Spatial distribution of heavy metals in groundwater based on structural equation and development of leisure agriculture tourism

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Received: 5 June 2021 / Accepted: 15 July 2021 / Published online: 7 August 2021
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Abstract
This paper mainly from the structural equation through conventional measurement and visual measurement model, analyzes the relationship between groundwater heavy metals and it, to establish the measurement model on the spatial distribution of groundwater heavy metals influencing factor model, analyzes the influence effect of various indicators on the spatial distribution of groundwater heavy metals, and their mutual influence effect. However, due to many characteristics of heavy metal groundwater, long-term use and management, it has become the research focus in the field of potential environmental protection, and has become an indispensable part of this study. Heavy metal pollution in groundwater not only endangers the safety of ecosystem, but also seriously damages the health of residents. A typical integration area between urban and rural areas is selected to understand the current situation of heavy metal pollution in groundwater, analyze the spatial distribution characteristics of heavy metal ions, and conduct qualitative and quantitative research on heavy metal pollution sources in groundwater, which has important theoretical and practical value for promoting urban sprawl, It also provides a scientific basis for the local government to formulate the strategy of protecting water resources. Of course, this problem also has a certain impact on leisure agricultural tourism, and leisure agricultural tourism is one of the important ways to promote the structural adjustment of agricultural sector and increase farmers’ income, which is also an important practical process of developing multifunctional agriculture. In this paper, through structural equation analysis of underground heavy metal factor model, to understand its impact on leisure agricultural tourism.

Keywords Structural equation · Heavy metals in groundwater · Spatial distribution · Leisure agriculture tourism

Introduction
With the development of society and the complexity of the world, statistical science is developing from the simplest counting method to the analysis system that can study data and information deeply, regardless of the corresponding historical stage. In view of the fact that the traditional analysis method is still widely used, a new generation of research method structural equation model (SEM) is proposed. On the basis of traditional analysis methods, structural equation establishes logical relationship, solves the problem of potential variables, makes up for the deficiency of traditional analysis in theoretical assumptions, expands the limitations of traditional analysis methods, and provides a new information model. Therefore, the application of structural equation to the spatial distribution of heavy metals in groundwater is the main problem at present. Water resources is an important pillar of sustainable development of ecological environment and an important strategy to support the stable and healthy development of national economy (Mahala 2018). However, with the development of the city, the pollution of groundwater environment is becoming more and more serious. Taking the groundwater as the research area, this paper analyzed the status of groundwater iron pollution in detail, and collected five periods of shallow groundwater and soil samples (Michard et al. 2010). Through statistical analysis, the spatial...
distribution and enrichment characteristics of heavy metals were discussed. The pollution sources of heavy metals in groundwater were qualitatively analyzed by principal component analysis. Finally, the pollution sources of Fe3+ in groundwater were quantitatively analyzed by using multiple regression analysis with iron ions as the main research object. In terms of leisure agricultural tourism, this paper conducts field research and searches for relevant materials in rural areas (Nyesheja et al. 2019). In addition, it has also extensively studied such cultural resources as rural geographical culture, human resources, agricultural culture, and so on. This paper classifies the village leisure agricultural tourism resources and scientifically evaluates them by using the analytic hierarchy process (AHP), constructs the classification and evaluation system of Village Leisure Agricultural tourism, and fills in the gaps in the classification and level of ancient rural leisure agricultural tourism (Moses 2017). At the same time, from the market point of view, the leisure agricultural tourism market of the village is analyzed. In the form of questionnaire survey, the tourists and residents of the tourism destination are investigated to study the characteristics of tourists and residents. Then, the SCP paradigm is used to analyze the development of agricultural leisure tourism in the village and evaluate its function. Cultural and creative development in the market plays a central role in the market. Finally, the paper discusses the positioning of leisure agriculture, the mode of tourism product development, and establishes the development system of cultural and creative tourism industry of leisure agriculture in old villages, so as to provide guidance for the development of leisure agricultural tourism in ancient villages in the future (Naqvi et al. 2013).

