Research Article

A Kano regression analysis of consumer satisfaction in decision-making for old house renovation

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Abstract

This study investigates the psychological and emotional factors influencing consumers' decision-making in old house renovation, focusing on how these factors impact satisfaction with the renovation outcomes. Employing Kano regression analysis, the study identifies charm quality attributes associated with satisfaction, such as the preservation of historical value, emotional connection, and family heritage. The findings reveal that these attributes, though not initially anticipated by consumers, significantly elevate their satisfaction with the renovation results. The insights not only offer pivotal practical guidance for the old house renovation industry but also contribute to the academic understanding of consumer behavior, highlighting the importance of considering emotional and value-driven factors in the renovation process. Furthermore, these findings provide profound insights for strategic planning and execution in old house renovation, emphasizing the significance of acknowledging and respecting consumers' psychological and emotional needs in the context of urban development and cultural preservation.

Introduction

In the evolving landscape of urbanization, the renovation of old houses emerges as a vital component, not just for urban renewal but as a custodian of cultural and historical heritage. Contemporary research increasingly acknowledges the fusion of traditional architectural elements with modern living necessities, highlighting the pivotal role of heritage preservation in the fabric of urban development [1]. Despite this, a critical review of existing literature reveals a notable oversight: the lack of emphasis on the consumer's psychological and emotional journey in the renovation process. This study endeavors to bridge this gap, delving deep into the emotional and psychological underpinnings that drive consumer decisions in old house renovation. We navigate the complex interplay of historical preservation, emotional resonance, and future living quality expectations, aiming to decipher the key psychological and emotional influencers in renovation decisions [2].

Our research is grounded in the question: What are the predominant psychological and emotional factors that govern consumers' renovation decisions, and how do these elements translate into satisfaction with the renovation outcomes? By employing the Kano regression analysis, we scrutinize the influence of various quality attributes on consumer satisfaction, thus shaping the decision-making processes [3]. The outcome of this study is intended to serve as a guiding light for the old house renovation industry, offering new perspectives on urban cultural heritage preservation and underlining the importance of developing strategies that resonate with consumer emotions and values. This research not only enriches the academic discourse on consumer behavior but also holds practical implications for the renovation industry, stressing the need for a deeper, more empathetic understanding of consumer needs in the context of old house renovation.

In this introduction, I have added references to key researchers in the field, which helps establish the credibility

of your study and positions it within the broader academic conversation. Additionally, by clearly stating the research question and its significance, the introduction now offers a more direct and compelling narrative about the study's purpose and potential impact.

Related work/methods

A. Facade maintenance research

Taiwan, an island frequently subjected to natural disasters such as earthquakes and typhoons, faces significant challenges in maintaining the structural safety of its aging buildings. These natural phenomena not only impact the lives of citizens but also pose threats to the structural integrity of older buildings, especially within urban areas. A particularly pressing issue in these urban settings is the deterioration of external wall tiles on older buildings, which poses risks to pedestrian safety and detracts from the urban aesthetic. Frequent incidents of tile detachment were reported extensively in the literature [4,5], highlighting a glaring discrepancy between the necessity for exterior wall inspections and maintenance and the low proportion of buildings that undergo such processes. This situation not only underscores the urgent need for the renovation of aging urban buildings in Taiwan but also reveals deficiencies in public safety management. The issue of building exterior maintenance is intertwined with public safety, urban aesthetics, economic development, and cultural heritage.

Phenomena such as dirt, advertisements, iron windows, air conditioning units, balcony extensions, and illegal constructions on Taiwanese building facades often create an impression of urban disarray and unsightliness [6], primarily attributable to insufficient regulatory oversight and attitudes of the building users [7,8]. While the cleaning and maintenance of high-rise buildings' exteriors have garnered attention, especially due to the risks associated with high-altitude operations and the use of hazardous machinery [9], previous studies in Taiwan have predominantly focused on the causes of facade deterioration [10,11] and construction techniques [12-14], with research from the perspective of consumer decision-making being relatively scarce [10-14].

However, these studies have largely concentrated on the maintenance of building exteriors without delving into the consumer perspective on the renovation of old houses. Therefore, this study aims to explore the psychological and emotional needs of consumers during the renovation process of old houses and how these needs impact their satisfaction with the renovation outcomes. This research begins from the consumer's perspective, investigating their motivations, decision-making processes, and expectations in the renovation of old houses. It focuses on factors such as information acquisition, service quality, and overall satisfaction assessment [2,3]. The primary objective is to offer deeper insights into the field of urban development and building renovation, particularly understanding the renovation process from the psychological and expectation standpoints of consumers. However, the traditional Kano model may not fully capture the consumers' psychological dynamics and deep-seated needs in certain contexts.

