



## THE APPLICATION OF GEODESIGN IN A BRAZILIAN ILLEGAL SETTLEMENT

PARTICIPATORY PLANNING IN DANDARA  
OCCUPATION CASE STUDY

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### ABSTRACT

*The paper discusses the results of the application of Geodesign framework proposed by Steinitz (2012) in a case study of an informal settlement in Belo Horizonte, capital of Minas Gerais, Brazil. The local plans that promote illegal settlements urbanization were proved inefficient in terms of time required to produce results and limited involvement of locals. In order to find an alternative planning strategy, the municipality decided to test the Geodesign method, due to its interdisciplinary structure combining design technologies, geographic information system and shared common language and visualization tools to engage stakeholders. The workshop considered all the stakeholders involved in the case and produced a co-created project, where all the actors participated actively. Dandara occupation is considered one of the biggest planned illegal settlements in Brazil, but the people are still living in precarious conditions. After only two days of intense workshop, an agreement has been reached: the plan appeared more simplified, responding to the real needs of Dandara people in accordance with the local rules. The next step, that is the main focus, is to promote another Geodesign workshop, now involving Millennials in a workshop for the same scenario. The main goal is to test the methodology and the tools with different participants and compare the results of academic workshop with the real one that had involved the residents. Can the Millennials understand properly the problems of the area and produce coherent proposals for this reality? What is the role of web-based technologies to support decision making in informal settlement issues?*

### KEYWORDS

*Geodesign; Participatory Urban Planning Informal Settlements; Geotechnologies*

## 1 INTRODUCTION

Brazil can be regarded as an urban country since the 84.3% of the Brazilian population is concentrated in urban areas that represent only the 1% of the whole territory (Farias et al., 2017). That explains why nowadays the majority of Brazilian problems are linked with urban contexts, where the right of housing is the most important issue in this debate. Housing deficit - that measures the shortage compared with the totality of houses in a area - in Brazil is constantly worsening: as shown by the data, it moved from 9% in 2014 to 9,3% in 2015 (Pinheiro, 2018). So it's clear that housing and city access are not already rights for everybody. That is reflected in a uncontrolled and segregating urbanization.

Belo Horizonte original urban planned was following the modernist models of that architecture that revealed, right from the beginning, its weakness that resulted in the first informal settlements. This phenomenon reflects the lack of facility to access to the formal city. Since the 1970s, with a major boost to the industrialization, a big social and demographic transformation occurred in Minas Gerais State bringing an intense urban densification (Monte-Mor et al., 1994).

"Favelization" process was a consequence of these events and further exacerbated by the inappropriate low-income housing policy, a strong interference of the private enterprise sector in the social housing market and a general rising in land prices.

Although, from the 1970s until today, the housing policies have taken some steps forward, the situation is not really improved: the housing deficit in the RMBH (Metropolitan area of Belo Horizonte) increased of 53883 from 2011 to 2014 (FJP, 2018). Consequently, irregular settlements in urban areas represent an alternative and solution to such denial of right. The paper's case study is part of this context. *Dandara* informal settlement was created in 2009 in the prime district of Pampulha in the North region of RMBH. It's considered the largest organized and planned occupation in Brazil supported by various sectors of society (Soares, 2013) but they are still waiting for the urban and juridical regularization. Nowadays the legal instrument for irregular settlements urbanization is the Global Specific Plane (PGE), which sets out the development guidelines and defines the hierarchy of the interventions to be implemented. It became mandatory, since the 1990s, for that *vilas* and *favelas* which had earned the Participatory Funding (OP) and the necessary financial resources for the PGE implementation (Conti, 2004).

