating emotions and addressing psychological needs, UX helps establish a deeper connection with the product, ultimately leading to greater user satisfaction. A successful product integrates aesthetics

and functionality, which are key elements in creating products that resonate with UX, fostering emotional connections and satisfaction (Chen, 2020). Capturing opportunities to impact UX during the product development process is important for many product development companies. According to Merritt and Zhao (2021), UX has become a critical factor in maintaining competitiveness within the business industry, as modern users increasingly embrace technology, which drives product innovation. Product designers embrace UX as an essential element in their NPD process with the opportunity to create a new business model that can deliver the quality, marketability, and success of a product by fulfilling the user's needs and expectations. In UX based design innovation, user-generated data and design are two valuable resources for various design activities, such as identifying opportunities and generating design ideas (Yang et al., 2023). Regardless of these resources, the actual innovation of UX designs is commonly based on previous experience, trial and error, and duplication (Karvonen, 2019). The utilisation of the UX design objective is to assist in the development of experiences with products in the design process. It can be considered a technique of user-centered design work and can be used as part of the approach in design guidelines.

User Knowledge

An understanding of user knowledge plays a pivotal role in shaping product evaluation and decision-making processes. Research indicates that users' familiarity with a product can enhance their ability to assess its value, thereby influencing their subsequent actions and engagement with the product (Elsya & Indriyani, 2020). There are three levels of knowledge users. According to Shluzas et al., (2013), a professional user is defined as a user with rich interaction knowledge, task knowledge, and domain knowledge of specific systems who is skilful in obtaining and using this knowledge to achieve goals. Rahardja et al, (2021), stated that experienced users tend to develop a strong relationship with a product as a result of their interactions and experiences. Experienced users will have a good perception that will automatically make them evaluate and compare what they want to receive from a product so that they spend focusing only on their interests. While novice users may require more cognitive effort to process product information, they are less likely to have the cognitive capacity to search for and acquire information needed to learn about new products. They are not able to process information effectively because they don't have a higher level of product-related knowledge (Chinchanachokchai et al., 2021). An effective approach for product evaluation can assist in promoting the success of a product design. Arabadzhieva (2016) suggested that, during the NPD stages of idea generation and concept creation, experienced and professional users are the ideal targets for collaboration. Professional users will provide freedom to create more novel and essential solutions in product development process while experienced users are likely to understand the innovation strategy product designer will execute (Kenea, 2020). Different levels of knowledge and understanding have a significant impact on product purchasing behaviour. Product designers must address the varying needs and knowledge of users to engage their interest in the product while simultaneously gaining deeper insights into user demands. This approach contributes to the development of products that facilitate a closer alignment between the user and the product (Alonso-García et al., 2020). User knowledge is crucial for identifying the functional requirements and needs of a product. The insights provided by users must be systematically processed into design information, which is then incorporated into the final product, resulting in a user knowledge-driven design experience. By integrating user knowledge throughout the product development process, designers can create products that not only fulfil functional requirements but also enhance user satisfaction, thereby ensuring a more effective and engaging product-user relationship.

Product Development Process

The product development process refers to the stages involved in designing, creating, and bringing a new product to market. According to Yin and Zhang (2021), this process consists of a series of phases and activities, including product planning, concept design, detailed design, manufacturing, testing, and improvement. It is also the process of creating a new product that satisfies user needs and differentiates it from competitors. This process has been described as converting a new market opportunity into a commercial product through a series of activities to achieve specific objectives (Ulrich & Eppinger, 2016).

Figure 1. Product Development Process

The product development process is important for business success and growth. According to Gao and Bernard, (2018) developing a new product can be complex and risky, the success of a new product depends on many variables. It is essential for product growth and gaining a competitive advantage in the market.

Design changes frequently occur during the early stages of the product development process, which involves planning and concept development. These changes may require significant modifications to product specifications and design parameters (Zhang et al., 2020). Understanding the key characteristics of a new product is a critical task during the early stages of the product development process. Recent studies have shown that the interaction between aesthetics and functionality product characteristics is influenced by user emotions and perceptions. User involvement is important in the product development process, user can be a representative of needs and preferences for product design (Naous & Legner, 2021). According to Dou et al., (2021), the success of a new product strongly depends on the level of user satisfaction and preferences toward the product. Creating a satisfied user's product can help product designers increase profits and product value.

Integrating User Experience and Knowledge in Product Development Process

To analyse interactions between users and products, a conceptual guideline for UX should be established. The first component of this guideline focuses on identifying the types of UX and knowledge to include in product appraisal information modelling. Measurement and structural guidelines for UX will be based on cognitive and ergonomic experiences. According to Berni and Borgianni (2021) and Berni et al. (2023), two main categories of experience are identified in both individual and collective user experiences:

Table 1. User Experience Categories

Categories of Experience	Description
Cognitive experience	Aligns with perception (Alben, 1996; Goto, 2004; McCarthy et al., 2004; Colbert, 2005; Kuniavsky, 2010) and users perceive it through the exterior and aesthetics of a system (Hassenzahl, 2004; Hekkert, 2006; Desmet & Hekkert, 2007; Norman & Nielsen, 2016; Chen et al., 2020).
Ergonomic experience	Contains features such as usability (Alben, 1996; Sutcliffe, 2009), affordances (Pucillo & Cascini, 2014), and effectiveness (Alben, 1996; Kuniavsky, 2010; Norman & Nielsen, 2016; Carbon, 2019).

Therefore, this study will use these two categories to determine the types of experience involved in product appraisal that evoke the targeted UX, supporting the concept of experience design in the product development process. Cognitive experience influences perceptions of aesthetic elements, while ergonomic experience is derived from functional elements. Aesthetics in design can affect user behaviour by enhancing sensory interactions with products, which in turn impacts

user attention and shapes their expectations. Functional factors also influence user behaviour, as users recognize that design aesthetics play a crucial role in their purchasing decisions, particularly when their functional needs are met. In a study by Alli et al. (2019), 20 elements of product design specifications were implemented as product design requirements. This approach offers product designers an effective means of determining the appropriate direction and establishing new design forms during the product development process. Tables 2 and 3 present the specifications for two categories: aesthetic and functional elements of product design.

