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Analysis of Building Costs for Social Interest Housing in Central Areas

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Abstract: Brazil's continental dimensions bring huge challenges for the Federal Administration, particularly in relation to low income housing. In this sense, in 2009, Federal Government has launched a huge habitational program entitled "Minha Casa Minha Vida" (in English MHMLP—the "My House, My Life" Program) which has been, so far, the biggest social housing Federal program, and has produced millions of SIH (social interest housing) units. The program was discontinued in 2018. Although the program has been huge, there were few units built in urban centers, increasing the urban sprawl. The feasibility of SIH enterprises in the context of the MHMLP leads to the production towards the outskirts, where the land cost better fits the budget. This cost analysis, however, does not take into consideration future costs of an inefficient infrastructure, poor social services and public safety issues, with impact on the cities' operational costs. This paper compares the total building cost of SIH in peripheral and central areas, emphasizing the benefits of production in central areas when considering indirect operational and infrastructure costs. The research takes into account the infrastructure already available in central areas and the opportunity of appropriate abandoned or underutilized buildings and urban empty spaces. In this sense, a case study has been conducted in two projects in the Metropolitan Area of Rio de Janeiro (RJ) comparing the estimated budget of SIH built far from urban centers, to the probable budget occupying underutilized buildings. Results indicate the necessity to review the parameters adopted when discussing the production of low income housing considering the cities' development as an integrated system.

Key words: SIH, urban integration, housing policy.

1. Introduction

Brazilian real estate market has undergone, in the last decade, a great transformation, particularly in the segment destined to the construction of SIH (social interest housing). In 2009, with the launch of the first phase of MHMLP (the "My House, My Life" Program—*Programa Minha Casa Minha Vida*, in Portuguese), an SIH program promoted by the Federal Government, the number of developments and the volume of resources increased considerably, driven by subsidies and other governmental incentives. Millions of SIH units were produced, however, only a small fraction were built close to urban centers, with the majority located on the periphery, contributing to amplifying the currently dominant model of dispersed urbanization in cities (disorderly, usually unplanned). The same mistakes of the past are repeated: large housing projects with low quality of urban insertion, isolated, generating more economic and social segregation of the low-income population, who suffer from poor access to public transport, facilities, services, employment, and other essential activities—exacerbating the problems of urban infrastructure in our cities.

Rolnik et al. [1] address the problem of the location of projects produced under the MHMLP context, noting that although it is innovative in granting a significant volume of subsidies to meet housing needs of the lower-income sectors of the population, the program did not take into account the territorial dimension as a relevant aspect of a housing policy oriented towards universal access to housing in adequate conditions. Therefore, there are some fundamental questions that need to be observed when discussing the future we want for our cities and the cities we are actually building: (a) encouragement of

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social segregation when directing low-income families to the areas that did not offer the necessary infrastructure; (b) overload of the already precarious transport system, by increasing the distance among citizens and jobs/services/schools/hospitals; (c) recurrence of solutions that did not work well in past experiences, amplifying social problems in cities, particularly in public security and health.

SIH supply should be considered in all urban planning intervention, as it is fundamental for life quality and prosperity of cities. The MHMLP is in its third phase, after having been interrupted shortly due to government change, and housing production returned—at a slower pace. But, if from a quantitative point of view the program can be considered successful, from the perspective of quality there are several issues.

One of the problems is location. So, it is necessary to design a solution that can bring together the budget restrictions, the proximity to urban centers' facilities and the quality of housing, taking into account the necessity to urgently meet the housing deficit of 7.7 million homes [2].

Another fundamental element to be considered is the *Estatuto das Cidades* (Cities' Statute) recently published by Brazilian Central Administration. This document brought together instruments aiming the expansion of areas destined to SIH. However, to achieve effective results, it is essential for the public authorities (especially Municipalities), to act as protagonists in the formulation of guidelines and in the execution of a housing policy integrated to the cities' development plan.

Aiming to bring a contribution on this topic, this paper presents the results of a case study with the comparison among the costs of social housing produced within and outside an important Brazilian urban center—RJ (Rio de Janeiro) City.

2. Quality of SIH Production

MHMLP was an important milestone in the Brazilian real estate market. Initiated in 2009, it was intended to replace previous housing programs, also part of the Federal Government's strategy to stimulate economic activity against the backdrop of the global financial crisis [3]. The program is currently in its 4th phase. Companies that already dominated the affordable housing segment prevailed, taking the opportunity to assume a prominent position in the National Construction Market, according to the 13th ITC (acronym for Construction Business Intelligence, in Portuguese Inteligência Empresarial da Construção) Ranking, published in July 2017, eight among the ten largest Brazilian Real Estate construction companies in the year 2016 operated mainly in the low-income residential segment, including the 4 leaders in the ranking [4].

Within the scope of the MHMLP, the participation of producing companies took place in two particularly distinct business models: (a) projects included into Level 1 of the program, where contractors are paid only for the construction; and (b) projects classified in Levels 2 and 3, where developers also operate, obtaining their earnings in the traditional operating model of the real estate market [3]. The discussion here will be concentrated on the first group (MHMLP Level 1), where the government has a fundamental role, particularly in the decision process of establishing areas with adequate infrastructure to receive projects.

The quality of SIH has been debated for decades, and it can be analyzed from very different (but complementary) dimensions. The quality of the project, construction materials, quality of surroundings, access to city's facilities, communities' life, urban insertion and proximity to public services must be considered.

