ITAPEMIRIM AND THE CHALLENGE OF SUSTAINABILITY: LESSONS FROM CURITIBA

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ABSTRACT

This article aims to critically analyze the characteristics of the cities of Itapemirim (ES) and Curitiba (PR), focusing on sustainability practices and smart cities. From a literature review, public policies, waste management, urban mobility and citizen participation in both municipalities were examined. While Curitiba stands out as an exemplary model of urban planning and sustainable management, Itapemirim faces significant challenges in implementing sustainable practices and mobilizing the community. The study discusses the importance of environmental education, green infrastructure and the use of smart technologies to promote a more sustainable city. The exchange of experiences between cities can provide valuable learning, allowing Itapemirim to develop urban planning that prioritizes sustainability and climate resilience. By adopting practices inspired by Curitiba, Itapemirim can transform its characteristics and challenges into opportunities for a more sustainable and inclusive future.

Keywords: Sustainability. Smart Cities. Town planning. Environmental education.

INTRODUCTION

Contemporary cities face the challenge of becoming sustainable in a context of increasing urbanization and environmental degradation. The videos presented address experiences of cities that have implemented innovative urban planning and sustainability practices, highlighting Curitiba as a reference model. Curitiba is widely recognized for its efficient public transportation system, abundant green areas, and recycling policies, all of which contribute to a superior quality of life. In contrast, Itapemirim, in Espírito Santo, has characteristics that reveal both opportunities and challenges in its urban development.

Itapemirim, with its rich natural and cultural heritage, faces issues such as the management of urban space and the infrastructure necessary to promote sustainability. Although the city has areas of scenic beauty and potential for ecotourism, its current practices in relation to urban planning and environmental management need to be critically analyzed. This article aims to discuss the sustainable characteristics present in Curitiba and compare them with the practices of Itapemirim, highlighting the positive and negative aspects that influence the quality of life of its inhabitants. In the end, we will propose recommendations so that Itapemirim can follow a firmer path towards urban sustainability, taking advantage of its potential and learning from the experience of model cities such as Curitiba.

When expanding the comparison to include Itapemirim (ES), it is important to analyze the similarities and differences in relation to Curitiba and its approaches towards sustainability and the concept of smart cities. Itapemirim, a coastal and tourist city, has characteristics that make it unique, but it also faces significant challenges that can be addressed in its quest for more sustainable development.

Sustainability in Itapemirim: Itapemirim has a rich biodiversity and a privileged natural environment, which gives it great potential for sustainable practices. The city has environmental preservation areas and an ecosystem that, if well managed, can contribute to local sustainability. However, solid waste management and urban infrastructure are areas that require attention. Disorderly growth, driven by tourism, can compromise environmental quality if there is no adequate planning.

Comparison with Curitiba: Curitiba, on the other hand, is widely recognized for its innovative public policies and its efficient public transportation system, which prioritizes sustainable urban mobility. The use of public transport and the creation of green areas are examples of how the city has integrated sustainability into its urban planning. The experience of Curitiba highlights the importance of well-structured policies, which include the participation of the population and social inclusion.

Smart Cities: In terms of smart cities, Curitiba stands out for the use of technology and innovation in its urban solutions. The city has invested in information systems that improve the management of public services and promote transparency. Data collection and citizen participation are key components for the success of initiatives aimed at improving the quality of urban life.

Itapemirim, in turn, can learn from Curitiba's experience in the implementation of technological solutions that promote the efficiency of public services and social inclusion. The use of applications for service management, such as transportation and waste collection, could facilitate interaction between the public administration and citizens, allowing for more agile and participatory management.

Both cities face challenges regarding sustainability, but how they approach these problems can be quite different. While Curitiba has an already established and recognized system, Itapemirim is still in the process of developing its sustainable practices. For Itapemirim, this means that there is an opportunity to learn from the best practices of Curitiba and other smart cities, adapting them to their local reality. The comparison between Itapemirim and Curitiba reveals the need for integrated urban planning that considers the particularities of each city, but also benefits from innovations and successful experiences. The path to sustainability is therefore a collective journey, where mutual learning and collaboration are essential to build more resilient cities adapted to the needs of their inhabitants.

Curitiba stands out globally as a reference in urban sustainability and innovation in the concept of smart cities. Over the decades, the city has implemented a series of public policies focused on urban mobility, waste management, smart use of public spaces, and social inclusion, creating an environment that balances economic development with environmental preservation. Curitiba's public transport system, for example, is one of the most admired in the world. The BRT (Bus Rapid Transit) model, implemented in the 1970s, optimized urban mobility, reducing the use of individual vehicles and consequently the emissions of polluting gases. The city also invests heavily in green areas and in the sustainable management of its parks and reserves, creating a network of public spaces that serve both leisure and environmental conservation.

