Article

Living in a Chinese Industrial New Town: A Case Study of Chenglingji New Port Area

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Abstract: Building new industrial towns has become a popular strategy for the Chinese government, as part of its aim to disperse the population and create new concentrations of activity. However, relevant studies have shown that these development strategies often struggle to provide appropriate infrastructure and public services to residents. In this paper, we explore the case of Chenglingji new port area, which is an industrial new town in Yueyang City, Hunan Province. To understand the provision of public services in the area, we analyzed the construction of public service facilities using GIS software, while 939 questionnaires were distributed and collected from local residents and workers. The survey results confirm the low level of satisfaction with the livability of the area, and the lack and unevenness of public services to meet the needs of local residents and foreign workers. It further emphasizes that the provision of public services should be considered in the future planning of the Chenglingji new port area. We also provide some suggestions on the construction of industrial new towns of the same type as Chenglingji and other developing countries.

Keywords: industrial new town; Chenglingji new port area; China; provision of public services

1. Introduction

The demands for new housing and centers of activity in China has led to the development of new towns all across the country. Scholars have identified four types of new towns in China, which are designed and developed to meet different demands, as follows: (1) industrial new towns, (2) new pastoral towns, (3) new sub-central towns, and (4) new administrative towns [1]. In this study, we focus on the industrial new town, which is a reinterpretation of China's typical industrial park or urban development zone [2,3]. The industrial new town relies on the mutual integration of industrial and urban functions, which leverages the driving effect of industrial development or urban construction on the surrounding areas [4]. In the past three decades, the Chinese government has aggressively promoted the construction of this type of new town through various transformation projects in the national industrial parks [5]. Some examples include the Suzhou Industrial Park [6], the Guangzhou Development Zone [7], and the Tianjin Economic and Technological Development Zone [8].

The growing population in and excessive development of China's industrial new towns has caused several urban problems, such as pollution, traffic jams, and a low level of public facilities and services. As a result, providing high-quality public services has become one of the most pressing issues in China's industrial new towns [9]. Scholars have identified the challenges faced by these new towns to meet the needs of residents [10,11]. The first is the difficulty concerning transport for company workers who travel to and from the industrial new town and the parent city [12]. The second is the imbalance between industrial development and infrastructure provision, which leads to poorer living standards.

The third is that some of the industrial new towns still have some environmental pollution problems [13,14]. Seemingly, the incapacity of industrial new towns to address the livability issues [15] has driven new problems that are related to slow urban population growth and population decline.

To prevent the worst case from happening, it is essential to assist these towns in developing better strategies to provide high-quality public services to the residents. Therefore, this study aims to clarify the problems in the provision of public service facilities in industrial new towns and will propose some measures to improve the development of industrial new towns in China. It will also provide a reference guide for the development of the same type of cities or regions in other developing countries. Chenglingji new port area is selected as the case study based on the following considerations. First, few studies have explored the case of Chenglingji, despite its status as a national Chinese high-tech zone. Second, this town has experienced rapid development in recent years. Chenglingji new port area is considered one of the fastest growing industrial new towns in Hunan Province. However, Chenglingji has experienced a slowdown in its population growth, which may pose a more serious threat in the future.

We will begin our paper with an introduction on the history and trends of industrial new towns in China. We will then describe the methodology that is used in this study and present the results and discussions. Finally, we will conclude the study and make some recommendations to improve the quality of public service delivery in Chenglingji.

2. History of Industrial New Town Development in China

This section begins by describing the history of China's industrial new towns, which began with the birth of the danwei system. We will then provide the history of industrial new towns in the dedanweilization period, which later led to the development of the modern industrial new towns that Chinese people are familiar with today.

2.1. Danwei System Period

Chinese people used to refer to the social organizations or institutions where they were employed (e.g., factories, stores, schools, hospitals, research institutes, government agencies, etc.) as "*danwei*" [16]. Foreign scholars, such as Bjorklund, translated *danwei* as work units [17]. In the late 1940s, after the founding of the People's Republic of China, a planned economic system was implemented. At the same time, to quickly complete socialist industrialization, the core of urban construction focused on production and industrial development [18]. Therefore, to solve the problems of housing, transportation to and from work, and medical care for workers, and to improve the productivity of the cities, the Chinese government proposed the solution of building *danwei* communities. Chinese scholar Chai explained this as a form of urban functional space and residential settlement that formed under China's planned economic system, in which the government took the lead in arranging residential areas and public services around the *danwei* (Figure 1), and as a social system that was proposed by the government from the perspective of the unified allocation of social resources [19]. *Danwei* played a significant role in the workers' livelihoods and defined their social, economic, and political lives [20]. According to Tan's study, *danwei* communities are spatially divided into the following three main components [21] (see Table 1): core functional areas, employee housing areas, and public service areas.

The space allocation planning for the cities in this period depended on the types and sizes of the *danwei* communities that were present [19]. As shown in Figure 2, Chinese cities are usually formed of numerous *danwei* communities of different types and sizes. These communities can be subdivided into industrial, administrative, commercial, medical, infrastructural, cultural, and educational categories. They can also be divided, based on their size, into hub, neighborhood, city district, and city levels (see Table 2).
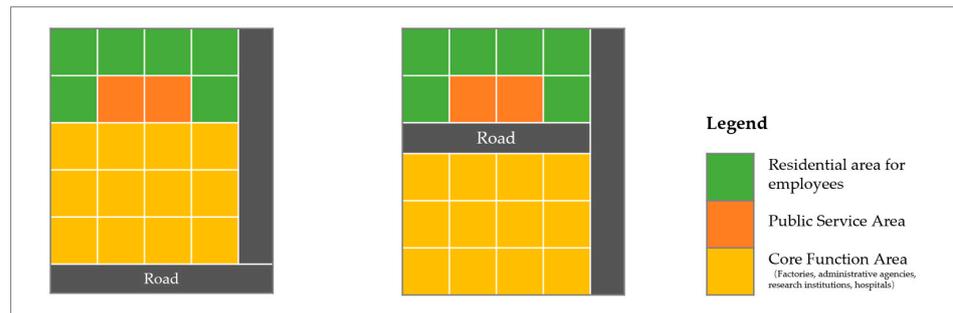
Figure 1. Two basic spatial patterns of the *danwei* community (adapted from [21]).

Table 1. Main functional zoning of the *danwei* community.

| Function Zoning	Content	Characteristics
Core functional area	Factories, administrative organs, scientific research institutions, large medical institutions, etc.	The core of the *danwei* community, occupying most of the land, is where the employees work and produce
Residential area for workers	Dormitory buildings, residential buildings	Allocated by the *danwei*
Public service area	Educational facilities, medical facilities, living facilities, recreational facilities	The larger the size of the *danwei*, the better the supporting service facilities
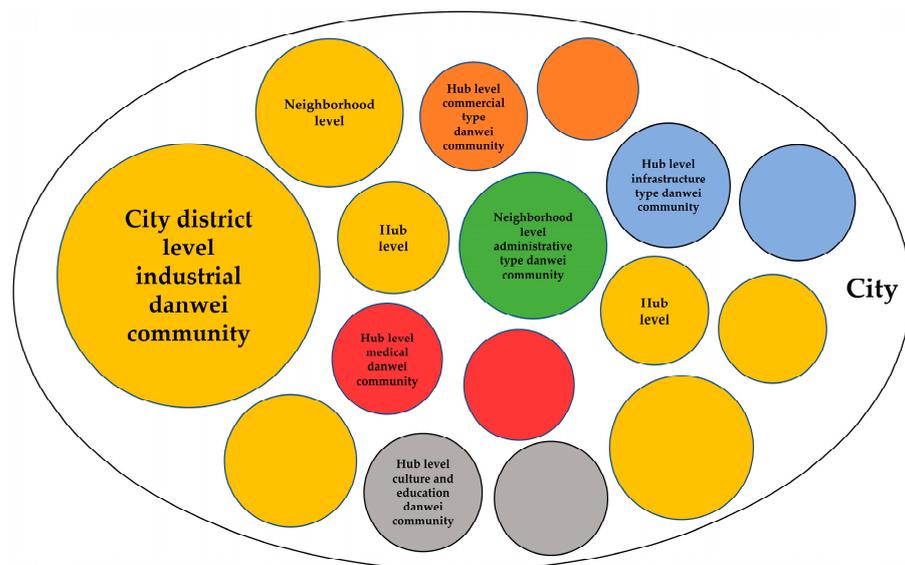
Figure 2. Distribution of the *danwei* communities in built-up areas of a Chinese city during the period (adapted from [19]).

Table 2. Size classification of the *danwei* community.

