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Customer's Requirements for Social Housing Designer: Systematic Literature Review

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Abstract: The high demand of housing units (HU) in Brazil, result of housing deficit, coupled with the need to deliver low cost HU's and with minimum requirements of quality, that can promote comfort, health and safety to users (final client), form a complex and challenging scenario to professionals related to the built environment. This article is inserted in the context, since it deals with the partial results of a project of scientific initiation entitled: quality of social housing design (SHD) in the municipality of Maraba, state of Para, in the Brazilian Amazon: customer's requirements. In this sense, the objective of the article is to identify the quality requirements of the SHD, through systematic literature review (SLR). For this, the SLR based on the 07 steps suggested by Morandi and Camargo: Definition of the central theme and conceptual framework; aggregative or configurative revision; choice of work team; search strategy; selection of data; research of, eligibility and codification; synthesis of results. It was analyzed 22 published studies related to the research problem and it was possible to identify 15 requirements. The SLR results were useful for the characterization of SHD, in addition to offering guidance subsidies for the search string, insofar as the theoretical information served as a reference to analyze the projects implemented, potentials and failures. Finally, the work contributes to the identification of some gaps in the theme and, consequently, the opening of opportunities for new research.

Key words: social housing, requirements, customer

1. Introduction

It is well known that a feedback on building performance is usually obtained through post-occupancy evaluation. For this reason, problems associated to the customers non-satisfaction generally is detected only when the project is finished, which results on constructive interventions as soon as the house is occupied. Due to structural modifications, damages on the quality of the building appear earlier than the expected [1]. So far, only a few critical solutions were made about this problem. Considering this aspect, a solution to housing units based on the customer's needs has been explored. The principle of this methodology is based on the management of customer's requirements, in social housing design (SHD).

Requirements can be defined as functions, attributes, and other characteristics of a product or service [2]. During the development of any project, the client's solicitation must be captured and introduced in the design; from this step, the requirement assumes the form of a construction attribute [3]. In some cases, client's requirement has been obtained through structured interviews [4-6]. Also, through post-occupation evaluation [7-9].

Customer's requirements involve a large amount of qualitative information [10]. The requirement process includes the identification, analysis and it is translation [2]. Translation means [11] to change the customer's requirements into a design requirement. The identification of a requirement includes the stakeholders' definition, design attributes, and

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performance criteria. Advises that the best requirement comprehension passes through the process of it is deployment in many levels; it makes possible the attribute final definition [5].

Based on those concepts, Minha Casa Minha Vida Program (MCMVP) can be used as an example, once it comprises an interface between the Social Housing Design and Customer's Requirements. This program was created in 2009 by the Brazilian Government in order to reduce the Brazilian housing deficit. Since the begin, MCMVP has been a target to many researchers [1, 5, 7, 8, 11-16], interested on the development of a product (housing units) with quality, added value, and that can be able to provide comfort and well-being to the customer.

Such an evaluation of customer's needs has rarely been extended to the social housing, the main idea of this paper is to identify the customer's requirements on social housing design (SHD), using the systematic literature review (SLR). This paper is a part of a research project called: quality of social housing design (SHD) in the municipality of Maraba, Brazilian Amazon. In this sense, it is necessary to study a better way to understand the method and technical concepts about customer's requirements in order to deliberate actions for sequential steps. For this reason, the concept of systematic literature review was used.

2. Research Methodology

The definition of a systematic literature review (SLR): "the identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest" [17]. Generally, a preliminary study is based on individual data that can be used as an input to SLR. The secondary study is constituted by the own SLR [17]. "The secondary studies are used to map, to find, to evaluate critically, to consolidate, and to aggregate the results of a preliminary study about a specific research topic" [18].

The word "systematic" refers to the way a research can be led. "It is related, according to the explanatory method, to the plan, to the responsibly, and to the justifiability, in order to allow the research to be unbiased, rigorous, auditable, replicable and updatable" [18].

Concerning the justifications for the using of an RSL: (a) to summarize the evidences about the benefits and limitations of a subject; (b) identify any gaps on the specific knowledge in order to suggest a research opportunity; (c) to provide a conceptual framework [17].

