

The Role of the Customer in Building Design: A Literature Review

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Abstract: Although nowadays building design as well as other design disciplines recognize the decisive role of the customer and the necessity of the early user needs identification to guarantee the effectiveness of solutions and design process, in building design this activity is not yet well-defined. In Italy the traditional approach based on dimensional standards and type solutions is widely applied even though a new approach based on customer requirements and corresponding performances is available. Besides, various experiences in the building sector show attempts to formalize the activity for the collection of the overall needs or requests for specific purposes. Building design may benefit from the introduction of well-established procedures for identifying customer needs. In order to evaluate contributions for the improvement of such activity, this study reviews the role of the customer in building design throughout the years and provides an overview on experiences and available design procedures developed in building and product design.

Keywords: Customer Needs, Building Design, Design Standards.

Introduction

Starting from the second half of the twentieth century, manufacturing companies have conceived their production to fulfill the identified customers' needs. The product is designed to satisfy specific needs. Therefore the understanding of the customer groups' needs is decisive for the success of the product and specific procedures are adopted in order to gain this knowledge. Throughout the centuries, buildings have always been products highly customized to specific customers' needs. However in Italy during the twentieth century, the active customer involvement began to be lost and came to increasing evidence starting from the post-war period. The primary necessity of dwellings to be available in a short time facilitated the establishment of standardization as one of the characteristics of the period since it allowed reaching a minimum dwelling quality at a feasible cost. It affected not only design solutions but even design activities in general and the customers' need collection in particular. Although recently identifying the customer needs has become important even in the building design and a new approach has been developed according to it, the traditional one is still applied in the current building design activity. Among other reasons, the design through dimensional standards and type-solutions was easily accepted even because the 80% of dwellings in big Italian cities was rented flats. Meanwhile in the last decades the tendency de-trended: the number of owned dwellings has strongly increased and nowadays the third-quarters of the Italian families own the dwelling

where they live. In Italy the dwelling demand has become similar to durable goods such as cars and furniture rather than goods of investments. Therefore the dwelling has acquired a "communication value": it expresses the personality of the owner. This aspect further expands the heterogeneity of the demand, which is a current trend among all the artifacts. Such heterogeneity creates a segmented building market which requires the introduction of specific procedures to understand the needs of different customer groups and thence design customized buildings. Some recent procedures in building design intend to formalize the collection of the overall customer needs or needs for specific purposes. Other design disciplines such as product design have already well-established such activity in the design process because they have started managing this issue earlier.

This study intends to review the role of the final users and some available procedures within the design process in building and other disciplines. Both these aspects are required to attain a wholly involvement of the customer in a building design.

Customer Needs in Building Design

Different Approaches to Customer Needs

In Italy two different approaches to customer needs in building design are defined during consecutive phases of development: a descriptive approach and a performance approach. In the initial phase, it is established the descriptive approach. It is based on quantitative standards defined according to the number of expected occupants, and it provides

descriptions of good solutions and models which designers and manufacturers should reproduce accurately as much as possible. Design solutions are evaluated by comparison with these standards and type-solutions. Such approach is not flexible regarding variations of the dwelling demand since many quantitative standards are the same for all distribution types, and there is a strict relation between number of habitants and minimum dwelling surface without involving other parameters related to different contexts, different users and demands (Regione Emilia-Romagna 1981). As a result the descriptive approach cannot regulate the building quality and it is not able to support the design innovation. These standards were fixed by the Italian government for no-profit house projects starting from 1896. Even in other European countries comparable dimensional standards were established for dwelling based on user number and minimum surface (Regione Emilia-Romagna 1981). In 1975 in Italy dimensional standards are updated: every inhabitant has the right to a minimum dwelling surface as well as to a minimum area for single, double and living rooms (Regione Emilia-Romagna 1981). In the '70, on the basis of dimensional standards, the Italian government entrusts the development of technical specifications to each Region in order to diversify the design of dwelling according to specific context. Unfortunately only few regions such as Emilia Romagna decide to perform studies and researches for the development of local technical rules (Regione Emilia-Romagna 1981).