The "big dilemma" is how to enable the production with quality in the quantity demanded by the population.

Pedro [5] discusses this quantity vs. quality dilemma, noting that the quantitative approach to housing construction has immediate advantages for

Table 1 Confronting quantity and quality aspects in SIH production.

Quantity	Quality
Promotes economic growth	Promotes well-being
Relevant on a national scale	Relevant on a local scale
Aims to achieve established production goals	Aims to promote sustainable neighborhoods and cities
Aims to respond to immediate needs	Aims to respond to present and future needs
Reduces concern about future implications	Focuses on future implications
It is easy to objectively define	Complex, variable and subjective concept
Meets the immediate interests of the economy	Meets present and future interests of the community

Source: Pedro [5].

the economy and society, but the goal of low-income housing construction should be the creation of vibrant and sustainable communities. The author presents a comparative framework that highlights some conflicts between the quantitative and qualitative approaches (Table 1).

According to Benetti et al. [6] projects developed within MHMLP context should be analyzed in 3 levels: (a) location in the city; (b) insertion in the neighborhood; and (c) quality of intermediary spaces within each housing development. The authors raise the discussion on how the low-income housing policy has not been considered as part of cities development plan within the scope of the MHMLP, noting that the guidelines adopted by large construction companies to respond to this demand do not always consider urban design values as a prerogative to create quality urban spaces [6]. Considering that the legalization processes are conducted by the City Halls these instances must analyze HIS solution considering its impact in the context of cities as a whole, and not just verifying if the projects comply with urban zoning codes.

To analyze the quality of SIH projects from the perspective of urban insertion, Rolnik [7] developed the Urban Insertion Assessment Tool. The purpose of this tool is to offer measurable parameters for location assessment, integration with the surroundings and urban design, to be used by technical members of City Halls' team for project approval, and by representatives of development agencies of Ministry of Cities, and members of budget control team at CEF (Caixa Econômica Federal), a state-owned Brazilian financial services company.

The establishment of best location for SIH is a recurrent problem throughout Brazil, not limited to the MHMLP Level 1 projects nor to the region of influence of the 2 largest Brazilian metropolises. Lima [8] makes a detailed analysis of projects in the 3 MHMLP levels in the Metropolitan Region of Porto Alegre, concluding that results repeated what occurred from 1964 to 1986, during another huge Federal Social Housing Program entitled BNH (acronym for Housing National Bank in Portuguese Banco Nacional da Habitação). The author emphasized the importance of evaluating the impacts of the location in the search for better qualified residential spaces that contribute to urban sustainability.

The impact of the predominant peripherization model in SIH projects extends from users' (in) satisfaction to budget extrapolation due to unconsidered costs of living and operating cities, representing yet another barrier to the sustainable development of the society.

3. Cost of SIH Production in Brazil

To design a solution for SIH production next to urban centers respecting budget restrictions, it is necessary to analyze: (a) the direct costs involved in the production of SIH, which include land, infrastructure and construction costs; (b) future indirect costs related to families residing in SIH; (c) how to evaluate the quality of urban housing insertion; and (d) the responsibilities and objectives of the stakeholders, whether public (in its 3 levels: municipal, state and federal), private (investors, construction companies, financial agents), in addition to the population and society as a whole, naturally.

Regarding total budget of SIH projects, indirect expenses (and benefits) must also be considered, for example social costs, life quality in the cities, environmental, public safety and health issues, among many others. These costs are often hard to be measured, but affect the cities' operational costs and should be taken into account as the solution for the housing deficit and the SIH supply cannot be treated only from the immediacy perspective. On the other hand, the urgency, the financial feasibility of SIH production and the land value cannot be diminished.

In this paper, the analysis will consider the first part of the problem: direct costs of producing SIH. Production costs of two SIH projects developed in peripheral areas of the Metropolitan Region of RJ, within the MHMLP context, will be detailed and compared with the estimated building costs of 3 selected projects in RJ central area.

To meet the demand for SIH with quality is more than a technical or market challenge for society, as it is also a social goal with a strategic importance, as it represents a condition for the sustainable development of cities.

The cost equation involved in the production of the SIH can be summarized as:

$$P = L + I + C \quad (1)$$

where:

P: SIH Production Cost

L: Land

I: Infrastructure (external and internal)

C: Construction

Regarding the cost of Land, as the economic logic of the market prevails, land at more affordable prices will, as a rule, be located in regions that are farthest from urban centers. Unless the government offers subsidies or designate areas in central regions specifically for SIH, the tendency is the prevalence of SIH location in the outskirts of cities.

With regard to construction costs, there is practically no possibility for reduction as the construction Companies that operate in this segment, optimized their costs as much as possible within the scope of their competitive strategy [8]. At this point, it is worth highlighting some characteristics that distinguish the processes and products of construction companies operating in the SIH segment from the other segments (specifically considering construction companies operating in the SIH segment):

- leaner organizational structure, to reduce administrative and indirect costs;
- enterprises with a shorter total life cycle than medium and high-end enterprises [8];
- replicable projects, less complexity [8];
- architecture design conceived by their own professional team work;
- investment in the efficiency of the construction process.

All aspects are somehow related to the search for greater efficiency and cost reduction, due to reduced profit margins and greater competitiveness in the sector. For these companies it is essential to work on large scale (enterprises with a large number of HUs (housing units)) and in the shortest possible time (shorter business cycle). Schramm et al. [8] summarize this analysis pointing three basic principles for competitiveness in the segment: cost, speed and quality. Companies that do not fit these conditions simply cannot survive in this market.

