A National Housing Improvement Program in Brazil: Dimensions, Costs, and Impacts to Overcome Inadequacies and Achieve SDGs [44,45]

Um Programa Nacional de Melhorias Habitacionais: dimensões, custos e impactos para superar inadequações e alcançar os ODS

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ABSTRACT

Housing improvements involve interventions in homes and their surroundings to ensure minimum conditions of habitability, safety, human and environmental health, and dignity. This article aims (i) to identify the relationships between housing improvements and the Sustainable Development Goals (SDGs), as well as (ii) to present a methodological approach for quantifying and qualifying housing precariousness in Brazil. The linking of these two elements is justified by the larger goal of producing indicators that can

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support decision-making and be used as baselines and references for the evaluation of ongoing actions. This is particularly relevant in the context of the new policy that should be established with the regulation of the MCMV - housing improvements modality. The combination of both analyses allows us to reflect on how a specific programmatic structure for a housing improvement policy could contribute to the transversality of urban, social, economic, and environmental agendas, corroborating with the achievement of the 2030 Agenda goals.

Keywords: Housing Inadequacies. Brazil. Sustainable Development Goals. Housing Policy. Urban Studies.

RESUMO

As melhorias habitacionais envolvem intervenções nas moradias e em seus arredores para garantir condições mínimas de habitabilidade, segurança, saúde humana e ambiental, e dignidade. Nesse sentido, este artigo tem como objetivos (i) identificar as relações entre as melhorias habitacionais e os Objetivos de Desenvolvimento Sustentável (ODS), assim como (ii) apresentar uma abordagem metodológica para quantificar e qualificar a precariedade habitacional no Brasil. A vinculação desses dois elementos se justifica pelo objetivo maior de produzir indicadores que possam apoiar a tomada de decisão e ser utilizados como bases e referências para a avaliação de ações em andamento. Isso se torna particularmente relevante no contexto da nova política que deve ser estabelecida com a regulamentação do MCMV – na modalidade de melhorias habitacionais. A combinação de ambas as análises nos permite refletir sobre como uma estrutura programática específica para uma política de melhorias habitacionais poderia contribuir para a transversalidade das agendas urbanas, sociais, econômicas e ambientais, corroborando com o alcance dos objetivos da Agenda 2030.

Palavras-chave: Inadequações Habitacionais. Objetivos de Desenvolvimento Sustentável. Política Habitacional. Estudos Urbanos.

INTRODUCTION

This article aims to identify the relationships between housing improvements and the Sustainable Development Goals (SDGs). This exercise allows to identify the link between indicators already used for monitoring and evaluating the SDGs in Brazil, and the actions of what could become a comprehensive and integrated public policy for housing improvements in Brazil.

The link between the impacts of housing improvements and the SDGs reveals to decision-makers and public managers their potential to transform the worst socio-spatial conditions that Brazilian society faces. This political innovation, especially those directly impact involves changing the lives of residents of precarious settlements and inadequate housing.

Additionally, this article presents the current methodological and analytical effort undertaken by the Institute for Applied Economic Research (IPEA) to qualify and

quantify housing inadequacies and estimate the costs to eradicate them in Brazil. The linking of these two research themes is justified by the larger goal of producing indicators that can support decision-making and be used as baselines and references for the evaluation of ongoing actions. This is particularly relevant in the context of the new policy that should be established with the regulation of the MCMV[46] housing improvements modality.

Data from the João Pinheiro Foundation (FJP, 2021) reveal that, in 2019, more than 24 million urban households[47] had at least one component of precariousness, whether related to urban surroundings, to the building itself, or to land tenure conditions. This research is usually used as a benchmark for the definition of housing and urban development policies. Nevertheless, it can and should be improved.

The building inadequacies measured by the João Pinheiro Foundation assess eight types of inadequacies, while the experiences of public policies for housing improvements analyzed by IPEA address at least eleven other types of inadequacies. This 19-set reveals a programmatic understanding of the actions to be foreseen in a housing improvement program. It is used here as an initial experience of qualifying and quantifying the ensemble of improvements to be carried out to overcome building inadequacies in the country.

The database used to measure the inadequacies is the Single Register for Social Programs of the Federal Government (CadÚnico, 2019), with a universe of 28,884,000 families in urban and rural households[48]. IPEA and partner institutions have proposed new methodologies to extract data on the topic of housing inadequacies from CadÚnico.

The decision to use this source of data is due to several factors. For example, it allows for municipal disaggregation; offers higher frequency of updating and employs active search procedures to gather information on families in the worst living conditions. In addition, as we will discuss later, there are recent limitations on the Brazilian Institute of Geography and Statistics (IBGE) surveys, the National Household Sample Survey -

[46] Refers to the National Housing Program called My House My Life, *Minha Casa Minha Vida*, in the original version.

[47] This number represents 39.8% of the total of urban durable permanent owner-occupied households. Improvised and rustic households are not considered, and rooms are also excluded, as they constitute part of the housing deficit (FJP, 2021).

[48] Of this total there are 116,332 families with incomplete information, making it impossible to specify the location (urban/rural).

PNAD and the Demographic Census. Finally, there is an ongoing effort, resumed in 2023, to improve that data base as the main registry used by the social policies of the federal government, including housing policies. This involves geocoding the CadÚnico addresses and linking the data base with the existing municipal georeferenced administrative records.

Thus, in this article we will start by briefly stating what is understood by housing improvements. In the following sections we discuss the impacts of housing improvements and an analysis of housing improvements impacts related to SDGs, their targets and indicators is presented. We add to that with a methodological proposal for quantifying and qualifying housing precariousness based on CadÚnico data.

THEORETICAL FOUNDATION: WHAT ARE HOUSING IMPROVEMENTS?

Here, we aim to provide a brief understanding of what housing improvements are. To do so, it is necessary to understand some other related terms and concepts used in this article. Therefore, we chose to present these terms as a kind of glossary, thus ensuring that access to this contribution is as objective and comprehensive as possible.