Table 2. Aesthetics Elements of Product Design

Aesthetic Elements of Product Design	Description
Shape	Quality of a product in having an exterior surface of specific form.
Colour	Visual property of the product.
Appearance	Physical properties of the product based on how it looks and feels.
Form	The relationship among the material, expression, appearance, and function that need to be present for the product to appear complete.
Material	Concerned with the physical properties of the product to show its character.
Interface	Product information in better definition between subsystems and components.
Texture	Variation in the intensity of a surface.
Emotion	Involves a relationship between the user experience and a particular object.
Semantic	The potential to communicate and interpret the meaning of a product.
Semiotic	The use of signs in the design of a physical product.

Table 3. Function Elements of Product Design

Function Elements of Product Design	Description
Usability	Achieve specified goals with effectiveness, efficiency, and satisfaction.
Safety	Provide safety for the intended user and meet the standard requirements.
Ergonomic	Comfortable to maximize efficiency.
Quality	Work reliably and perform all functions that fulfil user expectations.
Technology	Specific technology is used in a particular configuration to provide a technical platform to support product function.
Reliability	The product performs its intended function for a specified time period.
Effectiveness	Product capability to meet user requirements and preferences.
Lifetime	Operated or used economically before the specified period of time.
Components	Relationship between the product components and quality for user emotion and satisfaction.
Size	Specified quantity of the product.

To remain competitive in the market, product quality characteristics must be introduced, which will define how UX variables are structured in relation to these characteristics. UX drives individuals to establish an ongoing cycle of demand, stimulating a continuous need for product quality characteristics and serving as a guiding force for market competition (Djamasbi & Strong, 2019). Recognizing product quality as a potential strategic advantage to outperform competitors, it is essential to consider the characteristics of a product that significantly impact its ability to meet users' needs (Rajasa et al., 2023). Product quality encompasses a comprehensive evaluation of a product's performance in meeting the needs of users. A product is defined as something that can be sold, used, or consumed to fulfil a desire or requirement and can be offered in the market to attract attention. Garvin (1988) and De Giovanni and Zaccour (2023), have proposed eight dimensions of product quality to assess the construct of product marketability factors. Table 4 below shows Garvin's eight dimensions of product quality have significantly influenced product marketability assessment, particularly in response to technological advancements and evolving user preferences.

Table 4. Garvin's Eight Dimensions of Product Quality

Characteristics	Definition
Performance	Corresponds to a product's primary operating characteristics and involves measurable attributes.
Features	Additional characteristics and options that complement the basic functions, and make the product more appealing and the service more useful.
Reliability	The likelihood that a product does not fail within a specific time period.
Conformance	The capability of a product or a service to meet the specified standards.
Durability	Measures the length of a product's life and may be defined as the amount of use a consumer gets from a product before it breaks down and replacement is preferable to repair.
Serviceability	The consumer's ease of obtaining repair service, the responsiveness of service personnel, and the speed at which the product can be put into service after it breaks down.
Aesthetics	Indicates how the product looks, feels, sounds, tastes, or smells. This is a matter of personal judgement and a reflection of individual preference.
Perceived quality	An assessment of the quality of a good or service based on indirect measures.

Integrating these dimensions into future modelling efforts is crucial to understanding their impact on user assessments of product marketability and success marketability. Additionally, exploring how these dimensions affect the company's business model will provide valuable insights into optimizing product development strategies and enhancing competitiveness in the market.

Development of a Marketability and Success Product Conceptual Framework

A product development strategy is required to achieve marketability and ensuring the success of a product with the involvement of users, particularly professional users and experienced users. This collaboration is crucial for developing product characteristics that are competitive in the market while effectively addressing user needs.

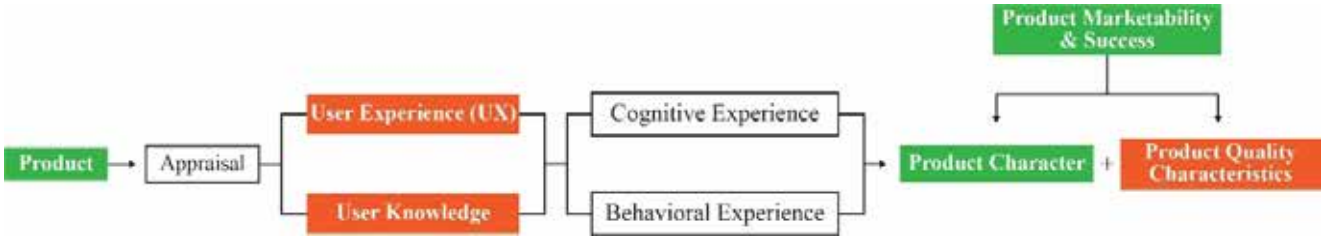

Figure 2. Marketability and Success Product Conceptual Framework

A well-structured model is essential to meet the objectives of NPD. The integration of UX and knowledge plays a pivotal role in the product evaluation process. Both cognitive and ergonomic experience are fundamental in shaping product characteristics. To positively impact the marketability and success of new products, it is crucial to integrate product quality with these characteristics. This collaborative involvement provides companies with innovative strategies to enhance their performance throughout the NPD process.

Method

The survey was conducted using a face-to-face approach. A structured self-administered survey was distributed to selected design experts with experience in NPD who are currently working in the product design industry in Klang Valley. The study aimed to identify the significance of their experience and knowledge in establishing new product characteristics during the early stages of the product development process.

A judgmental or purposive sampling method was employed to select participants based on specific characteristics relevant to this study. The participants were chosen based on their level of understanding, knowledge, and expertise in the field. Their contributions were invaluable in restructuring and refining the survey questions to maximize the impact of the study. Each participant possesses significant knowledge and expertise, having worked in the product design field for over five years. The criteria for selection included project leaders, executive designers, and professionals engaged in product research and development.

