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AMBIENTE CONSTRUÍDO E USUÁRIO: PERSPECTIVAS LATINO-AMERICANAS

# Opportunities for Social Housing upgrading in non-mandatory scenarios

## *Oportunidades de melhorias de Habitação Social em processos não obrigatório*

## *Oportunidades de mejora en Vivienda Social en procesos no obligatorios*

CONFORTO ERGONÔMICO E QUALIDADE AMBIENTAL (Adaptações no ambiente construído (edifício e ambiente urbano))

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## Abstract

Studies highlight shortcomings of housing programs in delivering quality, and recommend housing stock upgrading to address evolving social and technological needs, as well as to adopt sustainable practices to mitigate climate change. In Brazil, a no-mandatory upgrading prevails, and improvements are usually user induced as attested by the many transformations of housing, however without feasibility studies. Thus, the objectives of the study are to understand how housing programs support upgrading and how to choose a suitable upgrading action based on investment and complexity. A literature analysis was developed to identify upgrading in Brazil. An analysis of decision-making and improvement were evaluated to define an upgrading opportunity scenario, based on investment and complexity of interventions. Current policies need to be more comprehensive, and sensitive to embrace the urgent global problems to guarantee the effectiveness of housing improvements.

Keywords: Upgrading. Interventions. Social Housing. *Non*-mandatory process. Decision-making.

## *Resumo*

*Estudos destacam as deficiências dos programas habitacionais na oferta de qualidade e recomendam a modernização do estoque habitacional para atender às necessidades sociais e tecnológicas, bem como a adoção de práticas sustentáveis para mitigar as mudanças climáticas. No Brasil, melhorias não obrigatória prevalecem, e são geralmente induzidas pelos usuários, como atestam as inúmeras transformações no setor habitacional, porém sem estudos de viabilidade. Assim, os objetivos do estudo são compreender como os programas habitacionais apoiam melhorias e como escolher uma ação adequada com base no investimento e na complexidade. Uma análise da literatura foi desenvolvida para identificar melhorias no Brasil. Uma análise da tomada de decisão e da melhoria foi avaliada para definir um cenário de oportunidade, com base no investimento e na complexidade das intervenções. As políticas atuais precisam ser mais abrangentes e sensíveis para abranger os problemas globais urgentes e garantir a eficácia das melhorias habitacionais.*

*Palavras-chave: Melhorias. Intervenções. Habitação Social. Processo não obrigatório. Tomada de decisão*.

## *Resumen*

*Estudios destacan las deficiencias de los programas de vivienda para ofrecer calidad y recomiendan la modernización del parque habitacional para atender las necesidades sociales y tecnológicas, así como la adopción de prácticas sostenibles para mitigar el cambio climático. En Brasil prevalecen las mejoras no obligatorias, generalmente inducidas por los usuarios, como lo demuestran las numerosas transformaciones en el sector habitacional, pero sin estudios de viabilidad. Así, los objetivos del estudio son comprender cómo los programas de vivienda apoyan las mejoras y cómo elegir una acción adecuada en función de la inversión y la complejidad. Se desarrolló una revisión de literatura para identificar mejoras en Brasil. Se evaluó un análisis de toma de decisiones y mejora para definir un escenario de oportunidad, basado en la inversión y complejidad de las intervenciones. Las políticas actuales deben ser más integrales y sensibles para abarcar los problemas globales más urgentes y garantizar la eficacia de las mejoras en la vivienda.*

*Palabras clave: Modernizaciones. Intervenciones. Vivienda Social. Proceso no obligatorio. Toma de decisiones.*

## Introduction

Brazilian housing policies and programs primarily aim to provide new Social Housing (SH) for low-income populations and to reduce the housing deficit of the country (Muianga; Kowaltowski, 2024a). Although a large number of new homes have been built through such programs they have shown a limited effectiveness to reduce the housing deficit, and many studies highlight shortcomings of these programs in delivering quality housing (Muianga; Kowaltowski; Moreira, 2023). These findings indicate that not only designs of new projects should be revised, but importantly the existing SH stock requires more than routine maintenance. Significant upgrades to address evolving social and technological needs, as well as to adopt sustainable practices to mitigate climate change are essential (Peters; Halleran, 2021).

