Constructing and Researching the Numerical and Intelligent Measurement Indicator System for the Construction of the Demonstration Area of Firmly Fostering the Community Consciousness of the Chinese Nation

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Abstract: The purpose of this paper is to explore the construction of a measurement index system for casting the Chinese group community consciousness demonstration area by means of mathematical intelligence. First, this paper analyzes the shortcomings and challenges of the current research, then combines the actual cases, proposes a set of scientific indicator system, and verifies its validity through quantitative and qualitative analysis. Among them, the field research validation results show that the social integration scores of Area A, Area B and Area C are 85, 78 and 90 respectively. The case study validation showed that the social integration score of District D was 88. Finally, the results of the simulation experiment showed that the social integration, cultural identity, and policy implementation effects were 90, 85, and 88 points, respectively, in the economic growth scenario. These data results show that the Numerical Intelligence Measurement Indicator System has good adaptability and stability under different scenarios.

1. Introduction

Forging a strong sense of community among the Chinese nation is an important task for the cause of socialism with Chinese characteristics in the new era. As the construction of demonstration zones advances, how to scientifically and effectively assess their construction effects has become a key issue. At present, many assessment methods have problems such as inconsistent evaluation standards and insufficient quantitative analysis, which make it difficult to accurately reflect the actual construction of the demonstration zones. Therefore, it is particularly important to construct a set of scientific and comprehensive mathematical and intellectualized evaluation index system to enhance the scientific and effective construction of demonstration zones through data-driven methods. This research not only helps to improve the quality of the construction of demonstration

zones, but also provides strong support for the equationtion and implementation of related policies.

In this paper, we validate the numerical intelligence measurement index system through field research, case studies, and simulations. We developed a multi-level indicator system—encompassing social integration, cultural identity, and policy effectiveness—and applied the Analytic Hierarchy Process (AHP) to assign weights to each indicator. Our analysis utilized techniques such as multiple regression, factor analysis, and cluster analysis to evaluate the performance of the demonstration area comprehensively. The results confirm that our index system accurately assesses the area's performance across various dimensions, serving as a scientific tool for decision-making and development assessment.

This paper firstly introduces the methodology of constructing the index system for numerical intelligence measurement, including the specific steps of data collection, processing and analysis. Then, the validity and applicability of the measurement index system are systematically verified through field research validation, case study validation and simulation experiment. Finally, the results of the study are summarized, limitations of the study are discussed, and directions for future research are proposed.

2. Related Works

In recent years, scholars have conducted extensive research on forging a strong sense of Chinese national community. For example, Ma P analyzed the importance of enhancing the sense of Chinese national community and the significance of relevant education for college students. He discussed the ways to enhance the Chinese national community consciousness of college students from the aspects of teaching form, teacher quality and practice courses, and provided feasible suggestions for colleges and universities [1]. Enhancing the sense of Chinese national community is the core of national ethnic work in the new era, and it is an important ideological foundation for promoting national unity. Chen G believes that ideological and political courses should give full play to their main role in enhancing the education of Chinese national community consciousness [2]. Establishing a strong sense of Chinese national community is the main line of national work in the new era. Chen N explored in depth the innovative ideas of national unity and progress work in Ganzi Prefecture, emphasizing that it not only relates to the high-quality development of Ganzi Prefecture and long-term peace and stability, but also affects the regional security and national unity [3]. National costume culture is the external expression of the history and civilization of the Chinese nation, as well as the humanistic embodiment of China's splendid civilization, which has a positive effect on the national unity education of college students. Zhou Y believes that the study of the national costumes in Sichuan, Yunnan and Qing regions helps to enhance the enthusiasm of building the culture of the Chinese national community [4]. Khan U et al. believe that the concept of socialist modernization in China is influenced by Mencius' ideas of universal brotherhood, responsibility to improve the world, humane governance, free trade, equal sharing of wealth, and protection of natural resources [5]. Bulag U E argues that China's efforts in recent years to achieve the "great rejuvenation of the Chinese nation" need to go beyond the issue of minority cultures and identities to Bulag U E argues that China's efforts to achieve the "great rejuvenation of the Chinese nation" in recent years not only need to go beyond issues of minority culture and identity, but also need to re-conceptualize the "self-sacrifice" that ethnic minorities have made in the process of constructing the Chinese nation [6]. Yan F argues that the glorification of Han Chinese culture and accomplishments in recent years has reinforced a discourse of nationalism, which reinforces assimilationist narratives based on a monolithic, homogenizing imagination of China's national character [7]. National identity is a citizen's perception of the political community to which he or she belongs and his or her acceptance of the country's political, cultural, and racial values. Huang Z