In 2009, when the MHMLP was launched, the real estate construction market in Brazil was under a crisis. In addition to seeking a solution to the housing problem, the program has been considered as an opportunity to boost the economy by reheating the civil construction sector. Companies that normally did not operate in SIH sector also have been attracted to this economic opportunity.

Back to the analysis of the composition of SIH production costs, considering the 3 main items (land, infrastructure, and construction), Table 2 presents, in a simplified way, the confrontation between the periphery and the center regarding production costs of SIH. Projects in the periphery are cheaper, especially due to

Table 2 Comparative analysis of SIH production costs in the Periphery x Center.

Item cost	Periphery	Central Areas
Land	Low	High
External infrastructure	Medium/high	Medium/low
Internal infrastructure	Medium	Low/null
Construction	Low	Medium/high

the cost of the land, which is also selected considering its topography and shape, more compatible with the "industrialized" and lower-cost construction model. In order to make these projects viable, it is also necessary to consider the infrastructure costs which, in some cases, to ensure the project's viability, are assumed by the government (in the form of subsidies and/or execution).

The advantage of locating SIH in central areas is the possibility to use the existing urban infrastructure. However, it is not simple to establish the financial benefits arising from the use of existing urban infrastructure with the construction of SIH projects in already consolidated central regions as there are no criteria to determine a fair comparison of the real costs of SIH projects in central areas versus the total costs of those located in the periphery.

The construction cost is another obstacle for SIH projects in central areas, especially in abandoned or underutilized properties, as this option has no scale (low number of new HUs) nor constructive efficiency in production management, increasing the total cost. This is a great challenge, because although MHMLP serves families with an income of up to 3 minimum wages, the use of its resources becomes unfeasible, since the costs of rehabilitated HUs exceed the limits established in this program for this income range [9].

4. SIH: Periphery *versus* Central Areas

To demonstrate the cost analyses, a case study has been conducted considering two SIH projects (MHMLP Level 1) built in the Metropolitan Region of RJ. The production cost of these enterprises, are compared to the costs of 3 selected projects from ReHab [9]. In this subitem the main characteristics of these projects will be presented to ease the comparative budget analysis.

4.1 SIH Projects on the Periphery

The construction company responsible for the selected projects is one of the national leaders in the production of HUs by MHMLP, standing out as one of the ten largest Brazilian construction companies in 2016. In addition to SIH, the company is also active in the development of commercial and residential buildings, condominiums of houses and housing complexes, being classified at level A of the PBQP-H (Brazilian Federal Government Program for Quality and Productivity in Housing). Its activities are concentrated in the southeast region of Brazil.

4.1.1 Project A (Periphery)

The first project is located in the city of Queimados, in RJ State, and has been built from January 2013 to May 2017 considering the entire development cycle, from land acquisition to completion and delivery of the last units. It is included in the MHMLP Level 1, with a total of 1,500 HUs distributed in 5 independent condominiums with 300 HU each, in a land with a total area of approximately 135,000 m².

According to the company's technical team, the property where this project was implemented had a relatively unfavorable topography. Fig. 1 presents the master plan of one of the project's condominiums. This feature of the land represented 2 challenges for the efficiency of the project and its results: a low ratio between the number of units and the total area of the land, in addition to the increase in internal infrastructure costs (earthworks, small retaining walls and stormwater drainage).

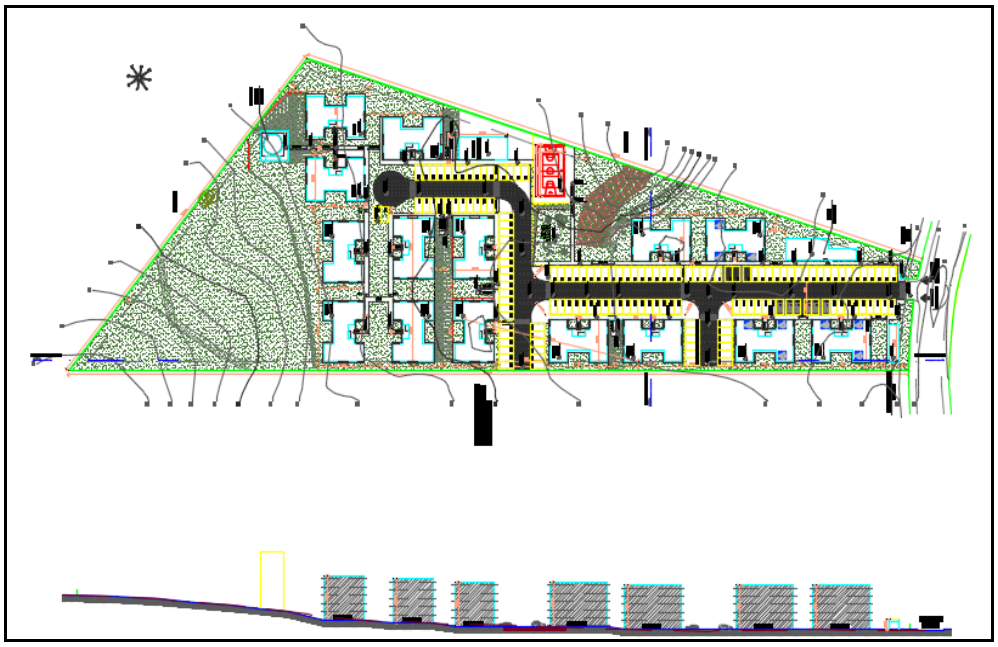

Fig. 1 Proj. A (Queimados) Master Plan, cross section.

