Experience of a Geodesign Workshop in the Metropolitan Region of Palmas, Tocantins, Brazil

Experiência de um Workshop de Geodesign na Região Metropolitana de Palmas, Tocantins, Brasil

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Lucimara Albieri de Oliveira
Doutor em Arquitetura e Urbanismo pela USP
Instituição: Professor efetivo da Universidade Federal do Tocantins, Curso de Arquitetura e Urbanismo
Endereço: Quadra 109 Norte, Av. NS 15, Campus Palmas, Bloco 01, Curso de Arquitetura e Urbanismo
E-mail: lucimaraalbieri@mail.uft.edu.br

Édis Evandro Teixeira de Carvalho
Mestre em Arquitetura e Urbanismo pela UFBA
Instituição: Professor efetivo da Universidade Federal do Tocantins, Curso de Arquitetura e Urbanismo
Endereço: Quadra 109 Norte, Av. NS 15, Campus Palmas, Bloco 01, Curso de Arquitetura e Urbanismo
E-mail: edis@mail.uft.edu.br

José Marcelo Martins Medeiros
Doutor em Arquitetura e Urbanismo pela UnB
Instituição: Professor efetivo da Universidade Federal do Tocantins, Curso de Arquitetura e Urbanismo
Endereço: Quadra 109 Norte, Av. NS 15, Campus Palmas, Bloco 01, Curso de Arquitetura e Urbanismo
E-mail: medeirosjose@gmail.com

ABSTRACT
This article reports the dynamics of the first Geodesign Workshop of the Metropolitan Region of Palmas and highlights the potentialities and weaknesses perceived during its application, in view of the regional countryside specificity. The Metropolitan Region of Palmas was created in December 2013 and is located in the expansion area of the Brazilian agricultural frontier. An area of recent occupation and with an urban network not yet consolidated. It is needed advances in public planning and management in a context of socioenvironmental weaknesses and significant changes in territorial dynamics. The workshop is part of the General Project called Geodesign Brazil: Trees for Metropolitan Regions coordinated by the Federal University of Minas Gerais, which uses the Brazilian geodesign platform entitled Giscolab. The results aim to contribute to the methodological improvement of geodesign as a co-creation tool based on applied experience, as well as to contribute to the production of knowledge of the local reality.

Keywords: Geodesign, Geoprocessing, Territorial Planning.
RESUMO
Este artigo relata a dinâmica do primeiro Workshop de Geodesign da Região Metropolitana de Palmas e destaca as potencialidades e fraquezas percebidas durante sua aplicação, tendo em vista a especificidade do campo regional. A Região Metropolitana de Palmas foi criada em dezembro de 2013 e está localizada na área de expansão da fronteira agrícola brasileira. Uma área de ocupação recente e com uma rede urbana ainda não consolidada. São necessários avanços no planejamento e gestão pública em um contexto de debilidades socioambientais e mudanças significativas na dinâmica territorial. A oficina é parte do Projeto Geral chamado Geodesign Brasil: Árvores para Regiões Metropolitanas coordenadas pela Universidade Federal de Minas Gerais, que utiliza a plataforma brasileira de geodesign intitulada Giscolab. Os resultados visam contribuir para o aperfeiçoamento metodológico do geodesign como ferramenta de co-criação baseada na experiência aplicada, assim como contribuir para a produção de conhecimento da realidade local.

Palavras-chave: Geodesign, Geoprocessamento, Planejamento Territorial.

1 INTRODUCTION
The state of Tocantins, where the Metropolitan Region of Palmas (RMP) is located, was created with the promulgation of the republic in 1988 [1] through the dismemberment of the north of the state of Goias in the central region of the country, as a development strategy the region (Fig. 1). Its occupation is recent and has expanded with a focus on agriculture and agro-industry, as it is part of the last Brazilian agricultural frontier. In the center of Tocantins, the city of Palmas was created in 1989 with the intention of being the capital of the state.