- **Urban Inadequacy or Precariousness**

Inadequate or precarious urban or infrastructure conditions occur when there is a lack of or issues related to services such as electricity, water supply, sanitation, and waste collection, which in turn require urban improvements (FJP, 2021). Intermittent services are also considered inadequacies. In this case, housing improvement is associated with the ability of families to adapt to this condition in different contexts (urban, peri-urban, rural, etc.). In the metropolitan context, in settlements with high density, the eradication of this form of precariousness depends on the infrastructure that is the responsibility of the public authorities or concessionary companies and similar – again, housing improvements are taken here as basic palliatives.

- **Inadequate or Precarious Building Conditions**

Inadequate or precarious building conditions correspond to housing problems related to: the lack of an exclusive bathroom (domestic sanitary unit); the lack of water

storage; inadequate floor and roof situations; in addition to excessive crowding of residents in the household (FJP, 2021). Added to the inadequacies calculated by this institute are the following situations that already make up the range of items that can be financed (as "kits") recognized by the current federal policy of housing improvements - Reg-Mel[49] Program: high degree of deterioration; unsanitary conditions; structural integrity issues; the lack of the minimum building and habitability standard defined by municipal regulations; and the need for accessibility for people with disabilities.

- **Inadequate land access and tenure insecurity**[50]

Inadequate land access and tenure insecurity refers to the existence of housing, settlements, or properties on public or private land that do not have their legal situation related to land ownership recognized under a variety of possible instruments that guarantee land tenure, hence the right to housing (FJP, 2021).

- **Housing Improvement**

Housing improvement refers to interventions made in existing households that aim to guarantee the habitability of that built space, for example by expanding the built area of homes that are too small for the needs of the family; improving natural lighting and ventilation conditions; installing and/or improving sanitary facilities (sinks, toilets, etc.); among other interventions that also seek to solve building and urban precariousness, improving the "habitat health" (Balbim et al., 2024) and the inhabitants' quality of life (Gomes, 2014; Balbim et al., 2024).

[49] This is the Land Regularization and Housing Improvement Program, established by Resolution CCFDS No. 225, of December 17, 2020, of the Social Development Fund Board (CCFDS). With the aim of promoting the right to adequate housing for low-income people through the granting of financing, under special subsidy conditions, for the execution of works and services aimed at the land regularization of informal urban areas and housing improvements, the program serves families with monthly income of up to R$ 2000.

[50] Land tenure regularization can be an important complement to housing and urban improvements in order to consolidate human settlements and guarantee decent housing. However, this policy will not be discussed here because it deals with actions of a different nature than housing improvements (legal, administrative, notarial, etc.).

- **Technical Assistance and Support for Social Housing (ATHIS)**

Technical Assistance and Support for Social Housing (ATHIS) was defined by Law No. 11,888/2008, which legally ensures this public policy, which aims to guarantee the provision of "free public technical assistance for the design and construction of social housing for their own household". It is part of the social right to housing provided for in the Brazilian Constitution of 1988, aiming at the right to decent housing for families with monthly income of up to three minimum wages (BRASIL, 2008; Balbim et al., 2024). According to Law No. 11,888/2008, technical assistance within the scope of ATHIS "covers all work of design, monitoring and execution of the work by professionals in the areas of architecture, urban planning and engineering necessary for the construction, renovation, expansion or land regularization of the household". In addition to the right to housing, the technical assistance service also seeks to: make better use of "the built space and its surroundings"; formalize the construction or renovation of the household with the public authorities; "avoid the occupation of areas at risk and of environmental interest"; and ensure that the occupation of urban land is in line with the relevant legislation, notably urban and environmental (BRASIL, 2008).

- **Technical Consultancy**

This is a term commonly used to refer to non-profit organizations formed by architects, social workers, engineers, lawyers and other professionals with the purpose of providing technical consultancy to social movements struggling for guaranteeing their right for housing, communities and organized groups seeking access to housing production, whether or not with state participation, and other social policies. The development of these entities dates back to the state-sponsored promotion of self-management mechanisms. The so-called Technical Consultancy (*Assessoria Técnica* in Portuguese) has developed mainly from São Paulo, and today is mostly present in the southern and southeastern regions of the country. More recently, and with emphasis on the support and promotion of the CAU system, in addition to the initiatives of residency (postgraduate training) in architecture and urbanism of universities, the northeastern

region is also experiencing a significant increase in the number of technical consultancies[51].

- **Habitat Health**[52]

"The notion of habitat health encompasses the building, sanitary, environmental, and landscape conditions related to housing and the urban setting that guarantee the quality and adequacy of the internal and external environment of the house, ensuring the dignity of the lives of its residents and the appreciation of the place of life." (Balbim et al., 2024).

- **Social Production of Housing**

"Social production of housing refers to the various forms of housing production, which involve, to varying degrees, formal circuits of the economy, whether public or private, but which keep the organization of the process and the definition of the main guidelines of the project and post-occupancy in the hands and in the mechanisms of collective organization of the residents themselves." (Balbim & Krause, 2014, p. 190). In the field of public housing policies, the actions already developed in Brazil related to the social production of housing, including housing improvements, have always had the status of "alternative programs". Consequently, there is a huge housing stock in precarious settlements throughout the country, with various inadequacies and, still, devoid of specialized technical work in its production (Balbim et al., 2024).

- **Self-management**

[51] For more information, see: Fórum de Assessoria Técnica Popular do Nordeste: https://forumatpne.wixsite.com/site/publicacaoatual and also Rede Moradia-Assessoria: https://www.moradiaassessoria.org.br/mapa.

[52] The notion of habitat health was developed from collective discussions for the design of the programmatic modeling for ATHIS, more specifically in the context of the IPEA-CAU/BR partnership. The definition of this broad term is part of the objective of an ATHIS program. This definition, as well as others associated with it, can be found in the Research Report "Project 'Logical modeling for programmatic structuring of Technical Assistance and Support for Social Housing (ATHIS)'", available in Portuguese at: https://repositorio.ipea.gov.br/handle/11058/12191 (Preliminary Publication).

