Research Article

Realization of the New Situation Based on Reliability Mathematics Application in Public Administration

Jing Du1 and Shizhou Feng2,3

1Chongqing College of International Business and Economics, Chongqing 401520, China
2Chongqing College of Mobile Communication, Chongqing 401520, China
3Chongqing Key Laboratory of Public Big Data Security Technology, Chongqing 401420, China

Correspondence should be addressed to Shizhou Feng; xrlin@heuet.edu.cn

Received 6 June 2022; Revised 18 July 2022; Accepted 29 July 2022; Published 31 August 2022

Academic Editor: Sagheer Abbas

Copyright © 2022 Jing Du and Shizhou Feng. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

With the acceleration of social modernization, the level of public management has also been significantly improved compared with previous times. People are more and more aware that a harmonious public life is the basis for realizing a good personal life. As an important guarantee for a harmonious public life, public management occupies an extremely important position. However, the great changes in the economy and society have brought forth new problems in modern public management, and the tasks and burdens of public management have become heavier and heavier, which has had a huge impact on the effectiveness of social governance. On the basis of studying the factors affecting the development of public management and the problems of management, this paper integrates the new situation of reliability mathematics application, and explores and solves the problems of public management. In the experiment, the effectiveness of the method proposed in this paper is tested from two aspects of management analysis and management effect, and the feasibility of this method is verified by comparing with the traditional management method. The final experimental data show that the innovation degree and coordination degree of management work under the traditional management method are 16.6% and 58.4%, respectively. The innovation degree and coordination degree of management work under the method of this paper reach 36.1% and 78.8%, respectively. It shows that the analysis and realization of the new situation of reliability mathematics application in public management have certain operability.

1. Introduction

As the main means of social science management, public management has very important value and significance. Under the background of the continuous progress of the times, the level of public management has also been improved to a certain extent. But with the rapid economic development, new management problems emerge one after another, such as poor implementation and poor transparency. The existence and continuous development of these public management problems force the quality and effect of public management to not be significantly improved, and the huge impact on social stability has seriously disturbed the normal social production and life order. Therefore, how to effectively analyze the events and problems in public management in a scientific and reasonable way and improve the efficiency of public management is an urgent problem to be solved in the development of modern public management. This paper analyzes the public management problem in combination with the new situation of reliability mathematics application, which can promote the development of management value. From the perspective of the handling of public management, deeper innovations can also be achieved, so that public management can play a better role and create greater impetus for social construction.

In recent years, many scholars have conducted research and analysis on public management issues. Grimmelikhuijsen et al. discussed the theories and methods of public administration and related fields, and pointed out that public administration can be developed through integration with other disciplines [1]. Zareh et al. believed that administrative reforms that improve the internal efficiency of
the bureaucracy could alleviate the trade-off contradiction between integrating the provision of public management services [2]. Belle and Cantarelli discussed the role of some factors in the development of public management and believed that self-control is very important to achieve good public management results [3]. Iacovino et al. analyzed the existence of different management methods in public organizations in the Tuscany region of Italy and highlighted the phenomenon of the existence of multiple frameworks in organizations [4]. Marijani believed that the sustainable development of public management needed to rely on the theoretical basis and the interpretation and scientific guidance of related disciplines [5]. Laihonen and Mantyla explored recognition of the importance of interpretive processes, discussion, and organizational learning in public management and argued that knowledge gaps still existed in terms of dialogue mechanisms [6]. With the continuous development of social economy, the original public management methods are no longer applicable at this stage, and the combination of reliability mathematics and public management has become a more efficient choice.

