

Mainstreaming environmental issues into housing plans: the approach of Strategic Environmental Assessment

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ABSTRACT

The need of providing social housing for a growing urban population triggers government action in several countries. Considering that these initiatives can cause significant environmental and social impacts, the potential contribution of Strategic Environmental Assessment (SEA) to address such challenges is investigated. By reviewing the documents of the major Brazilian housing plan named “My House My Life” and building on the literature, a framework to mainstream environmental and social considerations is proposed. The potential outcomes of its application are outlined as recommendations for both housing planning and project development. The results show that SEA systematic, comprehensive and flexible approach can contribute to inform and influence decision-making about initiatives to reduce housing shortage by: (i) fostering sustainability-oriented related strategic actions, such as the promotion of clean energy and sustainable materials industries and the creation of corresponding jobs; (ii) identifying and assessing alternatives for achieving the strategic goal of providing affordable housing, defining an adequate mix of means to reduce shortage, such as social rent and incentives for using the existing stock, especially in inner cities, and; (iii) identifying risks to achieve the strategic goal, such as economic constraints for delivering social houses with sustainable materials and management of the land and housing stock.

1. Introduction

As the share of world population living in cities is set to increase (García-Ayllón, 2016), the provision of social housing is both a political and an economic challenge for local and national governments. By encroaching on greenfields, densifying existing neighborhoods or filling void or underused areas in inner cities, building houses at a large scale modifies both natural and urban environments and affects human life.

Direct environmental and social impacts of housing include: (i) increase of sediment load during construction and consequent degradation of aquatic habitats; (ii) increase of runoff due to soil impermeabilization and consequent floods downstream; (iii) degradation of water quality due to diffuse, nonpoint sources or sewage discharge; (iv) degradation of air quality due to dust generation during construction and increased traffic; (v) loss of semi-natural habitats (such as agricultural fields or tree stands) and fauna disturbance due to noise and light emissions; (vi) disturbances of neighborhood and; (vii) increase demand for jobs caused by occupation of the buildings and new inhabitants (Al-Shihri, 2016; Gangolells et al., 2009; Scheidt et al., 2010). In addition to those essentially local-scale consequences, Balaban (2012) points out that massive housing construction results in:

(i) urban sprawl across greenfield and green areas; (ii) generation of construction wastes; (iii) emissions from embodied housing as well as from dwellers commuting and; (iv) consumption of materials, energy and resources. Hence, the range of consequences of housing schemes is wide enough to require structured approaches capable of mitigating their adverse, mostly unintended, consequences, without jeopardizing their potential to provide affordable and decent dwelling for a growing urban population.

Moreover, a relevant issue in massive social housing provision is the need of infrastructure and services to meet the increased demand for: (i) transportation, such as roads and public transportation; (ii) urban facilities, such as hospitals and schools; (iii) public services, such as garbage collection (Rolnik et al., 2015; Marques and Rodrigues, 2013). Effective integration is needed to avoid a mismatch between housing and territorial urban plans (Choguill, 2007).

Those side-effects call attention to the need and relevance of assessing the negative environmental consequences of housing development at both project and planning level (Forsberg and von Malmberg, 2004). Addressing environmental and social issues of housing initiatives, the literature focuses on: (i) evaluating the life cycle impacts of buildings (Marzouk and Azab, 2016; Paulsen and Sposto, 2014); (ii)

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developing and evaluating building rating schemes (Saldaña-Márquez et al., 2018); (iii) framing the environmental aspects to quantify the severity of environmental impacts of construction (Gangoelle et al., 2009) and; (iv) developing indicators to measure the performance and monitoring housing programs and buildings (Al-Jebouri et al., 2017; Gan et al., 2017; Siqueira-Gay et al., 2018). Studies of this kind are important to provide a better understanding of potential consequences of housing schemes as well as developing and testing mitigation actions. However, there are few studies on comprehensive approaches and procedures to undertake the environmental assessment of housing plans and programs (López-Salgado & Picción, 2016; Nuissl et al., 2009).

This is the realm of Strategic Environmental Assessment (SEA), a planning approach that has received increased attention of researchers in recent years (Li and Zhao, 2015). Therivel et al. (1992) define SEA as a formalized, systematic and comprehensive approach which aims at evaluating the environmental impacts of Policies, Plans and Programs (PPP) and their alternatives, while OECD (2006) conceives SEA as “a range of analytical and participatory approaches” to integrate environmental considerations into PPPs and in evaluating their possible connections with economic and social considerations.

Those definitions show that SEA literature provides different lines of argumentation about its purpose and suggests that SEA can follow several frameworks (Tetlow and Hanusch, 2012). A distinction is often made between “impact-centred” and “strategy-centred” SEA (Partidario, 2015). The former is modelled upon project EIA whereby the impacts of PPPs are predicted, mitigation is designed to avoid, reduce or compensate significant adverse impacts and enhancement measures are proposed to improve potentially positive outcomes. In contrast, a strategy-centred SEA is rooted in the strategic thinking rather than the traditional scope of impact assessment (Noble and Nwanekezie, 2016) and seeks to integrate environmental and sustainability goals in the design of strategies to meet social needs (Sánchez, 2017).