In Table 3, the values referring to the main groups of production costs are briefly described. The construction company provided only the percentages for each group and the "CEF value per HU" (the amount paid by the state-owned Brazilian financial services company to the contractor for each HU). The values of the costs per HU and total columns were inferred from the percentages and value per HU. Note that the sum of land and infrastructure costs (internal + external) represents 17.30% of the total amount paid by CEF per HU.

4.1.2 Project B (Periphery)

The second project is located in the city of Duque de Caxias, in RJ State, and has been built from May 2013 to January 2018 also considering the entire development cycle from land acquisition to completion and delivery of last units. It is also included in the MHMLP Level 1, with a total of 980 HUs distributed in 4 independent condominiums, in a property with a total area of approximately 47,000 m². The summary of production costs is presented in Table 4.

According to the company's technical team, the land where this project was implemented had a favorable topography (Fig. 2 illustrates the master plan of one of the condominiums), with a lower cost for internal infrastructure. Note that the sum of land and infrastructure costs represents by the time 16.90% of the total amount paid by CEF per HU.

4.1.3 Periphery Projects Analyses

The HUs on both projects are very similar (exactly the same architectural design), but there are some differences regarding the characteristics of the land with impact on the cost.

Due to its more regular topography, the Duque de Caxias development (Project B) allows for more efficiency in the implementation of buildings, with more HUs per square meter of land. This greater efficiency in deployment can also be seen in the costs of internal infrastructure (earthwork, containing walls, drainage, paving, etc.). On the other hand, in this project, the cost of external infrastructure was higher—both, in total values and per HU. This was not necessarily a problem for the construction company, as long as this external infrastructure budget has been accurately estimated prior to land acquisition. The biggest problem for builders is when the cost of external infrastructure exceeds what has initially been considered.

Builders seek for areas where the sum of land and infrastructure costs (internal and external) fall within the desired limits. Ultimately and from the perspective of the real estate market, it can be concluded that, in the context of MHMLP Level 1, the value of the land is determined by its morphological characteristics (which affect the efficiency of implementation and the costs of internal infrastructure) and by the availability (or deployment costs) of external infrastructure. The sum of these items typically varies from 17% to 20% of the total budget.

Table 3 Project A (Periphery): distribution of budgeted production costs.

Project A: Queimados (RJ) (1 USD ((United States dollar))= 3.20 BRL (Brazilian Real) as in 2017)					
Land area			134,982 m² (89.99 m²/HU)		
Total built area			78,825 m²		
Total private area			68,640 m²		
HUs			1,500 HU		
CEF value per HU			USD 23,437.50 (BRL 75,000)		
Total project budget			USD 35,156,250 (BRL 112,500,000)		
Land value (total)			USD 2,039,062.50 (BRL 6,525,000)		
(Equiv.)			15.11 USD /m² (48.34 BRL /m²)		
Item	%	USD/UH	BRL/UH	USD total	BRL total
Land value	5.80%	1,359	4,350	2,039,063	6,525,000
External infrastructure	1.00%	234	750	351,563	1,125,000
Internal infrastructure	10.50%	2,461	7,875	3,691,406	11,812,500
Construction cost	59.50%	13,945	44,625	20,917,969	66,937,500
Inflation risk correction	5.30%	1,242	3,975	1,863,281	5,962,500
Income tax	1.00%	234	750	351,563	1,125,000
CEF expenses	2.00%	469	1,500	703,125	2,250,000
Total costs	85.10%	19,945	63,825	29,917,969	95,737,500
Estimated profit per HU	14.90%	3,492	11,175	5,238,281	16,762,500

Table 4 Project B (Periphery): distribution of budgeted production costs.

Project B: Duque de Caxias (RJ) (1 USD = 3.20 BRL as in 2017)					
Land area			47,000 m² (47.96 m²/HU)		
Total built area			51,456 m²		
Total private area			44,933 m²		
HUs			980 HU		
CEF value per HU			USD 23,437.50 (BRL 75,000)		
Total project budget			USD 22,968,750 (BRL 73,500,000)		
Land value (total)			USD 1,010,625 (BRL 3,234,000)		
(Equiv.)			21.50 BRL/m²		
Item	%	USD/UH	BRL/UH	USD total	BRL total
Land value	4.40%	1,031	3,300	1,010,625	3,234,000
External infrastructure	3.40%	797	2,550	780,938	2,499,000
Internal infrastructure	9.10%	2,133	6,825	2,090,156	6,688,500
Construction cost	59.50%	13,945	44,625	13,666,406	43,732,500
Inflation risk correction	5.30%	1,242	3,975	1,217,344	3,895,500
Income tax	1.00%	234	750	229,688	735,000
CEF expenses	2.00%	469	1,500	459,375	1,470,000
Total costs	84.70%	19,852	63,525	19,454,531	62,254,500
Estimated profit per HU	15.30%	3,586	11,475	3,514,219	11,245,500