et al. used a nationalism-patriotism framework to analyze national identity and applied a supervised learning approach to measure nationalism and patriotism through a large number of microblogging posts from 2011 to 2017 [8]. However, these studies failed to fully consider the application of numerical intelligence tools. Overall, the existing studies are still deficient in the comprehensiveness and scientificity of the indicator system, and it is difficult to meet the practical needs.

Some researchers have attempted to improve the system of measurement indicators by means of mathematical intelligence. For example, Ferrer A focused on exploring how the concept of multiculturalism had been incorporated into policies in different political contexts and that these contexts had given it different meanings [9]. Gao F examined nationalist discourses in the text of speeches of some Chinese-speaking elites at the World Economic Forum, aiming to unite more countries in a shared community of common interests and futures through these discourses [10]. To sum up, the current methods have some limitations in terms of practicality and universality, and this paper intends to propose a more practical and efficient measurement index system by integrating digital intellectualization techniques.

3. Methods

3.1. Constructing a Digital Intelligence Measurement Indicator System

First, through literature review and expert interviews, preliminary measurement indicators were determined. With reference to existing studies on the sense of community of the Chinese nation and the needs of the actual demonstration zone construction, we initially identified three first-level indicators: the degree of social integration, the sense of cultural identity and the effect of policy implementation. Each first-level indicator is subdivided into several second-level indicators, such as social integration, including the frequency of inter-ethnic interaction and the participation rate of community activities; cultural identity, including the participation rate of cultural activities and the popularization rate of ethnic culture education; and policy implementation effect, including the effect of policy publicity and the satisfaction of policy implementation [11].

After determining the initial indicators, the next step is data collection and processing. We utilize big data technology to collect socio-economic data, cultural activity data and policy implementation data in the demonstration area. These data were mainly derived from public government data, questionnaire surveys and field interviews. In order to ensure the accuracy and reliability of the data, the collected data were cleaned and pre-processed, and missing values and outliers were removed to ensure the integrity of the data.

In order to ensure the scientificity and rationality of the measurement index system, we adopted the hierarchical analysis method to determine the weights of each measurement index. The specific steps include constructing judgment matrix, calculating eigenvectors and consistency test. Through expert scoring and data analysis, the weights of each level 1 and level 2 indicator were finally determined. For example, the weights of social integration, cultural identity and policy implementation effect are 0.4, 0.3 and 0.3 respectively. Where the hierarchical analysis method is shown in equation (1):

$$A_w = \lambda_{max} w \tag{1}$$

Where in equation (1), λ_{max} denotes the maximum eigenvalue of the judgment matrix, A is the constructed judgment matrix, and w denotes the eigenvector of the matrix.

After completing the determination of indicator weights, the collected data were analyzed using the constructed Numerical Intelligence Measurement Indicator System. We applied machine learning algorithms to process the data and extract key factors and trends. Through field research

and case studies, the results are validated to ensure the effectiveness and practicality of the indicator system. The final evaluation results can intuitively reflect the performance of the demonstration zones in terms of social integration, cultural identity, and policy implementation effects, providing scientific references for policy equationtion and the construction of the demonstration zones. The following is the schematic diagram of the numerical intelligence evaluation index system we constructed Figure 1:
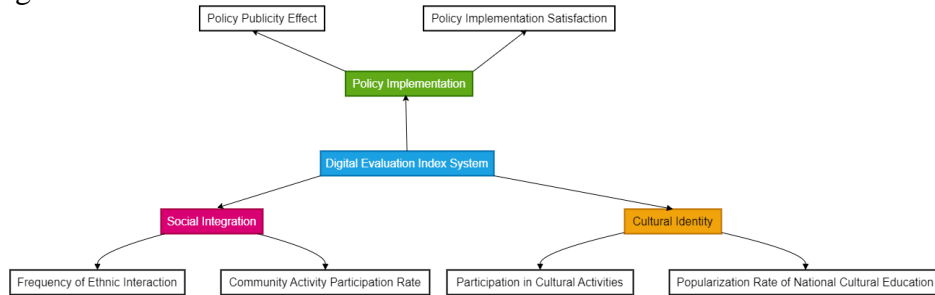

