

The Construction of the Density, Verticality and Sustainability Indicator (DVSI) for Condominiums: A Case Study in the City of Campo Grande/MS

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Abstract: The challenge of disorderly growth and lack of planning, resulting from the processes of urban occupation in many Brazilian cities, the need to build environmentally healthy, balanced and sustainable urban spaces has arisen, as an attempt to guarantee protection of the anthropic and natural environment and the quality of life for current citizens, without compromising future generations. Academic and governmental discussions cover social, environmental and economic aspects and problems established in the urban environment in order to plan sustainable cities. Therefore, the creation of a sustainability indicator becomes an important tool to measure and understand the aspects and processes of the built environment in cities in order to contribute to the planning and actions of the various actors involved. The study presents the study for the construction of the Density, Verticality and Urban Sustainability Indicator (DVSI) for vertical condominiums in the municipality of Campo Grande, in the state of Mato Grosso do Sul, Brazil. Developed with the purpose of finding an ideal indicator of housing with quality in the public space and private condominiums. Researches were developed within the density, verticality and sustainability aspects, establishing parameters indicated by area professionals (urban planners, teachers, researchers and builders) who established different weights among the items surveyed. The variables chosen are divided into 10 items for "outside the condominium" and 10 for "inside the condominium". The study concludes that from the integrated analysis of some existing condominiums in the city of Campo Grande, Brazil, it was possible to verify their conditions in the face of the various variables of the DVSI. Thus allowing obtaining a tool to assist in the planning process, and decision-making in the implementation of condominiums in urban areas, based on the concepts of verticality, density and sustainability.

Keywords: Indicator, Density, Verticality, Sustainability

1. Introduction

In discussions about sustainable cities, there has been a need to create sustainability indicators for both the city and the built space, so that they can contribute to the decisions of planners, architects, builders, respond to the expectations of citizens, and improve the quality of life in cities.

This study resulted in the elaboration of DVSI, an indicator of density, verticality and urban sustainability in the city of Campo Grande, in the state of Mato Grosso do Sul, Brazil. It was elaborated from studies on the themes at the Architecture and Urbanism Observatory of the Federal

University of Mato Grosso do Sul – UFMS [1]. Realizing that when analyzing the city, integration and multidisciplinary are important for the generation of variables and results of the indicator. Integrating the concepts of sustainable city, density and verticality resulted in the creation of an indicator covering these three concepts with the objective of answering complex questions of urban space and the built environment and its relationship with its inhabitants and nature. This indicator is a methodological proposal that can be used as a method by other researchers or users.

Theoretical research to promote the knowledge of the

theme - density and verticalization with sustainability - observed the pioneers in this discussion, especially Le Corbusier and Jane Jacobs, Mascaró, Accioly, more recently, Jan Gehl. In other words, there are theoretical references to analyze and contextualize the city in the world, its origins in verticalization and densification.

The first impressions on the concept of sustainability began in 1972, through meetings of some intellectuals who understood and were concerned about environmental issues, politics, international economy and sustainable development. [2]

In Brazil, this theme began with the United Nations Conference on Environment and Development (UNCTAD), which took place in Rio de Janeiro in 1992, where it became known as RIO-92 or ECO-92. Researchers, heads of state and representatives of organized society from 179 countries participated in this conference, with a total of approximately 35 thousand people present, for discussions related to the environment and sustainable development for the 21st century. The great discussion perpetuated in the criticisms about the dangers of the development model portrayed in the world population, with this, we sought to create a document represented as an international agreement of actions that sought to improve people's quality of life and the environment as a whole, presented as Agenda 21¹

The Agenda 21 highlighted the importance of sustainable development, in accordance with the Declaration of the Stockholm Conference (1972), where they presented proposals for new concepts and methodological instruments for a range of actions and investigations that were based on the relationship between the human being and the environment [3].

The thought of building sustainable cities emerged through these intellectual meetings discussed about sustainability (around the 1970s). The sustainable city seeks the application of good practices in the urban environment, encouraging the use of less polluting materials, quality public transport, efficient land use and people's quality of life.

"A sustainable city is one that meets the needs of its current citizens, without depleting the resources of future generations around the world (...) of resources" [4].