SEA literature advances its potentialities of: (i) integrate sectoral and land use plans (Bragagnolo and Geneletti, 2013; Oberling et al., 2013); (ii) link to other strategic actions (Partidario, 2012; Therivel, 2004); (iii) identify and assess strategic options to achieve the goals of a PPP (Balfors et al., 2018; Partidario, 2012); (iv) contribute to more sustainable PPPs, including mainstreaming key environmental issues in the decision making (Partidario, 2015); (v) improve project EIA by scoping out broad issues (addressed at policy or program level) to focus EIA on locally relevant issues (van Doren et al., 2013; Sánchez and Silva-Sánchez, 2008; Fischer, 2007); (vi) identify risks and opportunities to achieve the strategic action (Partidario, 2012; Therivel, 2004).

SEA can be required by law or regulation (Fischer, 2010; Weiland, 2010), by donor agencies (Sánchez and Croal, 2012), or can be conducted as a voluntary procedure (Silva et al., 2014; McGimpsey and Morgan, 2013). A non-mandatory context represents a challenge for SEA application, as decision-makers and stakeholders have to be convinced of its value and an appropriate procedural framework should be presented to motivate the practice (Montaño et al., 2014).

SEA has been performed and researched for a wide range of PPPs. Energy, transportation and land use are among the most studied sectors, while housing received limited attention in the literature, although massive housing provision undoubtedly causes significant environmental impacts.

This work contributes to the literature by identifying the potential contribution of SEA to mainstreaming environmental and social issues into a massive initiative of housing shortage reduction and seeks to derive lessons for the environmental assessment of housing plans more generally. To explore this question, a Brazilian program aimed at reducing housing shortage was reviewed, the “My House My Life” (*Minha Casa Minha Vida*, hereafter MCMV). The Brazilian housing deficit in 2014 was estimated at 6 million housing units, 87% of these located in urban areas. As a huge effort is needed to overcome such a deficit, Brazil is an appropriate set for the purposes of the research. In 2009, the

federal government launched MCMV. It planned to provide more than 3 million new houses through investments of a scale never previously intended in the Brazilian housing sector (Campos and Guilhoto, 2017). Based on the review of documents pertaining to the MCMV Program, the environmental licensing of one large housing project and SEAs for housing plans and local urban development in other countries, an approach to mainstreaming environmental and social issues into a Brazilian housing plan is proposed and its potential contribution is outlined. The possibilities of general application to other contexts are discussed.

In the sections that follow we first describe the research methods and documents analyzed. Afterwards, we briefly contextualize MCMV and present an overview of the existing process to assess the environmental impacts of housing projects. We also review one housing project funded by MCMV to identify the current environmental issues addressed in EIA and the potential of SEA to influence project level decision-making. In the following section, the potential outcomes of applying SEA to the MCMV program are presented and general contributions of SEA to massive housing initiatives are outlined. Finally, conclusions are drawn.

2. Methodology

To explore the potentialities of SEA to mainstream environmental issues into housing plans, the study followed the steps in Fig. 1. An environmental issue, in this investigation, is considered as any interaction of a housing project or PPP with its biophysical or social environment, both at local level (i.e. a project's surroundings) and regional and global levels. Hence, environmental issues include impacts of construction and use of buildings as well as embodied emissions of construction materials and home appliances.

As the MCMV program was never formally stated in any kind of policy paper, but established by law and further regulation, it was necessary to identify the key government documents that established the program (Table A1). As MCMV provision's scale and functionality involve different types of funds and beneficiaries (Campos and Guilhoto, 2017), this research focused only on housing provision by private promoters, which represents the biggest funding target (Cardoso and Aragão, 2013). Those documents were reviewed by the first author and two questions guided this review: (i) are environmental issues factored in the MCMV housing program? (ii) which issues are considered and how? To determine which are the current environmental concerns addressed in the MCMV, the review was conducted on the basis of the “keywords in context” technique (Hsieh and Shannon, 2005) using the word “environment” to identify explicit quotes in the documents.

Projects funded by the program must conform to local land use regulations and environmental licensing process, both of which vary across the country. Such requirements were reviewed for São Paulo municipality, the biggest in Brazil and featuring a huge housing shortage. Accordingly, the municipal and the national housing plans (Table A2) were also reviewed in order to identify possible mentions or requirements pertinent to environmental matters and linkages with the MCMV. The “keywords in context” technique was adopted by using the keywords “environment” and “*Minha Casa Minha Vida*” or “MCMV” for identifying possible connections between the existing housing programs and MCMV.

Besides those planning documents, a recent project submitted to EIA and located in São Paulo municipality was reviewed for the purpose of: (i) identifying the key environmental issues arising during environmental approval and (ii) discussing if those issues could have been anticipated and addressed at a strategic level. The Environmental Impact Study (EIS) and Review Report (Technical Opinion) of the environmental agency (Table A3) were the source documents. This project was intentionally chosen for review because: (i) it is a massive undertaking located in a city with high housing deficit that hosted several MCMV projects; (ii) complete information about its environmental

