

## Retraction

# Retracted: Analysis on Influence of Business Intelligence Information Quality over User Information Adoption Based on Multiple Mediating Effects

### Discrete Dynamics in Nature and Society

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.


The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### References

- [1] X. Guo, L. Wang, Y. Gao, and L. Guo, "Analysis on Influence of Business Intelligence Information Quality over User Information Adoption Based on Multiple Mediating Effects," *Discrete Dynamics in Nature and Society*, vol. 2021, Article ID 7032037, 16 pages, 2021.

## Research Article

# Analysis on Influence of Business Intelligence Information Quality over User Information Adoption Based on Multiple Mediating Effects

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From the perspective of information, this paper constructs a theoretical model based on information system (IS) success model and information adoption model (IAM), aiming to further disclose the action mechanism of business intelligence (BI) on user information adoption (UIA). Firstly, the BI factors affecting UIA were modeled in reference to the existing literature. Next, a questionnaire survey was carried out to collect valid samples from 423 Chinese enterprises. After that, an empirical analysis on structural equations was conducted on Amos 24.0 and SPSS 26.0. The results show that BI information content quality (ICQ), expected performance (EP), expected ease-of-use (EEOU), and perceived risk (PR) have a direct and significant influence on UIA, and ICQ further significantly influences UIA via mediators such as EP, EEOU, and PR; BI information access quality (IAQ) has a direct yet insignificant influence on UIA, but exerts a significant positive effect on UIA of BI via EP and EEOU. The research provides a new perspective into BI user behaviors in the context of big data, and a good reference for the successful implementation and use of BI in practice.

## 1. Introduction

With the aid of information technology (IT), BI converts data into information and knowledge [1], providing information support to the decision-making of managers and facilitating the realization of business goals [2]. The rapid development of artificial intelligence (AI), big data and Internet of Things (IoT) has caused business intelligence (BI) to evolve continuously in the wave of innovation and entrepreneurship. Currently, many enterprises are investing heavily in BI, the investment or implementation of BI is expected to transform the collected data (e.g., massive complex heterogeneous big data) into effective information for gaining a competitive edge. However, not all BI systems can successfully bring competitive advantages to businesses. BI failure usually occurs when the manager has a poor awareness or understanding of the key factors leading to success. The development of information system (IS) intends

to provide users with information and help them execute tasks. But this process is easily affected by users, organizations, systems, and environmental factors. This complicates the implementation and management of BI.

Hartono et al. [3] summarized the Pearson correlation coefficients in the previous studies and ranked the relevant influencing factors. It was found that user participation is the leading impactor of the successful implementation of IS. If the users reject its information, BI will not act on the organization. Matei [4] held that BI cannot be successfully applied in business without the participation and BI adoption by the employees. To realize user information adoption (UIA), the IS must provide users with information of expected quality, so that user perception meets their demand [5] and convinces them to adopt the information [6]. The recipient is the subject of information adoption. Song and Wang [7] defined the information adoption as the users' purposeful selection, evaluation, absorption, and utilization of information during decision-

making. Venkatesh et al. [8] suggested that UIA is both affected by the subjective factor of user perception and the objective factor of information quality. The latter is the primary impactor of the persuasion effect on users. Islam and Rahman [6] empirically analysed the factors affecting user participation and identified information quality and interaction as the leading impactors.

To date, most studies on BI focus on technology, system features, or qualitative description. There is little research on the behaviours of BI users. From the perspective of BI information quality, this paper carries out surveys to check and analyze user adoption of BI information, based on IS success model and information adoption model. Multiple aspects of user perception were considered during the analysis.

This paper mainly deals with the following issues: (1) How does BI information quality affect UIA? How does user perception of information quality affect UIA? (2) What is the relationship between BI information quality and user perception? How do they interact with each other and jointly influence UIA?

The remainder of this paper is organized as follows: Section 2 introduces the relevant concepts and theoretical bases; Section 3 presents the hypotheses and constructs the model; Section 4 carries out empirical analysis; Section 5 analyzes the data and obtains the results; Section 6 summarizes the main findings, proposes management suggestions, clarifies contributions and limitations, and looks forward to future directions; Section 7 wraps up the research.