"Cities are an immense laboratory of trial and error, failure and success, in city building and city design. This is the laboratory in which city planning should have been learning, forming, and testing its theories. Instead the practitioners and teachers of this discipline (if such it can be called) have ignored the study of success and failure in real life, have been incurious about the reasons for unexpected success, and are guided instead by principles derived from the behavior and appearance of towns, suburbs, tuberculosis sanatoria, fairs, and imaginary dream cities-from anything but cities themselves." [5].

Through theoretical studies, analyzing the thinking of

several national and international authors, it was possible to analyze aspects of potentials and conditions as a path in which to follow to guide the studies for the elaboration of an indicator of density, verticality and sustainability.

2. Purpose

Density, verticalization and urban sustainability are currently issues that are walking together in search of an alternative to a sustainable city. In order to have a sustainable city, it is necessary to find the ideal urban density for the city, considering several theoretical and specific aspects of the municipality. What is the ideal density? How can verticality influence the quality of life in the city? How to promote sustainability in architecture and in the city at the same time? These questions need to be answered, always examining the urban context and all urban possibilities in order to understand the way in which the city is produced and reproduced.

Urban density, therefore, is one of the most important variables for urban sustainability. We can think of controlled, limited, inclusive urban density, but we must reflect on issues of verticality and on constructive and urban aspects and study proposals that can contribute to the balance of urban and human development.

Thus, this work aims to develop an indicator of sustainability in horizontal and vertical condominiums, the DVSI, to contribute to the production of urban space, construction projects and the evaluation of essential aspects for architectural and urban projects, having the city of Campo Great as a study for that indicator.

3. Construction of DVSI

The sustainable city is currently defended as a humane and balanced city, where daily activities such as employment, school and food are close, as well as sanitation, safety and culture issues are adequately addressed.

The concept of a compact city was absorbed by the academic and technical circles linked to urban planning, as a response to the occupation of space in the face of major issues of urban life related to environmental degradation, fuel consumption and gas emissions, pollutants, urban mobility, socio-spatial exclusion, and the decay of public space [6].

A sustainable city must meet social, environmental, political and cultural requirements, as well as the economic and physical objectives of its inhabitants [7]. These characteristics are extremely linked with the so-called compact city, which is conceptualized with the concentration of use and occupation of mixed land planned in a balanced way and with high urban densities, that is, an adequate and planned use of urban land, mixing urban functions (housing, commerce, services, leisure, etc.) efficiently, together with an urban mobility system that generates a qualified connection of public transport, and consequently the incentive to use the modal on foot and by bicycle.

The compact city as the ideal city due to its sustainable

¹ The Agenda 21 is a document signed on June 14, 1992, in Rio de Janeiro, by 179 countries, the result of the "United Nations Conference on Environment and Development" – Rio 92, which can be defined as an "instrument of participatory planning towards sustainable development".

characteristics (figure 1), with housing in the form of a community, he claims that the city has to be close and experienced by its inhabitants, providing connectivity and quality of life [8].

The schematic model of urban sustainability (Table 1) presents some pillars that support and structure effective urban sustainability.

Some aspects are totally linked to the sustainable and compact city, and that are primordial factors for the implementation of this concept in cities, which are qualified density, efficient basic urban needs, social interaction, solution of housing deficits and the lack of socio-territorial

diversity, and orderly growth of the territory (figure 1).

Table 1. Defining themes for urban sustainability indicators Axes for Urban Sustainability indicators.

1	Sustainable construction and infrastructure
2	Governance
3	Mobility
4	Housing
5	Territorial planning and ordering
6	Environmental issues
7	Security
8	Services and equipment
9	Opportunities

