Co-Producing Resilience in Social Housing: a Brazilian Case

Simone Barbosa Villa, Fernando Garrefa, Paula Barcelos Vasconcellos, Rafaela Rezende de Deus and Giovanna Rodrigues Messias

Federal University of Uberlândia

Author Note

Simone Barbosa Villa, Faculty of Architecture and Urbanism and Design (FAUeD), Federal University Of Uberlândia (UFU), Brazil.

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Correspondence concerning this article should be addressed to Simone Barbosa Villa, Faculty of Architecture and Urbanism and Design, Federal University of Uberlândia, Av. João Naves de Ávila, 2121, Uberlândia (MG), Brazil - 38411368. E-mail: simonevilla@ufu.br/ simonevilla@yahoo.br.

Abstract

In times of significant impact, amidst the current urban, economic, political and social crises, it is necessary to look for acting ways that can respond to it, producing quality growth as well as developing the resilience of the built environment. The main challenges are the densification of low-density suburbs, the use of appropriate building systems and materials, design and construction techniques for specific climatic zones, as well as the existing housing adaptation with the new technologies. When government housing programs attempt to address this deficit, low defined standards lead to highly inadequate housing for their inhabitants, forcing them to make changes to buildings that are not necessarily prepared for adaptation, leading to material waste and resource inefficiency. The [MORA] Housing Research Group, alongside the local community of a social housing complex, develops the research. It has a general objective to develop methodological procedures of POE and Co-production in social housing, focusing on its adaptability and resilience. For verification, the methodological procedures developed were applied in a case study at a social housing complex in the *Sucesso Brasil* Neighborhood, in the city of Uberlândia, MG. It aims to support reflections on how we can build local resilience and adaptability in preparation for major social challenges such as climate change, scarcity of resources, increases in extreme weather events, changes in demographics and so on. This article presents a focus in part of the research, turning its attention to the main results derived from the general data collection and application of the Co-production methodology regarding engagement and well-being of the local community.

Keywords: Adaptability; Resilience; Social Housing Complexes; Post-Occupancy Evaluation; Co-production

Co-Producing Resilience in Social Housing: a Brazilian Case

The Context: Social Housing in Brazil

The issues involving social housing in Brazil came from a historical background, initiated primarily in the XX century when European immigration followed by industrial development (Villa, 2010) was made visible. This process came accompanied by a fast increase in population and urban growth. From these phenomena, Brazilian cities experienced new challenges, and providing houses for low-income people was one of them. Therefore, since 1950´s several federal social programs have been adopted in order to overcome the housing deficit (Villa, Saramago & Garcia, 2015).

One of the first attempts of substantially reducing the housing deficit was the creation, in 1964, of the National Habitation Bank (BNH) that was responsible for the production of almost 5 million housing units during a period of 20 years (Valença & Bonates, 2009). However, in 1974, with the petroleum crisis', the production suffered from a slowed down economy, becoming more focused in assisting the middle and high social classes, primarily because the financing resources were not coming directly from the state anymore. By the end, the program did not execute its initial aim of reducing the housing deficit, lacking proper public politics as well as delivering low-quality projects. After BNH's extinction in 1986, the federals programs of social housing suffered a large discontinuity with a low rate of planning and investment towards housing policies.

In 2008, however, the political and economic scenario changed, intending to decrease the impacts of the international economic crisis. Consequently, the federal government adopted measures that made possible the maintenance of credit, allowing investments in infrastructure to sustain the more affected areas (Cardoso, Aragão & Araújo, 2011). Then, in March of 2009, the Brazilian Government, in partnership with the private sector, introduced the program Minha Casa, Minha Vida - MCMV ("My home, My life" in literal translation). A responsibility of the Caixa Econômica Federal (Federal Bank), the program aimed was to improve the national housing scenario and combat the housing deficit – around 6 million according to IPEA (Institute of Applied Economic Research). The program assists the

population within two income brackets, divided as income bracket 1 – social housing (0 to 3 minimum wages), and income bracket 2 – medium-income (until 10 minimum wages), as follows (Figure 1).

