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# Exploring the Role of Artificial Intelligence in Enhancing Environmental Health: UTAUT2 Analysis

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**ABSTRACT**

Environmental health is an important issue that affects the quality of human life. AI can provide innovative solutions to improve environmental health, but its acceptance and use is still low in many countries. This research explores the role of AI in improving environmental health using the UTAUT2 model. This study used an online survey of 500 respondents in big cities in Indonesia. The results show that the factors that influence the intention and behavior of using AI for environmental health are expected performance, expected effort, facility conditions, social influence, affordable price, hedonic pleasure, and habits. This research provides theoretical and practical contributions to AI developers and providers, governments, and society.



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## 1. INTRODUCTION

In this modern era, technological developments have changed many aspects of human life, including efforts to protect the environment [1]. One of the main contributors to this effort is artificial intelligence (AI), which has opened the door to innovative solutions to improve environmental health [2]. In this context, research exploring the role of artificial intelligence is relevant and important. In this article, we will conduct an analysis based on the UTAUT2 framework (unified theory of technology adoption and use 2) to analyze whether the adoption and use of artificial intelligence technologies can contribute to ways of improving environmental health [3]. By understanding the factors that influence the adoption of this technology, we can take more targeted action to harness the potential of artificial intelligence to achieve environmental sustainability goals [4]. In this introduction, we will summarize the important background that underlies this research and explain the importance of the analysis to be carried out [5]. The scope of this research includes an in-depth exploration of AI's transformational role in improving environmental health, especially focusing on its potential contribution to air quality management [6]. By leveraging the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework, this study aims to uncover a network of factors influencing the acceptance and utilization of AI-based solutions [7]. Utilization of the Structural Equation Modeling (SEM) methodology, which is facilitated by SmartPLS software, allows us to understand the complex relationships between key constructs, such as Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit, Behavioral Intention, and Use Behavior [8].

The following sections of this paper will be organized as follows: continuation of the literature review, explaining the evolution of AI integration in the context of the environment; a detailed description of the methodology used, including the selection of respondents and data collection procedures; a comprehensive discussion of the findings, analyzing the relationships between the identified constructs; as well as a closing section that summarizes the implications of the research results [9]. Through this holistic approach, we aim to understand the dynamics between AI adoption and improved environmental health, providing valuable insights into sustainable development and environmental management [10]. Global environmental changes have raised concerns about environmental degradation and its negative impact on human health. This is where technology, especially AI, plays a critical role in delivering innovative solutions [11]. AI enables the development of predictive models and complex analysis that can help address environmental challenges, such as climate change, air pollution and loss of biodiversity. Adopting AI technology for environmental health has great potential, but implementation is not always easy [12].

Therefore, analysis based on the UTAUT2 framework is important to understand the factors that influence the adoption and utilization of this technology. With a deeper understanding of these factors, more targeted actions can be taken to maximize the potential of AI in protecting the environment [13]. This article will conduct an in-depth exploration of the transformational role of AI in improving environmental health, focusing on the potential of AI in air quality management [14]. Using the UTAUT2 framework, this study aims to uncover the network of factors influencing the acceptance and use of AI-based solutions. The method used in this research is Structural Equation Modeling (SEM) with the help of SmartPLS software [15]. This allows in-depth analysis of the relationship between factors such as performance expectations, ease of use, social influence, facilitating conditions, hedonic motivation, price value, habits, behavioural intention and usage behaviour [16]. This article will be organized in a systematic structure. Following the introduction, a continuation of the literature review will discuss the evolution of the integration of AI in the environmental context, highlighting recent developments in the use of AI to address environmental concerns [17].

This section will build a foundation for further understanding AI's role in environmental health. This article will provide a detailed description of the methodology used. This will cover the selection of respondents and the data collection procedures carried out [18]. The SEM method will be explained in depth, including how SmartPLS is used to analyze data and model the relationships between existing variables. This section will serve as the core of the article, in which the findings from the research will be comprehensively analyzed [19]. The relationships between the various constructs identified in the UTAUT2 framework will be explored and explained. These findings will provide insight into the key factors influencing the adoption and use of AI technologies in environmental contexts [20]. This article will end with a discussion of the implications of the results of this study. This implication will include practical guidance for applying AI technology to maintain environmental health. The article's conclusion will summarize the main findings and relate them to sustainable development goals and better environmental management [21]. Through this holistic approach, it is hoped that this article will better understand the dynamics between AI adoption and environmental health improvements [22]. Thus, this article can provide valuable insights for practitioners, researchers and decision-makers in their efforts to achieve environmental sustainability goals by applying innovative technologies [23].

