



Incorporating user values into housing design through indirect user participation using MEC-QFD model



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ABSTRACT

This study aims to incorporate user values into housing design. Incorporating user values is essential for developing quality housing. Data was gathered in three stages using the Means-End Chain and Quality Function Deployment models. To identify the factors that create values, the MEC model was conducted using soft laddering interviews with 15 apartment occupants in Bushehr, Iran. Next, weight assessments were done for value creators. With data from the first phase, a hard laddering questionnaire survey of MEC was created and distributed among 150 respondents. Nine architects developed design strategies in a focus group discussion to establish the House of Quality of QFD based on responses. The developed strategies involved four main categories including Building Organizational Emphasis, Interior Design Emphasis, Exterior Design Emphasis, and Indoor Environmental Emphasis. The combination of MEC and QFD facilitates indirect user participation and fulfills person environment congruence.

1. Introduction

The issue of translating end user values into their living environment is a universal concern. This is because end user values play a fundamental role in delivering quality housing. Åslund and Bäckström [8] maintained that quality improvements are achieved based on the creation of value for end-users. Cockton [19] believed that quality in use and fit to context is insufficient, and that design should be broadened to include the concept of value as the ultimate goal. Efforts to enhance quality should focus on closing the gap between internal production quality and external consumer values. Closing this gap means translating quality aspects through the value chain [62]. Evidence suggests that the creation of superior value for users is an effective instrument for business success [12]. Design practice, design thinking, and users are beneficial for value creation [41,45]. The quality of mass-produced housing in Iran is negatively affected by the disparity between housing design and occupant values, along with a lack of user participation in housing development [7,11].

In Iran, qualitative housing design issues are of great concern. These issues stem from a disparity between housing design and occupant lifestyle and values. This is considered part of the recently acknowledged “crisis of identity” which is a major concern experienced by various groups in Iran [66]. To create suitable design solutions,

designers have to refrain from foisting their values upon end-users [68]. This is because architects and users have different values and perceptions of built environments [24,54]. Architects usually design mass produced houses without end-user inputs, thereby disregarding the values of end-users. A failure to incorporate social aspects and user values has negative effects on residents [1]. Users play a key role in value creation [41]. The unsuccessful identification and incorporation of user needs and user activity patterns results in inferior systems that do not have much value. Existing issues in produced houses originate from incongruities between the values of designers and users [40].

Several authors discussed the significance of values in housing [29,32,40]. In recent years, there has been increased interest in the incorporation and translation of user values into housing design [12,21,22,33,41,74,75]. This is because value creation is an important factor in quality design for end users [53]. Establishing optimum psychological congruence between users and their built environment is crucial [67]. Place making is shifting away from the geometric design of spaces towards a more comprehensive consideration of user perceptions and behaviours within physical settings [55]. Since uncertainty still exists regarding strategies for incorporating user values into housing design, it is necessary to examine how designers deliver user values in the form of quality housing. Research is required to develop design practice tools that enable designers to actively enhance value

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creation. This study aims to translate and incorporate user values into housing design. Two models, MEC and QFD in three sequential stages were combined to accomplish the objectives of this study.

2. Incorporating user values through indirect user participatory design process

User participation is essential for the development of sustainable housing [26]. Effective user participation fosters project sustainability [36]. Creating suitable design solutions requires user participation [2]. User participation is a process which gives opportunities to both designers and users to express their ideas [50]. It facilitates user involvement in essential design decisions, helping them express their needs in their desired living environment [46]. It may occur in the planning phase, the design phase, construction, or the evaluation phase [61]. User involvement not only helps designers to meet user values, it is also important during the construction phase because it prevents unnecessary modifications after occupancy [35].

Keinonen [38] identifies three types of user participation: inactive, reactive, and proactive. Saleh et al. [60] divides participation levels into five categories depending on architect control or user requirements. The first level is “non-participating”, where the architect is the main controller of the project. The second level is “low level”, where user participation is insignificant. The third level is “equally-balanced level”, in which the opinion of the user is equal to the opinion of the architect. The fourth level is “high level”, in which the architect is only there to guide and to advise the user. The fifth level is “top level”, where the role of the architect disappears and the user is the main controller of the project.