Materials and methods

Overview of the study area

This paper studies the lowest area of L Province, and the area of H Province is about 80 square kilometers. The land is rich in other crops, such as rice, peanuts, wheat, corn, and cotton, as well as vegetables and grains. At the same time, the industry in the area is relatively developed: there are many steel mills in the area, and the water will seriously pollute the groundwater and soil. According to residents, different pollutants will be discharged from the steel works on a regular basis. In the vicinity of the steel plant, the extracted groundwater is muddy and cannot be drunk (Ouabid et al. 2017).

Therefore, based on the investigation and field study of the relevant data in the study area, we have a detailed understanding of the meteorology, hydrogeology, and groundwater pollution in the area, and on this basis, we have carried out a detailed field investigation. If the study area is more evenly distributed, a total of 17 sampling points will be used and checked. Groundwater and soil samples were collected from the control points in the area, and groundwater samples were collected continuously for 5 times from the middle of each month, and the depth of shallow groundwater level was measured manually to find out the dynamic field, chemical substances, and groundwater level (Ouassou et al. 2006). At the same time, a shallow drill was used at each sampling point to expose the aeration zone at the groundwater sampling point, and six soil samples were collected at equal intervals from shallow to deep. 17 sets of shallow groundwater samples and 102 sets of soil samples were collected, and their chemical compositions were tested and analyzed.

Research methods

Structural equation model

The measurement model shows the relationship between observed variables and latent variables. When latent variable is regarded as a factor, measurement model represents the relationship between index and factor, which is why it is also called factor model. The equations in the model are called measurement equations, such as Eqs. (1) and (2).

\[
X = \Lambda_\eta \eta + \varepsilon
\]

Equation model is a combination of causal model and factor model. Therefore, the basic form of the model is formula (4).

\[
\begin{align*}
\eta & = B\eta + \Gamma \xi + \zeta \\
X & = \Lambda_\xi \eta + \delta \\
Y & = \Lambda_\eta \eta + \varepsilon
\end{align*}
\]
The generalized structural comparison model includes measurement model and structural model. In the construction of structural equation model, we must focus on the principle of simplicity, and must meet the following conditions: first, the explanation of objective phenomena must be powerful, that is, whether the theory can correctly and generally explain various phenomena. Secondly, the theory must be testable, and testability is one of the conditions for the existence or nonexistence of scientific characteristics: only testable theories have scientific characteristics, and possible errors can be corrected, so that the theory can do this. Thirdly, the simpler the theory is, the higher the level of explanation is available, and the less concepts and relations can be used to express the theory of phenomenon (Pradeep et al. 2015).

Quantitative identification method of heavy metals in groundwater

Multiple linear regression analysis is a kind of regression analysis. It refers to the linear regression model with multiple independent variables, which is used to express the linear relationship between dependent variables and several independent variables (Shrimali et al. 2001). It is very useful for dependent variables and many single variables. There is a linear relationship in the quantitative relationship. If there is a relationship line between multiple individual variables and linear relationship in the quantitative relationship. If there is a dependent variables and many single variables. There is a dependent variables (Shrimali et al. 2001). It is very useful for relationship between dependent variables and several independent variables, which is used to express the linear relationship. It refers to the linear regression model with multiple independent variables, the regression analysis we are doing is multiple regression. If the dependent variable \( y \) is a single variable and there is a linear relationship between multiple independent variables and the dependent variable \( y \), the mathematical model of multiple linear regression is as follows:

\[
Y = b_0 + b_1 x_1 + \cdots + b_k x_k + e
\]  

(5)