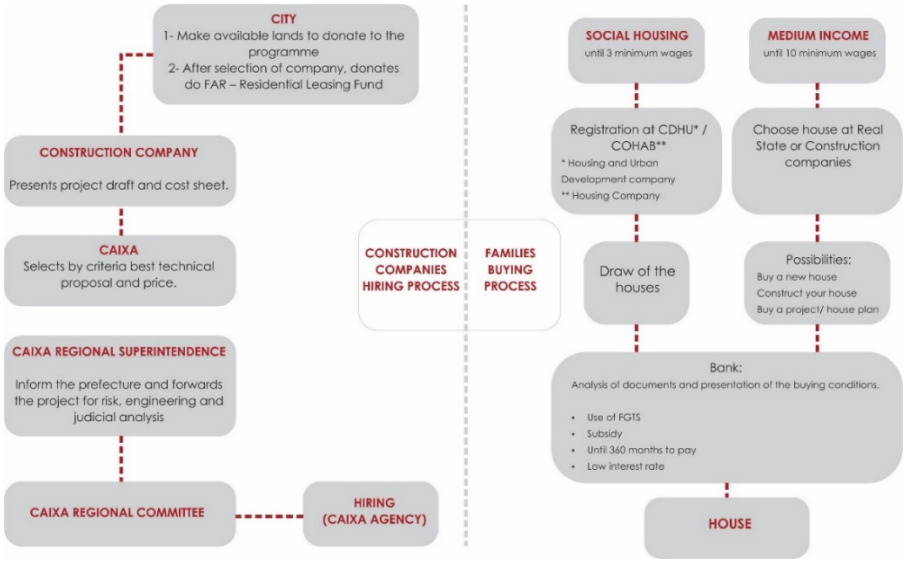


Figure 1. MCMV Program Functioning. Taken from: "Method of analysis of the Resilience and Adaptability in Social Housing Complexes through Post Occupancy Evaluation and Co-production" by S. B. Villa et al. 2017. Research Report. Copyright (2017) by MORA. Reprinted with permission.

Even after ten years from the program launching, the housing demand still grows. According to the João Pinheiro Foundation (Bohm, 2018), recent data (2015) shows a housing deficit of about 6,3 million. However, if we look at the qualitative housing deficit, the numbers are even more significant: representing around 11,3 million families living on inadequate housing.

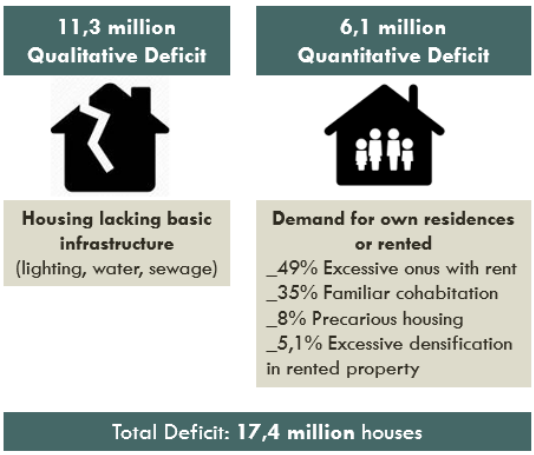


Figure 2. The Brazilian Housing Deficit numbers. Adapted from: "Minha Casa Minha Vida não reduziu deficit habitacional, afirma estudo", by T. Bohm, 2018, Retrieved from https://www2.senado.leg.br/bdsf/bitstream/handle/id/538499/Cidadania_622.pdf?sequence=1. Copyright by Jornal do Senado. Adapted with permission.

From 2009 to 2016, the MCMV program delivered 1,2 million units according to the Cities Ministry. However, the lack of quality of what was produced (low-quality architecture; inefficient infrastructure; lack of urban integration; standardization of the housing units) remains as a current problem (Tramontano, 1993). Furthermore, the spatial and social segregation from the allotments location on the cities' outskirts, due to economics forces and land price, indicates a profit-led design practice that reinforces the social vulnerability of the lower classes affected. (Maricato, 1999; Villa, Oliveira & Saramago, 2013).

More than 2400 researches debate the struggles of Minha Casa Minha Vida, not only verifying but also proving the number of problems brought alongside the program's launching. Major parts of these problems are not assessed since these researches have a limited influence on the design practice and production of these houses (Kowaltowski, et al., 2018). However, through the resilience optic, it is possible to minimize those factors and start a positive change in the housing units of the MCMV program. On the recommendations established by UN-Habitat – World Cities Report 2016, resilience is the way to combat the vulnerable state caused by the fast developing process and growth of the urban centers, mainly in small and medium cities with less than a million inhabitants.