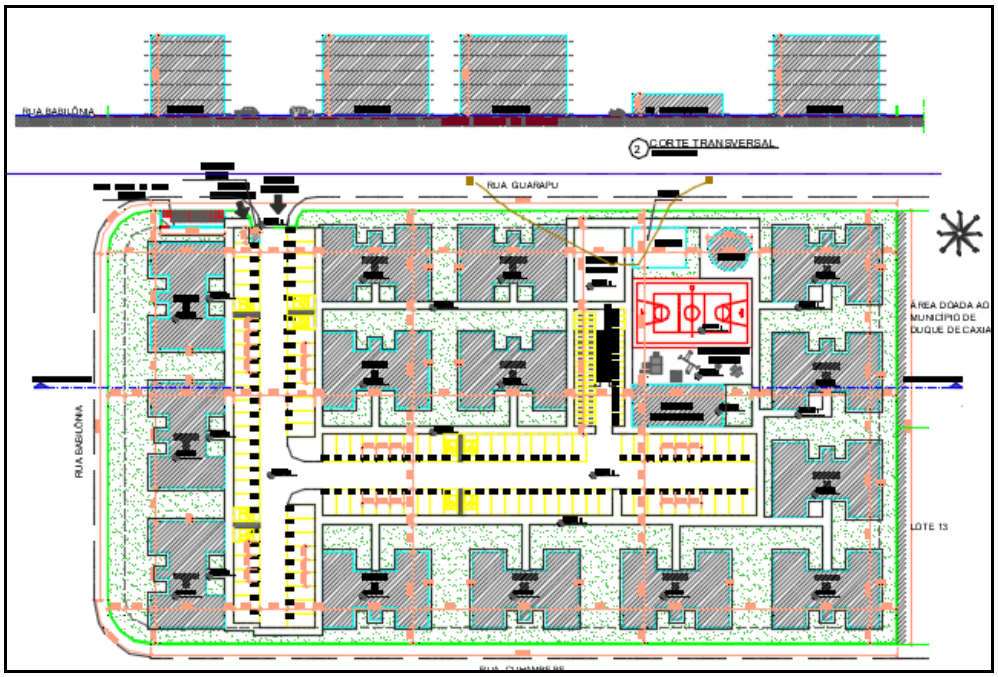

Fig. 2 Proj. B (D. Caxias) Master Plan, cross section.

Considering the amount of USD 23,437.50 (BRL 75,000) paid at that time by the MHMLP Level 1, the amount available to the purchase of land and execution of infrastructure must be limited to USD 5,000 per HU (as shown in Tables 3 and 4). Values are incompatible with those practiced by the market in the central regions of large and medium-sized cities. Even when it comes to areas that are already urbanized and would not need to invest in infrastructure, the budget challenge is almost insoluble for the reality of the Brazilian real estate market.

Finally, it is also worth noting the long time required to complete the 2 projects: 52 months (project A) and 56 months (project B). According to the construction company's board, the main reason for the delay in completion was the slowness in the approval process for obtaining construction permits. The inefficiency of City Halls and Infrastructure Services Companies (sewage, electricity, among others) is associated with bureaucratic legislation and the incompatibility among regulations, with an impact on the overall feasibility of the project. The damages go beyond the delay in the delivery of HUs to families, incorporating additional risks into the investment due to exposure to external factors, such as economic (inflation, financial costs) and political instability (government changes, at all levels).

4.2 Selected Projects Located in the Central Region

The ReHab-Plan for the Rehabilitation and Occupation of Real Estate in the State of RJ in the Central Area of the City of RJ, developed by the LabHab (Housing Laboratory) of PROARQ/FAU-UFRJ, mapped abandoned or underutilized properties located in the central region of RJ [9].

To compare the budget of projects located in peripheral and central areas, three projects were analyzed. These projects were selected due to the similarity with the HUs produced in the large MHMLP developments (2 rooms/approximately 50 m² of private area).

4.2.1 Project A (Central Area): Rua do Resende, 182

As described in the ReHab Report [10], this intervention occurred to an existing village building much degraded, located in the middle of the block, with residential use. The demolition of all units was

considered due to their poor conditions. The linear deployment next to the boundary creates a living space, through which the vertical circulation cores and the ground floor apartments are accessed. The volume is a consequence of the projection of the service area and bathroom of the units in relation to the plan of the living room and bedrooms, generating sun protection and privacy to them.

The project foresaw the delivery of 24 duplex HUs, all with 2 bedrooms and 46.55 m² of private area (see Fig. 3).

4.2.2 Project B (Central Area): Rua da Lapa, 49

The second proposal analyzed in this research is referred to a new construction (4 floors) located on an empty land in the middle of the quartier, prior used as commercial parking use. The maintenance of existing trees, added to the morphological characteristics of the land, defined the linear implantation away from the boundaries, favoring cross ventilation. On the ground floor, collective uncovered areas were created, through which the vertical circulations are accessed, and individual uncovered areas referring to the units on that floor. The front of the lot is occupied by linear apartments, and inside the lot, modular duplex apartments are underlayed, with vertical access to every two units [10].

The project considered the delivery of 12 HUs, all with 2 bedrooms, 4 one-storey (4 × 40.85 m²) and 8 duplex (6 × 39.95 m² + 2 × 41.30 m²), see Fig. 4. Unfortunately, this project has never been executed.