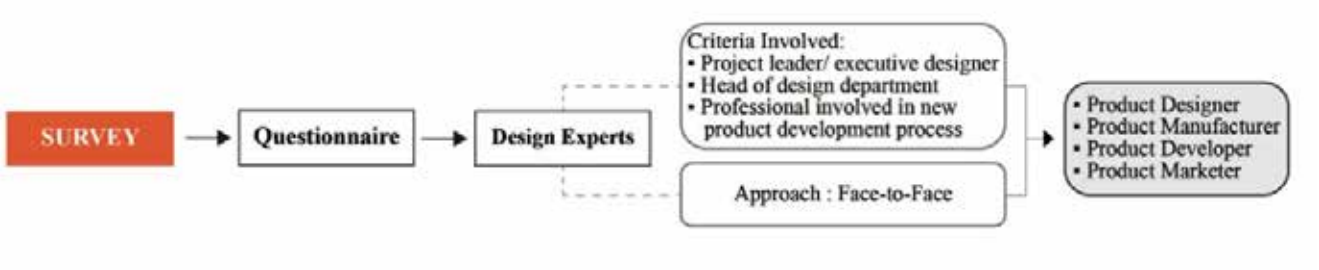

Figure 3. Procedure of Conducting Survey for Design Experts

To evaluate UX and needs as a method of analysis for defining a product's marketability and success, Dewi et al. (2020) suggest that usability inspection methods, such as heuristic evaluations and cognitive walkthroughs, can be employed by experts to assess UX and identify areas for improvement in a product. The evaluation data in this study are derived from experts using the User Experience Questionnaire (UEQ) technique (Sularsa et al., 2015). This questionnaire, along with an information-processing instrument linked to UX, complements user satisfaction metrics and provides quantitative data from the evaluation process. As an appraisal method, the UEQ uses a series of questions to gather information from the user's perspective, aiding designers in creating products that align with user preferences.

Data Analysis And Results

Design Expert's Involvement in Product Development Process

This section presents an analysis of the involvement of design experts in the product development process, focusing on their professional experience and participation in NPD activities. The data was collected from a survey of design experts with significant industry experience.

Experts were selected from the highest management level to obtain their knowledge of product design and development processes. Respondents have a minimum of 10 years' experience in the design industry and are considered design experts. Most of the design experts who participate in this survey have a total of experience ranging from 10 to 14 years, which represents the majority with N = 47 (48.5%), followed by 25 to 30 years of experience with N = 24 (24.7%), 15 to 19 years of experience with N = 17 (17.5%), and the least with 20 to 24 years of experience with N = 9 (9.3%). The majority of design experts surveyed have between 10 and 14 years of working experience in the design industry, indicating a solid foundation and contribution of expertise.

Table 5. Design Experts Working Experience

Working Experience	Frequency (N)	Percentage (%)
10 – 14 years	47	48.5
15 – 19 years	17	17.5
20 – 24 years	9	9.3
25 – 30 years	24	24.7
Total	**97**	**100.0**

Respondents who participated in this study have years of involvement in product development activities. The majority of experts have 10 to 15 years of knowledge experience, with N = 47 (48.5%), followed by N = 38 (39.2%) within 6 to 9 years, and only N = 12 (12.4%) of design experts have 1 to 5 years of knowledge experience. Most respondents possess substantial knowledge experience in product development, with nearly half having between 10 to 15 years of relevant experience.

Table 6. Design Experts' Knowledge Experience

Knowledge Experience	Frequency (N)	Percentage (%)
1 – 5 years	12	12.4
6 – 9 years	38	39.2
10 – 15 years	47	48.5
Total	**97**	**100.0**

Most of the design experts are involved in 20 to 30 NPD activities (N = 18, 60.0%), followed by those involved in 15 to 19 activities (N = 5, 16.7%). Additionally, some experts participate in 10 to 14 activities (N = 4, 13.3%), and the rest are involved in 5 to 9 activities (N = 3, 10.0%). The data indicates that most design experts are actively involved in numerous NPD activities, with a significant number participating in over twenty activities.

Table 7. Design Experts' Involvement in NPD Activities

Involvement in NPD Activities	Frequency (N)	Percentage (%)
5 – 9 activities	10	10.3
10 – 14 activities	12	12.4
15 – 19 activities	16	16.5
20 – 24 activities	31	32.0
25 – 30 activities	28	28.9
Total	**97**	**100.0**

Correlation Between Age, Working Experience, and Involvement in NPD Activities and Design Experts That Affect in Knowledge Contribution Towards NPD Process

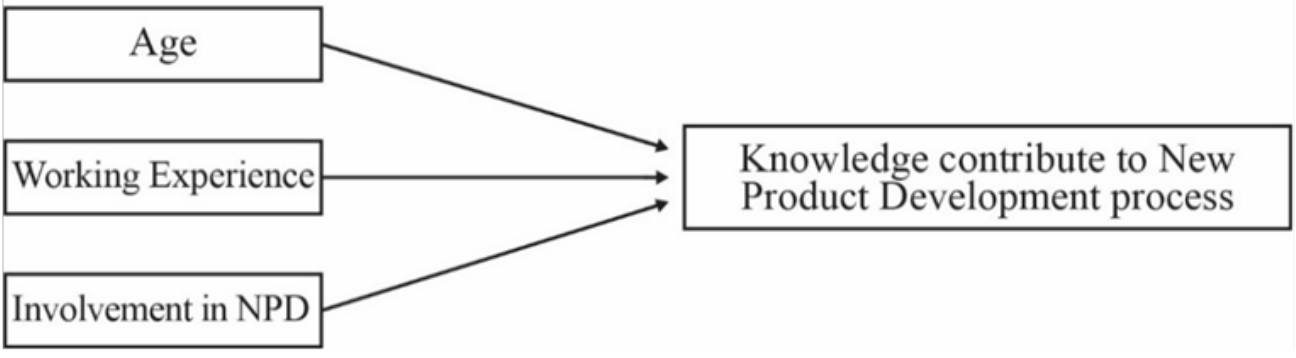

Figure 4. Conceptual Framework of Age, Working Experience, New Product Development Involvement of Design Experts in Knowledge Contribution Towards New Product Development Process

This section explores the relationships between age, working experience, and involvement in NPD activities of design experts, focusing on how these factors contribute to knowledge sharing and experience effectiveness in the NPD process.

H_1: There is a positive correlation between the age of design experts' knowledge and their contribution to the NPD process.

The results of the Spearman correlation indicate a significant association between the age of the design experts and their knowledge contribution to the NPD process ($r = 0.715$, $p < 0.01$). and acknowledged that the hypothesis H1 is accepted. Hence, the significant correlation is strong and positive. Increasing age will encourage design experts to provide more reliable knowledge to determine the good characteristics of product design. Age will help the design experts enhance their mature decision-making skills and provide a positive commitment that can be affected during the product development process.

H_2: When the working experience of design experts is developed, reliable knowledge will contribute to the NPD process.

