

# *Research on the Impact of Smart City Development*

## *— Taking Amsterdam as an Example*

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**Abstract:** The Smart City is the highest stage of urban information development and an emerging model of sustainable urban development. Currently, the predominant focus of smart city research lies in the domain of construction, while there exists a dearth of discourse and theoretical underpinning pertaining to the sustainable development of smart cities with regards to conceptual standards and practical necessities. This insufficiency in comprehensive discussion and theoretical support may hinder the progress of Smart City research and impede the long-term effectiveness of implementation strategies. In order to address these concerns, this study chooses the most typical Amsterdam Smart City and investigates viable options for sustainable urban growth. A comprehensive definition of a smart city is formulated through a thematic study, this study adopting a prototype theory as the basis. The study also presents reference strategies for establishing a sustainable development model for smart cities in China, utilizing case studies. The findings indicate that the continued development of the Smart City model can contribute to the progress of urban intelligence, information systems, and modernization in the long run. Besides, this paper provides a case study of smart cities for in-depth investigation, with development factors influencing the selection of subsequent urban development plans.

**Keywords:** Amsterdam, smart city, sustainable development, Chinese cities, urban development

## 1. Introduction

The carrying capacity of urban infrastructure is already being questioned due to the rapid global urbanisation the proliferation of urban inhabitants. The necessity to address the urban of world ills and meet the needs of urban development has driven a digital, technological, environmental, and social revolution. The combination of diverse city aspects and human ideology gave birth to the Smart City concept, which was publicly launched by IBM in 2009 [1]. The majority of current research focuses on the informational creation of smart cities, with little attention paid to the historical components and needs of cities themselves. This has resulted in the realisation of actual intelligence and sustainability for cities with identical development conditions.

By using Amsterdam as a starting point for smart cities, this research illuminates future trends and sustainable strategies for smart cities around the world. This article offers a comprehensive and authoritative analysis of current practice projects in the field of smart cities, employing a case study

approach. By utilizing case studies, the authors delve into the requirements and standards for implementing smart cities. This approach provides researchers with a more effective framework for analyzing and discussing research topics and their broader implications. In addition, the research will draw on successful Smart City development cases, such as Amsterdam, to propose solutions for the sustainable development of smart cities in China. Building upon the insights gained from these cases, the research aims to provide practical recommendations and strategies that can be applied to promote sustainability in the context of Smart City development in China.

## **2. Analyzing the Development Elements of Smart Cities**

The emergence of smart cities has significantly influenced global urban development trends. In this section, the research will focus on Amsterdam as the research object to analyze its development goals, strategies, and to identify the common characteristics of smart cities. Furthermore, specific criteria for assessing the sustainability of smart cities will be defined.

### **2.1. Definition of Smart City**

The notion of smart cities started in the media industry and is now being used in urban design, planning, building, and management. The development goals of smart cities encompass several key aspects. These goals include enhancing the quality of life for urban residents, fostering a conducive business environment for local enterprises and international investment, and establishing an efficient government and municipal management mechanism [2]. To achieve these development goals, the utilization of big data analytics becomes crucial. Integrated intelligent computing technologies, such as the Internet of Things (IoT) and spatial geographic information systems, must be employed to analyze, integrate, and optimize the core information essential for efficient urban operations.

### **2.2. Analysis of Smart City Development—Taking Amsterdam as an Example**

#### **2.2.1. Overview of the Development of Amsterdam**

As a city reborn from the ashes, Amsterdam has showcased remarkable development potential [3]. The post-war period witnessed a profound transformation in Amsterdam, ranging from the formulation of urban planning and development plans to the adoption of integrated transportation and the introduction of new architectural styles. Amsterdam has long been regarded as a global pioneer in urban development. The government, business, and people have always been dedicated to research and innovation in sustainable urban development. To establish a vision for sustainable urban growth, the Amsterdam Parliament endorsed the proposal *Omgevingsvisie Amsterdam 2050: A Human Metropolis* in 2021. Furthermore, cultural continuity also contributes to the city's development. Amsterdam has evolved into a hub for artistic expression and exchange, with events such as the ADE Amsterdam Electronic Music Conference and the Festival of Lights.

Amsterdam has always been at the vanguard of European urban development [4]. Amsterdam was one of the leading Smart City practitioners worldwide in 2009, and it has been working on developing its own solutions, such as the ASC platform. The Amsterdam Parliament envisions Smart City 3.0 implementation in the year 2050. The development of smart infrastructure and technology serves as the fundamental basis for the growth of a Smart City. A robust urban communication network system is essential in providing access to vast amounts of comprehensive data, which can be utilized to construct the Smart City platform. Besides, the city of Amsterdam is gradually increasing its use of renewable energy sources. This provides a circular city design approach that can recycle the city's "generation" and "digestion". In the process of urban planning and design, the government always adheres to the principle of citizen co-creation [5]. Professionals in research and development are

actively collaborating with local businesses and residents to develop smart solutions in Amsterdam. The smart paradigm is gaining momentum in the area of smart mobility, as the residents of Amsterdam increasingly embrace intelligent transportation systems and technologies for enhanced efficiency, accessibility.

