Toward the Smart Eco-City Governance: The Vital Role of Big Data

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Keywords: Smart eco-city, Big data, Ecological civilization, Governance.

Abstract. Smart eco-city limns a great picture where big data technology has been applied to all aspects of urban governance and development. This paper studies the characteristics and applications of big data technology, especially its significant value to ecological civilization, attempting to clarify the inner link between them. A holistic view and the duality of big data’s value are underlined first, which unfold the inner correlations and are also confirmed in the latest policies. Practically, the smart eco-city needs to governed in economic, social and natural dimensions, which are discussed in detail. The highlight of this paper is not only the specific application but also the theoretical basis of practical application. Although many obstacles exist in the process of smart eco-city governance, the prospect of the applications could still be anticipated.

Introduction

With the progress of information and communication technology (ICT) and the rise of digital city, the concept of smart city was proposed and widely discussed. It is proposed by IBM to take full advantage of ICT to monitor, analyze, integrate key information in the city system operation, and then to response various demands including the people’s livelihood, environmental protection, public security, urban services and commercial & industrial activities, so as to improve city life [1]. Smart city construction depends on the update of a new generation of data and a complete information infrastructure, where big data is commonly considered to play an irreplaceable role.

Over the last decade, the big data has been applied to various fields of smart city governance with transportation, housing, power grids and other forms of public services included. Meanwhile, the applications of big data technology, especially its significant value to ecological civilization, is increasingly worthy of looking forward to, when addressing the increasing resource constraints, severe environmental pollution and a deteriorating ecosystem. It’s an opportunity as well as a challenge to assimilate ecological concept into intelligent urban governance with the aid of big data, Internet of things and cloud computing, so as to establish an efficient, harmonious, sustainable and habitable city.

This paper focuses on the inner correlations between the characteristics of big data and ecological civilization to unfold the value and prospect of the application, distinguished from the interpretations to the connotation of smart eco-city in the previous research. Another contribution is to study how the government deploys the applications of big data and establishes the governance system of the smart eco-city in three dimensions: economic ecology, social ecology and natural ecology, and what obstacles and problems might appear in the process.

The Inner Correlations between Big Data and Ecological Civilization

The Holistic View

Big data refers to using all the data for analysis rather than simplified methods like stochastic analysis [2]. Big data can be described by the “5V” characteristics: volume, variety, velocity, variability and veracity. The globally transformation from randomness leads to it from causality to correlation on the way of research. People prefer to look for common rules in a large amount of data to analyze phenomenon accurately. In this sense, the core connotation of big data can be summed up as the analytical way of the holistic view.
Meanwhile, ecological civilization is a special social formation based on the harmonious coexistence among human, nature and society, the virtuous cycle, the comprehensive development and the continued prosperity [3]. Actually, the whole world is viewed as a macro system, where the three represent obvious taches, coordinate and imbue with each other. That is also the embodiment of the holistic view.

In contrast, it can be found that similarities exist the content of the two, which inspires us to underline the holistic view simultaneously instead of separation during the process of smart eco-city construction.

**The Duality of Big Data’s Value**

In recent years, haze appears frequently in most areas of China. Numerous local governments publish the big data sources of the weather conditions. The purpose is to gather various participants into environment governance. The use of big data technology could analyze the cause of haze and find solutions radically. The above two ways reveal the duality of big data’s value: as the value of information resources (VIR) and as the value of technological means (VTM).

VIR provides the raw material, while VTM is a tool when constructing the ecological civilization. The two values appear along with big data. Almost it reflects VIR, and VTM is reflected simultaneously. Even though it’s difficult to be separated, realizing and distinguishing the two values also contribute to deepen the awareness of big data and make it applied to ecological civilization construction to the extreme extent possible.

**The Policy Framework of Ecological Big Data**

According to *The Overall Plan of Ecological Environment Construction with Big Data* released by Ministry of Environmental Protection (Document No. 2016-23) in March 2016, a new architecture was proposed, including one mechanism (big data management mechanism on ecological environment), two systems (organization guarantee and standard specification system, unified operation and information security system), three platforms (infrastructure layer, data resource layer and application layer).