Self-management can be understood as a means of productive and social organization, a concept used since the beginning of the 19th century, when it emerged as an alternative mode of production to the prevailing capitalist model. Equality among people constitutes the maxim that underlies self-management, and self-management associations seek to collectively overcome vulnerabilities by addressing gaps produced by the lack of public policies or even in association with policies to encourage self-management. The first comprehensive experience of self-managed housing production in Brazil took place in São Paulo, under the administration of Luiza Erundina from 1988 to 1992, in the context of the FUNAPS-Comunitário Program, which consolidated previous community experiences, some of which were even fostered in the last years of the National Housing Bank (BNH), which was extinguished in 1986. In 2004, the creation of the Crédito Solidário Program by the first government of President Lula da Silva had associations and cooperatives as operators of the process, with freedom to manage the resources allocated to the production of their own homes. This modality, from 2009 on, becomes part of the Minha Casa Minha Vida (MCMV) program, an axis called "Entities" (Guillerm and Bourdet, 1976; Lefebvre, 1969, Moreira, 2009; Balbim et al., 2024).

RESULTS AND DISCUSSION

HOUSING IMPROVEMENTS IMPACTS

Studies point to the difficulty of assessing the impacts of housing improvements on society and the environment, or even of individualizing them, due to their non-linearity, subjectivity, and potential or accomplished “cascading” or spillover effects (Balbim et al., 2012; Balbim & Krause, 2019; Frediani et al., 2023). For example, in the programmatic structuring of housing improvements promoted by the CAU/Brasil system, through ATHIS, at least 116 causes and 125 consequences of the problem faced could be listed (IPEA, 2023).

Another shortcoming in the assessment of the impacts of housing improvements is the fact that it is not always possible to forecast how individuals' lives would have unfolded in a scenario without housing improvements, as there are multiple factors involved in such projections. In other words, what is known in impact assessment as "counterfactual" is difficult to replicate in habitat policy topics.

Finally, the lack and difficulty of producing data on precarious settlements and housing inadequacies also make it difficult to measure and assess the impacts of improvements (Denaldi, 2022).

At the same time that difficulties arise in measuring the impacts of improvements that are diverse, complex, and subjective, these characteristics contribute to the transversality of the theme of housing improvements in relation to the SDGs and in helping to achieve the 2030 Agenda.

In this perspective, several studies seek to measure and suggest methodologies that allow for an approximation of the measurement of these impacts, in order to present concrete data regarding the benefits of investment in housing and, more specifically, in housing improvements. This section presents a brief overview of this literature, in order to exemplify in a broad way the impacts that housing improvements can promote.

Based on the findings of the IPEA/CAU-Brasil research (Balbim et al., 2024) and the literature review cited here, it can be said that housing improvements have direct impacts on the entire economy and on the conditions for achieving full citizenship.

Here we list the main economic sectors and aspects of everyday life impacted by housing improvements, for which there is some degree of evidence of these impacts. Below we present related studies so that they can be analyzed and measured. They are: 1) GDP growth and reduction of inequalities; 2) local and solidary economy; 3) job creation; 4) decent work; 5) community life; 6) women's empowerment and gender policies; 7) environment; 8) food security; 9) safe water access; 10) sanitation access; 11) family health; 12) community health; 13) mental health; 14) health system and policy; 15) human dignity and basic hygiene, especially for women; 16) access to transportation, access to electrification and other services; 17) education, especially early childhood education; 18) security; 19) happiness; 20) access to rights; 21) environmental resilience; 22) climate conditions of the living environment; 23) land tenure security.

Thus, as will be further detailed, it is observed that investing in housing improvements can meet or even exceed the targets and indicators set for SDG 11. It is therefore relevant to analyze in greater depth the relationship between these interventions and the other SDGs in order to contribute to greater articulation, integration, and transversality of this agenda.

A recent report published by the NGO *Habitat for Humanity* (Frediani et al., 2023) shows that the eradication of inadequacies effect in terms of income can generate a direct impact of up to 10.5 percentage points on GDP over the years. It also points out that the economic growth and improvement of living standards in precarious settlements would have an economic impact greater than the cost of ensuring adequate housing for many countries.

The Economic Commission for Latin America and the Caribbean (ECLAC) estimates that the construction sector not only has the potential to drive a country's economy, but can be key to the resumption of economic growth, such that for every 1% growth in the construction sector, the GDP growth rate can increase by up to 0.07% (Housing..., 2022). In Brazil, the Growth Acceleration Program (PAC), initiated in 2007, was an example of how the construction sector can contribute to boosting the economy.

Sometimes the inability of residents to invest in their housing can be an obstacle to improving their households and living conditions. This problem can be addressed through people-led or community-led initiatives – which can be supported by public policies, as has already occurred in Brazil – such as loans from cooperatives, community banks, and local currencies that help to stimulate the local economy without leaking money into the upper circuit of the economy (Santos, 1975; Moreno, 2022; Pupo, 2022).

Investments in housing improvements and the urbanization of precarious settlements (slum upgrading) contribute to fostering job creation[53] and decent work[54] in these spaces, especially in contexts of initiatives with people-led or community-led partnerships and self-construction, as demonstrated by the study by Smith and Brown (2019). In precarious settlements, self-construction is the norm, especially in the Global South, revealing great potential for the establishment of public-popular partnerships[55] in this area, with positive impacts on the social capital of communities.

[53] It is important to note that studies that estimate the number of jobs created are based primarily on the construction of new homes, with no data available for jobs created by housing improvement projects.

[54] The concept of decent work is central to the Sustainable Development Goals and the 2030 Agenda, and is understood as productive and quality work, in conditions of freedom, equity, security, and human dignity. More information at: https://www.ilo.org/brasilia/temas/trabalho-decente/lang--pt/index.htm.

