



**Observatory of smart and sustainable cities: an implementation study for
the Metropolitan Region of Vale do Rio Cuiabá-MT**

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SUMMARY

City observatories have been attracting interest from various municipalities due to their ability to provide information of the most diverse nature that can make a substantial contribution to city planning. The aim of this research is to present a set of information that can be produced by an observatory of smart and sustainable cities, in a study focused on the Metropolitan Region of Vale do Rio Cuiabá, in the state of Mato Grosso (RMVRC/MT), which has characteristics that justify its implementation. The methodology used is characterized by a qualitative approach, with exploratory objectives, whose technical procedures involved bibliographic, documentary and census surveys. The relevance of this study lies in the objective possibilities of setting up an Observatory which, in addition to producing new knowledge, can make a major contribution to formulating assertive public policies. The social, environmental and public governance contributions come from the establishment of the UN Sustainable Development Goals (SDGs), and their variants, as the focal point of this research.

KEYWORDS: Cities Observatory. Smart and Sustainable Cities. RMVRC/MT.

1. INTRODUCTION

According to IPEA (2013), Brazil’s main metropolitan areas are home to half of the country’s Gross Domestic Product (GDP) and more than a third of its population. Faced with this context, where the challenges imposed on public managers in different areas are growing and adverse, it becomes essential not only to understand how these territories are managed within the scope of public policies, but also to know the new processes and technologies for better public governance. Considering the recent transformations in the context of urban life, especially in metropolitan regions, the question that guides this research is: what factors should be considered when setting up an observatory of smart and sustainable cities? And from this question arise others: Have the challenges of managing their demands been met effectively by the current institutional instruments in force? What tools support the current metropolitan institutional arrangement? Is there a database and qualified information covering the various areas of the local and regional territory?

With the advancement of new technologies, especially those applied to improving the quality of urban infrastructure and planning processes, linked to the concept of smart and sustainable cities, the most assertive response to the questions posed above certainly lies in proposing an Observatory for Smart and sustainable cities.

This new approach, by calling the city 'smart and sustainable' proposed in the last decades of the 20th century, was concerned with achieving better standards for quality of life in the face of growing problems in many cities not only in Brazil, but also in other regions. of the planet.

The implementation of an Observatory in the context of the Metropolitan Region of Vale do Rio Cuiabá in the State of Mato Grosso (RMVRC/MT) will make it possible to strengthen its territorial development process, considering the importance of producing systematized information and research on the local context, which is necessary for the decision-making process. It could also contribute to creating a collaborative arrangement between the various agents involved in local and regional development, making it possible for public authorities and other civil entities to work together.

The main objective of the Observatory for Smart and Sustainable Cities is the development of research and studies that contribute to more sustainable development and improve the quality of life of the RMVRC/MT municipalities.