In the meantime starting from the 1976, a new approach was introduced due to emerging differentiated dwelling demands and the need for the customization of the building process. This new approach analyzes the building as a system able to satisfy specified needs by performances. Different user needs reflecting variable lifestyles and contexts are collected and translated in requirements. Then the specified requirements are reached by building performances. To be effective, such perspective needs requirements and performances measurable by parameters (Regione Emilia-Romagna 1981). This approach is able to address specified level of quality and to support the design innovation because no solution is suggested. It is based on the definition of goals that might be achieved through different solutions (Regione Emilia-Romagna 1981). National and regional building rules traditionally based exclusively on quantitative standards are progressively integrated with qualitative requirements (Regione Emilia-Romagna 1981). Crucial research for the development of this type of approach is carried out by Emilia Romagna region starting from 1978. It intends to elaborate a regional technical regulation for no-profit residential buildings laying the foundations for the new approach based on needs

and requirements. The experience finds a large consensus at the national level and in other regions. In 1995, the Emilia-Romagna region defines the building regulation type (RET) on the basis of the new approach in order to provide a regional guide for each local building regulation. The document is then updated in 2000 following the large revision of the national building rules: voluntary requirements are added to mandatory ones updating the previous version. Unfortunately the spreading process of such approach is long and national and local building regulations are not everywhere adapted to it (Rossini *et al.* 2000).

The Role of the Customer

Initially the attention is paid to the object-product, and the customer is merely considered the buyer of the house. Therefore its real involvement on the decisions influencing the quality of the product is missing (Regione Emilia-Romagna 1982). The basic standard on a minimum dwelling space per user is the leading rule. The main reasons are two: the need of planning resource usage in relation to the real necessity and the need of assuring minimum privacy and hygiene conditions with respect to number of user and space dimensions.

Because the dwelling need evolves from a quantitative demand for survival typical of the post war periods to a qualitative demand typical of the globalization era, a different approach for the customers' need collection arises driven by new business development strategies more focused on the market rather than on the product. The attention shifts from the object-product to the subject-user: the customer becomes a user. The user behavior and its demand are analyzed in order to orient the house production offer towards the customers' needs. According to it, new regional technical regulations are developed in order to promote a new strategy and support the conversion of the production toward the satisfaction of the current needs. The performance approach is developed starting from the analysis and classification of the users through their involvement in the definition of user profiles, user needs and for the evaluation/validation of the existing standards (Regione Emilia-Romagna 1981).

During the last decades, while public bodies are generally resilient at changing to the subject-user approach, society and market evolve at a different, faster speed. In Italy the dwelling demand has become similar to durable goods such as cars and furniture rather than goods of investments. Therefore the dwelling has acquired a so called "communication value": it expresses the owner's personality (Castaldo and Sabbadin 2009, Sabbadin 2011). The sector leadership was traditionally taken by the construction company whereas now the private customer is gaining importance and represents a

“new” segment of the market. All the stakeholders within the construction value chain are competing to become its preferential speaker (Sabbadin 2007). Both these aspects, 1) the house as a durable good and 2) the attraction of a new sector, increasingly involve the owner but even highlight its actual weakness among the stakeholders in construction. It is due to the heterogeneity of the demand which is a current trend among all the artifacts and to the lack of information coming from experience in such acquisition as happens with other goods (Sabbadin 2007). Moreover actual technologies require a deep consciousness in choices which highly impact the building management and user behavior. A great improvement in marketing might balance the situation. Particularly, the introduction of specific procedures to understand the needs of different customer groups and thence to design customized buildings is necessary.

Identifying Customer Needs

In some design disciplines such as in building design, clients' needs are seldom clearly expressed and collected in a structured way at the early phase of the design process. In building design usually initial statement of design objectives is brief and rather vague. Some objectives are expressed during the design brief; others are obtained by interviewing the clients or by discussion within the design team. This activity is usually performed by the architects using their experience and knowledge without the support of methods. However, the need for identifying customer needs in architectural design is likely to expand due to the increasing complexity of buildings and building systems (American Institute of Architects 2000). Some experiences show the need to format such activity. On the contrary, in product and engineering design, identifying customer needs is already a well-defined activity due to the primary need of offering mass customized products and because it is common knowledge that identifying customer needs in an organized manner facilitates effective design process (Ulrich and Eppinger 2008).

Following the change of the attention from the object-product to the subject-user started in different design sectors, a new approach in the building one emerged in Italy at the end of 70s. This approach focused on the definition of products that satisfy the needs of the users. In order to define the dwelling demand in terms of users and their qualitative and quantitative dwelling needs, the Emilia-Romagna Region experiments a different approach. It is developed starting from the collection of data from no-profit housing habitants via questionnaire and interviews. Data are analyzed and classified for the definition of user profiles (Regione Emilia-Romagna 1982). Afterwards user profile representatives are

involved in small group meetings and workshops to collect data regarding user dwelling needs. In order to stimulate the definition of their needs, technical tools such as projects of different plan solutions, drawings and videotape are used. The behavior of user samples are examined and classified and the results are directly checked and validated by comparison with the involved users. By applying this procedure, the users are directly included in the design process and in the validation of the existing dwelling standards (Regione Emilia-Romagna 1981).