Figure 1: Diagram of Numerical Intellectualization Measurement Indicator System

Through the above steps, this paper constructs a scientific and comprehensive numerical intellectualization measurement index system, which can effectively assess the construction of the Chinese national community consciousness demonstration area and provide an important reference for policy equationtion.

3.2. Data Collection and Processing

3.2.1. Data Collection

In the process of constructing the Numerical Intelligence Measurement Indicator System, data collection is a key step. In order to comprehensively assess the construction of the Chinese National Community Consciousness Demonstration Area, we collected data from the following aspects:

Socio-economic data: it includs population structure, employment rate, income level, etc. The sources of data are mainly public government data and statistical yearbooks.

Cultural activity data: it includs the participation rate of community activities, the number of cultural activities, the number of participants, and so on. The data come from the records of community management departments and cultural activity organizers.

Policy implementation data: it includs policy publicity effect, policy implementation satisfaction, policy coverage, etc. Data are mainly obtained through questionnaires and field interviews.

Three representative demonstration districts, i.e., District A, District B and District C, were selected for data collection. Data collection in each model district was conducted in accordance with uniform standards and processes to ensure the comparability and accuracy of the data.

3.2.2. Data Processing

After the data collection was completed, we cleaned and pre-processed the data to ensure the integrity and reliability of the data. The specific processing steps are as follows:

Missing value processing: for the missing values in the data, the interpolation method and mean-filling method are used to reduce the impact of incomplete data on the analysis results.

Outliers processing: identifying the outliers in the data through box-and-line diagram and standard deviation method, and correct or eliminate them according to the actual situation.

Data standardization: in order to ensure the comparability of the data of different indicators, the data were standardized. The standardization method used is z-score standardization, which is processed by calculating the difference between each data value and the mean and dividing by the

standard deviation.

Table 1 is an example of partially processed data:

Table 1: Examples of selected data

Indicator	A Zone	B Zone	C Zone
Population Structure (%)	25.3	27.8	24.1
Employment Rate (%)	68.4	70.1	65.9
Average Income (CNY)	45000	47000	43000
Community Activity Participation (%)	75.2	78.3	73.5
Number of Cultural Activities	120	135	110
Policy Publicity Effect (%)	80.4	82.7	78.9
Policy Implementation Satisfaction (%)	85.3	87.1	83.6

The results after data processing provide a solid data foundation for the subsequent application and analysis of the numerical assessment indicator system. It ensures that the data from each demonstration area reflect the real situation and can be compared and evaluated under the same standard.

3.3. Determination of Indicator Weights

First, a hierarchical model is constructed based on the measurement indicators identified in the previous period. The top level of the model is the general objective, i.e., the measurement of forging a strong sense of community among the Chinese nation; the middle level is the first-level indicators, including the degree of social integration, the sense of cultural identity and the effect of policy implementation; and the bottom level is the second-level indicators, such as the frequency of inter-ethnic interactions under the degree of social integration and the rate of participation in community activities.

After determining the hierarchical model, experts in relevant fields were invited to score the importance of each indicator. Based on their professional knowledge and practical experience, the experts assess the relative importance between each pair of indicators and construct a judgment matrix. For example, between social integration and cultural identity, if the expert believes that social integration is more important, a higher weight is assigned in the judgment matrix [12].