The result of the Spearman correlation shows that the design experts' working experience and knowledge were statistically significant in contributing to the product development process ($r = 0.802$, $p < 0.01$). The hypothesis H2 is accepted, and the presented significant correlation is strong and positive. The design experts' working experience will contribute to reliable knowledge and information in the product development process.

H_3: When design experts are involved more in NPD activities, they will contribute more proficient knowledge to the NPD process.

The result shows that the Spearman correlation is statistically significant between the design expert's involvement in product development and their knowledge contributed ($r = 0.962$, $p < 0.01$). This hypothesis H3 is accepted, and the correlation is very strong and positive. The more design experts involved in the product development process, the more experiences and knowledge will be established, which can be used as important information and interaction during the product design process.

The table shows the correlation matrix of age, working experience, and involvement of design experts in NPD as independent variables that contribute to the product development process. The correlation result is intended to test the three hypotheses that there is a significant relationship between each of the independent variables and the dependent variable correspondingly.

Table 8. Spearman Correlation Test Regarding Design Experts' Factors that Influence in Knowledge Contribution to NPD Process

Variable	M	SD	1	2	3
Knowledge contributes to new product development process	**8.49**	**3.86**			
Age	**43.26**	**7.00**	**.715****		
Working Experience	**19.53**	**6.36**	**.802****	**.916****	
Involvement in NPD	**21.62**	**8.08**	**.962****	**.656****	**.649****

Note. **. Correlation is significant at the 0.01 level (2-tailed).

The Importance of Aesthetics Elements Towards Cognitive Experience in Product Development Process

To analyse the importance of various aesthetic elements as perceived by design experts, a non-parametric Friedman test was conducted. This test compares the mean ranks of related aesthetic elements based on the experience and knowledge of design experts. The results revealed a statistically significant difference in visceral quality based on the perceived characteristics of aesthetic elements in the product development process, with a chi-square value of $\chi^2(12) = 24.29$, $p < 0.019$.

The results indicate that 76 out of 97 design experts (78.8%) agreed that the shape element, with a mean score of M = 4.06 ± 0.704, is an important variable in design characteristics, as detailed in the table below. Additionally, although scoring the lowest, semiotic elements were supported by 56 experts (58.4%), who rated them as a useful variable for product characteristics, with a mean score of M = 3.01 ± 0.860. Furthermore, the findings highlight that aesthetic elements are considered significant variables in product characteristics, which can be leveraged in the product development process to assess the cognitive experience of product appraisal.

Table 9. The Non-Parametric of Friedman Test to Compare the Mean Ranks Between Aesthetics Elements Based on Experience Knowledge of Design Experts.

No.	Variable	Percentage (%)			Mean (M)	Standard Deviation (SD)
		25th	50th (Median)	75th		
1.	Shape	4.00	4.00	4.50	4.06	0.704
2.	Form	4.00	4.00	4.00	4.04	0.644
3.	Colour	4.00	4.00	4.00	3.94	0.659
4.	Appearance	3.00	4.00	4.00	3.86	0.661
5.	Material	3.00	3.00	4.00	3.51	0.709
6.	Texture	3.00	3.00	4.00	3.43	0.877
7.	Emotion	3.00	4.00	4.00	3.35	0.830
8.	Interface	3.00	3.00	4.00	3.28	0.887
9.	Semantic	2.00	3.00	4.00	3.07	0.960
10.	Semiotic	2.00	3.00	4.00	3.01	0.860

Table 10 summarizes how respondents rated the importance of various aesthetic elements across three levels (high, medium, low) in relation to product characteristics within the product development process. The results from both tables indicate that certain aesthetic elements significantly influence the cognitive experience of products:

- **High-Priority Elements:** Shape, form, colour, and appearance are considered essential for creating an appealing product that resonates with users on a cognitive level.
- **Medium-Priority Elements:** Material, texture, emotion, interface, semantics, and semiotics contribute to the overall aesthetic but are not as critical as the high-priority elements.

The cognitive experience established through effective aesthetic design not only enhances user satisfaction but also fosters long-term attachment to products.

Table 10. Distribution of the Importance Level of Aesthetics Elements Towards Product Characteristics in Product Development Process

Level of aesthetics element characteristics	Variables
High (3.67 – 5.00)	
	Shape
	Form
	Colour
	Appearance
Medium (2.33 – 3.66)	
	Material
	Texture
	Emotion
	Interface
	Semantic
	Semiotic
Low (0.00 – 2.32)	
Mean = 3.55	
SD = 0.036	

Function Elements Towards Behavioural Experience in Product Development Process

The table below analyses the importance of various functional elements as perceived by design experts. The Chi-square test revealed a statistically significant difference in behavioural quality based on the functional elements perceived as characteristics in the product development process, $\chi^2(14) = 30.27$, $p < .007$. The results indicate that 81 out of 97 design experts (86.0%) identified the technology element, with a mean score of M = 4.34 ± 0.888, as the most important variable in design characteristics for product development criteria. Although it received the lowest score, 57 experts (59.1%) acknowledged that the component, with a mean score of M = 3.05 ± 1.004, can also be considered a contributing variable to product characteristics in the product development process. These findings underscore that functional elements are significant variables in product characteristics and can be leveraged in the product development process to assess the behavioural aspects of product appraisal.

Table 11. The Non-Parametric of Friedman Test to Compare the Mean Ranks Between Function Elements Based on Experience Knowledge of Design Experts

No.	Variable	Percentage (%)			Mean (M)	Standard Deviation (SD)
		25th	50th (Median)	75th		
1.	Technology	4.00	5.00	5.00	4.34	0.888
2.	Usability	4.00	4.00	5.00	4.21	0.660
3.	Reliability	4.00	4.00	5.00	4.19	0.601
4.	Quality	4.00	4.00	5.00	4.14	0.629
5.	Safety	4.00	4.00	5.00	4.13	0.671
6.	Ergonomic	4.00	4.00	4.00	3.97	0.637
7.	Effectiveness	3.00	4.00	4.00	3.86	0.612
8.	Size	3.00	3.00	4.00	3.65	0.817
9.	Lifetime	3.00	4.00	4.00	3.62	0.895
10.	Component	2.00	3.00	4.00	3.05	1.004

Table 12 summarizes how respondents rated the importance of various functional elements across three levels (high, medium, low) in relation to product characteristics within the product development process. The results from both tables indicate that most functional elements significantly influence the behavioural quality of products:

- **High-Priority Elements:** Technology, usability, reliability, quality, safety, ergonomics, size, effectiveness, and lifespan are considered essential for creating an appealing product that resonates with users on a behavioural level.
- **Medium-Priority Elements:** This category includes only the component element, which contributes to the medium-priority level.