The focus of this paper is to present a research-in-progress, developed by [MORA] Housing Research group. The analysis focuses on exploring knowledge about social housing complexes identifying aspects to improve in future projects through advanced Post-Occupancy Evaluation (POE) and Co-production techniques. This paper focuses on community engagement and well-being aspects through the application of Co-production techniques. The partnership between academics and non-academics can encourage an empowerment and engagement environment, in order to achieve a positive level of local resilience of these social housing complexes.

Understanding Resilience and Co-Production

Resilience has been placed as an answer to growing problems and needs, due to its basis in ecology and the understanding of complex systems (Davidson et al., 2016). The term is considered as a boundary object, as it acts interchangeably between several areas of knowledge and their interfaces (Meerow & Newell, 2016). Therefore, when it comes to covering the complexity of urban systems, resilience has found its popularity, becoming an essential goal in city planning, especially in the case of environmental disasters and climate change (Meerow, Newell & Stults, 2015).

New urban agendas, dealing with climate change and disaster risk reduction, place resilience as its action driving force. Recommendations established by UN-Habitat - World Cities Report 2016, place resilience as a way of combating the vulnerable state provided by the rapid growth of urban centers, especially in medium and small cities with less than one million inhabitants, considering that its population represents 59% of the world's urban population. The City Resilience Index, which has given rise to the 100 Resilient Cities project, seeks to restore urban balance in 100 cities from the concept of resilience and actions planned to start this optic. Besides, Goal 11 of the SDG Indicators affirms the need to make cities and human settlements inclusive, safe, resilient, and sustainable.

The Resilience Concept

The term Resilience comes from the Latin term *resilio*, which means "to recover" (Meerow, Newell & Stults, 2015 Apud Klein, Nicholls & Thomalla, 2003). Its primary connotation is associated with engineering, being considered as the property that causes an object to return to its original state after being distorted by a force. Already in the 1970s, a more ecological perspective of the term, considered as the origin of the modern definition that we use, arises with Holling (1973), defined as the capacity of a system to absorb, and even to benefit, of incidental impacts, without the system suffering permanent damage in its structure or functioning.

Therefore, the traditional concept of resilience is usually associated with the ability of a system to absorb disturbances and reorganize when subjected to change, while being able to maintain its essential functions, structure, identity, and mechanisms (Walker et al., 2004; Thackara, 2008). However, applying

the concept of resilience in different contexts requires answers to the following questions: Resilience to whom and for what? When? Where? And why? (Meerow, Newell & Stults, 2015).

This research considers Resilience as the capacity for adaptive recovery in the face of diversified impacts, from a physical, environmental or social order. It uses a positive and evolutionary definition of social resilience, established by Maguire & Cartwright (2008). This definition identifies the capabilities and adaptability that a community can use to overcome the problems that can result from change, building on its inherent capabilities, rather than relying on outside interventions to overcome vulnerabilities. Thus, social resilience is the ability of a community to deal with disorders or changes and to maintain adaptive behavior. It has economic, political, spatial, institutional and social dimensions (Adger, 2000).

Co-production

From the Resilience concept established above, we seek evaluation methodologies with unconventional approaches that consider other components of the evaluation - not the physical measurement of the constructed environment, but those that deal with the different perceptions of the characteristics that interfere in the users' behaviour - through the use Co-production (Petrescu, Petcou & Baibarac, 2016; Trogal & Petrescu, 2015). Collaborative practice is an important tool for the positive transformation of project practices. To do so, the implementation of shared social actions in a community function as a key element for the system resilience at the human scale level (Petcou & Petrescu, 2015). For that reason, understanding and recording how the adaptation movement occurs within a specific set of social housing will provide a rich substrate for consultation and evolution of the resilience concept, providing various social actors with current, reliable and relevant material to support their endeavors.