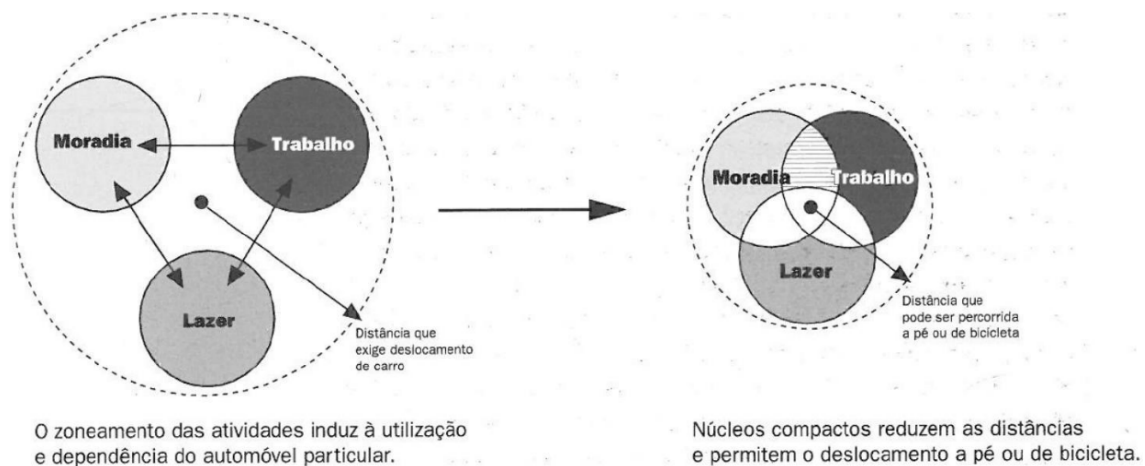


Figure 1. Compact city scheme.

“The sustainable city is based on an urban development model that promotes relatively high densities in a qualified way, that is, with adequate and planned mixed land use, mixing urban functions (housing, commerce and services.” [7].

The arguments in favor of compact cities, with a high degree of densification, as opposed to the processes of sprawl and low relative densities present in dispersed urbanization, have raised questions regarding urban densities that are not always expressed with the necessary clarity. On the other hand, definitions of urban densities are usually associated with normative recommendations in urban regulations, notably in the definition of urban indexes present in the zoning of land use and occupation. What is implicit in these two cases is the establishment of maximum and minimum density, implying, at its limit, the hope of establishing an optimal density with validity, if not universal, at least applicable in a general way depending on the capacity of the infrastructures, in particular transport ones. In an expanded context, it deals with the complementary and simultaneous themes of the congestion of parts of cities - notably their central areas - and the discontinuous and uneven expansion of urbanization over large portions of territory, themes that have dominated the urbanization process and the imaginary of urbanists and planners since the mid-19th century [9].

Analyzing the applications and tribulations of the concept of densities, it presents the following guidelines [10]:

1. Density measures must be clearly explained, as well as the objectives with which they are used;
2. The complexity of the real world and the interrelationships between the multiple variables present in the establishment of densities must be clearly explained;
3. This complexity includes the perceived densities – the perception of densities – by countless social actors, in particular by managers and planners;
4. There is no single solution (or in other words, an optimal density), but a variety of settlement, neighborhood, housing and transport solutions, based on specific configurations of needs and expectations;
5. Much more research is needed regarding the various aspects and ramifications of different types and levels of density, in particular the relationships between objective density, perceived density, and positive and negative evaluations.

“In spite of the differences between urban planners around the world, there is almost unanimity in the criticism of the dispersed city”. This reinforces the idea that *“the wide and horizontal extent of low-density land use, of which the American suburbs are the main example, is environmentally and economically unsustainable.”* [11]

The defense of the compact city model as a counterpoint to the dispersed city, because:

1. The dispersed city is the cause of longer daily trips

sustained mainly by the individual motor vehicle. The automobile and fossil fuel, as we know, are one of the biggest promoters of global warming and diseases caused by air pollution.

2. In the dispersed city, infrastructure networks – water, sewage collection, rainwater drainage, public lighting, paving – are also more extensive and, therefore, more expensive in terms of per capita cost. Either its construction or installation, as well as its maintenance, are less economical. It is also necessary to remember that the services are more expensive. This is the case of garbage collection and disposal, education and health services, etc.
3. In the dispersed city, for the reasons mentioned, residents spend more time in transport, time that is not dedicated to leisure, to family.
4. The dispersed city, based on road transport, results in a greater waterproofed surface affecting the environment. Much of the city is destined for the streets and parking lots.

The mix of building use provides a livelier (and safer) city during the day or night. The living city is related to a certain density and to the diversity of uses (housing, services, commerce and recreation), and it will be culturally and socially richer, or even fairer and safer, if it presents a diversity of ages, ethnicities and incomes. The community formed only by rich or poor, or by a certain social characteristic, often presents urban and social problems. Housing densities are so important to most urban districts and their future development and so rarely considered a vitality factor. “High densities are frowned upon in orthodox urbanism and housing planning theory. They are believed to lead to all kinds of difficulty and failure.” The large concentrations of people are one of the necessary conditions for the flourishing of urban diversity. Without enough people, this diversity does not exist. High urban density is not overpopulation; it means number of people per hectare. Overpopulation is an excessive number of people per household. Adequate urban densities are a matter of functionality and that should promote the adequate use of available resources and promote the diversity of the neighborhood [5]. In short, the medium is the best, neither high – above 1000 inhabitants per hectare nor low, below 80 inhabitants per hectare. Functional diversity must encompass the diversity of buildings.