Classification	Core	Population Size	Characteristics
Hub level	Small state-owned enterprises or state-owned institutions	Less than 10,000 people	Public service facilities are limited and need to rely on other public service facilities in the city
Neighborhood level	Medium-sized state-owned enterprises or state-owned institutions	About tens of thousands	Perfect, independent community-supporting facilities
City district level	Large state-owned enterprises or state-owned institutions	About 100,000 people	Fully functional, it even has its own hospital, university, and business district
City level	Super large state-owned enterprise	Hundreds of thousands	The *Danwei* community evolved into a separate, integrated city

Among all of the *danwei* communities, the city level was often regarded as being very special. These were industrial satellite towns that were based on major industrial projects [22,23]. Relying on their resources, these new towns were engaged in mining, industrial production, and so on, and were seen as a super community. Typical examples are the town of Daqing, which was formed by the Daqing oil field in Heilongjiang Province, and the town of Panzhihua, which was created by the Panzhihua Steel Company in Sichuan Province. This phenomenon can also be found in other countries, such as the Ruhr industrial region in western Germany, where coal and steel companies were located in relation to cities such as Bochum and Dortmund. Most of these industrial satellite towns were arranged in the suburbs of the city to serve the parent city, and at the same time enable the employees to enjoy better service facilities in the city. The industrial satellite towns were established at that time due to their historical background and were one of the origins of the industrial new towns in China.

2.2. The Dedanweilization Period

With the reform and opening up that occurred in 1978, China's development model that had been based on the *danwei* system and the planned economy gradually changed to a development model that was based on the market economy [24,25], which Chai called *dedanweilization* [19]. Wei's study showed that during this period, due to the promotion of the commercial housing system, housing was no longer uniformly allocated by the unit and residents were free to choose where to live in the city [26]. Meanwhile, the Chinese government also began to move and concentrate industrial parks in the periphery of the city. This resulted in the formation of special economic zones, economic and technological development zones, and high-tech industrial development zones (which are referred to as development zones) and triggered a boom in the construction of development zones by governments across the country [27,28]. The production and living spaces in the *danwei* communities were gradually dispersed and divided. As the window to China's opening to the outside world and the main site of urban industrial production, development zones have gradually become an important pillar of national and regional economic revitalization [29,30]. They have also greatly contributed to the industrialization and economic development of China.

2.3. Development Zone to Industrial New Town Period

Zhang believes that China's development zone model is derived from the international export processing zone and technology park models [31,32]. Chen's study considered that because most of the development zones are spatially independent urban areas that are close to or separate from the old city, this has led to the emergence and rapid development of a number of new towns [33]. However, Bai's study concluded that due to the distance between these new cities and the main urban areas, which carry the main functions and activities of the city, the supporting services have not yet been perfected, the living atmosphere is insufficient, and the ability to gather the population is limited [34]. As a result, some Chinese scholars have begun to advocate for the improvement of public service facilities in development zones [35,36] and the transformation of development zones from single-function industrial agglomerations to industrial new towns with integrated urban functions.

2.4. The Current Development of Industrial New Towns in China

The difference between industrial new towns and the previous industrial parks and development zones is that they emphasize the independence of economic operation and urban management and are also well-equipped with supporting facilities. Wen explains an industrial new town as a city-level complex that integrates industry, housing, offices, commerce, leisure and entertainment, medical care, schools, and other essential urban resources [37]. However, current research shows that the unbalanced allocation of public service facilities [38], a lack of infrastructure [39], and the separation of jobs and housing [40]

have also emerged in China in the construction process of industrial new towns, which has led to population loss and a slowdown in the development of industrial new towns. Therefore, how to rationally plan basic public service facilities in the process of industrial new town development is an urgent problem that needs to be studied and solved at this stage.

3. Research Area and Data Collection

3.1. Research Area

Chenglingji new port area was established in December 2009 and is located in the northeast of Yueyang City, Hunan Province (see Figure 3). This is the connecting point of the Yangtze River Delta and the Pearl River Delta Economic Belt, and the intersection of the Changsha–Zhuzhou–Xiangtan City Cluster and the Wuhan City Circle. Chenglingji new port area, with a planned area of 100 square kilometers and 11.9 km of Yangtze River deep water gold coastline, is a national industrial new town in China. Chenglingji Port is also one of the first foreign trade ports that was opened in the country and the only port connecting the river to the sea in Hunan Province. By 2021, the GDP of Chenglingji new port area was CNY 27.52 billion and the resident population was 109,800 (source: the government's public website http://www.cljxgq.gov.cn/, accessed on 1 September 2022), which is the core area of Hunan Province's opening to the outside world and a center of new economic population growth.
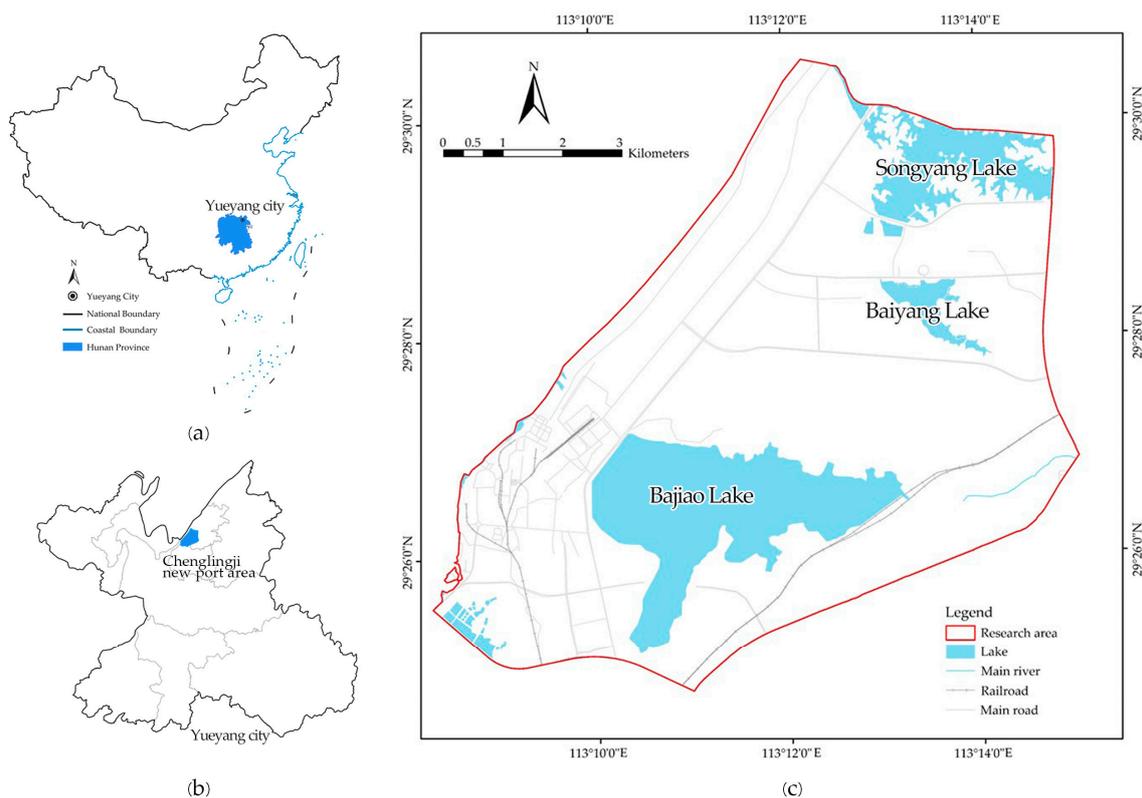
Figure 3. Location of Chenglingji new port area. Note: (**a**) Yueyang City's location in China and Hunan Province; (**b**) location of Chenglingji new port area in Yueyang City; (**c**) Chenglingji new port area.

3.2. Data Collection and Analysis

To systematically understand the problems in the construction of the industrial new town, we first obtained information on the local economy, population, and public service facilities from the statistical yearbook and planning documents of Yueyang City. We also collected POI (point of information [1]) data on the local public service facilities through the

open platform Gaode Map for analysis and carried out field surveys in the local area to understand the current state of the public service facilities in the Chenglingji new port area.

Secondly, a research questionnaire was designed through participant observation and fieldwork, and was distributed to residents and employees in the Chenglingji new port area through WeChat to understand their basic information and the demand for public service facilities. The main contents of the questionnaire are shown in Table 3. A total of 939 valid questionnaires were collected. Based on the basic information in the completed questionnaires, we cross analyzed the basic information from the respondents with their needs to more accurately understand the needs and differences of different types of people for public service facilities.

Table 3. Main contents of the questionnaire.