[55] In recent years, the term "public-popular partnerships", or PPPop, has been used in a generic way to refer to partnerships with the organized civil society to enable and expand self-management initiatives and others, such as the case of housing improvements. In 2019, Bill 4517 was presented, which establishes the Public-Private Popular Partnership - PPPP, within the scope of the competence provided for in Articles 24, item I, 25, 1st paragraph and Article 182 of the Federal Constitution and in Federal Law

It is important to note that job creation is primarily, but not exclusively, for the residents of precarious settlements. Taking as an example Technical Assistance and Support for Social Housing (ATHIS, Law 11,888/2008) initiatives, interventions that result in housing improvements employ professionals in the fields of architecture and engineering, directly related to the construction sector, but also in the areas of health, social assistance, law, and others indirectly related.

On the same topic, Degert et al. (2016) highlight the potential to create economic opportunities based on community empowerment, starting from housing conditions and initiatives associated with the local community. This would contribute to strengthening the lower circuit of the urban economy (Santos, 1975). Similar experiences have had positive impacts on strengthening community aspects in the context of the struggle for housing and the emancipation of women, emerging from initiatives promoted by community banks (Pupo, 2022).

Smith and Brown (2019) also assess that, beyond job creation, investments in housing improvements can sometimes promote changes in the livelihoods of residents of precarious settlements. In the case study conducted in Kenya by the authors, it was observed that the improvement of housing conditions – in this case, access to larger plots – led 90% of households to start developing activities related to urban agriculture.

This finding by Smith and Brown (2019) reveals the complexity and cascading or spillover impacts that investment in housing improvements can promote. In this case, there was an indirect boost to urban agriculture, which in turn has positive impacts on the environment, notably on the ecological footprint of cities, as well as on food security, the promotion of the local economy, and others.

When it comes to improvements associated with access to basic services, studies observe the direct impact of promoting access to water supply and sanitation on the health of residents (Degert et al., 2016). In this context, it is worth revisiting the WHO data that for every dollar invested in water and sanitation, there is a return of 4.3 dollars saved in the health system (Every..., 2014).

No. 10,257, of July 10, 2001 – the Estatuto da Cidade (City Statute). Recently, an article was published in the Argentine newspaper Pagina 12 about similar partnerships specifically for housing improvements executed with resources from the tax on large fortunes (See: https://www.pagina12.com.ar/572683-pala-pico-e-inclusion-el-plan-de-integracion-sociourbana-en-?ampOptimize=1).

In addition to health, the lack of water supply in housing primarily impacts the lives of women and girls, as they are typically responsible for collecting water, facing challenges also related to sanitation and menstrual hygiene (UN, 2016). The lack of sanitation facilities in households also negatively impacts these realities, and initiatives such as the "Nenhuma Casa sem Banheiro" (No house without a bathroom) project from the Rio Grande do Sul Council of Architecture and Urbanism (CAU/RS) have a positive impact on the dignity, health, quality of life and gender security of women living in precarious settlements (Somekh and Balbim, 2023; "Nenhuma..., 2020).

Considering the provision of basic services from both a quantitative and qualitative perspective, the positive impacts are multiplied. Samad et al. (2016) observed that access to electricity is associated with a 9.6% increase in the income of residents of precarious settlements. However, if the access is to a stable service, without interruptions or blackouts, the observed increase in income was 17%.

A similar situation was also observed during the COVID-19 pandemic in Brazilian precarious settlements, as residents of these localities had difficulty complying with WHO hygiene recommendations due to interruptions and intermittent water supply (Rodrigues, 2021).

Irregularities in the provision of basic services can also lead to lost opportunities for work or education (Obolensky et al., 2019), for example in the case of problems with public transportation, or the difficulty of young girls attending school during their menstrual period (UN, 2016).

It is estimated that amounts between 0.1 and 0.2% of GDP are lost annually due to the provision of unreliable services to users – such as the aforementioned cases of blackouts, water shortages, and transportation disruptions (Obolensky et al., 2019).

In the case of education, housing improvements can increase the results of children's education, since aspects of housing that are improved, such as natural and electrical lighting and adequate natural ventilation, as well as space for activity, contribute to studying and carrying out educational tasks in the context of the home and can thus have an impact on education. Consequently, adults who have had their education interrupted will have greater difficulties in finding jobs and obtaining income (Cunningham and MacDonald, 2012). According to Frediani et al. (2023), the expected school attendance rate could increase by up to 28% in some countries. Globally, up to

41.6 million children and young people could be enrolled in primary and secondary education as a result of housing improvements, which is equivalent to 16.1% of the total number of children and young people who currently have no access to education (idem).

In the health field, housing improvements have enormous potential not only in improving the health of the residents themselves, but also in the savings generated for the health system and in improving the environmental conditions associated with health (Henson et al., 2020; Gomes, 2021). As for life expectancy, the eradication of inadequacies could increase up to 4%, or 2.4 years more on the world's average, solely due to the direct effect of ensuring access to adequate housing in precarious settlements (Frediani et al., 2023). On a global scale, up to 738,565 deaths could be avoided annually (idem), a number greater than that resulting from the eradication of malaria.

Adebowale et al. (2017) found a correlation between households built with inadequate or precarious materials and the mortality of children under five years old in Nigeria. Cattaneo et al. (2009) observed a decrease in diseases caused by parasites, diarrhea, and anemia in young children after housing improvement actions that cemented the floors of the dwellings, previously made of earth. There was also an improvement in the cognitive development of these children.

In the field of mental health, an increase in stress has been observed in low-income groups for people who do not own their own homes (Bloze and Skak, 2012). At the same time, well-being and quality of life have increased with satisfaction with their housing, reducing levels of depression and stress (Cattaneo et al., 2009).

Another subjective impact was observed by Galiani (2016). In this research, in Latin America, it was found that residents of households that were the focus of housing improvements were happier with their quality of life, observing in some cases a feeling of greater security and also an improvement in the health of children.

Soares (2007), Ferreira and Santana (2013), Silva and Burnett (2015), Albernaz et al. (2017), and Smith and Brown (2019) also observed that housing improvement initiatives with people's participation were able to establish a collective identity of communities, as well as improve the ability to defend their rights, being other subjective aspects of the impacts of improvements.