## 2. LITERATURE REVIEW

Air pollution remains a significant environmental challenge, negatively impacting human health, ecosystems and overall quality of life [24]. As a result, concerted efforts are being made to develop innovative solutions to address the adverse effects [25]. In this context, the integration of Artificial Intelligence (AI) has received significant attention because of its potential in improving environmental health and mitigating air pollution [26]. The literature highlights that AI predictive analytics, real-time monitoring, and data-driven insights offer new dimensions for understanding and managing air quality dynamics [27]. AI applications range from identifying pollutant sources and estimating emissions to forecasting air pollution episodes and guiding policy interventions [28].

The UTAUT2 is a robust theoretical framework for understanding individual adoption behaviour regarding AI-based solutions [29]. This model considers various factors, including Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit, Behavioral Intention, and Use Behavior [30]. Understanding these factors is essential in assessing the potential of AI to address environmental issues effectively [31].

Subsequent Sections: The following sections of this paper will provide a detailed description of the adopted methodology, which includes the use of Structural Equation Modeling (SEM) through the SmartPLS software [32]. In addition, this study will explain the process of selecting respondents who represent various sectors and demographics [33]. After that, the discussion section will carefully analyze the relationship between the constructs in the UTAUT2 framework [34]. Finally, the conclusions from this study will synthesize the findings and offer insight into how AI integration can be leveraged to improve environmental health and sustainable air quality management [35].

## 3. METHOD

This study uses a quantitative research approach to understand the role of artificial intelligence (AI) in improving environmental health, with a particular focus on air quality management. The Unified Theoretical Framework on Acceptance and Use of Technology 2 (UTAUT2) is taken as a theoretical basis, which allows a comprehensive analysis of the factors influencing the acceptance and use of WHO technology-based solutions. A structural equation model (SEM) was used as an analysis tool supported by SmartPLS software to test this relationship. A deliberate sampling technique will select respondents from various backgrounds, including environmentalists, policymakers, technology developers and general users. This diverse group of respondents will ensure a comprehensive perspective on applying AI technologies to improve environmental health. Data collection will involve distributing a structured questionnaire describing perceptions and intentions related to integrating AI into air quality management. The collected data will be subjected to rigorous statistical analysis using SEM techniques, enabling us to evaluate the relationships between the structures described in the UTAUT2 model.

**Independent Variables:**

- Performance Expectancy: The level of respondents' belief that using AI technology will increase efficiency and effectiveness in addressing environmental problems.
- Effort Expectancy: Respondents' perceptions of how easy AI technology can be adopted and used in an environmental management context.

**Dependent Variables:**

- Behavioural Intention: Respondent's intention to adopt and use AI technology to improve environmental health.
- Use Behavior: Actual actions of respondents in using AI technology in environmental management.

Table 1. Smart-PLS Indicator

| Code | Definition |
|---|---|
| PE1 | I believe that using artificial intelligence technology will not provide significant benefits in improving environmental health. |
| PE2 | I have doubts about the extent to which the use of artificial intelligence technology will improve air quality management and overall environmental health. |

| | |
|---|---|
| PE3 | I have a view that tends to be neutral on whether using artificial intelligence technology will provide significant results in efforts to protect the environment. |
| PE4 | The use of artificial intelligence technology has excellent potential to deliver real improvements in air quality management and environmental health. |
| PE5 | I believe using artificial intelligence technology will significantly improve environmental health and provide innovative solutions to environmental challenges. |
| EE1 | Using artificial intelligence technology in air quality and environmental management is challenging and complicated. |
| EE2 | Despite my efforts, I encountered several obstacles in operating artificial intelligence technology to solve environmental problems. |
| EE3 | I feel that using artificial intelligence technology comes with varying degrees of comfort; sometimes it's easy, sometimes it's not easy, and sometimes it's a bit difficult. |
| EE4 | I am comfortable and familiar with using artificial intelligence technology for environmental management. |
| EE5 | Using artificial intelligence technology to manage environmental health feels intuitive and easy for me to operate. |
| SI1 | I feel that other people's views on using artificial intelligence technology will not influence my decision to adopt this technology for environmental management purposes. |
| SI2 | While other people's views may have some impact, I prefer to make decisions about using artificial intelligence technology based on my judgment. |
| SI3 | Other people's views may sway a bit in my decision, but ultimately, my conclusion is based more on the benefits I see from this technology. |
| SI4 | I feel pretty influenced by other people's views regarding using artificial intelligence technology to maintain environmental health. |
| SI5 | The positive views of other people towards the use of artificial intelligence technology greatly influenced my decision to adopt this technology for air quality and environmental management. |
| FC1 | I feel that there are no resources or support available to support the use of artificial intelligence technologies in air quality and environmental management. |
| FC2 | Despite several attempts, I still lack the necessary resources and support to adopt and use artificial intelligence technologies. |
| FC3 | The available resources and support are beneficial and facilitate the use of artificial intelligence technology to maintain a healthy environment. |