Classification	Questions	Answers
X Basic information for residents	**X1** Gender	**X1$_1$** Male **X1$_2$** Female
	X2 Age	**X2$_1$** Under the age of 29 **X2$_2$** 3 to 49 years old **X2$_3$** Over 50 years old
	X3 Education level	**X3$_1$** University **X3$_2$** High school **X3$_3$** Junior high school
	X4 What industry do you work in?	**X4$_1$** Industrial **X4$_2$** Government departments **X4$_3$** Commercial **X4$_4$** Service industry **X4$_5$** Other industries
	X5 Monthly wage income	**X5$_1$** Under CNY 3000 **X5$_2$** CNY 3000–5000 **X5$_3$** CNY 5000–8000 **X5$_4$** More than CNY 8000
	X6 Marital status	**X6$_1$** Married **X6$_2$** Unmarried **X6$_3$** Divorced
	X7 With or without children	**X7$_1$** Yes **X7$_2$** No
	X8 Place of daily living	**X8$_1$** The new port area **X8$_2$** Other areas
	X9 Commuting time	**X9$_1$** 5–10 min **X9$_2$** 10–30 min **X9$_3$** More than 30 min
Y Residents' demands for public services	**Y1** What public service facilities do you think are currently lacking in the Chenglingji new port area? (multiple answers possible)	**Y1$_1$** Scientific, educational, and cultural service facilities **Y1$_2$** Sports and leisure service facilities **Y1$_3$** Commercial complexes **Y1$_4$** Schools **Y1$_5$** Children's services facilities **Y1$_6$** Others
	Y2 What other public services would you like to see built in the area in the future?	Write a sentence in the questionnaire
	Y3 Are you satisfied with the livability in the area?	**Y3$_1$** Very satisfied **Y3$_2$** Fair **Y3$_3$** Dissatisfied **Y3$_4$** Very dissatisfied

Finally, semi-structured interviews were conducted with 15 local government officials, business leaders, grassroots employees, and local residents to gain insight into their views on and needs from the area.

4. Analysis of the Public Service Facilities in Chenglingji New Port Area

4.1. Provision of Public Services in Chenglingji New Port Area

4.1.1. Spatial Distribution of Public Service Facilities

Based on the POI classification of the Gaode Map and the requirements of the Chinese government for basic public service facilities in industrial new towns, we conducted an in-depth investigation and collected POI data on the sports and leisure service facilities, schools, scientific, educational, and cultural service facilities, shopping facilities, restaurants, medical service facilities, parks, and children's services facilities in the Chenglingji new port area. A total of 709 valid pieces of data were obtained. All of the data were sorted and classified using the geographic information spatial analysis software ArcGIS. The specific classification for each type of data and the number of POI points are shown in Table 4.

Table 4. Classification and quantity of POI points for public service facilities in the Chenglingji new port area.

|	Sports	School	Science	Shopping	Catering	Medical	Park	Children
POI point Classification	Playground	Kindergarten	Museum	Duty-free shop	Chinese restaurant	Clinic	Eco-park	Early education institutions
	Stadium	Primary school	Library	Ordinary shopping mall	Fast-food restaurant	Emergency center	Civic square	Children's training institutions
	Basketball court	Middle school		Convenience store	Casual dining	Pharmacy		
	Swimming pool			Featured commercial street	Café	Pet hospital		
				Comprehensive market	Tea house			
Chenglingji new port area points	6	17	4	250	367	42	4	19

By analyzing the spatial distribution and quantity of various public service facilities in the Chenglingji new port area (Figure 4), it can be seen that the public service facility system in the area needs to be more balanced. In terms of quantity, there are more dining and shopping facilities, while there are fewer scientific, educational, and cultural service facilities, parks, sports facilities, children's services facilities, and so on. Spatially, they are mainly concentrated in the area to the southwest of Bajiao Lake, near the main urban area of Yueyang City and in the area around Baiyang Lake, with less distribution in other areas.

4.1.2. Evaluation of the Current Public Service Facilities

Referring to the method of Chinese scholar Wei et al. [41], this study analyzed the accessibility of public service facilities and the carrying capacity. We evaluated them comprehensively to objectively determine what problems exist in the construction of public service facilities in the Chenglingji new port area at present.

1.   Evaluation of the accessibility of public service facilities

Firstly, according to the principle of proximity and using the attribute that any position in the Tyson polygon [2] is closest to the sample point (public service facility point) of the polygon, we delineate the service area of each public service facility in the Chenglingji new port area using GIS spatial analysis software, as shown in Figure 5.
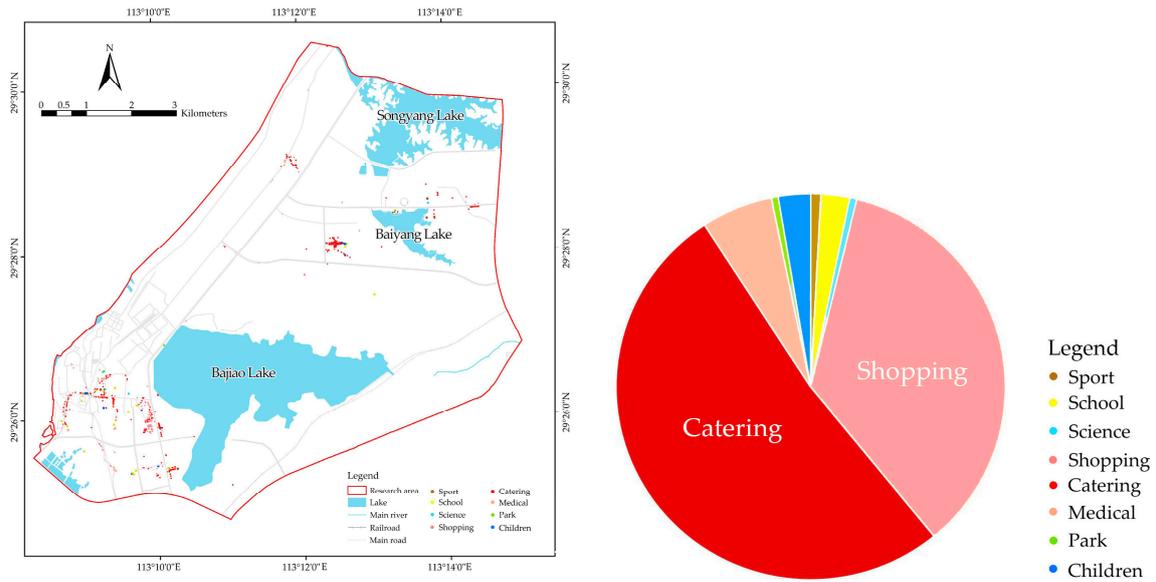
Figure 4. Map of the spatial distribution and proportion of the number of various types of POI public service facilities.
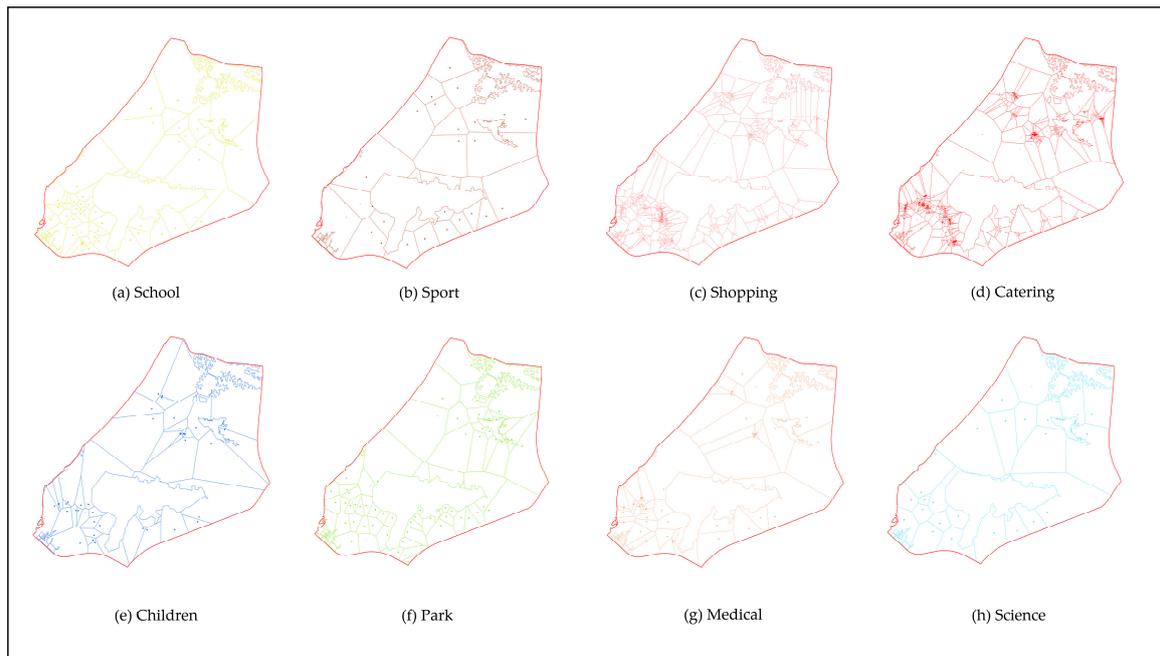
**Figure 5.** The service area of each public service facility.