## 2. Relevant Concepts and Theoretical Bases

**2.1. IS Success Model.** Proposed by Delone and McLean [9], IS success model, i.e., the Delone and Mclean model of information systems success (D&M model), holds that IS is mainly affected by such six variables as IS information quality and IS system quality. Information quality affects the willingness to use the IS. In 2003, the two scholars further modified D&M model. The modified version contains the following variables: information quality, system quality, service quality, willingness to use, user satisfaction, and net income [10].

Since its proposal, the IS success model has been widely used in IS evaluation. For instance, Mohammadi [11] learned that system quality and information quality significantly affect user satisfaction with electronic learning systems. Xie [12] found that the user adoption of WeChat platform of college libraries depends heavily on platform quality, service quality, and information quality. Liu et al. [13] discovered that readers' attitude towards mobile libraries is promoted by the system quality and service quality of these libraries.

The IS success model considers the three elements of IS, i.e., information content, functional service, and system interface, as important factors affecting user adoption and willingness to use. As an advanced IS, BI converts data into information and knowledge through data integration and analysis, such as to assist user decision-making. Drawing on the IS success model and the previous research, this paper treats BI information quality as an important factor affecting UIA.

**2.2. Information Adoption.** The concept of information adoption stems from the technology acceptance theory. The technology acceptance model (TAM) was proposed by Davis [14], who discarded group factors based on the theory of rational behavior and focused on the usefulness and ease-of-use perceived by individuals, during the research of factors affecting user adoption of IS. TAM has been proven to be widely applicable to user adoption of different ISs. Venkatesh et al. [8] combined TAM with other famous theories and acceptance models into the unified theory of acceptance and use of technology (UTAUT). This is the best model for the research of IS adoption, owing to its strong explanatory power.

With the development and expansion of the technology acceptance theory, more and more researchers have been attracted by information adoption, which refers to the purposeful utilization of information. Based on TAM and elaboration likelihood model (ELM), Sussman and Siegel [15] explored the information adoption of emails and constructed the information adoption model (IAM). Their model regards information adoption as an active information behavior influenced by information quality and information sources; information adoption could be promoted, if the information is perceived as useful by mediating variables.

Starting from the analysis mechanism of user information demand, Song and Wang [7] extended UTAUT into information adoption behavior model (IABM) and defined information adoption as the user selection, evaluation, absorption, and utilization of information during decision-making. Song and Wang [7] and Venkatesh et al. [8] suggested that UIA is influenced by both subjective factors and objective factors. The subjective factors refer to user cognition and practice, i.e., the users' knowledge composition and ability to solve problems and tackle difficulties. Expected performance (EP), expected ease-of-use (EEOU), and perceived risk (PR) are the most representative subjective factors.

Specifically, EP was defined by Venkatesh et al. [8] as how much a user believes using a specific system could help him/her improve job performance. Davis [14] and Song and Wang [7] defined EP as the degree of improvement to job performance perceived by users through information utilization.

EEOU, also known as expected effort, was defined by Moore and Benbasat [16] as the reduction of physical and mental efforts perceived by users for using a specific system. Venkatesh et al. [8] defined EEOU as the user perception of the ease or difficulty in using a technique or system. Davis [14] and Song and Wang [7] defined EEOU as the degree of efforts to be paid by users to achieve their purposes or goals through information adoption.

Concerning PR, Stone and Winter [17] defined risk as the expected loss dependent on subjective factors. The greater the possibility of loss, the greater the risk perceived by individuals. Under the framework of IS acceptance theory, Im et al. believed that, apart from uncertainty, the significance of PR lies in that the users ought to realize: extra output will bring unnecessary economic and psychological losses.

The objective factors include information quality, the reliability of information sources, etc.

Some scholars have adopted information adoption in the light of both subjective and objective factors. For example, Peng et al. [18] relied on IAM to examine the information adoption of female users of online guides for fashion shopping, pointing out that information quality and source reliability greatly affect information usefulness and in turn promote information adoption.

