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A Truly Model City or Just a Fairy Tale?

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Abstract: Nowadays, all kinds of climate disasters, such as global warming and the melting of glaciers, are happening all over the world. Human beings also gradually realized the importance of protecting our only earth and took some measures. Green cities were proposed in the course of the "Green Movement" to protect the global environment. The green city refers to urban construction that emphasizes not only ecological balance and nature protection but also human health and cultural development. Curitiba, Brazil, as one of the representatives of green cities, has not only made innovations in the city's public transport system, BRT but also combined the urban park green space with water control, which not only managed the flood disaster but also provided leisure and entertainment space for citizens. At the same time, they also advocate the EcoCitizen program, which encourages citizens to exchange garbage for food and solves the problem of garbage sorting and recycling and also deals with most of the excess food. At the end of the article, we also searched some pieces of literature and video interviews with Curitiba residents to discuss whether these measures are effective as advertised by the government, as well as the existing problems of green space fairness and the bicycle system. And take Curitiba as a case to summarize and analyze.

Keywords: Curitiba, green city, sustainable development, urban planning

1. Introduction

The charm of the city is that it gathers all kinds of novel and gorgeous things. It gives us a convenient way of life, a high income from work, and a modern life. There are shadows behind the light. The development of urbanization brings a series of problems, such as global warming, sea-level rise, extreme weather, and so on. Humans have broken the balance of nature and paid a corresponding price. How do maintain the development of human

urbanization while living in harmony with nature?

Green cities are a new concept that has been proposed in recent years. It pays full attention to the natural ecology, environmental characteristics, and laws ignored in the past urban construction, determines the principle of overall priority and ecological priority, coexists "demand" and "restriction", and strives to combine the artificial environment and the natural environment to create an ideal urban environment in the future [1].

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2. Background

The green city can be understood as an ecosystem that should achieve its internal balance within a definite range. The green city is a concept of urban development, which is dynamic and consists of ecological ethics and ecological aesthetics. The concept no longer regards people as the first goal of development, but takes ecology as the first goal, attaches importance to other environmental systems, attaches importance to the connection between man and nature, and emphasizes that urban development cannot only focus on production and acquisition without ignoring the stability of the basic environment. There have been many attempts at present, and 15-minute-city is a good one. The concept, offering a novel perspective of “chrono-urbanism”, adds to the existing thematic of Smart Cities and the rhetoric of building more humane urban fabrics [2]. These concepts also need to be followed in the process of building a green city, and they are similar in purpose.

To observe the practices and impacts of green cities from a small perspective, this paper selects Curitiba as a case study. Curitiba is a city located in the south of Brazil. This article will elaborate on two very important green city initiatives in Curitiba, mainly the construction of urban transportation systems and urban parks. In terms of the construction of the urban transportation system, the impact of the rapid transit system on energy conservation and emission reduction and the construction of green cities is mainly discussed. Given its importance in reducing transport emissions, we are also considering extending it to 15-minute-City. In terms of urban park construction, we mainly discuss the role of urban parks in flood control engineering and waste disposal. And analyze their connection with human development, and explore the problems and future directions of green city development.

3. Bus Rapid Transit: Make Public Transport Possible

In the 1870s, Curitiba pioneered the establishment of the world's first BRT bus line with great success. The planner must reconcile three conflicting interests: to "grow" the economy, distribute this growth fairly, and in the process not degrade the ecosystem[3]. Curitiba's attempt became the prototype of the BRT system that later appeared in countries such as the United States, France, Japan, and South Korea.

Bus Rapid Transit (BRT) is a new high-capacity public passenger system between rapid rail transit and conventional public transport. It is a unique urban passenger transport system that uses modern bus technology to cooperate with intelligent traffic and operation management, builds bus-only roads and builds new bus stations, realizes rail transit operation services, and achieves light rail service standards. The system is mainly composed of five parts: dedicated right of way, advanced vehicles, well-equipped stations, line organization oriented to passenger demand, and an intelligent operation management system. The Curitiba Integrated Transportation Network (ITN) is the core system composed of transfer terminals, express routes, direct routes using boarding tubes, feeder routes, and inter-district routes[4]. Curitiba has created a bus-only expressway in the center of the road, and the closed road design ensures the exclusive rights of the bus. The driver can control the traffic lights at the intersection, and the speed is comparable to that of the subway, up to 60 kilometers per hour. At the same time, they use large-capacity double-articulated buses to operate, and cooperate with the transformation of traditional bus stations, such as level landing and outside ticket sales, which not only facilitates passengers to get on and off the bus, but also saves waiting time.