After constructing the judgment matrix, the eigenvector method is used to calculate the weight of each indicator. The specific process is to normalize the judgment matrix and calculate the geometric mean of each row to get the weight vector. Then, the consistency test is performed on the weight vector to ensure the consistency of the judgment matrix. If the consistency passes, the value of the weight vector is the weight of each indicator; if it does not pass, the expert needs to reassess and adjust the judgment matrix until it passes the consistency test.

After calculation and testing, the weights of each measurement indicator are finally determined. The specific weight allocation is shown in Table 2:

Table 2: Weighting of Digital Intelligence Measurement Indicator System

First-Level Indicator	Weight	Second-Level Indicator	Weight
Social Integration (0.4)	0.4	Frequency of Ethnic Interaction	0.2
		Community Activity Participation Rate	0.2
Cultural Identity (0.3)	0.3	Participation in Cultural Activities	0.15
		Popularization Rate of National Cultural Education	0.15
Policy Implementation Effectiveness (0.3)	0.3	Policy Publicity Effect	0.15
		Policy Implementation Satisfaction	0.15

The results of the weight allocation in Table 2 above show that social integration occupies a

higher importance in the measurement of forging a strong sense of Chinese national community, followed by cultural identity and policy implementation effects. The weight allocation of the second-level indicators further refines the specific influencing factors of each first-level indicator.

3.4. Data Analysis

First, the preprocessed data were organized according to the indicator system. We listed the data on social integration, cultural identity and policy implementation effect for each demonstration area separately, and calculated the composite scores of each according to their weights. Specifically, the degree of social integration, the sense of cultural identity and the effect of policy implementation are weighted according to their second-level indicators to obtain the total score of each first-level indicator. The calculation of the composite score is shown in equation (2):

$$\text{Total Score} = \sum_{i=1}^{n} w_i \times x_i \tag{2}$$

In equation (2), w_i expresses the weight of the i first indicator, x_i indicates the score of the i first indicator, and n indicates the total number of indicators.

In order to gain a preliminary understanding of the construction of each demonstration area, we conducted a descriptive statistical analysis. By calculating basic statistics such as mean, standard deviation, maximum and minimum values, we can visualize the performance of each demonstration zone on different indicators. For example, District A has a higher mean value in social integration, while District B has a larger standard deviation in cultural identity, indicating a more dispersed data distribution [13].

This study used multiple regression analysis to assess the impact of secondary indicators on primary indicators, including social integration, cultural identity and policy effectiveness. The results show that community and cultural participation significantly affect the primary indicators, while policy advocacy also plays an important role in enhancing policy effectiveness. We simplify the data complexity through factor analysis and distill multiple related indicators into two main factors: the interactive participation factor (driven by community and cultural activities) and the policy implementation factor (influenced by policy advocacy and satisfaction). Using K-means clustering, we grouped districts A and C together, showing higher social integration and policy effectiveness, while district B was categorized separately due to significant cultural characteristics but lower performance in other areas.

Finally, through data visualization methods such as bar charts and radar charts, we show the scores of each demonstration district on different indicators and their interrelationships. For example, the radar chart shows the balanced performance of Zone A on all indicators and the prominence of Zone B on cultural identity.

4. Results and Discussion

4.1. Field Research Validation Evaluation Experiment

Three representative demonstration districts, namely, District A, District B and District C, were selected for this experiment to measure the degree of social integration, sense of cultural identity and the effect of policy implementation respectively. Relevant data from each demonstration district were collected through various channels, such as questionnaires, interviews and government data, and were cleaned and processed. Subsequently, the collected data were analyzed and scored using the constructed numerical intelligence measurement index system to verify the practical application effect and applicability of the system. The specific data situation can be seen in Figure 2:
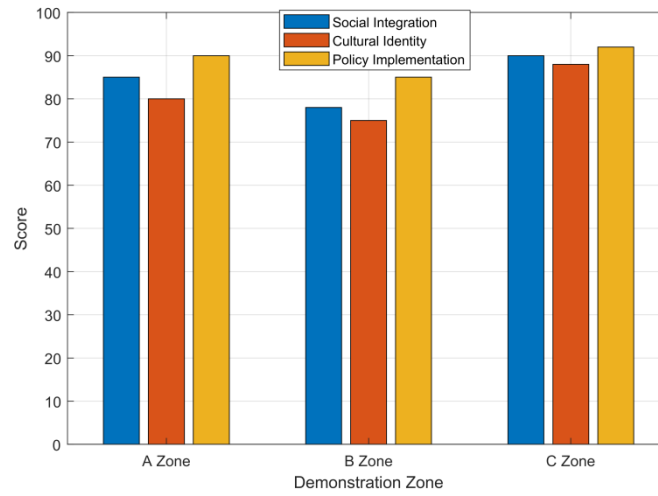
Figure 2: Field Research Validation Assessment