The above studies have shown that information adoption is essentially a decision-making process, which depends on both subjective and objective factors. This paper considers that the process of information adoption is jointly constituted by objective and subjective factors, as well as their interactions and correlations. In the light of the features of BI, this paper starts from such two perspectives as BI information content quality (ICQ) and BI information access quality (IAQ) and explores the BI UIA from the three dimensions (EP, EEOU, and PR) on two layers (perceived benefits and perceived losses).

*2.3. Dimensions of BI Information Quality.* The deepening of global informatization has induced an explosive growth of information. Information overload becomes an increasingly prominent problem. When the massive information hinders efficient and convenient UIA, the information quality perceived by users will decline.

Information quality is a complex variable involving multiple dimensions. There is not yet a unified view on information quality or its dimensions. Wang and Strong [19] treated information quality as the set of multidimensional attributes that can be effectively used by users. Ferran and Watts [20] defined information quality as the basic factor for information receivers to conduct validity assessment in the systemic process. Yang [21] viewed information quality as the usefulness of information content perceived by the receivers and suggested that information quality could convince the receivers to change their attitude.

Different scholars have proposed different ideas on the testing of information quality. Focusing on the intrinsic features of information, Lin and Lu [22] divided information quality into five dimensions: accuracy, integrity, up-to-date-ness, suitability, and reasonability of arrangement. Eppler [23] believed that information quality contains the information quality based on information content and that based on media and established a framework covering information fuzziness, information background, and information behavior. Eppler's information quality framework consists of relevant information, reliable information, optimization process, and reliable infrastructure, all of which determine information quality. Specifically, relevant information includes integrity, accuracy, clarity, and applicability to specific problems; reliable information stands for the consistency, appropriateness, and timeliness of information; the optimization process refers to efficiency, interactivity, and convenience; the reliable infrastructure is defined as ease of access, ease of acquisition, and ease of maintenance.

Li and Sun [24] proposed the main metrics of information quality: relevance, accuracy, comprehensiveness, richness, reliability, up-to-date-ness, and privacy protection. Gorla et al. [25] identified the connotations of information quality as integrity, accuracy, timeliness, and convenience. Li et al. [26] divided information quality into two parts: ICQ and information utility quality. The ICQ comprises four aspects: authenticity, accuracy, timeliness, and integrity, reflecting the consistency between information content and objective reality. The information utility quality involves two aspects: demand satisfaction and practicality, aiming to measure the quality features related to the task completion by information receivers.

As the relevant research goes deeper, scholars at home and abroad divided information quality into various dimensions. The results of some representative studies are listed in Table 1.

BI adds value to the information value chain from the very first link. According to the employed technology, BI collects data and transforms them into information. The implementation of BI can improve intelligence in various ways. For example, BI enables fast information access, simplifies query and analysis, and realizes advanced interaction. The data consistency could be enhanced through data integration and other data management activities (e.g., data cleaning). The term intelligence covers the traditional indicators of data quality, information relevance, and functions related to information access. To understand and analyze the benefits of BI, it is necessary to regard information quality as a broad concept covering all the above aspects.

For the purpose of this research, Eppler's information quality framework was adopted, as it offers an extensive and complete criterion for intelligence analysis. The framework offers a total of 16 standards and provides four metrics about information quality (related information, sound information, optimal process, and reliable infrastructure). Relevance and soundness are related to the information itself and thus correlated with content quality. The other two metrics depend on the quality of information transmission and the infrastructure. Hence, information quality is partially affected by media quality. As a result, this paper handles BI IAQ and BI ICQ separately to better understand the relationship between information quality and the other aspects of IS success model.

According to Popovic et al., BI information quality could be split into BI ICQ and BI IAQ; both dimensions are positively correlated with BI system maturity. Considering the features of BI, this paper determines and improves the connotations and denotations of BI ICQ, based on the ICQ examined by Popovic and other scholars, the research of information quality attributes, and the relevance and reliability in Eppler's information quality framework: the information is complete, precise, realistic, and consistent; the scope of information is appropriate; the information is not distorted, biased, or erroneous; the information is up-to-date and timely, and easily understandable to the users. This paper also determines and improves the elements and criteria of BI IAQ, based on the IAQ examined by Popovic and

other scholars, the research of information quality attributes, and the optimization process and reliable infrastructure in Eppler's information quality framework: the information is easy to access, acquire, and maintain; interactive access is allowed; the information can be processed and delivered swiftly and efficiently.