Fig. 1 - Location of the State of Tocantins and city of Palmas.

These actions triggered a process of territory reorganization, in urban functions and spatial pattern of the cities network in central Brazil, which is still ongoing and has caused profound economic, social and environmental transformations [2]. As an example, the average annual growth rate for Tocantins between 1991 and 2000 was 2.6%, much higher than the average for Brazil, which was 1.6% per year (IBGE, 1991; 2000). The rate remained above the average between 2000 and 2010, 1.8% in Tocantins, while the Brazilian average was 1.2% per year (IBGE, 2000; 2010).

In the past, Tocantins, formerly known as Northern Goias (Fig. 2), was considered an economically backward region. From the 1950s onwards, and with greater intensity after the creation of the state of Tocantins, the urban centers “started to receive functions related to the modernization of the countryside, both in grains and meats production”, as is perceived “the arrival of large national and multinational agribusiness corporations” [2]. The authors continue to point out the implementation of modern structures in retail and wholesale trade and new service provision activities, in addition to the increase in state institutions for political and administrative management and public services. Over time, and due to a certain political direction at the federal level, the creation of the Metropolitan Region of Palmas was envisioned.

Fig. 2. The image on the left shows the State of Goias before the territorial division that gave rise to the State of Tocantins. The image on the right shows the inclusion of Tocantins in the North Region.

Metropolitan Region (MR) is a region defined by State Law, formed by a group of neighboring municipalities that have strong socioeconomic and flow interactions, aiming to enable the planning and execution of integrated public policies. Complementary Law No. 14, of June 8, 1973, established the first 8 MRs in Brazil and due to the difficulties of municipal management in the face of industrialization problems and the
swelling of cities; they were concentrated in the south and southeast regions and in more developed coastal cities.

According to Barreto [4], this initial model of conducting the metropolitan fact was marked by a highly centralized administration model and, therefore, with little decision-making power from the municipal bases. The city halls were the vital and indispensable organisms for a plural and participatory metropolitan government of the units that compose MRs. Therefore, the focus of Geodesign and the Giscolab Platform is to enable municipalities, residents and other important actors within the management of public, social, political, economic and cultural policies and actions.

Batista [5] claims that there was an intensification of MRs creations between the years 2005 and 2013. The creation of more MRs was also driven by the study Regions of Cities Influence (REGIC) of the Brazilian Institute for Geography and Statistics (IBGE) in 2008 that detected the internalization of the country’s urban network. This study defines the hierarchy of Brazilian urban centers and delimits the regions of influence associated with them, differentiating them between three categories of metropolises, three categories of regional capital, two categories of sub-regional center and two categories of zone, depending on the spatial range of its influences. The level of influence is associated with the concentration of certain equipment and services, such as universities, hospitals and airports. Palmas was classified as Regional Capital B, as it still does not concentrate many facilities and services and has a medium level of attractiveness due to the low occupation in central Brazil, despite being an important regional hub.

In 2012, the government of Tocantins updated the Atlas of the state, delimiting a Metropolitan Region around Palmas defined by eleven neighboring municipalities [6]. However, this delimitation was suggestive, requiring regulation by State Law. On December 30, 2013, the Law that instituted the MR of Palmas was approved, expanding its composition to sixteen municipalities [7] (Fig.3).
Fig. 3. Demarcation of the municipalities that make up the Palmas MR according to Complementary Law No. 90, of December 30, 2013. In yellow the municipalities that were not included in the Atlas of Tocantins in 2012 [6].

Source: organized by the authors using shapes from IBGE and images from Google Earth and Wikipedia.

The objective of institutionalizing the MR, according to the State Law created, is to promote regional planning, cooperation between the three levels of government (federal, state and municipal) with the maximum use of public resources, the balanced use of the territory, the natural, human and cultural resources, the protection of the environment, the integration of planning and execution of public functions of common interest and the reduction of social and regional inequalities [7].

