Evaluation of air pollutants based on embedded system and PPP project performance factors

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Abstract
In this paper, an air pollutant assessment and monitoring system based on arm series-embedded system S3C44BOX module is proposed. On this basis, this paper analyzes the annual data of PM2.5, PM10, CO, NO2, SO2, O3, and other air pollutants of 17 monitoring stations in C City in the past year. The results show that the air pollutants have air permeability. At the same time, meteorological factors, temporal and spatial changes, and air pollution factors are discussed. At the same time, this paper uses literature and expert interviews to determine the performance factors of PPP projects. PPP mode realizes the participation of social capital in infrastructure construction. We identified 34 factors and used a structural equation model to analyze the path of 333 PPP project performance factors. One of the main performance factors is to apply the results of air pollution assessment based on an embedded system to the research of performance factors of PPP project, so that this paper could successfully promote the effective implementation of PPP project. Through the continuous research of embedded system and its application in air pollution evaluation and PPP project performance, it can effectively improve the air pollution evaluation and PPP project performance.

Keywords Embedded system · Assessment of air pollutants · PPP project · Performance factors

Introduction
This paper first presents an air pollution assessment and monitoring system based on embedded system. It uses a precise electrochemical gas sensor, which has small volume, low price, and no special maintenance requirements. When the GPRS network is used for data transmission, the remote platform can provide powerful functions such as high bit rate, low bit error rate, low delay, and powerful real-time performance to complete data transmission (Pakrooh et al. 2020). The system can also be connected to some environments where sensors are used to detect other gases in the environment, such as sensors that can be used to detect harmful gases in airports and railway stations (Tsakiris et al. 2007). This kind of air pollutant evaluation and monitoring system based on embedded system and GPRS transmission has undoubtedly been widely used and marketed. Based on this, the air pollutants in C City have been evaluated and analyzed in the past year (Moghimi et al. 2019). The results show that the hourly variation trend of PM2.5 and PM10 in urban area of C City shows two peaks and two valley values. The trend of two changes is consistent, and the typical pollution period is consistent with the holiday. Monthly changes usually show a peak and a low trend. The average particle concentration in four seasons was PM2.5/PM10 = 0.66, indicating that PM2.5 accounted for a higher proportion of the particle composition (Omer et al. 2020). The results of water-soluble ion analysis show that the PM2.5 in the central circle of Y District, meteorological Park in area B and Q high school are mainly CaSO4 pollutants. In the typical pollution period, long-distance air flow will not have too much influence on the concentration of pollutants in metropolitan areas, and short-distance air flow is the main pollutant in typical polluted weather. Finally, according to the characteristics of PPP project and the research status at home and abroad, 35 influencing factors of evaluation of distribution performance of PPP urban rail transit infrastructure project are proposed, and many literatures and interviews with experts are put forward (Musie et al. 2020). Finally, it is
Materials and methods

Data source

C City is located in the transitional zone between the QZ plateau and the middle and lower reaches of the Yangtze River. The boundary between the second stage and the third stage is CX plateau in the west, D and YG plateau in the South, and DB mountainous construction area in the north. The main mountains are h, t, m, N, Z, B, F, and others. C City is divided into mountains, hills, plains, and basins alternately. The mountainous area is 78% and the average height is 450 meters (Ullah et al. 2020). There are high mountains (1500–2500 m) in the north of Y, middle mountains (1000–2000 m) in the southeast of Y, and Makinen mountains (200–500 m) in the southwest. The central parallel ridge valley (500–1000 m) is higher in the Northeast and Southeast, but lower in the Midwest. This is an important area of parallel mountain ridges and valleys in eastern Sichuan. The parallel mountain ridges and valleys are in the north of China, and the most beautiful area of eastern mountain ranges is also the most important folded mountain range in the world. It is also known as the three largest Jura fold mountains in the world and is as famous as the Jura Mountains on the border of France and Switzerland and the Appalachian Mountains in the United States. All urban areas are in the p-valley area. The overview is shown in Figure 1.

Collection and analysis methods of air pollutants

Detailed analysis procedures can be found on the website. The filter membrane used to collect ozone is covered with nitrite solution (Yu et al. 2020). Ozone reacts with nitrite to form nitrate, while NOx is collected by another filter membrane. After sampling, the membrane was extracted with ultrapure water (milli-q), and the nitrate ion was analyzed by ion chromatography, and the total amount of recovered ozone was calculated.