The behavioural quality established through functional design not only enhances user satisfaction but also improves the overall functionality of the product.

Table 12. Distribution of the Importance Level of Function Elements Toward Product Characteristics in Product Development Process

Level of function element characteristics	Variables
High (3.67 – 5.00)	
	Technology **Usability** **Reliability** **Quality** **Safety** **Ergonomic** **Effectiveness**
Medium (2.33 – 3.66)	
	Size **Lifetime** **Component**
Low (0.00 – 2.32)	
Mean = 3.93 **SD = 0.036**	

Product Quality Characteristics in Product Development Process Towards Product Marketability and Success

This analysis examines the mean ranks of product quality characteristics in the product development process and their impact on product marketability and success. The Chi-square test revealed a statistically significant difference in reflective quality related to the product development process and its influence on the product appraisal process, $\chi^2(8) = 25.75$, $p < .001$. The results show that 82 out of 97 design experts (84.9%) identified aesthetics as the most important product quality characteristic, with a mean score of M = 4.38 ± 0.756. This was significantly followed by other qualities that enhance product marketability and success. In contrast, only 47 experts (48.8%) considered serviceability (M = 2.93 ± 1.340), and 56 experts (58.6%) considered conformance (M = 2.44 ± 1.407) to be important, ranking them lowest among the characteristics contributing to product marketability and success. These findings suggest that achieving a successful and marketable product requires prioritizing quality characteristics that significantly enhance marketability and success.

Table 13. The Non-Parametric of Friedman Test to Compare The Mean Ranks Between Product Quality Characteristics that Affect the Product Marketability and Success

No.	Variable	Percentage (%)			Mean (M)	Standard Deviation (SD)
		25th	50th (Median)	75th		
1.	Aesthetics	4.00	4.50	5.00	4.38	0.756
2.	Features	4.00	4.00	5.00	4.11	0.999
3.	Performance	3.00	4.00	5.00	3.89	1.190
4.	Reliability	3.00	4.00	5.00	3.59	1.272
5.	Durability	2.75	3.50	5.00	3.52	1.138
6.	Perceived Quality	2.00	3.00	4.25	3.32	1.335
7.	Serviceability	2.00	3.00	4.00	2.93	1.340
8.	Conformance	3.00	1.00	2.00	2.44	1.407

Table 14 summarizes how respondents rated the importance of product quality characteristics across three levels (high, medium, low) in relation to product characteristics within the product development process. The results indicate that only three variables significantly influence product quality characteristics:

- **High-Priority Elements:** Innovation, design, and technology are viewed as critical for achieving product success and are essential for enhancing marketability and overall effectiveness in the product development process.

- **Medium-Priority Elements:** This category includes functionality, quality, brand, market, and regulation. While these characteristics are considered important, they are not as crucial as those in the high-priority category. Their medium ratings suggest that they contribute to product success but play more supportive roles.

Table 14. Distribution of the importance level of reflective quality that affect the product marketability and success

Level of product quality characteristics	Variables
High (3.67 – 5.00)	
	Aesthetics Features Performance
Medium (2.33 – 3.66)	
	Reliability Durability Perceived Quality Serviceability Conformance
Low (0.00 – 2.32)	
Mean = 3.54	
SD = 0.040	

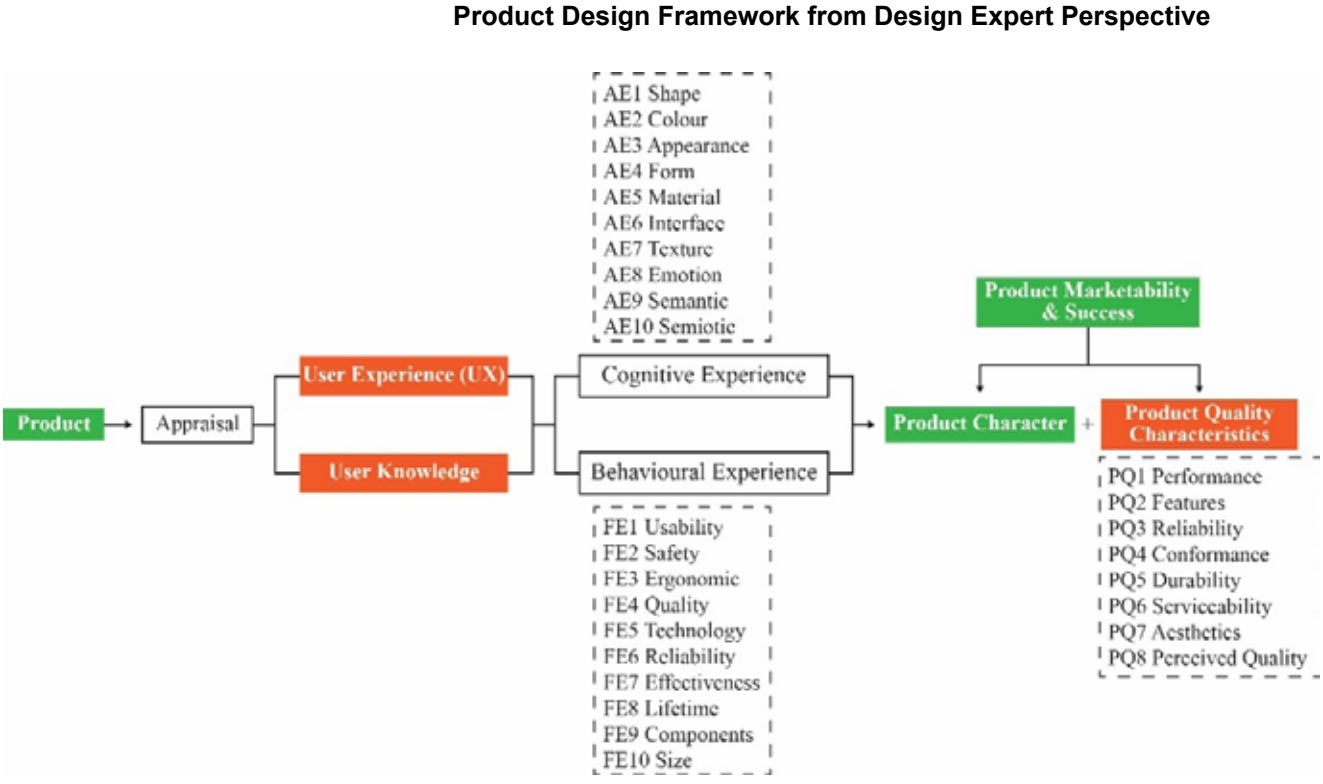

Figure 5. A Conceptual Framework Integrating Product Characteristics and Quality Attributes to Achieve Marketability and Success

Figure 5 illustrates the importance of integrating UX and knowledge into the product appraisal process. The cognitive and behavioural experience characteristics of a product shape user needs and preferences, which in turn help determine the product's attributes. These attributes must then be integrated with product quality characteristics, serving as a guideline for product designers to identify and create products that meet the goals of marketability and success.