The field of architecture and planning already presents a great tradition of participatory practices, understanding them as a collective action in providing the citizens' right to the city (Trogal & Petrescu, 2015). In this manner, Co-production is currently seen as an economic and social solution to current problems, since it places the need to involve the community in the provision of public services, in a context in which these services have already become ineffective and need to be restructured, and where state is no longer present to provide them (Petcou & Petrescu, 2015). The practice emerged as a reaction

to a social, political and economic context in which the public administration does not respond in time to the urban demands, which are constantly becoming more complex.

Consequently, Co-production is a collaborative action technique that treats the researcher as a facilitating element in the process of production and space management by the users involved. Here, the researcher's mediation (researchers, architects, planners) allows for more partnerships and broader and more effective community participation. The projects, rather than merely seeking a specific result of a physical transformation, can, during the process, contribute to the social and political emancipation of the users working in this space.

The group has gone through six co-productions, exploring the use of maps, presentations, conversations in order to identify the main problems, and from where to intervene. It is expected that this collaborative work among residents and academics can increase the social capital of neighborhoods, contributing to social learning through collaborative research processes and products (Stevenson & Petrescu, 2016).

Co-Producing Resilience: a Methodology

This work is part of a research composed of three stages, utilizing both quantitative and qualitative research methods in order to understand the environment and behavior complex problems. All three stages have as the principal object of study the Housing Development Sucesso Brasil, located in the city of Uberlandia: (i) Stage 1 – EVALUATING. A general survey of the area (Data Collection), along with Post-occupancy Evaluation research (APO), performance analysis and diagnosis. Beginning of Co-production activities with the community with indicative for the following stages (developed during 2016/2017, financed by Santander); (ii) Stage 2 – ACTING. Start of Co-production focusing on a housing unit of a specific block in the study area (2017/2018); (iii) Stage 3 – EMPOWERING. Co-production consolidation, focusing on the housing unit of a specific block in the study area. Population takes over the actions (2018/2019).

Stage 1 provided a multi-methods approach through Building Performance Evaluation (BPE) tools (Leaman, Stevenson & Bordass, 2010). After its initial physical data collection phase, customized

social POE tools were developed, collecting in-depth information with Questionnaires, Walkthroughs and Co-productions. The initial Co-production sessions provided opportunities to further investigate, during stages 2 and 3, aspects revealed by other tools.

This present research project deals with stages 2 and 3 related to the actions of Co-production in the study area for the implementation of resilience and adaptability. The research will focus on the adaptability and resilience of the built environment in meeting the needs of its residents and the environmental impact resulting from these ongoing transformations. For verification, the techniques developed of Co-production will be applied in a case study located in the city of Uberlandia, Brazil.

The Co-production will focus on three elements: (i) BUILT ENVIRONMENT - an edified set contemplating the neighborhood scale, neighborhood relationships and unit scales, and the related impact on built and natural environment relationships; (ii) AGENTS - agents that interfere in the social dynamics of the place; (iii) USERS - residents of the development.

In order to meet the proposed objectives, the following stages are carried out: (i) bibliographic research - theoretical foundation and definition of terms and concepts used; (ii) exploratory research - collection of data and information from the study object and (iii) empirical research - development and application of Co-production in a case study.

Objective

Its primary objective is to implement and enhance the resilience and adaptability of social housing developments through Co-production techniques. The research-action will focus on the adaptability, transformation, and resilience of the built environment in meeting the needs of its residents and the environmental impact resulting from these ongoing transformations. For verification, the techniques developed will be applied in a case study in the city of Uberlandia, called "Shopping Park" neighborhood.

Assessment Matrix

The research considers the Resilience of the built environment as a positive factor, directly linked to the concepts of sustainability, vulnerability, and adaptive capacity. Accordingly, it uses a Matrix of

Assessing the Resilient System, giving continuity to a database previously raised and to the process of investigating indicators of resilience. The Matrix considers the following concepts:

- RESILIENCE ATTRIBUTE – objectives that the built environment must pursue in order to achieve resilience
- RESILIENCE INDICATOR – derived from the analysis of factors identified as important to enable urban communities to recover from shocks and stresses. Together they make up the "immune system" of the built environment
- IMPACT – impacts, shocks, and stresses identified in the system associated with the resilience attribute
- RECOMMENDATION FOR RESILIENCE – actions or strategies that favor the resilience of the system
- PARAMETER – information/reference on which the recommendation

From the incident impacts on the community - vulnerabilities or adaptive capacities - we have identified resilience indicators, grouped in great attributes that can combat these impacts, characterizing the environment as resilient. As a consequence, action strategies (recommendations) are identified, based on established parameters. The Matrix of Assessing the resilient System is composed of the respective attributes: 1. Adequacy to Climate Change; 2. Environmental Adequacy; 3. Well-being; 4. Engagement; 5. Accessibility; 6. Flexibility.