For example, passive sampling time = 24 hours, sampling volume = 5 ml deionized water, ion chromatography extraction concentration = 0.7104 μg/ml nitrate, total nitrate = 7104 μg/ml × 5 ml = 3.552 μg, passive ozone sampling rate = 4.8 ml/min, and O are the concentrations in formula (1).

$$O_{ppm} = \frac{3.552 \mu NO_3}{21.8 ml/min \times 1440 min} \times \frac{1 \mu mol}{62 \mu NO_3} \times \frac{1 \mu mol}{1 \mu mol NO_3} \times \frac{24.45 \mu l O_3}{1 \mu mol O_3} \times \frac{10^6 M_3O_3}{1000 \mu l O_3} \times 0.045 ppm \times 0.045 \times 1000 = 45 ppb$$

(1)

Suppose the temperature is 20 °C. When the relative humidity is 70%, the conversion coefficient of NO and NO2 is 60 and 56 respectively, and the minimum detection limit is 2 ppb. Before sampling, all components have been thoroughly cleaned, acid- and base-cleaned, and the air dried and filter membrane placed in a clean environment to avoid NOX pollution. The minimum shutter speed is 24 hours. When outdoors, it is necessary to add protective cover and support to prevent sunlight and rain pollution from exposing them. Put the fiber filter membrane in 25 ml glass tube, add 8 ml water, shake well, extract immediately for 30 minutes, and use different NO2 and NOx glass tubes (Zare Feyz Abadi et al. 2006). The glass tube must be closed before use. After shaking, cool the glass to low temperature and color it. Shake it quickly, and keep it cool at low temperature for 30 minutes.

After 20 minutes of equilibration at room temperature, it was transferred to a 545 nm spectrophotometer for detection. The concentrations of NO2 and NOX are calculated from the standard curve of NO2 and NOX prepared with standard nitrite solution. See equation (2).

$$NO_2_{ng} = \frac{m_1 - m_b}{G} \times 8 \times 1000$$

(2)

NO2 is calculated in the same way as NO zero, where no is the difference between NOXs and NO2. Then, the temperature and humidity of the sampling period are used to calculate the corresponding influence factors ano2 and ano. Next, multiply the obtained concentration by the minimum value of sampling time t (using formula 3, formula 4, and formula 5).
\[
\begin{align*}
\text{NO}_2 \text{ppb} &= \frac{\text{NO}_2 \text{ng} \times \alpha_{O_2}}{T} \\
\text{NO} \text{ppb} &= \frac{\text{NO} \text{ng} \times \alpha_{NO}}{T} \\
\text{NO}_{x} \text{ppb} &= \text{NO}_2 \text{ppb} + \text{NO} \text{ppb}
\end{align*}
\]

**Hardware implementation of embedded system**

The embedded microprocessor used in the system is Samsung S3C44B0. The MPU is a 32-bit high-speed processor with a reduced instruction system based on arm 7tdmi core. S3C44BO integrates many components. In order to build the above-mentioned embedded system, in addition to the SDRAM and flash memory required by MPU operation, peripheral circuits and interface circuits must also be expanded. Figure 2 shows the specific hardware block diagram of the system (Zarei 2018).

As shown in Figure 3, the circuit has two amplifier stages. The first stage is full phase input with high input resistance. The symmetrical circuit structure can prevent zero drift. The second stage is the differential amplifier circuit, which can effectively prevent the intrusion caused by interference.
Questionnaire design of PPP project performance factors

Questionnaire design

In this paper, the survey includes five main parts: (1) background information focuses on the employment data of employees responding to the survey, such as the work unit, nature, and length of service of PPP; (2) the questionnaire includes six potential factors, including project characteristics, financing and market development, innovation and learning organization construction, stakeholder satisfaction, process management, and project performance evaluation using five levels of Likert scale; (3) it usually means important; (4) it means important; and (5) it is very important.

Questionnaire distribution

The questionnaire is divided into two main formats: paper format and electronic format: (1) distributed by colleagues of internship units and graduate students in PPP field and (2) by studying the teachers, classmates, and friends of other institutions such as Nanshi urban construction group, Longda Hengxin, and Provincial Planning Institute. A total of 385 questionnaires were distributed in two forms, 355 of which were recovered, with a recovery rate of 92.8%. Among them, there are 21 incorrect questionnaires (a total of 333); the questionnaire efficiency is 94.3%.