The ones with the powerful and organized political leadership could be more successful in obtain this right: that was *Dandara's* case, although it was considered a young settlement. The PGE instrument represented an historical turning point in this matters but it has represented some failure in the applicative and methodological aspects. According to Conti (2004) the PGE's weak points are: lacking of feedback among the steps of the process, shared agreement between the actors but unfulfilled at the end, superficial knowledge of these issues, inflexible methodology that cause rise in prices, high people expectations and the difficulty of implementation caused by administrative and technical obstacles. These facts produce tensions between public powers and users, and scepticism among the communities about new proposals. Consequently there is the need of a new urban planning methods and more participatory approaches, fast and so cheaper and efficient. Geodesign methodology aims to developing planning solution that could be applied to different scales. Steinitz's (2012) framework is based on six models from the conceptual analysis to the design creations itself, simulation and impact assessment, with the Geographic Information System (GIS) support.

At the end of 2017, a team of the Geoprocessing Laboratory of UFMG was invited by the Municipality of Belo Horizonte (PBH) to realize the first Geodesign workshop involving *Dandara* residents to produce an Urban

Regularization Plan (PRU) (De Paula et al., 2017). The PBH had already tested this framework to another illegal settlement case, the *Maria Tereza* occupation (Zyngier et al., 2017), but the *Dandara* case has been the first application involving the people of the place to create a real upgrading project to be implemented. Residents, technicians and professionals participated to PRU's proposal through a collaborative planning, aim to obtain a coherent program with the local expectations.

This was a very new approach for the municipal plan way because for the first time included actively the population, increasing dynamism and fluency of the procedure. All this ingredients could reduce the risk of the obsolescence of the proposed plan, as this is one of the main problems for these informal areas affected by rapid changes. The residents participated in the production of proposals along the decision-making process, from the analyses to the final shared plan.

This will attend all participant needs and make the Municipality able to play its role of democratic director of the city, respecting what is stated in the City Statue (Federal Law 10.257/2001<sup>1</sup>). The PRU has reached a final agreement after only five months from the workshop (March 2018) demonstrating the rapidity and efficacy of the methodology in conflict's resolution in urban regularization cases.

This paper discusses another workshop applied to *Dandara* case in April 2018, but in this case was an academic experiment involving *Millennial* - young born between 1980 and 1994 - totally from the architecture and urbanism field of study.

## 2 OBJECTIVE

The main objective of this experiment was to test again the application of Geodesign methodology as a participatory planning process in a social interest area. These areas are poor in basic infrastructure and fragile in social situations, so a different planning and monitoring approach are necessary. This makes this application really unique comparing with other Geodesign workshop already done that involved the formal city. The methodology rapidity could directly economize financial resources and indirectly reduce conflicts between the stakeholders, differently affected by the changes, and join them working towards a common goal. The second aim was to test the Millennial ability to understand the potentiality and vulnerability of the area using the web-based technologies.

These tools simplify the comprehension of the area and catalyze the participants' interaction promoting interoperability between the actors. So it was possible to deduce the participants' differences in terms of interaction with these platforms. The more interesting contribute was the variation of results between the young students and the occupation residents. Finally the other objective was to compare the results of this new workshop with the other one that involved the people of the place analyzing the quality of the proposals and the Millennial involvement and evaluating their creativity and innovation level. So could be possible to infer which condition and aspect influenced each project: are the cultural and social differences between the participants, their academic background and/or the insufficient knowledge offered before the workshop? It was possible to deduce it thanks to the critical posture of the technicians during the experiment and further with the final feedbacks from participants. The results of this application won't be applied in the real context because the presence of the people directly affected by the changes is indispensable.

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<sup>1</sup> Senado Federal, Law nº 10.257, July 2001. Estatuto da Cidade – Brasília, DF.

However this academic experiment has been helpful to understand the efficacy of the tools and the difficulties faced along the process, as well as the approach of Brazilian young architects in these conflicting scenarios.

### 3 GEODESIGN FRAMEWORK

The Geodesign concept has been worked and improved exponentially in recent years, but the origin of this concept is not new. For the creator of the Geodesign Framework (2012), Professor Carl Steinitz of Harvard University, the origin of the term "Geodesign" is not well defined. Some sources indicate Kunzmann (1993) as the first user of the term to mention spatial scenarios and discussion of opportunities and threats, with a view to urbanization for European metropolises (Fonseca, 2016).