The American Institute of Architects (AIA) considers the customer need collection (called architectural programming) as a pre-design service related to, but distinct from architectural design (American Institute of Architects 2000). It aims at a systematic evaluation of organizational and project values, goals and needs of clients, users and surrounding community. According to AIA analysis, government agencies use programming service extensively to provide a fully program for the design procurement. Even owners of complex institutional facilities and developers recognize the need for a careful analysis of design issues unlike residential clients who are concerned by additional design cost (American Institute of Architects 2000). It focuses on value identification, project goal setting, discovery of related facts (constraints and opportunities) and development of specific project requirements. This phase may be preceded by preliminary studies (financial feasibility, site suitability and master planning services). The architectural programming is a team process that involves several persons according to the scale of the project, type of facilities, functions and possibly constraints: at a minimum, the programmer, the client and the user, but even sometimes community participants (American Institute of Architects 2000). Five types of information gathering are proposed in architectural programming: literature search/review, interview, observation, questionnaire/survey and group session. The collected data should be organized to be retrieved and analyzed quickly and easily. Therefore only the decisive information in making design decisions should be sought and recorded. Performance and design criteria are identified analyzing all the gathered information. Usually criteria encompass space requirements, space relationships, circulation, ambient environment, safety and security, needed surfaces, furnishings, flexibility and site information. Moreover matrixes showing space allocations and relationships and bubble diagrams showing adjacency relationships are developed. Some preliminary ideas about solution options are then proposed in order to support the evaluation and to recommend the most effective alternatives. The deliverable may be a written architectural program report composed of the

methodology documentation, the executive summary, the value and goal statements, the relevant facts, the data analysis conclusions and the program requirements. It also includes project cost estimation and a project schedule (American Institute of Architects 2000).

HOK, an international architectural, engineering and planning firm, has developed a problem analysis method in order to improve the requirement seeking process. This method intends to clarify, to understand and to state the problem that will be solved by design which starts after an exhaustive problem statement. In order to define the whole architectural problem, it is specified in terms of function, form, economy and time (Peña and Parshall 2012). Problem seeking method proposed by HOK intends to support the requirement analysis covering the wide range of factors that influence the design of different building types and also to incorporate sustainable requirements in order to determine the level of sustainability of design and construction (Peña and Parshall 2012). To perform these activities, the method establishes five steps: establish goals, collect and analyze facts, uncover and test concepts, determine needs and state the problem. It provides techniques on how to collect, organize and analyze data, then on how to interview users for data gathering and finally on how to use that information during the decision-making work sessions. An information index is used as a key-word checklist of questions to retrieve appropriate information and to classify them. The process involves the client and the architect group since the early phase of the activity to determine organization needs related to a proposed building project. Before interviews and work sessions, the main decision makers are identified. When a variety of design options is developed, games and simulation techniques support project team and client in taking decisions (Peña and Parshall 2012).

Other experiences involve the customers in the initial phase of the design process to collect specific needs in order to address specific aims during the design process. Fraunhofer IAO (Spath *et al.* 2010) developed a methodology to provide concepts and guidelines for designing optimized space office. The procedure consists of 3 steps: the analysis of work structure and user requirements; the development of user scenarios for the new working environment; the definition of the new work structure and the final work space concept. The first work package takes place in group sessions and workshops at two different settings, the management level (top-down) and the worker representative level (bottom-up). Work structures and processes are analyzed to define the current space usage and possible future evolution, to identify spaces and equipment requirements, to collect and to evaluate qualitative and quantitative

user requirements. Then working activity types are defined considering culture, communication, organization, IT concept, knowledge management and economical aspects. On the basis of the defined working activity types, the second work package (work space management strategy) develops office module types, specifies common spaces (project area, meeting-room and connections), and identifies IT integrated support, lighting, acoustics, arrangements and aspects regarding the needs of concentration, communication and brand identification. The final work package provides functional and distribution guidelines for designing to the design team (Spath *et al.* 2010).

The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) has developed several models to assess water needs in the pre-design phase and to provide objectives, strategies and targets for designing sustainable water usage in the functional recovery of an urban industrial area in Bologna (Italy). These models refer to corresponding design activities: investigation, data acquisition, data analysis and scenarios development. First a specific web-based survey tool is set to record indoor and outdoor water needs. The survey is organized on the basis of expected activities. For each activity, any possible furniture and equipment are indicated with relative water consumption and water waste features in order to assess the water usage on the basis of survey results. Then an assessment tool is set to rank input data and to develop scenarios. Finally the resulting data is evaluated for selecting opportunities of greater efficiency in each major usage category and cost-effective possibilities of usage from one process to another.

