

Study on the Application of Data Visualization in Public Administration

Qian-Hui JIA^{1,a,*}, Chen LI^{2,b} and De Long GAO^{3,c}

^{1,2,3}No.2006, Xiyuan Avenue, West Hi-tech Zone, Chengdu, Sichuan, P.R. China

^ajiaqianhui3350507@163.com, ^b64098611@qq.com, ^csin20501314@126.com

*Qian-Hui JIA

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Abstract: Now, human society has entered a new historical stage - the era of big data. Big data makes people's way of thinking, behavior patterns, management ideas fully innovated, which contains great potential for application and innovation in the field of public management. As the dominate data occupant, the government holds the data of all aspects of society. However, "how to analyze the massive data to predict the public service demand?" and "how to use the data visualization technology to show the social phenomenon, to optimize the social management process?" become the problems the government administrations need to solve. Data visualization is aesthetically presented by data acquisition, analysis, filtering, mining, representation, modification, and interaction. This paper puts forward the idea of innovating public management and service in the way of data visualization, discusses the value and presentation method of this method in public management and service, and discusses the possibility of using this method through concrete case analysis in order to improve the transparency and patriotism of government management by the use of data visualization technology, so as to promote the sustainable development of China's public management.

Introduction

At the present, China is in a significant strategic transition period, the scale, the speed and the depth are unprecedentedly great. In many social transformations, the transformation of government management is the most important core. The transformation of government functions with the institutional reform is a self-revolution. However, what to change and how to change it become the realistic problems before the leaders. Government reform requires not only determination, but also the direction and path, while the emergence of big data for the government management reform provides new opportunities. Big data is a massive data state with the data technology to deal with this state. In this era of data explosion, everyone is the manufacturer of data. The amount of data and data types are at an alarming rate of growth, but the content of big data is far more than this. It is a way of thinking and ideas. Thinking in the opposite view of social management with big data, people can see the population, transportation, health, taxation, social security and so on. Social management content is a huge database. Government departments, as a dominate owner of big data in all areas of society, have a natural advantage in terms of data possession. On the one hand, the government has specialized statistical departments and cadres, which calculate and master enormous economic and social operation data; on the other hand, because the work is closely related with the people's livelihood, the government in the daily administrative process, also naturally accumulated the data about all kinds of society life, and the government can also according to demand, require enterprises, institutions, industry associations to provide a variety of data.^[1]But the reality allows us to see that the various departments of the government data has not been highly integrated, while the data of each department is just like a lonely island, bringing inconvenience to the government coordination, the procedures of people's affairs, affecting the government's profound transformation, and restricting the "the government of wisdom" to establish.

The management innovation under the big data is that the government is transformed from the political function of emphasizing its own governance to the service-oriented government, from the management of its own experience to the scientific and foreseeable management, from the paper

document to the e-government management. These governments' transformation cannot be separated from its possession of big social data. However, the strategic significance of big data is not the mastery of the data, but the analysis presentation and interpretation of the data of the meaning and value.

In the complex data, how to visually present the key information of the data for the leaders to make decisions, How to find the laws and trends hidden behind the data, how to better interact with the citizens to meet their political participation demand? The data visualization provides a possible platform. Data visualization based on big data can express the inherent law of data through the form of graphic, which is an important way to interpret complex data and understand complex phenomena. At present, many government agencies abroad have developed terminal as data visualization platform when advancing smart city construction, so the city administrations could find problems, make predictions, and design schedules through real-time data charts.^[2] This paper takes the important part of big data - data visualization as the study object, with the government website as the research content, to explore and explain the connotation and characteristic value of the data visualization, and tries to interpret the application of data visualization in public management, in order to provide some reference for government management practice.

Interpretation of Connotation and Value

Definition of Data Visualization

Data visualization originated in the 1960s computer graphics, while people use the computer to create a graphical chart, visualize the extracted data, present the various properties and variables of the data. In the narrow sense, digital visualization refers to the data presented in the statistical chart, in a broad sense, data visualization is one of the categories of information visualization, which mainly aimed at the use of graphical means to clear and effective communication and communication information.^[3] Commonly used in daily life, pie charts, histograms, scatter charts, histograms, etc., are the most primitive statistical charts, which are the most basic and most common application of data visualization. However, the most primitive statistical charts can only show basic Information on the structure of the data, visualization of quantitative data results. With complex or large-scale heterogeneous data sets, such as business analysis, demographic distribution, audience behavior data, the situation of data visualization will be more complex. With the expansion of data visualization platform, the increase of application field, the changing form of expression, the increase of real-time dynamic effects, user interaction and so on, the boundaries of data visualization is expanding. According to the research content of this paper, based on the definition of data visualization in the broad sense, the author distinguishes it as a kind of visualization of information, which is mainly through a variety of graphical means of expression to communicate intuitively and vividly and convey effective information.