### 3. Hypotheses and Modeling

**3.1. Modeling.** From the perspective of information, this paper relies on IS success model and IAM to study the factors affecting BI UIA, in the light of BI features. It is assumed that information adoption is made up of subjective and objective factors, as well as their correlations and interactions. The influence on UIA was investigated in two dimensions, namely, BI ICQ and BI IAQ. Meanwhile, the authors highlighted the effects of EP, EEOU, and PR over UIA, three dimensions of perceived benefits and perceived loss, including both positive effects and negative effects. Furthermore, the authors studied the mediating effects of EP, EEOU, and PR on the relationship of UIA with BI ICQ and BI IAQ. The above theoretical models and BI features were synthesized to model the influence of BI information quality on UIA (Figure 1).

#### 3.2. Hypothesis

**3.2.1. BI Information Quality and Information Adoption.** Focusing on purposeful utilization of information, information adoption refers to the process in which users make judgement, selection, and decision of information [15]. The users will be more willing to adopt information, if they can acquire more comprehensive, timely, reliable, relevant, convenient, and authoritative information.

Some literature has shown that information quality is the criterion for user judgement of the effectiveness of information, and users are more willing to accept highly professional and reliable information. In fact, quality of information directly affects the UIA intent. Larcker and Lessig [27] claimed that users will use the information, which is sufficiently important to their decision-making (relevant, useful, meaningful, or significant) and readily available (well-formatted, clear, or readable). Filieri and McLeay [28] identified the six dimensions of information quality: timeliness, understandability, relevance, accuracy, value-added property, and integrity and suggested that these dimensions contribute to UIA. Sharma and Wang [29] discovered that an information platform providing complete, accurate, timely, and well-formatted information could maintain a good relationship with users, make them more satisfied, and retain users. Zha [30] examined the user search of academic information in Weibo and learned that users will have positive emotions and cognitions, when they perceive the high quality of information (complete, timely, relevant, accurate, and understandable). Cheng [31] held that the user comfort and judgement of a WeChat public account are influenced by the completeness, neatness, and diversity of the information pushed by the account, and these attributes determine whether the users would adopt

the information. Culnan [32] believed that information accessibility, manifested as convenient access to information sources and convenience of information supply, would affect the extent of information utilization.

Drawing on the above studies, there is reason to believe that the users will perceive BI information as positive, valuable, and comfortable, if the information is complete, precise, realistic, consistent, proper in range, easy to access, acquire and maintain, and in support of interactive access; In this case, users will be more willing to adopt BI information. For information adoption, information quality reflects the overall user cognition of information and directly affects information utilization. Therefore, this paper proposes the following hypotheses:

H1-1: BI ICQ promotes information adoption

H1-2: BI IAQ promotes information adoption

**3.2.2. EP and Information Adoption.** Considering the previous definitions of EP and our research contents, this paper defines EP as the degree of improvement to job performance perceived by users through using BI information.

Gonzalez et al. [33] demonstrated that the adoption of configuration management could be promoted by the benefits provided by managers, the usefulness of the system in work, and the productivity expected to acquire from the system. Wu [34] studied the factors affecting the mobile commerce users of 4G transactions. The empirical results show that the perceived usefulness significantly influences the willingness to adopt the mobile commerce of 4G transactions.

As they work with BI information, the users judge the return of using the information. The users would utilize and adopt BI information, if they found the information is useful, related to their work, in line with their usage habits, more beneficial than other resources, inspirational to their work, and conducive to their job performance. The willingness to use and adopt increases with the perceived usefulness.

According to Venkatesh et al.'s UTAUT, EP has a significant positive impact on user behavior and intent. Based on UTAUT, Song and Wang [7] modeled the information adoption behavior and empirically verified the direct effect of EP on user willingness to adopt. Therefore, this paper proposes the following hypothesis:

H2: EP promotes BI UIA

**3.2.3. EEOU and Information Adoption.** Considering the previous definitions of EEOU and our research contents, this paper defines EEOU as the degree of efforts to be paid by users to achieve their purposes or goals through BI information adoption.