Developing upgrading programs to improve existing SH may reduce the housing deficit, enhance the quality of housing to meet recommended standards, and decrease the demand for new units (Kowaltowski et al. 2019). These upgrades must also address the issue of social costs (SCs), which encompass recurring impacts as well as economic and non-economic justifications for improvement initiatives (Muianga et al. 2021). The process of upgrading may involve different types of interventions to improve the physical aspects of a building and the surroundings of housing projects. Increased functionality is important to serve the present-day needs of people (Gustavsson; Elander, 2016). Also, refurbishment should address housing preservation, extend the life cycle of a building, promote safety, comfort and accessibility for people and provide attractive and safe neighborhoods (Poortinga et al., 2017).

Most existing upgrading programs in Europe primarily address the issue of climate change impacts both of and on buildings and neighborhoods as those programs are mandatory to attend to sustainability directives (Stenberg, 2018). Maintenance and improvements of building infrastructure are usually coupled to energy efficiency refurbishments. To improve the quality of life and social relationships of SH users should also be an overriding goal in upgrading projects (Muianga; Kowaltowski, 2024b; Kowaltowski et al. 2024). The physical health, psychological well-being of people and opportunities given to improve life conditions through better education and jobs are also objectives (Stenberg, 2018).

In the case of Brazil, no-mandatory upgrading exists. The introduction of improvements is usually user induced as attested by the many transformations of SH that occur without: feasibility studies; planning; technical support; and which may generate social costs mainly for the beneficiaries of

these homes as not all results are positive, especially in single family houses (Muianga et al. 2022). Analyzing and understanding the priorities for decision-making in SH upgrading in a Brazilian context is essential to mitigate negative impacts of housing on people and society. To address this issue, our research identified opportunities for upgrading through sub-programs linked to SH initiatives, such as the "housing improvement KIT[1]". The objectives of the study were guided by two key questions:

- How do SH programs support upgrading?
- How to decide which upgrades are more suitable for less or more investment, and complexity?

## Background

Environmental sustainability of housing is concerned with the impacts of housing developments on the environment, particularly due to climate change. To meet current laws and standards, upgrading interventions are mandatory in most developed countries to improve energy performance, introduce decarbonisation, and prepare buildings for future conditions (Karvonen, 2013). Upgrading may also involve improvements that go further than the issue of carbon emissions and energy performance, such as improvements on: modernizing finishing (floors, wall tiles), lighting, facades, ventilation conditions, electrical, hydraulic and IT infrastructure, security, and automation. All considered important aspects to achieve better comfort and functional performance (Kowaltowski et al. 2024).

Upgrading strategies for the requalification of buildings for SH are becoming more prevalent in Brazilian cities in recent years (Sanches; Alvim, 2016; Anitelli, 2017; Ebert; Giacomelli; Silva, 2017; Pinho, 2018; Junior, 2019). Upgrading is seen as a strategy to requalify existing buildings whether in use or not, characterized as expropriated, idle, abandoned, deteriorated, unfinished, empty or underused (Anitelli, 2017, 2020, 2021). Requalification is primarily developed in order to reduce the housing deficit of a specific city. By promoting housing for low-income people, the need for new construction is reduced.

To analyze upgrading in Brazil, the housing improvement processes already existing in other countries must be understood. In developed countries, in particular in Europe, the SH stock was

[1]https://www.gov.br/cidades/pt-br/acesso-a-informacao/acoes-e-programas/habitacao/programa-minha-casa-minha-vida/minha-casa-minha-vida-rural/arquivos/composicao-dos-kits_mel__2023_site.xls/view

built mainly after WWII and is thus 75 years old or more. Thus, many housing developments are no longer consistent with current standards and with the users' expectations. The most urgent need is to bring older buildings to current energy efficiency standards. A large part of the older buildings employs construction techniques such as external concrete walls with low maintenance possibilities, but poor energy efficiency as well as comfort conditions (Barnett, 2023). Upgrading becomes increasingly necessary concerning the constructive model of such older buildings (Lilley; Davidson; Alwan, 2017). Furthermore, refurbishments and retrofits work in favors of building structure preservation that extends the useful life of buildings, and modernization to meet current sustainability, energy efficiency or safety requirements (Karvonen, 2013).

**Upgrading in Brazilian SHs**

In Brazil, the cities of São Paulo and Rio de Janeiro stand out as pioneers in creating upgrading processes. In São Paulo, through assessments, a large volume of idle and unfinished buildings with a potential for conversion into housing was identified and the city government destined these for SH (Devecchi, 2014). The requalification of existing buildings, generally presented and publicized as retrofit projects, aims to readapt properties for new purposes. The urban infrastructure context of many abandoned or idle buildings predestines these for residential use (Ebert; Giacomelli; Silva, 2017). Retrofits would reduce demolitions and new constructions, as the existing infrastructure is reused and the useful life of properties is extended (Santos, 2019).