Currently, it is aware that the proximity of services and commerce in the surroundings of the residences makes it possible for a part of the trips are made on foot or using bicycles and with that motorized trips are eliminated or shortened and the built environment will be more friendly to the elderly and children.

Urban densification is good and necessary and cities can function better if their objective is to mix people, it is possible to place more people per hectare and bring together the various urban functions, because:

1. A more compact city, less spread out, not only makes it easier to go from home to work and from home to the

bakery, but also makes it easier to meet friends for a chat. Densification allows for more planned or spontaneous interactions, although it is not the only factor necessary for this to happen.

2. Densification, by allowing more people to be grouped on less land, allows, in theory, to consume less land and, consequently, leave more part of the natural environment untouched.
3. Densification causes savings in infrastructure. For example, the road network is smaller and serves more people. If people start to live outside the urban center, in distant condominiums, the need to travel will be greater and the costs to provide this infrastructure will be greater. In fact, sprawl can even make some public services such as public transport unfeasible, as sprawl creates long journeys with low demand. Commerce and private service offerings are hampered by low density, especially on a local scale: in a dense area, the owner of a small market is able to have a sufficient number of potential consumers within a small radius of travel, which can be done at on foot or by bicycle. In the middle of a residential area of condominiums in the Rural Zone, it is possible that there are no more than ten houses within a radius of 500m, small markets become unviable and residents end up moving by car to do weekly shopping in hypermarkets. [12]

Finally, too low density damages urban vitality, the movement of people on the streets, making them more deserted and dangerous. Even in urban areas, as Jane Jacobs has noted, density in surrounding areas is one of the most important conditions for parks that are heavily attended to become successful.

Excessive densification comes with costs that must be balanced against expected gains, such as the argument of economy in infrastructure is only valid up to the point where the infrastructure capacity is not exhausted and it becomes necessary to invest in its expansion [12]. This argument is quite clear with road infrastructure: low density and sprawl generate costs with the expansion of the road network, but too high density (and a car-based mobility model) also generates infrastructure depletion.

The argument of the preservation of the natural environment also has limited validity, as it does not help much, in practical terms, in terms of improving the quality of life in the daily life of the citizen, if we only think about preserving the environment. This may make some sense from a global perspective, due to carbon emissions and limiting the greenhouse effect, the loss of vegetation cover within cities that creates heat islands, degrades the urban landscape and diminishes or makes public living areas uninviting. If the densification is done by intense verticalization, without respecting setbacks and without using architectural strategies, such as pilotis, the impact on the microclimate worsens with the obstacle to ventilation. In addition, loss of vegetation cover also increases soil sealing, affecting rainwater drainage, resulting in the usual Campo Grande flooding that occurs at certain times of the year.

Therefore, and considering that the city wants to become sustainable, there are several ways to densify and we have only invested in one of them, verticalization, and a verticalization with certain characteristics that end up reducing the gains of densification and increasing its disadvantages.

Verticalization contributes to the creation of a more compact, sustainable city that generates social and cultural activities, through the best use of the lot [13].

Densification and verticalization are not synonymous. Paris and Barcelona have densities, whether in proportion to the built-up area or in the number of inhabitants per hectare, sometimes higher than that of the more vertical areas of several Brazilian capitals. In addition, densification does not always stimulate urban vitality and security due to the presence of people on the street. It is a precondition, but not a sufficient condition.

Gradually, with the lack of control by the public power, commerce has been grouped into shopping malls and hypermarkets and the city, with its urban development planned by construction companies, has repeated one of Brasília's mistakes: the agglomeration of certain types of activity in "poles". All this encourages even more motorized commuting, degrading the environmental quality of the streets, making them dangerous and creating a vicious circle in favor of the car. Finally, urban laws, instead of taking into account the exhaustion of streets before allowing new buildings, encourage the construction of more parking spaces and the use of the car.