Each variable needs to have complete statistical information and easy to determine its predictive value. The parameters of the multiple regression model almost the same as those of the linear regression equation, and the least square method is used to solve these parameters assuming that the square error must be the minimum. Among the bilinear regression model as an example, the values of \( b_0, b_1, \) and \( b_2 \) can be obtained by solving the equation, so as to solve the standard equation of regression parameters. It can also be obtained by the following matrix method:

\[
\begin{bmatrix}
\sum y = nb_0 + b_1 \sum x_1 + b_2 \sum x_2 \\
\sum x_1 y = b_0 \sum x_1 + b_1 \sum x_1^2 + b_2 \sum x_1 x_2 \\
\sum x_2 y = b_0 \sum x_2 + b_1 \sum x_1 x_2 + b_2 \sum x_2^2
\end{bmatrix}
\]

(6)

By solving this equation, the values of \( b_0, b_1, \) and \( b_2 \) can be obtained. The following matrix method can also be used.

\[
b = \left( x'x \right)^{-1} \cdot x'y
\]

That is,

\[
\begin{bmatrix}
b_0 \\
b_1 \\
b_2
\end{bmatrix} = \begin{bmatrix}
\sum y \\
\sum x_1 \\
\sum x_2
\end{bmatrix} \cdot \left( x'y \right)^{-1}
\]

(8)

Evaluation system of leisure agricultural tourism development

Yaahp is used to calculate the maximum eigenvalue and eigenvector \( w \) of each matrix. Because the evaluation matrix cannot be completely consistent, it is necessary to check the consistency.

\[
CI = \frac{\lambda_{\text{max}} - n}{n-1}
\]

(9)

\[
CR = \frac{CI}{RI}
\]

(10)

According to the comprehensive evaluation model of agricultural leisure tourism resources, each factor was evaluated by 10 horticultural experts and 20 horticultural students, and each factor was compared to create each evaluation matrix. An analytic hierarchy process software is used to measure the weight of each component and perform continuity testing. As shown in Table 1:

Results

Statistics of heavy metal elements in groundwater

According to the design scheme of sampling point and traffic location map of the research area, combined with the actual terrain of the research area, the appropriate position of sampling point is determined, and the actual position of sampling point is determined by GPS during field sampling. If landfills, coal stacks, and other locations are not suitable for sampling, the appropriate sampling location shall be selected within 100 m around them. The depth of the borehole is 3 m, sampled at equal intervals, once every 50 cm, with a weight of about 500 g per layer, sealed in a self-contained bag.

The chemical water ion data tested in this experiment mainly include the contents of Fe, Mn, Zn, Pb, Fe3+, Fe2+, Cr6+, and Co. In this paper, spss20.0 is used to analyze the heavy metal content in water samples, and the statistical indexes such as standard deviation, coefficient of variation, and mean value are used to analyze the content of heavy metals in water samples. Table 2 lists the statistical characteristics of heavy
metals in groundwater at each stage. Due to the special geographical location of the study area, the concentration of heavy metal ions in underground water varies greatly in different time periods.

**Statistics of heavy metal elements in soil**

According to the experimental results of the collected samples, the content of heavy metals in the soil samples of the study area was tested and analyzed. The statistical characteristic values are shown in **Table 3**.

The above table shows that the average Fe2O3 content of different depths in different time periods is as high as 3.26 mg/kg, and there is abnormal large surface area, with the maximum value of 6.07 mg/kg. In different time periods, almost all the variation coefficients are more than 30%, which is the average variability. However, the maximum FeO content was 1.10 mg/kg and 1.74 mg/kg at different time periods. Therefore, the extreme value has a small influence and the coefficient of variation is small, which is actually weak variability.

The results show that the content of iron oxide is low by comparing the FeO and Fe2O3 contents of sampling points 1 and 17 near the steel plant and 12 and 16 which are the farthest from the steel plant, the range of grade change is very small. The background level of heavy metals in soil before the construction of steel plant in the study area is obtained from other sources, see **Table 4**.