Strategies for the requalification of buildings in urban centers are becoming more widespread, with significant potential for large-scale developments. However, existing SH and its need for upgrading, a type of retrofit, has not yet been given the same attention by policy agendas, although SH studies have shown that maintaining buildings in their current, less than adequate, conditions increase social costs (Muianga; Kowaltowski, 2023). Thus, investments in retrofit and refurbishment can mitigate social service costs for health care and policing for instance. To address these issues, improvement processes must encompass existing underused buildings in urban centers and low-income SH currently in use (Muianga et al. 2022).

However, upgrading in SH in Brazil revealed that these processes are not fully documented regarding the specific interventions to classify them as retrofits, despite being labelled as such. In Brazil, retrofit is defined according to the Brazilian association of technical standards (NBR ABNT). NBR 15.575 (Performance Standard) defines retrofit as "remodeling or updating the building or systems, through the incorporation of new technologies and concepts, normally aiming to

increase the value of the property, change of use, increase useful life, operational and energy efficiency". So, what can be assessed from studies is that buildings undergo requalification and adaptations to serve as residences for low-income families (Anitelli, 2017). On the other hand, buildings initially designed as SH and occupied by the lowest-income groups, have not been included in upgrading processes, even though the majority urgently require improvements. This underscores the need to include SH models in upgrading programs, making the current requalification efforts more comprehensive. Such an approach would ensure better living conditions for the population at present living in inadequate conditions.

## Methodology

In this study, a literature analysis was developed to identify upgrading in Brazilian SHs. A survey was based on a specific protocol (Kitchenham et al., 2009). The survey was based on a systematic literature review, applied to identify previous research that analyses upgrading in the city of São Paulo, in order to collect information on types of interventions.

For our keywords and variations on retrofit, upgrading and refurbishment were identified, as well as SHs variations, to constitute our search strings. Inclusion and exclusion criteria were applied to the screening process. To identify retrofitting cases in Brazilian SHs was one of our essential objectives. For this reason, the filter on geographic location was applied to determine our sample. We set up the keyword variations and the search strings to apply in specific databases (Table 1). Scopus, Web of science, Scielo and google academic were used. Google academic was used to amplify our search; as Brazilian information is often not published in the main scientific databases. It was essential to identify papers that cover updating and upgrading issues in social housing in our local context.

Forty-two (42) articles were identified with twenty-five (25) that made specific mention to retrofit but not describing full application cases. Such publications were removed from our sample. Also, few studies mention retrofit in SHs in Brazil. Even with the delimitation of the location in the screening process, eleven (11) papers developed in other countries were identified, which for this reason do not constitute the main search for our study. These publications however serve as important cases to analyze parallel retrofit issues. Only nine (9) papers specifically addressed retrofitting in SHs in Brazil, but our analysis extended to twenty (20) papers to build more robust results from our analysis

**Table 1: Sample analysis**

| | Strings | database | Sample 1 |
|---|---|---|---|
| | (Updat* or Upgrad*) and (Maint* or Improv* or Interven*) and (Refurbish* or retrofit or requalifat*) and ("Public hous*" or "low-income hous*" or "Social hous*") | Web of science | 38 |
| | (Updating or upgrading) and (Maintenance or Improvements or Intervention) and (Refurbishment or Retrofit) and ("Public housing" or "low-income housing" or "Social housing") | Scopus | 44 |
| | Interventions and social housing or public housing | Scielo | 43 |
| | (Updating or upgrading) and (Maintenance or Improvements or Intervention) and (Refurbishment or Retrofit or requalification) and ("Public housing" or "low-income housing" or "Social housing") and Brazil | Google academic | 114 |
| | Retrofit and "*habitação social*" and *brasil* | | 32 |
| | **Total papers (sample 1)** | | **271** |
| | **Criteria 1 (database analysis)** | | |
| Exclusion | Not open access | | -45 |
| Exclusion | Not SH papers, and not cover actions for upgrading in SH, and Not matched Brazilian SH | | -170 |
| Exclusion | Duplicate | | -14 |
| | **Criteria 2 (after reading keywords, abstracts)** | | **42** |
| | Not SH papers and not cover our objectives | | -25 |
| | Other countries SHs retrofit | | -11 |
| Inclusion | Snowballing | | 3 |
| | **Final sample composition** | | |
| **Sample** | **Brazilian SHs retrofit** | | **9** |
| (Sanches; Alvim, 2016); (Anitelli, 2017); (Ebert; Giacomelli; Silva, 2017); (Junior, 2019); (Pinho, 2018); (Anitelli, 2020); (Anitelli, 2021); Report[2]; Report[3] | | | |