For Carl Steinitz (2012) - the author of the framework - Geodesign is based on some questions and develops in a certain structure to solve complicate and relevant design problems in different geographical scale. Steinitz has created a "framework" to apply better the Geodesign concept. Its workflow is dynamic as Geodesign can be applied to any context but rarely with the same structure (Steinitz, 2012). It is essential to create a interdisciplinary team that should consider also the people of the area of application (Fig. 1).



Fig. 1: Team of Geodesign and the framework. Source: Steinitz, C., 2012

Steinitz formulated a methodological structure focused in six elementary questions that are guidelines for the entire process. To answer to each question Steinitz created six models. Each one is referred to one question for three times, along the adjustment process and are of Representation, Process, Evaluation - that represented the 'assessment' phase -, Change, Impact, Decision - that represented the 'intervention' phase (Fig. 2). Each time is called "iteration" and answer to:

- "Why?" - analyze the area of study;
- "How?" - definition of the methodology;
- "What? Where? When?" - realize the plan.

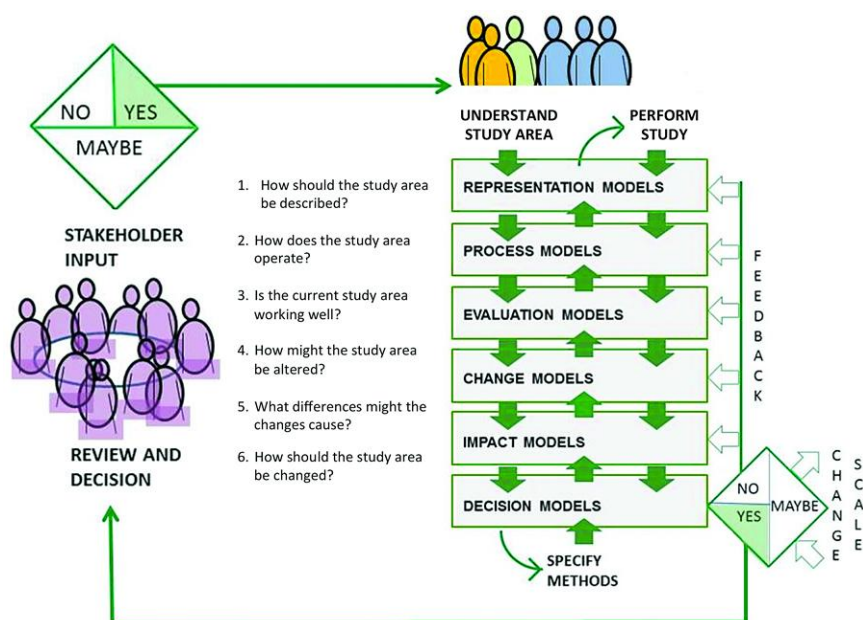


Fig. 2 Framework of Geodesign by Carl Steinitz. Source: Steinitz, 2012

The methodology is flexible so there isn't a rigid procedure for each model: the way to develop each models doesn't follow a fixed structure. The framework for Geodesign was created to realize participatory projects, involving all the actors in the process and respecting the different opinions. This methodology is totally different from the traditional and linear procedures, because, according to Fonseca (2016), in the framework is possible to return to the previous steps at any time and this doesn't represent a waste of time but a gain of knowledge for the studied area. Therefore the Geodesign method is also adaptable to the object of study. The application of this framework is becoming increasingly used all over the world and it is an evolution of the way to plan the territory, "with" and "for" it, integrating planners and social actors (Fonseca, 2016).

## 4 DEVELOPMENT OF *MILLENNIALS* WORKSHOP FOR *DANDARA* OCCUPATION

### 4.1 THE CASE STUDY

The Dandara occupation just turned 9 years. It was established in April 2009 organized by the Housing Forum of Barreiro, People's Brigade, Landless Workers' Movement (MST), Land Pastoral Commission and also received the support of the Legal Aid of Minas Gerais State and of the Juridical Assistance Service of PUC-Minas. And last, but not least, the support of architects, town planners and students of UFMG and PUC-Minas Universities to design of the urban plan in the first months of occupation<sup>2</sup> The Dandara can be

<sup>2</sup> More detailed information about *Dandara* occupation: Branco, 2014.

considered as one of the biggest land conflicts in the Minas Gerais State and has gone through many difficulties before becoming what is today.