The present research will focus on the results from the perspective of two attributes, considered essential to understanding, through collaborative practice, the relationship between resilience and its impact on the built environment. The attributes are, as follows: (i) Well-being: the strength of an individual's relationships and how they work within the community and the built environment; (ii) Engagement: active participation in subjects and circumstances, having a direct and demonstrable impact on productivity and performance, which lead to results - especially in Co-productions (Schaufeli & Bakker, 2003; Anderson et al., 2016).

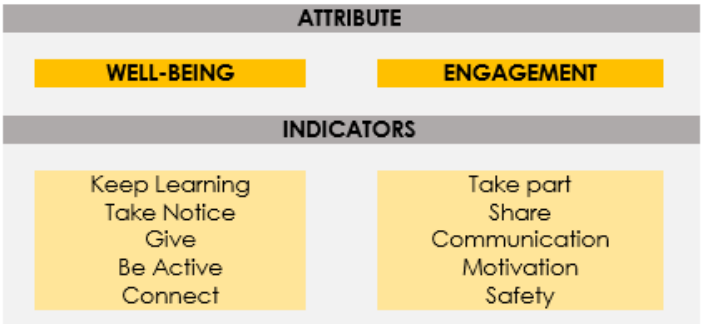


Figure 3. Well-being and Engagement Indicators. November, 2018.

Case Study: The *Sucesso Brasil* Neighborhood

Sucesso Brasil ("Success Brazil" in literal translation) is one of the allotments of the Shopping Park Integrated Neighborhood, located south of Uberlândia city at Minas Gerais State, in Brazil (Figure 4).

The following allotments compose Shopping Park: Parque dos Ipês, Shopping Park I and II, Gávea Sul, Parque dos Jacarandás I and II, Residencial Xingú, Tapajós, Sucesso Brasil, Vitória Brasil, Villa Rea,l and Villa Nueva. These allotments were the first site of the city destined to the production of over 3000 housing units from the Minha Casa Minha Vida program, within the income bracket 1 (0 to 3 minimum wages) during the 2010-2013 period.

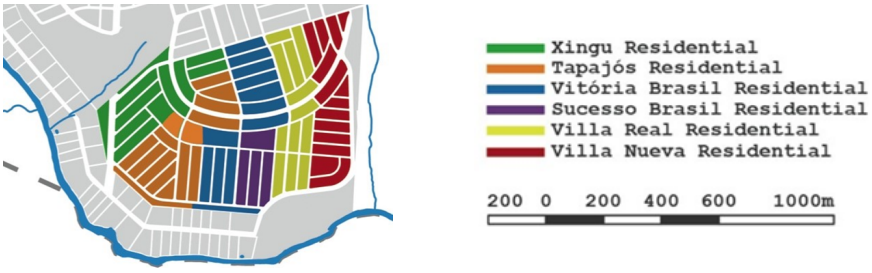


Figure 4. Sector, Neighborhood and Allotments Division. Adapted from: "Method of analysis of the Resilience and Adaptability in Social Housing Complexes through Post Occupancy Evaluation and Co-production" by S. B. Villa et al. 2017. Research Report. Copyright (2017) by MORA. Adapted with permission.

Sucesso Brasil (Figure 4) is composed of 141 housing units. It was chosen as the case study due to its surrounding dynamics: proximity with the main leisure facility of the neighborhood, The Centre of

Unified Arts and Sports (CEU), as well as its close relation with the Uberabinha River, a green area of permanent preservation.

The current neighborhood scenario (Figure 5) has been showing since its establishment clear constructive, environmental, economic and social problems. It serves as proof of the project inefficiency, failing to provide housing of quality according to the original goal of the MCMV program.

Figure 5. Sucesso Brasil Allotment Housing Units. Taken from: "Method of analysis of the Resilience and Adaptability in Social Housing Complexes through Post Occupancy Evaluation and Co-production" by S. B. Villa et al. 2017. Research Report. Copyright (2017) by MORA. Reprinted with permission.