The densification, as a way of multiplying the initial area of the land in a built-up area, is also a factor of strong appreciation of the soil and, consequently, of speculative pressure on plots not yet explored to their maximum economic potential. It is customary to argue in favor of little regulation of the real estate market based on the idea that the free fulfillment of demands and a strong densification will ensure a supply high enough to push prices down. However, this appreciation of the soil with the increase in densification ends up making the units produced more expensive and reducing the effect of the increase in supply. In addition, it creates speculative pressure on homes that still survive in a given area and makes areas occupied by low-income communities a target for real estate capital. The side effect of this is the gradual expulsion, violent or by force of the rising cost of living, of the low-income population from central areas and close to the most "noble" neighborhoods. This creates a densification only among the richest and a spreading and peripheralization of poverty, which, in addition to the obvious segregation between classes, creates greater mobility problems just for the less privileged part of the population and the great distances to be covered daily.

Scattered and fragmented cities (the case of Campo Grande) have their problems and can occur because of two issues: low urban density resulting from lots with large areas and lack of continuity in the urban fabric, called leapfrogging or urban voids. In these cases, *"while the cost of land tends to be low, the pattern of development is economically*

insufficient, making it undesirable and being the subject of frequent studies in recent decades"[14]. The lack of continuity in the urban fabric, resulting from a large number of urban voids within the urbanized area, typical of Campo Grande, causes very low densities, increasing the costs of public services and urban infrastructure.

The average of installments after Federal Law 6.766/1979 is 30 lots per hectare (or around 100 people per hectare, if all are occupied), with only one single residential building per lot, but, due to urban voids, the average density found for medium-sized cities is only 40 people per hectare (Campo Grande has less than 30 people per hectare).

The most adequate density varies between 300 and 350 people per hectare, and we can consider a minimum of 40 people per hectare to be economically acceptable. These densities, for them, still allow for a good environmental quality of the city and are efficient from the energy point of view, taking advantage of the favorable aspects of the local climate [15].

The urban density when you mix residential and commercial and service use causes a gigantic visual impact, with the image of thousands of buildings, we have to be careful about the resulting urban problems. The recognition of the residential space, in which a large part of the daily lives of the residents of a city takes place, as a central theme in the question of the quality of the built space, is essential in this discussion. In the conformation of the residential space, three major components, or fields of analysis, are identified: the dwelling itself; infrastructure, services and urban equipment; and the surroundings or landscape. The main analysis variables of each component can be described as follows:

1. Housing: size/occupancy density; functionality; material and construction technique; architectural type; conservation state; thermal comfort;
2. Infrastructure, services and urban equipment: water: type of supply/treatment; sewage: collection/destination/treatment; garbage: collection/destination; light and telephone; transport; school; health Center; green areas, squares and parks; cultural spaces: museums/libraries/theater; business; and
3. Surroundings: built environment – architectural heritage; afforestation; Traffic; noise; ventilation; insolation – sun exposure; safety; neighborhood.
4. However, what can be seen in the conclusions of the research carried out is a division between more compact cities, with strong centers and good public transport conditions and multinuclear cities, theoretically capable of serving both public and private transport. It is still worth reinforcing the type of climate, socio-economic situation or local culture [16].

In the 1980s, there were the first proposals for the construction of sustainability indicators, to contribute to the decision-making of the actors involved in both the public and private spheres, but the different concepts and concepts became complex and the elaboration of indicators at the time.

There are currently several international and national models on sustainability in cities and construction. Like the recently approved NBR (Brazilian Standard) ISO 37120/2017 for sustainable cities.

3.1. Parameters for DVSI

From the studies of the concepts of sustainable, compact city for the construction of the indicators, considering some parameters:

1. Qualified densit, urbanistically planned for each context, according to the various suitable uses, not conflicting with the needs of users, seeking to value mixed use on an intra-urban scale and that favors the local population to be close to their basic urban needs.
2. Residents' basic urban needs are everything they need in their daily lives: basic urban services and equipment, green spaces, commerce and local and access to the public transport system and must be in compact and accessible nuclei in, at most, 10 minutes walking or being in maximum distance from your home of 1000 meters.
3. Social interaction, the resident population has more opportunities, as well as a better sense of public security, since the sense of community is better established (proximity, mix of uses, and sidewalks and spaces for collective use).
4. Urban mobility, the immense bottleneck of the housing deficit and the lack of socio-territorial diversity in large

Brazilian cities must be solved with new models of sustainable urban development, incorporating processes that promote housing in denser and more compact areas, with a mix of uses, close to the mobility system, which offer typological diversity and promote a more inclusive and less isolated urban life.