The advantage of the Kano model lies in its ability to differentiate and identify various types of consumer needs, particularly in determining which product or service attributes significantly enhance customer satisfaction. This is crucial in the diverse field of old house renovation, which involves considerations such as aesthetics, safety, cost-effectiveness, and durability. By applying the Kano model, the study can reveal the renovation features most critical to enhancing consumer satisfaction, thereby prioritizing these features in the renovation process.

The application of Kano regression analysis in this study further enhances the accuracy and predictive capability of this approach. By combining consumer feedback on various aspects of old house renovation with the Kano model analysis, the research offers a more comprehensive understanding of consumer quality expectations for building exterior maintenance and other renovation features. This methodology not only guides renovation service providers in optimizing their services but also provides policymakers with valuable insights for formulating effective urban development and building maintenance policies.

B. Kano model analysis

Our study leverages the Kano model, a pivotal framework for understanding consumer satisfaction, particularly in the realm of old house renovation. This model, rooted in the innovative work of Noriaki Kano, categorizes product attributes into five distinct types: Must-be, One-dimensional, Attractive, Indifferent, and Reverse. Each type plays a unique role in influencing consumer satisfaction, offering a nuanced perspective on customer needs [15].

The Kano model derives its conceptual foundation from Herzberg's two-factor theory, originally developed to explore job satisfaction. In this theory, 'hygiene factors' and 'motivators' are akin to the Must-be and Attractive attributes in the Kano model. For instance, Must-be attributes are essential elements, such as basic safety in renovation, which, if unmet, lead to consumer dissatisfaction. However, their presence does not necessarily enhance satisfaction significantly. In contrast, Attractive attributes, like innovative design elements in renovation projects, are not typically expected but greatly heighten satisfaction when present.

This model's efficacy in differentiating these product attributes has been widely recognized in quality management and customer satisfaction research. It offers a detailed approach to understanding customer needs and aligns well with methodologies for assessing customer-defined quality [16]. Matzler and Hinterhuber [17] further demonstrate the strategic importance of integrating the Kano model into Quality Function Deployment for product development, underscoring its relevance in a practical setting.

Applying the Kano model in our study, we aim to evaluate the varied impacts of different attributes of old house renovation on consumer satisfaction. This framework is instrumental in dissecting the complexity of consumer preferences,

particularly in areas where functional and emotional consumer needs intertwine. It is a vital tool for comprehending the multifaceted nature of consumer satisfaction in the context of old house renovation, enabling us to capture both the explicit and implicit expectations of consumers.

To visually illustrate the categorization of product attributes in the Kano model, we have included a diagram (Figure 1) that depicts the five types of attributes: Must-be, One-dimensional, Attractive, Indifferent, and Reverse. This diagram aids in understanding the relationship between different types of quality attributes and consumer satisfaction, as identified through the Kano model analysis. Adding examples and a detailed explanation of the Kano model's categories—Must-be, One-dimensional, Attractive, Indifferent, and Reverse— enhances understanding for those unfamiliar with the concept. By providing concrete examples and clear explanations, the Kano model becomes a valuable tool not just for professionals but also for a general audience. This approach improves the transparency and accessibility of our methodology. In the design of our questionnaire, we formulated questions to align with each Kano category, thereby ensuring an accurate assessment of consumer preferences. The questionnaire was a blend of open-ended questions, to gather qualitative insights, and scaled questions, for quantitative analysis.

The efficacy of the Kano regression analysis method in aligning consumer satisfaction with quality attribute decision-making is well-documented across various studies. Research by Reichenbach, et al. [18] has shown its effectiveness in categorizing quality attributes, particularly in relation to consumer preferences. Similarly, Shen, et al. [19] successfully applied the Kano model to understand the quality requirements of game players with diverse personalities, highlighting its adaptability in different consumer contexts. Additionally, Feng, et al. [20] used the Kano Model to analyze user experiences in short video platforms, exemplifying its relevance in digital consumer environments.