Source: The Authors

## Results and discussion

### General observations:

A documentary survey was conducted to identify buildings classified as SH that have undergone upgrading processes in Brazil in recent years, starting in 2010. The research included databases, published news reports, official documents, and various accessible sources. Limited information was found regarding SH upgrading efforts in Brazil. This lack of information reflects a broader gap

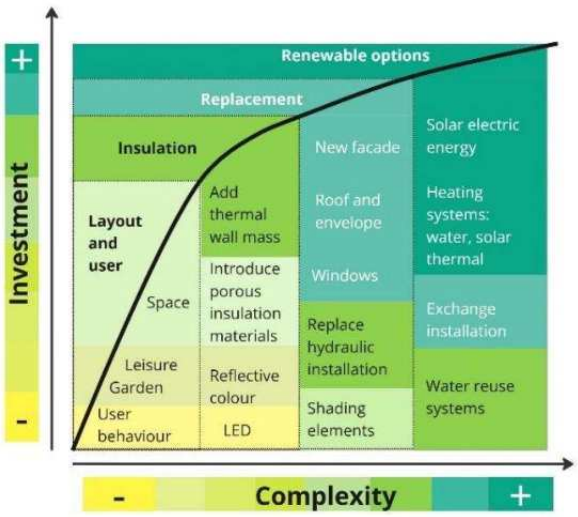
[2]https://g1.globo.com/jornal-da-globo/noticia/2022/03/14/uma-das-maiores-ocupacoes-verticais-do-pais-vai-ser-transferida-em-habitacao-popular-em-sp.ghtml

[3]https://capital.sp.gov.br/w/noticia/prefeitura-de-sao-paulo-aprova-1o-projeto-de-retrofit-do-programa-requalifica-centro

in scientific production on this theme (Anitelli, 2017). Few studies or reports provide retrofit details about buildings reclassified for SH.

Upgrading needs to comply with safety and environmental standards, energy-saving requirements, and respond to economic sustainability needs (Boeri; Gabrielli; Longo, 2011). Furthermore, upgrading should be based on a range of parameters, such as building size, age, social value, function, occupant needs, user behavior and the financial state of dwellers to define a retrofit procedure (Teli et al., 2016). Complexity and investments are parameters to decide which type of upgrading interventions should be executed to achieve benefits and reduce the negative impacts of maintaining SH in its current stage (Holladay, 2010).

**Figure 1: Buildings upgraded**




Source: The Authors, based on HOLLADAY, 2010

To illustrate this issue, Fig. 1 presents a scale concerning intervention complexity for building upgrading projects to serve as a decision-making guide. The scale is based on a previous study by Holladay (2010). The improvement opportunities were analyzed. Issues related to energy efficiency and environmental comfort are considered more invasive and demand high investments, and specific technical considerations to be carried out. Some less complex interventions, such as garden improvements, painting, and simple maintenance are more tangible, and demand less specialized technical labor.

According (Muianga; Kowaltowski, 2024b), most improvements demand technical analysis, since they involve the addition of rooms or the enlargement of spaces which can affect several other variables such as environmental comfort and functionality for instance of a dwelling. Many actions demand planning for decision-making, where user desires should drive improvement. Investments can be seen to also vary from low to high levels. It is essential too to remember that many retrofit actions are one-time interventions, others demand repeated or continuous actions, impacting planning processes.

**Upgrading opportunities in Brazil scenario**

In Brazil, the federal housing program called *Minha Casa Minha Vida* - MCMV, has issued the possibility of upgrading of SH in its latest version, through the development of an improvement KIT. The new MCMV has financial resources for the requalification of existing properties. The KIT as outlined in Table 2, and involves the possibility of improvements to infrastructure, adding of new rooms, changes to the finishing, and changes to the roof. Financial appropriations values vary from state to state. Table 2 demonstrates by the color that most actions presented in the KIT are considered less complex, with low investments. However, new rooms and replacement of tiles have significant costs and all interventions demand technical assistance. Also, important is the fact that the new program does not include energy efficiency interventions, considered essential in view of climate change.

Other potential improvements are outlined in Table 3. These possibilities are not included in the Housing improvement Kit. However, considering the environmental comfort of users, these improvement interventions are important. Also, we consider that energy efficiency should be on the agenda of future changes in the housing program.

