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Intelligent comprehensive evaluation system using artificial intelligence for environmental evaluation

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ABSTRACT

Environmental evaluation plays a significant role in the development of the culture and economy in modern times. When the environmental condition becomes degraded, the complete evaluation of ecological analysis is highly necessary to evaluate the environment. Hence, the development of a scientific assessment system of environmental assessment is highly significant in the development of the culture and economy. In this research, the present state of environmental evaluation is discussed, and the evaluation system is integrated through a computational process. Secondly, an environmental evaluation system is presented to establish the model in the evaluation process. Further, in this research, Advanced Artificial Intelligence Framework (AIF) for environmental development and protection has been proposed to improve the culture and economy in modern times. Studies reports indicate clear connections between the criteria of environmental assessment, the protection and development of the environment. The practical application of study findings involves establishing specific proposals for reducing pollution and improving the protection of the environment in China.

1. Background of the study

Environmental Management (EM) combines research, strategy, and socioeconomic implementations to analyze the implication of the ecological process (Yang et al., 2019). The EMS aims to identify areas for enhancing productivity and savings. Waste disposal, energy use, shipping, manufacturing and the use of products are fields that can generate real advantages and financial savings. The other big advantages are: greater alignment with environmental regulation. In particular, it emphasizes discovering solutions to the problems faced by people in cooperation with nature, resources management (Díaz-Casallas et al., 2019), and waste generation (Bui et al., 2020). An Environmental Management System (EMS) is a set of processes that enable an establishment to reduce its environmental effect and enhance its operative efficiency. Environmental management in a purely anthropocentric context (Kadry, 2013) is discussed about the fundamental issue of how to innovate technologies to develop while determining the natural environment (Feng et al., 2014) continuously. The EMS is "a framework and database which integrates processes and procedures for personnel training as well as the supervision, review and reporting to internal and external stakeholders of a firm of specialised environmental performance information." Build an EMS, including the recognition and creation of environmental aspects, planning. Environmental management is strongly connected to the problems of sustainable economic growth, efficient and reasonable resource distributions, and the conservation of natural resources for future generations (Dong et al., 2020).

Environmental management is a reaction to human activities because of the growing seriousness and importance of the catastrophic social impact on ecosystems (Mi et al., 2010). It is promising that the world can recover itself from human misuse and exploitation with a smaller global population base and less widespread use of technology (Peng and Deng, 2020). Still, it is generally recognized that in many situations, constructive action is necessary to recovery in the world because people have attached more significant value to economic increase (Tee et al., 2017).

Environmental assessment is a method for checking whether a company or an organization does what it needs to make (Xu et al., 2016). For example, an evaluation of regulatory conformance

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Fig. 1. Basic structure of environmental management system.

guarantees the environmental practices of the organization (i.e., what the business does) are consistent with the regulations (i.e., what it will do). An environmental evaluation can notify a corporation or agency that their waste management policies (Zhang et al., 2014) (i.e., what they do) adhere to the best practice standards within the industry field (Fig. 1) (Shi et al., 2020).

Over the last five decades, environmental evaluation has evolved as one of the leading ecological public policies (Aujla and Kumar, 2018; Wen and Zhang, 2020; Li et al., 2019; Zhu et al., 2015). Hence, with significant scientific advances and operational knowledge concerns, the environmental assessment does not achieve its environmental protection for sustainable development.

Presently, China is focused on various research particulars in environmental assessments by developing new approaches and ideas for the evaluation of the environment (Abdel-Basset et al., 2020; Gu et al., 2020; Jing et al., 2020; Ye et al., 2020). Ecological, economic monitoring, identification, appreciation and responsibility are vital features of environmental assessment. In addition, the accountability of environmental evaluations should be optimally improved with additional responsibilities (Muscarella et al., 2014). The ecological assessment will give the ecosystem fund operating as a promising approach in the Ecological system, which has founded on a vast range of resources, and industrial pollution is regulated (Chang et al., 2019).

On the other side, it has practical significance to create a harmonious ecological evaluation system and carry out a complete evaluation. The environmental evaluation should organize the evaluation system to enhance the performance assessment work to evaluate the local leading framework evaluation for economic accountability. Environmental protection and development assessment systems are proposed based on the Artificial Intelligence Framework which has been discussed below.