The land is located in the Céu Azul neighborhood, in the prime district of Pampulha, in the Northern region of Belo Horizonte (Fig. 2).

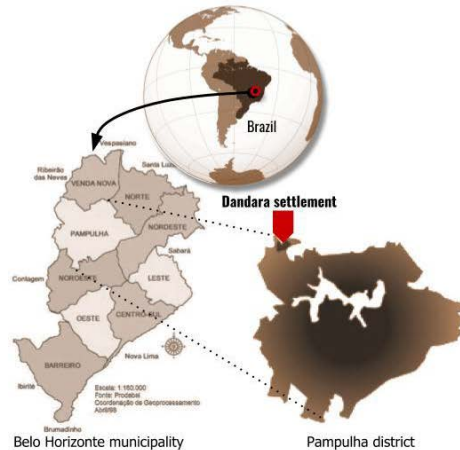


Fig. 2 Localization of Dandara occupation. Source: Authors

The occupation is close to the metropolitan borders of Belo Horizonte, Ribeirão das Neves and Contagem. The neighborhoods around the area and close to the Pampulha lake area are of middle class families. The other ones belong to lower and lower-middle classes. The occupied area is 315.000 m<sup>2</sup> large and had been vacant since the 1970s - although it is ownership of a construction company-. That's because the real estate market wasn't interested in investing there because of the legal restrictions for building and increasing the population of the area. So in this context the *Dandara's* movement began in order to give the social function to the property and obviously offer housing for those who needed. *Dandara* became well known and popular for the media and it's still under investigation by several fields of study such as social and political investigation and urban planning. The occupation and parceling plan was elaborated by a technical team together with the residents. The original plan considered collective plots to facilitate the placement of many dwelling as much as possible. But the residents insisted to receive individual plots and so the number of houses was drastically reduced. Furthermore were left free areas for future public equipments and the permanent preservation area (APP) was left unoccupied as required by federal law (Law n° 12.651/2012<sup>3</sup>). The success was so huge that new plots demand increased exponentially.

This circumstance led to the parceling of the public area and as well as the occupation of a part of the APP. Today the *Dandara* occupation has 3.336 habitants, as reported in the second census by the Developer and Housing Company of Belo Horizonte (Urbel) in 2017.

<sup>3</sup> Senado Federal, Law n° 12.651, of 25 May 2012. Dispõe sobre a proteção da vegetação nativa, Brasília, DF.

## 4.2 PREPARATION OF THE WORKSHOP

The framework application was realized with a majority participation of Millennial students of School of Architecture and Urbanism of UFMG. The workshop lasted for only 8 hours and took place in the Geoprocessing Laboratory. Before a workshop application is necessary to organize the data and the processes which has already been discussed in the chapter 3. In the "Representation Model" were gathered information about the area, which the Belo Horizonte Municipality had already produced for the previous workshop or had been deducted by the fieldwork or as well as produced by the authors. In this phase are defined the systems to describe the area. Basically these are guidelines for develop of the proposals, as they're constituted from a set of variables that characterize that area and its dynamics. The systems applied in this workshop were generic and symbolic and concerned the main issues to be discussed: History/Cultural, Agriculture, Blue Infrastructure, Green Infrastructure, Gray Infrastructure, Energy Infrastructure, Industry, Housing, Commerce, and Institution.

All these systems were adapted to the specific reality of the occupation: the Historical/Cultural was referred to their remembrances linked with the occupation or Industry considered the opportune areas for local production. The next step was the "Process Model", the variables for each system were defined and processed to understand the area dynamics. Then, in the "Evaluation Models" were produced the evaluation maps, that were used as diagnostic references by the participants during the workshop, as they show the potential areas suitable for new proposals.