Working with the Community: Co-Production Results

At this stage, the group has experienced six sessions of Co-production and one Collaborative Action with the dwellers of Sucesso Brasil. As in Figure 6, the first three sessions were part of Stage 1 of the research. For the research in course, Stages 2 and 3, the group managed to assemble three other sessions of Co-Production along with the Collaborative Action.

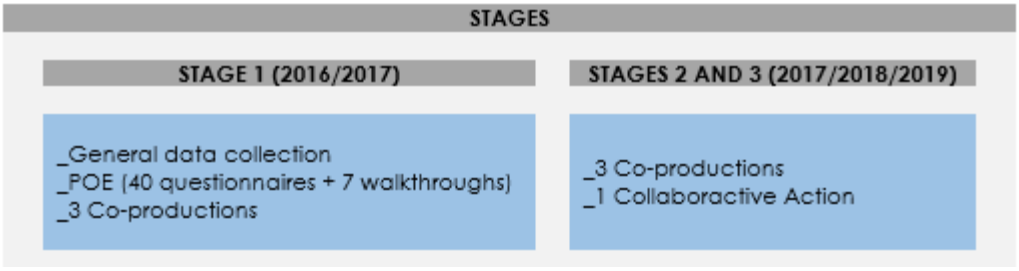


Figure 6. Research Stages Overview. November, 2018.

The Co-productions

The Co-productions during Stage 1 (Figure 7) had as main objective to identify the major vulnerabilities and potentialities of the site according to the residents, as well as acting as a first approach between the research group and the local community. The meetings were realized at the CEU (Figure 8), and contact was made through personal visits or via social media, since 87,5% of the residents had cell phones, and 72,5% of the cell phone users, used it to access the internet.

CO-PRODUCTIONS - STAGE 1

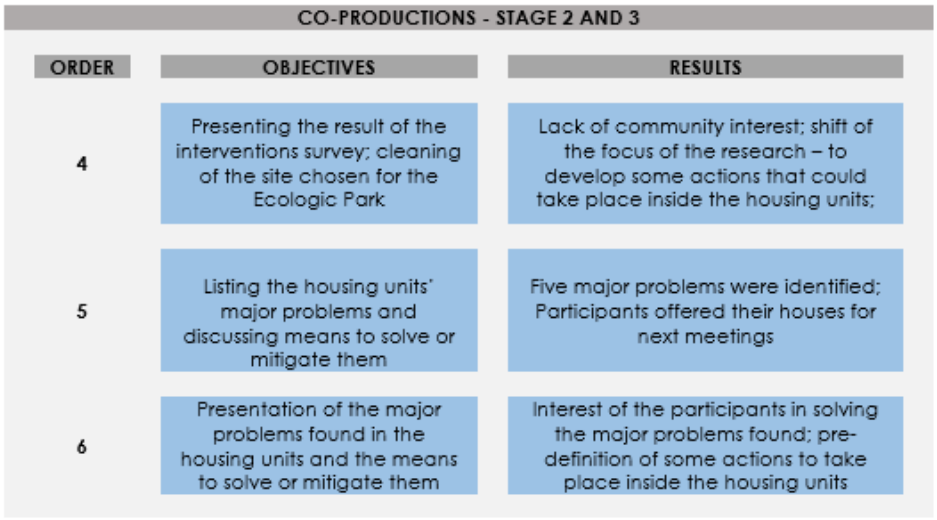
ORDER	OBJECTIVES	RESULTS
1	"Collective Coffee" – presenting the project to the community	Drawings and a map containing the reflections of the residents about the place they live; Definition of a name to identify the project: *Renova Shopping Park* ("Renew Shopping Park")
2	"I Meeting Renew Shopping Park"- finding positive and negative aspects of the neighborhood	Drawings and a map containing the potentialities and problems of the neighborhood
3	"II Meeting Renew Shopping Park" - election of four possible interventions to improve the neighborhood	The residents chose the construction of an Ecologic Park as an intervention to be implemented in the neighborhood

Figure 7. Co-productions Stage 1. November, 2018.

Figure 8. Realization of the first Co-production. October, 2016.