Yan [35] demonstrated that users have a strong willingness to use Baidu products, if they feel that the interaction with these products is clear and that it is easy to learn how to skillfully use these products. After building and analyzing a learning behavior model of massive open online course

TABLE 1: Dimensions and indices of information quality.

Authors and year	Dimensions	Indices
Wang, 1996	Intrinsic information quality	Accuracy, objectivity, credibility, authority
	Associated information quality	Relevance, value-added property, timeliness, integrity, appropriateness
	Accessible information quality	Accessibility, access security
	Formal information quality	Interactivity, ease of understanding, conciseness, consistency
Eppler, 2006	Set layer	Comprehensiveness, accuracy, clarity, availability
	Product layer	Conciseness, consistency, correctness, contemporariness
	Process layer	Convenience, timeliness, traceability, interactivity
	Infrastructure layer	Accessibility, security, serviceability, swiftness
Alkhattabi, 2010	Scenario quality	Conciseness, verifiability, consistency, understandability, information quantity, authority, integrity
	Accessibility	Relevance, availability, accessibility, response time
	Intrinsic quality	Objectivity, accuracy, credibility
Filieri and McLeay, 2014	Information quality (one-dimensional)	Timeliness, understandability, relevance, accuracy, value-added property, integrity
Cao Ruicang et al., 2002	ICQ	Objectivity, correctness
	Information set quality	Relevance, integrity
	Information expression quality	Understandability, clarity, accuracy, consistency, conciseness
	Information utility quality	Usefulness, real-timeliness, background interpretation, appropriateness
Zha Xianjin et al., 2010	Information resource content	Correctness, integrity, relevance, novelty
	Information resource form	Accuracy, ease of use, cleanness, and degree of standardization
	Information resource system	Completeness, availability, responsiveness, reliability
	Information resource utility	Availability, appropriateness, utilization rate, value-added property
Li Jing, 2015	ICQ	Authenticity, accuracy, timeliness, and integrity
	Information utility quality	Demand satisfaction and practicality
Xu Jiahui et al., 2019	ICQ	Authenticity, integrity
	Information utility quality	Applicability, timeliness
	Information carrier quality	Systematicness, security, functionality, operability

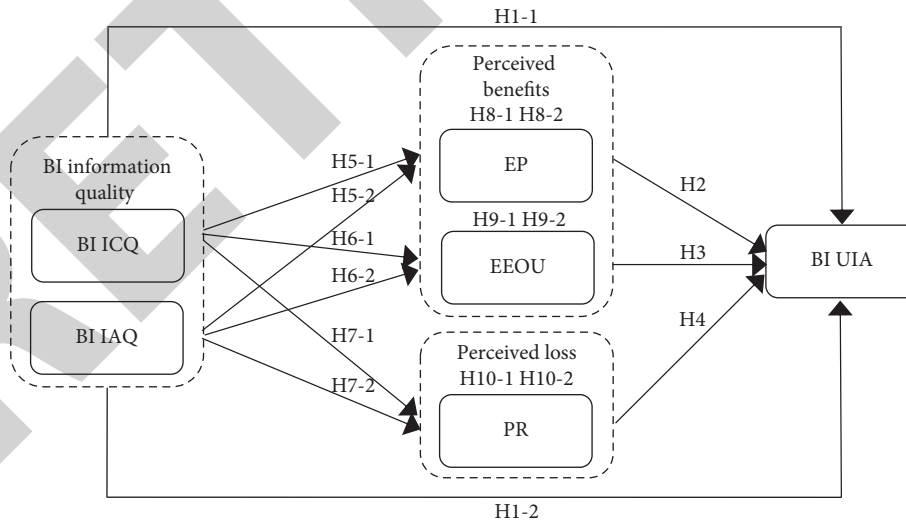


FIGURE 1: Model for the influence of BI information quality on UIA.

(MOOC), Wang and Mao [36] discovered that the students are very willing to learn on MOOC platform, if they perceive that the platform is easy to operate and utilize. During the work with BI information, the users can utilize the information without taking much effort, if the information is easy to acquire and understand. In this case, the users will be

more active about using BI information and more willing to adopt the information.