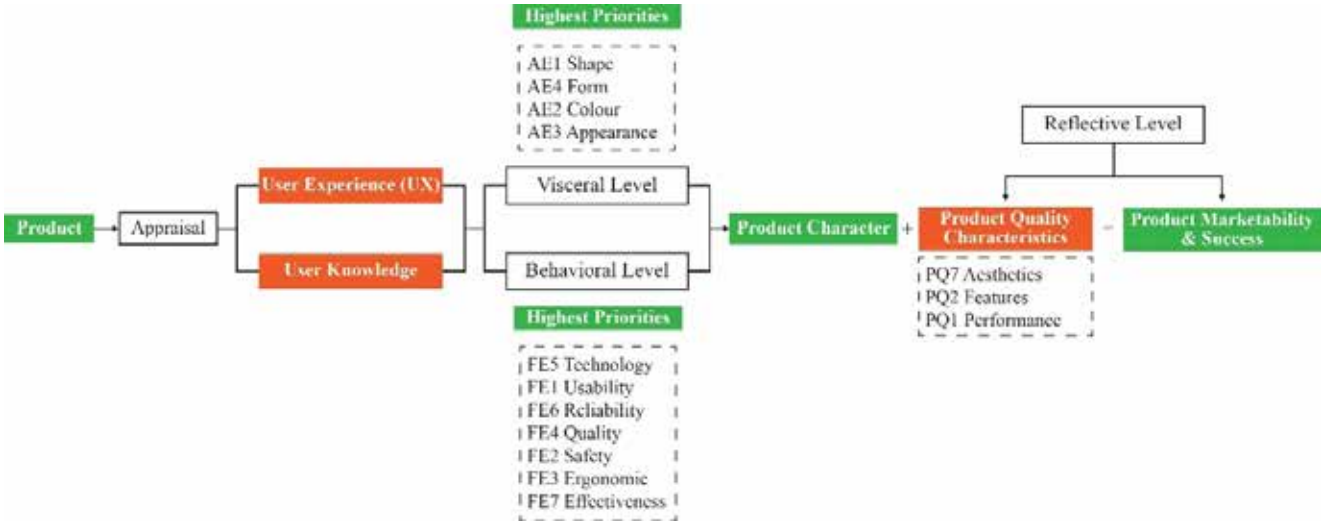

Figure 6. Predictions of Product Marketability and Success Characteristics from Design Experts to be Used as Preferences in the Product Development Process

Figure 6 above presents a perspective of the product characteristics guideline from the viewpoint of design experts. To achieve product marketability and success, product designers must prioritize key aesthetic and functional elements. These elements should be integrated with product quality characteristics, a strategy that is expected to enhance the product's marketability and success.

Discussions

The experience and knowledge of design experts play a pivotal role in identifying characteristics that enhance product marketability and success. A preliminary survey was conducted to assess the capabilities and expertise of these experts within the NPD process. The insights provided by design experts serve as essential and reliable information for effective product development.

The contribution of experience and knowledge was further supported by correlations observed between age, work experience, and involvement in product development activities among the design experts. Hypothesis 1 (H1) was accepted, revealing a positive correlation between the age of design experts and their contribution to the NPD process ($r = 0.765$, $p < 0.01$). This suggests that the maturity associated with age enables design experts to make informed decisions based on their accumulated knowledge and expertise. Additionally, Hypothesis 2 (H2) was supported, demonstrating that increased work experience among design experts is positively associated with the generation of reliable knowledge that benefits the product development process ($r = 0.802$, $p < 0.01$). This finding highlights the importance of work experience in fostering expertise that contributes to the success of NPD.

Further, a correlation test assessed the impact of involvement in design activities on the knowledge contribution within the NPD process. Hypothesis 3 (H3) was accepted, showing that greater involvement in product development activities correlates with a higher contribution of proficient knowledge from design experts ($r = 0.962$, $p < 0.01$). Engaging in a range of design activities enables professionals to accumulate valuable insights, which are instrumental in shaping product development decisions.

A non-parametric test was also employed to compare mean ranks between aesthetic elements, functional elements, and product quality characteristics. The results indicated that mean rank values effectively identify key variables in the product development process, which are predicted to enhance marketability and success.

Overall, the findings from this preliminary study underscore the importance of the experience and knowledge of design experts in the product development process. Their expertise and involvement in various stages of NPD contribute significantly to creating products that meet market demands and achieve success.

Conclusion

The product development process is crucial for business success, with well-designed products playing a central role in achieving this goal. The marketability and success of a new product rely on a deep understanding of UX, needs, and preferences. This study emphasizes the vital contribution of professional users, particularly design experts, in the early stages of product development. Their expertise shapes valuable knowledge that directly influences product purchasing decisions. This knowledge not only improves the success rate of products but also enhances decision-making, leading to better outcomes. The findings underscore that insights from design experts foster innovation and positively impact product marketability. In conclusion, leveraging the experience and knowledge of design experts is essential for identifying product characteristics that meet market demands. Integrating these insights into the development process enables product designers to create more successful and marketable products.