There are many ways to conduct a SLR, among it, stands out the proposal of Morandi and Camargo [18]. The proposed method consists in 07 steps: choice of the main theme and the conceptual framework; aggregative or configurative review; choice of work team; search strategy; data selection; search, eligibility and codification; summarize results.

Configurative review explores open and oriented issues of the generation of qualitative data, through the exploration of more heterogeneous primary studies. On the other hand, the aggregative review uses a more homogeneous primary study, mostly involving qualitative data; it is orientated by testing a theory (closed questions) from the collection of empirical observations.

According to the steps proposed by Morandi and Camargo [18], in this work, the method was chosen considering the main idea, social housing, focused on the study of customer's requirements in a project of quality of social housing design (SHD).

Fig. 1 presents an example of a social house located at Ponta de Pedra, archipelago of Marajo, Brazilian Amazon: (a) frontage project; (b) layout; (c) the construction final phase.

The conceptual framework adopted has restrictions, therefore, the framework contemplates the keywords considered relevant to the theme. Furthermore, by definition, the review was characterized as configurative; from the preliminary results, it was extracted the qualitative data, which was analyzed throughout the study. The work team was selected at the beginning of the project; the team work was

composed by 03 professors and 02 undergraduate students in Civil Engineering.

In terms of strategy, were considered 03 renowned databases that can be accessed by almost all universities around the world: Scielo, Scopus, and Web of Science. The search terms chosen were: requirements; social housing; design; customer; and construction. For the bias minimization, the exact words were used with the boolean operators, considering order, word, and operators. In addition, the technique called truncation was used, which consists in the use of the symbol (*), allowing the symbol's predecessor root to assume different terminologies, improving search efficiency. Table 1 summarizes the methodology used during the research step.