Combined with the background level, the average level of iron oxide in the study area does not exceed the background level of the local soil, and the sewage discharged from the...
Spatial distribution characteristics of heavy metals in groundwater

The experimental data of groundwater samples were used to study the spatial distribution of heavy metal ions, and the inverse distance interpolation weighting method was used to analyze the spatial distribution of heavy metal content in groundwater by ArcGIS. This paper focuses on the analysis of the spatial distribution characteristics of Fe, CO₆⁺, and Co ions.

By checking the spatial distribution of heavy metal concentration in groundwater, we can more directly see the distribution characteristics and pollution of heavy metals in the whole study area. On this basis, the spatial distribution map of Zn and Cr₆⁺ was created from the same water level of groundwater in different time periods, as shown in Fig. 1.

It can be seen that Zn ion has accumulated a certain amount in the groundwater of the study area, and the content is high. The reason is that there are many industries and mining companies in the area, and the wastewater discharged from the melt will have a certain impact on the concentration of heavy metals in groundwater. It can be seen from the figure that the maximum zinc concentration in the study area is affected by the steel plant, but the maximum concentration does not exceed many standards and will not cause serious pollution.

Figure 2 shows that the concentration of Cr₆⁺ in the groundwater of Tinghe city is relatively high: with the groundwater flowing from northeast to southwest, the concentration of Cr₆⁺ gradually increases.

It can be seen from Fig. 3 that the spatial distribution characteristics of lead and zinc ions show an opposite trend. The pollutants mainly come from wuguzhuang village in the south of Jing’an City, and the distribution area continues to increase.

It can be seen from Fig. 4 that iron and cobalt ions accumulate together with groundwater in the city, which indicates that the heavy metal ions in the groundwater of the whole basin mainly come from a large ironmaking plant on the north bank. According to the results of previous studies, the above-mentioned iron works have been discharged into groundwater at different times. According to the spatial distribution of heavy metal ions, it can be seen that hot metal has clear discharge behavior, and the most important iron ion is iron (III).

Correlation analysis and principal component analysis were used to analyze the pollution sources of heavy metals in the groundwater of the study area, fully understand the relationship and distribution of heavy metals in the groundwater of the study area, and find out the control factors of the source and content of heavy metals.

Correlation analysis of heavy metal ions in groundwater

Under the influence of similar activities, ions follow groundwater from upstream to basin. The shallow water level of the whole Lu River Basin is relatively flat, and the topography of the study area is also very flat. Shallow water level can represent the characteristics of groundwater discharge, and the depth and flow direction of groundwater level have important influence on the temporal and spatial distribution of chemical elements in water. Because of the correlation between the depth of shallow water level and each ion, the migration characteristics of each ion with groundwater flow can be qualitatively described. The correlation between each ion and the buried depth of groundwater table is analyzed. The results are shown in Table 5.

The table shows that there is a significant correlation between the buried depth of groundwater table and geochemical ions in water. Among them, the buried depth of groundwater level is negatively correlated with Zn, Ca and TDS. In the flow...
direction, the concentrations of the above three ions gradually decrease, which further indicates that the shallow groundwater has pollution sources. Fe, Pb, and Fe$^{3+}$ ions are positively correlated with the depth of groundwater table, indicating that they gradually accumulate with groundwater flow.

It is worth noting that natural factors will affect the Fe$^{3+}$ ions in shallow groundwater due to atmospheric precipitation, and the process is more complex. When washed by rain, the iron oxides in the soil enter the shallow groundwater in the form of Fe$^{3+}$. The relationship between the contribution of Fe$^{3+}$ ions in different depth soil layers to Fe$^{3+}$ ions in shallow groundwater and the change of precipitation in different periods is obtained, as shown in Fig. 5.