References

Al-Kalouti, J., Kumar, V., Kumar, N., Garza-Reyes, J. A., Upadhyay, A., & Zwiegelaar, J. (2020). Investigating innovation capability and organizational performance in service firms. *Strategic Change*, *29*(1), 103–113. https://doi.org/10.1002/jsc.2314

Alben, L. (1996). Quality of experience: Defining the criteria for effective interaction design. *Interactions*, 3(3), 11–15. https://doi.org/10.1145/235008.235010

Alli, H. (2018). User involvement method in the early stage of new product development process for successful product. *International Journal of Sustainable Tropical Design Research and Practice*, *11*(1), 23-28. Retrieved from http://psasir.upm.edu.my/id/eprint/64500/

Alli, H., & Mohd-Rashid, M. S. S. (2019). Users' emotional responses and perceived product quality towards sustainable design. *International Journal of Sustainable Tropical Design Research and Practice*, *12*(1), 38–45. Retrieved from http://psasir.upm.edu.my/id/eprint/70009/

Alonso-García, M., Pardo-Vicente, M., Rodríguez-Parada, L., & Nieto, D. M. (2020). Do Products Respond to User Desires? A Case Study. Errors and Successes in the Design Process, under the Umbrella of Emotional Design. *Symmetry*, *12*(8), 1350. https://doi.org/10.3390/sym12081350

Arabadzhieva, I. (2016*). New products: The Importance of Product Characteristics in the Buying Process Depending on the Product Type*. Master Thesis: Erasmus Universiteit Rotterdam.

Berni, A., & Borgianni, Y. (2021). From the definition of user experience to a framework to classify its applications in design. *Proceedings of the Design Society*. 1, 1627-1636. https://doi.org/10.1017/pds.2021.424

Berni, A., Borgianni, Y., Basso, D., & Carbon, C. C. (2023). Fundamentals and issues of user experience in the process of designing consumer products. *Design Science*. 9, e10. https://doi.org/10.1017/dsj.2023.8

Cantele, S., & Zardini, A. (2018). Is sustainability a competitive advantage for small businesses? An empirical analysis of possible mediators in the sustainability–financial performance relationship. *Journal of Cleaner Production*,*182*, 166–176. https://doi.org/10.1016/j.jclepro.2018.02.016

Carbon, C. C. (2019). Psychology of design. *Design Science*, 5, e26. https://doi.org/10.1017/dsj.2019.25

Chen, M., Mata, I., & Fadel, G. (2020). Interpreting and tailoring affordance based design user-centered experiments. *International Journal of Design Creativity and Innovation*. 8(1), 46-68. https://doi.org/10.1080/21650349.2019.1651675

Chen, X. (2020). The new thinking in emotional user experience: From visual metaphor to interactive affordance. In *Advances in Usability and User Experience: Proceedings of the AHFE 2019 International Conferences on Usability & User Experience, and Human Factors and Assistive Technology, 10,* 490-497. https://doi.org/10.1007/978-3-030-19135-1_47

Chinchanachokchai, S., Thontirawong, P., & Chinchanachokchai, P. (2021). A tale of two recommender systems: The moderating role of consumer expertise on artificial intelligence based product recommendations. *Journal of Retailing and Consumer Services*. 61, 102528. https://doi.org/10.1016/j.jretconser.2021.102528

Colbert, M. (2005). User experience of communication before and during rendezvous: Interim results. *Personal and Ubiquitous Computing*. 9(3), 134-141. https://doi.org/10.1007/s00779-004-0318-3

Cooper, R. G. (2018). Best practices and success drivers in new product development. In *Edward Elgar Publishing eBooks*. https://doi.org/10.4337/9781784718152.00030

Dabić, M., Posinković, T. O., Vlačić, B., & Gonçalves, R. (2023). A configurational approach to new product development performance: the role of open innovation, digital transformation and absorptive capacity. *Technological forecasting and social change*, *194*, 122720. https://doi.org/10.1016/j.techfore.2023.122720

De Giovanni, P., & Zaccour, G. (2023). A survey of dynamic models of product quality. *European Journal of Operational Research,* 307(3), 991-1007. https://doi.org/10.1016/j.ejor.2022.06.010

Desmet, P., & Hekkert, P. (2007). Framework of product experience. *International Journal of Design*. 1(1), 57-66.

Dewi, P. W. S., Dantes, G. R., & Indrawan, G. (2020). User experience evaluation of e-report application using cognitive walkthrough (CW), heuristic evaluation (HE) and user experience questionnaire (UEQ). *Journal of Physics*, *1516*(1), 012024. https://doi.org/10.1088/1742-6596/1516/1/012024

Djamasbi, S., & Strong, D. M. (2019). User Experience-driven Innovation – Theory and Practice: Introduction to special issue. *AIS Transactions on Human-computer Interaction*, *11*(4), 208–214. https://doi.org/10.17705/1thci.00120

Dou, R., Li, W., Nan, G., Wang, X., & Zhou, Y. (2021). How can manufacturers make decisions on product appearance design? A research on optimal design based on customers' emotional satisfaction. *Journal of Management Science and Engineering*, *6*(2), 177–196. https://doi.org/10.1016/j.jmse.2021.02.010

Elsya, P., & Indriyani, R. (2020). The Impact of Product Knowledge and Product Involvement to Repurchase Intention for Tupperware Products among Housewives in Surabaya, Indonesia. *SHS Web of Conferences*, *76*, 01037. https://doi.org/10.1051/shsconf/20207601037

Falahat, M., Chong, S. C., & Liew, C. (2024). Navigating new product development: Uncovering factors and overcoming challenges for success. *Heliyon*, *10*(1). https://doi.org/10.1016/j.heliyon.2023.e23763

Gao, J., & Bernard, A. (2017). An overview of knowledge sharing in new product development. *The International Journal of Advanced Manufacturing Technology*, *94*(5–8), 1545–1550. https://doi.org/10.1007/s00170-017-0140-5

Garvin, D. A. (1988), *Managing Quality: The Strategic and Competitive Edge*, The Free press.

Goto, K. (2004). Brand value and the user experience. *Digital Web Magazine*.

Hassenzahl, M. (2004). The interplay of beauty, goodness, and usability in interactive products. *Human–Computer Interaction*. 19(4), 319-349. https://doi.org/10.1207/s15327051hci1904_2

Heskett, J. (2017). Design and the creation of value. *Bloomsbury Publishing Plc eBooks*. https://doi.org/10.5040/9781474274289

Hekkert, P. (2006). Design aesthetics: Principles of pleasure in design. *Psychology Science*, 48(2), 157.

