Affective-based Human Factors Design: Design Thinking & Sustainability Approach

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Abstract. This paper proposes a refined framework of affect/Kansei-based applied to product/service experience considering design thinking and sustainability approaches. Design thinking facilitates more comprehensive step-by-step methodology starting with more human basic needs, followed by the global issues which also requires more humanized and environmental consideration. Essentially, this framework facilitates both forward and backward flows, which is market pull and capability push of an organization. It is expected that this framework will facilitate both practitioners and academicians dealing with product or service improvement considering customer's affect embedded with complex environment such as customer dynamics and common global issues. A discussion on a particular study published in a reputable journal is provided. It is hoped that the expected applicability of this current study is realized.

Keywords: Affective, Kansei, Design Thinking, Sustainability.

1 Introduction & Opportunity

"This building is so magnificent, and it makes me so excited!", said by a guest visiting a brand-new auditorium accommodating about 1,000 people. It is called Kansei, an impression of people influenced by stimulus. It is emotions and feelings which the customer and user have in their mind. Kansei is also called as affect, an emotional impression of a user due to stimuli evoked by either product or service experiences [1]. According to [2], Kansei should be translated into product design characteristics. It is facilitated by Kansei Engineering (KE) as a method translating customer emotional impressions and feelings into ergonomic design specifications. Its applications now become so diverse. It ranged from physical products, services, and macro-ergonomics or organizations. More general, it is called as a tool translating user or customer or worker's emotional responses to proposed changes to product or work system into micro- and macro-ergonomic engineering specifications. Moreover, its flexibility shows its application in service design and improvement incorporating relevant quality tools such as quality function deployment, Kano model, theory of inventive problems solving – TRIZ, and even mining process [3].

Inherently, customer already has prepossessed expectation and visual representation when he or she buy product, enjoy it, and evaluate it. During her or his encounter

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process, the visual representation will be evaluated. This is another term of Kansei. Once it is positively confirmed, he or she will be much delighted. It is "a wish" for every product designer and service provider. KE implements human emotions in the field of design to produce products that match customer feelings to maximize customer delight. Customer psychological response (Kansei) is a more general qualitative characteristic. To transfer customer emotions to the field of design, qualitative data must be quantified. In other words, qualitative psychological phenomena must be transformed into measurable characteristics.

Though affect can be used to create products that not only meet functional needs but also evoke positive emotions in users through KE, its flexibility in KE methodology is still widely open. It is especially when KE deals with more complex problem and issues. Still and all, the methodology or approach is expected to be efficient and lean. Similarly, in service design, affect or Kansei can be used to create experiences that evoke positive emotions in users. For example, a restaurant that not only serves delicious food but also has a warm and welcoming atmosphere can evoke positive emotions in customers and create a memorable dining experience. Affect can also be used to encourage sustainable behavior in users. For example, a product designed using affective design principles could be designed to elicit positive emotions, such as pride or joy, in the user for making sustainable choices, such as using less energy or generating less waste. Overall, affect is an essential consideration in product and service design as it can help create products and services that not only meet functional needs but also evoke positive emotions and satisfy the psychological and emotional needs of users.

Design Thinking (DT) has been growing rapidly; it covers the fields of information technology, product design, business, education, medicine, and engineering used as a problem-solving tool. Its applications become richer and fresher. Due to sudden change and disruption, the simple problem becomes more complex. Thus, it needs more understanding of more uncommonly phenomena and the puzzle of problems. DT can be promoted as a way in dealing with these [5]. DT is a human-based iterative problem-solving method in solving complex problems. Through a creative and innovative approach, DT involves empathy, experimentation, and collaboration to understand and address the needs of the user or customer. The process typically includes five stages such as empathize, define, ideate, prototype, and test. DT is often used in various fields, including product design, service design, engineering, and business strategy.

According to Hartono [4], there is a close relationship between Kansei Engineering (KE) and Design Thinking (DT) in terms of the exploration of the deep layer of customer and user basic needs related to feelings and impressions. Even, KE shows its superiority in modeling the usability as an important component in any design activities [6]. However, due to KE's flexibility covering various quality tools and contexts, this current KE framework is potentially refined. Hence, DT and sustainability are adopted and embedded into KE methodology to make it more relevant and reliable subjected to the consideration of effectiveness and efficiency.

2 Brief Literature Review

2.1 Major characteristics of Design Thinking

Design Thinking (DT) can be a valuable approach for businesses to solve complex problems, improve customer experiences, and drive innovation. By putting the needs of the customer or user at the center of the problem-solving process, businesses can create solutions that are more effective, efficient, and engaging. DT can be applied to various aspects of business, including product design, service design, marketing, and strategy development. It can help businesses to identify opportunities for growth, create new products and services, and improve existing offerings. By using a collaborative and iterative approach, DT encourages experimentation, learning, and continuous improvement. In short, design thinking can help businesses to stay competitive and adapt to changing customer needs and market conditions [5]. It can also foster a culture of innovation and creativity, which can lead to long-term success.