Results

Evaluation of temporal characteristics of air pollution particles

The results show that the concentrations of PM2.5 and PM10 vary from 7:00 to 9:00 and 19:00 in spring. There are three peaks from 23:00 to 1:00, and we believe that the main reason for the increase of pollutant concentration at night is the passage of heavy trucks. According to the change of particles in C City with time, it can be concluded that the particle source in C City is also possible.

Based on the real-time monitoring data of 17 C City monitoring stations during 2016–2019, the average hourly particle concentration of the study area can be obtained from the average value, which can directly reflect the 24-hour trend and particle change law. From Figure 4, we can see that the changes of PM2.5 and PM10 are synchronous. In other words, there are two peaks and two valleys in the hourly trend of metropolitan C. Pm2.5/pm10 = 0.66 in the main urban area, indicating that PM2.5 accounts for a large proportion of the total concentration.
The analysis shows that the PM2.5 fine particles are at a considerable level in spring and summer, and the particle concentration is high, which indicates that it will change accordingly. In autumn and winter, the increase of particle concentration is obvious; as shown in Figure 5, the concentration of PM10 varies greatly according to the season, which is also consistent with the research of relevant researchers.

The seasonal fluctuation of respirable particulate matter in the atmosphere is closely related to meteorological conditions. The concentrations of respirable particulate matter in four seasons are winter > autumn > spring > summer. The main reasons are dry weather, low temperature, stable air structure, less rainfall, and serious pollution in autumn and winter. In addition, due to the monsoon climate and cold and high pressure in the north and sandstorm, the overall quality of the atmosphere in winter is also poor except for the mountainous areas. These conditions make it difficult for pollutants to diffuse, and the existence of inversion layer further prevents the diffusion of respirable particles. In spring and summer, the solar radiation increases, the temperature rises sharply, the height of the air mixture layer rises, the vertical and long-distance diffusion ability of the atmosphere improves, and the respirable particles in the air rise rapidly. Even in a short period of heavy rain, the concentration of pollutants will not decrease.

**Evaluation of spatial characteristics of air pollution particles**

As shown in Figure 6, the regional distribution characteristics of PM2.5 annual average concentration are mainly commercial areas > mixed commercial and residential areas > industrial areas > suburbs with some nuclear pollutants and some clean areas. J Mountain, I Bay, and Tu clean areas are J Mountain National Forest Park, G Mountain National Forest Park, and Xi Forest Park respectively. Residential areas and recreation centers are mainly located near I Bay. The comparison between pollution centers and clean centers shows that human activities are an important factor affecting PM2.5 level.

Compared with the annual average concentration of PM10, the distribution of total annual spatial occupancy in the south is higher than that in the north, while the functional area is expressed as commercial area > industrial area > residential area > suburb. The typical clean place coexists with the core pollution area. As shown in Figure 7, by analyzing the spatial...
distribution of PM2.5 and PM10, the PM2.5 concentration in the spatial distribution can represent a variety of nuclear pollutants and clean areas at the same time. The PM10 concentration in the regional distribution is mainly centered on the core area, and the rest of the area is continuously divided. This state is the real-time performance obtained by analyzing the annual data at the monitoring point. The formation of PM2.5 and PM10 nuclear-contaminated areas is composed of many factors. Because PM2.5 particles are more sensitive to human activities, the monitoring area tends to have some contaminated areas or some clean areas, while the particle size range of PM10 is larger, including a larger space area. Therefore, there is a major area of nuclear pollution and the rest will be appropriately divided. The total concentration of particulate matter emission in metropolitan areas is higher in the central region, but lower in the north and south. The high forest
coverage in the south makes the industry not particularly concentrated and enhances the ability of diffusion and absorption of nature.

**PPP project performance factor research results**

The reliability tests of the 333 questionnaires returned were used to verify the quality and reliability of the query, which helps to show the consistency between the measured variables and the potential variables. The standard of reliability test is the alpha coefficient of Cronbach, and if the coefficient is greater than 0.7, the consistency is good. If the coefficient is greater than 0.35 and less than 0.7, the reliability is normal. If the coefficient is less than 0.35, the reliability is low. This paper uses SPSS to conduct 333 point investigation reliability test results (see Table 1).

The results show that the chi square value is 0.045 is less than 0.05, AGFI is 0.889 and is less than 0.9, RMSEA is 0.026, and GFI value is 0.911. According to the evaluation criteria of structural equation, the two chi square values and AGFI index do not match urban railway infrastructure projects and the final model for calculating performance factors (see Figure 8).

Combined with factor load, the influence value of PPP urban rail transit infrastructure performance factors on performance evaluation can be obtained. Then the primary influencing factors are shown in Table 2.