Considering environmental issues, housing improvements make dwellings and their residents – and, to a greater extent, settlements in general – more prepared for risks

related to the climate crisis, through greater adaptability of structures that allow avoiding or reducing possible negative effects of disasters or environmental catastrophes (Satterthwaite et al., 2020).

In this sense, we can cite households with greater thermal comfort that help residents withstand extreme temperature waves, drainage structures appropriate to the reality of each settlement, households that allow and preserve ecosystem functions, contributing to the reduction of disaster risk, mapping of areas with the highest geological and environmental risk to identify the need for relocations, and the installation of alert and evacuation systems for extreme cases (UNISDR, 2015; Satterthwaite et al., 2020).

However, it is important to note that environmental improvements are not always able, on their own, to prevent all types of environmental risks in precarious settlements. Some risks require integrated public policy actions, which may even go beyond the scope of the settlement, such as the need for comprehensive and integrated stormwater management programs to prevent flooding and inundation in settlements (Satterthwaite et al., 2020). One possible strategy for public policy is the definition of typologies that indicate the kind of intervention or action required, for example, in local plans for social housing (PLHIS) or in inter-municipal housing diagnoses (Denaldi, 2022).

Degert et al. (2016) list air quality and biodiversity conservation as points that are usually not included in the scope of housing improvement projects or, as mentioned earlier, cases in which the necessary actions go beyond the scope of the project, requiring articulations between different public policies.

In this sense, Denaldi and Ferrara (2018) highlight the persistence of the challenge of articulating urban and environmental public policies, a challenge similar at the global scale (Frediani et al., 2023), despite the advances observed in slum upgrading actions in Brazil (Balbim and Krause, 2019).

It is important to note that there have been advances and setbacks in this articulation. In the case of land regularization, the enactment of Law No. 13,465/2017 made it a predominantly bureaucratic practice in Brazilian housing policy, weakening the environmental aspects it previously carried in the repealed legal framework; and the re-edition of the Minha Casa, Minha Vida (MCMV) program in 2023 did not reverse this change (Balbim, 2022; Balbim, 2023).

On the other hand, the MCMV previously had initiatives – albeit limited – to install solar panels for the generation of sustainable electricity, with proven viability (Souza and Ferreira, 2019) and great social potential, as it is understood to improve the quality of life for families and communities (Melo et al., 2018). In this sense, the re-edition of the program in 2023 included a "green subsidy", which provides additional funding for projects that incorporate sustainable technologies (Balbim, 2023). These are issues that should be given greater prominence in the program's actions, seeking greater alignment and integration with the 2030 Agenda, the SDGs, as well as the sustainability, adaptability, and resilience of human settlements, particularly precarious settlements, from the perspective of "leaving no one behind".

HOUSING IMPROVEMENTS ACTIONS AND IMPACTS ON THE SDGs AND THEIR INDICATORS

Continuing the effort to formulate a structured program or policy for housing improvements based on evidence, we sought to relate the potential and expected impacts of actions and guidelines associated with housing improvements verified in the programmatic structuring under development in partnership with CAU/Brasil to each of the 17 SDGs.

The potential and expected impacts were classified as direct and indirect, and it was found that housing improvement actions, listed from the programmatic structuring, impact all 17 SDGs, 9 of them directly and 8 indirectly.

In addition to the analysis of potential impacts, we verified the national goals[56] and indicators of each SDG that were most closely related to actions and guidelines of a housing improvement program. The analysis began by listing the SDGs and identifying the actions related to each one, with a focus on the structure of Brazil's housing improvement programs, particularly at the federal level. The next step involved establishing the same connections to identify national targets and related indicators,

[56] The global targets were adapted to Brazil's priorities, taking into account national strategies, plans and programs and the country's challenges of the country. More information at: https://repositorio.ipea.gov.br/bitstream/11058/8636/1/Agenda%202030%20ODS%20Metas%20Nac%20dos%20Obj%20de%20Desenv%20Susten%202018.pdf.

carefully examining hundreds of SDG targets and indicators in the context of housing improvements[57].

In total, 27 national goals and 38 indicators are related to housing improvements, revealing the adherence of this policy to the broader framework of the SDGs and, above all, indicating the diversity of possibilities for evaluating the efforts that may be made by the State and society to overcome housing precariousness.

MEASURING AND UNDERSTANDING THE NEED FOR HOUSING IMPROVEMENTS IN BRAZIL

There are several challenges to measuring the need for housing improvements around the world, as well as to the development of public policies and their necessary monitoring and evaluation.

In order to support the planning of this public policy in Brazil, based on evidence of the scale and multiplicity of the problem, we looked at administrative records for alternatives to census restrictions that would make it possible to qualify the inadequacies and produce indicators that are adherent, at least, to the municipal level.

In Brazil, the main indicator used to monitor housing needs is the sequence of studies on the housing deficit, produced by João Pinheiro Foundation (FJP, 2021). This study highlights four components of the quantitative housing deficit, which represents the demand for a new household: precarious (or rustic) households, excessive density (crowding) of rented households, families sharing a housing unit and excessive urban rent burden.

Additionally, there is the so-called *qualitative* housing deficit, that is, the inadequacy of households, which reflects the portion of the population that lives in durable permanent housing, but with some type of building precariousness, urban precariousness (lack of utilities) or in a situation of land tenure insecurity, representing the demand for housing improvements, urban services and land tenure regularization.

[57] The detailed analysis is not included in this article, but you can find it in the technical note "Dimensions, Costs, Impacts of Housing Inadequacies and Their Relation to the Sustainable Development Goals: Support for a National Housing Improvement Program in Brazil," available at: https://repositorio.ipea.gov.br/handle/11058/12397.

The FJP study contemplates a municipal estimate every 10 years, based on the Demographic Census sample, and an aggregate estimate by state and metropolitan region in the intercensal period based on the National Household Sample Survey (PNAD).