Value Analysis of Data Visualization in Public Management

In general, the visualization of data has the characteristics of intuition, relevance, artistry and interaction. Intuition is intuitive and visualized to show the data so that the audience can quickly and clearly understand the law and connotation behind the data, relevance can excavate and present the relationship between the data, directly and quickly to understand the relationship between the data; artistry is that data visualization using different forms of expression to enhance the data presented by the artistic effect, not becoming boring but flexible; interaction is that the interaction between data and the audience, enhancing the audience for the data control and management, to achieve a visual personalized presentation.

It can be seen from the four characteristics that the data visualization integrates the functional and aesthetic needs comprehensively to achieve a deep insight into the huge data through the intuitive and vivid transmission of data information. The development of data visualization greatly speeds up the process of understanding the data, at the same time it facilitates the interaction between people to people and people to computer, so that people can observe the use of traditional methods which is

difficult to observe the phenomenon and laws, thus contributing to the more effective use of data and analysis of data. The value of data visualization in public management is more helpful in the analysis of data, that is, to help decision makers in the complex data to find out the law in order to make effective decisions, while the visualization of data presented to a certain extent, to promote the data open, to increase the transparency of government information, and to strengthen the citizen participation, and to meet the citizens' demands of the open government. Therefore, the application of data visualization in public management is the proper way in the big data background, and it is also a booster to promote the transformation of government management.

The Presentation Method of Data Visualization in Public Management

Data visualization is to show the data in graphical or graphical form. Different presentation forms affect the visualization of data and also affect the reader's understanding. Therefore, in the process of dealing with large amounts of data, besides finishing, filtering, the presentation of the data is also an important part of the design. In the process of government management, facing with a large number of untreated raw data, the intact and complex redundant form of presentation is boring for most readers, and is inefficient and in disorder for decision makers. Therefore, e-government administrations are necessary to make efforts on visualization whether for the decision-makers or the readers. At present, the data visualization presentation methods can be divided into the following:

Index, Index Values, the Graphical of Index Relationships

Data visualization is based on a large number of data. The graphics is composed of data in orders. The index means the characteristics of the data. The index value is a data. In the data visualization process, the value of the data is usually represented in graphical manner, such as the length of the column or the height of the performance of the data size, which is the most common used visual form. Traditional forms of visualization are mainly bar charts, pie charts, etc., but these manifestations are likely to bring about aesthetic fatigue while lacking innovation, so that some changes on the graphic visual style can be tried to make. For example, gender distribution (male 80 %, Female 20%), with the traditional presentation for the "male 80%, female 20%", the visualization technology will use male and female figures to show male and female body indexes, and the amount of the figures means the index value. Because the indexes often have some associated features, such as from simple to complex, from low to high, from front to back, etc., therefore, corresponding scene or building the scene can be used to show the index relationships, for which it could be more intuitive and vivid.

Conceptual Conversion

In the process of visualization of data, while facing with the huge amount of data, the reader is very difficult to perceive the number of the data. In order to enhance the reader's perception of the data and the understanding of the data in the visual process, the conceptual conversion of data often needs to be taken, and the general methods of the conversion are comparison and metaphor. For example, in the introduction of the number of Chinese smokers, the order of the data magnitude is huge, but the specific amount is difficult to perceive, then you can put a map of the United States, representing the number of Chinese smokers is more than the sum of the US population, in such a contrast, the perception of the data is deepened.

The Visualization of Time and Space

Seeing the changes in the value of the index through the time dimension, the observers generally increase the form of the timeline, that is, the common trend form, and when there are the existence of regional information and the need to highlight the performance, the map can be the main carrier to combine the time and space to present a hot event.

Dynamic Visualization

Dynamic is a more vivid way compared to the traditional static for presentation. The chart of visualization and manipulability can help the readers to understand the process of data changes, to enhance the experience. Dynamic visualization is usually in two ways of interaction and animation: interaction including mouse floating, click, the response of multi-chart linkage, etc., such as the New York Mayor election interactive map made by the data group of WNYC (New York public radio), the interaction of the map can show the number of votes in each neighborhood, the district is very detailed, with color harmony, intuitive and it can indicate the trend, the deeper color means the lower voting rate. When the readers put the mouse to a specific area, it will show the specific data. Animation mainly includes admission animation, interactive animation, playing of animation and so on.

Data Visualization Promotes Public Management Process Optimization

At present, more than 30 countries have opened the government data website around the world. There are developed countries such as the United States, Germany, Britain and France, as well as developing countries such as Peru, Uruguay, Chile and Kenya. In China, only Hong Kong has opened a government data website. According to preliminary estimates, government departments have more than 80% of the data resources.^[4] The construction of government data website is the carrier of data visualization, but also the basis of data visualization technology. On the current reality, with the rapid development of e-government, the government has set up government websites to provide a variety of government information, and more and more citizens are willing to visit the government website from the website to be concerned about government information; at the same time, data visualization technology continues to break through, many software has actively followed up. The construction of the platform, the expectations of citizens, and the advancement of technology have promoted the development of data visualization, but also deepened the significance of data visualization.