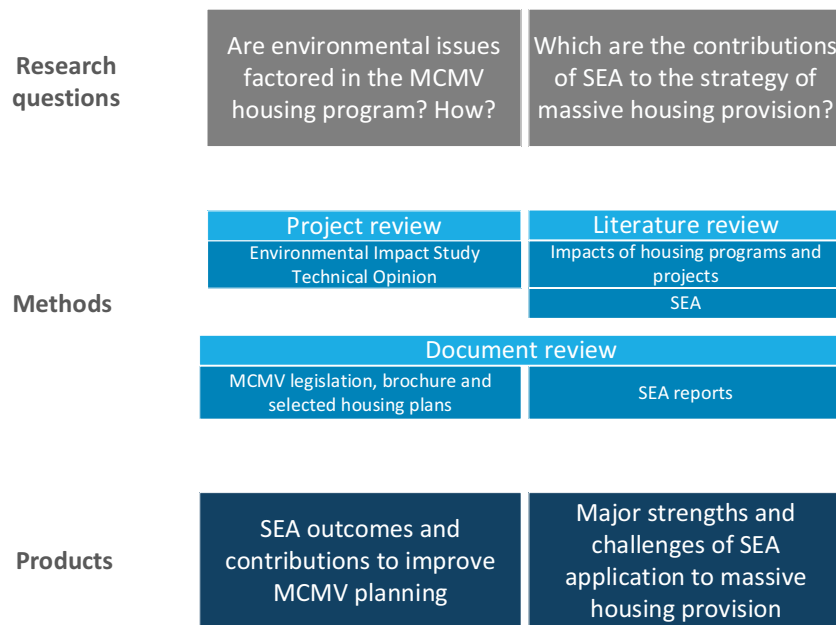


Fig. 1. Research questions, method and outputs.

licensing process is available online. As a large project, an EIA was required for granting environmental approval. This is in contrast with most, smaller, housing schemes under MCMV, that have an environmental license granted on the basis of a simplified process. As an EIA has to fully appraise the environmental impacts of a project and propose mitigation (Fonseca et al., 2017), it can be expected that it features an in-depth analysis of the project's local impacts.

For identifying the contribution of SEA to housing plans, in addition to a literature review, an internet search of SEA reports of both housing provision and urban development plans was conducted in English, Portuguese and Spanish, looking into websites hosted by governments, development agencies and multilateral development banks. Few applications for housing initiatives were found. Among the results, a selection of SEA reports from the UK, focused on local housing strategies, was consulted (Table A4). Although social housing problems in Brazil – and in Latin America more generally – largely differ from similar problems in Europe, the assessment of a housing strategy, as practiced in one jurisdiction, could provide insights to the environmental assessment of housing programs elsewhere and show its value to decision-makers and stakeholders (Montaño et al., 2014). Additionally, the SEA report of the master plan of Tianjian Eco-city, developed in cooperation between China and Singapore governments, was also reviewed for featuring the assessment of housing provision in another developing context. The review of these documents was guided by the question: which are the potential contributions of SEA to the strategy of massive housing provision?

The proposed framework was developed on the grounds of SEA literature by relating the main steps of SEA to a generic decision-making model and listing the potential contributions to MCMV had its planning process followed an approach inspired by SEA. The expected outcomes of applying the approach to housing planning in the Brazilian context were simulated using insights and recommendations from the literature and the reviewed SEA reports. The recommendations are directed to the main agents at both project and planning level. Finally, challenges and strengths of applying SEA to future massive housing provision initiatives generally are considered.

3. Massive housing provision in Brazil and its environmental consequences

The MCMV is an important housing initiative created by the federal government of Brazil in 2009 and redesigned in 2011. According to Law n°12.424/2011, the program aims to “create mechanisms to encourage the production and acquisition of new housing units or redevelopment of urban property, production and refurbishment of rural housing for families with monthly income up to R\$ 4650¹”. The program provided more than one million houses in its first phase. During the first five years, it delivered as much as 80% of the houses provided during the 22 years (1964–1986) of the National Housing Bank existence (Amore et al., 2015).

MCMV comprises two subprograms: the National Rural Housing Program (PNHR) and the National Urban Housing Program (PNHU). There is also a special component that involves self-construction, named “MCMV Entities”. The program aims at serving three income segments. The first target group is composed of families with monthly income up to R\$ 1395 per month, or 3 minimum wages (m.w.),² which receive high subsidies; the second, up to R\$ 2790 (3 to 6 m.w.), which receive moderate subsidies; the third, up to R\$ 4650 (6 to 10 m.w.), not subsidized. Although the first segment represents the largest percentage of the country's housing shortage, it was neglected by previous housing plans (Bonduki, 2014; Valença and Bonates, 2010).

Despite its merits, the MCMV program, through massive funding of housing construction, has been criticized for its adverse impact on Brazilian cities, especially for issues regarding: (i) buildings located on the outskirts of cities, implying long commuting time and high social costs of providing public services (Marques and Rodrigues, 2013); (ii) continuity of high segregation pattern of previous social housing initiatives (Marques and Rodrigues, 2013); (iii) poor transportation infrastructure and urban equipments (Rolnik et al., 2015). Furthermore, the literature highlights issues regarding the construction standards of buildings: (iv) poor architectural quality (Amore et al., 2015); (v) indiscriminate repetition blocks (Ferreira, 2012).

¹ One US dollar at the time was equivalent to BRL 1.57. Then, the maximum income was about USD 2961.

² Amount in Brazilian Reais in 2011

3.1. Environmental approval of funded projects

The existing procedure to evaluate the environmental consequences of housing provision consists on the assessment of individual projects as part of the environmental licensing procedure. In the context of MCMV, the federally-owned bank CEF approves project funding while an environmental license is granted by a State or a municipal authority (hereafter called environmental agency). Brazilian legislation requires an environmental license for certain urban development projects, including social housing. An EIS is required for major undertakings (Duarte et al., 2017), while most housing projects require a Simplified Environmental Report and an Environmental Management Plan (a “Detailed Report of Environmental Programmes” in the local terminology). The certificate of project's approval is a requirement for issuing an environmental license.

