Research on the Digital Transformation Methods and Practices of Grassroots Statistical Work under the Background of Big Data

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Abstract: *The deep application of big data technology promotes the transformation of public governance towards data-driven approach. As the "nerve endings" of the statistical system, the digital transformation of grassroots statistics is a key link in promoting the modernization of statistical reform. At present, grassroots statistical work in China is facing practical difficulties such as lagging technological application, cumbersome and inefficient processes, and weak talent support, making it difficult to adapt to the core needs of statistical data in the new era of governance. This article takes the digital transformation of grassroots statistical work as the research object, and adopts research methods such as literature research and survey interviews to systematically analyze the current situation and core challenges of grassroots statistical work transformation, and construct a three-dimensional transformation framework covering "principles methods paths". Research has clarified that transformation should follow four core principles: adaptability and systematicity. A method system integrating technology empowerment, process optimization, talent cultivation, and mechanism guarantee has been proposed, and a three-stage practical path has been designed for early preparation, core implementation, and consolidation and improvement. The research results provide theoretical references and practical guidance for solving the difficulties of grassroots statistical digital transformation and improving the efficiency of grassroots statistical governance, enriching the research from the grassroots perspective in the field of statistical digital transformation.*

Keywords: *big data; grassroots statistics; digital transformation; transformation methods; statistical governance*

1. Introduction

In the era of digital economy, the deep application of big data technology promotes the transformation of public governance mode towards data-driven. As the fundamental support of the national governance system, statistical work has attracted much attention in its modernization reform process. Grassroots statistics are the "nerve endings" of the statistical system, responsible for the source of data collection, organization, and reporting [1]. The quality of their work directly determines the authenticity and decision support value of statistical data. However, the traditional grassroots statistical model is limited by inherent defects such as manual operation and hierarchical transmission, and is no longer suitable for the core requirements of "real-time, accuracy, and multidimensionality" of statistical data in the era of big data.

At present, grassroots statistical work faces many practical constraints: the cumbersome data collection process leads to time lag, the inconsistent standards of multi-source data make integration difficult, the single data analysis method restricts value mining, and the uneven digital literacy of grassroots statistical personnel further exacerbates the resistance to transformation [2]. In this context, the "14th Five Year Plan for Modernization of Statistics Reform" clearly regards digital transformation as the core direction of statistical reform, requires strengthening the deep integration of modern information technology and statistical work, and provides policy guidance for grassroots statistical transformation.

Although existing research has focused on statistical digital transformation, it mostly focuses on the macro level and lacks practical research on grassroots scenarios, making it difficult to effectively solve key issues such as technology adaptation and mechanism construction IJN in grassroots transformation. Based on this, this article focuses on grassroots statistical practice scenarios, with digital transformation

as the core topic, and systematically explores the core methods and practical paths of transformation. The research adopts multiple methods such as literature review and survey interviews, aiming to make up for the lack of grassroots perspectives in existing research, and provide theoretical references and practical guidance for improving the efficiency of grassroots statistical governance and promoting statistical modernization reform.

2. Analysis of the current situation and digital transformation challenges of grassroots statistical work under the background of big data

2.1 Survey on the current status of grassroots statistical work

In order to accurately grasp the actual operational situation of grassroots statistical work under the background of big data, this survey adopts a multi-stage stratified sampling method, selecting three major regions in eastern China (such as Jiangsu and Guangdong), central China (such as Henan and Hubei), and western China (such as Gansu and Guizhou), covering a total of 60 sample counties including economically developed counties, moderately developed counties, and underdeveloped counties, and synchronously extending to 120 township level statistical institutions for research. The research comprehensively used three research methods: questionnaire distribution, in-depth interviews, and field observations. 820 questionnaires were distributed to grassroots statistical workers, and 756 valid questionnaires were collected, with an effective response rate of 92.2%; Select 45 heads of statistical agencies at the county and township levels, business backbones, and frontline statisticians to conduct semi-structured in-depth interviews; Conduct on-site observations of 20 typical township statistical offices and data processing processes, and systematically review the operational status of grassroots statistical work in the three core dimensions of organizational structure, workflow, and technological application.