Administrators' Perspective: Speaking with the Data Improves the Level of Scientific Decision-Making, with data-Driven Public Management, to Make Management Efficiency.

Data visualization is based on big data, of which the key is the extraction and presentation of valuable data. Data visualization of public management reorganize and reproduce many valuable data, so administrators do not need too much explanation and description, only a data or a picture can explain the problem. It changed the traditional "racking one's head" type of decision, but to speak with the data. The data as a basis improves the level of scientific decision-making and forecasting capabilities, in addition, the application of data visualization technology is helpful to improve the management efficiency. In the case of CompStat, the New York City Police Department, CompStat (Computer Statistics, or Comparative Statistics), under a high crime rate in New York City, established a criminal tracking and management system under the leadership of Secretary William Bratton of New York City Police. The CompStat system collects the data on a regular basis and then analyzes the data in conjunction with the basic police assessment tools and rules and maps the data to the map, combined with the GIS (Geographic Information System), where the person is responsible for meeting in a dedicated meeting room, in which the data analysis will be used according to the problems, and the responsibilities will be clear. After the meeting, the police will take appropriate measures to carry out criminal tracking and police management.^[5] The main purpose of CompStat is to improve the hierarchical management efficiency of the police and to reduce crime more effectively. It is an interactive map of criminal activities and an information management system. It is a subversion of traditional management methods.

Citizens' Perspective: Understanding Government Management Information, to Enhance Understanding of Society and Support for Government Management.

Citizens as a member of society enjoy the right to know the information, and this right not only lies in the knowledge of their own interests and information but in the social information, government information. Data visualization technology helps citizens more quickly and directly to understand the real situation of the current society and the government's policy implementation, thereby increasing the trust and support of government management. Taking the US unemployment rate as an example, when the major US newspapers reported that the US unemployment rate reached 10 %, which is not the real case from the unemployment rate interaction map. This interactive map divides the population into different types. When the different population characteristics are selected at the top of the picture, the unemployment rate will change. If in the age of 25-44 years old, college-educated white women, then the population of the unemployment rate was only 3.6%, which is well below the newspaper reported 10%. It can be seen data visualization could help readers quickly understand the data. At the same time, it will also help readers to grasp the real development of society to enhance the understanding of the status quo of society and the government.

Government's Perspective: Promoting Government Data Disclosure to Improve Government Governance, Build a Transparent Government, the Sunlight Government, and the Government of Wisdom.

Data visualization tool of Brazilian government DataViva is a successful representative of data open. DataViva's success, not only lies in its user-friendly application interface, but in its rich content, a variety of development products and big data audience. DataViva is the website of the Danish Giras (a state of northern Brazil), launched by the Macro Research Group at the Massachusetts Institute of Technology's Media Research Institute (MIT Media Lab) at the end of 2013, using the government's publicly available data. Team leader Caesar Hidalgo argues: "Opening the data in a visual way is the most important way to make data face to the public. Data visualization allows people to really use data." DataViva includes a variety of different data visualization applications to provide readers with the same set of different data presentation, including the stack of curves, maps, tree-maps and so on. Some applications allow readers to compare work locations, pay, and filter out different areas, while others visualize different occupations to find their common ground, or to show which jobs are becoming hot in some industries and regions. Both tables and graphs are designed to present the data in the simplest way. Data liberalization can facilitate rapid decision-making, through government data open, to transform data into information, and then information into knowledge. And citizens can use this knowledge to make decisions and take action. Open data is not only a way for the government to progress itself, but also to improve government governance approach of cooperating of government and citizens.^[6]

Conclusion

The advent of the big data era has brought opportunities and challenges. How to seize this opportunity to solve the development problems we face is the important issue that the government administrators need to seriously consider. Data visualization technology after years of development has produced a large number of excellent product tools, and it have been more mature applications in engineering, computing, finance, medical and other fields.^[7]But in the application of public management, it is still insufficient. To build a data management based on the public management and service is a item that cannot be hurried in a short time. But it brought the management concept of change with innovation and promoted the development of public management, which cannot be ignored. Based on the visualization of data, this paper explores the innovation of public management and service. It is believed that the visualization of data can improve the management form, promote the government information disclosure, and analyze and forecast the public service

demand of the public. Based on the cases, it provides a certain reference from the data presentation angle to improve the public management. However, how to use a deeper and more detailed way of big data to solve the problems encountered in the actual management process, and how to avoid authenticity, security and other issues in data in the visual application still need further study and discussion.

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