It can be seen from the figure that the contribution of Fe$^{3+}$ ions in the first unsaturated zone to Fe$^{3+}$ ions in shallow groundwater is basically the same as that of rainfall, while the contribution of Fe$^{3+}$ ions in the second unsaturated zone increases with rainfall. The change of
environment has changed to some extent, but the overall change still shows the same characteristics. On the contrary, the contribution of Fe$^{3+}$ ions to Fe$^{3+}$ ions in groundwater from the third to the sixth unsaturated areas is not consistent with the change of precipitation, which also indicates that precipitation has the greatest impact on the migration of Fe$^{3+}$. The ions in this region have shallow water. With the increase of depth, their influence on deep Fe$^{3+}$ ion migration gradually decreases, which is consistent with our traditional understanding.
Discussion

Analysis of the influence factors of heavy metal spatial distribution in groundwater

The long-term sampling and testing of shallow groundwater samples and soil samples in aeration area of downstream region of the river can clearly understand the evolution characteristics of water and chemical soil environment inside and outside the study area. The source and contribution rate of Fe3 + ions in shallow groundwater are as follows:

The statistical analysis and spatial distribution of heavy metal content in the groundwater in the investigation area show that the groundwater in the investigation area is polluted to different degrees. The pollution in Zhongbao town and
Tingliuhe Town, as well as the flow direction of groundwater, is more serious (Abuzied et al. 2016).

The results of qualitative analysis show that the heavy metal ions in the groundwater of the research area mainly come from three sources: wastewater from iron and steel plants, the source of heavy metal ions, natural factors, and the influence of human activities (Alexakis et al. 2013). Zinc and lead are mainly derived from human agricultural activities. Cr6+ and Co mainly come from the raw materials formed by soil, which is a natural factor, which is different from the source of Fe and Fe3+. They are not only affected by the pollution of steel mills, but also by natural factors and human activities.

The contribution of three kinds of Fe3+ sources in groundwater is quantitatively described by multiple regression. The contribution of Fe3+ ions to groundwater is 44.4%, 32.4%, and 25.7% respectively. The rates in June were 43.3%, 24.6%, and 32.6%, respectively. The ratio in July was 21.6%, 32.5%, and 45.3%, respectively; The ratios in August were 38.4%, 24.4%, and 34.2%, respectively. The ratios in September were 23.2%, 43.4%, and 33.4%, respectively.

According to the analysis results, the contribution of pollutants to groundwater pollution in steel plant was the biggest in May, June, and August. In July, human contributions were the highest in five stages. Therefore, the environmental protection of groundwater in the area must be strictly controlled.

**Analysis of leisure agricultural tourism market**

Through the analysis of the survey results, the consumers of leisure agricultural tourism are mainly mountain tourists
The proportion of tourists in Shancheng district is higher, reaching 86%. From the perspective of tourism professional distribution, the main government institutions, accounting for 45%, followed by the employees in the surrounding areas of the city, accounting for 20%. Students are also an important tourist group, especially in the region, where the proportion of students in the province is 15%. As shown in Fig. 6.

According to the survey data, most of the leisure tourists have college or undergraduate education, accounting for 66.46% of the education level (Benselama et al. 2018). They have received higher education. Technical secondary schools and secondary schools account for 16%, and the proportion of primary and secondary schools in this level of education is relatively small, about 8.77%. As shown in Fig. 7.

It is not difficult to see from the above survey results that the cultural level and occupation of tourists also have different characteristics, and the income level of agricultural tourists in leisure time is also very different. Among them, 21.34% had a monthly income of more than 7000, 21.46% had a monthly income of 3500–7000, and 40.27% had a monthly income of 2000–3500. As shown in Fig. 8.

Agricultural tourism continues to change the concept of tourism consumption, and tourism consumption expenditure mainly focuses on short distance travel (Bouchaou et al. 2008). The share of rural holiday travel spending is increasing. The results show that the willingness of agricultural tourists to pay for recreational activities is mainly between 300–500 yuan, accounting for 53.25% of the total tourism expenditure. Among them, 27.6% of tourists spent on leisure and food, 23.7% on tickets, 10.27% on accommodation, and 16.33% on transportation. The survey data show that the consumption of leisure agriculture is still very low. This also shows that the structure of leisure agricultural tourism products is relatively simple, and that the potential large consumer groups are the income groups in high-end cities.