The public transport network in Curitiba is divided into three levels: the first level is the BRT system, and there are five radial expressway axes in the city. The second level is the ring road system and there are three ring lines in the city. The three loops connect five radial bus rapid transit roads into a network. The third level is the supply line. The supply line is a general public bus road. The supply line mainly connects the surrounding satellite towns and express bus lines. Through the

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reasonable connection of these three levels of bus lines, passengers can quickly and easily reach any place in the city.

Curitiba has successfully realized the close integration of land use planning and transportation, which has achieved good results. Not only does the policy encourage mixed land-use development, but the master plan zoning for all land uses and development densities are centered on the roads where the city's bus lines are located. Urban land development is also characterized by the guidance of the BRT corridor. The five BRT corridors present high-density and high-intensity development. The high accessibility provided by the integrated road system promotes concentrated development along transportation corridors, and this development is enhanced by land-use planning methods that allow the most efficient use of Curitiba's land and improve the efficiency of public transport operations and land-use efficiency.

Good operational management is another highlight of the Curitiba system. The government innovation adopts the way of joint investment between the government and the private to build the public transportation system, but puts the dominant power in the hands of the government and prevents it from becoming a tool for private profit-making. Even so, its scientific management system keeps the operating revenue and expenditure of the bus system in a relatively balanced state.

Currently, there are 700,000 cars in Curitiba, but 3/4 of the citizens use the bus every day. All in all, at present, the average vehicle fuel consumption is reduced, making Curitiba the first in Brazil in terms of car ownership per capita, but the pollution is far lower than in other cities of the same size, and traffic congestion is rare.

4. Green Parks: Give Space Back to Green and River

It takes some momentum to build these large urban parks. In the mid-19th century, for example, a large number of public urban parks were built in the United States to mitigate the spread of disease and epidemics and their associated costs of poverty and reduced labor productivity[5].

If disease prompted the creation of urban parks in countries such as the United States, it was nature that did so in Curitiba.

Every city has its own natural geographical challenges. During the city's first two centuries, people and the river lived in harmony. But that changed in the 1950s and 1960s. The world was in a period of explosive population growth. Since 1950, cities have been growing by a million babies and migrants a week and there are now more people living in cities (3.2 billion) than there were in the world in 1960[6]. People began to settle on the low plains flooded by the river. The pressure of urban expansion has intensified the illegal development of the flood plain. The old municipal works cannot bear the pressure of drainage of the new city. Water control has become one of the most important problems in Curitiba city.

Wealthy US cities such as New Orleans and Sacramento, which also suffer from flooding, have opted to build levee systems in flood plains, but they are costly to maintain. Sao Paulo, Brazil's largest city, chose to increase the depth of its rivers to deal with flooding, at a cost of more than $1 billion. But Curitiba cannot afford such amount of money.

At the time, Mayor Lerner, proposed to let the water flow freely, to make a park for people to see the water. He decided on an unorthodox solution: the government would buy flood plains and build wetland parks. The government mobilized people living in flood plains to relocate to other areas and dug artificial canals to increase river capacity. Now the entire floodplain is a huge wetland park, and the sponge city is basically formed. The flood was diverted into the park's artificial channels and lakes, and the flood was resolved, protecting the valley floor and river banks, and providing recreation and relaxation for thousands of citizens.

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According to the latest statistics, Curitiba has 35 parks, 1,004 protected areas and 78,000 square meters of natural forests. Overall, it's about 64 square meters of green space per person, but 50 years ago, it was less than one square meter of green space per person.

In an effort to protect nature, the city government has banned the paving of hard roads in the park. All of these measures are designed to protect the health and integrity of the natural system and to maintain the water circulation of the city so that rainwater can soak in place when it falls.

5. Waste Disposal: Ecocitizens Program

Currently, more than 70 percent of Curitiba's waste is recycled and reused through the program. Cities do not dispose of garbage for free, and all residents must pay for it as they pay for electricity and water. But the government also encourages participation. Every household must separate organic waste from general waste, especially plastic, glass and metal, so that it is easier to recycle and dispose of waste. About one to three times a week, the government comes to pick up trash for free.

But in slum or shanty conversion areas, the provision of lifeline infrastructure lags far behind the pace of urbanization, and slums around cities often have no formal utilities or sanitation facilities [6]. So regular garbage pickup is impossible. Curitiba has come up with Ecocitizens program. When it's time to recycle, people in the neighborhood swap bags of trash for food: For example, 60kg of rubbish can be exchanged for 60 vouchers, enough to buy food for the whole family for a month, as well as bus tickets, school exercise books or Christmas toys.

The eco-Citizen program is capable of collecting 500 tons of rubbish a day. Since its launch, it has collected a total of 11,000 tons of rubbish, spending nearly a million bus tickets and 1200 tons of surplus food in kind. The program benefited 31000 families in 60 slum areas by improving sanitation in their neighborhoods.