2. Literature survey

Styles et al. (2012) introduced the 8 Best Environmental Management Practices hierarchy (BEMPs), which intends to methodically focus on enhancing retail supply chains that are most damaging to the environment. Enforcing environmental supplier standards, and company development systems focused on benchmarking of results and the implementation of best business practices, are additional BEMPs that can be included along with third party approval. BEMP has lower priority due to the well-documented limits on the consumer option of ecological products.

Nazarova et al. (2020) developed a model of accounting and audit support suitable for use by forest industries. In the rational forest management system, support for its management in accounting and auditing has primitive significance since it enables all parties involved in the financial and economic activities of forest users to be monitored, recorded, and verified for reliability. The key elements in the creation of a framework of Forestry Accountability and Auditing (FAA) are the artifacts, source material, methodologies, and subjects of research to the connections of the two aspects: accounting (by type) and forest capital economic and environmental audit. The nature of the audit target and the contrary and multi-level ties between its key components complicate the efficiency of an environmental audit for the forest sector. Internal auditing is one of the few resources available and under viewed at the same time, which can improve the efficiency of the business and help to manage business development appropriately.

Aslam et al. (2020) explored the importance of the external audit of the environment among Energy and Resource Management Practices (EMPs). In brief, they discuss the significance of the environmental efficiency of environmental audit integration with environment protection activities. This analysis focuses on generalized lesser quadratic regression with random consequences to investigate the relationship between variables. Empirical results show that businesses with the internal framework of the EMP are more practical to obtain greater environmental efficiency by utilizing an external audit tool. Furthermore, the results confirm the valuable ability to produce better environmental performance through the internal mechanism for environmental management practices.

Castka et al. (2020) introduced a system to present the original Financial Statements Evaluation Technique (FSET) that assesses the efficiency of disclosing details on potential environmental factors events. The dialectic theory of scientific knowledge is the conceptual basis for research. This approach considers financial reporting intending to interconnect all financial and economic processes in the audited organization. The review supports the environmental audit method, rather than an environmental audit perspective, which addresses environmental concerns in general terms to the financial statements. The audit approach described focuses on ecological and economic associations with commercial activities that allow the efficiency of potential events caused by environmental variables. The results of the analysis will be utilized by auditors to investigate businesses that pollute the atmosphere and accountants to create successful accounts that represent ecological impacts.

Marwa et al. (2020) investigated the connection between environmental audit and the quality of environmental information measured through voluntary disclosure. They find a significant and statistically relevant association between optional environmental knowledge releases rates and environmental audit committee, environmental auditor's big 4, debt levels and firm sizes using a multi-theoretical system and using the sample of 81 French non-financial firms listed on the SBF 120 index over the 6 years 2012 to 2017. However, the analysis of the findings demonstrated that the CSR committee has no connection to the extent of voluntary disclosure of environmental disclosure.

3. Proposed methodology

3.1. Basic description, development, and implementation of environmental evaluation

Environmental evaluation innovations started early in 1988. It has been studied in-depth, and it is essential to note that over time the environment evaluation has evolved, which indicates that there are four phases of its development, indicating improvements in the primary objective of environmental evaluation and environmental tasks (Fig. 2).