From the perspective of organizational structure, grassroots statistical institutions generally adopt the setting mode of "administrative affiliation+hierarchical transmission", which is mostly attached to the county and township government offices or economic development departments, lacking independent management authority and operational guarantees. Research data shows that the proportion of full-time statistical personnel in grassroots statistical institutions in the sample area is only 36.8%, less than 40%, with the proportion of full-time personnel in underdeveloped counties as low as 28.3%; The proportion of part-time employees is as high as 63.2%, and some township statistical positions are even undertaken by personnel from civil affairs, agricultural technology and other departments on a part-time basis, resulting in problems such as "one person holding multiple positions" and unclear rights and responsibilities. At the same time, there is strong mobility among grassroots statisticians, with an average annual turnover rate of 18.5% among county and township statisticians in the sample area in the past three years. Among them, the turnover rate in economically underdeveloped areas exceeds 25%, and frequent personnel changes have led to a discontinuity in the inheritance of statistical business and poor work connection.

From the perspective of workflow, the path dependence problem of traditional models is prominent, and the foundation of digital transformation is weak. In the data collection process, 68.3% of the sample townships still rely mainly on manual filling and paper submission, and only 31.7% of regions have introduced simple electronic reporting systems. However, these systems are mostly electronic copies of traditional paper processes and have not achieved direct connection with statistical objects such as enterprises and farmers. They still require manual input and verification, and the average data collection cycle is 7-10 days, which is difficult to meet real-time statistical needs. In the data processing stage, 82.5% of grassroots statisticians rely on basic office software such as Excel to complete data organization and accounting, lacking professional big data cleaning, integration, and analysis platform support; Faced with cross departmental multi-source data such as industry and commerce, taxation, agriculture, etc., due to the lack of unified data docking standards, data integration and verification take more than 45% of the time, and deep mining capabilities are seriously insufficient. Only basic data aggregation can be completed, and effective release of data value cannot be achieved.

From the perspective of technological application, the construction of digital infrastructure for grassroots statistics lags behind, and the level of technological application is relatively low. Field observations have found that 42.3% of township statistical agencies in underdeveloped areas have problems such as unstable network coverage and insufficient bandwidth, which cannot meet the needs of big data transmission and processing; 35.8% of the sample institutions are still using expired hardware devices such as computers and printers, which have low operational efficiency and are prone to data loss

risks. In terms of the application of big data technology, the technical application of grassroots statistical institutions in the sample area is mostly limited to basic levels such as data storage. Only 12.7% of county-level statistical institutions have attempted to use big data technology to carry out simple data classification and storage. However, there are obvious gaps in advanced application areas such as economic operation prediction and early warning, industrial development trend analysis, and accurate profiling of people's livelihood needs, and the role of technology empowerment has not been effectively played. The core conclusions of this survey can be visually presented in the table below, which clearly reflects the differences in core shortcomings of grassroots statistical work in regions with different levels of development, as shown in Table 1.

Table 1. Differences in core shortcomings of grassroots statistical work in regions with different development levels

Research dimensions	Core evaluation indicators (%)	Economically developed counties	Medium developed county	Underdeveloped counties	Overall mean of the sample
Organizational structure	Proportion of full-time statisticians	45.2	37.1	28.3	36.8
	Annual average turnover rate in the past three years	12.1	18.7	25.3	18.5
Workflow	Proportion of electronic reporting system applications	52.6	30.4	12.1	31.7
	Proportion of data integration verification time	32.4	46.7	55.2	45.1
Technology application	Hardware equipment compliance rate	82.3	57.6	34.2	58.0
	Proportion of advanced applications of big data	23.5	9.8	4.2	12.7