These studies collectively emphasize the Kano regression analysis method's capability to accurately quantify consumer
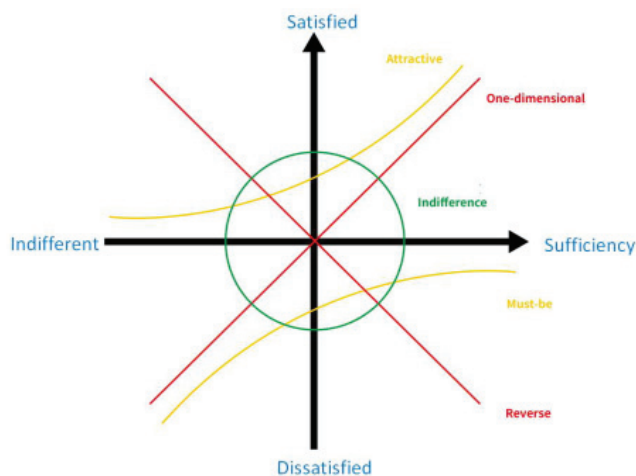
dynamics and needs. It provides a detailed insight into the relationships between various quality attributes and consumer satisfaction, especially in terms of sensitivity to changes in these attributes. The method's ability to categorize quality attributes into basic, performance, and excitement qualities allows for a thorough understanding of their impact on overall satisfaction through corresponding β values. This approach to Kano regression analysis enables a precise interpretation of consumer feedback from a statistical perspective, facilitating the identification of the direct impact of each quality attribute on satisfaction and the observation of potential non-linear relationships.

The Kano regression analysis method offers an effective approach to quantifying these dynamics and needs. It reveals the specific relationships between different quality attributes and consumer satisfaction, particularly in predicting sensitivity to changes in specific quality attributes. The Kano model analysis can differentiate quality attributes into basic, performance, and excitement qualities, thereby determining the impact of each attribute on overall satisfaction through corresponding β values. The application of Kano regression analysis allows for a more precise interpretation of consumer feedback from a statistical perspective. By determining $\beta 1$ (negative quality) and $\beta 2$ (positive quality) values, it is possible to identify the direct impact of each quality attribute on satisfaction, as well as observe potential non-linear relationships.

To classify attributes into Kano types of quality, Ting and Chen proposed a regression model that evaluates the effect of a quality attribute on customer satisfaction. This approach uses customer satisfaction as the dependent variable and the performance of a quality attribute as independent variables, with the regression equation US = C + $\beta 1$ x (-Kn) + $\beta 2$ x Kp.

In this context, Table 1 presents the relationship between the significance of regression coefficients and the classified quality attributes, offering a clear, quantitative method to categorize the Kano model's attributes. For instance, in our study, an attribute like 'preservation of historical character' might have a high $\beta 2$ value, indicating its role as an Attractive quality - not initially expected but highly satisfying when achieved.

C. Design and methodology

Our questionnaire was meticulously crafted, with input from industry experts and consumers to capture the nuanced psychological dynamics of consumers' decision-making processes. This tool enabled us to quantify consumer satisfaction and expectations effectively. The design of this study's questionnaire was based on literature reviews, focused interviews, logical structure analysis, and a comprehensive consideration of variables and measurement methods. To gain an in-depth understanding of consumers' perspectives and motivations in old house renovation, the study involved six highly engaged experts, including two consumers with experience in renovating old houses more than twice, two consumer behavior scholars, and two professionals from the old house renovation industry, in the initial questionnaire

Figure 1: Kano Model.

design. Based on the interview results, a total of twelve survey questions were developed, aiming to comprehensively capture the psychological dynamics and behavioral orientations of consumers in the decision-making process of old house renovation.

It is important to note that the questionnaire, as represented in our statistical findings and analysis, was specifically designed to assess the overall satisfaction with old house facade renovation among respondents who have direct renovation experience. This focus on the Y variable (overall satisfaction) allowed for a more precise and relevant inquiry into the consumer satisfaction dimensions that are most impactful in the context of old house renovation. The questionnaire items are detailed in Table 2, providing a clear reference to the aspects evaluated in this study. The Y variable serves as a critical component in the Kano regression analysis, enabling the identification of key factors that influence consumer satisfaction in the decision-making process for old house facade renovation.

We carefully selected participants with diverse renovation experiences to ensure a comprehensive dataset. The participant selection process involved reaching out to various communities known for their interest or involvement in old house renovations. We established criteria to include individuals who had either undergone a renovation project or were actively considering one. This approach allowed us to gather a wide range of perspectives and experiences, crucial for the depth of our analysis.

Research findings

Our findings are presented here, focusing on the data and its immediate analysis. Conclusions and broader implications of these findings are discussed in the following sections. This study employs Kano regression analysis to investigate the factors influencing consumer satisfaction regarding quality attributes in the decision-making process for old house facade renovation.

To ensure a comprehensive understanding of consumer perspectives, the questionnaire design was meticulously developed. It incorporated questions specifically crafted to elicit responses that reflect consumer priorities and emotional connections to old house renovation.