Reliability mathematics has attracted the attention of many scholars because its scientific validity and its application in new situations can bring considerable economic benefits. Cook et al. proved the concentration of some unbounded magnitude-bias coupling through reliability mathematics and obtained a tail estimate similar to that given by Bennett's inequality [7]. Katz-Buonincontro et al. used probabilistic and statistical methods in reliability mathematics to explore the relationship between students’ perceived creativity and actual creativity, and to understand the correlation between creativity and learning [8]. Combined with teaching practice, Zhang used reliability mathematics to model and analyzed the teaching effect, which provided a reference for further improving the teaching quality of probability theory and mathematical statistics [9]. Patrick and Puterman combined reliability mathematics to provide a new management approach to the problem of an aging population and the challenges of overused equipment and facilities [10]. Based on reliability mathematics, Jie et al. explored a solution to match bed planning and personnel scheduling from the perspectives of decision-making, problem setting, and modeling [11]. Hurd described simulations used in two engineering design problems through reliability mathematical methods and showed that similar methods can be used for other management problems [12]. These studies reflect the application value of reliability mathematics from different perspectives. There are few studies on the integration of the new situation of application and public management, in order to alleviate the contradictions and problems in public management. It is very important to analyze and realize the new situation based on reliability mathematics application in public management.

Based on the reliability mathematics theory, this paper conducts an effective research on the events and problems of public administration. It can be seen from the experimental results that in the management analysis, the comprehensive score of the analysis results of various events under the reliability mathematics application method is 8.75 points, and the systematic score of the analysis results is 7.94 points. In terms of the effectiveness of management work, the highest test value of innovation degree of public management work under this method is 48.2%, and the highest test value of coordination degree is 81.2%. The average management cost of various public events is only 15.06 million, and the average management cost of traditional management methods is 15.6 million, which proves the dual advantages of this method in management analysis and management effectiveness.

2. Public Administration Based on Reliability Mathematics

2.1. Overview of Public Administration. From the ideographic analysis, the public is owned by the majority of people. Modern social governance has been transformed from “dominant” to “managerial,” and then “public management” has emerged [13]. Public management is classified into two categories according to the literal meaning of “public + management,” and its essence is a fair behavior with the purpose of solving public problems and expressing public will. From the perspective of management subjects, public management work means that the main body aims to achieve public interests and strengthens the actual governance of the object through economic and political means to improve the level and quality of management work, thereby providing more reasonable benefits to the public. The object of public management, that is, the object, represents the public affairs of society.

From a theoretical point of view, why the society conducts public management is of great significance for understanding the value of public management. In the process of social development, it is found that there are 6 main factors affecting the development of public management, as shown in Table 1.

In the simultaneous development of society and public management, it can be found that in the process of management, public management has carried out orderly planning of various development elements of society to a certain extent, but it also has many problems and challenges. These issues and challenges are also likely to lead to governance failures. This paper mainly studies and analyzes four types of problems existing in public management at this stage.

2.1.1. Innovation. While emphasizing the division of labor, public management also emphasizes a certain degree of coordination and collaboration. And this kind of cooperation exists not only between different levels of the bureaucratic government that have subordinate relationship, but also between various departments of the same level that are not subordinate to each other. From this perspective alone, the innovation of collaboration and integration advocated by public management is actually very limited. Because most management organization forms are still hierarchical, consultative, and networked, public managers still continue to do a lot of work within the hierarchical system. Although many scholars agree that networks are...
replacing hierarchies, interorganizational and interdepartmental interdependencies are bringing more and more horizontal connections across organizational boundaries. However, the emergence of various horizontal connections is only to supplement and assist the hierarchical level, rather than replacing them [14].

2.1.2. Coordination. According to the coordination requirements of public management, the arrangement of management activities is based on the consensus reached by all parties involved, but it is very difficult to achieve consensus in practice. Before reaching a coordination relationship and consensus, there is often more conflict between organizations, as well as between individuals, than collaboration until coordination and consensus are reached. And public management is the process of managing conflicts in the process of organizational cooperation. There are many types of conflicts in public administration, such as resource conflict, time conflict, interest conflict, and goal value conflict. This can easily lead to endless viewpoints in the process of public governance, negotiation cannot be carried out, and it is difficult to achieve public governance goals that are in line with the interests of all parties and are recognized by all parties.