Presently, many companies have begun hiring, training, and

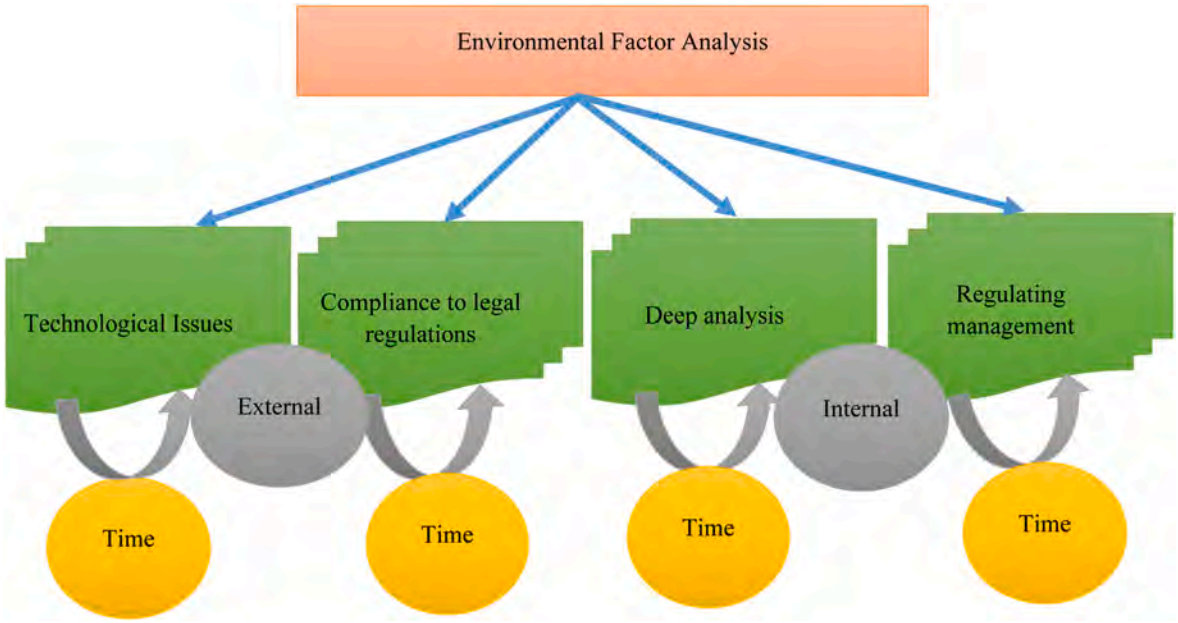

Fig. 2. Environmental evaluation based on time.

utilizing their internal financial auditors as an expansion to their standard annual operational evaluation for environmental evaluation to enterprises. Fig. 2 demonstrates clearly that environmental auditors are primarily interested in technology and corporate enforcement with the climate. However, they have been engaged in a comprehensive analysis of the environmental issues and monitoring systems over the past 20–30 years. The original study of external factors, environmental assessment has changed to review and analysis of internal business factors. The theoretical framework of research is based on the assumption that despite different time-frames in evaluation principles and application, three global approaches to environmental evaluation concept and development emerged:

- An environmental assessment identifies the extent to which business processes are compliant with environmental standards and regulations
- Environmental evaluation is designed to evaluate environmental management effectiveness
- Environmental assessors evaluate the environmental effect of the company.

For this analysis, the Environmental evaluation is described broadly and accurately by considering all 3 approaches and practical needs into account: the Environmental assessment is a management method used in the process of comprehensive, evidence-based, regular and accurate evaluation of all environmental practices, management planning and enforcement activities of the company. The above global approaches and a detailed description of environment evaluation indicate that the particular focus has been put on its significance as a tool for maintaining consistency with the specific tasks of Environment Management systems. Most countries have established and developed EM and environmental an evaluation as voluntary approaches.

3.2. Requirements of international standards

International environmental management and protection standards are highly unified and established for ecological interpretation. A continuous improvement of environmental attitude is a fundamental requirement of environmental standards. This framework defines an environmental management program, which will allow the organization to implement strategies, goals, and required details about all relevant aspects of the climate, taking into legal consideration specifications. Through the elimination of environmental costs and pollution, increasing employee satisfaction and customer satisfaction, as well as improved product and public relations, businesses incorporate the environmental approach into their corporate plan to gain many benefits by efficient environmental management. The environmental standard provides clear criteria and instructions for the implementation of this standard as per environmental management systems.

The standard reflects the idea that that the regulations and stakeholders' deep concern for environmental protection and sustainable growth needs businesses to show their success for continued environmental security. Environmental appraisal applies to all organization types, and sizes can be adapted to different environments, geographical, and cultural circumstances. The ultimate goal of the international norm is to encourage environmental safety, emission reduction, and socially and economically similar initiatives. The ultimate goal is established by the implementation of the specific approach to environmental protection, as shown in Fig. 3.

3.3. Artificial intelligence framework (AIF) for environmental evaluation

The importance of ecological evaluation is discussed, and the artificial intelligence framework has been demonstrated as an evaluation framework and process. A comprehensive evaluation of environmental evaluation to accomplish the accurate research findings is a dynamic process, so the researchers must establish a more scientific and reasonable evaluation model to describe this evaluation process. The maximum sustainable economic benefit may be obtained by utilizing a quantitative evaluation system. With the criteria of ecological resource efficiency and primary ecological role, the economic value is estimated provisionally. Fig. 4 demonstrates the process of evaluating the artificial intelligence framework in this paper.