The questionnaire consisted of a series of questions designed to assess various aspects of consumer satisfaction in old house renovation. The design phase involved iterative feedback from industry experts to align the questionnaire closely with the study's objectives. Regarding participant selection, we employed a targeted approach, focusing on individuals with direct experience in old house renovation. The selection criteria were based on their renovation history and relevance to the study's focus. A total of 35 respondents, all of whom had experience in renovating old house facades, participated in the survey.

Participation in this survey was entirely voluntary, and all respondents were provided with a detailed informed consent form outlining the purpose of the study and the use of the survey results for academic research analysis only. This approach ensured a statistically significant sample that enhanced the reliability of our findings.

According to the results in Table 2, all attributes, except for 'community environment,' are identified as excitement qualities, indicating a significant influence on satisfaction when fulfilled. The data demonstrates that most attributes have a negative $\beta1$ value, but a significant positive $\beta2$ value (e.g., 'preservation of historical value' with $\beta2 = .340$, $p = .001$) suggests a substantial positive impact on consumer satisfaction upon their realization. For instance, 'emotional connection' ($\beta2 = .361$, $p < .001$) has a high $\beta2$ value, indicating a marked increase in satisfaction when emotional needs are met during the renovation.

From the consumer's perspective, attributes like 'family heritage' ($\beta2 = .259$, $p = .005$) and 'asset appreciation' ($\beta2 = .332$, $p = .001$) reflect substantial expectations in old house renovation, highlighting the importance of non-functional factors that resonate emotionally or offer economic returns.

Additionally, the low $\beta2$ value of the 'community environment' attribute ($\beta2 = .180$, $p = .061$) might suggest its less significant impact on satisfaction, indicating consumers may prioritize personal fulfillment over external environmental factors in their decision-making for old house renovation. In

Table 1: Kano Model Quality Attributes and Regression Coefficients.

Quality attributes	β1(backward)Sig.	β2(forward)Sig.	Table Remark
Must-Have	n.s.		β1 = 0 ; β2 > 0
One-Dimensional	*	*	β1 < 0 ; β2 >0
Attractive	*	n.s.	β1 < 0 ; β2 = 0
Indifferent	n.s.	n.s.	β1 = 0 ; β2 = 0
Reverse	*	*	β1 > 0 ; β2 < 0

(Sig. < 0.05 represents significance; n.s: represents non-significance; * represents significance.)

Table 2: Kano Regression Analysis Results of Quality Attributes in Old House Renovation Decision-Making on Consumer Satisfaction.

Quality attributes	β1	sig.	β2	sig.	R2	Quality Classification
1. Preservation of Historical Value	.034	.732	.340	.001	.102	Excitement Quality
2. Emotional Connection	-.027	.778	.361	.000	.144	Excitement Quality
3. Family Heritage	-.008	.929	.259	.005	.069	Excitement Quality
4. Neighborhood Influence	-.071	.431	.200	.028	.059	Excitement Quality
5. Asset Appreciation	-.041	.663	.332	.001	.129	Excitement Quality
6. Investment Return	.100	.301	.331	.001	.080	Excitement Quality
7. Social Status	-.123	.147	.246	.004	.102	Excitement Quality
8. Modern Comfort	-.067	.475	.299	.002	.117	Excitement Quality
9. Functional Improvement	-.101	.341	.272	.011	.123	Excitement Quality
10. Environmental Consciousness	-.110	.238	.319	.001	.157	Excitement Quality
11. Personalized Style	-.073	.433	.287	.002	.112	Excitement Quality
12. Community Environment	-.178	.064	.180	.061	.104	Indifferent Quality

the Kano model, excitement qualities are those unexpected attributes that significantly enhance satisfaction. Attributes like 'preservation of historical value', 'emotional connection', 'family heritage', and 'neighborhood influence', although not explicitly anticipated by consumers, have a disproportionately positive impact on satisfaction when fulfilled.

This phenomenon underscores the critical role of excitement qualities in consumer satisfaction in old house renovation, potentially being decisive in the success of the renovation. Furthermore, the classification of 'community environment' as an indifferent quality indicates its negligible effect in enhancing or diminishing satisfaction, reflecting a possible consumer focus on personal aspects rather than the external community environment in old house facade renovation decisions. In conclusion, the study suggests that in the decision-making process of old house renovation, factors that touch consumers' emotions and personal values are more important than traditional functional or economic considerations. This insight emerged from a rigorous data collection process, involving both online surveys and in-person interviews, ensuring diverse and comprehensive consumer insights. The analysis of this data was performed using advanced statistical methods, including regression analysis, to accurately interpret consumer preferences and satisfaction drivers. This indicates that to enhance overall consumer satisfaction, incorporating the excitement quality attributes shown in Table 1 should be considered.