The relationship between environmental licensing and project development by private builders is illustrated in Fig. 2. The federally-owned bank CEF approves the building project, manages and transfers financial resources to a developer. Municipalities are responsible for selecting qualifying families and making building land available for private housing developers, who are responsible for the design, construction and delivery of houses to the program's beneficiaries.

In the MCMV context, some projects are big enough to trigger the preparation of an EIS. The following subsection shows one such project to highlight a number of environmental problems at the local scale of a project funded by the MCMV program. This project illustrates some of the existing drawbacks that could be ameliorated by SEA.

3.2. Project review

The MCMV related literature demonstrates the existence of conflicts with neighborhoods during project appraisal (Amore et al., 2015) and territorial impacts of buildings construction (Cardoso and Aragão, 2013). Those authors focused on the urbanistic and social impacts of MCMV projects. In this study, we review the environmental and social consequences of a large project, as assessed in the EIS and the environmental agency's technical opinion (Table A3) in order to illustrate how is the current consideration of environmental concerns in housing projects and the potential of SEA to influence also in project decisions.

The project, called “Reserva Raposo”, in the West region of São Paulo municipality, aims at building towers and houses totaling 18,930 housing units, making room for about 60,000 inhabitants. It is expected to provide houses for all target groups of MCMV, and also includes commercial development and urban facilities, such as areas for health and leisure services (Walm, 2015). The surrounding area comprises other social housing blocks, commercial and industrial buildings.

Due to its scale, the environmental approval of this project required an EIS, submitted in 2015 to the municipal Department of Environment. According to the EIS (Walm, 2015), the main impacts are: (i) degradation of water and soil quality; (ii) degradation of air quality; (iii) disturbance of neighborhood; (iv) loss of habitat; (v) change in the landscape; (vi) increased tax collection and jobs generation; (vii) increased commuting traffic.

These adverse impacts, as well as the rationale of building such a large scheme in a region underserved by public transportation and social services, was challenged by social movements and neighbors during the review phase of the EIA process. We will briefly comment on two of those impacts. Firstly, the EIS analyzed impacts caused on road traffic, public transportation and general infrastructure and services provision, given the increase in demand induced by the project. The EIS foresees a considerable increase in traffic due to an estimated 77,000 new daily travels on an already saturated road system. Mitigation, as described in the EIS, would be limited to future improvements documented in the city's Master Plan, such as the construction of two new bus corridors and one bus terminal in the project surroundings. However, the Technical Opinion issued by the Department of Environment requires,

among other measures, the study of the future demand of public transportation, and a proposal for optimization and integration of public transportation network, as conditions for the environmental license approval (SVMA, 2016).

Another concern of opponents was the risk of increased floods downstream. In the current state of the area, runoff is limited because rainfall infiltrates in the soil. However, as in other dense urban areas, the project will remove 82% of native trees and impermeabilize about 450,500 m² of soil surface. The significance of this impact was downplayed in the EIS and a supplementary study of green and impermeable areas was required in the technical opinion (SVMA, 2016).

This brief review of a project's impacts shows a number of shortcomings of a government initiative that, aiming at addressing one kind of problem, creates or exacerbates other problems. The prior knowledge about potential conflicts at project appraisal could be anticipated by a strategic approach to planning (White and Noble, 2013).

4. The potential contributions of Strategic Environmental Assessment

This section presents the research results showing how SEA could contribute to a systematic consideration of environmental and social impacts as well as sustainability-oriented opportunities to the design and implementation of social housing plans. The SEA approach is conceptually applied to MCMV to illustrate its possible outcomes and connections in order to influence planning decisions.

4.1. SEA contributions to MCMV

In order to realize the SEA potential, it is necessary to design a consistent approach to integrate the SEA rationale and activities with planning practices, in such a manner as to show its benefits to decision makers and allow them to become more acquainted with the plan's content, its environmental and social implications (van Doren et al., 2013) and opportunities to enhance its contribution to sustainability.

Building upon SEA and housing literature, as well as the reviewed documents, a framework (Fig. 3) is proposed as a structured approach to mainstream environmental and social issues into massive housing planning. The key elements of a decision-making process relative to strategic actions is represented in the left-hand side. The main steps of SEA are featured in the central column. Briefly, it is important to set SEA goals and scope from the outset (van Doren et al., 2013; Fischer, 2007); the environmental issues should be aligned with the concerns of key stakeholders, which is one reason why public consultation is important in SEA (Rega and Baldizzone, 2014; Fischer, 2005); the identification of other strategic actions is the search for PPPs that can influence or be influenced by the planning process under assessment (Partidario, 2012; Therivel, 2004); risks and opportunities related to the strategic action should be mapped and assessed (Partidario, 2012; Therivel, 2004); the identification and assessment of suitable alternatives to achieve the strategic objective should consider their potentially significant effects (Balfors et al., 2018; Partidario, 2012). SEA findings and recommendations are documented in reports that should clearly communicate its findings and recommendations, such as guidelines tailored for different government agencies (Bidstrup and Hansen, 2014; Fischer, 2005). Monitoring and follow-up aims at monitoring the impacts of plan implementation and analyzing the governance and processes of action (Monteiro et al., 2018; Lobos and Partidario, 2014). Examples of linkages between SEA and strategic decision-making on massive housing supply are shown in the right-hand side of Fig. 3. The double-ended arrows show the SEA relation with a generic decision making and the single-ended arrows demonstrate the contributions of such interaction.