5. Orderly growth of the territory as a basic prerequisite for a more sustainable city. Composing this theme, there are the parameters that define it as the elements of urban design, which form the urban adequacy of the territory (forms of adequate implantation, visual adaptations, landscape and sound, pre-existences to maintain, geography to respect), the level of compactness of the territory (where to compact the city more and with what indices), qualified density (density with mixed use parameters suitable for each part of the city), the axes growth and urban development at the regional and macro-metropolitan scales, the degrees of urban renewal, the desirable territorial growth integrated with the mobility system and the levels of mixed use and collective use of the territory. In this aspect, it is possible to perceive that the sustainable city cannot be implemented without the combination of the search for an ideal urban density and verticalization, concepts previously worked on.

Finally, after the theoretical discussions presented, the Positive and Negative Points of Urban Density and Verticality were constructed and indicated in table 2:

Table 2. Positive and Negative Points of Urban Density and Verticality.

Positive Points	Negative Points
Increase in tax collection per hectare; Causes congestion in general; Lower deforestation per hectare; It promotes the loss of the urban landscape; Concentration of the entire support infrastructure, whether for transport, communication, water, sewage, energy or data systems, or for the social systems of education, health, culture, sport and leisure; Increases urban noise; Increase in soil permeability per hectare; Time-consuming repairs and maintenance can harm the collective; Increase in the availability of green area per inhabitant; Thermal comfort tends to get worse caused by heat islands; Increased mobility on foot and by bicycle; Increase in environmental pollution; Increased community security; It can worsen the attendance of essential public services and private consumer services;	Neighborhood compactness; Loss of urban memory and cultural heritage of the place; Occupation of urban voids; Loss of citizen privacy; Creation of new urban centers; Insecurity in the surroundings, through streets with only high walls without active facades. Allows you to create active facades; It can lower the cost of essential services, especially public transport; Improvement in the provision of public services in general.

3.2. Density, Verticality and Sustainability in Campo Grande

The city of Campo Grande, capital of Mato Grosso do Sul, Brazil, began its occupation at the confluence of the Prosa and Segredo streams at the end of the 19th century. Today it has an area of 8,092.951 km² with 786,797 inhabitants, with approximately 99% of the population living in urban areas [17]. The intense urbanization process caused extensive

empty areas, at the same time a concentration of vertical buildings in some regions and closed horizontal housing condominiums, mainly located in the most peripheral part of the city.

The city has as very striking characteristics, the lack of continuity of the urban fabric, due to the large number of urban voids, which causes very low densities, increasing the costs of public services and urban infrastructure, and little verticality, which began in the 40 but it was in 1977 that the city's master plan indicated several areas in the city that

would have the potential to verticalize, with possible areas for more than 12 floors for construction and new areas to build. Currently Campo Grande has a density of below 30 inhabitants per hectare and about 910 vertical buildings with more than 03 floors (figure 2).



Figure 2. Few vertical buildings and many empty urban lots in Campo Grande, Brazil.

In 1986, the National Council for the Environment defined criteria and standards for the analysis of Environmental Impact in the country [18], and the city of Campo Grande entered the process of environmental and sustainability discussion. With the approval of Municipal Law no. 2,567/1988, the Urban Land Use and Occupancy Law in Campo Grande, the first legal frameworks emerged and were transformed and evolved throughout this period, until the present day. This law was very innovative in urban environmental issues.

This law was very innovative in urban environmental issues and established criteria for licensing all polluting or impacting activities, instituted environmental protection, with authorization for the creation of Conservation Units and approval of the Environmental Impact Study, provided for in federal legislation.

The last institutional changes in relation to the themes of the environment and sustainability, which began in 2000, took place with the definition of the roles of the Urban Planning Institute (PLANURB) and the Secretariat for the Environment and Urban Development (SEMADUR).

4. Indicator Methodology

Based on the Positive Points previously presented in table 2, the potentialities and constraints of the three study axes were listed - density, verticalization and urban sustainability that will be guiding aspects for the construction of the Indicator of Density, Verticality and Urban Sustainability (DVSI), presented in tables 3 and 4.