The proposal emphasizes that the main task is to plan big data platform with a whole view and to promote the pilot project construction of big data. In order to achieve the scientific decision-making, precise regulation and convenient service, big data management institution and the specific application need to be improved and extended.

The above policy confirms the significant role of big data in the process of smart eco-city governance again. Therefore the next stage is how to improve the application of big data in the smart eco-city governance.

**The Application of Big Data to Smart Eco-City Governance**

**Big Data and Economic Ecology Governance**

The big data industry would be promoted in the economic ecology governance system. According to B mode of global development (a category of ecological economy guided by eco-laws) proposed by Brown [4], it’s an inherent requirement for economic ecology governance to transform the pattern of economic development and reduce energy consumption. Big data industry, e.g., e-commerce and smart finance, characterized by data capitalization, technology innovation, decision-making intelligence, service personalization [5], stresses transformation from B2C to C2B and analyzes the requirements of customers with big data to configure resources reasonably.

The big data industry could optimize the ecological industry chain as well. Take sewage disposal for example, various types of sewage need various technologies. Government has the responsibilities to establish accurate database and design the process of production, in order to help enterprises find suitable operators. Extending and broadening the ecological industry chain means reducing pollution emissions, making the process of production tend to ecological civilization as far as possible.
Big Data and Social Ecology Governance

The applications of big data in social ecology governance include two areas. The first is based on infrastructure construction. The processing and transmission of big data depends on a broad coverage and high speed of Internet. In addition to the hardware, software facility—open data is also required. Open data and open crowdsourcing have become the necessary links of smart eco-city governance abroad [6]. On the basis of that, governments could publish relevant policies to support participants to design procedures and Apps, which contributes to environmental protection and monitoring.

The second application is based on smart governance. A city produces a huge amount of data every day. The analyzed data may reflect more valuable information, which benefits the city governance. The current data source mainly includes video information, environmental information and terminal users’ information, separately collected by city cameras, various sensors and mobile apps [7]. The above information, analyzed by data mining (DM), can be used to monitor and forecast city emergencies. Moreover, the provided smart systems for citizens can realize their autonomic governance.

Big Data and Natural Ecology Governance

The applications in natural ecology governance contain smart energy and smart environment. As for the smart energy, big data is beneficial to energy usage management. In many cities, sensors installed in power grid systems can collect energy consumption information instantly to allocate and supply the energy in time, which has promoted their energy efficiency [8]. Another application focuses on environmental quality monitoring, and the installation of sensors in various items are the key. Bicycle wheels, street lamps even windows are all the good choice to collect information of noise, air pollution and light pollution.

As for smart environment, in addition to providing and analyzing huge information resources, big data, especially DM, can set targets of environmental governance quantitatively and achieve complete regional defense and command [9]. Besides, the connection between mobile apps and data centers offers more opportunities for citizens, NGOs and enterprises to participate in the process of environmental governance.

Conclusions and Obstacles

Discussions in previous sections indicates that the smart eco-city plays a vital role in connecting the world economy with the needs of cities, which is not a simple aggregation of smart city and eco-city. The holistic view, as the common value of big data and ecological civilization, as well as the duality of big data’s value, as a tool to understand the applications, have contributed to deepen understandings of smart eco-city. As for the practice, this paper just provides some feasible applications in three dimensions, while there are still other applications need to be explored. Some obstacles, however, still exist in the application process, especially the limitation of understanding about smart eco-city and the absence of operation centers, which hinders the steps to govern smart eco-city.

Although the potential obstacles are inevitable, carrying out theoretical research on the fusion of smart city and eco-city first is necessary. It will lead to further research directions, for example, the performance and the degree of the fusion, which meets the demand of ecological civilization. Moreover, holistic governance needs to be underlined. Establish operation centers to design comprehensive procedures to make smart eco-city more systematic and scientific. In order to promote the efficiency of smart eco-city governance, it is better to disassemble the final goal into a few of specific targets, and then integrate with the government performance assessment framework. In conclusion, smart eco-city is becoming the tendency of the ecological civilization today, which needs to be explored continuously.
Acknowledgments

This research was financially supported by National Social Science Foundation of China (Grant No. 15CKS014) and the Fundamental Research Funds for the Central Universities.

References