The promotion of clean energy and sustainable materials industries and related jobs could be set as an opportunity to envision other strategic goals. Choguill (2007) highlights the importance of related

policies for undertaking more sustainable housing initiatives, such as land use and the establishment of buildings standards with infrastructure and services in the surroundings. On the other hand, availability of suitable land to deliver the number of houses required to reduce the shortage could be considered as a risk to the strategic action. Denaldi (2013) highlights the challenge to effectively implement a regulatory structure for the land market based on the existing instruments, especially face the overheated real estate investments in cities and metropolitan areas in recent years in Brazil. Facing other risks related to the economic constraints for delivering social housing with sustainable materials, green technologies for buildings construction also deserve careful consideration, as the possibilities of cost overruns are not negligible. Given the existing limitation for implementing this kind of initiative, especially for social housing schemes (Gianfrate et al., 2017), financial and regulatory incentives, including subsidies, may be needed (World Bank, 2011), exemplifying with initiatives, such as “Green Mortgage”, to overcome the upfront costs of energy efficient technology in the context of social housing.

The strategic goal of MCMV is to reduce housing shortage all over the country. The program does not assess alternatives to the provision of subsidies to build new housing units. No formal document states the program's goals and its implementation tools beyond those listed in Table A1. Exploring alternatives to achieve the strategic goal could contribute to break with the historical practice of funding exclusively new houses in Brazil, seen as detrimental in terms of urban land use, among other problems (Bonduki, 2014). Options such as social rent, improvement of informal houses, urban settlements refurbishment, retrofit of residential and derelict commercial buildings, and housing development on brownfield sites (World Bank, 2011), could be the target of the funding scheme and combinations of such options could be considered. Beyond just identifying alternatives, it is necessary to assess their environmental effects in order to choose the preferences to improve the sustainability of the strategic action. This approach, supported by SEA, may turn the strategic action of reducing housing shortage into a more comprehensive initiative with different solutions.

SEA could also contribute for monitoring the side-effects of PPPs. Follow-up in the MCMV program, carried out by CEF, includes providing support for the families after home delivery, through social work, and actions such a guidance for using facilities and environmental education. Although the program documents state issues to be addressed by social follow-up, the literature highlights problems with violence and conflicts (Amore et al., 2015).

Besides its contributions to the rationale of the planning process, SEA can contribute to support decision making by using appropriate methods and techniques (Lobos and Partidario, 2014). As examples, Marull et al. (2007) use a hierarchical system of maps in support of SEA, resulting in a Land Suitability Index, and Bragagnolo and Geneletti (2013) simulate future scenarios to support SEA of land use plans. When applied to housing developments, these and other tools are useful to select places to receive new housing initiatives and to integrate housing with land use planning. Although actual decision-making is influenced by an array of beliefs, political practices and even vested interests (Weston, 2010), and notwithstanding arguments that SEA should be flexible enough to adapt to different decision-making contexts (Gazzola, 2008; Noble and Nwanekezie, 2016), it is necessary to conceptualize a structured model of planning to explore the potential contribution of SEA. In the conceptual framework (Fig. 3), the main potential contributions to SEA are shown.

4.2. Outcomes

SEA is credited with the potential to promote “horizontal” integration with other PPPs (Noble and Nwanekezie, 2016) as well as “vertical” combination with lower levels of planning, such as projects associated with a plan or program, known in the literature as “tiering” (Sánchez and Silva-Sánchez, 2008). Hence, the outcomes and the

possible influence of SEA on decision-making depend on how such integration is achieved as well as the institutional setting contributing to or diffculting the adoption or acceptance, by decision-makers, of SEA findings and recommendations (van Doren et al., 2013). Fig. 4 shows how SEA of a housing program could unfold into recommendations for both horizontal and vertical integration. Example recommendations for the Brazilian context are drawn from the reviewed literature (World Bank, 2011; Triana et al., 2015; Tubelo et al., 2018) and from this research.

The top-down or tiered approach could produce recommendations for the major agents depicted in Fig. 4, including the development or adaptation of certification schemes appropriate for social housing. The existing “Selo Azul” (Blue Label), for example, the CEF-led certification of social housing, that presents three levels of requirements according to the number of points achieved, could be improved on the basis of SEA findings, incorporating, for example, water harvesting devices in the semi-arid region and energy-smart thermal comfort technologies. The horizontal integration of a housing program with other PPPs potentially include a vast array of synergies, as the examples shown in Fig. 4.

In contrast, the MCMV is a funding initiative that provides financial resources disregarding local housing initiatives that has been inducing urban segregation and, in some cases, unnecessary urban sprawl (Ferreira, 2012). The expression “my house, but where is the city?” (Amore et al., 2015) synthesizes a substantial part of current criticism, but other sustainability-oriented opportunities represented by unleashing massive housing investments were largely ignored or downplayed. The SEA rationale and the role of public participation in it could at least have made explicit the trade-offs and the lost opportunities represented by the way MCMV was formulated and implemented.