Moreover, AIF is a descriptive method and quantitative data analysis. The AIF model is highly practical and realistic based on significant expert impacts. Based on quantitative analysis and ecological evaluation appraisals of the system process, a comprehensive AIF evaluation system has been designed. Due to the modification of AIF non-consistency judgment matrices with automatic computer implementation, many different professions have implemented it extensively. This study evaluates the ecological value in China, focused upon an environmental evaluation theory and the AIF methodology, referred in the evaluation

Fig. 3. Structure of environmental evaluation.

system. First, the key measures and concept of sequence in the resolution of real problems are briefly presented by the AIF method.

- Decision matrix development at various stages

The AIF procedure for comparing factors in combinations to create a matrix in quantities by taking two factors K_a and K_b each time using x_{ab} to reflect the effect ratio of K_a and K_b with P, using $X = (x_{ab})_{m\times m}$ to n reflects all the results of a parallel comparison with A, which means that X is a matrix for the $P - X$ relation. If the K_a to Pratio is x_{ab}, then the K_a and K_b to P ratio is x_{ab}, the K_a and $K_b$the ratio on P has been shown as follows:

$$X = (x_{ab})_{m\times n},\ x_{ab} > 0,\ x_{ab} = \frac{1}{x_{ab}} \tag{1}$$

If the results of many contrast scales are used, the evaluation system is more comprehensive and informal.

- Single level with synthetic level ordering

If the maximal eigenvalue δ_{max} of decision matrix X is, the correct eigenvector is:

$$\rho = (v_{11}, v_{12}, \ldots\ldots\ldots, v_{1m})^T \tag{2}$$

- Test the consistency

The index weight and accurate test results are determined in combination with an AIF questionnaire to experts:

$$CI = \frac{\delta_{max}}{(m-1)} \tag{3}$$

- RA value calculation

It uses the entire data structure to measure the value of the RA.

- Confirmation factor calculation

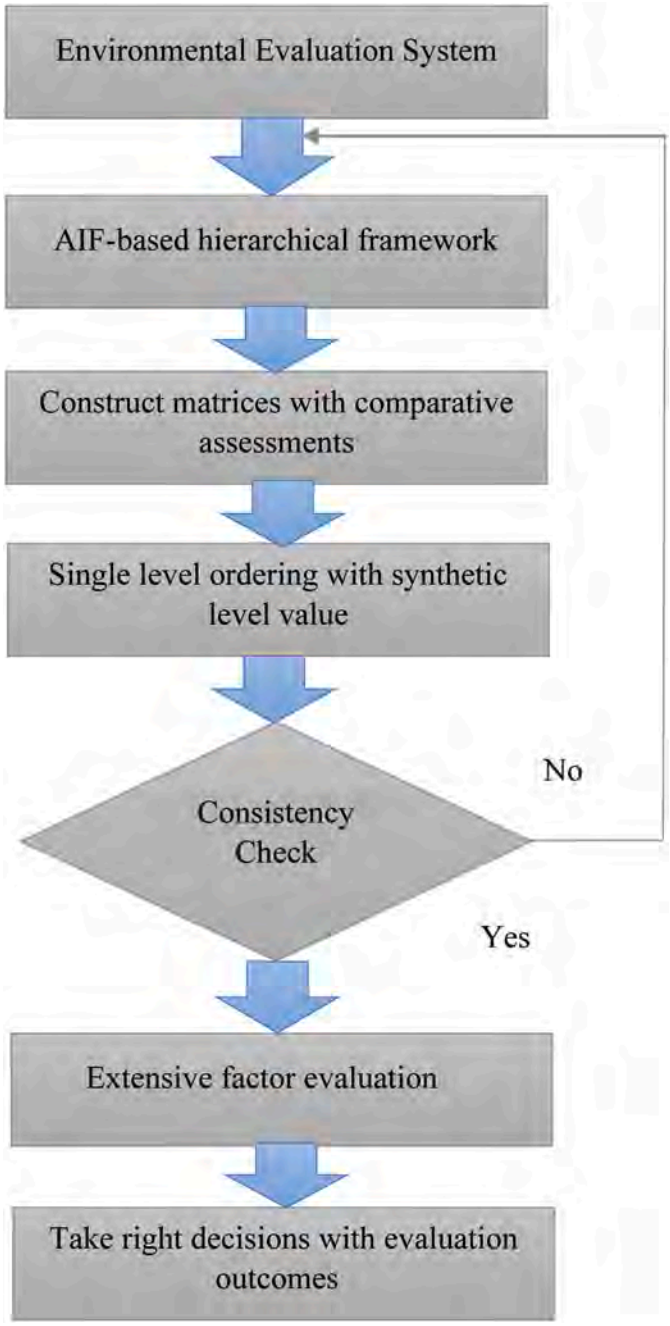

Fig. 4. AIF based evaluation system.