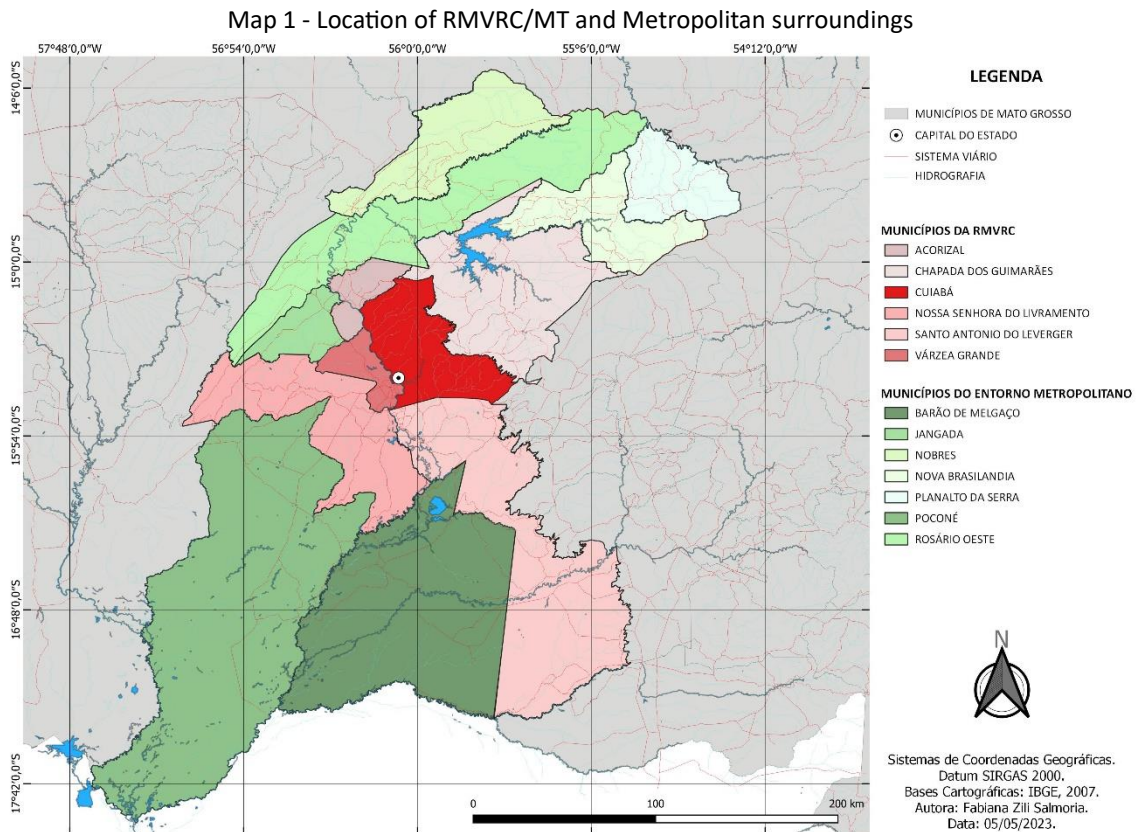
Among the specific objectives are: the creation of a network of researchers and collaborators for the development of research; the creation of a database and information that can support the territorial development process; the creation of a homepage to disseminate information and data on the metropolitan context; stimulating the implementation of the SDGs in the region’s municipalities; supporting actions to strengthen spaces for social participation and public debate on local and regional public policies within the scope of the proposed theme; and contributing to the training of managers and technicians qualified in the themes addressed by the Observatory.

Although there is a considerable range of definitions in the literature, the concept is innovative in that it brings with whole apparatus of technology as an ally for the imminent challenge of guiding planning and management processes based on the principles of sustainability sought by the most relevant international treaties, and the most recent regulatory instruments, such as master and sector plans, zoning laws and many others aimed at the good management of urbanized spaces. Its importance increases even more when considering the latest projections from the World Cities Report 2022 (UN_HABITAT, 2022), estimate that by 2050, 68% of the population will live in cities. The impacts of this will put an even greater strain on city infrastructure, as well as severely impacting natural situation will further overload the cities', in addition to severely impacting natural resources, compromising the cities' environmental quality.

Faced with this situation, it is believed that it will be of great importance to analyze the constitution of a system that can work with suitable indicators to monitor the planning and management processes of urban localities with a view to their well-being and quality of life, for which, the implementation of an observatory will be strategic.

Thus, initially presents some of the aspects involved in a setting up an Observatory for the development of studies and actions dedicated to promoting smart and sustainable cities¹. The RMVRC/MT made up of six municipalities, is delimited for this research: Acorizal; Chapada dos Guimaraes; Cuiabá; Nossa Senhora do Livramento; Santo Antonio de Leverger; and Várzea Grande, because it encompasses the municipalities, but above all because of the importance of two of them: Cuiabá and Várzea Grande. These two municipalities stand out for having the highest population density in the state of Mato Grosso, however, there is no obstacle to expanding the area of operation to include the other four municipalities in the proposal, as well as the seven municipalities in its metropolitan surroundings: Barão de Melgaço, Jangada, Nobres, Nova Brasilândia, Planalto da Serra, Poconé and Rosário Oeste (Map 1). The metropolitan surroundings refer to the municipalities located in the Cuiabá River Valley and that are in some way affected by the metropolization process.

¹ Smart and sustainable city - MMCISB foresees the alignment of municipal administration around a vision and concept of a sustainable smart city as evidence of higher maturity. It is a requirement for this alignment that the city uses a concept shared between the various sectors of municipal management and that it operates in a way that registers its vision of digital transformation in documents that govern this process (MMCISB, 2021, p. 46).