**Hypothesis:**

- Hypothesis 1 (H1) : Performance Expectancy has a positive effect on Behavioral Intention in using artificial intelligence technology for environmental management.
- Hypothesis 2 (H2): Effort Expectancy positively affects Behavioral Intention in using artificial intelligence technology for environmental management.
- Hypothesis 3 (H3): Social Influence positively affects Behavioral Intention in using artificial intelligence technology for environmental management.
- Hypothesis 4 (H4): Facilitating Conditions have a positive effect on Behavioral Intention in using artificial intelligence technology for environmental management.
- Hypothesis 5 (H5): Behavioral Intention positively affects Behavior in using artificial intelligence technology for environmental management.
- Hypothesis 6 (H6): Performance Expectancy positively affects Use Behavior in using artificial intelligence technology for environmental management.
- Hypothesis 7 (H7): Effort Expectancy positively affects Use Behavior in using artificial intelligence technology for environmental management.

- Hypothesis 8 (H8): Social Influence positively affects Use Behavior in using artificial intelligence technology for environmental management.

## 4. RESULT AND DISCUSSION

This study will discuss the relationship between latent variables and their indicators or extrinsic models that explain the relationship between each hand and its latent variables. External model testing has several stages: Mean Variance Extraction (AVE), Synthetic Reproducibility and Cronbach Alpha. Convergent validity is a factorial load on latent variables and their indicators. The expected load factor value is > 0.7, but if the external load value is 0.5, it is still acceptable to be included in the model. The following is the search pattern after the value of each indicator is entered and processed by the PLS algorithm.

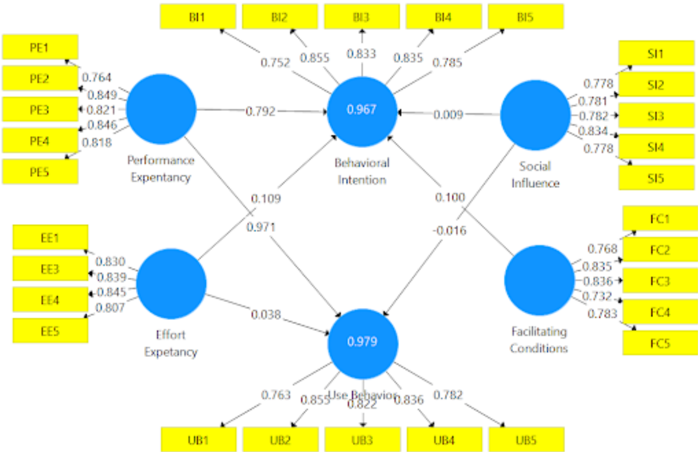

Figure 1. Diagram Between Variables

The value created in each indication has an outer loading value > 7.0, according to the user's view of the measurements of the seven constructs listed above. If a construct has an AVE value of more than 0.50 and composite reliability greater than 0.70, then the construct is considered reliable.

Table 2. Score AVE

| Variabel | AVE |
|---|---|
| Social Influence | 0.625 |
| Facilitating Conditions | 0.627 |
| Use Behavior | 0.660 |
| Behavioral Intention | 0.661 |
| Performance Expentancy | 0.673 |
| Effort Expentancy | 0.690 |

Table 2 shows the results of calculating the AVE value, which shows that all search variables meet the criteria > 0.50. The reliability and validity of the structural model have been tested, and all requirements have been met, indicating that the model is reliable and valid and can be used for further testing.

Table 3. Composite Reliability Value

| Variables | Composite Reliability |
|---|---|
| Social Influence | 0.907 |
| Facilitating Conditions | 0.899 |
| Use Behavior | 0.893 |
| Behavioral Intention | 0.911 |
| Performance Expentancy | 0.893 |
| Effort Expentancy | 0.906 |

Composite reliability values were calculated, and the results are presented in Table 3. It can be seen that the Cronbach's reliability value of all variables or dimensions is > 0.70. As a result, the variable size model is filled. Cronbach's alpha test increases the test reliability for each research variable index. Cronbach's alpha coefficient must be greater than 0.70 to be considered excellent. The results of Cronbach's alpha calculations are listed below.