2.1.3. Management Costs. The optimization of public management has huge advantages for social governance, but the high management cost in it is also a problem that cannot be ignored. For different types of management entities, the management costs to be paid are relatively different. But for most of the subjects involved in the management work, the management cost is mainly manifested in the loss of the original institutional authority and institutional resources of the managers. For example, the government managers who are the participants know best about the government agencies. Therefore, there should be government managers to carry out missions and programs, which relinquish the power of other participants. Problems at these levels are common. At the same time, they constitute an important weight for the management itself is complex, such as a high degree of thinking, which is also a resistance to management. Fourth, people’s fear of change is the inertia of people’s jobs because of management, they will resist the management work. Third, people’s fear of change is the inertia of people’s thinking, which is also a resistance to management. Fourth, the management itself is complex, such as a high degree of uncertainty in tasks, a generally large number of participants, diversity, and inconsistent goals and agendas.

These four types of problems are not isolated, but are closely related to each other. In different time periods, the mechanism of the negative effects of various problems is different. Therefore, when analyzing public management, it should be considered comprehensively.

2.1.4. Manage Laziness. At this stage, public management work can realize the sharing of resources and information, and help to solve complex public problems and cross-departmental problems. But it does not mean that any organization can carry out effective management, nor does the management under any circumstances play a good role. In principle, public administration can indeed produce economies of scale. But in fact, the management process is complex, and the management often spans time, space, organization, and cultural environment. In the process of management, various factors such as interpersonal relationships, technical conditions, and people’s will have to be considered, and the expected management results are difficult to achieve. From the perspective of managing inertia, the current challenges are mainly as follows: First, people from different agencies rely on different technologies. Those who work within the management system need to be trained in new technologies, which cost time and money. Second, cultural challenges generate resistance from individuals. When people lose their original jobs because of management, they will resist the management work. Third, people’s fear of change is the inertia of people’s thinking, which is also a resistance to management. Fourth, the management itself is complex, such as a high degree of uncertainty in tasks, a generally large number of participants, diversity, and inconsistent goals and agendas.

These four types of problems are not isolated, but are closely related to each other. In different time periods, the mechanism of the negative effects of various problems is different. Therefore, when analyzing public management, it should be considered comprehensively.

2.2. New Situation of Reliability Mathematics Application. The mathematical theory of reliability was originally proposed to meet the research and development needs of military equipment brought about by the industrial revolution. Later, with the development of science and technology, reliability mathematics has been widely used in the optimization of electronic products. This stage belongs to the budding period of reliability mathematics application in the new century. With the gradual development of aerospace technology, communication engineering, and nuclear energy research, the application of reliability mathematics has gradually entered the right track era. With the development of the market economy, reliability mathematics has rapidly developed in various industrial fields and has been fully integrated with a number of value fields, such as construction engineering and product research. At the same time, the application of reliability mathematics has gradually formed a new situation with the progress of the times; that is, the mathematical models are used to solve problems existing in actual events or phenomena. This new situation has
flourished in social production. Its basic framework is shown in Figure 1.

In practical applications, the problems existing in an event or phenomenon are generally transformed into a reliability study of an element in the event or phenomenon problem [15]. With the improvement of the economic level, the research level of reliability mathematics is gradually improved, more and more problems appear in practical application, the structure is more complex and profound, and the application of reliability mathematics is more and more extensive. Therefore, qualitative or quantitative mathematical models are established to explore events or phenomena and gradually become the research topic of scholars. By analyzing the relationship between the elements of the problem, it is the latest situation of the application of reliability mathematics to transform the mathematical reliability research into the research of a certain element through the method of modeling.

In order to comprehensively consider and solve the existing problems in public management and promote the progress of modern public management, this paper conducts in-depth research on the effective realization of public management combined with the new situation of reliability mathematics application. In the process of analyzing and realizing effective public management, the reliability mathematical model is directly used to revise the management work. It can not only effectively quantify the effectiveness of public management, solve the problem of excessive task calculation and measurement needs during management, but also effectively improve the coordination and efficiency of management work.