Iheanachor, N., Umukoro, I. O., & David-West, O. (2021). The role of product development practices on new product performance: Evidence from Nigeria's financial services providers. *Technological Forecasting and Social Change*, *164*, 120470. https://doi.org/10.1016/j.techfore.2020.120470

Karvonen, H. (2019). *User Experience Goals in Human-Centred Design of Safety-Critical Systems*. PhD Thesis: Faculty of Information Technology, University of Jyväskylä.

Kenea, D. A. (2020). The role of innovation strategy in improving organizational performance and productivity: focus on Heineken beverage industry, Ethiopia. *Annals of the University of Craiova for Journalism, Communication and Management*, *6*(1), 31-56.

Kim, J., & Heo, W. (2021). Interior design with consumers' perception about art, brand image, and sustainability. *Sustainability*, *13*(8), 4557. https://doi.org/10.3390/su13084557

Kuniavsky, M. (2010). *Smart Things: Ubiquitous Computing User Experience Design*. Elsevier. https://doi.org/10.1016/b978-0-12-374899-7.00010-2

Majali, T. E., Alkaraki, M., Asad, M., Aladwan, N., & Aledeinat, M. (2022). Green transformational leadership, green entrepreneurial orientation and performance of SMEs: The mediating role of green product innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(4), 191. https://doi.org/10.3390/joitmc8040191

Marimba, F. F., Faizin, A., Widodo, A. S., & Purwaningrum, L. (2024). Young interior designers' creative pattern to draw potential consumers' attention: Expectation, capital, and strategy. *Journal of Graphic Engineering and Design*, *15*(2), 31-38. https://doi.org/10.24867/jged-2024-2-031

Marinidarraga, D. A., & Cuartas-Martin, J. C. (2019). Relationship between innovation and performance: Impact of competitive intensity and organizational slack. *Journal of Business Management*. *59*(2), 95-107. https://doi.org/10.6084/m9.figshare.8127899.v1

Marion, T. J., & Fixson, S. K. (2021). The transformation of the innovation process: How digital tools are changing work, collaboration, and organizations in new product development. *Journal of Product Innovation Management*, *38*(1), 192-215. https://doi.org/10.1111/jpim.12547

McCarthy, J., Wright, P., & Cooke, M. (2004). From information processing to dialogical meaning making: an experiential approach to cognitive ergonomics. *Cognition, Technology & Work*. 6(2), 107-116. https://doi.org/10.1007/s10111-004-0149-z

Merritt, K., & Zhao, S. (2021). An innovative reflection based on critically applying UX design principles. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(2), 129. https://doi.org/10.3390/joitmc7020129

Naous, D., & Legner, C. (2021). A preference-based approach to incorporate the "voice of the customer" in mass-market software product design. *Applied Computing Review*, *20*(4), 35–49. https://doi.org/10.1145/3447332.3447335

Norman, D., & Nielsen, J. (2016). The definition of user experience (UX). *Nielsen Norman Group Publication*. 1, 2-1.

Pilch, A. (2024). Generating customer insight for digital product development: a start-up case study.

Pucillo, F., & Cascini, G. (2014). A framework for user experience, needs and affordances. *Design Studies,* 35(2), 160-179. https://doi.org/10.1016/j.destud.2013.10.001

Rahardja, U., Hongsuchon, T., Hariguna, T., & Ruangkanjanases, A. (2021). Understanding impact sustainable intention of s-commerce activities: The role of customer experiences, perceived value, and mediation of relationship quality. *Sustainability*. 13(20), 11492. https://doi.org/10.3390/su132011492

Rajasa, E. Z., Manap, A., Ardana, P. D. H., Yusuf, M., & Harizahayu, H. (2023). Literature Review: Analysis of Factors Influencing Purchasing Decisions, Product Quality and Competitive Pricing. *Jurnal Ekonomi,* 12(01), 451-455.

Shluzas, L., Sadler, J. A., Currano, R., Steinert, M., Katila, R., & Sanks, T. (2013). Comparing novice and expert user inputs in early-stage product design. In *Proceedings of the 5th International Congress of International Association of Societies of Design Research (IASDR).* Tokyo, Japan: August 26-30.

Sularsa, A., Prihatmanto, A. S., & Nugroho, E. (2015). Evaluasi User Experiences Produk iDigital Museum dengan Menggunakan UEQ. *Jurnal Teknologi Informasi*, *2*(2), 56–62. Retrieved from http://journals.telkomuniversity.ac.id/jti/article/view/505

Sutcliffe, A. (2009). Designing for user engagement: Aesthetic and attractive user interfaces. *Synthesis Lectures on Human-Centered Informatics*. 2(1), 1-55. https://doi.org/10.2200/s00210ed1v01y200910hci005

Taha, Z., Alli, H, & Abdul-Rashid, S. H., (2012). User involvement in the new product development process: A designer's perspective. *Journal of Industrial Engineering and Management System.* 10(3), 191-196. https://doi.org/10.7232/iems.2011.10.3.191

Ulrich, K. T., & Eppinger, S. D. (2016). Prototyping. *Product Design and Development*. 291-312.

Varadarajan, R. (2018). *Innovation, Innovation Strategy, and Strategic Innovation. In Innovation and Strategy*. Bingly: Emerald Publishing Limited. https://doi.org/10.1108/s1548-643520180000015007

Wu, L. (2023). Agile design and AI integration: revolutionizing MVP development for superior product design. *International Journal of Education and Humanities*, *9*(1), 226-230. https://doi.org/10.54097/ijeh.v9i1.9417

Xu, J., Lu, H., & Xu, J. (2023). Defining a product characteristic framework of excellence for meaning-driven radical innovation. *The Design Journal*, *26*(3), 459-477. https://doi.org/10.1080/14606925.2023.2182005

Yang, B., Liu, Y., & Chen, W. (2023). A twin data-driven approach for user-experience based design innovation. *International Journal of Information Management*, *68*, 102595. https://doi.org/10.1016/j.ijinfomgt.2022.102595

Yin, C., & Zhang, W. (2021). New Product Development Process Models. In *2021 International Conference on E-Commerce and E-Management (ICECEM)* (pp. 240-243). IEEE. Dalian, China: September 24-26. https://doi.org/10.1109/icecem54757.2021.00054

Zhang, J., Cao, G., Peng, Q., Tan, R., Zhang, H., & Liu, W. (2020). A time correlation-based clustering method for a design of a transformable product. *Applied Sciences*. *10*(1), 406. https://doi.org/10.3390/app10010406