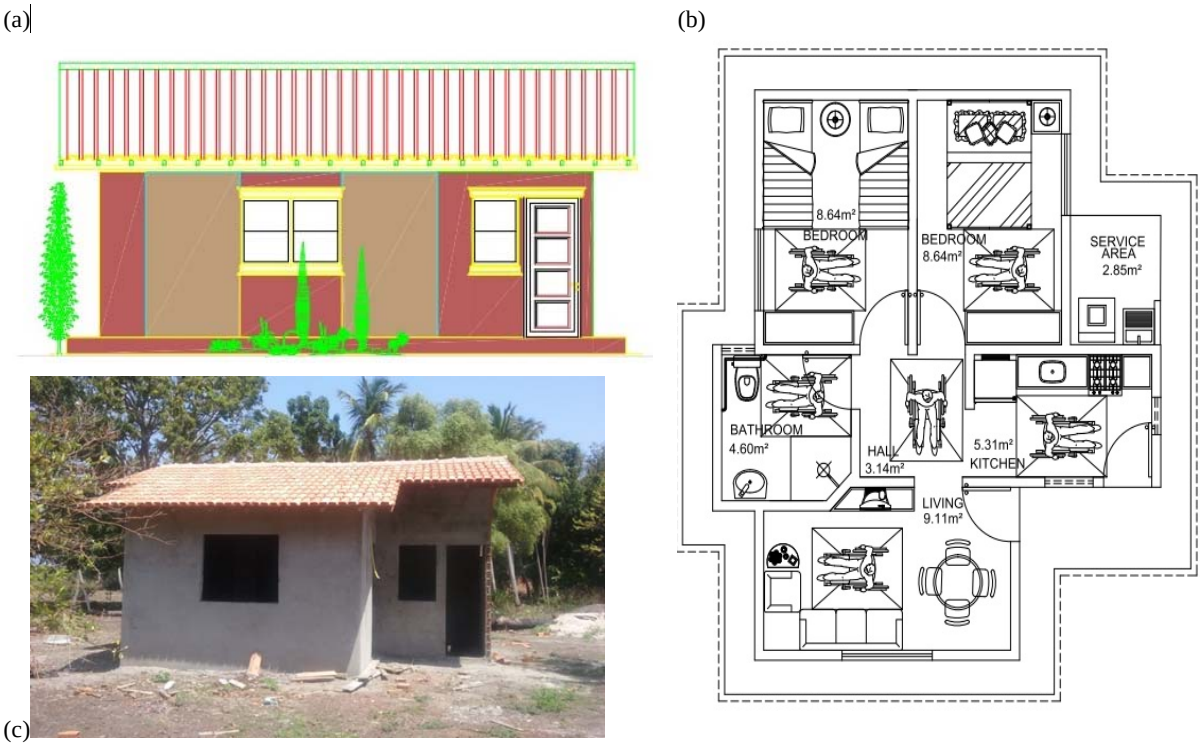

Fig. 1 Example of a social house unit located at Ponta de Pedra, archipelago of Marajo, Brazilian Amazon, (a) frontage project; (b) layout; (c) the construction final phase.

Table 1 Electronic databases selected as search source.

Search	Sources	Boolean Operators
Search 01	Scielo, Scopus e Web of Science	Requirements* AND Social housing* AND Design* AND Construction
Search 02	Scielo, Scopus e Web of Science	Requirements* AND Social housing* AND Design
Search 03	Scielo, Scopus e Web of Science	Requirements* AND Social housing* AND Customer
Search 04	Scielo, Scopus e Web of Science	Requirements* AND Social housing* AND Design* AND Customer* AND construction

Parameters as such as search, eligibility, and codification, corresponds to operationalization. In each database, the boolean operators were imputed. On filtering information, articles from journals and conferences were considered. There was no restriction on time factor; it was used all the papers inside this theme without year restriction, which means building a timeline for a specific topic. Zotero (an extension of Mozilla Firefox available free of charge) was used for data storage and management. The papers were classified as the repetitions of publications, titles of the publications, abstracts, full reading, and quality

analysis. From the synthesis of the data, it was presented a mapping of the subject including: number of publications found; publications by country; and publications per year.

Not all publications were tracked by the 04 searches indicated on Table 1, due to this limitation, the backward and forward procedures were used. Backward procedure considers the references cited on the papers used, and forward seeks new studies that have cited the document already selected, in order to track new publications.

3. Results and Discussion

3.1 Bibliometric Aspects

Bibliometric aspects involve the results obtained during a specific search. In this case, it is related to the numbers of papers published, authors, journals, year of publication, etc., which has some relation with the theme of interest, social housing design and it is customer's requirements. Table 2, summarizes the results of the general search (Web of Science, Scopus, Scielo), as well as the filtering process (search criteria). Concerning the found papers, it was obtained 106 publications from Web of Science, 252 from Scopus, 14 from Scielo, and 10 using the backward e forward proceedings, totalizing 382 publications.

A simple methodology presented in Fig. 2 summarizes the steps used during the systematic literature review (SLR), as well as the filters used in each part of the SLR.

Fig. 2 shows the results obtained by using the specific filters defined according to the project. The criteria used in the filtering were: exclusion by repeated papers, title reading, summary reading, accessibility to the full paper, full reading, and quality analysis, the final number is 22 published works on the indexed journals, approximately 6% of all publications (22 of 382). As it can be seen (Fig. 3), considering the concerns with the client on social housing construction, predominantly researchers from Brazil where found. In addition, there are publications from Chile and Peru, 01 publication each. From the European continent, there are 02 publications from the United Kingdom. From Africa, there were 02 papers from South Africa. The Asian continent contributed with 02 papers, one from China and one from Yemen.

The indexed journals used are: Ambiente Construído; Gestão e Tecnologia de Projetos; International Journal of Housing Markets and Analysis; Journal of Construction in Developing Countries; Building Research and Information; The TQM Journal; Habitat International; Product Development and Design Management; Procedia Engineering; Architectural Engineering and Design Management; Built Environment Project and Asset Management; Frontiers of Architectural Research; Construction Innovation. Still on publications includes the repository of dissertations and theses of the Federal University of Rio Grande do Sul.

Another extract obtained corresponds to the year of publication. As shown in Fig. 4, between 2002 and 2009 the number of publications remained constant, with only 01 publication. The three papers published in 2010 have indicated an improvement, what was confirmed in 2011 with 07 publications, the highest in the series.