The reliability mathematical model proposed in this paper consists of a random process and a linear regression model, and its model expression is shown in

$$f(x_i) = f^T(x_i)\beta + z(x_i).$$

(1)

Among them,

$$\beta = [\beta_1, \beta_2, \ldots, \beta_p]^T,$$

(2)

$\beta$ is a vector of coefficients of the public administration regression model, $f(x_i)$ is a polynomial function of variable $x$, and

$$f(x_i) = [f_1(x_i), f_2(x_i), \ldots, f_p(x_i)]^T,$$

(3)

$z(x)$ is a random distribution with nonzero covariance and obeys the normal distribution $N(0, \sigma^2)$. Using least squares estimation, the estimated values of $\beta$ and $\sigma^2$ can be obtained, as shown in [16]

$$\hat{\beta} = (F^T R^{-1} F)^{-1} F^T R^{-1} Y,$$

(4)

$$\hat{\sigma^2} = \frac{1}{d} (Y - F\hat{\beta})^T R^{-1} (Y - F\hat{\beta}).$$

(5)

Among them, $F$ is the vector matrix of public management sample events, $Y$ is the response column vector for the public administration sample event, and $R$ is the management space matrix, where the elements are

$$R_{ij} = R(x_i, x_j) (i = 1, 2, \ldots, d).$$

(6)

The definition of each parameter in (6) is shown in Table 2.

In order to better fit with the actual public management work, the reliability mathematical model has been optimized, as shown in Figure 2. The Latin hypercube sampling method was used to extract sample management events within the parameter interval to be resolved in the initial management work. It is divided into training set and test set (the training set and test set data are different from each other), and the corresponding response values are calculated by finite element method.

Then, the training set is used as the input of the mathematical model, and the corresponding response values are regarded as an objective function. This objective function is the root mean square error between the response corresponding to the test set and the response value predicted by the mathematical model, as shown in

$$RMSE = \frac{1}{dy} \sqrt{\sum_{i=1}^{d} (y_i^m - y_i^m)^2}.$$

(7)

Among them, $y_i^m$ and $y_i^m$ are the response values predicted by the test set response value model corresponding to the group $i$ public management sample events and are the average value of the test set response values. Then, RMSE is used to evaluate the accuracy of the model, and the closer the value is to 0, the smaller the error between the expected value of the test set and the predicted value of the model is. At this time, the innovation, coordination degree, and pursuit of management cost of public management work are regarded as an objective function. This objective function is the root mean square error between the response value corresponding to the test set and the response value predicted by the mathematical model, as shown in

$$RMSE = \frac{1}{dy} \sqrt{\sum_{i=1}^{d} (y_i^m - y_i^m)^2}.$$


sub-iteration, as shown in Figure 3. And the optimal solution in each iteration process is solved and denoted as $\theta_{\text{best}}$, according to the algorithm to judge whether the conversion probability is $p > 0.8$, and finally according to the acceptance rate, whether to accept the candidate value is judged. If so, the parameter value after the second iteration is the optimal solution to the public management event or phenomenon.

### 2.3. Public Administration Test

The management test in this paper selects the most representative cases of public management events in a certain place from 2017 to 2021 according to the impact of events, and the fields and scope of events are not limited. According to the event attributes (such as economy, culture, and politics), it is divided into 5 major categories, which are, respectively, expressed as A-type events, B-type events, C-type events, D-type events, and E-type events. Table 3 shows part of the data of the local public management report from 2017 to 2021. The empirical analysis is carried out by examining the public management work under the idea of algorithm. The method is investigated in the aspects of comprehensiveness and systematicness of management analysis, innovation degree, coordination degree, and management cost of public management work, and compared with traditional management methods to verify the effectiveness of this method.