Table 3. Potentiality of the study axes.

POTENTIALITIES
Density Verticalization Urban Sustainability
Efficiency in infrastructure provision
Concentration of investments Infrastructure
Efficient use of land
Employment and income generation Governance

POTENTIALITIES
Urban vitality
Heating up the real estate market
Mobility
Income generation
Connectivity with daily activities Housing
Greater social control
Concentration of uses
Planning and territorial ordering
Economies of scale
Enhancement of land use and infrastructure
Environmental issues
Ease of access to consumers
Security
Greater accessibility to daily activities
Services and equipment
Miscegenation of uses economic public services efficient public transport
Use of parks and equipment by a greater number of people

Table 4. Conditioning of the study axes.

CONDITIONING
Density Verticalization Urban Sustainability
Layout of settlements and balance between public and private Issues of modernity
Basic urban needs for the population
Availability of urban land
Technique, space and verticalization
Access to available information
Housing typology Impacts on the internal structure of the city
Social interaction
Number of projects
Urban legislation for verticalization
Housing policy and socio-territorial diversity
Size and shape of buildings
Real estate development and verticalization
Housing units produced
Location of units
Stages of verticalization
Orderly growth of the territory
Legislation and planning
Qualified density
Nearby activities surroundings
Quality and location of available services and equipment
Lot size and dimension
Infrastructure concentration
Urban planning
Total area of housing units

For the purposes of this study and considering these variables above, the team, with the advice of Professor Leandro Sauer from UFMS, prepared a list of goods and services for urban sustainability.

In order to define the list of essential goods and services for a community, 10 (ten) important items were taken as a basis for the framing of horizontal and vertical condominiums in Campo Grande/MS, in order to promote a qualification and we can build the DVS INDICATOR.

The criteria used to prepare this list considered items that are INSIDE THE CONDOMINIUM, that is, that belong to the internal limits of the property and that are for the exclusive use of its residents. In addition, items that are OUTSIDE THE CONDOMINIUM, that is, that in addition to being use by residents are also shared by other people in the neighborhood and city.

List of goods and services within the condominium:

1. Have a net density of less than 300 inhabitants per hectare;
2. Have a construction system that uses sustainable techniques²;
3. Have a bicycle garage in addition to the cars;
4. Have a reserved and controlled permeable area greater than 12.5% of the land³;
5. Reuse wastewater⁴;
6. Have selective garbage collection guided and encouraged;
7. Store rainwater;
8. Use solar panels in common and private areas;
9. Have spaces for visitors to the condominium (external/internal);
10. Possess a complete leisure area for residents⁵;

List of goods and services outside the condominium:

1. The building has an accessible sidewalk;
2. Surroundings with adequate lighting and trees;
3. Have an active facade⁶;
4. Have an inhabited and dense environment/neighborhood;
5. Have a dense environment with commercial activities/services;
6. Have local shops (market, bakery, pharmacy) nearby (300 meters radius);
7. Have squares, parks and/or walking trails in the surroundings (300 meters radius);
8. Have a bus stop/public transport nearby (500 meters radius);
9. Have health units and day care centers or public or private schools (500 meters radius);
10. Have Public Security Units (500 meters radius).

Based on these variables, a questionnaire was prepared, 15 experts consulted, including professors, researchers, architects and urban planners, builders, entrepreneurs, and local entities, each one answered their priorities in the combinations of desirable items. The questionnaire corresponds to a simple combination between the items, later quantifying and summing the answers for each preference item, assigning different weights to the qualification of the enterprise.

This questionnaire resulted in a sequence of priorities, which, according to the quantity among the chosen elements, different weights were assigned between the items with a total equal to 1,000 (one), according to tables 5

and 6, and the closer to 1,000 (a), more favorable is the condominium in the relationship between density x verticality x sustainability.

Table 5. Indicators for inside the condominium and weight of each item.

ITEM	OUTSIDE THE CONDOMINIUM	WEIGHT
01	Net density less than 300 inhabitants per hectare	0.080
02	Having a construction system that uses sustainable techniques	0.093
03	Have a bicycle garage in addition to cars	0.049
04	Have a reserved and controlled permeable area greater than 12.5% of the land	0.104
05	Reuse wastewater	0.114
06	Have oriented and encouraged selective garbage collection	0.132
07	Store rainwater	0.150
08	Using solar panels in common and private areas	0.119
09	Have spaces for visitors to the condominium (external/internal)	0.074
10	Possess a complete leisure area for residents	0.086
TOTAL		1,000

Table 6. Indicators outside the condominium and weight of each item.