The João Pinheiro Foundation methodology has undergone several adaptations since its first publication in 1990 (FJP, 2021). In the most recent publication, it started using administrative records from CadÚnico to estimate improvised households, since the question referring to this component was not included in the Continuous PNAD, the IBGE survey that subsidized the estimate for the 2016-2019 period. In the next publication of the municipal housing deficit, the FJP's methodology will have to undergo yet another revision, as the 2022 Demographic Census sample questionnaire[58] did not include questions about the value of rent and access to electricity. Thus, there is the possibility that new models for measuring the housing deficit will be proposed in order to respond to the demands for improving public policies, as reported here.

- **CadÚnico as a database for quantifying/qualifying inadequacies**

CadÚnico has been used as a data source to monitor the evolution of Espírito Santo state's housing situation by the Jones dos Santos Neves Institute (IJSN) since 2015. This made it possible to identify the municipal quantitative housing deficit annually and establish the deficit profile by the following categories of analysis: sex, race, age group, education, occupation and disability (IJSN, 2019). Taking the IJSN study in Espírito Santo as a reference, the Mauro Borges Institute (IMB) produced a similar study for the state of Goiás (Lima, Prado & Cardoso, 2018). The same methodology was adapted by IPEA to investigate the existence of a housing deficit in the previous housing situation of the families who moved to the Minha Casa Minha Vida program estates, in the country's 20 largest cities (CMAP, s/d; Krause, Nadalin, Pereira and Simões, 2023).

Due to the need to estimate the housing deficit and inadequacy at the municipal scale, Feitosa, Cunha and Rosemback (2023) also proposed a methodological approach for estimating the housing deficit with data from CadÚnico. In this study, the qualitative housing deficit is also computed, referring to building and urban precariousness, a component that was not addressed in the IJSN and IMB methodologies.

58 https://censo2022.ibge.gov.br/np_download/censo2022/questionario_amostra_completo_CD2022_atualizado_20220906.pdf

- **What are the shortcomings of CadÚnico and what can be improved?**

Two initial considerations are in order here. It is important to highlight that the data contained in CadÚnico are self-declared and it has therefore been recommended that the responsible ministry build a verification strategy, through sampling, which could improve the reliability of the data (CMAP, s/d).

Another caveat concerns the profile of the families enrolled in CadÚnico. In general terms, CadÚnico can register families with a monthly per capita family income of up to ½ minimum wage, or up to 3 minimum wages of total monthly family income, or who have an income above these, but are linked to or have an interest in some welfare program or benefit that uses CadÚnico in its concessions. On the other hand, the main social programs that actively search and include families in the Register have lower income limits: in the case of Bolsa Família[59], the limits are usually lower than ¼ of the minimum wage of per capita household income, which is also the income limit for families covered by the Continuous Cash Benefit Program (BPC)[60]. Therefore, it is possible that potential beneficiaries of other programs and actions, such as ATHIS, have not necessarily been included in CadÚnico through an active search. Therefore, registered families would correspond, in general, to the most vulnerable portion within the universe of families eligible for programs and actions that can also reach families with higher income – still within a low-income segment, roughly speaking (Krause, Nadalin, Pereira and Simões, 2023).

Seen from another angle, these indications show a tendency to consider the families enrolled in CadÚnico as that portion of the beneficiaries who have the highest priority for ATHIS and housing improvements, which is why we continue to use this cut-off. It is also reinforced that CadÚnico has "an almost censitary coverage of the poor population and their living conditions, which allows diagnoses to be made in order to define and operationalize the country's social policies" (Direito; Koga and Licio, 2023:45).

On the other hand, CadÚnico has been heavily impacted by political issues in recent years, which is why we decided to use the 2019 database, which is considered to

[59] Bolsa Família is Brazil's largest cash transfer program.
[60] The Continuous Payment Benefit (BPC) is a guarantee of one minimum wage per month to the elderly aged 65 or over or to people with disabilities of any age.

be more accurate[61]. The current scenario is one of improving the database, including new families via social programs, especially the MCMV, and the possibility of identifying their location through geocoding, which is fundamental for using the database in intra-urban analysis and for precision in defining the universe of beneficiaries of policies such as the housing improvements.

- **Quantitative analysis of housing inadequacies from CadÚnico**

To analyze the demand for housing improvement policies, only permanent owner-occupied homes were considered. In other words, improvised, collective or rented homes were not considered. Furthermore, the address declared by the families was used to identify apartment-type homes that may not be eligible for some types of housing improvement.

Rooming houses were considered, a reference to what are commonly called tenements[62]. This caveat is made because this is the only variable used that overlaps with the method used by the FJP to calculate the housing deficit.

There is also the exception of rustic households, which, although considered, are highlighted in the totals. Because they have inadequate wall materials, they would require partial or total reconstruction of the household, an item provided for in housing improvement policies such as the successful efforts of the Federal District Government's Housing Development Company (Codhab-DF). This universe will be computed and analyzed separately, due to its high cost and also because it is understood that the solution may involve new housing units.

In the case of households with building precariousness, the need for housing improvements can be read directly from the situation of inadequacy. For example, households without a bathroom require the construction of a new bathroom, either isolated or contiguous.

[61] According to the analysis carried out by Direito, Koga and Licio (2023:46) for the publication Desmonte e Reconfiguração de Políticas Públicas, "CadÚnico went through different expansion movements until 2016, when trends of retraction and demobilization or, even, redirection of capabilities began to be identified, presenting the risk of dismantling the institutional environment built until then". Despite this recent "dismantling", CadÚnico has once again become a priority for the federal government and the methodology proposed here can be immediately used in the revised bases in 2023.

[62] Cortiços, in Portuguese.

With regard to urban precariousness, the data source does not allow identifying whether it occurs due to the lack of public utilities' coverage or the lack of connection to them (water, sanitation and electricity). Once there is no sewage system, for example, it may be possible to connect to the general network (drainage) when available; otherwise, the installation of a septic tank can be considered, still a housing improvement, in contexts where their use is acceptable. In this sense, it was decided to encompass all the components on the understanding that, with or without the immediate possibility of connection to the service network, there is a need for housing improvements, or the installation of a water tank as an alternative to the non-existence or intermittency of the supply service.