It is important to highlight that the federal government did not establish technical criteria for the definition of the Metropolitan Regions and delegated the competence to act to the states. The studies that supported the composition of the Palmas MR were not widely disseminated, leaving doubts as to its coherence and reasoning, since there are municipalities with fragile relations with the capital Palmas, in addition to the fact that the population growth of the municipalities that compose Palmas MR does not proved to be very significant [8].

This occurrence is not exclusive to Palmas RM. Batista [5] states that many RMs were “abruptly institutionalized, without previous studies and without groupings that support them as an entity on an urban-regional scale”. The author goes on to affirm that this has become a subterfuge to access a larger amount of resources to be applied in road, water, housing, public health and educational facilities, among others.
The first metropolitan regions, although full of mistakes in their planning, were equipped with technicians and received some flow of resources from the Union and, even after the end of the military government, given the economic prominence and socio-spatial polarization that they play in the urban network, continued to guarantee large investments. States with less fiscal capacity and/or medium-sized cities that are still consolidated in the Brazilian urban system and in the economic structure, however, with desires and demands for resources, diversification in equipment and services, could associate the creation of a “metropolitan region” with some possibility of access to federal resources and investments [5, p.96].

Faced with the difficulties in putting actions into practice, the federal government instituted the Metropolis Statute in January 2015 [9]. The Statute highlights some criteria for identification, organization and institution of a metropolis, such as high rate of urbanization, high demographic density, interrelationships between municipalities and the core city, among others.

The difficulty in planning and implementing integrated policies between municipalities occurs in the Brazilian context as it is not a historically experienced practice. However, in the specific case of Palmas MR, there was little action towards planning and managing the metropolitan region after its establishment. Possibilities and opportunities in planning and management are faded due to weak relations between municipalities in the unconsolidated region. In this sense, Soares & Barreira (2018) defend the revision of the Law of Palmas MR in order to adapt it to the Statute of the Metropolis, since it was previously approved to this.

2 METHODOLOGY

Territorial planning processes have advanced with the advent of technology, especially with the possibility of incorporating georeferenced information and data generation tools and programs from the crossing and manipulation of this information. The Geodesign approach has been developed as a territorial planning strategy, collaborating both in completing an intermediate planning scale and in co-creation throughout its process [10] (Fig. 4).
In the Brazilian context, co-creation has a fundamental role in the planning process, since the Federal Constitution of 1988 defines the participation of citizens in actions that are of collective interest. The articles dealing with urban policy were later regulated by the City Statute (Law 10.257 / 2001), corroborating the mandatory social participation in the preparation of the Municipal Master Plans.

This article reports the experience of co-creation using a Geodesign tool developed through a doctoral thesis at the Federal University of Minas Gerais. It was a pilot experiment in an academic environment with the intention of inducing to broader situations involving public administration in the near future.

The workshop is part of the General Project “Geodesign Brazil: Trees for Metropolitan Regions” coordinated by the Federal University of Minas Gerais (UFMG), which uses the Brazilian geodesign platform called Giscolab [12]. The workshop was applied in thirteen Brazilian Metropolitan Regions. The UFMG Group generated the basic thematic maps, inserted them on the Giscolab platform and defined the steps to be followed.

O workshop da RM de Palmas was coordinated by a group of professors with the participation of undergraduate and graduate students from the Federal University of Tocantins. The team was divided into two groups: Group A and Group B, working in separate virtual rooms and, at the end of each stage, the groups shared and discussed the results. The workshop was applied in four stages:
1) Reading enrichment stage. At this stage, the groups read the basic thematic maps built by the UFMG team in order to contribute more information and / or confirm the existing information. The maps were constructed from data from official database, SDI (spatial data infrastructure) or collaborative platforms, depending on the availability of access. Ten themes were chosen: water, agriculture, vegetation, energy, transport, trade / industry, institutions, housing, tourism / leisure and carbon credit (Fig. 5).

Fig. 5. Layers activated on the Giscolab platform during Palmas RM Workshop.