In contrast, Itapemirim, in Espírito Santo, is still at an incipient stage when it comes to adopting policies and practices that foster sustainability and transformation into a smart city. While Curitiba benefits from decades of urban planning, Itapemirim faces challenges typical of medium-sized cities in less industrialized regions with less technological support. The city has great natural potential, especially in relation to ecotourism, due to its beaches and

environmental preservation areas. However, the lack of adequate investments in sustainable urban infrastructure and the absence of integrated planning make it difficult to take full advantage of these resources. One of the central issues that differentiates Itapemirim from Curitiba is the level of urban planning focused on sustainability. In Curitiba, the planning is based on a long-term vision that involves both the public authorities and the private sector and civil society. The implementation of bike lanes, the priority to public transport and the projects aimed at social housing show how the city manages to align urban growth with environmental preservation. In Itapemirim, urban development is still fragmented, without a clear articulation between environmental and urban policies. The city suffers from problems related to the collection and management of solid waste, as well as a lack of infrastructure aimed at sustainable mobility, such as bike lanes and quality public transport.

On the other hand, Itapemirim has some characteristics that, if well managed, can put it on a path of sustainable growth. The city has vast potential in terms of generating renewable energies, such as solar energy, due to its geographical location and high solar incidence for much of the year. In addition, the environmental richness of the region, with its preservation areas, offers unique opportunities for the development of sustainable ecotourism policies, which can benefit both the local economy and the environment. However, for this to happen, a robust sustainable development plan would be needed, something that Curitiba has implemented continuously and strategically over the years.

In addition, the concept of smart cities — which involves the use of technology to improve urban management, increase the efficiency of services, and promote quality of life — is still little explored in Itapemirim. Curitiba, on the other hand, has been investing in technological solutions for public management, such as sensors for traffic monitoring and efficient public lighting, as well as initiatives aimed at citizen participation, allowing residents to actively participate in urban planning and sustainability decisions. Connectivity and digitalization of urban services are fundamental for the development of smarter cities, which creates challenges and opportunities for Itapemirim, which still needs to invest in technological infrastructure and platforms that promote innovation.

In summary, while Curitiba is a consolidated example of how a city can integrate sustainable practices and innovative technologies to improve the quality of life of its citizens, Itapemirim still has a long way to go to achieve this integration. The city has great natural and energy potential, but faces significant challenges in terms of urban planning, mobility, waste management, and the implementation of smart technologies. For Itapemirim to become a truly sustainable city, it will require a collective effort, involving public and private

investments, policies to encourage sustainability, and a clear commitment to the preservation of its natural resources. By learning from cities like Curitiba, Itapemirim can chart its own path towards urban sustainability and smart development.

METHODOLOGY

The methodology of this article will be of a bibliographic nature, seeking to analyze and compare the sustainability characteristics and practices of smart cities in Curitiba and Itapemirim. The research will take place through the review and analysis of academic literature, technical reports, articles, and relevant publications on sustainable urbanism, ecotourism, and the management of smart cities.

First, a search will be carried out for bibliographic sources that address the concepts of urban sustainability and smart cities, including books, theses, and scientific articles. The focus will be on studies that deal specifically with the cases of Curitiba, widely recognized for its innovative urban planning practices, and Itapemirim, whose urban reality is less discussed, but equally relevant to understanding the challenges and opportunities that cities face in the search for sustainability. From the selection of sources, a qualitative analysis of the data collected will be carried out, with the objective of identifying the main characteristics that differentiate the approaches adopted by Curitiba and Itapemirim in relation to sustainability. This analysis will include the evaluation of indicators such as urban mobility, waste management, green areas, and the use of smart technologies.

In addition, official documents, such as master plans, municipal laws, and public policies related to urbanism and the environment, will be considered to understand how the municipal administrations of both cities have structured their actions in favor of sustainability. The methodology will also contemplate the critical comparison between the practices adopted in Curitiba and Itapemirim, highlighting the positive and negative aspects observed in each context. From this analysis, the article will seek to propose recommendations that can help Itapemirim in building a more sustainable future, inspired by the experiences of Curitiba.

Finally, the study will be systematized in a text that articulates the main findings of the research, highlighting the lessons learned and the possibilities of sustainable development that Itapemirim can explore, considering its unique characteristics and the socioeconomic context in which it is inserted. This approach will allow for a deeper understanding of urban dynamics in both cities, contributing to the debate on urban sustainability in Brazil.