The procedures to construct an index structure is completed. The confirmation factor of CF describes the following

$$CF = \frac{CI}{RA} \tag{4}$$

In case of $CF < 0.1$, the accuracy of the decision matrix is appropriate.

- Performance evaluation index ordering

In the following formula, weight can be calculated for each index within this layer.

$$\rho_l = v_{l1} / \prod_{a=1}^{m} v_{l1},\ l = 1, 2, \ldots\ldots m \tag{5}$$

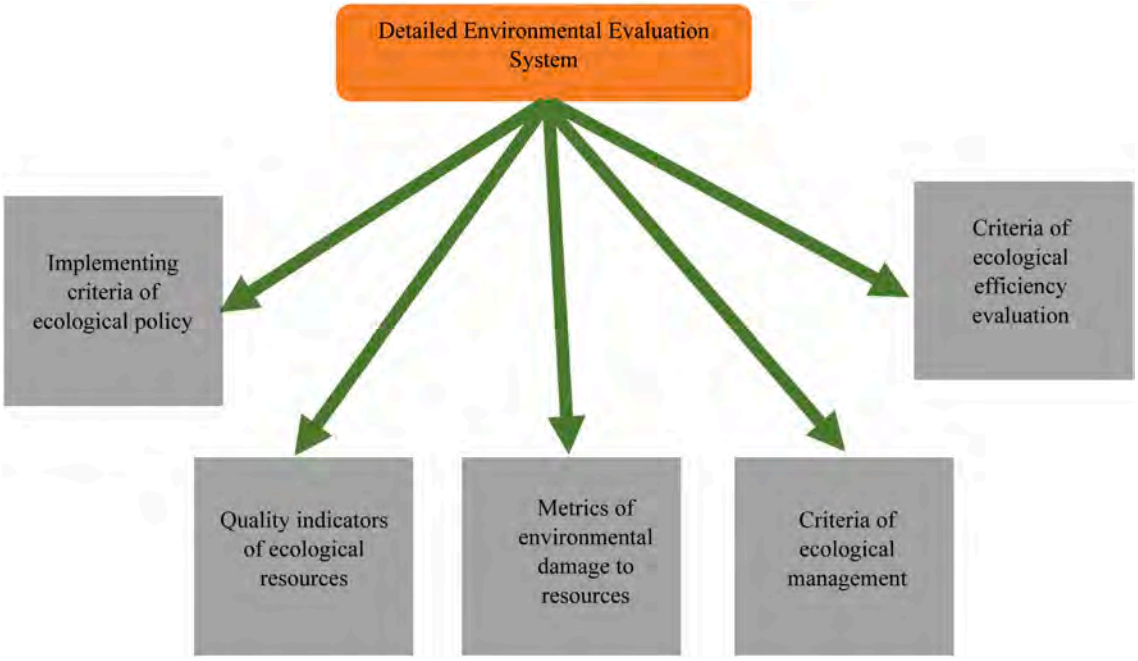

Fig. 5. The detailed ecological evaluation system.

Moreover, by analyzing different variables of impact and the weight value of each variable, it has been able to examine the detailed evaluation matrix.

3.3.1. Application of AIF for environmental evaluation

The analysis aims to divide the ecological evaluation index, defining the evaluation method and the quality of reliable protocol for each factor. In this analysis, an example has been the index method for evaluating the effect of ecological evaluations in China. The particular environmental evaluation method is illustrated below. The detailed environmental evaluation is shown in Fig. 5.

In addition, an analysis of different influencing factors provided the ecological evaluation system results. Therefore, the environmental assessment system of the government is established in combination with the facts about China. This paper tests the effectiveness of the ecological evaluation focused on the AIF concept. It is defined as ways to evaluate the environment through the evaluation process. First, a relatively significant degree and weight measure of the first stage and second level may be determined by utilizing the AIF structure evaluation matrix. Table 1 shows the relative value scale and weight.