Having made these initial considerations, Table 1 lists the types of inadequacies, their description and the corresponding demand identified by CadÚnico. The solutions presented on Table 2 are based on the regulations of the federal government's Land Regularization and Housing Improvement Program (RegMel)[63].

Based on the demand for housing improvements from CadÚnico and the individual costs of the solutions, an initial estimate of the overall cost of a program with this scope was made, which is shown in Table 2. The individual costs used are those provided in the RegMel Program normative, with the exception of the estimate for total reconstruction, which was obtained by using as reference the costs for building a single-family, ground-floor, 43.6 m² household used by SINAPI[64]. Individual costs vary by state, so the reference value presented is an average of the global costs divided by the demand.

Of the 28,884,000 families registered in CadÚnico in 2019, 28,767,688 had complete and consistent records and were therefore considered in the analysis. Thus, the proposed methodology indicates that at least 13,408,451 families (46.6%) of the total of 28,767,688 included in the analysis could benefit from a program of free technical assistance and housing improvements.

[63] The regulations for the RegMel Program can be found in the publication: Casa Verde Amarela. Instruction manual. Land Regularization and Housing Improvement Program. 2021. 45p. In addition to this, the costing sheets for the housing improvement kits were also used to draw up and refine the inadequacies to be dimensioned.

[64] SINAPI is the National Research System for Construction Costs and Indexes. Information available at: https://www.caixa.gov.br/Downloads/sinapi-demonstracoes-de-uso-fichas-tecnicas/Ficha_Tecnica_13105.pdf.

Based on this demand, it is estimated that an investment of over R$ 118 billion would be necessary in housing improvements, without considering cases of housing deficit (total reconstruction of rustic households). Considering total reconstruction, the global costs would be of R$ 192 billion.

It is important to highlight the limitations of the methodology applied. The number of beneficiaries and costs could be even higher, since, as already pointed out, not all low-income families are registered in CadÚnico and there are other types of building inadequacies that are not registered by the questionnaire. On the other hand, it is not possible to state that the proposed solutions are applicable in all cases in which precariousness has been identified. It is possible that some households without public water supply already have a water tank, for example. Therefore, the quantitative analysis of demand and global costs is a work in progress. The research foresees the inclusion of new data sources, which will be combined to obtain a more accurate estimate.

The RegMel program proposed to invest resources through "housing improvement kits" for each type of inadequacy. It is understood that the Ministry of Regional Development (MDR) took as a basis for the elaboration of the kits suggestions and evaluations carried out by the Inter-American Development Bank, IDB (Eloy et al, 2021), in addition to the results of partnerships with the Federal Comptroller General's Office (CGU) and the Federal Court of Accounts (TCU).

The typology of inadequacies presented below was drawn up based on the CadÚnico variables (table 1 and solutions presented), the housing improvement kits of the RegMel Program and the housing improvement kits developed by the Federal District Government (GDF) through the Housing Development Company (Codhab) and, obviously, the identification of the type of inadequacy referring to each of these kits.

The forms of inadequacy presented are being used as variables in the IPEA/CAU/Brasil research, which is currently in the data collection phase. A research form was designed so that local governments, entities and organizations that carry out housing improvement actions can inform the dimension of the evidenced precariousness and their specific types of inadequacies. This next stage of research, together with the preliminary data presented here, was announced at the Housing Week of CAU/Brasil, held in the city of Aracaju, state of Sergipe, in the Northeast of Brazil from July 25 to 29, 2023, which celebrated the 15th anniversary of the ATHIS law.

Table 1. Number of families with inadequacies and respective solutions.

Type of inadequacy	Housing Improvement Solution	Description	Number of families (CadÚnico, 2019)		
			Urban	Rural	Total
Inappropriate Wall Material	Total reconstruction	Families who live in a household where the predominant material of the external walls is reused wood, straw, or other material (except masonry, rustic wooden walls and adobe).	410,405 (4.9%)	372,066 (7.4%)	782,471 (5.8%)
	Exterior wall cladding	Families who live in a household where the predominant material of the external walls is adobe without plasterwork.	98,708 (1.2%)	254,891 (5.1%)	353,599 (2.6%)
Excessive density with the possibility of housing improvement	New isolated/contiguous room	Families who live in a household where 3 or more people sleep in one bedroom, excluding apartments.	2,767,963 (33%)	850,727 (16.9%)	3,618,690 (27%)
Lack of bathroom	New isolated/contiguous bathroom	Families who live in a household without a bathroom or toilet, either in the household or on the property, excluding apartments.	381,457 (4.6%)	978,445 (19.4%)	1,359,902 (10.1%)
Inadequate Floor Material	Cement screed and ceramic tile flooring in a standard room	Families who live in a household where the predominant material of the floor is earth or reclaimed wood.	471,867 (5.6%)	537,916 (10.7%)	1,009,783 (7.5%)
Lack of Piped Water	Review/installation of plumbing and sanitary installations	Families who live in a household without piped water in at least one room.	924,965 (11%)	1,925,031 (38.3%)	2,849,996 (21.3%)
Lack of sewage	Septic tank and drainfield	Families who live in a household without connection to a sewage or septic tank system, excluding apartment-type homes.	4,379,630 (52.3%)	2,861,776 (56.9%)	7,241,406 (54%)
Absence of Water Supply by Public Network	Water tank	Families who live in a household that is not connected to the general distribution network.	2,110,541 (25.2%)	3,500,856 (69.6%)	5,611,397 (41.8%)
Lack of electricity in the household or rooms	Review/installation of internal electrical network	Families who live in a household without an electricity meter.	1,264,080 (15.1%)	738,442 (14.7%)	2,002,522 (14.9%)
Total number of families living in their own household with at least one type of inadequacy			8,377,532 (36.8%)	5,030,919 (83.5%)	13,408,451 (46.6%)
Total number of families registered in CadÚnico			22,742,536 (100%)	6,025,132 (100%)	28,767,668 (100%)