2.2 Kansei Engineering and Design Thinking

As discussed previously, Kansei Engineering (KE) and Design Thinking (DT) have something in common. KE and DT are two problem-solving approaches that focus on meeting the needs and desires of users or customers. DT is a human-centered, iterative approach to problem-solving that involves empathy, experimentation, and collaboration. It is widely used in various fields, including product design, service design, and business strategy. It encourages creativity and innovation by involving end-users in the process of ideation, prototyping, and testing [5].

KE, on the other hand, is a customer-driven approach that focuses on understanding and satisfying the emotional and psychological needs of the user. It involves analyzing the sensory and affective aspects of the user's experience and translating them into design parameters. Kansei engineering aims to create products and services that evoke positive emotional responses in the user.

While there are some similarities between KE and DT, such as the emphasis on understanding the user's needs, desires, and preferences, they differ in their methods and tools. KE is more quantitative and data-driven, while DT is more qualitative and user-centered. However, both approaches can be used in combination to create products and services that are not only functional but also emotionally satisfying and aesthetically pleasing to the user [4].

2.3 Kansei Engineering and Sustainability

Kansei Engineering (KE) is primarily focused on creating products that evoke positive emotional responses in users and can also be used to create sustainable solutions. By understanding the emotional needs of users related to sustainability, KE can help designers create products and services that encourage sustainable behavior [1]. For

example, a product designed using KE principles could be designed to elicit positive emotions, such as pride or joy, in the user for making sustainable choices.

KE can also be used to create products that are more sustainable in themselves. For example, by understanding the emotional needs of users related to environmental sustainability, designers can create products that are made from sustainable materials, use less energy, or generate less waste. Furthermore, KE can encourage collaboration and interdisciplinary thinking, which can help designers create holistic solutions that consider the entire life cycle of a product or service. This approach can lead to more sustainable solutions that consider the environmental and social impacts of a product or service throughout its life cycle, from production to disposal. Once these two aspects of sustainability fulfilled, it will lead to economic impact as well. The producer or company is recognized as a caring entity promoting more humanized and environmentally practices. It will bring good image to the company, and it led to good business. The company is well-known as a caring and global agency which addressing the entire sustainability practices. For instance, this practice has been orchestrated by Unilever, a well-known company of brands and people with a clear purpose making sustainable living entity.

KE. can play an important role in creating sustainable solutions by helping designers understand the emotional needs of users related to sustainability and creating products and services that encourage sustainable behavior and are themselves more sustainable [7].

2.4 Design Thinking and Sustainability

Design Thinking (DT) can play an essential role in creating sustainable solutions to address the environmental and social challenges we face today. Sustainability is a critical consideration in the design thinking process, as it encourages designers to create solutions that are not only effective but also environmentally friendly and socially responsible. It can help identify opportunities to reduce waste, conserve resources, and create products and services that have a positive impact on the environment and society. It can also encourage collaboration and interdisciplinary thinking to create holistic solutions that consider the entire life cycle of a product or service, from production to disposal.

One of the core principles of DT is empathy, which involves understanding the needs and desires of the user. In the context of sustainability, empathy can help designers understand how their solutions can have a positive impact on the environment, society, and economic as well. Afterward, it leads how they can encourage sustainable behaviors among users. It also promotes experimentation and prototyping, which can help designers test and refine their solutions to ensure they are effective, sustainable, and user-friendly. This iterative approach can lead to more sustainable solutions that are continually refined and improved.

3 Proposed Refined Conceptual Framework Development

With respect to research opportunity discussed previously, a refined conceptual framework of Kansei Engineering (KE) for product or service design considering sustainability issue and Design Thinking (DT) methodology is developed. It is shown in Figure 1. It comprises 2 core components, i.e., (i) Part A: existing condition and adjustment, and (ii) Part B: proposed improvement strategies, implementation, and feedback. In Part A, it consists of empathizing followed by defining stage. In the empathizing stage, there will a balance between "market pull" and "technology/opportunity push" in exploring the root and basic problems faced by user or customer in product or service encounter.

In the defining stage, it is where Kansei or affect and product or service attribute exploration takes place. Product or service or product and service experience will be filtered through Kano categorization to prioritize the most critical product or service attribute(s) connected to Kansei response linear or non-linearly [9]. In achieving more representative and relevant Kansei due to context, the confirmatory mechanism for Kansei model is applied. It is to filter out manually which Kansei not relevant to the perceived product or service experience. The expected result is critical product or service, or product and service attributes need to be improved. They are deemed to be sensitive to user or customer Kansei.