The next section enlarges the focus from the Brazilian context to discuss the potential benefits, as well as a number of hurdles of applying SEA to massive housing provision.

5. Discussion

Worldwide, social housing is provided under different arrangements, involving private and public sectors and, in some countries, community-based organizations. As an example, in the 1970's, Chile, facing a large shortage, launched a new approach with subsidies, aiming at partnering government and private sector to deliver massive housing (Gilbert, 2004). This arrangement was an alternative to reduce government costs and promote economic leverage through civil construction. Similar initiatives were adopted in Costa Rica, Colombia, South Africa (Gilbert, 2004) and Mexico (Janoschka and Salinas, 2017). However, such an approach was criticized for problems related to both building's quality and location, usually far from areas concentrating jobs and public services (Gilbert, 2004), also a shortcoming of MCMV.

In order to apply SEA to housing plans, the rule-of-thumb of flexibility and adaptation to the decision-making context is of paramount importance (Gazzola, 2008; van Doren et al., 2013). An example of context-specific SEA reviewed here is its application to Local Housing Strategy in the UK (Table A4), a local authority's primary strategic document for housing in a given area that sets out priorities and plans for delivering housing and related services. The SEA reports point to issues important to that context, including quality of housing standards, energy efficiency, public health and well-being of the city's residents.

Different priorities arose in the SEA of Tianjian Eco-City, which focus on land use and housing stock management. The SEA of the eco-city master plan shows the opportunity of a land use plan to integrate other initiatives, such as planning for new housing development according to the available housing stock identified by a zoning initiative. The document also defends that such integration with other plans and programs can support services and facilities provision in order to provide a good quality of life for the citizens.

In general, the strengths of SEA application are broadly stated in the

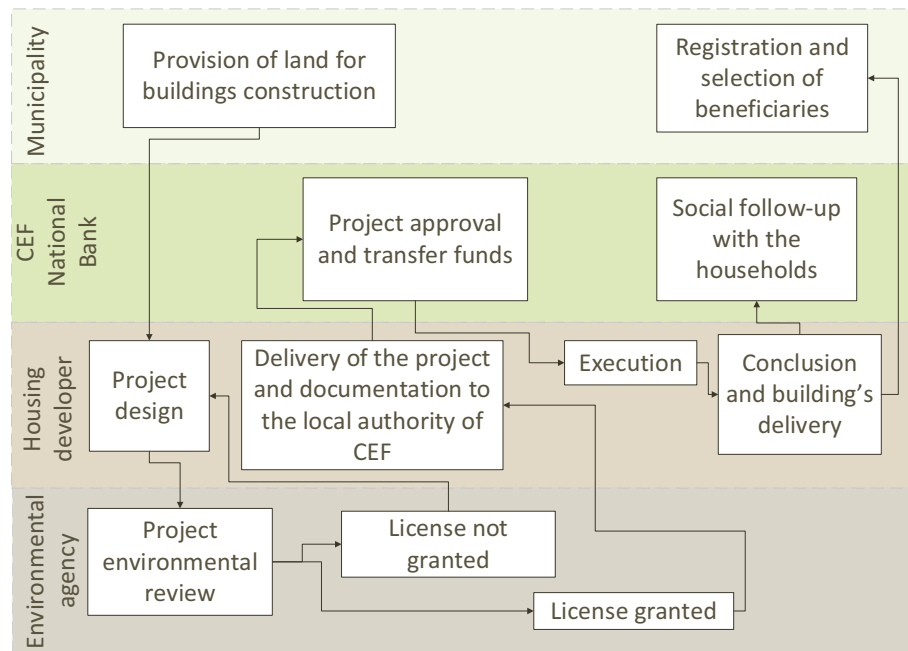


Fig. 2. Project approval process for the first attendance segment of MCMV Brazilian social housing program. Based on information from Cardoso and Aragão (2013).