## 4.3 THE DYNAMIC OF THE WORKSHOP

The workshop began with a short slide presentation about the dynamic of the experiment: a presentation of Geodesign methodology and of the area and then showing the Evaluation Maps produced by the authors explaining which variables were used to produce each one. Then the participants were divided in groups that were distinguished for the way they produced proposals for the area. This group definition became directly from the methodology author, Carl Steinitz, who promote Geodesign workshops all around the world using the same structure: the scale of the case study, the groups typology and the time frame of the two shifts.. The *Dandara* case study is the smallest scale of a totality of three different sizes scenarios. The types of groups are:

- "Non Adapter": in the proposals making phase, who belong to this group, assumes that neither the policies nor the way to plan will change in the future. So the proposals will be more reasonable and follow the current legislation;
- "Late Adapter": this group assumes that the policies won't change as well, but only in the first shift of time. In the next and last one, after the traditional version, they could begin to suggest more innovating projects;
- "Early Adapter": they propose in a forward-looking way from the beginning.

The first time frame is a near future from the present (2018-2020) to 2035. Then this first shift, will be produce a project for each group, all projected for the 2035. In the second shift the projected future is until 2050. It is in this one that the second group, the Late Adapter, begin to propose more progressive and contemporary projects, as well as the Early Adapter (Fig. 3).

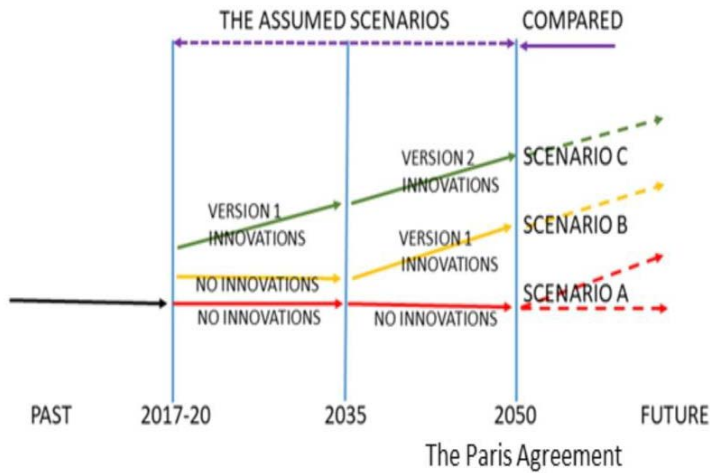


Fig. 3 Temporal logic and groups dynamics. Source: Carl Steinitz. [https://en.wikipedia.org/wiki/Paris\\_Agreement](https://en.wikipedia.org/wiki/Paris_Agreement)

These dynamic was explained during the workshop to the participants. So they start producing proposals for the Dandara occupation using the Geodesignhub web platform. This is the tool through the participant can sketch their ideas for each system. The projects are constantly synced in real time so everybody can visualize in the screen what is going to be created by the different groups. In order to support and help the decision making, increasing the understanding of the area, they can consult the Webmap tool. This is a visualization and interaction map tool via internet in geographic information system. There were the main contextual bases of the area and the evaluation maps as well. This tool aim is to pass information to support and facilitate the decision making process and it has a big potential: it takes advantage from the users' ability to use social media and internet to transmit important information that will contribute in the discussions about the space to be planned and managed. They also use the Google Earth platform where they be able to visualize satellite pictures with a better resolution (Fig. 4).



Fig.4 Pictures from the Geodesign Millennials workshop. Source: Authors

The totalities of the diagrams start appearing sequentially during the workshop. Later, all these products were examined and each group designed a project for the 2035 with their own point of view: Non Adapter (NOAD), Late Adapter (LAAD) and Early Adapter (EAAD) (Fig. 5). As they finished their first projects they were invited to have a comparative analysis between the projects, considering also the impacts. This can be done, for example, observing how much is the areas percentage for each system. As can be noted in the previous image, the traditional group (NOAD) had a lot of proposals for the Habitation system compared to the third group (EAAD) who did so much more projects for the systems related with the infrastructure, in



this case Blue and Green Infrastructure. They also didn't provide diagrams for the Energetic and Habitation systems and this can be observed in the image above as well: in the impacts chart the columns for these two systems are without representation.