Analysis of the challenge of leisure agricultural tourism

Relatively insufficient tourism reception capacity

Although a city has made some progress in the development of leisure agriculture and the protection of bamboo culture, according to the above analysis, it can be known that there are still many deficiencies in infrastructure construction, especially tourism infrastructure. Infrastructure investment is inconsistent, and a large amount of money is invested in high

Table 5  Correlation coefficient table

| Water chemical ion | Depth of groundwater level | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |
|--------------------|----------------------------|--------|--------|--------|--------|--------|
| K                  | -0.002                     | 0.011  | -0.029 | -0.093 | -0.081 |
| Na                 | -0.528                     | -0.351 | -0.412 | -0.691 | -0.408 |
| Ca                 | -0.414                     | -0.378 | -0.441 | -0.501 | -0.424 |
| Mg                 | -0.198                     | -0.02  | -0.173 | -0.231 | -0.218 |
| Cl                 | -0.397                     | -0.26  | -0.347 | -0.432 | -0.329 |
| SO4                | -0.333                     | -0.357 | -0.446 | -0.633 | -0.435 |
| HCO3               | 0.283                      | 0.289  | 0.403  | 0.599  | 0.312  |
| NO3                | -0.416                     | -0.25  | -0.29  | -0.35  | -0.347 |
| F                  | -0.239                     | -0.391 | -0.452 | -0.36  | -0.391 |
| TH                 | -0.378                     | -0.289 | -0.383 | -0.45  | -0.379 |
| Total alkali       | 0.283                      | 0.289  | 0.402  | 0.6    | 0.311  |
| Acid value         | 0.064                      | 0.199  | 0.434  | 0.444  | 0.048  |
| TDS                | -0.434                     | -0.332 | -0.417 | -0.559 | -0.416 |
| Metasilicate       | 0.492                      | 0.554  | 0.567  | 0.528  | 0.475  |
| Free CO2           | 0.064                      | 0.199  | 0.434  | 0.445  | 0.048  |
| Fe                 | 0.337                      | 0.34   | 0.496  | 0.521  | 0.52   |
| Mn                 | 0.327                      | 0.394  | 0.461  | 0.558  | 0.412  |
| Zn                 | -0.091                     | -0.352 | -0.347 | -0.415 | -0.408 |
| Pb                 | 0.545                      | 0.349  | 0.47   | 0.584  | 0.47   |
| Fe3+               | 0.556                      | -0.025 | 0.523  | 0.495  | 0.533  |
| Fe2+               | 0.244                      | 0.076  | -0.036 | 0.011  | 0.199  |

According to Aydda et al. (2019), the proportion of tourists in Shancheng district is higher, reaching 86%. From the perspective of tourism professional distribution, the main government institutions, accounting for 45%, followed by the employees in the surrounding areas of the city, accounting for 20%. Students are also an important tourist group, especially in the region, where the proportion of students in the province is 15%. As shown in Fig. 6.

Fig. 5. Variation of contribution rate of Fe3+ ions in soil to groundwater with rainfall

Fig. 6. Occupational structure of leisure agriculture tourists
flow areas, such as the city center, but neglecting investment in surrounding and remote rural areas (Chafai et al. 2020).

**Fierce homogenization competition of similar products**

With the rapid development of leisure agriculture in the province, rural tourism with distinctive cultural characteristics around scenic spots is booming. Therefore, as a part of scenic spots, the city needs to develop rural tourism to develop leisure agriculture (Dai et al. 2013). It must correctly identify the tourism market environment in which it is located. If it is to stand out in the competition, it must dig into its own advantages, meet the tourism services and tourism projects that tourists need at present, and improve their brand awareness and cultural connotation.