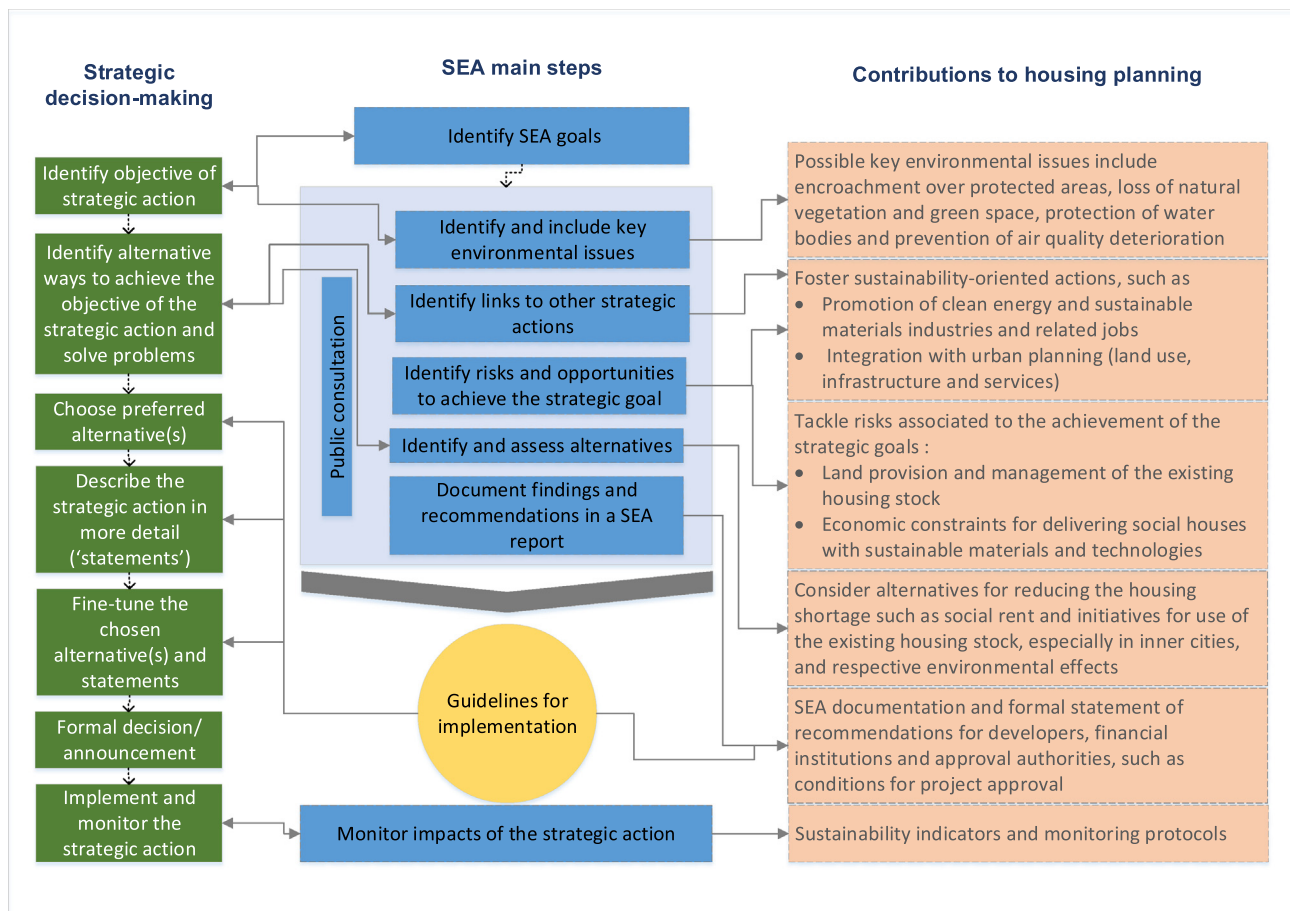


Fig. 3. An approach to mainstreaming environmental and social issues into housing plans. Sources: “Strategic decision-making” from Therivel (2004); “SEA main steps” modified from Partidario (2012) and Therivel (2004).

literature (Noble and Nwanekezie, 2016, among others). In short, in addition to contributing to more sustainable policy outcomes, SEA practice can lead to a more transparent process and raise awareness

about environmental consequences of strategic actions (Tetlow and Hanusch, 2012), as well as educate and be a driver of a learning process for practitioners (Fischer et al., 2009). If applied to housing PPPs,