Secondly, the walking time of the furthest residents in each service area was calculated, according to the area of a specific public service facility. With a walking speed of 4 km/h as the baseline, the accessibility of public service facilities was divided into the following four categories: comfortable (0~15 min), relatively comfortable (16~30 min), slightly uncomfortable (31~45 min), and uncomfortable (more than 45 min), to analyze the residents' accessibility to each public service facility, as shown in Figure 6. Among them, it can be broadly seen that the accessibility of parks, science, education, and cultural facilities is very uncomfortable, and most residents need to walk for more than 45 min to reach these public service facilities.

(a) School (b) Sport (c) Shopping (d) Catering

(e) Children (f) Park (g) Medical (h) Science

Comfortable (0–15min) Relatively comfortable(16–30min) Slightly uncomfortable(31–45min) Uncomfortable(More than 45min)
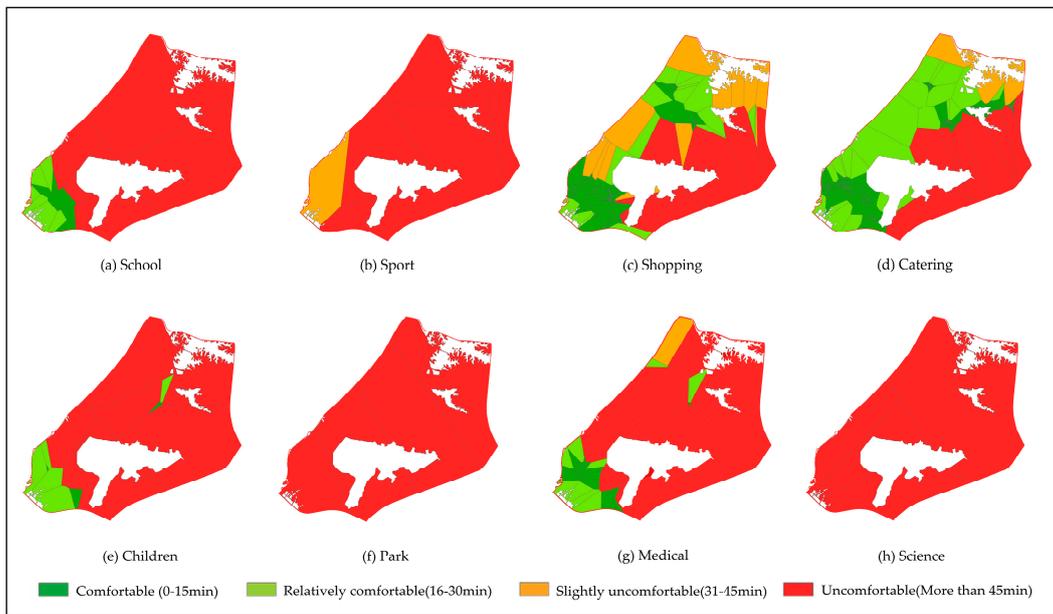
Figure 6. Residents' accessibility to public services.

2. Evaluation of the carrying capacity of the public service facilities

Thirdly, using the population density data [3] of China in 2020 (Figure 7), the population carried by each public service facility was calculated. At the same time, the Jenks natural breaks classification [4] was used to visualize the carrying capacity by all kinds of facilities' service areas (Figure 8). The carrying capacity of the facility was evaluated using the following four levels: low, relatively low, slightly high, and high. Of these, this region has the highest carrying capacity for schools and child-serving facilities.
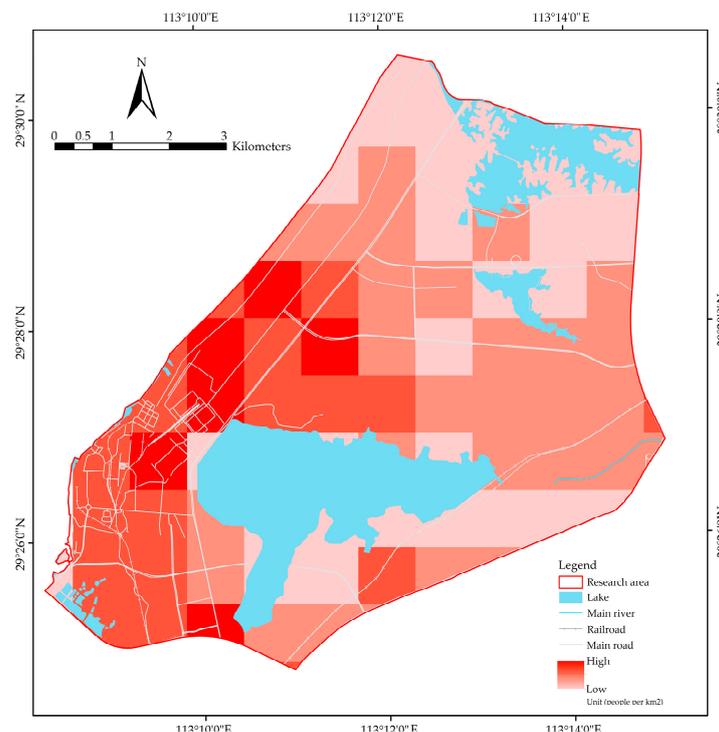
Figure 7. Population density data for the Chenglingji new port area in 2020.
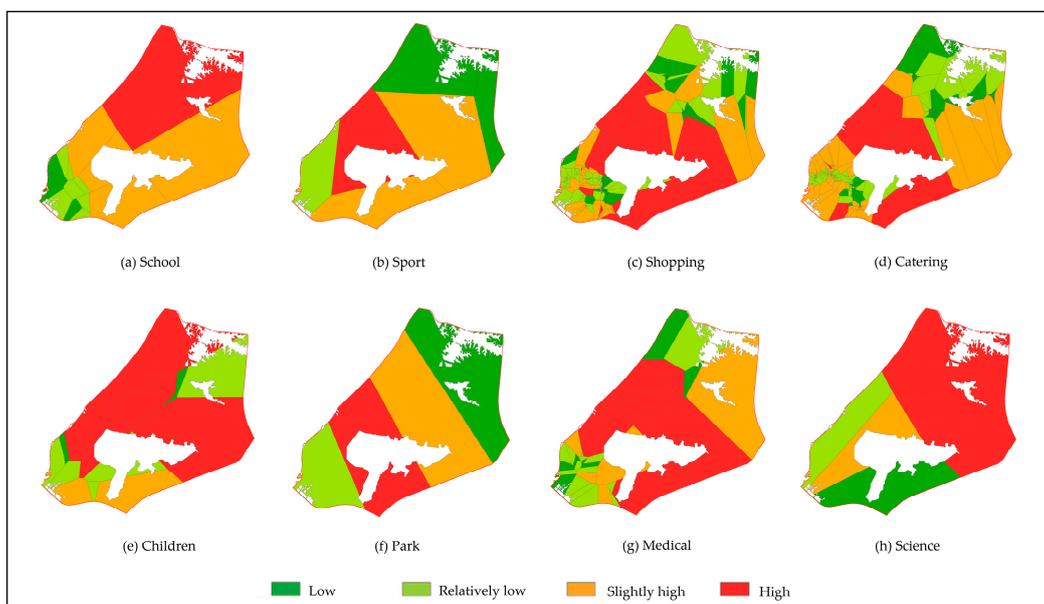
Figure 8. Carrying capacities of the public service facilities in the Chenglingji new port area.

3. A comprehensive evaluation of the public service facilities

To compare different public service facilities in the Chenglingji new port area, the average service scope [5], carrying capacity mean value [6], standard deviation, and coefficient of variation [7] of the various public service facilities were calculated using ArcGIS spatial analysis software (see Table 5). Referring to the method of Chinese scholar Wei et al. [41], this study analyzed the overall accessibility of the public service facilities and the carrying capacity were then comprehensively evaluated.

Table 5. Evaluation results for the public service facilities in the Chenglingji new port area.

|	Catering	Shopping	Medical	Children	School	Park	Science	Sports
Average service scope (km^2)	0.16	0.23	1.35	3.34	3.34	14.19	14.19	9.46
Standard deviation	0.60	0.78	2.76	4.29	6.18	4.35	11.16	4.09
Coefficient of variation	3.75	3.39	2.04	1.28	1.85	0.31	0.79	0.43
Accessibility	Comfortable		Relatively comfortable	Slightly uncomfortable		Uncomfortable		
Carrying capacity mean value (10,000 people)	0.29	0.34	0.72	1.23	1.21	3.29	3.64	2.29
Standard deviation	0.24	0.30	0.57	0.86	0.9	1.23	0.49	1.13
Coefficient of variation	0.83	0.88	0.79	0.70	0.74	0.37	0.13	0.49
Degree of carrying capacity	Low		Relatively low	Slightly high		High		

Generally speaking, although catering and shopping facilities have the most discrete data due to their uneven spatial distribution, they were still the public service facilities with the largest number, the best accessibility, and the lowest carrying capacity level in the Chenglingji new port area at present. The accessibility of medical services was relatively comfortable and the carrying capacity was relatively low, which showed that the current state of construction was relatively good. However, it should be noted that there are only small clinics and pharmacies in the area, and there is no large general hospital. Data dispersion, accessibility and carrying capacity of children's services and schools were slightly worse. Scientific, educational, and cultural service facilities, parks, and sports

and leisure service facilities were the worst constructed public service facilities in the Chenglingji new port area. Although they had the lowest discrete data, probably because of their small number and more balanced distribution in the area, their uncomfortable accessibility and high carrying capacity level indicated that the residents incurred the highest travel costs to access these public service facilities.