The UTAUT of Venkatesh et al. [8] also suggests that EEOU positively affects user behavior and intention. Song and Wang [7] derived an information adoption model from UTAUT and empirically demonstrated the direct influence

of EEOU over user willingness to adopt. Therefore, this paper proposes the following hypothesis:

H3: EEOU promotes BI UIA

**3.2.4. PR and Information Adoption.** Considering the previous definitions of PR and our research contents, this paper defines PR as the degree of uncertainty for the loss incurred after the users make decisions based on the information from BI system.

Pavlou [37] found that consumers could perceive the uncertainty of e-commerce environment and expected that PR would lower their willingness to transact online. Mallat discovered that the adoption of mobile payment will be affected by consumers' concerns about the privacy and security of this payment method. Bonnin [38] suggested that PR plays a key role in consumers' willingness to adopt: firstly, the users will not trust BI information, have a high PR of the information, and become reluctant to adopt the information, provided that they feel that the value of using BI information cannot offset the investment cost, or that the adoption of BI information will lead to wrong decisions and bring financial losses; secondly, the users will have a high PR and become unwilling to adopt BI information, if they are not experienced in using the information, unfamiliar with the information, and worried about the time and energy cost/loss of using the information, or if the adopted BI information cannot be fully utilized to meet the expected utility, resulting in poor job performance and losses. Therefore, this paper proposes the following hypothesis:

H4: PR suppresses BI UIA

**3.2.5. BI Information Quality and EP.** The measurement of EP mainly intends to evaluate the user expectation of the reward of information utilization, the degree of improvement to work results by the utilized information, and the user expectation of the degree of realization of their goals after using information. Sussman and Siegal [15] found that the integrity and accuracy of information have a significantly positive effect on the information usefulness perceived by knowledge workers. Zha [30] demonstrated that, when the users perceive the information of digital libraries as high-quality (i.e., complete, precise, and timely), they will feel that such information is useful, valuable, and helpful for their learning and work.

If the BI ICQ is high, BI integrates multisource information, and the information is complete, without any distortion, deviation, or error, the users will find the information can benefit their work or fulfill their work needs; if the information is precise and realistic, the users will find the BI information closely associated with their work and provides a good solution to their work problems; if the information is timely, and proper in range, the users will feel that the information is very useful, and utilizing the information would greatly facilitate their work.

Based on IS success model, Victor and Chen conducted an empirical study on business-to-business (B2B) e-commerce and discovered the positive effects of information

interaction and process quality on perceived usefulness. If BI IAQ is high, the information supports interactive access and boasts a high efficiency, giving inspiration to the users' work. Besides, the information can be processed and delivered swiftly. The high efficiency of the information will leave the impression that BI information is more beneficial than other resources, and contribute greater to job performance and work income. Therefore, this paper proposes the following hypotheses:

H5-1: BI ICQ promotes EP

H5-2: BI IAQ promotes EP

**3.2.6. BI Information Quality and EEOU.** The measurement of EEOU mainly aims to evaluate the degree of efforts saved in information utilization, the difficulty in information understanding and utilization, and the ease/difficulty of information acquisition and utilization. Lin and Lu [22] surveyed the factors affecting user acceptance of online shopping websites, using IS success model, TAM, and an exogenous variable (website system quality) and discovered the influence of information quality, response time, and system accessibility on EEOU. Cao et al. [39] and Yang et al. [40] carried out model fitting in the background of e-commerce and recommendation system function, respectively, and drew the following key conclusions: the EEOU of a thing is directly promoted by the accurate and clear display, reasonable sorting, and interaction function.