ITEM	OUTSIDE THE CONDOMINIUM	WEIGHT
01	The building has an accessible sidewalk;	0.098
02	Surroundings with adequate lighting and trees;	0.104
03	Having an active facade	0.047
04	Having an inhabited and densely populated surroundings/neighborhood;	0.130
05	Having a dense environment with commercial activities/services;	0.059
06	Have local shops (market, bakery, pharmacy) nearby (300 meters radius);	0.119
07	Have squares, parks and/or walking trails in the surroundings (300 meters radius);	0.123
08	Have a nearby bus stop/public transport (500 meters radius);	0.138
09	Have health units, nursery, public or private schools (500 meters radius);	0.101
10	Have Public Security Units (500 meters radius)	0.081
TOTAL		1,000

5. Conclusion

The result of the indicators with high favorable points are in pairs with the concepts related to diversity, inclusion, mixed use, etc. corroborating the theories of the authors used as conceptual parameters of the study [20-22].

Analyzing the results, in order of priority, the indicators with greater weight for “inside the condominium” are (table 7) rainwater storage; guided and encouraged selective garbage collection; use solar panels in common and private areas; reuse of wastewater and reserved and controlled permeable area greater than 12.5% of the lot.

The results of the indicators “outside the condominium” (Table 8), the most favorable and priority points were, in order of priority: having a nearby bus/public transport stop (500 meters radius); an inhabited and dense environment/neighborhood; having squares, parks and/or walking trails in the surroundings (300 meters radius); have local commerce - market, bakery, pharmacy- (300 meters radius) and surroundings with adequate lighting and trees.

2 Construction techniques that guarantee rationalization and the creation of cleaner and more environmentally correct works, either by their operating methods or by the materials used. They enable constructions with high productivity, more affordable costs and high quality.

3 In the city of Campo Grande, the Land Use and Occupancy Law requires that 12.5% of permeable area within the lots [19].

4 Water reuse, the process by which water, whether treated or not, is reused by man in the same function, or in another human activity different from the first.

5 Activities for all age groups within the condominium, with adequate equipment.

6 Active facade corresponds to the occupation of the facade located in the alignment of public sidewalks for non-residential use with open access to the population and opening to the patio.

Table 7. Indicators for the condominium and weight of each item - analysis of priorities.

ITEM	OUTSIDE THE CONDOMINIUM	WEIGHT
01	Net density less than 300 inhabitants per hectare	0.080
02	Having a construction system that uses sustainable techniques	0.093
03	Have a bicycle garage in addition to cars	0.049
04	Have a reserved and controlled permeable area greater than 12.5% of the land	0.104
05	Reuse wastewater	0.114
06	Have oriented and encouraged selective garbage collection	0.132
07	Store rainwater	0.150
08	Using solar panels in common and private areas	0.119
09	Have spaces for visitors to the condominium (external/internal)	0.074
10	Possess a complete leisure area for residents	0.086
TOTAL		1,000

Table 8. Indicators outside the condominium and weight of each item - analysis of priorities.

ITEM	OUTSIDE THE CONDOMINIUM	WEIGHT
01	The building has an accessible sidewalk;	0.098
02	Surroundings with adequate lighting and trees;	0.104
03	Having an active facade	0.047
04	Having an inhabited and dense environment/neighbourhood;	0.130
05	Having a dense environment with commercial activities/services;	0.059
06	Have local shops (market, bakery, pharmacy) nearby (300 meters radius);	0.119
07	Have squares, parks and/or walking trails in the surroundings (300 meters radius);	0.123
09	Have health units, nursery, public or private schools (500 meters radius);	0.101
10	Have Public Security Units (500 meters radius)	0.081
TOTAL		1,000

Within this study, the results found can serve as an aid when planning cities and implementing condominiums within the urban area, serving as an indicator of priorities so that the implementation of these condominiums has a basis of density, verticality and sustainability. As well as contributing to the understanding of the forms of production and reproduction of urban life. A simple, quantifiable and communicable indicator.

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