The secondary influencing factors of the influence value of performance factors on performance evaluation are shown in Table 3.

The three-level influencing factors of the influence value of performance factors on performance evaluation are shown in Table 4.

According to the contribution and influencing factors of urban rail transport infrastructure factors, the factors greater than 1.6 or higher are classified as the first-level factors, the factors greater than 1.5 or higher are classified as the second-level factors, and the other factors are classified into the following three levels: the first-level factors have a significant impact on the performance evaluation of urban rail infrastructure in the public-private partnership; the second-level factors have a significant impact on the performance evaluation of urban rail infrastructure in the public-private partnership. The second one has a smaller impact, and the third one has a smaller impact. However, this does not mean that PPP urban rail infrastructure cannot manage the project in the implementation process; its performance evaluation results can still play a role and interact with the first and second kinds of influencing factors.

**Discussion**

**Analysis of PPP project performance factors**

**Reasonable risk sharing and reasonable price change mechanism**

Fair risk sharing and reasonable price change mechanism PPP project cooperation are based on risk sharing, benefit sharing, and effective public-private partnership to ensure the maximization of the interests of the government and the private sector (Adeyeri et al. 2020). The principle of risk sharing is to share risks with well-disciplined parties so that they can get reasonable risk returns, and all parties can work together to achieve the success of PPP projects. Due to the loss of bilateral cooperation foundation to avoid risks, PPP urban rail infrastructure projects cannot be completed on time.

**Public satisfaction and social support**

PPP urban railway infrastructure projects are infrastructure projects with strong public welfare nature, which are closely related to public life. The audience can generate cash flow for the project and have a lot of influence on the implementation phase of the project (Adnan et al. 2018). Therefore, in a public-private city, it is very important for the public to support and satisfy the railway infrastructure life cycle by building and maintaining infrastructure and achieving common goals.

| Latent variable                           | Number of variables | Cronbach’s alpha coefficient |
|------------------------------------------|---------------------|------------------------------|
| Project characteristics                  | 10                  | 0.855                        |
| Financial financing and market development| 6                   | 0.746                        |
| Creation of innovation and learning organization | 4               | 0.834                        |
| Stakeholder satisfaction                 | 4                   | 0.706                        |
| Process control                          | 10                  | 0.843                        |
| Performance evaluation                   | 1                   | 0.786                        |
| Overall                                  | 35                  | 0.898                        |
Fig. 8 Final result of PPP urban rail transit infrastructure performance factor model

Table 2 Table of influence values of performance factors on performance evaluation (first-level influencing factors)

| Grade                        | Performance factor                                | Influence value | Sort |
|------------------------------|---------------------------------------------------|-----------------|------|
| First-level influencing factors | Reasonable risk sharing                           | 0.177           | 1    |
|                              | Public satisfaction                               | 0.176           | 2    |
|                              | Competitive bidding                               | 0.174           | 3    |
|                              | Reasonable fare adjustment mechanism              | 0.173           | 4    |
|                              | Profitability                                     | 0.172           | 5    |
|                              | Public support                                    | 0.171           | 6    |
|                              | Quality control                                   | 0.1711          | 7    |
|                              | Effective risk management                         | 0.17            | 8    |
|                              | Government regulatory subsidies                   | 0.169           | 9    |
|                              | Government satisfaction                           | 0.168           | 10   |
|                              | Private sector satisfaction                       | 0.167           | 11   |
Competitive bidding and state regulatory assistance

In the cooperation between state-owned capital and social capital, it is very important to choose partners. The selection of experienced partners is related to the success of our project. The implementation of these measures can effectively prevent government regulatory measures, large-scale partner elections and effective government supervision, promote public-private partnerships in urban infrastructure projects, and promote common interests.

Profitability

Because PPP mode realizes the participation of social capital in infrastructure construction, but the cooperative project is still the profitability of the project. Only the urban railway infrastructure project with higher profit can attract more private sector cooperation, effective competition, and maximize profits.

Quality control and risk management

In terms of project quality, project quality is not only the quality of construction project, but also the quality control of project operation stage. The quality of project construction and operation is directly related to the quality of the project. For the safety of the public, we should carry out quality control in the life cycle of the project. Effective risk management measures enable us to discover risks in time and take measures to reduce unnecessary losses in the whole life cycle of the project.