The individual matrices of the group preference matrix can be calculated.

$$X = \begin{bmatrix} 1 & 1 & 1/3 & 5 & 1 \\ 1 & 1 & 3 & 8 & 1 \\ 2 & 1/3 & 1 & 6 & 4 \\ 1/4 & 1/8 & 1/6 & 1 & 1/6 \\ 1 & 1 & 1/4 & 4 & 1 \end{bmatrix} \tag{6}$$

The maximum value of its eigenvalue and its eigenvector is determined as follows,

$$\delta_{max} = 6.045 \tag{7}$$

Through using the main factor in AIF theory, the feasible starting factor has been established.

The index weight value of CI has been determined:

$$CI = \frac{\delta_{max} - m}{m - 1} = \frac{6.045 - 6}{6 - 1} = 0.009 \tag{8}$$

In the following, the consistency factor of CF can be calculated as follows,

$$CF = \frac{CI}{RA} = \frac{0.009}{1.14} = 0.0078 \tag{9}$$

If CR $<$ 0.10, the matrices of the decision are consistent.

Next weight is indicated for each measurement index as:

$$\rho_l = v_{l1} / \prod_{a=1}^{6} v_{l1} = 0.0271 \tag{10}$$

Through utilizing a detailed ecological evaluation method, the decision taking is enabled more scientific and accurate

Table 1
Relative value scale and weight.

G	P	Q	R	S	T
P	1	1	1/3	5	1
Q	1	1	3	8	1
R	2	1/3	1	6	4
S	¼	1/8	1/6	1	1/6
T	1	1	1/4	4	1

3.4. Implementation of environmental evaluation

Based on the theoretical context of environmental evaluation and international standard series criteria, one may infer it is a continuous feedback process. The environmental evaluation has both protective and modifying impacts on the efficiency of the EM framework. This method is strongly standardized and formalized as it derives from universal norms. Research shows that the environmental manager has the primary role in the company's successful application of EM. Developed EM improves the company's understanding of environmental protection and environmental assessment criteria. Throughout this context, the environmental evaluation is viewed as consistently and considering the company's external impacts on the environment from the internal activities, by the environmental policies.

The environmental assessment can have various aspects, define main problems, evaluating compliance, recognizing and analyzing potential threats, providing feedback on environmental policy changes

Table 2
Process of environmental evaluation implementation.

Environmental evaluation actions	Earlier tasks	Specific management of the environmental analysis	Follow-up tasks
Acceptance of involvement	Prepare the evaluation plan and send user questionnaire	Establish the flow of evaluation execution	Classification of information obtained
Define the degree and scope of the evaluation	Environmental rating information	Description of the documentation needed	Formulation of the preliminary evaluation
Development of the evaluation group	Create a questionnaire for every environmental assessment region and evaluate the logistics strategy and development	Creating a list of collected data	Set of concerns and document amendments, Reviewing final reports

and initiatives, and determining the ability to minimize the environmental effect of the business. Recognizing that theory and experience of the execution of an Environmental evaluation method have distinct types, it needs to be emphasized in terms of the number and order of process steps, goals, and target categories of consumers. The analytical background and the standard methods utilized in the environmental assessment cycle, as illustrated in Table 2.

Planning is focused on specified goals, activities, and fields specific to the evaluation issue, which would be the first step in the implementation process. The environmental planning of evaluation takes into account a given organization's environmental strategy and EM operational standards. For the performance of evaluation procedures during the process of environmental evaluation, efficient and successful planning and evaluating logistics are essential. The environmental evaluation process starts with the planning of a business strategy and procedures.

Specific significance in the field of environmental evaluation refers to the quality of questionnaires prepared by auditors, as they are commonly used as a tool for collecting data. The survey is used to gather details about the extent of security of the environment and progress made by the organization to be evaluated. Throughout the environmental assessment report, the collected material is stored, reviewed, and assessed. This study is developed for local, as well as external consumers. In particular, numerous stakeholder organizations are involved in environmental assessment results: manufacturers, corporate operators, investors, consumers, rivals, municipal agencies, regulators, and the general public. It assesses the evaluation team's efficiency and environmental auditor's competencies.

4. Results and discussions

4.1. Weighted response for environmental pollution

Resource deficiency and environmental pollution issues are confronting in China. The environmental performance evaluation has been more critical with increasing concerns about resource use and environmental issues.