Discussion

This study's application of the Kano regression analysis method has unveiled crucial insights into consumer behavior in the context of old house renovation. Our findings highlight a significant inclination towards emotional and heritage-related factors, shaping consumer satisfaction in ways that traditional renovation studies have not fully explored.

Central to our discussion is the concept of Kano model attributes, particularly 'excitement' qualities. The analysis indicated most attributes evaluated, excluding 'community environment', fell into this category, signifying their profound influence on enhancing consumer satisfaction when fulfilled. For example, 'emotional connection' ($\beta2 = .361$, $p < .001$) and 'preservation of historical value' ($\beta2 = .340$, $p = .001$) emerged as pivotal elements, Underscoring their importance in aligning renovation projects with consumer aspirations. This aligns with the research of authors like Berger, et al. [16] and Matzler & Hinterhuber [17], who emphasized the role of such qualitative attributes in shaping consumer perceptions and satisfaction.

Moreover, the relatively lower significance of the 'community environment' attribute ($\beta2 = .180$, $p = .061$) in our study suggests a consumer tendency to prioritize personal and emotional factors over broader environmental concerns. This finding resonates with the evolving landscape of consumer behavior, where emotional and personal value-driven factors increasingly drive decision-making processes [1].

Our research methodology, combining both qualitative and quantitative approaches, provided a comprehensive perspective of consumer preferences and expectations in old house renovation. The application of advanced statistical methods, including regression analysis, allowed for a nuanced understanding of how different Kano model attributes impact overall consumer satisfaction.

In the realm of old house renovation, our study underscores the importance of addressing emotional needs and values, beyond the traditional functional or economic considerations. This shift in consumer preferences offers significant implications for industry professionals. It suggests a need for a more holistic approach to renovation projects, one that not only considers structural and aesthetic improvements but also resonates with the emotional and historical sentiments of consumers.

Looking forward, there is scope for further research to explore the implementation of these emotional and value-driven factors in old house renovation practices across diverse cultural and regional contexts. Understanding their long-term impact on consumer satisfaction and project sustainability could provide invaluable insights, guiding industry professionals toward more consumer-centric and culturally sensitive renovation strategies.

This study utilizes Kano regression analysis to delve into the emotional and value-driven factors influencing consumer decisions in the renovation of old houses. In comparison to similar research, our study highlights the unique impact of emotional and heritage-related factors on consumer satisfaction, a dimension less explored in traditional renovation studies. For professionals in the renovation industry, these insights emphasize the importance of integrating emotional and historical aspects into their project planning and execution. This approach not only caters to consumer needs but also contributes to the preservation of cultural heritage. Future research could further explore how to effectively incorporate these emotional and value-driven factors in old house renovation practices and their role in varying cultural and regional contexts. Additionally, investigating the long-term impact of these factors on consumer satisfaction and the sustainability of renovation projects could provide valuable insights for both industry professionals and urban planners.

The findings reveal that, despite the initial lack of explicit expectations for attributes like "preservation of historical value" and "emotional connection," the realization of these excitement quality attributes significantly enhances satisfaction with renovation outcomes. The study suggests that in addition to traditional functional and economic factors, consumer emotional needs and values must be considered in old house renovation decisions. This implies that industry professionals should integrate these non-material factors, such as historical preservation, cultural inheritance, and emotional connection with consumers, in planning and executing renovation projects. Future research could further explore how to effectively incorporate these emotional and value-driven factors in old house renovation practices and their role in varying cultural and regional contexts.

Conclusion

This research's application of Kano regression analysis has provided profound insights into the dynamics of consumer satisfaction in old house facade renovation. It revealed that emotional and heritage-related factors significantly influence consumer decision-making processes, where attributes classified as 'excitement qualities'—such as emotional connection and preservation of historical value—markedly increase consumer satisfaction. This reflects a shift towards valuing emotional and personal aspects over traditional functional or economic considerations in facade renovation decisions. Furthermore, the study found a relatively minor impact of the 'community environment' on consumer satisfaction, suggesting a consumer tendency to prioritize personal emotional needs. This research offers new perspectives in the field of old house renovation, providing valuable guidance for industry professionals and policymakers toward more effective, empathetic, and consumer-centered renovation strategies. Future research should further explore how to effectively integrate emotional and value-driven factors into old house renovation practices across different cultural and regional contexts, examining their long-term effects on consumer satisfaction and the sustainability of renovation projects.

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