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Review on Suitability Evaluation Methods of Local Products

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Abstract

As an important part of rural characteristic industry, the evaluation of local specialty products is of great significance for improving product quality, optimizing industrial layout and helping rural revitalization. This paper summarizes the common evaluation methods of native products, including single evaluation method and comprehensive evaluation method, and discusses the characteristics and application scope of these methods, which provides a reference for the scientific evaluation of native products.

Keywords

Local Products; Evaluation Method; Comprehensive Evaluation.

1. Introduction

Local specialty products refer to agricultural products that are produced using traditional techniques or special technologies, relying on the unique natural resources and ecological environment of a specific area, and have a unique flavor and excellent quality. These products not only carry local cultural characteristics and historical memories[1], but also become an important force in promoting rural economic development. With the deepening of the rural revitalization strategy, the development of local specialty products has received increasing attention. Scientific evaluation of local specialty products can not only improve product quality and market competitiveness[2], but also optimize industrial layout and help farmers increase income, which has important practical significance.

In recent years, with the continuous advancement of technology, various evaluation methods have been applied to the suitability evaluation of local specialty products. These methods include single evaluation methods and comprehensive evaluation methods, each with their own characteristics and scope of application. This article will provide a detailed introduction to these evaluation methods and explore their application in the suitability evaluation of local specialty products.

2. Evaluation Methods for Local Specialty Products

2.1. Single Evaluation Method

2.1.1. Analytic Hierarchy Process (AHP)

Characteristic: Analytic Hierarchy Process (AHP) is a decision analysis method that decomposes complex problems into multiple levels such as objectives, criteria, and solutions. By comparing pairwise to determine the weights of each factor, it is possible to effectively handle the problem of comprehensive evaluation of multiple factors. The core of AHP lies in

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constructing a judgment matrix, calculating the weights of various factors, and providing scientific basis for decision-making. AHP can not only handle quantitative data, but also qualitative data, with strong flexibility and applicability.

Scope of use: AHP is suitable for evaluation problems with multiple factors and clear hierarchy. It can decompose suitability into objective layer, criterion layer, and indicator layer, and determine the weights of each indicator through AHP to obtain comprehensive evaluation results. This method can effectively identify areas suitable for planting specific crops, providing important references for agricultural planning.

2.1.2. Fuzzy Comprehensive Evaluation Method

Characteristic: The fuzzy comprehensive evaluation method is based on fuzzy mathematics theory, which transforms qualitative evaluation into quantitative evaluation and can handle problems such as fuzzy evaluation criteria and inaccurate data[3]. This method is particularly suitable for situations where the evaluation criteria are unclear or the data is not precise enough. The fuzzy comprehensive evaluation method establishes a fuzzy evaluation matrix, calculates the membership degree of each factor, and thus obtains the comprehensive evaluation result.

Scope of use: The fuzzy comprehensive evaluation method is suitable for situations where the evaluation criteria are unclear or the data is not precise enough, such as environmental quality assessment, project evaluation, etc. In environmental quality assessment, due to the complexity and uncertainty of environmental factors, the fuzzy comprehensive evaluation method can effectively address these issues and provide scientific basis for environmental decision-making.

2.1.3. Geographic Information System (GIS) Analysis Method

Characteristic: The Geographic Information System (GIS) analysis method uses GIS software to overlay and analyze geographic spatial data, which can visually display the spatial distribution of evaluation results. This method is particularly suitable for evaluation problems that require consideration of spatial distribution, such as land suitability assessment, regional planning, etc. GIS technology can process various geographic spatial data, generate intuitive distribution maps, and provide visual support for decision-making. GIS technology can not only handle static data, but also dynamic data, with strong spatial analysis and visualization capabilities.

Scope of use: GIS analysis method is suitable for evaluation problems that require consideration of spatial distribution, such as land suitability evaluation, regional planning, etc. In regional planning, GIS technology can overlay and analyze data such as land use status, topography, and soil conditions to generate comprehensive suitability distribution maps, providing scientific basis for regional planning.

2.1.4. Principal Component Analysis (PCA)

Characteristic: Principal Component Analysis (PCA) reduces data redundancy, extracts key information, and simplifies the evaluation process through dimensionality reduction techniques. This method is particularly suitable for situations where there are a large number of indicators and there is correlation between them, such as economic evaluation, environmental evaluation, etc. PCA simplifies the evaluation process by extracting principal components and transforming multiple related indicators into a few unrelated principal components. PCA can not only handle linear correlations, but also non-linear correlations, and has strong dimensionality reduction and information extraction capabilities.

Scope of use: PCA is suitable for situations where there are a large number of indicators and there is correlation between them, such as economic evaluation, environmental evaluation, etc. In economic evaluation, PCA can transform multiple economic indicators into a few principal components, simplifying the evaluation process and improving evaluation efficiency.

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2.1.5. Comprehensive Index Method

Characteristic: The comprehensive index method standardizes multiple evaluation indicators, assigns different weights, and calculates the weighted sum to obtain the comprehensive index. This method is particularly suitable for situations where there are a large number of indicators and their importance varies, such as land suitability evaluation, comprehensive evaluation, etc. The comprehensive index method eliminates dimensional differences between different indicators through standardization, improving the scientificity and reliability of evaluation results. The composite index method can not only handle quantitative data, but also qualitative data, with strong comprehensiveness and applicability.