Table 3 shows the weighted response to environmental pollution. The overall production performance, average output, and average Eastern pollutant control rates are higher than the central and western regions in China. In the east of the world, many comparatively developing areas typically have more advanced manufacturing, state-of-the-art infrastructure, more significant management standards, and a high-quality workforce. Such benefits significantly help the effective use of resources and the production of less pollution. Moreover, it is well established at a high level by both the Chinese national government and local governments to cover industrial pollution and other environmental concerns. The proposed Artificial intelligence Framework gives a weighted response for manufacturing efficiency and pollutant processing due to technical developments and regulatory policies.

4.2. Weighted response for environmental sustainability implementation

Since China is implementing a sustainable development policy, the government has raised environmental protection expenses after the year based on substantial performance. The paradigm of artificial intelligence explores Chinese regional industrial structures to predict improvements in the overall productivity scores to investigate whether China's industry performs well after years of the system will improve different environmental policies that affect China's industrial output.

Table 4 shows the Weighted Response for Environmental Sustainability. The government will promote artificial Intelligence Interregional development collaboration. To learn and enhance technology, undeveloped central and western regions will collaborate with the eastern region. For example, it is necessary to encourage industrial change to make further effort in the design of sustainable development to initiate an assessment of sustainable design achievement. Regional manufacturing networks whose total inefficiency is primarily attributed to the inability of the pollutant treatment process will pay more attention to handling economic development. Further attempts will be made to promote the usage of pollutant treatment facilities by the manufacturing industries.

4.3. Weighted response on environmental health

Using the latest AIF-Network model that discusses China's policies on resource usage and environmental conservation, these findings include a robust environmental performance study of the Chinese national industrial network. As Table 5 demonstrates, improved performance is accomplished in national industrial systems through the proposed Artificial Intelligence Framework.

To allow manufacturing businesses conscious of the significant impacts of environmental regulation on the company's internal growth, the state can undertake educational initiatives on environmental law, management, and policy. Enhancing industrial corporations' environmental awareness will enable them to implement deliberately and

Table 3
Weighted responses for environmental pollution (%).

Number of industries	BEMPs	FAA	EMPs	FSET	AIF
100	56.5	52.6	56.7	58.1	59.6
150	70.5	72.5	76.5	80.3	82.3
200	66.6	68.3	74.2	76.5	79.9
250	55.8	58.4	62.6	65.9	68.3
300	60.5	67.5	70.4	73.7	78.9
350	74.3	85.7	87.2	90.5	97.6

Table 4
Weighted Response for Environmental Sustainability.

Number of industries	BEMPs	FAA	EMPs	FSET	AIF
100	45.2	46.3	48.5	50.9	52.6
150	55.3	57.6	60.2	63.4	65.9
200	70.5	76.2	78.4	80.3	82.6
250	60.4	62.5	65.8	67.5	70.5
300	72.3	76.4	79.5	80.5	85.2
350	75.2	77.6	79.5	86.4	95.4

Table 5
Weighted response for environmental health.

Number of industries	BEMPs	FAA	EMPs	FSET	AIF
100	67.8	68.5	69.3	71.4	72.6
150	50.2	54.6	58.9	60.3	65.4
200	70.5	76.5	79.3	80.2	84.7
250	65.4	69.7	73.6	79.2	82.3
300	73.4	76.5	79.1	82.8	86.5
350	80.3	84.7	87.6	89.3	94.8

Table 6
The efficiency of environmental evaluation.

Number of industries	BEMPs	FAA	EMPs	FSET	AIF
100	35.7	38.2	40.3	43.6	45.1
150	50.3	55.5	57.2	59.7	61.5
200	60.3	65.8	69.4	70.4	72.7
250	72.3	76.5	78.2	79.7	80.4
300	65.8	69.2	73.7	78.5	80.3
350	83.4	85.8	87.6	89.1	96.5

actively environmental protection steps. Environmental health may be incorporated into environmental growth by an increased condition for the environment in households or communities through biomass use, as well as ensure adequate water and sanitation.

4.4. The efficiency of environmental evaluation

Environmental problems rarely been an essential part of development strategies, particularly in countries like China. A company's key goal helps to maximize income and that it must be multidimensional: cultural, social, and environmental. Supporting initiatives for sustainable development has increased the company's confidence in evaluation systems of environmental effects and sustainable efficiency to achieve a comparative advantage in competitive positioning.