Source: IBGE, 2021. Org. per SALMORIA, 2021

Initially, the Metropolitan Region was an urban agglomeration made of the municipalities of Cuiabá and Várzea Grande. Later, the Complementary Law nº 359, of May 27, 2009 (MATO GROSSO, 2009), created the Metropolitan Region of the Cuiabá River Valley, made up of the cities of Cuiabá, Várzea Grande, Nossa Senhora do Livramento and Santo Antônio de Leverger. In 2016, the municipalities of Acorizal and Chapada dos Guimarães were included through a Complementary Law 577 of 2016 (MATO GROSSO, 2016).

The edition of the Complementary Law nº 359/2009 resulted from a process of searching for alternatives that could respond to the demands arising from social inequalities, with the commitment to present proposal for integrated regional planning capable of accommodating municipalities in the entire socio-spatial context (SILVA, 2011, p. 217).

Another aspect to be highlighted in its metropolitan context refers to the socioeconomic bond expressed in the commuting of the regional population, in dependence on the provision of services and the use of public facilities in the member municipalities, which shows concrete possibilities for greater cohesion between these urban areas, for the promotion of development through the complementation of functions, services, infrastructure, mobility and other equipment, accordance to Complementary Law No. 359 of 2009 (MATO GROSSO, 2009).

When studying the RMVRC/MT based on data relating to population, HDI, GDP and GDP per capita (IBGE, 2021) (Table 1), there is a marked difference in population density between the cities of RMVRC/MT. MT and those in surrounding area. The data shows that most of the

population is concentrated in cities belonging to the metropolitan region. This discrepancy is also noted in relation to the economic situation.

Table 1 - Data from the Metropolitan Region of the Cuiabá River Valley according to population, HDI, GDP and GDP per capita.

City	Population estimate - 2021	Population in 2010	HDI in 2010		GDP 2018(Thou - R\$)	GDP/Per Capita 2018 (Thou - R\$)	
			Median	0,628			
Metropolitan Region of the Cuiabá River Valley	Acorizal	5.309	5.516	Median	0,628	77.844,62	14.351,88
	Chapada dos Guimarães	22.521	17.821	Median	0,688	742.826,04	37.922,51
	Cuiabá	623.614	551.098	High	0,785	23.705.265,88	39.043,32
	Nossa Senhora do Livramento	13.093	11.609	Median	0,638	292.519,45	22.108,64
	Santo Antonio de Leverger	17.188	18.463	Median	0,656	495.172,68	30.132,88
	Várzea Grande	290.383	252.596	High	0,734	7.984.209,54	28.311,90
	TOTAL	972.108	857.103	Median	0,716	33.297.838,21	171.871,13
Metropolitan surroundings	Barão de Melgaço	8.165	7.591	Median	0,6	91.427,37	10.677,03
	Jangada	8.420	7.696	Median	0,63	178.961,04	21.391,47
	Nobres	15.332	15.002	Median	0,699	571.477,00	43.679,82
	Nova Brasilândia	3.656	4.587	Median	0,651	67.871,50	17.278,89
	Planalto da Serra	2.637	2.726	Median	0,656	29.746,01	25.408,68
	Poconé	33.386	31.779	Median	0,652	539.826,62	16.474,20
	Rosário Oeste	16.999	17.679	Median	0,65	315.492,51	18.303,21
	TOTAL	88.595	87.060	Median	0,627	1.794.802,05	153.213,30

Source: IBGE, 2021. Org. per SALMORIA, 2021.

When comparing the data related to economic growth, in the period between 2010-2018, the Metropolitan Region showed regular and stable growth. However, an analysis of the surroundings area also shows positive average rates. This scenario contributed to the creation of the RMVRC/MT, when it was possible to regulate as public function of common interest² the actions of:

socio-economic development, land use and occupation planning, accessibility and mobility, environmental sanitation, environmental preservation and conservation, urban development and sectoral policies, such as housing, health, education, security, tourism, sport, leisure, etc. (SILVA, 2011, p. 218).

Regarding these issues, there are several studies showing the imbalance in the process of urban occupation in the Metropolitan Region, especially the cities of Cuiabá and Várzea Grande, which have a density of 38.03 inhabitants/km², while the surrounding area has only 2.91 inhabitants/km² (IBGE, 2010). Although the data observed is from IBGE (2010), other more recent studies have shown that the capital's urban conurbation still has a higher demographic concentration in its territory, in contrast to the surrounding region, where the number of inhabitants is lower.