It can be seen from Table 3 that there are frequent public management events in this area every year. This has a great relationship with the economic development and public management construction level of the place, and the incident involves a wide range of fields. This paper selects this place as the experimental object, which has certain representativeness.

#### 2.3.1. Management Analysis

In the analysis of public management events, the comprehensiveness and systematicness of management analysis greatly affect the effect of subsequent management work. If the orderly analysis of events cannot be achieved, effective management strategies cannot be provided, and even better management results cannot be achieved. According to the management analysis standard, the analysis results of the two methods in different categories of events are scored, with a full score of 10 points. Of course, in the actual analysis of public management events, this ideal value cannot generally be achieved due to the influence of various interference factors, such as time and equipment. Therefore, the higher the score, the more the management analysis results meet the management analysis standards. The analysis results under the two methods are shown in Figure 4.

As can be seen from Figure 4, the comprehensiveness score of public event analysis under the method in this paper is obviously higher than that under the traditional method. The average comprehensive score of the analysis results of various events under the reliability mathematics application method is 8.75 points, while the average comprehensive score of the traditional management method is only 7.73

### Table 2: The definition of each parameter of the equation.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Parameter</th>
<th>Paraphrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$d$</td>
<td>Number of samples of public administration events</td>
</tr>
<tr>
<td>2</td>
<td>$\beta$</td>
<td>Function of $\theta_k$</td>
</tr>
<tr>
<td>3</td>
<td>$\sigma^2$</td>
<td>Function of $\theta_k$</td>
</tr>
<tr>
<td>4</td>
<td>$\theta_k$</td>
<td>The only factor that determines management efficiency in reliability mathematical model</td>
</tr>
</tbody>
</table>

### Table 3: Partial data of the local public management report from 2017 to 2021.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Period</th>
<th>Number of events</th>
<th>Number of fields involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>March–August</td>
<td>35</td>
<td>8</td>
</tr>
<tr>
<td>2018</td>
<td>January–June</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>2019</td>
<td>July–December</td>
<td>55</td>
<td>12</td>
</tr>
<tr>
<td>2020</td>
<td>April–September</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>2021</td>
<td>September–December</td>
<td>29</td>
<td>7</td>
</tr>
</tbody>
</table>

![Figure 2: Optimized mathematical model of reliability.](image-url)

![Figure 3: Optimal solution in iterative process.](image-url)
points, and the gap between the two is obvious. In actual work, public management work has a certain complexity and comprehensiveness. After the reliability mathematical model is optimized, the coverage of the initial management work becomes wider. In the process of analyzing the event, the analysis of each influencing factor is more in-depth, taking into account the long-term impact of time and space differences such as environment and development level on work performance. However, traditional management methods often face the dilemma of fragmentation, often only considering the existing problems and development interests, which greatly affects the comprehensiveness of public relations management.

In the systematic performance of the analysis results, the average score of the method in this paper for various events is 7.94 points, and the average score of the traditional method for various events is 8.00 points, which is related to the management experience accumulated by traditional management methods in long-term practice. These experiences provide regular guidance for management analysis and make the analysis results more reasonable and orderly. Although the method in this paper has an absolute advantage in the comprehensiveness of the analysis, it has not yet formed a relatively scientific plan in the actual public management work and may not be applicable to some special management events. But this is related to the length of application time, and it also shows that the analysis and realization of the new situation of reliability mathematics application in public management still have a lot of room for development.

2.3.2. Management Effectiveness. Generally speaking, after the event is analyzed and planned, the implementation phase of management work is entered. The effectiveness of management work is often determined by the degree of innovation and coordination of management work. Because in a narrow sense, public events involve multiple management objects. In the management work, it is often necessary to innovate the management mechanism and coordinate the rights and interests of multiple objects. And in this coordination process, due to factors such as human and financial resources, it consumes a lot of management costs. Therefore, this paper takes the level of management cost as one of the parameters to examine the effectiveness of the method. Besides the visible tangible resources, there are also various intangible inputs and expenditures in the management cost, such as system implementation costs and negative effects of events. Due to the limited experimental conditions in this paper, the management cost analysis here only considers tangible human and financial costs. Traditional cost accounting methods include quantitative algorithms and qualitative algorithms. In this paper, a more direct quantitative algorithm is used for accounting. The test data are shown in Figures 5 and 6.