Table 2 Results based on the source search (Web of Science, Scopus, Scielo).

Search data	Web of Science	Scopus	Scielo
Search 01	21	62	5
Search 02	78	167	9
Search 03	6	19	0
Search 04	1	4	0
Publications found from electronic databases	106	252	14
	372		
Backward and forward method	10		
Total papers found	382		

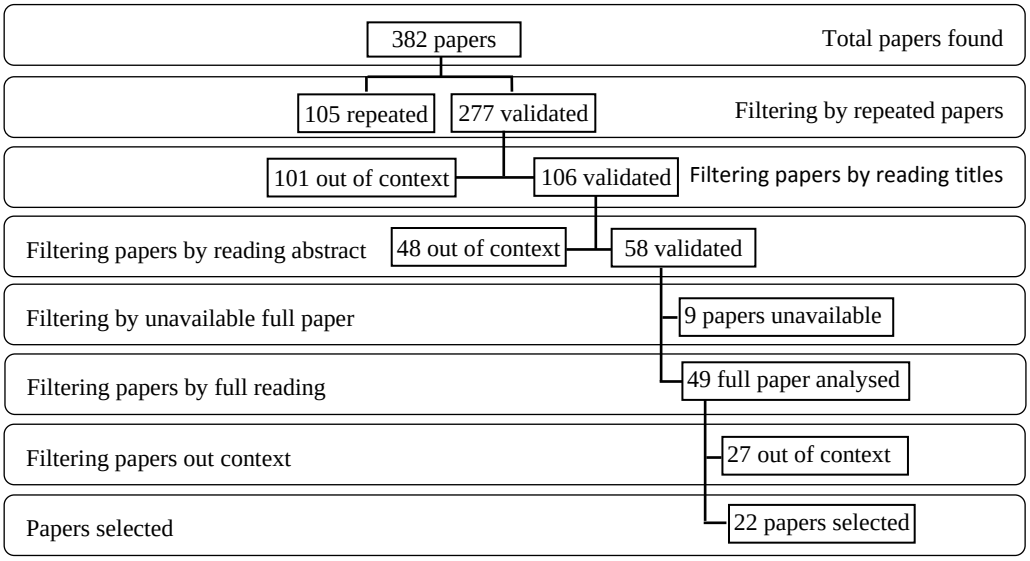

Fig. 2 Steps used during the systematic literature review (SLR).

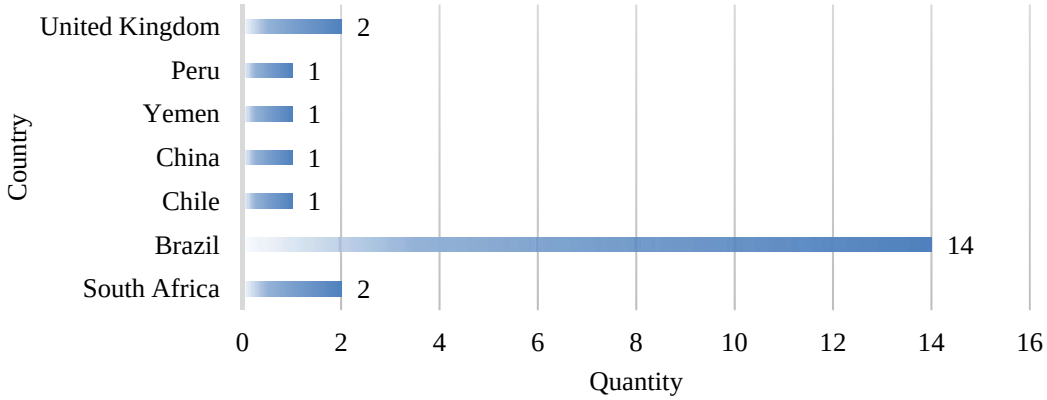

Fig. 3 Number of publications per country.