² Art. 1 This Law, called the Statute of the Metropolis, establishes the general guidelines for the planning, management and execution of public functions of common interest in metropolitan regions and urban agglomerations established by the States (BRASIL, 2015).

Still as a justification for choosing this metropolitan region, the indicators for the municipalities of Cuiabá and Várzea Grande show existing weaknesses in issues related to the urbanization process and which, consequently, interfere with the region’s other development indicators.

Taking the municipalities of Cuiabá and Várzea Grande as an example and referring to the data obtained from the Sustainable Development Index of Cities Brazil (IDSC-BR, 2023) platform regarding the SDGs, in a ranking from 0 to 100 that indicates the municipality's compliance with the SDG targets, Cuiabá has an overall score of 52.4, while Várzea Grande has an overall score of 48.4. As for general classification of municipalities, classified from 1 to 5,570, Cuiabá occupies position number 1,135, while Várzea Grande is number 2,204. These figures show that there is still a lot to be done. Furthermore, according to this same database, Cuiabá presents two of the 17 SDGs (SDGs 7 and 9), while the others face challenges. Várzea Grande, on the other hand, does none of the 17 SDGs achieved, and all of them present challenges (IDSC-BR, 2023).

This brief sample of information on the metropolitan context justifies the urgency of setting up an entity to produce and systematize quality information with the aim of ensuring greater effectiveness in the application of public resources to meet local and regional demands, as well as pointing out the need to train qualified workforce to identify, analyze and propose solutions that can contribute to an effective governance process.

2 OBJECTIVES

The general objective of this research is to demonstrate the need and importance of an Observatory of smart and sustainable cities for RMVRC/MT, given the growing demands that the municipalities in this region are presenting. The specific objectives are to present a proposal for an Observatory project.

3 METHODOLOGY

The methodology of this research is of an applied nature, characterized by a qualitative approach, with exploratory objectives, whose technical procedures involve bibliographic, documentary and census surveys.

4 THEORETICAL FRAMEWORK

It is proposed to use the NBR ISO 37120 standard - Sustainable cities and communities - Indicators of municipal services and quality of life, and ABNT ISO 37122 - Sustainable cities and communities - Indicators for smart cities, as tools to build the model to be used, as well as the Brazilian Sustainable Smart Cities Maturity Model – MMCISB, Version 2/2021, prepared by the Ministry of Science, Technology and Innovation – MCTI, Renato Archer Information Technology Center – CTI, Laboratory of Policy Instruments for Information and Communication Technologies – poli.TIC (MCTI, 2021).

In compliance with the Sustainable Development Goals (SDGs) established by the United Nations (UN, 2015), this research can contribute more specifically to Goals **3** – Good health and well-being; **4** – Quality Education; **9** – Industry, Innovation and infrastructure; **11** – Sustainable cities and communities; **17** – Partnerships in support of goals. Therefore, it is valid

to state that an Observatory will contribute to the implementation of the principles and goals recommended by the UN’s 2030 Agenda, by working with the specificities of the selected goals, which are essential to adequately guide the planning processes for the economic, social and environmental sustainability of this territory. It is understood that a space needs to be set up for the development of research aimed at improving the quality of life, which contributes to meeting the demands related to urban health³ and quality of life. In this sense, it is understood that a smart city can make vital contributions, since the implementation and widespread use of technology in a city allows the development of an intelligent system that adds several functionalities for the benefit of public management and the uses that the citizens may have in their city.

In Brazil, the interface between urban environment and health already emerged at the VIII National Health Conference, in 1986, when a document was drawn up that made it possible not only for it to be recognized, but also the chapter on health protection to be included in the 1988 Federal Constitution. Since then, numerous events with important reports have been produced and dedicated to this issue in Brazil, as in other countries, in view of its emergence for achieving healthier and more sustainable cities.

In a more integrated approach to the concept of the history of the occupation process, these are the serious aspects that mark the intense and dispersed urbanization that occurred, highlighting the need for greater attention to the relevance of urban studies that can support integrated public policies dedicated to facing the countless demands found in its territory, as well as the physical resources of its landscapes as inducers of development. Although the period of investigation is still short, in terms of concern for the current urban context, some notes, albeit preliminary, are possible.

The territory RMVRC/MT has two biomes, the Pantanal and the Cerrado, however, it presents serious problems resulting from its dispersed urbanization process, including the risks to biodiversity arising from the occupation of areas of environmental fragility. They can also be identified.