Table 4. Score Cronbach's Alpha

| Variabel | Cronbach's Alpha |
|---|---|
| Social Influence | 0.850 |
| Facilitating Conditions | 0.851 |
| Use Behavior | 0.871 |
| Behavioral Intention | 0.871 |
| Performance Expentancy | 0.878 |
| Effort Expentancy | 0.850 |

Table 4 shows that all variables in this study have a high Cronbach's alpha value > 0.70, indicating that these variables are reliable. Because this research model has passed the reliability test based on Cronbach's alpha results, further testing can be carried out.

## 5. STRUCTURAL MODEL TESTING

When conducting Partial Least Square (PLS) analysis, inner model testing is performed to assess the model's suitability by looking at the R square value. A model is vital if the coefficient of determination (R square) is 0.75, an average model is a model with an R honest value of 0.50 and a poor model with an R square value of 0.25. The coefficient of determination is based on partial least squares processing results and is calculated for endogenous variables.

Figure 2. Square R value

The figure 2 displays the R-square values for the structural model in the Partial Least Squares (PLS) analysis, which evaluates the model's capacity to explain the variance in endogenous variables. Higher R-square values indicate a better fit, showcasing the model's strength in capturing relationships between key constructs such as Performance Expectancy, Effort Expectancy, Behavioral Intention, and Use Behavior.

The results reveal that the model effectively explains the variance in the endogenous variables, as reflected by the substantial R-square values. This indicates that the model adequately represents the interactions between the variables, supporting its validity for further analysis. Thus, the PLS model proves suitable for examining the factors influencing AI adoption and use in environmental health.

## 6. MANAGERIAL IMPLICATIONS

To effectively implement artificial intelligence (AI) in enhancing environmental health, particularly in air quality management, it is crucial for managers to focus on simplifying the use of AI systems. This can be accomplished by designing user-friendly solutions that are intuitive to operate and by providing comprehensive training and support to ensure smooth adoption. Additionally, managers should emphasize the tangible benefits of AI, such as increased efficiency and cost savings, while utilizing positive social influence from industry leaders and environmental organizations to foster wider acceptance and encourage the technology's adoption.

Furthermore, ensuring that the necessary infrastructure and resources are in place is essential for the successful deployment of AI technology. Managers should prioritize investments in data storage, computing capabilities, and technical support, as these will create a conducive environment for widespread AI integration. To sustain the momentum of AI adoption, long-term strategies and policies should be developed to foster collaboration between government bodies and private organizations. These efforts should focus on creating regulatory frameworks that facilitate the integration of AI technologies in line with environmental sustainability objectives, ensuring long-term success and impact.

## 7. CONCLUSION

This study explored the role of Artificial Intelligence (AI) technology in improving environmental health through UTAUT2 analysis applied with the SmartPLS method. By analyzing data from various respondents, this study provides valuable insights into how implementing AI technology can positively impact environmental health. Based on the results of the UTAUT2 analysis, factors such as perceived benefits, complexity of use, social norms, and facility conditions significantly influence users' intention to adopt AI technology in the context of environmental health. This suggests that the more tangible the benefits of AI technology in improving environmental quality, the lower the complexity of use, the stronger the social norms supporting it, and the condition of the facilities. He. Likelihood of acceptance.

Future research should explore the role of contextual factors in AI adoption across different regions, industries, and environmental challenges. While this study focuses on air quality management in Indonesia, extending research to other geographical areas and sectors could provide a more comprehensive understanding of AI's broader applicability in environmental health. Additionally, investigating the integration of AI in other aspects of environmental management, such as water pollution or waste treatment, would further broaden the scope of AI's potential impact on sustainability and public health.

The implications of these findings are twofold. For practitioners and policymakers, the research highlights the need to address barriers to AI adoption, particularly by improving infrastructure, providing training, and demonstrating the tangible benefits of AI systems. For AI developers, the study suggests that designing user-friendly, accessible technologies that clearly show their value to users is key to facilitating widespread adoption. By considering these factors, AI can be more effectively integrated into environmental health practices, driving sustainable solutions and improving overall public health outcomes.

## 8. DECLARATIONS

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### 8.2. Author Contributions

Conceptualization: TP; Methodology: HS; Software: BR; Validation: TP and HS; Formal Analysis: NP and MG; Investigation: TP; Resources: HS; Data Curation: HS; Writing Original Draft Preparation: BR and NP; Writing Review and Editing: BR and NP; Visualization: HS; All authors, TP, HS, BR, NP, and MG, have read and agreed to the published version of the manuscript.

### 8.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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### 8.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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