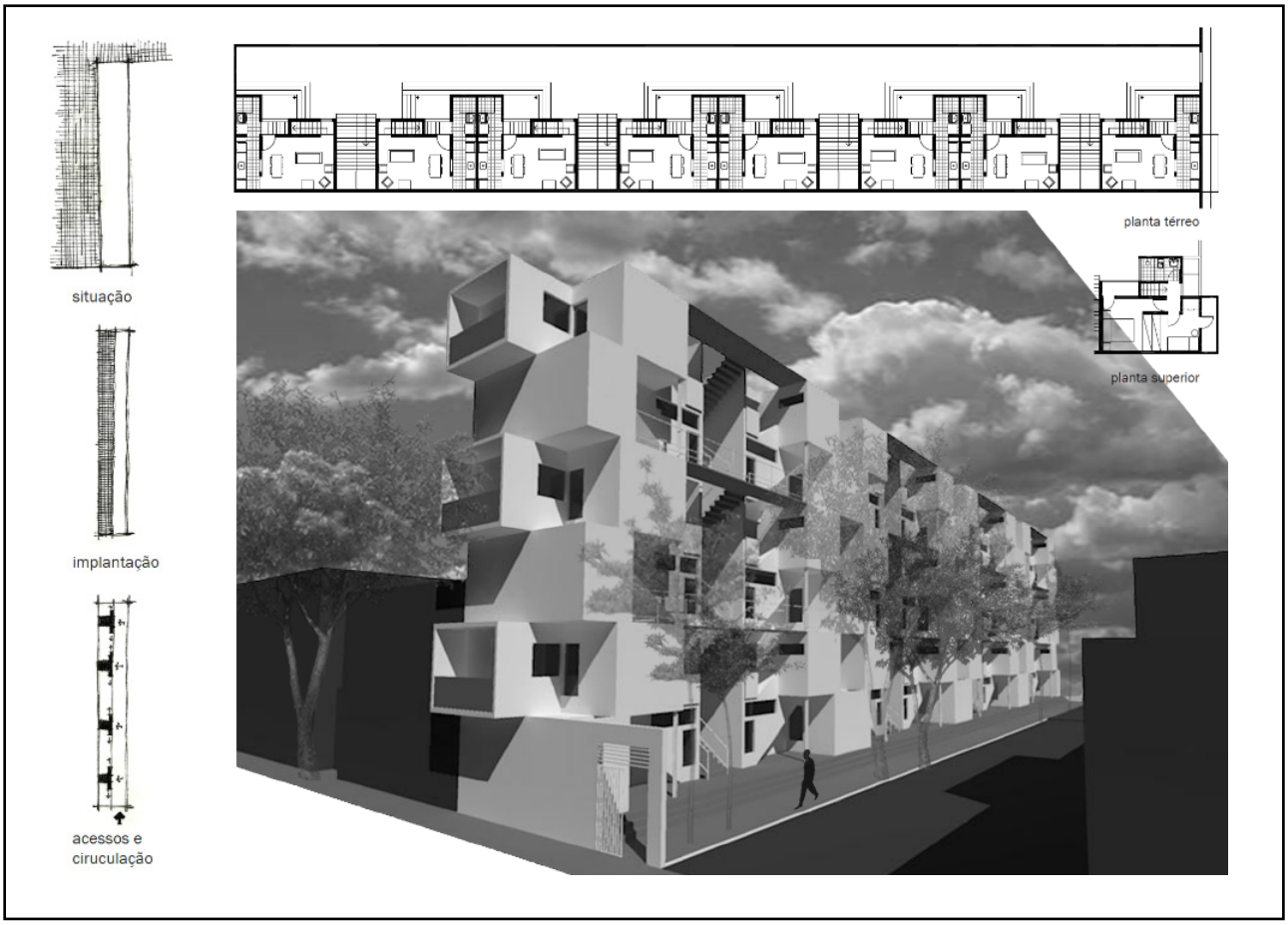

Fig. 3 Project A: Rua do Resende, 182.
Source: Labhab [10], adapted by the author.