Co-productions during Stage 2 (Figure 9) had a shift in the actions' focus from the urban scale (neighborhood area) to the housing unit scale, due to the lack of participation/interest of the local community. By focusing on the housing problems, the residents became more interested, especially by

focusing on constructive and design problems and how they could be solved. Through a matrix of five main problems, some courses of action were decided together with the residents, a fact that showed positive effects with more participation in the next Co-productions. In this phase, the meetings were realized both at the CEU and a Residents' house, seeking more proximity to the community.



CO-PRODUCTIONS - STAGE 2 AND 3		
ORDER	OBJECTIVES	RESULTS
4	Presenting the result of the interventions survey; cleaning of the site chosen for the Ecologic Park	Lack of community interest; shift of the focus of the research – to develop some actions that could take place inside the housing units;
5	Listing the housing units' major problems and discussing means to solve or mitigate them	Five major problems were identified; Participants offered their houses for next meetings
6	Presentation of the major problems found in the housing units and the means to solve or mitigate them	Interest of the participants in solving the major problems found; pre-definition of some actions to take place inside the housing units

Figure 9. Co-productions Stage 2. November, 2018.

The main problems identified – also validated by the residents themselves – were a poor acoustic performance, lack of green areas and high rates of soil sealing, waste disposal, poor thermal performance, and storage difficulty. The participant residents showed great interest in the project development and even offered their houses as a possible location for future meetings.

As mentioned earlier, the sixth Co-production took place inside the house of a dweller of Sucesso Brasil. This session was destined to present the five major problems identified together with means to solve or mitigate them. The actions proposed by the research group were: the extension of the shared wall to reduce the acoustic problem; the planting of vegetation to increase the green areas in the housing units and to reduce the rates of soil sealing; a compost workshop with the dwellers to reduce waste disposal; the production of a Tetra Pak ceiling to increase thermal performance and the production of storage furniture with recyclable materials to reduce the storage problem. Eight dwellers went to the meeting and presented

their view on the housing problems, providing an exchange of knowledge between the group, as well as showing their approval of the solutions proposed.

A Collaborative Action

Following the results mentioned above, the research in partnership with another research group assembled a Collaborative Action to plant seedlings (Figure 10). The main factors reasoning the action choice were: (i) The search for more residents participating in the project; (ii) Complaints voiced during co-productions in regards to the lack of green areas in their residences; (iii) 87.5% have some plant in their residence, but 60% still feel the lack of landscaped areas; (iv) 47.5% produce some food at home (vegetables, fruits...).

During the questionnaires application, the residents were asked to participate in the action, leading to ten selected houses from the Sucesso Brasil allotment to host the action directly inside their lot or at their sidewalks. The seedlings included medicinal, fruitful and decorative plants. The action showed itself successfully, as the action taking place directly at the housing units sparkled the interest of other residents, resulting in more than ten houses participants. As a result, there was an increase in the level of interest towards the project, allowing the group to name some essential leadership inside the community, to engage in future actions.

Figure 10. Collaborative Action. June, 2017

This action resulted in a closer relationship between the research group and the community, making it possible to identify, associated to the information raised through the POE and data collection, some key information regarding the attributes of Well-being and Engagement.

The lack of adequate leisure facilities (57,5% of the residents lack leisure moments mainly due to precarious infrastructure), as well as a proper space for flourishing at home lead the residents to a high number of changes in their residence, in order to adequate their needs (98% of the residents made some alterations to the original house project). These numerous changes indicate a lack of feeling of belonging, of being part of the community, which leads to a low level of Engagement in the overall activities of the neighborhood.

In addition to that, the lack of safety (50% feel unsafe in their residences), prevents a more significant experience of the local surroundings, good relation within neighbors and it configures a major physical aspect of the place, in which all the residents construct walls around their houses as soon as they can financially afford. In this sense, Co-production presented itself as a positive element, being the start of these connections between neighbors, allowing the growth of a feeling on safety led by the trust in the research group, and increasing the participation of residents in overall activities.