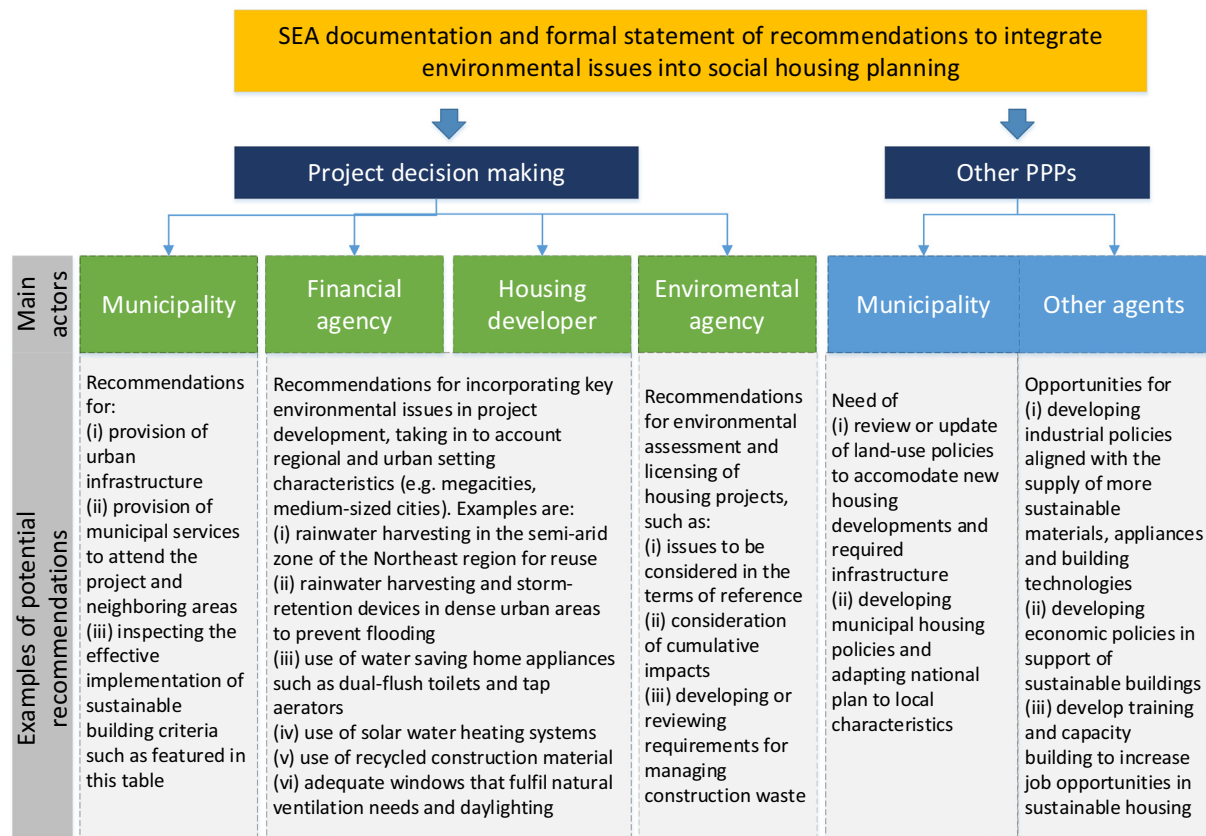


Fig. 4. Potential outcomes of SEA if applied to 'Minha Casa Minha Vida' Brazilian social housing program.

despite the limited international experience with this particular kind of initiative, SEA would benefit from an array of lessons learned from its application to other PPPs, thus accelerating the learning curve of housing planning professionals.

Notwithstanding its conceptual grounding and widespread call for application (Sánchez and Croal, 2012), challenges for effective SEA are acknowledged in the literature, especially in non-mandatory contexts (Margato and Sánchez, 2014; Mc Gimpsey & Morgan, 2013). López-Salgado & Picción (2016), researching SEA of housing plans in Uruguay, where it is not mandatory, found that specialists' capabilities could determine the level of methodological innovation due to the limited practical experience of planners in applying the procedure. A perceived limitation of politicians' decision-makers powers has also been suggested as a barrier to SEA adoption in Brazil (Sánchez, 2017).

The resistance of planning practitioners and the complexity of analysis at the strategic level represent a hurdle to the SEA practice (Lobos and Partidario, 2014). The institutional and finance arrangements define the stakeholders involved into the decision making and it also can influence SEA performance (López-Salgado & Picción, 2016). Besides that, especially in developing countries, effective SEA application faces challenges such as economic constraints to deliver new and more sustainable buildings and management of the existing housing stock.

6. Conclusion

By reviewing the literature, SEA reports and examining a major social housing plan in Brazil, it was found that Strategic Environmental Assessment can provide a structured approach to strengthen planning for reducing housing shortage, avoiding or minimizing its shortcomings and enhancing its intended benefits.

This work contributes to the literature by identifying the potential

contribution of SEA to mainstreaming environmental and social issues into a massive initiative of housing shortage reduction and seeks to derive lessons for the environmental assessment of housing plans more generally. SEA of housing policies, programs and plans could contribute to: (i) foster sustainability-oriented strategic actions, such as industrial policies aimed at promoting clean energy, sustainable materials and appliances, with corresponding job creation; (ii) identify and assess the environmental effects of alternatives for housing provision and finding an adequate mix of means to reduce housing shortage; (iii) identify and address risks to achieve the strategic goal of reducing housing shortage - such as economic constraints for delivering social houses with sustainable materials and land management. The outcomes of SEA should unfold into recommendations for: (i) tiering downstream with individual housing projects; and (ii) integration with other relevant policies, programs and plans.

Although this paper brings insights from a national experience, the results show potential benefits arising from SEA if applied to other contexts of massive housing programs. More can be done by investigating the potential of SEA for social housing in developing countries, especially exploring its role in integrating housing with other plans and initiatives. Given the existing and future need to accommodate the increasing population of large cities, massive housing schemes are likely to be developed in many countries. The extent to which such initiatives can contribute to sustainability as they also deliver affordable and decent housing will be a measure of their success.

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Appendix A

Table A1

Documents reviewed: MCMV.

Documents	Description
Program legislation	Law n°11.977/2009: regulates the MCMV Program Phase one. and land use in urban environments, modified by Law n°12.424/2011 Law n°12.424/2011: regulates the MCMV Program Phase two Decree n°7.499/2011: regulates Law 11.977/2009 Decree n°7.795/2012: modifies Decree n°7.499/2011
Explanatory Booklet (2012)	It explains the program functionality and its main attendance modalities

Table A2

Documents reviewed: housing planning in Brazil and São Paulo.

Documents	Description
Housing National Plan (PlanHab) 2009-2023	It establishes instruments for the implementation of national housing policy
Local Housing Plan 2009-2024.	It provides strategies for local initiatives aimed at housing development

Table A3

Documents reviewed: Housing project.

Documents	Description
Environmental Impact Study (Walm, 2015)	Environmental Study of the Project “Reserva Raposo”. It contains studies performed for the environmental assessment of the project, as required by the municipal environmental agency.
Technical Opinion Report (SVMA, 2016)	Review of the EIS conducted by the municipal environmental agency. It comprises a summary of the project's impacts and mandatory conditions for issuing the environmental license

Table A4

Documents reviewed: SEA studies.

Documents	Description
SEA Guidance (2005)	A Practical Guide to the Strategic Environmental Assessment Directive
SEA Reports	Aberdeen 2012-2017 Glasgow 2011-2016 South Lanarkshire 2012-2017 South Ayrshire 2010-2015 Comprehensive Summary of SEA for Sino-Singapore Tianjian Eco-City (2008)

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