According to our field survey, the dining and shopping facilities in the Chenglingji new port area are of low quality and there are no large shopping malls or commercial complexes. Although basic medical services, such as clinics and pharmacies, are relatively good, there is no large general hospital in the area, and there are no elderly and disabled services. Finally, among the children's services, there are some early education and child training institutions, but there are no childcare institutions serving children aged 0–3.

4.2. Basic Information about the Respondents and Their Needs for Public Service Facilities

Based on the GIS spatial analysis, a questionnaire (Table 3) was designed in anticipation of exploring the basic conditions of the local residents and employees of enterprises, and their needs for public service facilities. By counting questions X1–X9 in the questionnaire, we can see the basic information profile for the respondents (Figure 9).
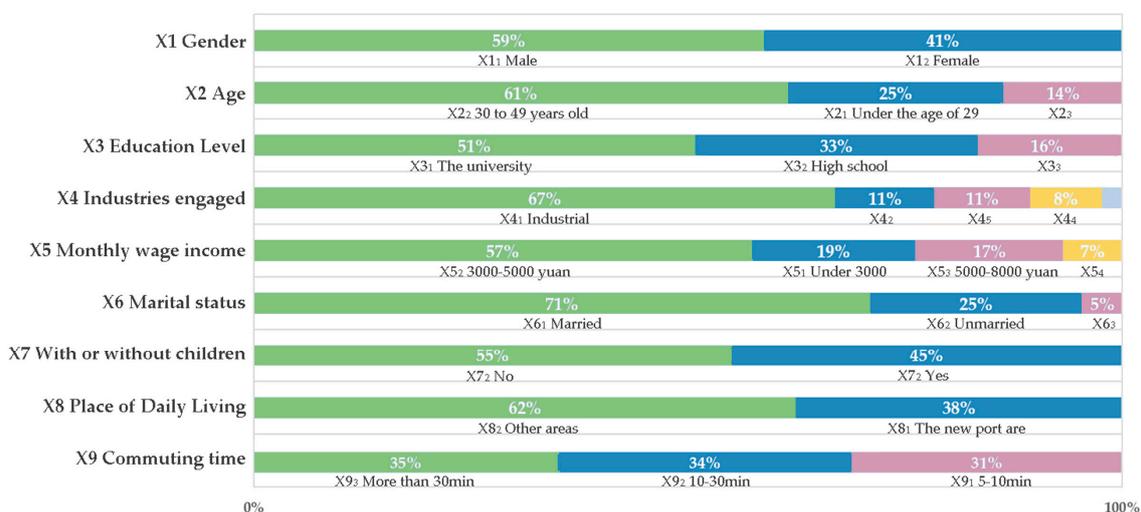
Figure 9. Statistics on the respondents' basic information in the questionnaire (questions X1–X9).

1. There were slightly more men than women, more middle-aged people, and fewer teenagers and older people.
2. The vast majority of people had university degrees and high school degrees, with fewer people with low education.
3. The largest number of people were engaged in industry, with most residents earning CNY 3000–5000 per month.
4. Most residents were married, and nearly half had school-age children at home.
5. Only 38% lived in the Chenglingji new port area, and 35% had a daily commute of more than 30 min.

According to Y3, it can be seen that only 14.67% of the respondents were very satisfied with the livability in the area. By counting the options in question Y1, it can be seen that they have certain needs for all kinds of public service facilities. In addition, to understand the other needs of the respondents in detail, we designed a fill-in-the-blank question Y2 for the residents to fill in their own suggestions for future construction in the area. The word frequency analysis also shows that public transportation facilities, commercial complexes, sports fields, parks, and large hospitals are among the public service facilities that most respondents expect the government to add (Figure 10).
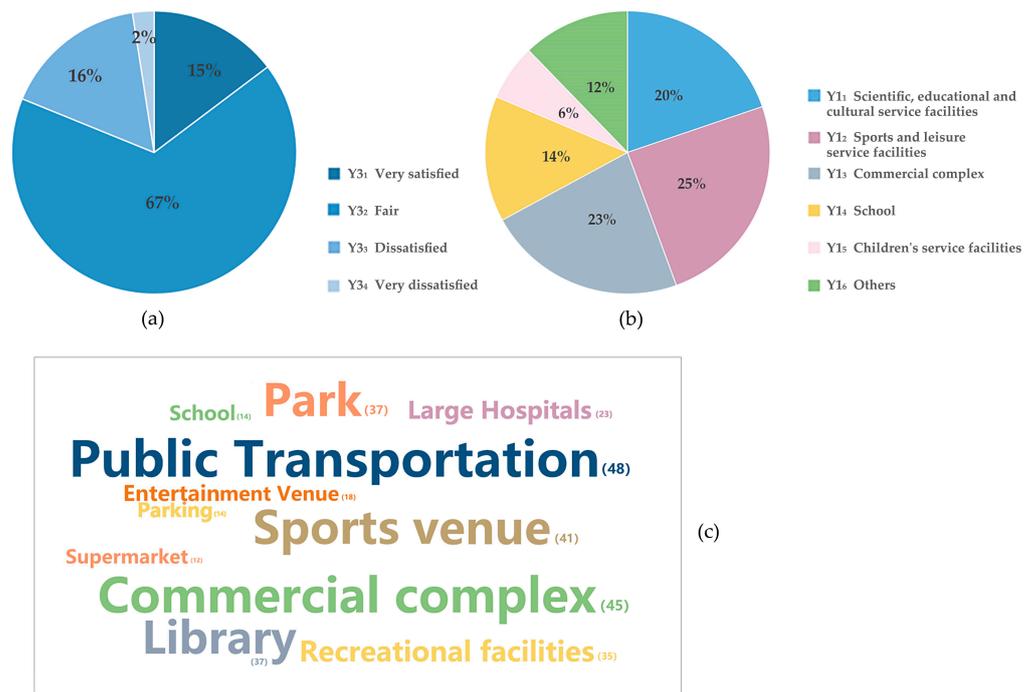
Figure 10. Respondents' perceptions of the local public service facilities. Note: (**a**) question Y3, satisfaction; (**b**) question Y1, demand for public service facilities; (**c**) word frequency analysis for question Y2.

4.3. Analysis of the Differences in the Needs of Different Respondents

To further investigate the differences in the demand for public service facilities among the residents of the Chenglingji new port area, we used SPSS software to cross-tabulate the basic information (questions X1–X9) and the demand for public service facilities (question Y1) in the questionnaire, in which the demand from residents of different age groups, with and without children and with different incomes showed significant differences. To understand the reasons for these differences, in-depth interviews were conducted with these groups.

1.　Demand from different age groups

Cross-tabulation analysis was used to analyze the demand for public service facilities by age group (Figure 11). The results showed a significant difference at the 0.05 level (x^2 = 18.734, *p* = 0.044 < 0.05). Combined with the interviews, it can be seen that the demand for other public service facilities is significantly higher, mainly among those aged 50 and above, who, according to the interviews, are more concerned about their health and the environmental quality of the area, and believe that at least a large general hospital needs to be built in the local area, and that the government should improve local air and water pollution. For example:

> *I've lived here since I was a child, and now I'm in my 50s and not in good health, but there isn't even a big hospital here. It is an industrial area and the environment is also very bad, the air and water quality are not good*. (Interview number: NPA08.)

Young people under 29 years of age felt that the area needed a commercial complex, as well as sports and leisure services, as in the following example:

> *It's really boring for us to work here. Although there are many small restaurants and stores here, there is no big commercial complex, and there are few gymnasiums and swimming pools, so we can only stay in the dormitory and play with our phones after work during the week*. (Interview number: NPA06.)
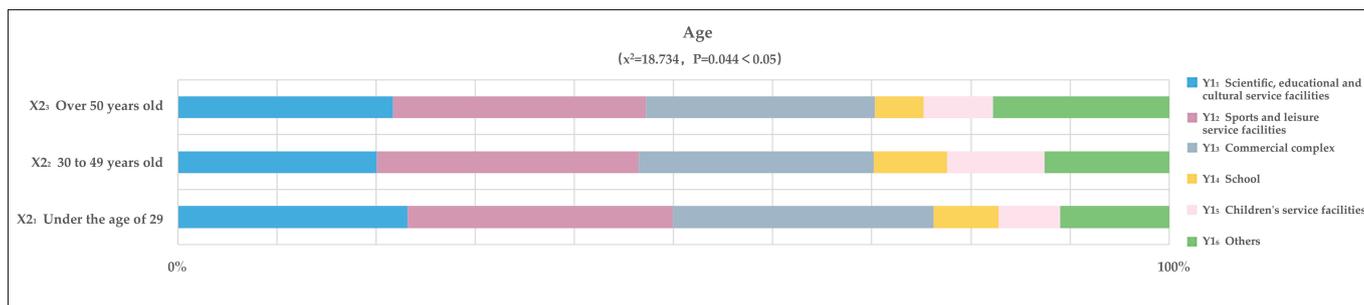
Figure 11. Demand from different age groups.