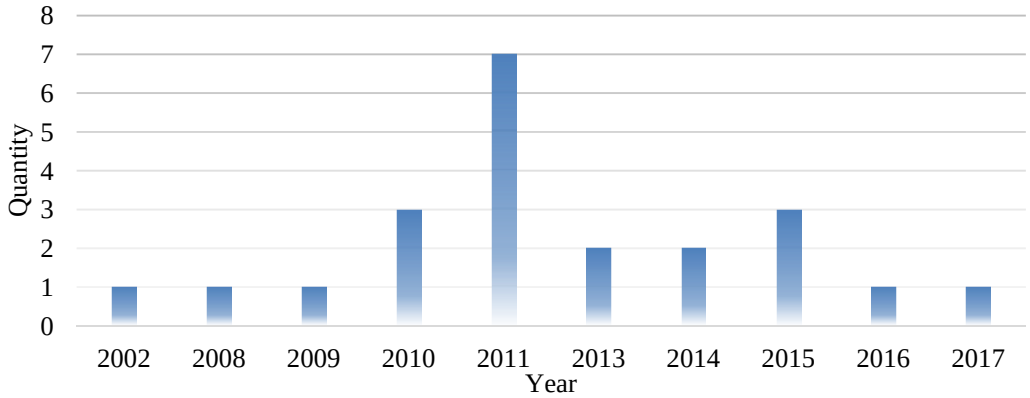

Fig. 4 Publications per year.

Some institutions achieved more than one publication. Federal University of Rio Grande do Sul had published 08 papers; University of Campinas had published 02 papers; and from University of Londrina it was found 02 papers. Considering a repetition of each author among publications: Miron contributed with 07 papers; 05

contributions from Formoso; 03 from Granja; and Kowaltowski has published 03 papers as well.

3.2 Specific Information — Customer's Requirements

Methodological proceedings for requirements identification was based on structured interviews with stakeholders; 80% of the requirements were identified by this methodology. As for the requirements raised through interviews, 49.9% were using questionnaires; 18.8% were obtained by using by post-occupation evaluation; and 31.3% by using Survey method. As for the methods for systematizing the requirements: 20% were systematizing by QFD (Quality Function Deployment); 15% with a customer feedback (post-occupation evaluation); 30% by using with statistical inference techniques; 30% with a value analysis; and 5% were systematized through a building information modeling (BIM).

Obtained from an adaptation of Kivinieme [10], the schematic details presented on Table 3 shows a relationship between the publishers, the customer requirements, as well as the amount, and the percentage of some requirements present in each article. Requirements are organized following the order: (a) conformity requirements (that includes location, space, and service); (b) performance requirements (indoor conditions, life cycle, security, adaptability, comfort, aesthetic, accessibility, and circulation); (c) environmental requirements (sustainability); (d) cost requirements (cost and price). Also, it was added the letter (e) system requirements that is included electrical systems and hydro sanitation facilities [5].

(a) Conformity Requirements

As for conformity, the location requirement was studied by the authors at 68% of the cases. This requirement involves the geographic location, in addition, it considers the public infrastructure. The customer considers in this requirement the availability of transportation, the distance from the residence to the bus stop, the distance from residence to school, to work, to the city center, to hospitals and for culture, sports, and leisure support points [19].

On the other hand, the space requirement, according to 77% of authors, refers to the functionality of space. The dimensioning and distribution of the rooms must follow the costumer's request; it must be compatible with the human need [9]. The functionality of the spaces includes the areas, the dimensions of the housing units, as well as the furniture and equipment of the housing units and common use spaces [5]. The author also considers functionality in terms of quality of construction, which encompasses space (construction of building components, floors, walls, frames, etc.). It is not considered the electrical and hydro-sanitary systems, although it has correlation with item functionality, these were treated in a separate requirement.

The service requirement (27%) indicates only tangible services (masonry elevation, coating, etc.) [10].

(b) Performance Requirements

Concerning performance requirements, the indoor condition was evidenced in 59% of the investigated papers. These criteria were based on the customer's request for the performance of the building in terms of lighting, climate, acoustics and room layout [10]. The arrangement of the room interfaces with the adaptability requirement was cited by the authors in 41% of the cases. This requirement is mentioned in terms of flexibility to expand the building; it was triggered by the analysis about the building adaptability considering the residents with special needs, a wheelchair, for example. The life cycle requirement (36%) was referenced in the articles, majority, for the requisition of maintenance of the building. The durability aspects of the building can be associated with shelf life, such as: durability of the structure; materials and components; durability conditions [9].