Table 6 shows the efficiency of the proposed environmental evaluation. The proposed Artificial Intelligence Framework (AIF) has better efficiency for environmental evaluation. The ability of an organization to achieve environmental goals is highly dependent on measuring environmental performance constantly through the efficient planning of organizational, economic, and technical improvement measures required.

4.5. Availability of the environmental evaluation

Sustainable development research should be carried out without a significant barrier. The ecological structures of sustainable development are fundamental human needs, such as quality and availability of air (i.e., pollution-free environment), water, food, shelters. Many attempts to render the corporate climate that is competitive and environmentally responsible by regular environmental assessments are demonstrated by public health risk through investments in biodiversity resources as a disruptive and robust power for sustainable growth. Several ecological contaminants, such as hazardous substances, vibration, etc. have been discussed in environmental legislation; regulates other practices, such as mines, energy production, etc. have been formulated; and include specific guidelines for the conservation of vital natural resources such as air, soil or water. Fig. 6 shows the availability ratio of the proposed Artificial Intelligence Framework (AIF). The proposed AIF method has better availability.

5. Conclusion

This paper presented an evaluation method for the ecological evaluation sources from the government based on artificial intelligence algorithms. This paper outlined the benefits of the detailed evaluation system of the government's environmental evaluation in the analysis of the index system based on the Artificial Intelligence Framework (AIF) by the current data situation. The research of this study has positive effects, in line with the present scenario, to support the government's ecological evaluation system. In addition, the authorized artificial intelligence algorithms can be used for analyzing measured data for the specific environmental evaluation process. Environmental evaluation system focused on international principles and professional practices by the environmental audits in China aims to address discrepancies linked to technically outdated infrastructure, inadequate production planning

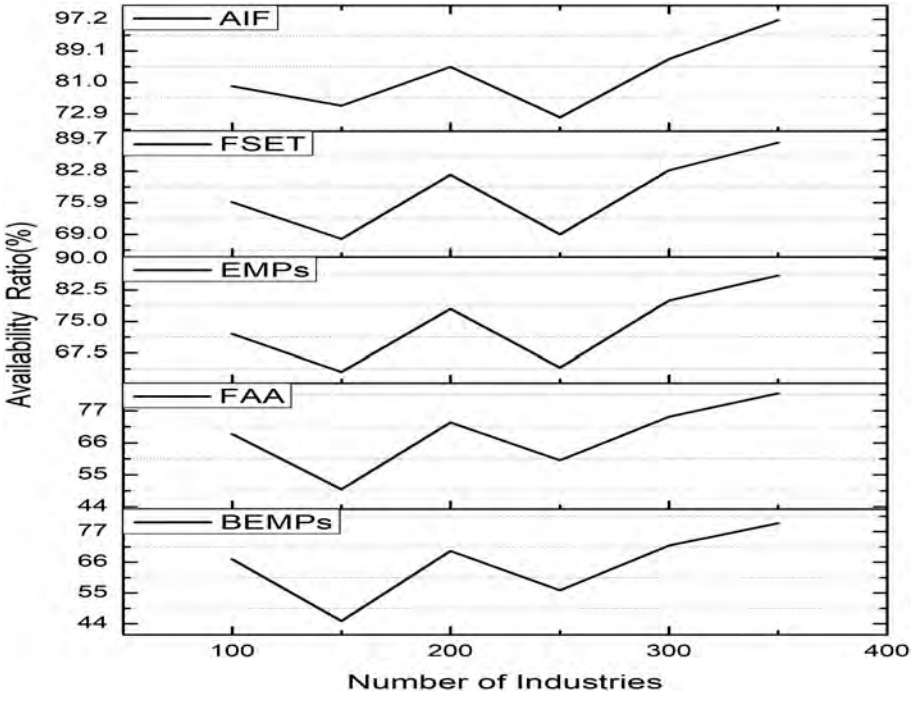

Fig. 6. Availability analysis.

and environmental hazards, and similar problems and primarily concern the soil and air quality and groundwater quality (e.g., oil refineries). The most significant benefits for the enterprising authorities are operational, economic, business, social, and community-based environmental evaluation and control systems.

Declaration of Competing Interest

The authors declare that they have no conflicts of Interest.

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