On the one hand, a strong capability of BI data integration and analysis ensures the quality of BI ICQ, the appropriateness of information range, the accuracy of information, and the visual display of information. As a result, the information will be easily understood by users, making it simple for the users to analyze information usefulness. After BI sorts out various structured and unstructured information, the information will become consistent, without any distortion, deviation, or error. Then, the users can directly make use of the information. On the other hand, a high BI IAQ means the information is easy to access, acquire, and utilize, as well as easy to maintain. The users will find it easy to obtain and use the information. With the proliferation of clients and 5G technology, BI information could be collected and used anytime anywhere. The convenience of information utilization will significantly reduce the user efforts needed to complete the same amount of work. Therefore, this paper proposes the following hypotheses:

H6-1: BI ICQ promotes EEOU

H6-2: BI IAQ promotes EEOU

**3.2.7. BI Information Quality and PR.** In general, bad information breeds poor decisions, resulting in unfavorable and harmful results. Information adoption is essentially a decision-making process, which is inevitably risky. Any user adopting information would worry whether his/her purpose could be achieved. Uncertain factors turn the users into risk-takers during information adoption.

PR originates from user uncertainty of information. If the information factors help the users judge the information validity, the users will perceive a high usefulness, and the PR of the information will be small. Studies have shown that the perceived information quality directly bears on PR. McKnight et al. [41] believed that the perceived information quality reduces risk cognition by increasing the perceived value of exchanged information. Sun [42] suggested that information factors facilitating individual judgement of validity normally reduce the PR of healthy information.

Firstly, a strong capability of BI data integration and analysis guarantees the ICQ, completeness, and consistency of BI information and eliminates distortion, deviation, or error. Then, the users will face less uncertainty in information utilization. Since the information is proper, precise, realistic, easy-to-understand, and up-to-date, the users will perceive a low risk of the mismatch between investment cost and information value, prevent the financial loss induced by wrong decisions in information use, and mitigate the risk perception of job performance.

Secondly, a high BI IAQ means the information is easy to access, acquire, and maintain. During information utilization, the users will spend less time and energy and perceive lower risk of loss. In addition, the information supports interactive access, quick processing, and fast delivery and meets use habits. Hence, the users will perceive higher advantages of information utilization and a lower PR. Therefore, this paper proposes the following hypotheses:

H7-1: BI ICQ suppresses PR

H7-2: BI IAQ suppresses PR

**3.2.8. Mediating Effect of EP.** The above analysis shows that BI information quality not only affects information adoption but also influences EP. Meanwhile, EP also has an impact on information adoption. The output quality of BI directly determines the usefulness and availability of information. If BI ICQ and IAQ are high, the information will be very helpful to users' work or learning, contribute to job performance, and increase the chance of user adoption of BI information. Hence, BI ICQ and IAQ could promote UIA via EP. Therefore, this paper proposes the following hypotheses:

H8-1: EP mediates the relationship between BI ICQ and information adoption

H8-2: EP mediates the relationship between BI IAQ and information adoption

**3.2.9. Mediating Effect of EEOU.** The above analysis shows that BI information quality not only affects the willingness to adopt but also influences EEOU. Meanwhile, EEOU also has an impact on information adoption. For users, high BI ICQ and IAQ mean the information is easy to understand and acquire and not costly to utilize. In this case, the users will be more likely to adopt BI information. Hence, BI ICQ and IAQ could promote UIA via EEOU. Therefore, this paper proposes the following hypotheses:

H9-1: EEOU mediates the relationship between BI ICQ and information adoption

H9-2: EEOU mediates the relationship between BI IAQ and information adoption

**3.2.10. Mediating Effect of PR.** The above analysis shows that BI information quality not only affects the willingness to adopt but also influences PR. Meanwhile, PR also has an impact on information adoption. The higher BI ICQ and IAQ, the better the information relevance, consistency, timeliness, accuracy, and integrity, the easier it is for the users to judge the validity of information, the lower the PR of BI information, and the greater the chance of user adoption of the information. Hence, BI ICQ and IAQ could promote UIA via PR. Therefore, this paper proposes the following hypotheses:

H10-1: PR mediates the relationship between BI ICQ and information adoption

H10-2: PR mediates the relationship between BI IAQ and information adoption

## 4. Empirical Analysis

**4.1. Sample Selection and Data Collection.** Our interviews target enterprise managers, who are familiar with BI, and capable of providing reliable and accurate answers. The original data were collected in three steps:

- (1) *Initial Questionnaire Survey.* The most suitable questionnaire was selected through field interviews and literature review and modified after face-to-face interviews on enterprise managers. All the questions in the preliminary questionnaire are accurate.
- (2) *Initial Survey.* The initial survey covered 33 respondents, including enterprise managers, master candidates, and six management professors. The questionnaire was subjected to reliability and validity tests. The improper questions were modified.
- (3) *Formal Survey.* The samples are Chinese enterprises registered in local governments. A random sample set of 780 enterprises was obtained from *Directory of Chinese Enterprises* through random sampling. The representativeness of the enterprises was guaranteed by a question "Has the enterprise adopted BI?"

