Big Data Analysis and Intelligent Management of Entry-Exit Border Inspection Information

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Abstract. Based on the status quo of entry and exit border inspection data statistics and management, analyzes its laws and characteristics, predicts its development trend, explores the use of modern information technologies such as artificial intelligence, big data, cloud computing, and improves the level of entry and exit border inspection data statistics management to enable entry and exit border inspection data statistics and management, which have become more scientific, standardized and intelligent.

Keywords: Information statistics · intelligence management · Big data analysis

1 Introduction

From January to June of 2021, a total of 66.973 million entry-exit persons were inspected at ports across the country; 7.527 million entry-exit transportation vehicles were inspected, of which 111,000 were cargo aircraft respectively, compared with 2019 and 2020 year-on-year, made an increase of 189.5%, 35%; and 380,000 person-times were issued residence permits for foreigners in China [1].

Entry-exit border inspection agencies collect, summarize, sort, analyze, and research data on port entry and exit personnel, transportation vehicles, and violations of entry-exit management laws and regulations to timely and accurately grasp the new information emerging at open ports. To monitor the implementation of immigration policies and regulations, provides a quantitative basis for scientific organization of services, provides a reference for the macro decision-making activities of national management agencies, provides a basis for formulating immigration border inspection policies, and guides immigration border inspections effective implementation of work [2].

2 Features and Functions

2.1 Comprehensiveness

Only complete statistical data can more accurately reflect the overall situation of entry and exit ports. Statistics on entry and exit data cannot be repeated or omitted. The meaning of relevant statistical items cannot be changed without authorization, so that the scope of the statistical investigation and the statistical investigation data are comprehensive.

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2.2 Accuracy

Accuracy refers to how close the statistical data is to the objective reality, that is, the true value. Entry-exit border checkpoints are required to verify various data and information when inspecting entry-exit personnel and transportation vehicles in accordance with the law. In the process of generating statistical data, they should reflect the true situation of entry-exit operational as much as possible.

2.3 Timeliness

Timeliness indicates that the entry border inspection statistics department provides the required statistical data and information within the specified time. Statistics are very time-sensitive. Entry-exit border checkpoints must classify and report the data within the specified time to reflect the situation of entry-exit border inspections in a timely manner.

2.4 Consistency

The process of organizing and transforming original data into secondary processing data or information must be consistent. The statistical indicator data and its components obtained from different sources or channels in different periods, different frameworks, and convergence. Operational data must ensure the connection between basic data and the entry-exit data information system, the connection between annual report data and regular data, the matching between total data and packet data, and the matching between other related data.

3 Process Design

The process of organizing and transforming the original data into secondary processing data or information must be consistent, and the statistical indicator data and its components obtained from different sources or channels in different periods, different frames, and channels must be corresponded and connected. Operational data must ensure the connection between basic data and the entry-exit data information system, the connection between annual report data and regular data, the matching between total data and packet data, and the matching between other related data. It is used to reflect the closeness of the relationship between discrete variables and summarize the data that has been generated, such as the formula (1).

$$r = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2 \cdot \sum_{i=1}^{n}(y_i - \overline{y})^2}}$$

3.1 Content Design

Carrying out scientific and rigorous planning and design for the collection and management of data information, make requirements for its scope, indicators, formats, channels, delivery, quality, etc., and establish a standardized process management system.

3.2 Collect and Report

Collecting and reporting to determine the list of data and information content as the object of statistics and management, uses the immigration information system and other channels to carry out information collection work and finally forms the data at this level, according to the required document output, tabulation, drawing, indicator interpretation, and visualization. Reporting statistics at this level from bottom to top in various forms such as charts, data and geographic information [3].

3.3 Analysis and Evaluation

Collecting and analyzing statistical information, through collision, comparison and quantitative analysis of statistical data, to deepen the understanding of the surface, nature and regularity of data information, and produce sequence evolution from shallow to deep process, and then come to scientific qualitative conclusions.

3.4 Feedback and Guidance

After collecting, collating, analyzing and evaluating statistical data, the corresponding data information file is formed, which can reflect the true situation of the overall statistical object to the greatest extent and discover its existing problems, and focus on the domestic and foreign countries that affect entry and exit activities. The situation and the development of entry-exit border inspection services, analyses data laws and development trends, formulates future-oriented policies and management goals, and achieve scientific quantitative management.

4 The Technical Path

The data analysis and intelligent management of entry-exit border inspection information uses information technology and other means to maximize the release of manpower through the processing of statistical data itself, the analysis and mining of statistical data, intelligent applications, and the interactive sharing of open data (Fig. 1).