2.2 The necessity and feasibility of digital transformation in grassroots statistical work

Digital transformation is an inevitable choice to break through the bottleneck of grassroots statistical work and has a clear necessity. From the perspective of governance needs, in the era of digital economy, national macroeconomic regulation and precise local governance have put forward higher requirements for the timeliness, accuracy, and multidimensionality of statistical data. The lag of traditional statistical models can no longer meet the needs of modern governance; From the perspective of work effectiveness, digital transformation can reduce manual intervention and data errors through process optimization, while improving data processing efficiency and alleviating the work pressure of grassroots statisticians. At the feasibility level, the policy support system is constantly improving. Policy documents such as the "14th Five Year Plan for Modernization of Statistics Reform" have clarified the direction and path of digital transformation of grassroots statistics, providing institutional guarantees for the transformation; On the technical level, the maturity and low cost of technologies such as big data and the Internet of Things enable grassroots statistical agencies to introduce highly adaptable technical solutions; At the practical level, some economically developed regions have carried out grassroots statistical digitization pilot projects, accumulating replicable experience and providing practical references for comprehensive transformation.

2.3 Core challenges faced by the digital transformation of grassroots statistical work

In the process of digital transformation of grassroots statistics, there are multiple challenges that constrain the effectiveness of the transformation [3]. Firstly, there is insufficient technological adaptability. Existing big data technology solutions are mostly designed for upper level statistical agencies, which do not match the fragmented and simplified needs of grassroots statistical work, and lack targeted technical guidance and operation and maintenance services. Secondly, the data governance system is not perfect, and there is a lack of cross departmental data sharing mechanisms. Different departments have inconsistent data standards and incompatible formats, leading to the widespread phenomenon of "data silos"; The data quality control lacks full process standardization, and the quality verification mechanism for source collection, intermediate processing, and other links is not sound. Thirdly, the talent support system is weak, and the digital literacy of grassroots statisticians is generally low, lacking professional abilities in big data technology application and data analysis. In addition, the talent attraction mechanism is not perfect, making it difficult to attract and retain compound talents. Fourthly, there are shortcomings in the mechanism guarantee, such as the lack of special funding guarantee and insufficient funds for digital infrastructure construction and technological upgrading; The lack of a coordinated mechanism for promoting transformation and unclear division of responsibilities among departments have resulted in insufficient synergy in the transformation process.

3. Construction of a methodological system for the digital transformation of grassroots statistical work under the background of big data

3.1 Core principles of transformation

The digital transformation of grassroots statistics needs to follow four core principles: adaptability, systematicity, safety controllability, and effectiveness orientation. The principle of adaptability emphasizes that transformation methods need to be tailored to the fragmented and low-cost needs of grassroots statistical work, avoiding over design of technology and processes; The principle of systematicity requires the integration of multidimensional elements such as technology application, process optimization, talent cultivation, and mechanism guarantee to form a collaborative force for transformation; The principle of security and controllability focuses on the full lifecycle management of statistical data, building a security protection system that covers collection, storage, sharing, and other aspects to ensure the authenticity and confidentiality of data; The principle of effectiveness orientation takes improving the efficiency of statistical work as the core goal, and regards improving data quality and accelerating service response as key evaluation criteria for transformation effectiveness.

3.2 Technical empowerment methods: the integration path of big data technology and grassroots statistical work

Technology empowerment requires the construction of a fusion path of "lightweight adaptation+full process coverage". In the data collection process, promote mobile collection terminals and IoT sensing technology to achieve automatic capture and real-time uploading of data in key areas such as agriculture and industry, replacing traditional manual filling modes; In the data processing stage, a lightweight big data analysis platform is introduced, integrating functional modules such as data cleaning, format conversion, and anomaly verification to improve the efficiency of multi-source data integration; In the data application stage, relying on visualization technology to build a grassroots statistical data dashboard, real-time monitoring of core indicators is achieved, short-term trend analysis is carried out with the help of prediction algorithms, and the forward-looking nature of statistical services is strengthened; At the technical operation and maintenance level, establish a guarantee mechanism of "superior coordination+grassroots implementation", with technical support provided by the superior statistical department to reduce the pressure of grassroots operation and maintenance.