2. Demand from people with and without children

Cross-tabulation analysis was used to analyze the needs of the respondents with and without children for public service facilities (Figure 12). The results showed a significant difference at the 0.05 level (x^2 = 12.245, p = 0.032 < 0.05). Combined with the interviews, it can be seen that among the respondents, residents with children have a higher demand for school and children's services facilities. During the interviews, we also found that there is an extreme lack of public kindergartens and childcare facilities in the local area, and the quality of education in schools is not as good as in the main city of Yueyang. This causes a lot of problems for corporate workers with children and can even influence whether they choose to work here, for example:
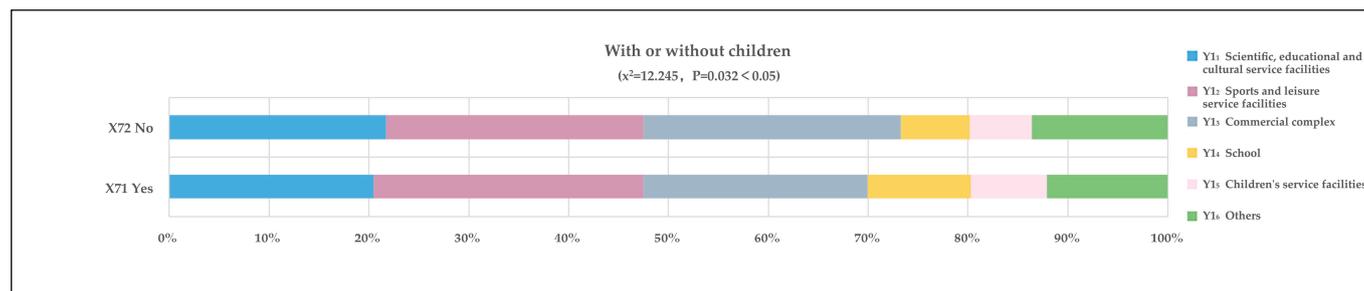

Figure 12. Demand from people with and without children.

> *I am a worker from other places and a mother of a 5-year-old child. Not only are there very few public kindergartens here but there are also no childcare facilities, and the quality of teaching in secondary schools is much worse than in my former city, so I am considering whether to return to my former city to work for the sake of my child.* (Interview number: NPA05.)
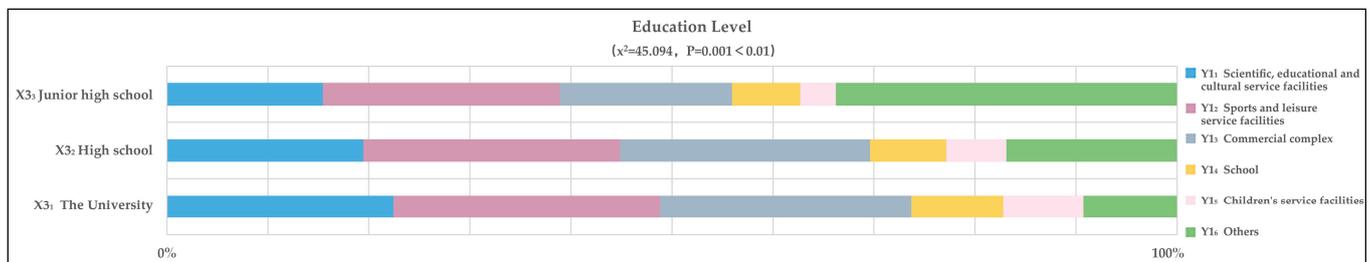
3. Demand from people with different educational levels

Cross-tabulation analysis was used to analyze the demand for public service facilities among respondents with different education levels (Figure 13). The results all showed significant differences at the 0.01 level (x^2 = 45.094, p = 0.001, p < 0.01). Combined with the interviews, we can see that the highly educated people are more interested in children's services, schools, and scientific and cultural services because most of them have children at home and are very concerned about their children's education. As reported by one of the respondents:

> *Although the houses here are cheap, I prefer to live with my children in the main city, considering the number of schools and the quality of teaching here.* (Interview number: NPA10.)

Meanwhile, the middle- and low-educated people mainly expect better public transport routes to be built in the local area because they are mainly grassroots workers in factories, have low incomes, do not have their own vehicles and live in company dormitories, as in the following example:

I used to be a farmer here, but now I live in the resettlement community. There is really little public transportation here and I have to wait 20 min on average for one, so it's not convenient to go anywhere without a car. The environment and social atmosphere in the resettlement community is also very poor, people are basically playing mahjong and rarely go to work in the factory. (Interview number: NPA14.)

Figure 13. Demand from people with different educational levels.

5. Discussion

5.1. Characteristics of the Chenglingji New Port Area

According to previous studies, there are some incidental problems in the process of building an industrial new town, such as: the unbalanced supply of public service facilities [42], long commuting time [43], a shortage of housing [44], environmental pollution [45], and so on. In this study, we found that the problems in the construction and development of the Chenglingji new port area mainly focus on the following aspects:

1. Relatively poor livability, scarcity, and the unbalanced supply of public services

Firstly, respondents generally felt that the livability of the area was not high. Given that livability is a broad concept, we believe that the main reason for this problem may be due to the lack of public services and uneven provision in the area. Apart from basic dining and shopping facilities, most of the public services in the area are poorly accessible and have a high carrying capacity. This may be due to a lack of funds in the early stages of construction of the industrial new town, with the government and enterprises preferring to prioritize the construction of production facilities and more economically efficient public service facilities. This has resulted in a disconnect between the production and living facilities in the city, which is a common problem found in emerging industrial new towns [5,9,46].

2. Low settlement rate among high income, highly educated people

Secondly, as with the construction of development zones during the *dedanweilization* period, industrial new towns are often built on the edge of a parent city [11]. Managers of industrial new towns usually expect to attract highly educated people and highly skilled workers to work and settle here, to better promote local economic development and industrial upgrading [47,48]. However, based on the questionnaires and field research, we found that although the majority of employees in the Chenglingji new port area are highly educated and earn high incomes, and there is a large number of newly built low-cost housing units in the area, these employees still prefer to endure long commutes back to their homes rather than settle here. We consider that the reasons for this are not only that these highly educated people have a greater need for scientific, educational, and cultural services, but also that they need to consider the needs of their children and the elderly, and have a particular need for children's services, schools, and a large general hospital, which are not easily satisfied due to the lack of public services in the Chenglingji new port area.

3. Difficulty in meeting the needs of local residents and the poor living environment of resettlement communities

Finally, in the planning studies of industrial new towns, how to properly resettle technicians, poor migrant workers, and landless farmers in new cities and build more inclusive new cities is a common challenge for developing countries, such as Ciudad

Guayana in Venezuela [49,50], Jakarta and other places in Indonesia [51,52], and Ilam industrial towns in Iran [53]. In our research, we found that the main people living in the Chenglingji new port area are technicians and migrant workers who work from outside the city, as well as former farmers who have lost their land and live centrally in resettlement houses. According to the questionnaires and interviews, these groups also generally identified the livability of the area as low, mainly because of the lack of sports and leisure services, integrated commercial facilities, public transport, and public schools, which affects their daily lives. In addition, the lack of scientific management and policy guidance for landless farmers in the area after centralized resettlement has resulted in a wide gap between the rich and the poor, poor community health and social climate, and a lack of community management in the resettlement community, which also indirectly affects the livability and living environment of the area.

5.2. The Future of the Chenglingji New Port Area

China's industrial new towns have gone through the process that started with satellite cities of industry and mining based on the *danwei* system planning, the construction of development zones and traditional industrial parks, and the development of independent composite industrial new towns. This model of industrial new town construction has similar examples all over the world, such as Tsukuba Science City in Japan [54], Silicon Valley in the U.S. [55], and Milton Keynes in the U.K. [56]. At present, the Chinese government is also trying to promote the development of such new cities into modern, ecologically livable industrial new cities. There are some successful cases, such as Suzhou Industrial Park [57] and Guangzhou High-Tech Industrial Development Zone [58].