Here it comes to the second main part, it starts with ideating, followed by prototyping, and wrapped up with testing. In the ideating step, relevant quality tools such as house of quality (HoQ), brainstorming, and theory of inventive problem solving (TRIZ). With respect to hot and relevant issues on sustainability, the content of sustainability referring to United Nation Sustainability Development Goals (UN SDGs) indicators and the scope of triple bottom line (i.e., people, planet, and profit) will be considered as a reference of proposed solution for validation. The engineering characteristics or specifications related to critical product or service, or product and service attributes will be defined.

Lastly, prototyping takes place by making a realization-like physical or non-physical model and will be followed up with testing of it, and all feedbacks will be gathered and followed up.

4 Discussion

The importance of affect and design thinking in improving product and service performance and tackling the hot issue on sustainability. A numerical example is given as follows (taken from [1]). An empirical study in an international airport service has shown 21 attributes including the three most critical ones, i.e., security in lounge and lobby, accurate delay notification, and accurate last call. Among them, the security in lounge and lobby was chosen to be the most important one.

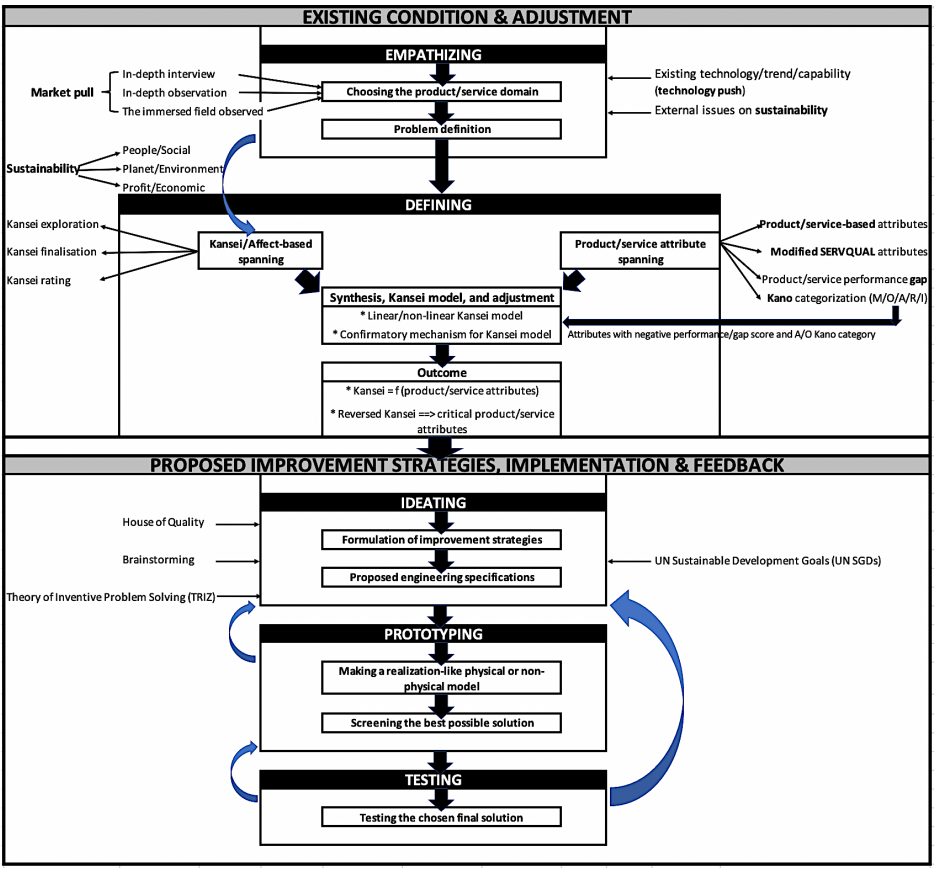

Fig. 1. A Conceptual Framework of **M**odified **A**pplied **R**ated **K**ansei-based **U**tility for **S**ustainability [abbreviated as MARKUS]

However, this study has not been covering a systematic ideating, prototyping, and testing. Through House of Quality (HoQ), for instance, the security in lounge and lobby iis set to be WHAT's item. It is linked to the possible metrics (provided in HOW items) such as multi-layer security checking, installed CCTV cameras, and an application of security system connected to the nearest police office. Those metrics should be validated to the sustainability indicators or items, such as using more efficient resources (electricity consumption) to support security lighting. Among those three metrics, using

certain criteria, the application of security system can be selected and tested. Any feedbacks from potential users will be collected for refining the prototype issues.

Thus, by considering the above numerical example, it gives confidence that the conceptual framework of modified applied rated Kansei-based utility for sustainability is potentially applied to product or service or product and service design and development focusing on the emotional satisfaction (Kansei) of user or customer.

5 Conclusion and Further Research

Still, study on the exploration and improvement of product or service experiences targeting on customer emotional satisfaction is highly interesting. Kansei Engineering (KE) shows its flexibility to be engaged with any service or product quality tools and methods consistently. It brings any alternate ways for designers and engineering in dealing with any complex problems focusing on user and customer emotional satisfaction. This study will be extended by testing the refined framework to real cases.

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