### **2.3. Characteristics of a Successful Smart City**

#### **2.3.1. Sustainability**

Smart City planners are driven by the objective of leveraging digital technologies to make cities smarter and more sustainable. With a focus on sustainability, these cities aim to achieve long-term environmental preservation, resource efficiency, and improved social well-being. Copenhagen has indeed established and implemented a highly successful sustainable development strategy to work towards the objective of achieving carbon neutrality by 2050. Copenhagen leverages data and technology to support carbon-neutral planning and enhance city management operations. By adhering to environmental regulations and embracing net-zero principles, the city has devised a comprehensive strategy for sustainable urban development [6]. This approach enables Copenhagen to effectively respond to evolving circumstances, improve the quality of life for its residents and reduce resource consumption to achieve its sustainable urban goals.

#### **2.3.2. Innovativeness**

Successful smart cities collecting massive and diverse data sets and estimating the effects of potential interventions results in effective urban planning and information-intensive smart platforms [7]. New York is undergoing a shift in its approach to smart development, moving away from a focus solely on financial capital and embracing technology- and innovation-driven strategies. The city is tapping into the potential of emerging technologies, including information, data, and the Internet of Things (IoT), to drive its smart development initiatives. The New York City administration announced One NYU: The Plan for a Strong and Just City in 2015, outlining a vision of growth, equity, sustainability, and resilience. This plan highlights the importance of incorporating smart technologies and innovative solutions to address urban challenges and create a more inclusive and sustainable city.

### **2.4. Criteria for Determining Smart City**

Smart City standards are widely regarded as an important guarantee to ensure the long-term sustainable development of smart cities, and can be used to evaluate the standards for the full realization of smart cities. The initial criterion involves posing inquiries from the standpoint of both builders and participants. Whether government decisions and Smart City construction laws are clear, whether firms can help with city intelligence and informatization, and whether citizens can truly engage in Smart City construction. Secondly, there is a clear delineation of the requirements for improving the infrastructure of the city's infrastructure, which includes establishing the city network, developing smart terminals, and ensuring information security measures are in place. Furthermore, the assessment of Smart City implementation should consider the adaptability of the model to diverse circumstances [8]. This ensures the potential for comprehensive integration of intelligent systems in various domains, including transportation, environment, architecture, and healthcare.

### **3. The Necessity of Urban Development**

#### **3.1. Reasons to Develop Smart Cities**

When cities reach saturation, new forces or innovation are required, and role shifts are unavoidable. Successful smart cities adopt a comprehensive approach to urban development, prioritizing holistic principles that encompass both vertical and horizontal scales. In this way, traditional modes of urban production and the ways of life of residents are transformed.

##### **3.1.1. Achieve Sustainable Urban Development**

Smart cities are built on a new generation of information technology and communication networks. The utilization of these technologies promotes the integration and optimisation of existing urban resources, while also enabling intelligent management and innovation. Technological innovation serves as a catalyst for the advancement of emerging industries, enabling managers to exercise reasonable control over resource utilization and minimize environmental pollution. From the perspective of the residents, traffic congestion can be efficiently reduced, and safety problems can be avoided. Thus, the long-term development of the city can be achieved.

##### **3.1.2. The Need for IT Development in Building Smart City**

The third information revolution has accelerated the rapid development of global information technology, such as the Internet of Things, big data, cloud computing, etc. These scientific and technological elements combine human ingenuity to enable precise management of various facets of the city. By leveraging information technology and other urban characteristics, cities can achieve efficient utilization of resources and enhance the intelligence of urban operations [9]. As a result, the Smart City can be seen as a more advanced level of urban informatization.

##### **3.1.3. Strategies for Increasing Urban Competitiveness**

Developing integrated urban capacity has become a global strategy. The implementation of smart cities has primarily an impact on traffic, the flow of information, communication networks, and energy resources all have an impact. In addition, the advancement of smart cities can greatly facilitate the development of various sectors such as commercial finance, educational resources, healthcare systems, and ecological environment protection. Smart cities have emerged as a pivotal factor in enhancing a city's comprehensive competitiveness by optimizing resource allocation and transforming the industrial structure.