RESULTS AND DISCUSSION

The comparative analysis between Itapemirim and Curitiba reveals significant differences in their approaches to sustainability and the development of smart cities. While Curitiba stands out for its innovative and successful practices, Itapemirim faces challenges that, if not properly addressed, can compromise its potential to become a sustainable city.

One of the main pillars of urban sustainability in Curitiba is its public transport system. The BRT (Bus Rapid Transit) model, implemented in the 1970s, transformed mobility in the city, promoting a significant reduction in the use of automobiles and, consequently, in greenhouse gas emissions. According to the Urbanization of Curitiba, "the public transport system is considered one of the most efficient in the world, integrating buses, terminals and exclusive lanes" (CURITIBA, 2021). This approach results in a more accessible and less congested city. In contrast, Itapemirim still relies on a public transport system that is limited and faces coverage and frequency issues. According to a study conducted by Oliveira et al. (2023), "the transport infrastructure in Itapemirim is insufficient to meet the growing demand, which contributes to the increase in the use of private vehicles and the consequent air pollution." Therefore, the lack of effective urban planning can negatively impact the quality of life of inhabitants, reflecting in an increase in mobility problems.

Solid waste management is another critical aspect in which Curitiba stands out. The city has implemented a selective collection and recycling system that achieves a recycling rate of approximately 70%, as reported by the Paraná Sanitation Company (SANEPAR, 2020). This initiative not only reduces the amount of waste destined for landfills but also promotes environmental awareness among citizens.

On the other hand, in Itapemirim, solid waste management is still a significant challenge. According to research by Silva et al. (2022), "less than 20% of the waste generated in the city is recycled, and the lack of an effective selective collection system results in negative impacts on the environment." The scarcity of awareness campaigns and adequate infrastructure for waste management highlights the need for urgent improvements in this sector.

Curitiba is also recognized for its extensive network of parks and green areas, which occupy approximately 53 m² per inhabitant, according to data from the Municipal Department of the Environment (2021). These areas not only provide recreation and recreation, but also contribute to biodiversity and the mitigation of the effects of urban heat islands. The city was a pioneer in integrating green areas into urban planning, creating a healthier and more pleasant environment for its citizens. In Itapemirim, although the city has

beautiful beaches and natural areas, the conservation of these spaces is still precarious. According to the study by Almeida and Sousa (2023), "uncontrolled urbanization and the lack of public policies aimed at environmental preservation have led to the degradation of important natural areas." This indicates a missed opportunity for Itapemirim, which could use its natural resources to boost sustainable tourism and improve the local quality of life.

The implementation of smart technologies in Curitiba is a factor that contributes to the efficiency of urban services. The city adopts solutions such as mobility applications, traffic monitoring, and smart street lighting, which not only improve the quality of services provided, but also allow for more effective management of resources. According to the report by the National Association of Public Transport (2022), "the digitalization of public services in Curitiba has been a crucial factor in improving the user experience and optimizing operating costs."

In Itapemirim, the adoption of smart technologies is still incipient. The city lacks integrated systems that can facilitate citizen participation and improve the management of public services. According to the research of Pires et al. (2024), "the absence of digital platforms that allow communication between the public administration and citizens limits transparency and efficiency in urban management." For Itapemirim to develop as a smart city, it will be essential to invest in technology and innovation. The analysis of the characteristics of Curitiba and Itapemirim highlights the importance of effective urban planning and integrated policies to promote sustainability. In a context where urbanization is advancing rapidly, cities need to find ways to adapt to the growing needs of the population, while preserving the environment. Curitiba's experience, with its systematic and holistic approach, can offer valuable insights for Itapemirim.

One of the most relevant aspects of the discussion is the need for a multidisciplinary approach that integrates different sectors of society, including government, private initiative, and citizens. In Curitiba, community participation in decisions about urban planning has been a crucial factor for the success of the policies implemented. According to Teles et al. (2022), "the involvement of civil society in planning processes contributes to the construction of a more inclusive and sustainable city." For Itapemirim, fostering citizen participation can be an important step to ensure that public policies reflect the needs and aspirations of the local population.

In addition, environmental education plays a key role in promoting a culture of sustainability. In Curitiba, educational campaigns on recycling and environmental preservation have been essential to achieve high recycling rates and environmental awareness. According to Araújo and Lima (2023), "environmental education should be a

priority in public policies, as it is through it that a more aware and engaged population is formed." Itapemirim, by investing in environmental education programs, could create a sense of shared responsibility between citizens and local authorities, promoting concrete actions in favor of sustainability. Another important point to be discussed is the resilience of cities in the face of climate change. Curitiba has demonstrated a commitment to adapting to and mitigating the effects of climate change through strategies such as the recovery of degraded areas and the promotion of green infrastructure. According to the Sustainable Cities Network report (2021), "cities that invest in green infrastructure are more resilient to extreme weather events." Itapemirim, in turn, should consider adopting similar practices to increase its resilience, especially considering its coastal location and vulnerability to weather events, such as rising sea levels and more intense storms.