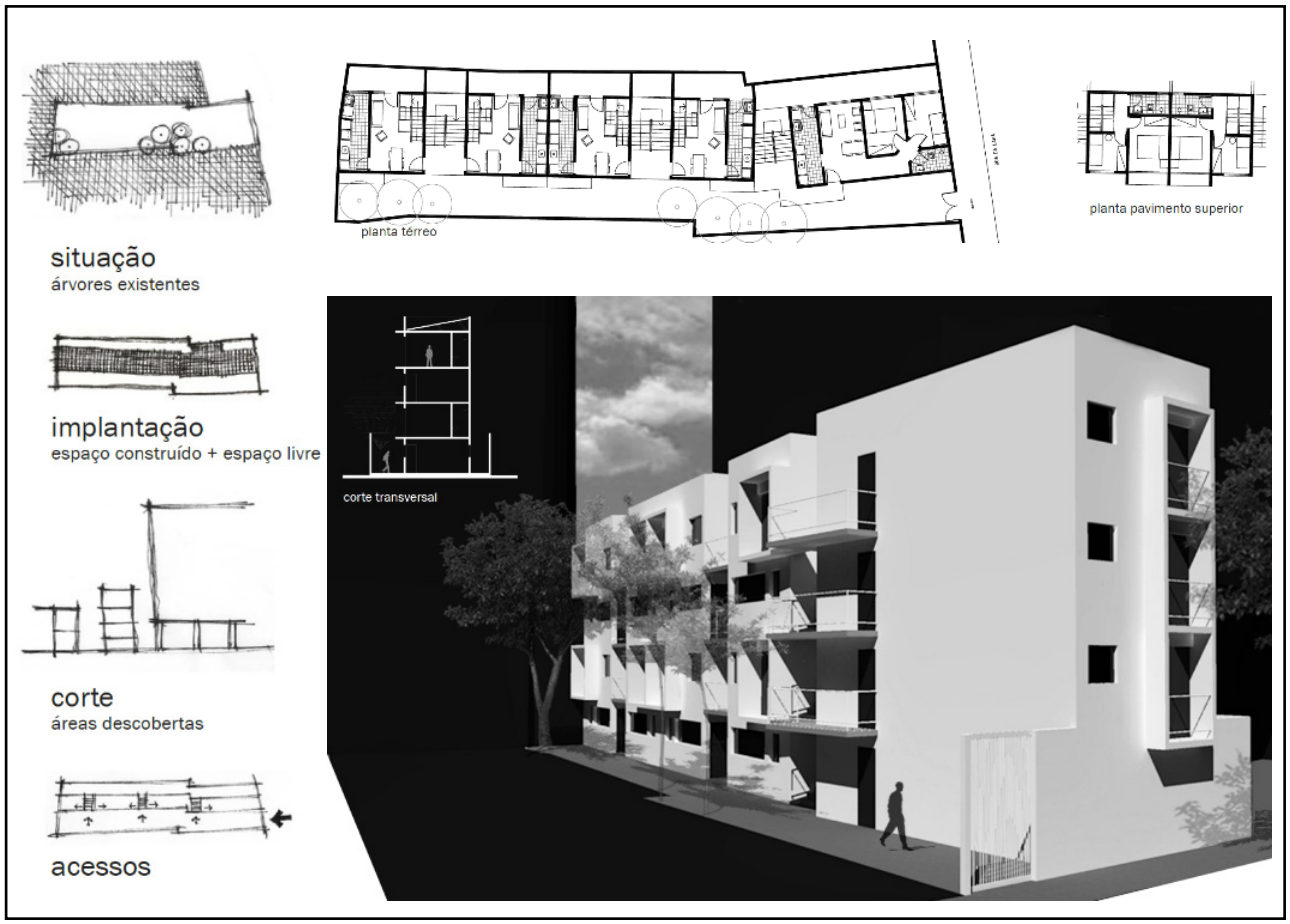

Fig. 4 Project B: Rua da Lapa, 492.
Source: Labhab [10], adapted by the author.

4.2.3 Project C (Central Area): Rua Regente Feijó, 55

The third project selected is an intervention in a building listed by the Brazilian Historical and Artistic Heritage Institute (in Portuguese known as IPHAN), consisting of 1 house next to the street and 8 internal houses. Interior modifications and new roof openings were necessary to adapt the property to current residential use, transforming alcoves into rooms with natural light and ventilation, and inserting bathrooms and kitchens for each unit. To the preserved manor, they were proposed not only internal changes, but also of use, destined for commerce, according to the current predominant use of this street [10].

The project consists of 8 2-bedroom HUs, all linear, in addition to 1 commercial unit. Seven of the 8 HUs have 42.16 m² of private area, the eighth HU with 55.43 m². The commercial unit has 129.15 m² and, as described above, will be the result of adjustments to the existing house that has been listed by IPHAN (Fig. 5).

The idea of creating a space for commerce, facing the street and also serving as access to the HUs, is to potentially generate income that could be used to amortize the additional production cost of the HUs or to maintain the set created.

Of the 3 projects selected, this one is perhaps the most challenging, due to the building's heritage status, but also the one that provides additional benefits to the main objective, which is the delivery of HUs. Besides, the heritage preservation is aligned to the sustainable development goals.