The security was the most expressive requirement, detected on 86% of the analyzed works. It was most evidenced in the sense of security of the residents and their patrimony. Security is strongly related to the location requirement (neighborhood security, street lighting, public transportation near the residences, etc.),

for this reason, it is an information constantly required by the costumer before to receive the housing unit (HU). As well as after receiving the HU, this requirement is triggered by the type of constructive intervention performed by the user. Protective and seal fittings are introduced in the building [9, 20], for example grilles, walls and alarm devices. The security is directly related to the user's ability to control [13].

Comfort and aesthetic obtained the same percentage, 45%. The first one was mostly related to the privacy of the residents, and it has strongly relation with the indoor conditions. Comfort includes: thermoacoustic isolation, natural and artificial illumination; adequate ventilation in rooms; thermic comfort; ergonomic comfort during handling or operating equipment. Concerning aesthetics, it was considered the building appearance [9]. Accessibility requirement was included in 9% of the analyzed papers. This requirement considers that the customer requests a building with improvements that allow access to HU itself, as well as access to areas and equipment of common use [5]. The circulation requirement was the less expressive (5%), which proves to be unusual on SHD. The circulation requirement can be to describe the circulation in the area or to describe the general system of circulation: lobby; corridor; stair; elevator; escalator; loading dock [10].

(c) Environmental Requirements

Environmental requirement was observed in 36% of the considered papers, which is an expressive amount. It refers to the sustainability items previously related with SHD. According to [9], a SHD should contemplate the renewable energy, such as: solar energy, biomass, etc. The same authors imply that the SHD should cover the rainwater harvesting and reuse systems, sewage treatment systems (septic tank, anaerobic filter and sink), as well as green areas.

(d) Cost Requirements

Cost requirements was found in 45% of the analyzed papers, mostly related to the building construction costs, proven by the nomenclatures founded on the papers — financial support, payment installments of a HU, etc. Although the SHD normally comes with a government support, the customers still consider the cost to as a preponderant factor in terms of requirements.

(e) System Requirements

Electric and hydro-sanitary systems correspond to 27 and 23%, respectively. Both are related to the facilities in the building [5]. This system makes an interface with the service requirement in the sense of quality of construction and final touch. Even with installations completed during the construction phase, the system remains active during the period of use of the HU. Therefore, the expectations of the user regarding these requirements, are related to the good operation and the durability of the installations.

4. Conclusion

The main objective of this work was achieved using the RSL. Considering a social housing design (SHD), 15 customer's requirements were identified, as well as guiding the search sequence. Insofar as the theoretical information served as a reference to analyze user requirements, it makes possible to know the potentialities and failures.

With the set of requirements identified, it is evident the need to offer projects whose conceptions add favorable values to the social, historical and cultural reproduction of users. However, if it is observed the modus operandi of the design of social housing projects, in general, the projects have technical solutions with a diminutive or non-participation of the users. Therefore, it is necessary to modify the paradigm of low participation of the customer's contemplated with the housing of social interest; if the designer of a housing project programs can count on the costumer's verification at the first step of the project, the adequacy with the reality and requirements of the customers could be done, avoiding future problems.

Finally, it was noticed the absence of research considering the users requirements that lives in the rural area. The 22 articles were focused on the capture and analyses of requirements in the urban area. This

fact constitutes a knowledge gap and opens the opportunity for further research.

References

[1] D. Q. Brandão, Disposições técnicas e diretrizes para projeto de habitações sociais evolutivas, *Ambiente Construído* 11 (2011) 73-96.

[2] J. M. Kamara, C. J. Anumba and N. F. O. Evbuomwan, Client requirements processing in construction: A new approach using QFD, *Journal of Architectural Engineering* 5 (1999) 8-15.

[3] L. I. G. Miron, Proposta de diretrizes para o gerenciamento dos requisitos do cliente em empreendimentos da construção, MSc. thesis, Federal University of Rio Grande do Sul, 2002.