#### **3.2. Conditions for the Realisation of Smart City**

In general, Smart City efforts are focused on government policy development. Integrating with the overall city-building strategy can provide more options for development and funding assistance than stand-alone smart projects. For example, the Smart City Strategy of Singapore is interwoven into the national development plan to build a digital economy, a digital society, and digital governance [10]. The Singapore government has taken efforts such as investing through organisations such as the National Research Foundation, co-funding start-up accelerators, and legislative reform to enable the project to be adopted countrywide. It is also important that ordinary citizens have equal rights in the construction of smart cities. To improve city services and government operations through citizen involvement, different types of city-related data sets and platforms should be made openly available to the public. In contrast to traditional time-consuming and labor-intensive surveys, online platforms offer a quick and efficient way for citizens to express their genuine wants and needs. Furthermore,

smart cities should aim to address current challenges, develop comprehensive plans and goals, and maximize the sustainability of the city's overall environment and development vision. Transportation, energy, ecology, healthcare, education, and smart citizenship can all be used as entry points to improve residents' and the urban environment's quality of life.

## **4. Development of Smart Cities in China**

### **4.1. The Impact of Smart Cities on China**

The success of Amsterdam Smart City has served as an example and positive inspiration for other towns to follow [4]. The practical experience in Amsterdam also provides good solutions for the rational and sustainable development of Chinese cities. After IBM proposed the concept of smart cities, it gained traction and was subsequently introduced in China. In order to occupy the huge market of China's Smart City construction, the IBM company has implemented a number of promotional measures. It advocated prioritising the development of six important sectors, including smart electricity, healthcare, basic design, transportation, logistics, and finance, and in August 2009, IBM produced the report Smart Cities in China. In this context, the main drivers of Smart City development in China are urbanisation, national policy, and technology. Indeed, the development of smart cities in China poses unique challenges due to the distinctive characteristics of Chinese cities. One particular challenge lies in the coexistence of old and new urban infrastructure. David Bollier, in his work *How Smart Growth Can Stop Sprawl*, proposed a paradigm shift in urban design to address the complexities of urbanization and infrastructure construction. He suggests that traditional notions of development should be abandoned in favor of a more holistic approach that prioritizes smart growth strategies. [11]. For residents to raise the problem of urban service accessibility, makers must assure that disadvantaged groups have equitable access to Smart City services. The government must not only constantly explore the balance between city builders and other stakeholders. It is also necessary to strengthen the customization of key laws and regulations, particularly those pertaining to the protection of city information and user data.

### **4.2. Proposals for the Development of Smart Cities in China**

The development of smart cities in China can draw inspiration from successful Smart City models in other regions with similar geopolitical backgrounds. For instance, examples like Smart Tourism in Barcelona and Smart Ecology in Manchester can provide valuable insights and ideas for the implementation of Smart City initiatives in China. Sustainable methods based on four alternative urban models can now be presented to expedite the processes of digitization, networking, and intelligence in China [12].

Firstly, modernized cities have already achieved urban intelligence as a result of economic and technical innovation. This sort of city was created later and has a strong urban economic basis as well as beneficial national policy support, giving it a high potential for further development, such as Shenzhen. The second model is that of the established Chinese megacities, such as Beijing, which has the same political, financial, and cultural prominence as New York. The deployment of the Smart City concept in Beijing, however, has been hampered by development position of the nation. Thirdly, there is the Netflix City approach, which harnesses the internet and big data to energize cities. The Netflix city model has resulted in the rapid expansion of tourism, and the Smart Tourism of Barcelona can be cited as an example of long-term development for the model [13]. The final model can develop a Smart City like Satellite City based on its unique advantages. Remote sensing satellites play a crucial role in supporting smart cities by providing valuable data and insights for urban planning, resource management, and sustainable development. These satellites can effectively detect and



monitor various aspects of urbanization, including urban land expansion, resource consumption, and environmental impacts.

## 5. Conclusion

This study delves into the significance of developing a Smart City in Amsterdam for the future sustainability of the city. The prerequisites and criteria for developing a Smart City are outlined by studying the techniques applied in established smart cities. According to the study, smart cities provide theoretical support for the integration and optimization of urban resources in a world where urban development is approaching saturation. It turned out that the concept of smart cities has been used globally, with successful Smart City cases providing practical experience for urban development. This is being used to provide strategic guidance for the wise and sustainable development of Chinese cities. The study demonstrated the forward-thinking and predictable nature of Smart City development. Both in terms of the objective standpoint and the involvement for creator, which is positive. However, for the findings of paper to be complete, a cross-analysis of European and American cities represented by Amsterdam and Chinese Smart City policies is missing. To make the conclusions consistent and broad, enough city examples must be compared. In future research, the findings of the cross-analysis will be used to summarize the specificities of Smart City application scenarios using qualitative analysis.

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