**Lack of leisure agricultural management personnel**

The development of leisure agriculture needs not only the support of funds, but also the support of professionals. The development of leisure agriculture needs a large number of professional talents, and the cultivation of talents is an important part of the development and development of leisure agriculture. However, in view of the current situation, there are relatively many professional talents with bachelor degree, while the leisure agriculture talents with graduate degree are short. The research on leisure agriculture in Fujian Province started late, which means that the development and reserve of talents are relatively backward, which leads to the relative shortage of high-level talents in leisure agriculture (Djoukbala et al. 2018). The development of urban leisure agriculture is still in its infancy (Ennih and Liégeois 2001). The cultivation and introduction of leisure agricultural talents have not been paid enough attention, and the development of leisure agriculture lacks experience. Therefore, the lack of sufficient talents to support the development of urban leisure agriculture leads to the lack of effective business strategies and scientific and reasonable planning experience in the process of development, which seriously limits the development and progress of urban leisure agriculture.

**Countermeasures for the development of leisure agricultural tourism**

**Carry out reasonable and scientific planning and design**

The development and construction of leisure agriculture requires scientific planning and design and proper spatial arrangement. The correct planning and design is to make reasonable arrangement and overall plan for the layout and development of urban leisure park by using scientific methods. The development angle is very meticulous, which can further promote the orderly, scientific, long-term and reasonable development of urban leisure agriculture (Geddes and...
The development of leisure agriculture is an old plan in the region, which is related to the future development direction of the region and the rights and interests of each farmer. Therefore, in planning urban leisure tourism, we must emphasize the combination of its own development characteristics, adhere to the basic principle of combining development and protection, and carry out scientific layout and macro understanding from the perspective of sustainable development. At the business level, we must adhere to the combination of theory and practice, consider protection and development equally, adhere to the development strategy guided by protection, so as to realize orderly and continuous development, and prevent the long-term interests of the city from being damaged in order to pursue short-term and personal interests (Kouli et al. 2009).

**Strengthen the construction of tourism infrastructure**

The tourism development of a city is still in the early stage. At the same time, the construction of agricultural leisure tourism infrastructure and the construction of various infrastructure necessary for the start of tourism are still imperfect. They are still in the development stage, planning stage or initial stage in the construction stage. From the current situation, the brand advertising of urban leisure agriculture is becoming larger and larger, more and more tourists have better understanding of urban leisure agricultural tourism, and the number of tourists is also increasing (López-Vicente et al. 2008). However, the existing agricultural leisure infrastructure reception facilities in the city are still imperfect, which cannot meet the needs of tourists. This not only limits the development of urban leisure tourism, but also limits the development, product development, and promotion of agricultural leisure tourism (Lu et al. 2004). Whether a city has a complete tourism infrastructure depends on its own actual economic situation. Therefore, the government should invest more money on tourism infrastructure, especially in the construction of transportation facilities and tourist reception services (such as accommodation and catering). We should combine public investment with investment promotion, broaden the fund channels for the construction of leisure farms, coordinate various forces of cooperative construction, establish multilateral relationship mechanism of leisure farm infrastructure, and determine the scientific progress and appropriate development of infrastructure construction.

**Conclusion**

Structural comparison model is a statistical analysis method with theoretical priori. It takes covariance theory as the core idea, integrates a large number of statistical analysis techniques, comprehensively considers the value range of fitting index and the overall quality of the model, expands the limitations of measurement error, and carries out measurement and step analysis at the same time, which provides a new solution to the problems between dependent variables and latent variables. Structural equation model originates from sociology, but it has been cited in many fields to enrich its theoretical basis and provide reference for decision-making. In terms of tourism, this work mainly focuses on the development, practice and theory of urban leisure agriculture. The development of leisure agriculture has unique natural resources, human resources, agricultural resources, and other resources, which provides unprecedented development opportunities for people in the context of large-scale tourism development. A city must keep pace with the times. The planning should make full use of own resources, political advantages and location advantages to meet the challenges, seize the powerful development opportunities, and vigorously promote the development of urban agricultural cultural tourism.

**Competing interests**

The authors declare no competing interests.

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