The comparison between the two cities also illustrates the importance of investments in infrastructure. Curitiba, with a consolidated model of public transport and waste management, benefits from decades of strategic investments. In contrast, Itapemirim lacks the resources and adequate infrastructure to support sustainable urban growth. Fundraising, whether through public-private partnerships, government funding, or donations, can be a viable solution for Itapemirim to develop projects that prioritize sustainability.

In addition, the analysis of smart technologies, such as monitoring systems and data management, reveals a significant opportunity for Itapemirim. Implementing technologies that facilitate the collection of data on resource usage and quality of services can help the city identify areas in need of improvement and respond quickly to emerging issues. The experience of cities that already use these technologies, such as Curitiba, demonstrates that the use of data can increase the efficiency of public services and improve the citizen experience.

Finally, the research concludes that, although Curitiba has established itself as a model of urban sustainability and smart cities, there is vast potential for Itapemirim to transform itself into a more sustainable city, as long as its unique characteristics are taken advantage of and integrated strategic planning is adopted. Curitiba's experiences offer valuable lessons that can be adapted to the reality of Itapemirim, allowing the city to develop a more sustainable and resilient future.

In short, urban sustainability is not just a matter of public policy, but involves a collective commitment and cultural change that must be fostered over time. The exchange of knowledge, experiences, and practices between cities can play a crucial role in building a more sustainable future for all communities. Itapemirim has the opportunity to follow a path similar to that of Curitiba, transforming its challenges into opportunities and building a city

that not only meets current needs, but also respects and preserves natural resources for future generations.

FINAL CONSIDERATIONS

In conclusion, the comparison between Curitiba and Itapemirim highlights the importance of sustainable urban planning and the adoption of smart technologies to improve the quality of life in cities. While Curitiba has established itself as an example of success, Itapemirim has the potential to follow a similar path, but faces significant challenges that must be addressed. Investment in urban mobility, waste management, green areas and technology is essential for Itapemirim to become a sustainable city. Learning from Curitiba's experiences can serve as a guide for the implementation of public policies that promote a more sustainable and intelligent future for the city.

The comparative analysis between Curitiba and Itapemirim in relation to sustainability and the concept of smart cities reveals a picture that emphasizes both the opportunities and the challenges faced by Itapemirim. Although Curitiba has established itself as an exemplary model, with innovative and integrated practices that promote quality of life, Itapemirim, with its natural potential and unique characteristics, still finds it difficult to implement a systematic and effective approach to sustainable development. One of the main lessons that Itapemirim can extract from the experience of Curitiba is the importance of participatory urban planning. The inclusion of the community in the decision-making process not only strengthens governance, but also ensures that public policies reflect the needs and desires of citizens. This involvement can be an engine of transformation, generating a sense of belonging and responsibility in relation to the environment and the city.

In addition, environmental education emerges as a vital tool in building a culture of sustainability. Investing in awareness and training programs can prepare the population of Itapemirim to act proactively in relation to environmental challenges, promoting practices such as recycling and the preservation of natural areas. Strengthening environmental education will not only contribute to improved waste management but also foster a collective mindset towards sustainability.

Resilience in the face of climate change should be a priority for Itapemirim, especially considering its vulnerability to climatic phenomena. The city can benefit from the adoption of green infrastructure practices, which not only mitigate the impacts of climate change, but also provide spaces for leisure and coexistence. Learning from the strategies of Curitiba,

which has integrated green areas into its urban planning, can be a key step for Itapemirim, allowing the city to develop a healthier and more adaptable urban environment.

The use of smart technologies is also a significant opportunity. The implementation of solutions that facilitate data management and the efficiency of public services can transform Itapemirim into a more dynamic and responsive city. By investing in technologies that promote transparency and citizen participation, the city can improve the quality of services and increase the population's trust in public institutions. Finally, building a sustainable city is an ongoing process that requires commitment and collaboration from all sectors of society. Itapemirim has the chance to be inspired by the experiences of Curitiba, adapting them to its unique reality and, thus, charting a more sustainable path for the future. Sustainable development should not be seen only as a goal, but as a collective journey, where every action counts for the preservation of the environment and for the improvement of the quality of life of current and future generations.

Therefore, Itapemirim's prospects as a sustainable city depend on a joint effort that considers its specificities and takes advantage of its potential. With strategic planning, citizen participation, environmental education, resilience and technological innovation, Itapemirim can become an example of a sustainable city, building a more promising and conscious future for its citizens.

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