Regarding Well-being, although the site presents clear characteristics of a deprived neighborhood with low schooling and income level (30% have not complete middle school, and only 15% completed High School), the residents present great awareness towards education and constant learning as a key to a better future. Residents voiced their interest during co-productions in further developing their education, especially in order to be able to construct and make changes to the residences' design properly. Also, they present a certain level of environmental awareness towards, understanding the importance of green areas and waste recycling (65% recycle their waste), although the later mainly occurs due to economic reasons.

It is clear that the collaborative action at a human scale, on a local level, can improve these residents inherent capacities, in order to guarantee positive outcomes from the changes they do to their homes, as well as providing a greater sense of community.

The next step

The present research has as the next step a Co-production with focus on the improvement of the residences from the external areas called "My green backyard" (Figure 11). The action emerged as an answer to the lack of green areas and high rates of soil sealing problem mentioned. Furthermore, besides

promoting resilience at a local level and empowering the community, it seeks to: Promote the importance of green spaces (garden, vegetable garden, among others); Provide the possibility of an income source; Provide facility for future house extensions, aesthetic improvement, and reorganization of space. This Co-production will investigate whether, from the sharing of technical knowledge and resources required for the action, a greater resilient character is obtained, enabling the residents to maintain their residences effectively, promoting well-being through an engaged community.

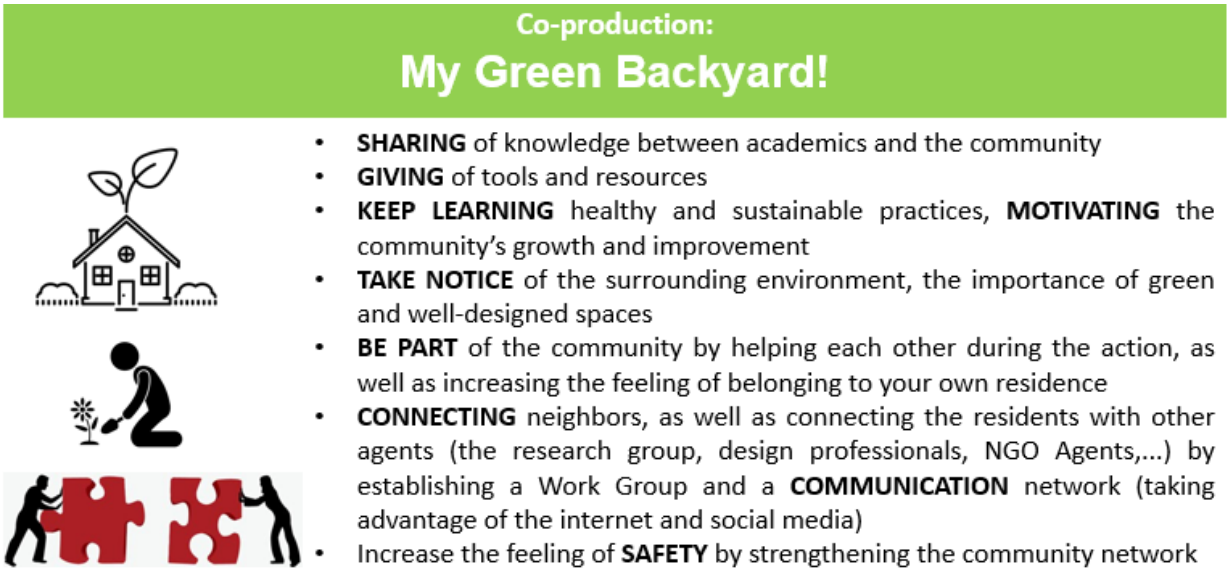


Figure 11. Action objectives through the attributes optic. November, 2018.

Conclusion

The present work highlighted partial results of the Co-production methodology application relating to specifics attributes of the Matrix of Assessing the Resilient System – Well-being and Engagement – and its relation to the built environment. Despite all the adverse impacts experienced by the residents, they keep adapting and seeking alternatives to improve their built environment. However, this is only partially resilient since little is done to develop genuinely sustainable and replicable solutions, due to the residents being restricted in their ability to overcome fragilities in a palliative way. By applying Co-production techniques, it was possible to confirm the collaborative practice role as a key to resilience, improving the residents' take of action through the guidance and exchange of knowledge from the mediators of the research group. This experience can promote a real and practical difference for Brazilian

residents and protect the future by providing detailed guidance for the most adaptable and resilient housing project in a local context, as evidenced by this study.

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