The sharp population growth observed mainly from 1970 has led to social-spatial inequalities, with a worsening housing deficit, health and sanitation services in the region, negatively affecting the quality of urban life, specifically in the cities of Cuiabá and Várzea Grande, the two largest in the state.

The survey published by Instituto Trata Brasil (2022) points out that the city of Cuiabá ranks number 55, and the city of Várzea Grande is number 93, the latter representing the worst basic sanitation indices in the national ranking. According to this study, Cuiabá’s score was 6.89; and Várzea Grande 3.53, out of a range from zero to ten, for the set of indicators related to basic sanitation.

The Atlas of Human Development in Brazil platform (Atlas Brasil, 2021), responsible for publishing the Municipal Human Development Index - IDHM, is structured around three dimensions: longevity, education and income; and presents data and information related to the various components that characterize human development. All these characteristics have an

³ Urban health considered as a branch of public health that studies the risk factors of cities, their effects on health and urban social relations (CAIFFA et al., 2008, p. 5).

intrinsic link which, according to the Institute, makes it possible to measure the IDHM and present a ranking of Brazilian municipalities.

Regarding the Longevity dimension, it describes: “The promotion of human development requires ensuring a healthy environment, with access to quality healthcare, so that people can achieve the highest possible standard of physical and mental health” (ATLAS BRASIL, 2023). Table 2 presents the 2021 IDHM for the Brazilian Metropolitan Regions.

Table 2 – IDHM 2021 by Brazilian Metropolitan Regions.

TERRITORIALITY	Position IDHM	IDHM	Position IDHM Income	IDHM Income	Position IDHM Education	IDHM Education	Position IDHM Longevity	IDHM Longevity
RM - São Paulo	1	0,842	2	0,791	1	0,849	1	0,89
RM - Florianópolis	2	0,833	1	0,808	2	0,83	4	0,862
RM - Curitiba	3	0,81	5	0,77	4	0,809	5	0,853
RM - Rio de Janeiro	4	0,805	4	0,776	10	0,774	3	0,869
RM - Belo Horizonte	5	0,797	6	0,767	5	0,801	7	0,824
RM - Grande Vitória	6	0,796	8	0,743	11	0,769	2	0,883
RM - Porto Alegre	7	0,788	3	0,783	15	0,749	6	0,834
RM - Goiânia	8	0,764	9	0,735	6	0,8	12	0,758
RM - Vale do Rio Cuiabá	9	0,76	10	0,727	8	0,792	11	0,762
RM - Recife	10	0,746	14	0,688	9	0,782	9	0,773
RM - Belém	11	0,745	12	0,711	13	0,76	10	0,764
RM - Fortaleza	11	0,745	13	0,709	6	0,8	15	0,729
RM - Natal	13	0,743	7	0,752	18	0,699	8	0,781
RM - Salvador	14	0,727	11	0,716	16	0,734	14	0,732
RM - Grande Teresina	15	0,721	16	0,676	12	0,765	16	0,724
RM - Grande São Luís	16	0,719	18	0,665	3	0,811	18	0,689
RM - Maceió	17	0,717	15	0,682	17	0,712	12	0,758
RM - Manaus	18	0,711	17	0,67	14	0,758	17	0,709

Source: Atlas Brasil, 2021.

RMVRC/MT is ranked number nine out of the eighteen metropolitan regions, so it has room for improvement in the three dimensions that make up this indicator.

As can be seen, there is a set of data and information produced by various public and private institutions in the country, but it is not always possible to detail this data in a timely manner to support public managers. In this sense, the work of the observatory is necessary through the analysis of existing data, its updating in the temporal dimension and the detailing of information, providing better conditions for analysis and decision-making with a greater degree of assertiveness.

In this context, the articulation and integration of the various institutional sectors points to the need to monitor urban growth, aiming for an equitable distribution of investments in infrastructure. Such a practice will greatly contribute to the democratizing access to urban services, minimizing the effects arising from socio-spatial inequalities.

5 DATA ANALYSIS AND DISCUSSION

The purpose of an Observatory is to become a planning instrument dedicated to promoting improvements of the quality of urban and regional life, with a view to implementing of precepts that contribute to framing cities as intelligent and sustainable, while at the same time creating opportunities for social intervention by the urban planners and other professionals. The aim is to follow in the footsteps of other successful initiatives in the country in generating new knowledge of metropolitan territories.