3.3 Process optimization methods: digital reconstruction of the entire process of grassroots statistical work

Guided by the theory of process reengineering, promote the digital reconstruction of the entire statistical work process. Sort out the existing workflow, eliminate redundant links such as manual verification and paper circulation, and build a closed-loop process of "collection processing analysis application feedback"; Establish standardized data collection standards, clarify data indicators, reporting

criteria, and submission deadlines for different statistical objects, and achieve uniformity in data collection; Promote data processing automation, achieve automatic collection and verification of cross departmental data through system integration, and reduce manual intervention; Build digital feedback channels to directly connect statistical data users with grassroots statistical institutions, accurately respond to data needs, and enhance service targeting.

3.4 Talent cultivation methods: construction of grassroots statistical digital talent team

Build a talent team construction system that combines precision cultivation and guidance. For existing personnel, carry out hierarchical and classified training, focus on digital tool operation skills in the basic layer, strengthen data analysis and technical application capabilities in the enhancement layer, rely on resources from higher-level statistical departments to build an online training platform, and reduce training costs; Establish a "mentorship" assistance mechanism, where technical backbone and business experts pair up to provide guidance and improve the effectiveness of training; Optimize the talent attraction and cultivation mechanism, introduce composite talents through targeted recruitment, part-time employment, and other methods, improve performance evaluation and incentive mechanisms, incorporate the effectiveness of digital work into evaluation indicators, and enhance the stability and enthusiasm of the talent team.

3.5 Mechanism guarantee method: construction of institutional system for digital transformation

Establish a multidimensional institutional guarantee system to support the implementation of transformation. Improve the organizational coordination mechanism, establish a transformation special working group led by grassroots governments, statistical departments, and relevant departments, and clarify the division of rights and responsibilities; Establish a sound funding guarantee mechanism, set up special funds for digital transformation, focus on supporting infrastructure upgrades and technology platform construction, and strive to supplement the funding gap with higher-level financial transfer payments; Establish an assessment and evaluation mechanism, set quantitative indicators such as data quality, efficiency improvement, and service satisfaction, and regularly conduct transformation effectiveness evaluations; Establish a system for data sharing and security management, clarify the scope of data sharing, division of permissions, and security responsibilities, solve the problem of "data silos", and ensure the standardized and orderly progress of transformation.

4. The practical path of digital transformation of grassroots statistical work under the background of big data

4.1 Preparatory stage: consolidating the foundation for transformation

Pre preparation is a prerequisite for the orderly promotion of transformation, with the core being the completion of current situation analysis, planning and resource reserve. Firstly, conduct a comprehensive assessment of the current situation, systematically sort out the core elements of grassroots statistical institutions such as organizational structure, personnel allocation, technical facilities, workflow, and data resources through questionnaire surveys, on-site visits, and discussions, and accurately identify transformation pain points and priority needs. Secondly, develop a differentiated transformation plan that combines grassroots reality with higher-level policy requirements, clarifies the overall goals, stage tasks, implementation steps, and expected results of the transformation, refines special plans for technology adaptation, process optimization, talent cultivation, etc., and avoids resource waste caused by blindly following the trend. Thirdly, strengthen the pre reserve of resources, on the one hand, coordinate with higher-level statistical departments to seek technical guidance and funding support, and establish special funds for transformation; On the other hand, we will carry out preliminary publicity and mobilization to enhance the awareness and recognition of transformation among grassroots statisticians, and create a good atmosphere of collaborative participation.