2) Stage of propositions without innovation - non adopter. This stage consisted of proposing traditional programs and projects that public administrations usually carry out commonly. Group A worked with a temporal universe of application for the year 2035, while Group B worked with a more extended time, for the year 2050.

3) Proposition stage with some innovation - late adopter. At this stage, greater boldness was suggested in the proposals for programs and projects in relation to technological innovations. The temporal universe of each group continued to be different: 2035 and 2050. For further clarification on what would be innovation, it was suggested to use a catalog of the global assumptions of IGC and the system innovations designed for 2035 and 2050 that were prepared by IGC researchers [13].

4) Proposition stage with a lot of innovation - early adopter. The aim was to deepen the possibilities of proposing technological innovation, even though it seemed an unlikely scenario in the real context of local investments. In the end, the groups evaluated each other's proposals, leaving comments and voting for acceptance or rejection.
After the end of the workshop, the professors tabulated the results in a matrix that correlates the theme of the accepted proposals with the Sustainable Development Goals (SDGs) of the United Nations (UN). A subjective score of negative, neutral or positive impact was assigned on five scales (-3, -1, 0, 1, 3) ending in the sum of the scores at each stage of the workshop. This matrix made it possible to detect whether there are advances in achieving the SDGs as proposals with greater technological innovation are introduced and to what extent this occurs.

3 DEVELOPMENT AND ANALYSIS: GEODESIGN WORKSHOP

As there were many participants, the first meeting was divided into two groups, Group A and Group B, and all subsequent dynamics were carried out following this division. At the first meeting, the internet was very slow with everyone accessing the platform simultaneously. It was decided that each participant would make their contribution individually at each stage at another time. After each stage, synchronous discussions of all contributions were made, with the two groups together fulfilling the activities defined for each of the four days of the workshop.

- Reading and Enrichment Stage

The objective of this phase was to allow Workshop participants to use Giscolab resources to recognize the locations, cross-check and complement information that can contribute to the planning and policies developed in Palmas Metropolitan Region. Group A made 64 annotations in different locations and covering all systems present on the work platform Fig. 6. Group B made 57 annotations (Fig. 7).

Fig. 6. Annotation Phase. Group A.

Source: organized by the authors based on images from Giscolab (2021).
This phase was important for the knowledge of the Metropolitan Region area, because, according to the information presented in the introduction, the area does not have great connectivity between the 16 municipalities that are part of this area. In addition, it is a recent MR and still in consolidation, with little scientific work and knowledge produced on this territory, and few actions and documentation in the state governmental sphere.

It was possible to notice that some important information for the definition of municipal development policies was absent from the base of maps that compose the variables of the maps, such as schools, especially those of public education. A specific feature of Tocantins State is the fish farming, which was not included in the database as an agricultural category, probably because of the standardization of the platform. Therefore, the group entered this information.

Other information that the Groups considered important to appear in the database can be highlighted: the indication of the existence of municipal master plans, population contingent of the municipalities, information related to the network of cities, maps with indication of the dominant winds, in addition to updating information relating to paved roads and Environmental Protection Areas (EPAs) in addition to those existing in the municipalities of Palmas, Porto Nacional, Lajeado and Aparecida do Rio Negro. As an example, there is an important EPA in the municipality of Paraíso do Tocantins that was not included in the cartographic base. In addition, the map on historical heritage has also generated many questions about being consistent with reality, even though it was developed from a reliable database of public institutions.
Due to little knowledge of the metropolitan scale, that is, the set of municipalities and the relationships that exist between them, the reading enrichment stage was extremely informative for the workshop participants. In this sense, the importance of the platform in the construction of knowledge of reality is recognized, despite the information gaps pointed out. Such gaps originated, most of them, from official database infrastructure, produced by Brazilian institutions and in the lack of investments in organized, updated and easily accessible databases.