Despite averaging 64.5 meters squared of green space per capita [7], Curitiba’s green space situation is not what it appears to be on the surface. The 64.5 square meters per capita is a number arrived at when looking at the entire city as a whole, it’s assuming that the green spaces are distributed evenly across the city, but this is not the case. Accessibility to green spaces is unequal. Most green areas are located in the northern section of the city where the elite neighborhoods are located; some are in the southeastern section of the city where some of the poorest neighborhoods are located; in the other two-thirds of the city, they are few and far between. Much of the green space in Curitiba is also privately owned. The public green area per capita is closer to 12.2m squared [7]. Only about 54% of Curitibans said that they use green spaces for leisure, the other 46% did not have access to one nearby [7].

Curitiba’s transportation system has some major flaws. Curitiba’s public transportation currently consists only of BRT (bus rapid transport) lines. The BRT system was once considered state of the art. When it started operations in 1974, it was praised as a model for all the world to look to. Even today 2/3 of the citizens still take it every day. However, in recent years more and more residents are opting out of taking it. There are multiple factors contributing to this.

Firstly, buses are slow. They have low speeds to ensure the safety of passengers on board since most are operating at full capacity. For residents who are on a time crunch buses are not a viable option. Secondly, bus fairs have been on the rise. Add to that the fare system of Curitiba’s BRT, fares are charged for each ride and not according to the distance traveled, and each bus transfer that requires riders to exit bus terminals also requires purchasing another ticket, riding the bus has become expensive, especially for those traveling short distances. In many cases, it was cheaper for families to commute by car than to take the bus and cars were by far what residents turned to. Curitiba now has the highest vehicle-to-residence ratio in Brazil, with 1.33 cars for every resident as of 2015[7].

The lack of alternative modes of transportation that are viable other than bus lines is what’s pushing residents to commute by car more and more[8]. As previously mentioned Curitiba’s public

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transportation only consists of BRT and there are no alternatives to choose from. Alternative modes of non-public transportation such as bikes or just walking are also mostly not viable. In surveys done by The University of Twente, they found that most residents of Curitiba consider cycling to only be viable for leisure purposes. This is reflected in the city's failed bike lane projects. The city tries to discourage driving in the city by limiting the number of roadside parking spaces available in the city center [9], but without proper walking or biking infrastructure in place, this is simply going to inconvenience residents. And regarding infrastructure that increases walkability, this city has made no efforts to improve it. City municipalities have only made efforts to build bike lanes intended for leisure and bike activist groups are often sidelined in political conversations regarding the future of mobility in Curitiba [10]. Safety concerns have been a long-lasting deterrent against walking and cycling and the city has yet to address the issue of unsafe streets [8].

Curitiba has its strong suites when it to sustainability but in many other areas, it fails to perform well. The city fails to build towards all aspects of sustainability, being unable to achieve walkability, defined as having dense cities in which services, amenities, and public spaces can all be reached in a short time frame either on foot, by bike, or through public transportation in MDPI's article 'Introducing the "15-minute-city"'. It also fails to consider all aspects that are important to urban planners. As written by Scott Campbell in his 1996 Journal of the American Planning Associations article, an urban planner has to work with the 'planner's triangle', balancing equity, economic development, and environmental protection. This balance is lacking from most if not all sustainable projects in Curitiba. The city fails to address issues of equity and some developments such as their car-centric city design undermines economic development by making it difficult for residents to be efficient with their time.

However, despite its problems, Curitiba's sustainable developments still reference value to cities around the world aiming to become more sustainable. Curitiba managed to build functional public transportation that had very low costs to set up and they were very efficient with both land and money when it came to their parklands that doubled as flood control. So in the end we conclude that despite Curitiba not being what it advertises itself to be to the world, it is still a city on its way to becoming more sustainable with developments that the world at large can look to for inspiration.

6. Conclusion

As one of the world's green city models, Curitiba has some innovation in its traffic system, park system construction and garbage collection strategy. In addition, these new methods and technologies have promoted the process of urban greening in Curitiba and the whole world. Compared with some previous studies, this paper adds the analysis of user feedback, and it turns out that it's not what we imagined at first and it creates new social problems. It is very easy to overlook problems when one isn't looking at the entire picture. This is very much present in the discussion surrounding Curitiba. In the end Curitiba is neither a model city or just a fairy tale. It may be far from perfection but this impression of it is based on reality, albeit a very narrow perspective on the truth. So perhaps in the near future, the green city process will not only need to solve technical and strategic problems, but also need to consider the fairness of people of different races and backgrounds. Let the case of Curitiba be a lesson on both striving towards sustainability and the importance of looking at every perspective. And in the future, in our collective path towards sustainability, make sure to bring the good in Curitiba along and avoid the mistakes it made.

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