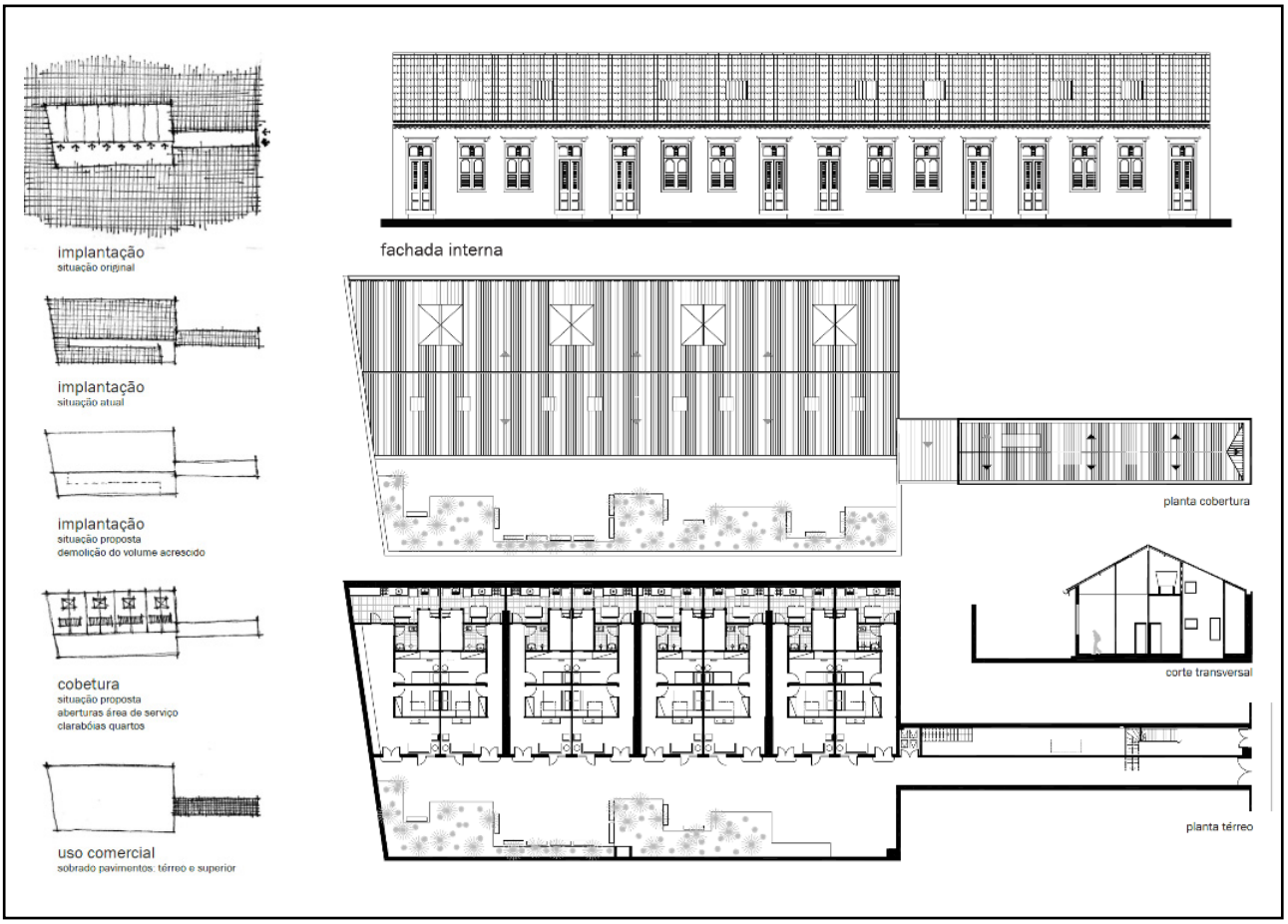

Fig. 5 Project Rua Regente Feijó, 55.
Source: Labhab [10], adapted by the author.

Table 5 Summary of ReHab Projects costs.

Project	HU	USD total	BRL total	USD/UH	BRL/UH
Rua do Resende, 182	21	1,184,843	3,791,496	56,421.07	180,547.44
Rua da Lapa, 49	10	616,924	1,974,156	61,692.38	197,415.63
Rua Regente Feijó, 55	8	364,417	1,166,134	45,552.10	145,766.72

Index Reference Month: July/2017.

4.3 Analyzing the Building Costs

Table 5 presents a summary of the budgets considered by ReHab for the 3 projects in the Central Area of RJ. The studies conducted by the ReHab working group took place throughout 2011, with the estimated construction budget considering July 2011 as the cost reference month. In order to avoid the influence of the variation of the ratio between Brazilian local currency (BRL) and USD, the original costs were reviewed based on INCC (Brazilian Construction Costs Index) variation between July 2011 and July 2017 (reference month for periphery projects), that was 47.04% (July 2011 index = 1,671.12; July 2017 index = 2,457.19).

Pricing updates and detailed budget analysis are two of the initiatives identified as necessary. The objective is to identify possible opportunities to optimize the budget through the analysis of the contracting model, based on the premise that the projects are already optimized and there are no feasible alternatives to optimize the construction method.

Budget items such as INDIRECT Costs (financial, taxes, permits, insurances), Contractors Fee (profit, administrative costs) and Design (architectural, engineering, surveys) represent, according to the detailed budget spreadsheet for each project, around 30% (thirty percent) of the total budget. These are items that are certainly affected by the peculiarity of the projects and the reduced scale, which affects efficiency and productivity.

5. Conclusions

The search for a solution to the problem of offering SIH that meets the needs of the population in the desired quantity and quality is not an exclusive concern of Brazilian cities or developing countries. This debate is recurrent and current also in rich countries, such as the United States, where the public policy model for social housing has been harshly questioned, the object of studies and research aimed at solving the problem and contributing to the development of more efficient public policies [11].

The main motivation of this research was to promote the debate around the total costs involved in the offer of SIH, demonstrating the importance to consider in this analysis the expenses that will incur in the medium and long term.

As presented in this paper through the 5 projects analyzed, the production cost per HU of SIH in central areas (varying from 45,500 up to 61,700 USD/HU) can be more then double of the production cost for projects in the periphery (23,500 USD/HU). The cost of SIH production in central areas is affected by its' peculiarities and the reduced scale, which impacts in efficiency and productivity. Thus, it is not possible for these projects to compete with peripheral projects when only immediate costs are considered,

Besides, most of these medium/long term costs comes from aspects directly related to solutions that compromise the accomplishment of the sustainable development goals, as the users' needs were not considered. In order to reduce immediate costs, these alternatives have a negative impact in cities' life quality.

To achieve these goals, the current dominant model for SIH supply that consider production costs as the most important aspect when determining the location of the housing units to be built has to be challenged. Otherwise, we will continue to move low-income population away from urban centers, amplifying segregation and social problems. The benefits of SIH units well distributed around the urban tissue (less traffic and pollution, more efficient public services, leaner infrastructure, jobs opportunities) must be quantified and considered by public authorities. It's not possible to build more sustainable, efficient and socially fair cities repeating the same mistakes of the past. A SIH supply model that privileges the integration of the low-income population with the urban centers can be part of the solution.

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