In spite of the significance of user participation, a lack of user participation in housing development is typical in Asian countries [46]. For most Iranians, the designs of their dwellings are far from their ideal conditions [11]. The problem is that existing approaches that involve user participation are not applicable or are difficult to conduct within current mass housing production. There is a need for an Indirect User Participatory Design Process (IUPDP) to accommodate user participation in the current process of housing design and delivery. The nature of user values influences design solutions. IUPDP refers to the identification, structuring, analysis, rationalization, and translation of user values into relevant design attributes. It was developed to formulate a method for processing indirect user participation and translating user values into housing design. Fig. 1 shows a representation of IUPDP, which shows the work process divided into mechanisms, phases, and participants. The boxes in the middle show the phases. Mechanisms are on the left side and participants are on the right side and they specify research approaches and participants, respectively. The arrows leading into the boxes represent inputs while the arrows leading out from the boxes represent outputs. Inputs are converted into outputs throughout each phase.

Translating user values enhances the quality of a housing environment and makes indirect user participation possible. QFD is a major tool used in the indirect participatory design process and the incorporation of user values. It is a model that forms links between people and the housing industry. The HoQ of QFD was used to develop design attributes based on customer voices. The process of translating user values through indirect participation was done by examining value creators and conceptualizing design attributes. MEC and soft laddering were the mechanisms used to identify factors that create value for future occupants. The second phase of this process involves the weight assessment of value creators for further analysis. Measuring the importance of identified requirements is the second step in establishing the HoQ of QFD. Although the data obtained from MEC and soft laddering is ranked according to their level of significance, the ranking is only based on an ordinal scale and the distance of differences between the weights of elements are unclear. To overcome these weaknesses and prepare the data for QFD, a hard laddering approach

for the MEC model using Association Weight Matrices (AWM) was adopted. This stage targeted housing occupants as the sample population. After defining value creators and prioritizing them according to their weight of importance, the data was transferred into HoQ of QFD. Using this mechanism, designers developed the necessary design considerations for incorporating user values.

MEC-QFD makes indirect user participation possible. Designers represent users using user information. The development of design strategies based on identified needs and concerns contributes to indirect user participation, allowing users to meet their desired values. It also decreases the existing gap between users, designers, and the housing industry.

2.1. MEC

MEC is a model that details how user values are fulfilled by services or products [27]. It is a model that draws a connection between conscious user choices, and the attributes that contribute to achieving values [42]. By asking questions like “Why is that important to you?”, laddering describes the relationships between attributes, consequences, and values [57]. Means-end chains or laddering refers to the links between attributes, consequences, and values. Studies that have adopted the laddering technique used “soft” or “hard” laddering techniques [76]. Attributes are known as the characteristics or properties of the goods, services or performances that customers desire or pursue [34]. Consequences refer to what the product provides or does to the customers at a psychosocial or functional level [71]. Valette-Florence and Rapacchi [73] believe that personal values are a part of life that provide guidance. Schwartz [63] defines values as “desirable trans-situational goals, varying in importance which provide guiding principles in people's lives”. MEC has been used by several housing studies [10,20,29,35,4,51].

2.2. QFD

Quality Function Deployment is an accepted tool used to design customer-driven products [25]. Akao [3] explains QFD as “a method which establishes a design quality through translating customers' demands into design attributes and also important quality assurances to be used throughout the production process”. This method transfers expected desires into quality characteristics and creates systematic development using the relationships between customer needs and technical characteristics [30,47]. To practice QFD, the House of Quality (HoQ) must be established. The HoQ provides product-design factors and their associations, namely customer needs and their importance, design attributes, the relationship between customer needs and design attributes, and correlations between design attributes [17]. HoQ is made up of an expected quality chart combined with a quality attributes deployment chart [3]. HoQ demonstrates how engineering characteristics meet customer requirements [48]. It has seven components [49]. To establish HoQ, the components must be fulfilled in their numerical order of 1–7 (Fig. 2). Room 1 is considered to contain customer needs and requirements. Room 2 presents the relative importance of these requirements. Room 3 has information required to transform customer needs into technical characteristics. The correlation between the formulated technical characteristics is depicted in room 4, whereas the correlation between each of the customer's wants and each technical characteristic is in room 5. Rooms 6 and 7 have the importance weights and a prioritized level of quality improvements to be made [28].

3. Research methodology

The process of incorporating user values into the housing design process is done by identifying the factors that create user values and translating them into proper housing design attributes. For this

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