**Table 2: home improvement KIT**

| Complete Kit | Cost in thousand R$ | Justification of intervention | Achievement/goals |
|---|---|---|---|
| Room interior painting kit | 0,72 | Personality | Appearance |
| Comfortable PVC ceiling kit | 0,8 | Low performance | Comfort |
| Electrical installation kit - room | 0,9 | Low performance | Functionality |
| Water tank installation kit | 0,95 | Low performance | Functionality |

| Complete Kit | Cost in thousand R$ | Justification of intervention | Achievement/goals |
|---|---|---|---|
| Subfloor and ceramic coating comfortable floor | 1,4 | Low performance | Functionality |
| Window removal/installation | 1,7 | Low performance | Functionality |
| Home energy input kit | 1,9 | Low performance | Functionality |
| Comfortable internal coating and painting | 3,1 | User transformation | Comfort |
| Ramp accessibility | 3,7 | Accessibility demand | Functionality |
| Removal/installation of door | 4,8 | Low performance | Functionality |
| Roof kit - tile replacement | 5,2 | Low performance | Functionality |
| Bathroom adaptation | 5,6 | Low performance | Functionality |
| Coating and painting exterior house | 6 | User transformation | Appearance |
| Hydro sanitary installation kit | 6,2 | Low performance | Functionality |
| Bathroom renovation | 6,9 | User transformation | Functionality |
| Septic tank and drain kit | 8,2 | Low performance | Infrastructure |
| Home exterior coating and painting kit | 8,5 | Personality | Appearance |
| Replacement of the wooden weave with the tiles | 13 | Low performance | Functionality |
| Replacement of tiles, wooden frame and lashing strap | 15 | Low performance | Functionality |
| Adaptable isolated or adjacent bathroom | 20 | User transformation | Functionality |
| Adaptable isolated or adjacent room | 24 | User transformation | Functionality |

Source: Authors based on housing improvement kit

**Table 3: Possibilities for improvement**

| Other Possibilities for improvement not considered in Housing kit | Minimum cost in thousand R$ | Need for evaluation | Justification of intervention | Achievement goals |
|---|---|---|---|---|
| Improvements in external common areas | Variable | Technique | User need | Health |
| Add balconies, and loggias | Variable | Technique | Comfort | Energy efficiency |
| Exterior shading of windows (awnings) | Variable | Technique | Comfort | Energy efficiency |
| Adding shading system on the building | Variable | Technique | Comfort | Energy efficiency |
| Improve natural lighting and ventilation | Variable | Technique | Consumption | Energy efficiency |
| Add new installation | Variable | Technique | Consumption | Energy efficiency |
| Envelope replacement | Variable | Technique | Consumption | Energy efficiency |
| Photovoltaic panels (reduce consumption) | Variable | Technique | Consumption | Energy efficiency |
| Solar water heaters (reduce consumption) | Variable | Technique | Consumption | Energy efficiency |

Source: The Authors

The potential to improve existing homes for low-income populations represents a significant advancement in new SH initiatives such as the new editions of the MCMV program. The kit is also

destined to requalify unoccupied housing complexes that no longer meet the current comfort and functionality requirements of residents, thus supporting the retrofit programs of many cities. In general, interventions to improve environmental comfort, functionality, and to personalize homes are possible. However, as transformations with similar objectives are common in Brazil, they should receive adequate technical support. For this purpose, the Social Interest Housing Technical Assistance program (*Assistência Técnica de Habitação de Interesse Social* - ATHIS), develops actions to produce what are called `decent housing`. To be more effective an improvement action priority list should be applied.

## Final remarks

Housing improvement processes involve assessment, problem identification, solution development, technical assistance, monitoring, and collaborative decision-making including all stakeholders, especially the users. There is also the need for investments, both public, through housing programs, as well as private, or improvements supported by the beneficiaries of these homes. Many upgrading actions developed in SHs in use are carried out through self-construction, without technical support, not always with positive results in relation to improved environmental comfort, energy efficiency and construction quality and resilience to severe weather events. Thus, technical assistance is paramount in SH projects to ensure that improvement interventions have adequate cost-benefits, improving people's homes aesthetically, and with comfort, functionality and safety in mind, avoiding unnecessary costs.

Our study considered actions to improve SH. As shown, all types of actions require to some degree technical assistance, as well as a level of investment, with a need for continuity. It is clear that upgrading goes beyond what the list of identified improvements as technological advances and demands from society and climate change impose new upgrading actions. The process of upgrading, as well, needs to be structured to include a diagnosis and assessment of problems, the identification of priorities and the definition of solutions, implementation and monitoring. All variables depend on the specific context and current policies need to be more comprehensive to local problems as well as embracing urgent global problems to guarantee their effectiveness.

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