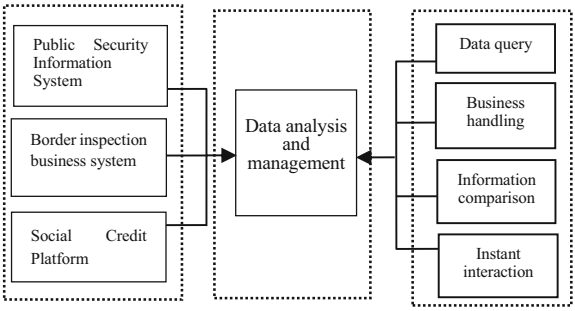

Fig. 1. Terminal architecture diagram

4.1 Building a Smart Cloud Database

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4.2 Information Digitization Drives

Through science and technology such as DBN, SAE, CNN, LSTM, etc. machine learning, Port space database, Human-computer interaction artificial intelligence, Perceptual visualization, etc., the massive data generated at a high speed is transformed into a basic resource and method of obtaining information. Realizing the classified collection and sorted of diversified data, and develops all kinds of data and information from traditional inefficient search and sorting to efficient and diversified development.

4.3 Intelligent Application of Big Data

Through data collection, storage, processing, and analysis technologies, calculation test plus parallel execution, we will comprehensively promote intelligent applications, mobile applications, and integrated applications to create digital borders and to build smart border inspections, and to do in-depth data mining, intelligent analysis, and automatic early warning on the basis of massive data. Constructing an integrated service operation mode of command, transfer, and operation that supports the integration of data, operation, and management.

4.4 Collaborative Data Exchange and Sharing

Entry-exit border inspection involves a large amount of data from civil aviation, transportation, tourism and other departments and organizations. Through the network security access platform, the inter-departmental private network, mobile phone applications, e-government services and other data resources can be exchanged and shared for entry and exit personnel. Providing a efficient and convenient customs clearance services to meet the convenience needs of entry and exit personnel [5].

4.5 Three-Dimensional Dynamic Digital Prevention and Control

In order to ensure the security of the country and the order of entry and exit, it is necessary to comprehensively use various technical means to make statistical data services practical, and apply big data, machine learning, artificial intelligence and other new technologies to discover potential connections and abnormalities between entry and exit border inspection operational data, and improve prediction early warning and disposal and response capabilities, and promote standardized law enforcement and security governance in border inspections.

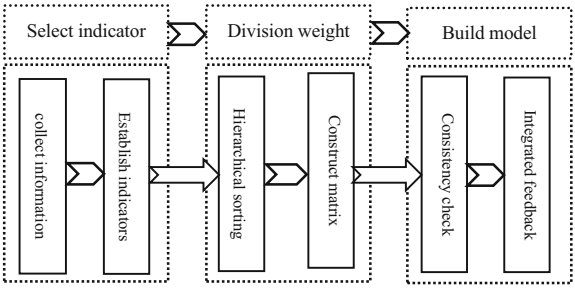

Fig. 2. Data usage model construction flowchart

5 The Development Trend

With the upgrading of information technology from information to intelligence, and from operation guarantee to innovation-driven transformation, new trends have emerged in the big data analysis and intelligent management of entry-exit border inspection information (Fig. 2).

5.1 Data Structure Standardization

With information standardizing the data structure and improving the information collection catalog, is to clarify the standards for collecting information, entering, transmitting, maintaining, and processing, and formulating a series of work specifications for data collection, management, opening, application, and exchange [6]. Highly integrated and hierarchically structured management of entry-exit border inspection data information, uses cloud computing to realize intelligent search, provides high-speed data search, single-table retrieval, cluster analysis and other services, and promotes the standardization and labeling of entry-exit border inspection data information to improve the application value of entry-exit border inspection data and information [7].

5.2 Refined Analysis, Research and Judgment

Establishing a predictive model for entry and exit data information is to classify, analyze, and comprehensively research and judge operational data information that occurs immediately. Analyzing and predicting work priorities through data relevance, analyzing and judging management targets is at fixed points and implement digital intelligence integration. Sensitive perception and precise early warning of all kinds of hidden dangers has formed a digital investigation and judgment model with data as the key element to realize more precise control and finer management.

5.3 Targeted Statistical Supervision

Through the establishment of a monitoring and control platform for data changes in immigration operational data, operational operating system operation, government service website information views, relevant Internet information data, immigration border

inspection and release time, etc., a dynamic work deployment and front-line implementation are formed. The curve intuitively reflects the work development and response time of different ports, forms targeted supervision of key objects, and promotes more standardized operation of border inspection services.

5.4 Intelligent Service Methods

Based on the information of immigration and border inspections, through the use of a large number of self-service equipment, a large amount of personnel information data is collected, and the principle of "legal, legitimate and necessary" information protection is followed to humanize and dynamically perceive the needs and changes of immigration personnel. The diversified and integrated resources is transformed management into information-led intelligent services.

6 Conclusions

Data information sub-calculation and management is the basic work of social governance and macro-control, and it is a tool that government departments must use for administrative management. The big data analysis and intelligent management of entry-exit border inspection information are the collection, statistics, analysis, and processing of operational data such as entry-exit inspection, on-duty management, and incident processing through information technology to form various information maps and data profiles for analysis and summary.

Big data analysis and intelligent management are guided by information-driven and supported by resource integration and technological integration. Understanding the status and laws of border inspections is from the dialectical relationship between quantity and quality. Big data analysis and intelligent management have become important means to promote the modernization of China's entry-exit governance system and governance capabilities. Entry-exit information resources play an increasingly important role in safeguarding national security and serving social and public utilities.

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