Private sector satisfaction

Private sector participants are the implementers and operators of the whole project. The satisfaction of the private sector has a direct impact on the quality of projects and project activities, as well as their close cooperation with the government in future projects. Transport infrastructure is an important participant and a relatively important stakeholder, because all parties in the private sector are involved in the public-private partnership in the field of urban transport. Therefore, for the sustainable development of the project, the department should actively participate in the process of project implementation (Bahrami et al. 2019).

Suggestions on improving PPP project performance

The performance factors of urban public transport infrastructure are various. According to the characteristics and structure

| Grade | Performance factor | Influence value | Sort |
|-------|--------------------|-----------------|------|
| 1 | Bidder and government’s mastery of PPP | 0.1647 | 12 |
| 2 | Cost management | 0.1644 | 13 |
| 3 | Social utility | 0.164 | 14 |
| 4 | Environmental protection | 0.161 | 15 |
| 5 | Political and legal environment | 0.16 | 16 |
| 6 | Project necessity | 0.159 | 17 |
| 7 | Steady growth in passenger flow | 0.158 | 18 |
| 8 | Reasonable financing plan | 0.157 | 19 |
| 9 | Ride comfort and stability | 0.1566 | 20 |
| 10 | Reasonable financial analysis and cost control | 0.1564 | 21 |
| 11 | Design and construction complexity | 0.1659 | 22 |

| Grade | Performance factor | Influence value | Sort |
|-------|--------------------|-----------------|------|
| 12 | Contract standard, practicality, and flexibility | 0.1553 | 23 |
| 13 | Government credit | 0.154 | 24 |
| 14 | Reasonable franchise period | 0.1538 | 25 |
| 15 | Safety management | 0.152 | 26 |
| 16 | Good atmosphere among all parties and within the project company | 0.15 | 27 |
| 17 | Macroeconomic environment | 0.147 | 28 |
| 18 | Punctuality of train operation | 0.144 | 29 |
Improve the reasonable risk sharing mechanism. The principle of self-acceptance of risk sharing error and the risk itself is caused by out-of-pocket expenses.

Get public support. Urban public and public transport infrastructure projects have strong public welfare, so it is necessary to carefully consider the public requirements in the project determination and implementation stage, so as to achieve public satisfaction and ensure public support. (i) Establish green feedback channels to enable the public to fully express their opinions and improve service quality. (ii) Formulate an implementation plan, which will satisfy the residents and minimize the impact on public life during the construction phase. (iii) After determining the appropriate price and service, the price change mechanism should be generally affordable (Huang et al. 2020).

Financial financing and market development suggestions

In the implementation of a PPP project, the profitability of the project is a major problem, and the criteria for continuous optimization are required as follows:

Flow stability: the traffic volume of PPP urban traffic infrastructure project is affected by many factors. In order to achieve the flow stability, we need to (i) accurately predict the traffic volume at the beginning of the project and predict the impact of traffic planning on the overall economic development and regional economic development and (ii) formulate strategies for reasonable sharing of traffic risks: for example, if traffic demand increases, the government can share profits, and if traffic demand decreases, the government can provide subsidies (Javadinejad et al. 2019).

Flexible prices and services: many factors need to be considered when setting prices, not only the costs and benefits of private organizations but also the overall well-being of urban railway infrastructure. Various factors are needed to determine the price: (i) the negotiation system should carefully consider the requirements of all parties and determine reasonable prices. (ii) Enable dynamic adjustment mechanism: if the price is low, the transportation volume will increase, and the quality is difficult to be guaranteed, and the price can be properly improved. If the price is high, the volume of transportation can be reduced. (iii) The private sector can develop an action plan to compensate for the lack of profit for urban rail infrastructure projects.

Making reasonable financial plan: reasonable financing plan can effectively manage financing cost, reduce initial project investment, and ensure the feasibility of the project. (i) Credit improvement—thanks to the good image

Suggestions on project functions

Since 2014, governments at all levels have been actively taking steps to promote the development of public-private joint ventures. However, so far, few public-private infrastructure projects of railway transportation have been implemented (Cheng et al. 2020). On the one hand, due to special reasons, the country has not formulated specific plans, and the competitiveness is not enough to ensure the effectiveness of future PPP railway infrastructure projects.

(1) Optimize system design and make law enforcement. The private sector guarantee in the field of infrastructure construction is systematic and legal. At present, there is no high-level and executable legislation to regulate urban rail infrastructure projects in public-private partnerships in China. Therefore, the relevant legal departments must actively participate. First of all, the service departments of various ministries and commissions jointly adopt high standard laws to ensure a unified legal basis, issue legally binding executive legislation, establish ways to evaluate the performance of each type of project, and define performance factors, so as to ensure that project participants work in the right direction.