[4] W. Alaghbari, A. Salim, K. Dola and A. A. A. Ali, Developing affordable housing design for low income in Sana'a, Yemen, *International Journal of Housing Markets and Analysis* 4 (2011) 84-98.

[5] J. P. Baldauf, C. T. Formoso and L. I. G. Miron, Modelagem de requisitos de clientes de empreendimentos habitacionais de interesse social com o uso de BIM, *Ambiente Construído* 13 (2013) 177-195.

[6] K. Kassela, M. Papalexi and D. Bamford, Applying quality function deployment to social housing? *TQM Journal* 29 (2017) 422-436.

[7] D. L. L. J. Aragão and E. H. Hirota, Sistematização de requisitos do usuário com o uso da Casa da Qualidade do QFD na etapa de concepção de unidades habitacionais de interesse social no âmbito do Programa Minha Casa, Minha Vida, *Ambiente Construído* 16 (2016) 271-291.

[8] P. A. Conceição, C. Imai and M. R. Urbano, Captura e hierarquização de requisitos do cliente de habitação de interesse social a partir da avaliação pós-ocupação e da técnica de preferência declarada, *Gestão & Tecnologia de Projetos* 10 (2015) 79-98.

[9] P. Orihuela and J. Orihuela, Needs, values and post-occupancy evaluation of housing project customers: A pragmatic view, *Procedia Engineering* 85 (2014) 412-419.

[10] A. Kiviniemi, Requirements management interface to building product models, Ph.D. thesis, Stanford University, 2005.

[11] L. P. Lima, C. T. Formoso and M. E. S. Echeveste, Proposta de um protocolo para o processamento de requisitos do cliente em empreendimentos habitacionais de interesse social, *Ambiente Construído* 11 (2011) 21-37.

[12] F. S. Bonatto, L. I. G. Miron and C. T. Formoso, Avaliação de empreendimentos habitacionais de interesse social com base na hierarquia de valor percebido pelo usuário, *Ambiente Construído* 11 (2011) 67-83.

[13] A. D. Granja, D. C. C. K. Kowaltowski, S. A. M. G. Pina, P. S. P. Fontanini, L. Barros, D. de Paoli, A. M. Jacomit and R. M. R. Maçans, A natureza do valor desejado na habitação social, *Ambiente Construído* 9 (2009) 87-103.

[14] L. I. Miron and C. T. Formoso, Value generation in social housing projects: A case study on the City Entrance Integrated Program in Porto Alegre, Brazil, in: *18th Annual Conf. of the Intern*, Group for Lean Construction, Haifa, Israel, 2010.

[15] D. A. B. Monteiro, L. I. G. Miron, J. S. I. Shigaki and M. E. S. Echeveste, Avaliação da percepção de valor em Empreendimentos Habitacionais de Interesse Social: perspectivas de técnicos e de usuários, *Ambiente Construído* 15 (2015) 37-54.

[16] J. A. Ruiz, A. D. Granja and D. C. C. K. Kowaltowski, Cost reallocation in social housing projects considering the desired values of end-users, *Built Environment Project and Asset Management* 4 (2014) 352-367.

[17] B. Kitchenham, Procedures for performing systematic reviews, Joint Technical Report Software Engineering Group, Department of Computer Science, Keele University, United King and Empirical Software Engineering, National ICT Australia Ltd., 2004.

[18] M. I. W. M Morandi and L. F. R. Camargo, Revisão sistemática da literatura, in: A. Dresch, D. P. Lacerda, J. A. V. Antunes Junior, *Design science research: método de pesquisa para avanço da ciência e tecnologia*, Porto Alegre: Bookman, 2015, pp. 141-172.

[19] A. O. Windapo and J. Goulding, Value-based perspectives of stakeholders' building requirements in low cost and government subsidised housing projects in South Africa, *Construction Innovation* 13 (2013) 424-444.

[20] L. I. G. Miron, Gerenciamento dos requisitos dos clientes de empreendimentos habitacionais de interesse social: proposta para o Programa Integrado Entrada da Cidade em Porto Alegre/RS, DSc., Federal University of Rio Grande do Sul, 2008.