Fig. 5 The first three projects for the 2035 designed in the Geodesignhub platform.  
Source: <https://www.geodesignhub.com/p/60a67109b11aa401/design/>

So each group finalized the first round with a project that better represented its concept. Later they were invited to create more diagrams but considering the long term for 2050, point out another time that the Non Adapter must continue to plan in a traditional way and the others (Late and Early Adapt) should be more progressive and revolutionary planners. As happened for the first round also at the end of the second, each group developed a new project for 2050. Finally it's the negotiation time. First, the workshop master starts present all the frequency diagrams to encourage the negotiation discussion and then the final diagrams that will create the final project. The frequency diagram (Fig. 6) reports the frequency of the vocation for each diagram, from proposal that obtained three votes - that it means that all the group voted for it - to diagrams that got only one vote - so only the group who design it vote for it. In this negotiation the diagrams with 3 votes weren't discussed collectively because everybody agreed with those ideas, and entered directly in the final project. Using the same logic the diagrams with only one vote were discarded. The proposals that received two approvals could be discussed between the participants.

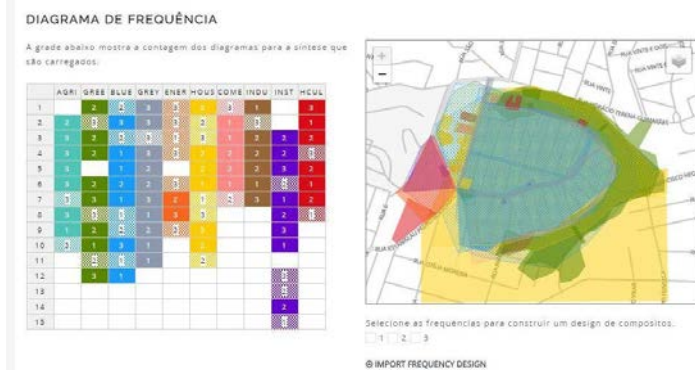


Fig. 6 Frequency chart for the 2050 projects  
 Source: <https://www.geodesignhub.com/p/60a67109b11aa401/design/>

In the negotiation, run by the master, the group who didn't approve that proposal could explain its reasons and the ones who voted for it could convince them of the proposal's relevance.

So in this case could be noted that the frequency vary from 1 to 3; this depends the number of the groups involved in the workshop. In GeodesignHub is possible to work up to ten groups, so that produces a possible frequency variation from 1 to 10 and so the negotiation become increasingly difficult, as the opinions and ideas are multiplied as well. At the end of this phase is produced a final shared project where are included the ideas and proposals created and chose by all the participants. Through the collective and collaborative work the *Millennial* co-created a pilot project of alternative futures for the *Dandara* occupation projected until to 2050 (Fig. 7).

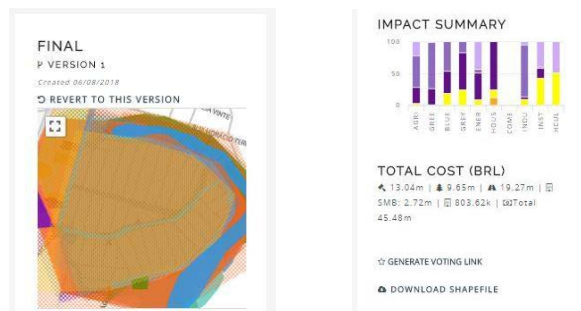


Fig. 7 The final project for 2050 and its impacts chart.  
 Source: <https://www.geodesignhub.com/p/60a67109b11aa401/synthesishistory/>

## 5 RESULTS

The Geodesign workshop with the *Millennial* was an academic experiment, the purpose of which was to compare the performance of different participants' profiles, facing a precarious situation that needs a urgent upgrading through Geovisualization technologies as support for these transformation planning. Furthermore, can be noted the participation of each member involved in the co-creation process, confirming that all the

participants play an important role contributing with their ideas and experiences to design interesting proposals coherent with the needs of the area.