However, compared to Suzhou and Guangzhou, which are large cities in China, Yueyang, as a third-tier city in central China, lacks the capital and population to directly replicate the successful experience of large cities. Unfortunately, in the discussions on industrial new towns by Chinese scholars, most studies are based on large cities such as Guangzhou [7,15], Suzhou [6,43,57], and Shanghai [40], and few researchers have focused on third-tier cities, such as the Chenglingji new port area. The problem of industrial new towns in this type of city is more that it is difficult to collect data and conduct field research work due to the imperfect construction and low level of informationization. We believe that if the local government fails to take the right measures to deal with the current problems, then the population growth in the Chenglingji new port area may further slowdown or even decrease in the future. This will affect the further development of the industrial new town and it will be difficult to develop it into an ecological, livable, and integrated industrial city with comprehensive functions.

6. Conclusions and Recommendations

This paper was based on the history of the development of industrial new towns in China. We have taken the Chenglingji new port area in Yueyang City, Hunan Province, as the object to explore the problems that exist in the construction of China's emerging industrial new towns. Based on the findings of this study, we believe that some recommendations can be made with the aim of helping the sustainable development of the area.

Firstly, we recommend rational planning on the timing of the construction of various types of public service facilities in the industrial new town. According to the current needs of the employees of the enterprises in the Chenglingji new port area, and taking into account the construction costs and economic benefits of various types of service facilities, priority should be given to the construction of childcare institutions, public kindergartens and commercial complexes, followed by the construction of large general hospitals, public primary schools and secondary schools (as government finances permit) and, finally, supplemented by the construction of facilities such as science and technology museums, libraries, and cultural centers.

Secondly, the location of various public service facilities should be optimized. Due to the limited resources in the first and middle term of the construction of the Chenglingji

new port area, in the process of siting public service facilities, large general hospitals, commercial complexes, and scientific, educational, and cultural facilities can be considered for construction near concentrated residential areas to meet the daily needs of local residents and to reduce traffic travel and operating costs. Meanwhile, childcare facilities and kindergartens should be located in areas where enterprises congregate to match the daily working hours of the employees. In addition, some land should be reserved for the construction of future public service facilities to make planning more flexible.

Thirdly, we recommend the scientific planning of road traffic and the reasonable addition of internal bus routes. A smart traffic management system can be introduced on the expressway between the Chenglingji new port area and the main urban area to manage signals and control road flow in real time according to road conditions to reduce congestion during the peak commuting period, while road land and road pipeline space should be reserved at an early stage in the planning for the new industrial city. Road construction should focus on access, simplifying the design of dividing widths and investing in roadside greenery. In addition, traffic routes should be reasonably added within the park according to the layout of enterprises and workers' residences, which will enhance the conditions for workers to travel to and from work, and for leisure and recreation.

Fourthly, innovative ways of cooperation between the government and enterprises should be explored. For example, at an early stage in the construction of an industrial new town, the government can communicate and coordinate with enterprises while granting urban land and encourage them to undertake the construction of some public service facilities by introducing relevant preferential policies. In the middle and later stages of the construction of new industrial cities, when land is limited but finances are abundant, the government should invest in the construction of workshops, workers' flats, and public service facilities to attract high-end enterprises to move into the area.

Finally, polluting enterprises should be encouraged to improve their equipment or move out gradually to prevent heavy polluting enterprises from moving in. The government of Chenglingji new port area can introduce policies to encourage the original heavy polluting enterprises to optimize their equipment to reduce pollution emissions. Meanwhile, in the planning process it should coordinate with the surrounding areas, lay out the three types of industrial land in the downwind periphery of the area, and guide the heavy polluting enterprises to move out gradually. In addition, in the process of attracting investment, attention should be paid to reviewing the environmental qualifications of enterprises to avoid attracting heavy polluting enterprises to the area and gradually improving the local environment.

Notes

[1] **Point of information:** Point of information is abbreviated as POI, which is any non-geographic meaningful point on the map, such as stores, bars, gas stations, hospitals, stations, etc.

[2] **Tyson polygon:** Each Tyson polygon contains only one point input feature, and any position in the Tyson polygon is closer to its associated point than to any other point input feature.

[3] **Population density data:** 1 km × 1 km population raster data is generated by using satellite remote sensing images, land use type data, population statistics, etc., supported by elevation, geomorphology, and other spatial data.

[4] **Jenks natural discontinuity classification method:** Based on the natural grouping inherent in the data, by identifying the classification interval, the similar values can be grouped most appropriately and the differences between different classes can be maximized. Elements will be divided into multiple classes, and for these classes, their boundaries will be set where the data values are relatively different.

[5] **Average service scope:** This represents the overall accessibility of this type of facility.

[6] **Carrying capacity mean value:** This represents the overall carrying pressure of the type of facility.

[7] **Coefficient of variation:** This is mainly used to compare the degree of dispersion of different groups of data and is the ratio of the standard deviation of a set of data to its corresponding mean value. It can be used to roughly estimate whether the supply of public service facilities is equal or not. Generally, the smaller the coefficient of variation, the less discrete the data.

References

1. Chen, J.S. *New Town Model*; Machinery Industry Press: Beijing, China, 2006.
2. Li, Y.; Beeton, R.; Sigler, T.; Halog, A. Modelling the Transition toward Urban Sustainability: A Case Study of the Industrial City of Jinchang, China. China. *J. Clean. Prod.* **2016**, *134*, 22–30. [CrossRef]
3. Wei, W.; Zheng, Y. Discussion on Land Use Planning of Modern Mixed-Use Industrial Parks-a Case Study of Sino-Singapore Guangzhou Knowledge City (Ssgkc). In Proceedings of the Global Conference on Civil, Structural and Environmental Engineering/3rd International Symp on Multi-field Coupling Theory of Rock and Soil Media and Its Applications, Yichang, China, 20–21 October 2012.
4. Zeng, Z.H.; Zhao, Y.H. *Development and Operation Management of Industry-Based New Town*; Hina Building Industry Press: Beijing, China, 2016.
5. Tianjiao, Y. Research on the Development of Industrial Parks in China and Suggestions for Future Policies. In Proceedings of the 2018 2nd International Conference on Management, Education and Social Science (ICMESS 2018), Qingdao, China, 23–24 June 2018.
6. Zeng, D.Z. Building a Competitive City through Integrating into Global Value Chains: The Case of the Sino-Singapore Suzhou Industrial Park. *China Int. J.* **2019**, *17*, 164–180. [CrossRef]
7. Yunfeng, H.; Yueqi, H. Identification of Urban Functional Areas Based on Poi Data: A Case Study of the Guangzhou Economic and Technological Development Zone. *Sustainability* **2019**, *11*, 1385.
8. Zhang, W.; Shaoyao, H.; Linke, J.; Jianbang, H.; Chengjun, T.; Kunyu, X. Calculation and Evaluation of Spatial Layout of Circum-Bohai Sea City Innovation Industrial Parks Based on City-Industry Integration. *J. Coast. Res.* **2019**, *94*, 732–737. [CrossRef]
9. Xuejia, L.; Hongjian, Y. Research on the Difficulties and Countermeasures of the Development of China's Industrial New City. In Proceedings of the 2019 International Conference on Economic Management and Cultural Industry (ICEMCI 2019), Shenzhen, China, 15–17 November 2019.
10. Li, C. Industrial Facility Planning While the Area Transformed into New City. *Planners* **2014**, *30*, 142–147.
11. Zhang, Z.Z.; Xia, C. Thinking of the Demand-Oriented Spatial Layout between Industry and City in New Industrial Cities: Analysis and Consideration to Constructing in Four New Industrial Cities around Capital Region. *Urban Dev. Stud.* **2018**, *25*, 138–142.
12. Shengxiao, L.; Pengjun, Z. Examining Commuting Disparities across Different Types of New Towns and Different Income Groups: Evidence from Beijing, China. *Habitat. Int.* **2022**, *124*, 102558.
13. Leskosek, M.; Masat, N.; Erzen, I.; Ursic, A. Some Ecological Solutions for Restoration of the City of Celje and Its Outskirts. *Water Sci. Technol.* **1998**, *37*, 229–234. [CrossRef]
14. Sengupta, S.; Venkatachalam, P. Health Hazard Assessment in an Industrial Town with the Help of Gram-Gis. *Environ. Monit. Assess.* **1994**, *32*, 155–160. [CrossRef]
15. Xu, S.G.; Li, J.F.; Cao, Y.; Liu, Y.T. Application of "Industrial Neighborhood Unit" on Planning of High-Tech Industrial Park: A Case Study on Nansha Electronics and Information Industrial Park in Guangzhou. *City Plan* **2013**, *37*, 42–46.
16. Ye, N.; Kita, M.; Matsubara, S.; Okyere, S.; Shimoda, M. Socio-Spatial Changes in Danwei Neighbourhoods: A Case Study of the Ams Danwei Compound in Hefei, China. *Urban Sci.* **2021**, *5*, 35. [CrossRef]
17. Bjorklund, E.M. The Danwei: Socio-Spatial Characteristics of Work Units in China's Urban Society. *Econ. Geogr.* **1986**, *62*, 19–29. [CrossRef]
18. Zhang, J.X.; Huang, L.Y. Transition of China's New Town Development in the Context of Urbanization 2.0. *Shanghai Urban Plan. Rev.* **2022**, *2*, 54–58.