A different experience regarding user need analysis in the building design is led by Experientia. This is an Italian design consultancy that supports companies and organizations in designing valuable user experiences through the understanding of how people really live nowadays and how they will live in the future. Experientia took part in designing a sustainable urban district in Helsinki. Because sustainable buildings require sustainable living practices, Experientia's responsibility among the design team was the delicate topic of how to address behavioral change to support a sustainable style of living in a new urban district. Since it is clear that technology is not sufficient to guarantee sustainability, the aim was to perform the reduction of energy demand and carbon emissions by enabling residents and workers to make better choices about their consumption maintaining a high quality of life (Experientia 2009). Experientia developed strategies to empower people's change, including engagement and awareness programs, through several measures: services aimed at creating social actions based on

green values; technology to assist people in making decisions, such as smart energy meters and dynamic pricing systems; reinforcement loops (with incentives and benefits) for people who live in, work in and visit this building block; and using the community as a knowledge network to share best practices. Therefore potential inhabitants of the new district were involved in the development of their future environments, through the design of sustainable services, and through the creation of behavioral change programs (Experientia 2009). In order to create the behavioral change concepts, Experientia drafted hypothetical profiles of the people who might inhabit the area and the kind of lifestyles they might live. Looking at the hypothetical day-to-day movement of these profiles, Experientia generated ideas on the type of needs and attitudes they might have, the type of services and products they might want, and how their behaviors should and may change for them to become more sustainable (Experientia 2009).

While the experiences mentioned above witness the already started process of establishing customer needs' collection in building design, in engineering and product design there are well-established methods to perform such activity. Some of them are analyzed in order to identify suitable references which can improve the identification of customer needs in building design. In manufacturing, connecting the customers to the product design has become essential to respond to the needs of current dynamic and competitive markets. An analysis of well-known and structured methodologies to capture and organize customer needs in the product design is provided by Kurniawan *et al.* (2004). The proposed framework is composed of 3 phases: customer need elicitation, customer need translation and utility analysis. In order to perform the first step the following methods developed in the marketing research are available: Voice of Customer, Kano Diagram and Web-based Consumer Elicitation Methods. The Voice of Customer is a set of customer needs hierarchically organized. The needs are collected by group or one-to-one interviews, then structured and organized in an importance rating according to the customer preference. The Kano diagram is used to categorize the customer needs on the basis of the level of customer satisfaction into three different customer need categories (expected, revealed and exciting). It supports the identification of design strategy according to different segment of market. The Web-based consumer elicitation method consists of web-based surveys and statistical analyses that provide information about customer needs, preferences and buying behavior. In order to perform the second step, designers can adopt Kansei Engineering method and Quality Functional Deployment (QFD) method. Finally in the third step the customer needs are analyzed using the Conjoint

Analysis method in order to identify the product space in the market (Kurniawan *et al.* 2004).

Ulrich and Eppinger (2008) propose another structured method to gather data from customers. It intends to foster the interaction between product developers and customers in the target market. This connection is essential for the innovation and the deep fulfilment of the customer needs. The method consists of 5 steps: gather raw data from customers; interpret raw data in terms of customer needs; organize the needs into a hierarchy of primary, secondary and tertiary needs; establish the relative importance of the needs; reflect on the results and the process (Ulrich and Eppinger 2008). Gathering raw data from customers is performed via interviews, focus groups and the observation of existing products. Interviews are considered the primary data collection method because inexpensive and able to provide information on the use environment of the product. Peculiar useful data source are those customers called lead users. They experience needs months or years in advance with respect to the average customer and they may have already invented new solutions. Data should be gathered from product end users and from any other type of customers and stakeholders decisive in the process (Ulrich and Eppinger 2008). The raw data provided by the customer should be collected in terms of statements and translated in terms of needs. Since the number of need statements may be too high to be directly used in the following design activities, a hierarchical organization of these needs is required for each market segment. A list is developed by designers throughout a step-by-step procedure and consists of a set of primary needs each of which may be characterized by a set of secondary needs. The secondary needs may be broken down into tertiary needs in case of complex products. Secondary and tertiary needs express needs in detail. Then the relative importance of the identified customer needs is established by numerical quantified weights through further customer surveys (Ulrich and Eppinger 2008). In order to verify their consistency, the results are finally compared using the information that the team has gathered during the surveys as well as a certain amount of intuition. The resulting customer needs are used to guide the team in establishing product specifications, generating product concepts and selecting the final solution concept (Ulrich and Eppinger 2008).