- Proposal steps: non adopter (without innovation), late adopter (with some innovation) and early adopter (with a lot of innovation)

The first workshop focused on proposals without innovations (non adopter). It is important to note that the group decided not to make proposals related to educational institutions due to the uncertainty of data since this map was generated from a collaborative mapping from an insecure source and that it is not faithfully portraying reality.

In the stage without innovations, we can see the continuity of traditional policies and traditional actions of local governments, such as paving roads, proposals for control and monitoring policies, energy generation and environmental protection. The proposals basically addressed improvements to roads, sanitation and housing infrastructure, land regularization, control of the urban perimeter and the promotion of trade and industry. In relation to agriculture, it was understood that the improvement of roads would have an effect on the expansion of agricultural areas and, consequently, increase investments and generate wealth. The group indicated improvements in the existing fish culture, although this category was not included in the map database. There were also proposals to expand the demarcation of Environmental Protection Areas (EPA) and investments in the recovery of vegetation in the existing EPAs, installation of photovoltaic plants and investments in sustainable tourism.

The second workshop sought to suggest proposals with some innovation (late adopter). As such, the themes expanded to include proposals for waterway transportation for passengers and cargo, incentive to permaculture, fast transportation routes between major cities with vehicles powered by renewable energy, solar highways, use of “cold” and permeable pavements, energy efficiency and control systems in agricultural irrigation structures, creation of sustainable neighborhoods and communities, forests for food, ecological corridors, use of drones to launch seeds for reforestation, wind turbines, articulation between environmental education and restoration of riverside ecosystems,
agro-tourism and assets, in addition to improvements in territorial database registration technology and health management. Other proposals that were already proposed in the previous workshop were expanded, such as photovoltaic plants, provision of social housing, land tenure regularization, urban perimeter control, promotion of fish farming and expansion and recovery of EPAs. Others were specified more precisely on the urban scale, such as the promotion of small businesses, street events and increased density with mixed use in centralities.

It was noticed that the proposals expanded significantly when the term “innovation” was included in the activity. Proposals have emerged with possibilities that are not currently considered in traditional managements. The group understood that proposals are possible to be applied, and that they would be fundamental to improve the planning model that is usually carried out today. The catalog with suggestions for innovation from the IGC's global assumptions clarified what would be considered innovation, substantially helped participants to expand their repertoires and include more proposals in several areas. In short, the number and variety of themes in the proposals was significantly higher compared to the previous stage.

The last workshop, with many innovations (early adopter), practically extended the same proposals as the previous one, using the innovations already mentioned in a more replicated way in the territory. Specifically in relation to energy generation, in addition to strengthening photovoltaic plants, wind farms have also stood out.

After the end of the work, a scoring matrix was created correlating the ten themes of the proposals in the columns (water, agriculture, green, energy, transport, business / industry, institutional, residential, tourism / leisure, carbon credit) with the 17 SDGs on the lines (1 no poverty, 2 zero hunger, 3 good health and well-being, 4 quality education, 5 gender equality, 6 clean water and sanitation, 7 affordable and clean energy, 8 decent work and economic growth, 9 industry, innovation and infrastructure, 10 reduced inequality, 11 sustainable cities and communities, 12 responsible consumption and production, 13 climate action, 14 life below water, 15 life on land, 16 peace and justice strong institutions and 17 partnerships to achieve the goal). The purple and lilac cells have a positive score, the yellow and orange cells have a negative score, and the white ones have a neutral score (zero) (Fig. 8).
The matrix result demonstrated the progress achieved when the innovations were incorporated in the proposals. The first table (non adopter) has noticeably less colored cells, that is, less diversity and quantity of proposals that are transversally articulated with the SDGs. This table reached 54 points, practically half of the table that represents the late adopter (some innovations), with 106 points. There was a slightly less expressive but significant increase from late adopter to early adopter (with many innovations), going to 134 points. It is observed in the latter more cells in purple, indicating that the proposals have deeper impacts on the SDGs.