19.　Cai, Y.W.; Xiao, Z.P.; Liu, T.B.; Ta, N. *Danwei Perspective of Urban Chinese*; Southeast University Press: Nanjing, China, 2016.

20.　Xie, Y.; Qing, L.; Xiaogang, W. Danwei and Social Inequality in Contemporary Urban China. *Res. Sociol. Work* **2009**, *19*, 283.

21.　Tan, W.Y. *Danwei Community-Review, Thought and Enlightment*; Chongqing University: Chongqing, China, 2006.

22.　Laki, I. Communist Built Industrial Towns, the History of Newly Built Towns and Cities. *Belvedere Merid.* **2015**, *27*, 38–48. [CrossRef]

23.　Gangyi, T.; Yizhuo, G.; Charlie, Q.; Xue, L.; Liquan, X. 'Third Front'construction in China: Planning the Industrial Towns during the Cold War (1964–1980). *Plan. Perspect.* **2021**, *36*, 1149–1171.

24.　Shixiong, C.; Zhiguang, R. An Equilibrium Path for Institutional Change in China. *Time Soc.* **2019**, *28*, 399–414.

25.　Shen, X.; Ma, L.J. Privatization of Rural Industry and De Facto Urbanization from Below in Southern Jiangsu, China. *Geoforum* **2005**, *36*, 761–777. [CrossRef]

26.　Wei, L.H.; Cong, Y.G. Studies on the Mechanism of the Locality of Urban Hukou System for the Evolution of Urban Social Space. *Planners* **2006**, *6*, 68–71.

27.　Chuanglin, F.; Yichun, X. Site Planning and Guiding Principles of Hi-Tech Parks in China: Shenzhen as a Case Study. *Environ. Plan. B Plan. Des.* **2008**, *35*, 100–121.

28.　Wei, W.; Chen, W. Industrial Park Reflection and Planning Model Research of Small and Medium-Sized Cities in Central China. *Adv. Mater. Res.* **2014**, *1065*, 2735–2739. [CrossRef]

29.　Kang, L.; Li, M. Expansion of Industrial Parks in the Beijing–Tianjin–Hebei Urban Agglomeration: A Spatial Analysis. *Land* **2021**, *10*, 1118. [CrossRef]

30.　Zhang, W. Summary of "Development Zone Fever". *Mod. Econ. Sci.* **1993**, *2*, 85–88.

31.　Ari-Veikko, A. The Saga of Kista Science City: The Development of the Leading Swedish It Hub from a High-Tech Industrial Park to a Science City. *Int. J. Technol. Policy Manag.* **2005**, *5*, 258–282.

32.　Zhang, Y. *The Practice and Transition of National Development Zones in China*; Tongji University: Shanghai, China, 2008.

33.　Xiao, C.; Xingping, W. From "Land-Oriented" to "Human-Oriented": Research on Evolution Features of China's Industrial Park Planning Standards. *Sustainability* **2022**, *14*, 5175.

34.　Yue, B.; Xuewen, L. Creative Destruction Path Selection for Industrial Park Transformation and Upgrading under the Concept of Character Town in the Era of Big Data. *Secur. Commun. Netw.* **2022**, *2022*, 2110039.

35.　Li, W.B.; Chen, H.; Hao, C. Analysis of City-Industry Integration and Planning Strategie. *Urban Plan. Forum.* **2012**, *S1*, 99–103.

36.　Zhang, D.G. New Concept of "Integration of Production and City". *Decis. Mak.* **2011**, *1*, 1.

37.　Wen, T.Y. *Study on the Planning of New Industrial City Based on the Principle of "Three Plans in One"*; Dalian University of Technology: Dalian, China, 2015.

38.　Siddiqui, S.; Akhtar, M.N.; Nejem, J.K.; Alnoumasi, M.S. Evaluating Public Services Delivery on Promoting Inclusive Growth for Inhabitants of Industrial Cities in Developing Countries. *Civ. Eng. J.* **2021**, *7*, 208–225. [CrossRef]

39.　Chen, F.; Wei, L.; Jun, C.; Qiyao, Y. Job-Housing Imbalance and Commuting of Coastal Industrial Town in Liaoning Province, China. In Proceedings of the IOP Conference Series: Earth and Environmental Science 2017, Zvenigorod, Russia, 4–7 September 2017.

40.　Yan, B.; He, X. Factors affecting formation and development of the urban industrial district in China—A case study on caohejing hi-tech park in Shanghai. *Chin. Geogr. Sci.* **1996**, *6*, 104–111. [CrossRef]

41.　Wei, W.; Hong, M.Y.; Zhou, J.; Xia, J.N. Study on Evaluation Method of Spatial Equalization of Basic Public Service Facilities from the Perspective of Homo-Urbanicus: Taking Wuhan as an Example. *City Plan* **2020**, *10*, 71–80.

42.　Huizhen, J. Research on Industrial Urban Integration in China: A Case Study of Suzhou Industrial Park. *Asia Pac. Res.* **2020**, *27*, 67–93.

43.　Zhou, J.; Wang, Y.; Cao, G.; Wang, S. Jobs-housing balance and development zones in China: A case study of Suzhou Industry Park. *Urban Geogr.* **2017**, *38*, 363–380. [CrossRef]

44.　Alaedini, P.; Yeganeh, N. New-Town Programs and Housing Schemes: A Case of Mutual Path Dependence in Iran. *J. Hous. Built Environ.* **2022**, *37*, 1607–1642. [CrossRef]

45.　Crook, N.; Malaker, C.R. Child Mortality in New Industrial Localities and Opportunities for Change: A Survey in an Indian Steel Town. *Health Transit. Rev.* **1992**, *2*, 165–176. [PubMed]

46.　Sidong, Z.; Xiaojia, B.; Yuan, Z.; Lin, L. Chinese Industrial Park Planning Strategies Informed by American Edge Cities' Development Path-Case Study of China (Chongzuo)-Thailand Industrial Park. *Procedia Eng.* **2017**, *180*, 832–840.

47.　Helgesen, Ø.; Erik, N.; Øivind, S. "Brain Drain" or "Brain Gain"? Students' Loyalty to Their Student Town: Field Evidence from Norway. *Eur. Plan. Stud.* **2013**, *21*, 909–943. [CrossRef]

48.　Tao, S.; Weidong, L.; Zhigao, L.; Yeerken, W. Chinese Overseas Industrial Parks in Southeast Asia: An Examination of Policy Mobility from the Perspective of Embeddedness. *J. Geogr. Sci.* **2018**, *28*, 1288–1306.

49.　Angotti, T. Ciudad Guayana: From Growth Pole to Metropolis, Central Planning to Participation. *J. Plan. Educ. Res.* **2001**, *20*, 329–338. [CrossRef]

50.　Rots, S.; Fernandez-Maldonado, A.M. Planning Ciudad Guayana, an industrial new town in oil-rich Venezuela. *Int. Plan. Stud.* **2019**, *24*, 353–368. [CrossRef]

51.　Hudalah, D.; Firman, T. Beyond property: Industrial estates and post-suburban transformation in Jakarta Metropolitan Region. *Cities* **2012**, *29*, 40–48. [CrossRef]

52. Soenarso, W.S.; Nugraha, D.; Listyaningrum, E. Development of Science and Technology Park (STP) in Indonesia to Support Innovation-Based Regional Economy: Concept and Early Stage Development. *World Technopolis Rev.* **2013**, *2*, 32–42. [CrossRef]

53. Jamshidi, A.; Davood, J. Analyzing the Effects of Ilam Industrial Town Construction on the Development of the Surrounding Villages, Iran. *Rom. Rev. Reg. Stud.* **2013**, *9*, 67–78.

54. Anttiroiko, A.-V. Science Cities: Their Characteristics and Future Challenges. *Int. J. Technol. Manag.* **2004**, *28*, 395–418. [CrossRef]

55. Moore, G.; Kevin, D. Learning the Silicon Valley Way. *Build. High-Tech Clust. Silicon Val. Beyond* **2004**, *7*, 36.

56. Peiser, R.B.; Chang, A.C. Is It Possible to Build Financially Successful New Towns? The Milton Keynes Experience. *Urban Studies* **1999**, *36*, 1679–1703. [CrossRef]

57. Dennis, W.Y.H.; Yuqi, L.; Wen, C. Globalizing Regional Development in Sunan, China: Does Suzhou Industrial Park Fit a Neo-Marshallian District Model? *Reg. Stud.* **2009**, *43*, 409–427. [CrossRef]

58. Liu, Z.; Adams, M.; Cote, R.P.; Geng, Y.; Li, Y. Comparative Study on the Pathways of Industrial Parks Towards Sustainable Development between China and Canada. *Resour. Conserv. Recycl.* **2018**, *128*, 417–425. [CrossRef]