Observing the Millennial contribution in this workshop, it is notable their comfort and rapidity with the offered web-based platforms, also adding the use of other sources of information - such as Google Earth or just using search engine tools - looking for more knowledge about the area or inspiration for the proposals to do. In the workshop with the local young of Dandara these different tools weren't used by the participants as support, although they were offered by the workshop masters (for more information about this workshop, consult: DE PAULA et al., 2017).

This could be explained by their deep knowledge of the area and the awareness of its problems. The Millennial who participated in the workshop were students of architecture and urbanism, so they were able to act as space planners. They started examining the contextual information to already produce a diagnostic mental map to build on these bases, so the ideas started to come up. Therefore, it's worth highlighting that their lack in knowledge of the real settlement condition was real, but despite this, they were still be able to produce interesting proposals. That can be explained by their academic background as future planners.

From the co-created projects can be observed that they answered to the basic necessities, as the occupation needs the implementation of the basic infrastructure, but, apart from this, they promoted to improve the urban quality for the residents. The most of the proposals are feasible and focused in environment, urban and community quality. The students planned projects and policies to encourage social activities, as cultural spaces; leisure centers; policies of environment education and land use as a means of production; support center for the families, children and elderly; incentives for sustainable activities.

If part of these projects and policies will be implemented, this entire region around the occupation will take advantage of this, thus creating a excellent qualified area. Reflecting on the projects of the local workshop is easy to perceive a huge difference in the proposals from the creative and qualitative standpoint. That's way the people of the place influences the decision making process so much more that the other involved actors, reducing the project to the main urgent problems to be solved. It is worth pointing out that the need of basic infrastructure takes the attention off the urban space, social activities and sustainable practices, as the real emergency to have electricity, running water, sewer system. Can be realized that the Millennial have a more developed creativity, and this is maybe because they represent a more positive generation, always have been using technological tools and they are academic actors. So it's normal that their ideas were more progressive, also highlighting that they knew to be part of an academic experiment so, although the focus was in a real area, they felt more detached from reality, and additionally there wasn't any budget to be considered. Analyzing the use of the web-based tools, can be perceived that are really useful as decision making support. More the information is complete and well explained; more will be the participant's comprehension and interest for the considered issues. The improvement in the visualization and interaction during the workshop was particularly remarkable. According to these points, the interactive map available via the web gave new channel of information, strengthening the way to make these data available to integrate the participatory planning, as in this case study just explained.

## 6 CONCLUSION

The Geodesign methodology fulfilled its role of catalyst for ideas and proposals made by a group of people with different opinion, to achieve a shared agreement materialized in a final co-created project. Can be concluded that the used platform make the decision making process so much easier.

The Geodesignhub has a good visualization and its support to reconcile consensus is undeniable. What really can't be substituted is the face-to-face debate, that's the most important moment in the negotiation phase. So it's clear that the web-based platform make a online workshop possible with dislocated participants, but the debate live contribution enriching the quality of the results so much that it is an issue that should be revised. About the quality of the ideas of the *Millennial* workshop can be observed that there are an improvement in the quality ideas especially those relating to environmental sustainability and incentive for social activities that improve the sense of community.

It didn't happen in the workshop with the locals because, as has already been mentioned in the results, the academic and social background strongly influenced the results.

The improvement of the quality of a urban regularization plan in such as urban situation, could be achieved by increasing the creativity of the people of the place, as they are no used to face this kind of mental practice. The introduction of some prearranged proposals created by planners also could be a starting point to show to the participants, especially the unqualified people, a way to create a more qualified plan that meet all of the requirements.

But this practice could be dangerous for the possibility of manipulate the people's decisions with preset ideas. Finally what makes the two experiences really different was the participation of these people: the *Millennial* couldn't have a proper knowledge of the area because they had never experiences situation like those and faced those kinds of problems.

So can be finally affirmed that the participation of the people of the place is essential in any kind of scenario to be planned, especially if it's considered the use of a participation planning methodology such as the Geodesign framework and a *favela*, *vila*, occupation scenario.

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