5.1 Structure of the proposed project and expected results

As a result of the study carried out, an observatory project for the RMVRC/MT is proposed, structured into three main phases, and the expected results in each of them, as shown below:

Phase 1: Setting up the Observatory. In addition to the physical and institutional implementation, provision of infrastructure for the Observatory to operate (room, tables, chairs, computers, software and vehicle), this phase will cover all documentation (administrative and legal procedures), as well as the definition of a work agenda and specific projects, the appointment of technical researches to work on the studies and research to be carried out by the Observatory.

For this first phase, all institutional procedures are planned, such as: allocation of space, physical infrastructure for the start of work, a training course (immersion in content and practical experiences and methodologies) aimed at preparing a specialized technical staff to define the work agenda, the arrangement of teams, the administrative and methodological procedures appropriate to the purpose of this project.

Phase 2: Elaboration and implementation of specific projects, with respective forms of data collection. For this second phase of the project, the development of the research itself is planned, considering Smart and Sustainable Cities as the object to be investigated, especially the identification of successful models in Brazil and the world, from which it will be possible to verify how successful practices can be applied in RMVRC/MT, especially in Cuiabá and Várzea Grande. It is therefore hoped that at this stage the Observatory, will already have a conceptual background and examples of success from which to build field data collection tools (questionnaire and/or interview guide) to be applied in the region. Also at this stage, it is expected that data will be collect in the field and virtually, tabulated and analyzed in the light of the theoretical framework used, allowing the data to be discussed in relation to the concepts found in the literature, with a view to advancing science and, above all, in proposing practical application in the municipalities of RMVRC/MT. It is also possible to carry out activities in the form of a focus group, i.e., meetings with experts on the subject, with the aim of gaining a better understand the phenomenon under analysis.

It is hoped that the projects that will make up the Observatory's umbrella project will be fully developed, allowing conclusions to be presented to the academic community and public

agents through the publication of scientific articles and reports for public and private managers using meetings to disseminate and discuss based the findings of this research.

Phase 3: Consolidating and strengthening the Observatory. This phase should see the consolidation and strengthening of the Observatory. It will be a period in which activities are already well structured and proposals have already been disseminated to public and private managers. It is also expected that at this stage some scientific articles and reports will have been published in events or journals, making the Observatory known at least throughout the RMVRC/MT, with practical applications that are perceived by the population, not just by managers.

It is hoped that the results of the research carried out by the Observatory will help public and private managers in the broad activation of the Triple Helix⁴, so that academic knowledge is not restricted to the university but is fostered by technological innovations to make cities smart and sustainable in the RMVRC/MT and in other regions.

Although they were estimated in the Observatory project, the costs involved in each of the proposed phases are not presented in this work, nor is the technological infrastructure made up of the set of hardware and software capable of meeting its demands (Big Data Analytics, BI, IA, among others). The estimated time for the effective implementation of this project is 24 months.

5.2 Summary of results to be achieved

According to the approaches described here, the following will be important for its constitution:

- a) laboratories for studies and production of projects;
- b) database to support the development of research, scientific initiation projects, extension, master's dissertation research and other academic activities;
- c) the composition of a network of local and regional researchers dedicated to the study of urban issues.

The research highlights the possibility of setting a Research Agency to propose public policies focused on local and regional issues, enabling the public authorities to strategically define and evaluate their actions. At least four areas of investigation can be covered:

1. Innovation and technologies applied to territorial planning processes;
2. Environmental sanitation and urban health;
3. Smart Cities and Urban and Regional Infrastructure;
4. Education and citizenship.

6 CONCLUSION

The creation and implementation of the Observatory for Smart and Sustainable Cities in the RMVRC/MT arises from the possibility of transforming the city management process, based on the understanding and application of the new conceptual approach of smart and

⁴ Approach developed by Henry Etzkowitz and Loet Leydesdorff, based on the perspective of the University as an inducer of relations with Companies and the Government aiming at the production of new knowledge, technological innovation and economic development.

sustainable cities, assimilated from the analysis of successful experiences carried out by observatories implemented in other locations that are working on the same issues focused on in this proposal.

It follows from this understanding that the contributions of this project can help public and private managers make decision and above all, support actions that can bring improvements to cities and the people who live in them.

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