Discussion and Conclusions

This paper focuses on the role of the customer and on the identification of customer needs in building design. An historical overview has shown the customer involvement through the last century. It has highlighted the attempt to move from the house as an object to the user as the main reference of the design.

A literature review regarding existing experiences and related procedures on identifying customer needs has been provided. Although the issue of customers' need assessment has grown in importance over the last decades, the study of methods to acquire them has been mostly neglected by mainstream literature. For this reason relevant sources on this topic are limited. Since the new role of the customer is not yet acquired

in the building design, this study has considered some procedures developed in product design where the customer involvement is well-established. In order to ease the comparison between such design fields, a scheme is introduced (table 1). The structure is based on the aims, the subjects involved in the procedure, the intended building type to design, the adopted procedure and suggested methods and techniques.

Table 1. Comparison Among Procedures for Identifying Customer Needs in Building and Product Design

Building Design				
	<i>A. aim/B. subjects/ C. object</i>	<i>Procedure</i>	<i>Technique</i>	<i>Method</i>
Regione Emilia-Romagna (1981, 1982)	A define users and user requirements; B no-profit housing habitants and end user profile representatives; C no-profit housing	1 user data acquisition	interview, questionnaire - survey	(not available)
		2 user data analysis	statistical analysis	(not available)
		3 user profile and need definition	group session and workshop	participation methods
American Institute of Architects (2000)	A define human, environmental, cultural, technological, temporal, economic, aesthetic, safety requirements; B clients, end users and community; C different building types	1 preliminary studies (financial feasibility, site suitability, master planning services)	(beyond the aims of the paper)	(beyond the aims of the paper)
		2 client and user value identification and prioritization	literature search review, interview, observation, survey, questionnaire, group session	(not available)
		3 design goal setting	data analysis	(not available)
		4 constraints and opportunity discovery	data gathering	(not available)
		5 development of program requirements	design team analysis	(not available)
HOK (Peña and Parshall 2012)	A define function, form, economy, time requirements; B client and end user; C different building types; entire design process	1 establish goals	interview, questionnaire, work session for data gathering; data management	Problem Seeking Process
		2 collect and analyze facts		
		3 uncover and test concepts		
		4 determine needs		
		5 state the problem		
IAO Fraunhofer (Spath <i>et al.</i> 2010)	A optimize space use; B managers and office workers; C offices	1 analysis of work structure and user requirements	group session and workshop	Fraunhofer Workspace Innovation
		2 development of user scenarios	data analysis made by design team	
		3 new work structures and space concept	(belongs to next design phase)	(belongs to next design phase)
ENEA (Clerici Maestosi <i>et al.</i> 2012)	A assess water need; B workers and researcher; C research laboratories and offices	1 investigation	design team analysis	(not available)
		2 data acquisition	web-based survey	(not available)
		3 data analysis	(not available)	(not available)
		4 project scenarios development	(beyond the aims of the paper)	(beyond the aims of the paper)

Experientia (2009)	A	reach sustainability by involving potential residents;	1	drafting hypothetical profiles of potential inhabitants and their lifestyles	stakeholder interviews, ethnographic research	Participation methods
	B C	end users; urban district	2	test and refine initial concept designs	user participatory design workshop	
Product Design						
Kurniawan <i>et al.</i> (2004)	A	capture and organize customer needs;	1	customer need elicitation	group or one-to-one interview; web-based survey	Voice of Customer, Kano Map, Web-based elicitation method
	B C	end users; products	2	customer need translation	consumer behavior investigation, ergonomic experiment	
			3	utility analysis	customer interview	Conjoint Analysis, statistical analysis methods
Ulrich and Eppinger (2008)	A	capture and organize customer needs;	1	gather raw data from customers	interview, focus group and observation of existing products	Product Design and Development
	B	end users and lead users;	2	interpret the raw data in terms of customer needs	data clustering and interpretation	
	C	products	3	organize the needs into a hierarchy	design team workshop	
			4	establish importance	customer survey made by design team	
			5	reflect on results and process	design team analysis	

Relevant results of this analysis are that some procedures are available to support the identification of user needs for different types of buildings, but the analyzed building experiences are not able to involve all different stakeholders. As the specific characteristic of the building sector is complexity, the final user is part of a group of different stakeholders that influences the building output. Their involvement and impact need to be analyzed and coordinated in a structure. Since well-established procedures are not yet available in building design, in the next future the research intends to test and eventually codify methods and procedures to address such challenge.

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