(2) Improve the public procurement mechanism, and enhance the competitive ability of bidding. In order to improve the market mechanism, the government should not treat the potential participants of urban rail infrastructure projects in the public-private partnership in different ways, crack down on speculation, and regulate the market order. (i) Treat social capital fairly, take performance as evaluation standard, and cannot implement multiple standard systems; (ii) In order to ensure the fairness and transparency of the bidding process, we will firmly put an end to the problem of unfair competition and make the public-private partnership of urban rail infrastructure projects develop smoothly (Erdem et al. 2014).

(3) Improve the reasonable risk sharing mechanism. Reasonable risk and reward sharing is the basis of PPP project cooperation, and reasonable risk allocation should be achieved. (i) Risk is positively correlated with return and combined with risk management ability. Risk sharing should consider the cost of risk management and need to have strong management ability, which means that the parties who bear the risk and cost are low. (ii) The principle of self-acceptance of risk sharing error and the risk itself is caused by out-of-pocket expenses.

(4) Get public support. Urban public and public transport infrastructure projects have strong public welfare, so it is necessary to carefully consider the public requirements in the project determination and implementation stage, so as to achieve public satisfaction and ensure public support. (i) Establish green feedback channels to enable the public to fully express their opinions and improve service quality. (ii) Formulate an implementation plan, which will satisfy the residents and minimize the impact on public life during the construction phase. (iii) After determining the appropriate price and service, the price change mechanism should be generally affordable (Huang et al. 2020).

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Making reasonable financial plan: reasonable financing plan can effectively manage financing cost, reduce initial project investment, and ensure the feasibility of the project. (i) Credit improvement—thanks to the good image
and credit level of the private sector, the credit information of the company has been improved, and the barriers between credit problems and financial markets have also been reduced. (ii) Establish good relationship with banks—at this stage, the safest financing is still carried out through social capital and banks. While strengthening the relationship with banks, we should strengthen the relationship with insurance banks as trust in financial management.

Suggestions on the construction of innovative learning organization

In PPP city’s public and private railway infrastructure projects, innovation is always a topic that needs attention. At this stage, the application of public-private partnership in urban railway infrastructure is not mature, so it is urgent to innovate in such projects (Jiang et al. 2019).

(1) Financing innovation: at present, banks and financial institutions are the main funding partners of PPP projects, but these two methods alone are not enough to solve the huge funding gap. (i) Develop a comprehensive financial plan. We provide other types of loans based on banks and financial institutions, such as financial leasing and trustee loans. (ii) In order to reduce the borrowing cost through the innovative lending system, we should consider the comprehensive borrowing cost and actively manage the comprehensive borrowing cost in the lending process.

(2) Technological innovation: urban rail transit infrastructure projects need to innovate rail transit technology to ensure population safety and the quality of services provided. (i) Show talents—private organizations and government can bring professional urban rail transit, improve their experimental and expertise, and provide better services than railway transportation technology. (ii) Introduction of advanced technology—in the implementation phase of the project, we will actively introduce advanced construction and operation technology to improve the function of public-private joint venture railway infrastructure projects (Marini et al. 2019).

(3) Building learning organization: in urban rail infrastructure projects, learning is an inexhaustible driving force of public-private cooperation. (i) Hire professionals for training—private sector and government departments can hire PPP and urban railway experts for training to participate in the development of the project. (ii) Employees learn from each other—the purpose of the team is for employees to acquire new knowledge together. Therefore, it is also important to create an internal learning environment (Marthews et al. 2019).

Conclusion

This paper uses the statistical data of 17 monitoring stations in the metropolitan area of C City in the past year and combines the weather data of Environmental Protection Bureau of C City and China Meteorological data network to understand the air pollution in different times. At the same time, we compare the changes of research conditions and surface formation, as well as the high humidity characteristic of C City, to confirm the relevant point of view to compare the impact of high static air density and other meteorological conditions on the change of pollutants. Finally, this paper makes a systematic investigation on the performance factors of PPP projects and weighs the impact of performance factors on performance evaluation: project characteristics (0.22), financing and market development (0.20), innovation and PPP projects start a good start, establishing a learning organization (0.15), stakeholder satisfaction (0.22), and process management (0.21). Improve the quality of infrastructure services, efficient project management, so the PPP project would have a good boost.

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Declarations

Conflict of interest The authors declare that they have no competing interests.

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