Scope of use: The comprehensive index method is suitable for situations where there are a large number of indicators and the importance of each indicator is different, such as land suitability evaluation, comprehensive evaluation, etc. In land suitability evaluation, the comprehensive index method can standardize indicators such as soil fertility, terrain conditions, and climate conditions, assign different weights, and thus obtain the comprehensive suitability index.

2.1.6. Regression Analysis Method

Characteristic: Regression analysis method establishes a regression model to analyze the relationship between various factors and the dependent variable, and predict the trend of the dependent variable. This method is particularly suitable for situations where there is already a large amount of measured data and it is necessary to predict future trends[4]. Regression analysis can accurately predict the trend of the dependent variable through regression models, providing scientific basis for decision-making. Regression analysis can not only handle linear relationships, but also non-linear relationships, with strong predictive and decision support capabilities.

Scope of use: Regression analysis is suitable for situations where there is already a large amount of measured data and it is necessary to predict future trends.

2.1.7. Machine Learning Algorithms

Characteristic: Machine learning algorithms include Random Forest (RF), Support Vector Machine (SVM), and Naive Bayes (NB), which can automatically learn patterns in data with high prediction accuracy. This method is particularly suitable for situations with large and complex data volumes. Machine learning algorithms can effectively handle complex data relationships and improve prediction accuracy by automatically learning patterns from data. Machine learning algorithms can not only handle structured data, but also unstructured data, with strong learning and predictive abilities.

Scope of use: Machine learning algorithms are suitable for situations with large and complex data, such as land suitability evaluation, ecological prediction, etc. Machine learning algorithms can combine a large amount of soil, climate, terrain, and other data to generate high-precision suitability distribution maps.

2.1.8. Expert Scoring Method

Characteristic: The expert scoring method invites experts from relevant fields to score each evaluation factor, and the evaluation results are obtained by synthesizing expert opinions. This method is particularly suitable for situations where there is a lack of data support but experienced expert opinions are available for reference. The expert scoring method can effectively address issues lacking data support and provide scientific basis for decision-making by synthesizing expert opinions. The expert scoring method can not only handle quantitative data, but also qualitative data, with strong flexibility and applicability.

Scope of use: The expert scoring method is suitable for situations where there is a lack of data support but experienced expert opinions are available for reference. The expert scoring method

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can combine expert opinions to comprehensively evaluate the feasibility and benefits of the project, providing important references for project decision-making.

2.2. Comprehensive Evaluation Method

2.2.1. Analytic Hierarchy Process (AHP) Combined with GIS Technology

Characteristic: Combining the multi factor comprehensive evaluation of AHP with the spatial analysis capability of GIS can simultaneously consider factor weights and spatial distribution. This method is particularly suitable for evaluation problems that require comprehensive consideration of multiple factors and spatial distribution[5]. AHP combined with GIS technology can effectively handle multi factor comprehensive evaluation problems and generate intuitive suitability distribution maps. This method can not only handle static data, but also dynamic data, with strong spatial analysis and visualization capabilities.

Scope of use: AHP combined with GIS technology is suitable for evaluation problems that require comprehensive consideration of multiple factors and spatial distribution, such as land suitability evaluation, regional planning, etc. In land suitability evaluation, AHP combined with GIS technology can overlay and analyze data such as land use status, topography, soil conditions, etc., to generate a comprehensive suitability distribution map, providing scientific basis for agricultural planning.

2.2.2. Crop Classification and Suitability Evaluation based on Remote Sensing Images

Characteristic: Using high-resolution remote sensing images for crop classification and suitability evaluation can quickly cover large areas. This method is particularly suitable for evaluating the suitability of crop planting in a large area. Remote sensing imaging technology can process various geographic spatial data, generate intuitive distribution maps, and provide visual support for decision-making[6]. Remote sensing imaging technology can not only process static data, but also dynamic data, with strong spatial analysis and visualization capabilities.

Scope of use: The crop classification and suitability evaluation based on remote sensing images are suitable for large-scale crop planting suitability evaluation, such as regional agricultural planning, ecological monitoring, etc. In regional agricultural planning, remote sensing imaging technology can overlay and analyze data on land use status, topography, soil conditions, etc., to generate a comprehensive suitability distribution map, providing scientific basis for regional planning.

2.2.3. AHP Analytic Hierarchy Process Combined with Grid Index Model

Characteristic: Determine the weights of each indicator through AHP, conduct spatial analysis using raster data, and generate a suitability distribution map[7]. This method is particularly suitable for evaluation problems that require refined spatial analysis. The combination of AHP and grid index model can effectively handle multi factor comprehensive evaluation problems and generate high-precision suitability distribution maps. This method can not only handle static data, but also dynamic data, with strong spatial analysis and visualization capabilities.

Scope of use: The combination of AHP and grid index model is suitable for evaluation problems that require refined spatial analysis, such as land suitability evaluation, ecological planning, etc. In land suitability evaluation, AHP combined with grid index model can overlay and analyze data such as land use status, topography, soil conditions, etc., to generate a comprehensive suitability distribution map, providing scientific basis for agricultural planning.

3. Conclusion

Evaluating local specialty products not only helps to improve product quality and market competitiveness, but also promotes rural revitalization, farmers' income increase, cultural

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inheritance, and industrial integration, which has important practical significance. The above evaluation methods each have their own advantages and disadvantages, and when selecting, it is necessary to comprehensively consider the specific problems and data characteristics. Future research can further combine big data and artificial intelligence technologies to develop more efficient and accurate evaluation models, providing stronger support for the development of local specialty products.

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