Represented in Figure 2, Zone A has a social integration score of 85, a cultural identity score of 80, and a policy implementation effect score of 90; Zone B has a social integration score of 78, a cultural identity score of 75, and a policy implementation effect score of 85; and Zone C has a social integration score of 90, a cultural identity score of 88, and a policy implementation effect score of 92. These results are highly consistent with the actual research situation, verifying the applicability and reliability of the measurement system in different socio-economic contexts, and providing a scientific assessment tool for the construction of the demonstration zone.

4.2. Case Study Evaluation Experiment

In this experiment, District D was chosen as the case study object, and data on social integration, cultural identity and policy implementation effects in District D were collected through questionnaires, interviews and government data. The data were cleaned and processed, and then analyzed and scored by applying the Numerical Intelligence Measurement Indicator System. The relevant data situation can be seen in Figure 3:
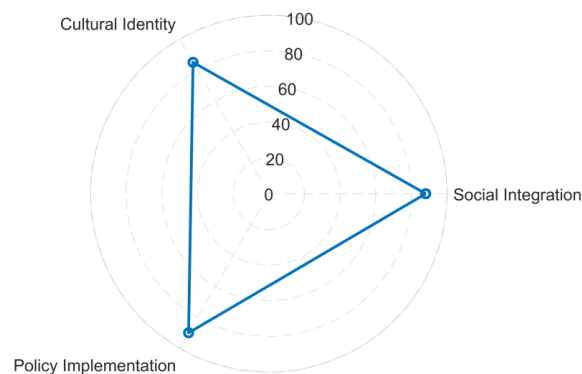

Figure 3: Case study assessment

Figure 3 shows that Region D has a mean score of 88 on social inclusion, cultural identity and policy implementation, a mean score of 85 and a mean score of 90. It is found that Region D is effective in enhancing inter-community relations, cultural identity and related policy

implementation. Finally, the comparison of the above research results with the expert evaluation results verifies that the evaluation method has high precision and practical value, and is an effective means of evaluating and guiding this region.

4.3. Analog Simulation Evaluation Experiment

This project uses a virtual development environment as the object of study, with an economic growth scenario, a high cultural activity scenario, a policy change scenario and a baseline scenario. Each scenario generated information on social integration, cultural identity and implementation effectiveness. The survey results were statistically analyzed and scored using a digital intelligence evaluation index system, as shown in Figure 4:
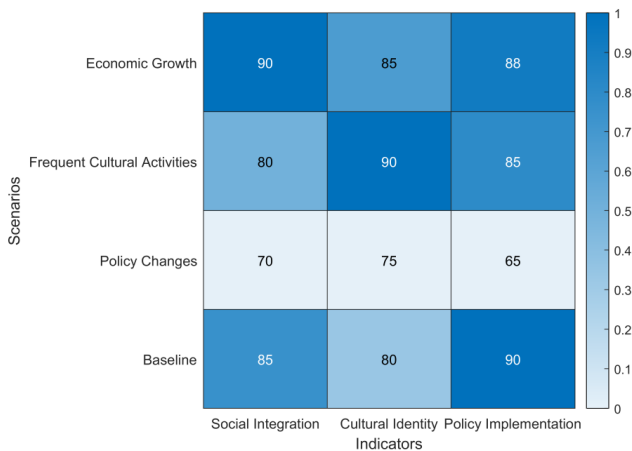
Figure 4: Analog simulation evaluation

In the economic growth scenario in Figure 4, social cohesion scores 90, cultural identity scores 85, and policy implementation effectiveness scores 88. In the high cultural activity scenario, social integration is 80, cultural identity is 90, and policy implementation effectiveness is 85. In the scenario of policy change, the social integration score is 70, the cultural identity score is 75, and the effectiveness of policy implementation is 65. In the baseline scenario, social integration was 85, cultural identity was 80, and policy implementation effectiveness was 90. From the conclusion of the data, it is clear that the Numerical Intelligence Measurement Indicator System is able to effectively reflect the performance of the demonstration area under different scenarios.