Source: prepared by the authors

Table 2. Individual costs of solutions and global costs of a Housing Improvement Program

Type of inadequacy	Housing Improvement Solution	Average individual cost of the solution	Global costs of the Program
Inappropriate Wall Material	Total reconstruction	R$ 95,500.28	R$ 74,726,196,082.00
	Exterior wall cladding	R$ 7,368.87	R$ 2,605,624,470.00
Excessive density with the possibility of housing improvement	New contiguous room	R$ 14,372.66	R$ 52,010,190,238.00
Lack of bathroom	New contiguous bathroom	R$ 11,230.32	R$ 15,272,133,692.00
Inadequate Floor Material	Cement screed and ceramic tile flooring in a standard room	R$ 992.05	R$ 1,001,754,361.00
Lack of Piped Water	Review/installation of plumbing and sanitary installations	R$ 2,624.06	R$ 7,478,569,544.00
Lack of sewage	Septic tank and drainfield	R$ 4,702.52	R$ 34,052,851,435.00
Absence of Water Supply by Public Network	Water tank	R$ 711.15	R$ 3,990,572,827.00
Lack of electricity in the household or rooms	Review/installation of internal electrical network	R$ 924.72	R$ 1,851,768,765.00
Global costs WITHOUT total reconstruction			R$ 118,263,465,332.00
Global costs WITH total reconstruction			R$ 192,989,661,414.00

Source: prepared by the authors

Table 3. Housing improvement services related to the different types of inadequacies.

Type of inadequacy	**Housing Improvement (Solution)**
Rustic household, expressed in inadequate wall material	Partial reconstruction or wall cladding or total reconstruction
Excessive density with the possibility of renovation	New isolated/contiguous room
Lack of bathroom	New isolated/contiguous bathroom
Inadequate Floor Material	Cement screed and ceramic tile flooring in a standard room
Lack of Piped Water	Review/installation of plumbing and sanitary installations
Lack of sewage	Septic tank and drainfield
Absence of Water Supply by Public Network	Water tank
Lack of electricity in the household or rooms	Review/installation of internal electrical network
Inadequate coverage*	Total roof replacement without reuse of existing materials or partial roof replacement with reuse of existing materials
Inadequate bathroom*	Bathroom renovation
Inadequate household accessibility*	1 meter accessibility ramp module
Inadequate bathroom accessibility*	Adapted bathroom
Non-existent internal coating*	Internal coating (plasterwork) and painting with PVA latex for wall [cost per room]
Non-existent external coating*	External coating (plasterwork) and painting with acrylic PVA for a 42 m² household
Non-existent / Inadequate door*	Door removal/installation
Non-existent / Inadequate window*	Window removal/installation
Non-existent / Inadequate roof insulation*	Roof insulation installation
Lack of ventilation in the room**	Construction of a ventilation shaft
Inadequate door and window structure**	Structural repair (beams/joists)

* Inadequacies incorporated from the RegMel normative
** Inadequacies incorporated from the Codhab-DF practices

Source: prepared by the authors

Once this set of 19 types of inadequacies to be tackled by public policy has been defined, at first through kits, and knowing that only 8 types of inadequacies can be estimated by CadÚnico, information is being sought regarding the surveys of the housing conditions of the dwellings that are the subject of already implemented housing improvement policies.

In this way, we hope to be able to infer the behavior of the variables not present in CadÚnico by comparing them with the general picture observed from the data collected, coming from experiences on a sub-national scale - whether regional, state or local - in order to measure the demand for housing improvements or even for carrying them out.

Finally, the most auspicious initiative in the research to qualify and quantify the necessary housing improvements comes from the Institute of Architects of Brazil, Maringá branch (IAB-Maringá), in partnership with the João Pinheiro Foundation and CAU/Brasil. The IAB-Maringá, together with the Municipal Health Secretariat, built a municipal housing diagnosis instrument that consists of a questionnaire applied by Community Health Agents (ACS) with a focus on sanitary and housing conditions that affect the health of citizens (Ferreira, 2022). The first data from this survey, as well as the questionnaire, were kindly provided to IPEA and used in the definition of the proposed methodology, as well as in previous analyses that corroborate the intention to "extrapolate" the inadequacy variables of CadÚnico to the larger set of existing realities.

It is currently being evaluated, and the stage of analysis of the technical and state capabilities of this research will seek to show, that this initiative in Maringá is a kind of pilot for the most consistent and viable model for collecting data on the health of, their households and their living environment.

In the next steps of this research, the preliminary results of the survey in Maringá and practical intervention experiences gathered in partnership with CAU/Brasil and CAU/UF will be used to estimate the types of housing inadequacies that are often associated, as well as an average estimate of the costs of interventions.

CONCLUSIONS REGARDING THIS STAGE OF THE RESEARCH

This article sought to highlight the transversality of the theme of housing improvements in relation to the SDGs, pointing out the relationships between housing

improvements and the SDGs and their potential in the accomplishment of the 2030 Agenda in Brazil.

It was identified that housing improvements are directly or indirectly related to all 17 SDGs, with 26 Brazilian indicators functional for the assessment of housing improvements, in addition to 12 indirectly related.

Additionally, it is important to highlight that housing improvements are directed primarily to the most vulnerable groups of the population, in line with the SDGs' "Leave no one behind" pillar and with the principles that rule the federal government's social policy based on CadÚnico.

The links between SDGs and housing improvements reveal the centrality and potential of housing improvements, as a public policy, to act as an umbrella for sectoral policies that converge towards the 2030 Agenda.

In this sense, IPEA and partners, notably CAU/Brasil, have been developing efforts to define a programmatic structure for a housing improvements' public policy in Brazil, embodying this potential.

With the diagnosis in hand, which at the moment is an estimate of the existing inadequacies, the next step is to quantify technical and state capacities and to calculate the necessary investment volume to overcome these ailments and advance the country towards a less unequal society, with greater access to services and opportunities, sustainability, and resilience.

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