- **Considerations about temporal universes: 2035 and 2050**

  The workshop dynamics considered two temporal universes for the proposals: 2035 and 2050. Therefore, at times, the two groups worked with the same level of innovation, but with different application periods for the proposals. For 2035 without innovations (non adopter), Group A presented 36 proposals that, as commented, indicated the continuity of traditional practices, but there was an understanding of the need for collective actions and policies involving municipalities, in addition to initiating certain advances with technologies that currently they have already been used, as new sources of energy (Fig. 9). Actions in the environmental sphere were also incorporated, such as the expansion of areas of protection of the savanna vegetation and of the archaeological and natural heritage, which still have little expression in traditional Brazilian policies.
Group B worked in a broader temporal universe, for 2050, in the scenario without innovation (non adopter) resulting in 26 proposals, considering that part of the scenario of 2035 reported above would already be implemented (Fig. 10). The proposals did not differ much from the traditional process of government policies, however, some areas indicated in 2035 continued to be the focus of the proposals, such as the need for land regularization policies, the expansion and maintenance of environmental protection areas and the creation of urban parks.

As tourism will probably be one of the industries that will grow the most by 2050, proposals aimed at controlling and regulating areas of restriction and expansion were important, seeking to maintain the sustainability of the activity and avoid creating or
encouraging predatory tourism. Finally, the indication of fragile areas where urban growth should be avoided can be highlighted.

In general, the importance of considering different temporal universes for the proposition of actions was perceived, however there was little time to further deepen the planning with this consideration. In a fast application workshop in order to cause a brainstorm, as was the reported case, the temporal universe was not decisive to achieve the activities results. It is understood that this strategy could be more effective in longer workshops with more time for detailing the proposals.

4 CONCLUSIONS AND DISCUSSIONS

Geodesign proposes a new way of doing participatory territorial and urban planning with a focus on democratic management, which strongly aligns itself with the Brazilian Federal Constitution. The first Geodesign Workshop applied to the Palmas MR was a fruitful essay so that its use can be seen in a broader and more institutionalized way, considering the various actors involved in the process. In addition, future potentialities were perceived for different work scales, such as the municipal, urban and intra-urban scales.

An expressive difficulty noticed right at the beginning of the workshop was the maps database, indicating the need for advances in data collection, in its organization and wide access. It is known that in less developed countries, this possibility is more restricted due to difficulties in accessing technologies, specialized labor and financial resources available for this, since the data must be georeferenced. On the other hand, it is a technology that is becoming more and more widespread and accessible.

Looking at an application scale at an urban or intra-urban level, this difficulty tends to deepen, since the data are not always disaggregated by neighborhoods or lots, for example. It should also be noted the difficulty of municipal governments in investing in the elaboration and updating of the database, as in the multipurpose cadaster that are generally applied in larger municipalities. In the Brazilian context, there are municipalities that do not have their own territorial cadastral base, and many have an irregular land ownership situation.

In pandemic times, the workshop was held in a totally virtual manner, which demonstrated a potential for expanding the participation of people who might not be present in the activity, or still not be able to participate in the stipulated hours. Even so, the group reported a lack of moments of face-to-face participation at specific times, such
as generating and discussing ideas, given that online discussions restricted side conversations that could be fruitful in propositions.

The insertion of the term “innovation” in the workshop led to the expansion of thinking about territorial planning in terms of future possibilities and the scope and diversity of insertion of public management responsibilities, especially in environmental aspects and in the generation of energy and alternative income, allied conservation of the ecosystem.

On the other hand, there were doubts regarding what to consider as innovation in the local context, since some technologies are already commonly used in other countries, while in Brazil, and more specifically in Tocantins, some of these technologies still seem far from reality. There are great disparities in the national scenario, with great regional inequalities, especially between the south / southeast and the north, where the workshop was applied.

In general, Geodesign, through the Giscolab application, proved to be a very promising tool for co-creation and participatory territorial and urban planning. In addition, working the workshops by inserting innovation actions will lead to reflections and advances in the way of thinking and planning the territory.
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