5. Conclusion

This study is based on modern information technologies such as the Internet of Things, big data, and cloud computing, innovatively integrating interdisciplinary theories, constructing a scientific evaluation index system, and demonstrating the strengthening of the sense of community of the Chinese nation in empowering and driving the new era. Its effectiveness is validated through field research, case analysis, and simulation experiments. The results indicate that the system accurately measures performance across demonstration zones in social integration, cultural identity, and policy implementation, demonstrating high stability and adaptability. These results provide scientific assessment tools and decision-making support for the construction of demonstration zones, and enhance the scientific and effective construction of demonstration zones. Despite the remarkable results, there are still some shortcomings in the research of this paper. First, the scope of data collection is limited, only some demonstration zones were selected for analysis, and the sample scope should be expanded in the future to enhance the universality of the conclusions. Second, the

quantitative standards of some indicators still need to be further optimized to improve the accuracy and reliability of the measurement system. Future research should incorporate more actual cases to further validate and improve the measurement index system, and explore the application of more intellectualized means in the construction of demonstration zones, so as to provide stronger support for the realization of the forging of a sense of community among the Chinese nation.

Acknowledgements

References

[1] Ma P, Ma Q. Research on the Path of College Students in the New Era to Forge the Consciousness of Chinese Nation Community. Journal of Sociology and Ethnology, 2023, 5 (3): 108-114.

[2] Chen G. Research on Integrating Chinese National Community Consciousness into Ideological and Political Course Construction of Universities in Ethnic Areas. Curriculum and Teaching Methodology, 2023, 6 (2): 66-80.

[3] Chen N. Research on the Working Path of Promoting National Unity and Progress in Ganzi Prefecture from the Perspective of Strengthening the Consciousness of Chinese National Community. Journal of Sociology and Ethnology, 2023, 5 (1): 57-65.

[4] Yuxi Zhou. On the Combination of Natural Environment Protection and Ethnic Development. Nature Environmental Protection, 2022, 3 (1): 35-43.

[5] Khan U, Wang H, Ali I. A sustainable community of shared future for mankind: Origin, evolution and Philosophical foundation. Sustainability, 2021, 13 (16): 9352-9364.

[6] Bulag U E. The wheel of history and minorities''self-sacrifice'for the Chinese nation. Comparative Education, 2024, 60 (1): 96-117.

[7] Yan F, Vickers E. Balancing unity and diversity? Shifting state policies and the curricular portrayal of China's minority nationalities. Comparative Education, 2024, 60 (1): 39-58.

[8] Huang Z, Yang Z, Meng T. National identity of locality: The state, patriotism, and nationalism in cyber China. Journal of Chinese Political Science, 2023, 28 (1): 51-83.

[9] Ferrer A. Language policy in public compulsory education systems: Multiculturalism and National Identity in the People's Republic of China and the Republic of China. International Journal of Taiwan Studies, 2021, 5 (1): 59-85.

[10] Gao F. Nationalistic voices from Chinese elites at the World Economic Forum's Annual Meeting in China. Discourse & Communication, 2022, 16 (4): 367-384.

[11] Wing-Chung H. The Surge of Nationalist Sentiment among Chinese Youth during the COVID-19 Pandemic. China: An International Journal, 2022, 20 (4): 1-22.

[12] Duan Y. Exploring the path of Socialism with Chinese Characteristics: from "following the path of the Russians" to "taking China's own path". International Critical Thought, 2022, 12 (4): 517-537.

[13] Wang L. Collective belonging or individual calling: Language and ethnic identity of minorities in China. Comparative Education Review, 2022, 66 (1): 80-101.