4.2 Core implementation stage: promote the implementation of multi-dimensional transformation

The core implementation phase focuses on the four core dimensions of technology, process, data, and talent, promoting the implementation and effectiveness of transformation measures. At the technical level, priority should be given to completing infrastructure upgrades, building a lightweight digital statistical platform that adapts to grassroots needs, and achieving interconnectivity with higher-level statistical

systems and data systems of relevant departments at the same level; Introduce simplified big data collection and analysis tools to lower the threshold for technological applications. At the process level, according to the reconstructed digital process, gradually replacing the traditional work mode, we will first promote the digital transformation of core links such as data collection and reporting, and then extend to the entire chain of data analysis and service output, synchronously establishing process operation norms and emergency response mechanisms. At the data level, we establish a standardized grassroots statistical database, unify the caliber of data indicators, coding rules, and storage formats; Break down cross departmental data barriers, establish a data sharing and collaboration mechanism, and achieve the integration and collection of multi-source data such as government data and social data. At the talent level, we will simultaneously carry out hierarchical classification training and precise talent introduction, enhance the digital operation and data analysis capabilities of existing personnel, and supplement the gap of composite talents through flexible talent introduction, targeted recruitment, and other methods.

4.3 Consolidation and enhancement stage: improve transformation guarantee and optimization

In the consolidation and improvement stage, with the goal of long-term operation, we will strengthen the construction of the guarantee system and dynamically optimize and adjust it. On the one hand, establish a sound long-term guarantee mechanism, improve organizational coordination mechanisms, and clarify the division of responsibilities among departments and personnel after the transformation; Optimize the funding guarantee mechanism to ensure that funds for subsequent work such as technical operations and personnel training are in place; Establish a data security management system, implement security protection measures such as data classification management and access control. On the other hand, regular effectiveness evaluation should be carried out, and a quantitative evaluation index system covering dimensions such as data quality, work efficiency, service satisfaction, and talent literacy should be constructed. Regular review of transformation effectiveness should be conducted to accurately identify problems in the implementation process. At the same time, we establish a dynamic optimization mechanism, combine evaluation results, policy adjustments, and actual demand changes, timely iterate and optimize digital platforms, workflows, talent cultivation plans, etc., continuously improve the quality and efficiency of transformation, and promote the transformation of grassroots statistical digitization from "completion and implementation" to "quality and efficiency improvement".

5. Conclusion

This article is based on the practical scenarios of grassroots statistical work, systematically exploring the methodological system and practical path of digital transformation under the background of big data. Through literature research, research analysis, and logical construction, the following core conclusions are drawn:

Firstly, in the era of big data, the digital transformation of grassroots statistical work is inevitable and urgent, and has feasible support in terms of policies, technology, and practical foundations. Research has found that current grassroots statistical work generally suffers from problems such as incomplete organizational structure, outdated technology application, and cumbersome and inefficient processes. Traditional models are no longer suitable for meeting the needs of modern governance for "real-time, accurate, and multidimensional" statistical data. Digital transformation is the core path to solving these challenges.

Secondly, the digital transformation of grassroots statistics faces multiple core challenges such as insufficient technological adaptation, lack of data governance, weak talent support, and shortage of mechanism guarantees. These difficulties are intertwined and mutually restrictive, leading to obstacles in the transformation process, highlighting the necessity of building a systematic transformation method system and practical path.

Thirdly, the three-dimensional transformation framework of "principles methods paths" constructed in this article has practical applicability. Transformation needs to follow four core principles: adaptability, systematicity, safety controllability, and effectiveness orientation; The methodology system covers four key dimensions: technological empowerment, process optimization, talent cultivation, and mechanism guarantee, forming comprehensive support; The practical path is divided into three stages: preliminary preparation, core implementation, and consolidation and improvement, presenting a gradual and orderly promotion logic, providing clear operational guidance for the digital transformation of grassroots statistics.

The lack of research is mainly reflected in the limited coverage of survey samples and insufficient in-depth research on the differential adaptation of grassroots statistical transformation in different economic development levels and regions. In the future, the scope of research can be further expanded to focus on the personalized needs of statistical transformation at the grassroots level in the eastern, central, western, urban and rural areas, and deepen the research on differentiated transformation plans; At the same time, combining the development of cutting-edge technologies such as artificial intelligence and blockchain, explore new directions and paths for the digital transformation of grassroots statistics, and continuously improve the efficiency of grassroots statistical governance.

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