In public management, different management mechanisms and management strategies need to be implemented according to different event attributes. If the management work is only carried out by copying the old systems and regulations, it often results in the unsustainability of public management. At this time, innovative systems are needed. When reliability mathematics is applied to management work, through the initialization of the management system and several iterations, it can meet the different needs of various events, so as to carry out effective management. As can be seen from Figure 5, the innovation degree of public management work under the method in this paper reaches 48.2%, which is extremely flexible. Targeted management can be carried out according to the characteristics and attributes of events, which is very innovative. The highest innovation rate of traditional management methods is only 25.3%, which obviously cannot meet the great changes in society in the new era. And the emerging information age and knowledge age require less fixed and more permeable organizational structures. Under the method of this paper, the average coordination degree of management work reaches 78.8%, and public management can be interrelated across internal functional divisions, organizational boundaries, and even geographical boundaries. In this sense,
departmental systems and cross-departmental cooperation can be realized in practical applications. However, the average coordination degree of traditional public management methods in various events is only 58.4%, which cannot effectively promote the effective coordination of multi-party management subjects in public management to meet the balanced interests of objects. This has a huge impact on the internal management capacity of the organization and the level of public management.

As can be seen from Figure 6, the method in this paper has certain advantages in terms of saving management costs, which is greatly related to management efficiency. The optimal solutions of public events or phenomena obtained by the reliability mathematical method enable the management work to be analyzed effectively and save a lot of time and energy for the later execution. When accounting for the management work in different categories in this paper, the total management cost under the method proposed in this paper is about 75.3 million, and the management cost under the traditional management method reaches about 78 million, which is a great improvement for public management work. Because this is a very time-consuming and energy-consuming project, in order to obtain good management results, it is necessary to coordinate the interests of all parties, and there are often high time and labor costs at this time. The management cost of traditional management methods in the face of large-scale public events is also huge. The influence and scale of the public events selected in this experiment are very representative, so the management costs of the two methods are also quite different. But at the same time...
time, it also proves the unique superiority of this method in saving management cost.

3. Conclusion

Society carries people’s study, work, and daily life, and the level of development quality of the times is also related to the level of public management. Organizational changes brought about by social changes and the technical support of the development of network and communication technologies have resulted in the emergence of many thorny public management issues. Combining with the new situation of reliability mathematics application, this paper makes an effective analysis on the events and phenomena in public administration. While saving management costs, it coordinated and innovated the public management mechanism to achieve higher management efficiency and effectively promote the achievement of public management effectiveness. The analysis and realization of the new situation based on the application of reliability mathematics in public management have certain practical value and significance, but the research on public management issues in this paper still needs to be improved. In the development of society, the problems in public management work are diverse, and this paper only studies a few types of events that are representative of a certain place. Due to the limited experimental conditions, the conclusions drawn may have certain limitations. In the future research life, it is necessary to continuously improve the research depth and experimental level, and provide more valuable research results for the analysis and realization of the new situation of reliability mathematics application in public management.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgments

This research study was sponsored by these projects: project one: Project of Association of Fundamental Computing Education in Chinese Universities, the name of the project is Ideological and political reform and practice of “Trinity” course under the background of new engineering—Taking Python language programming as an example, and the project number is 2022-AFCEC-635. Project two: Project of Chongqing College of Mobile Communication, the name of the project is Exploration and practice of Ideological and political construction in the “Trinity” course of new engineering, and the project number is 22]G318. The authors also thank these projects for supporting this article.

References