To ensure the recovery rate, the questionnaire was distributed in two ways. First, a questionnaire survey was completed through semistructured interviews on enterprise managers attending master of business administration (MBA) and executive MBA (EMBA) programs in five colleges of Xi'an and Zhengzhou. Second, questionnaires were issued to enterprise managers via wenjuan.com, colleagues, and friends through such channels as field interview, e-mail, online chatting, etc.

The formal survey lasted from April to December, 2020. A total of 780 questionnaires were distributed, and 476 (61%) were recovered. After removing 33 incomplete



questionnaires and 20 incorrect ones, 423 valid questionnaires were retained for analysis.

The sample enterprises belong to construction industry, real estate industry, information transmission, software and IT services, manufacturing, etc. In terms of ownership, the samples can be divided into state-owned enterprises (SOES)/collective enterprises, private enterprises, foreign enterprises, and joint ventures. The samples come from Shanxi, Guangzhou, Shenzhen, and Shanghai. Among the respondents, 13.7% are enterprise owners, 28.4% are senior managers, 40.7% are middle-level managers, and 17.3% are junior managers; 9.7% have been working for less than 5 years, 44% for 6–10 years, 36.4% for 11–20 years, and 9.8% for over 21 years. The basic information of the samples is recorded in Table 2.

To assess nonresponse bias, the authors compared the differences between the 216 early questionnaires and the 200 medium and late-phase questionnaires. The *t*-test results show no significant statistical difference at  $p \leq 0.05$ . Hence, nonresponse bias does not affect our analysis.

**4.2. Variable Measurement.** To ensure the content reliability and validity of each latent variable and question, all the latent variables and measurement variables in our model were properly improved against mature scales. There are six latent variables in our model, each of which contains 3–7 measurement variables (questions). Specifically, BI ICQ was adapted from the results of Eppler [23]; the BI IAQ scale was modified from the results of Eppler [23]; EP was improved from the results of Davis [14], Venkatesh et al. [8], and Song and Wang [7]; EEOU was revised from the results of Davis [14], Venkatesh et al. [8], and Song and Wang [7]; PR was extended from the results of Wood and Scheer [43], Pavlou [37], and Venkatesh et al. [8]; information adoption was changed from the results of Davis [14], Sussman and Siegal [15], and Venkatesh et al. [8]. The measurement variables were rated against a 5-point Likert scale, where 1 represents strongly disagree and 5 represents strongly agree. The specific questions are listed in Table 3.

## 5. Results

The data were processed on statistical software like Amos 24.0 and SPSS 26.0. Firstly, the samples were subjected to validity and reliability tests on SPSS 26.0. Next, Amos 24.0 was applied to implement confirmatory factor analysis (CFA) on the measurement model of structural equation modeling (SEM). Finally, a path analysis was performed on the structural model, and the hypotheses were tested one by one.

**5.1. Measurement Model Testing.** An exploratory factor analysis (EFA) was conducted on the 423 samples to evaluate the latent factor structure of scale items. According to the initial factor solutions, a total of six factors were found to have an eigenvalue greater than 1. Table 4 presents 28 screened items. Among them, six factors had clear structures and explained 63.4% of the total variance of the 28 items. A

single factor could explain 34.5% of the total variance at the most. Therefore, our analysis is not severely affected by common method bias (CMB) [44].

To ensure data availability and result validity, this paper evaluates the reliability and validity of our model on Amos 24.0 and SPSS 26.0. The validity test inspects the content validity, convergent validity, and discriminant validity of the model.

In terms of content validity, all the latent variables and measurement variables (questions) were adapted from the literature and presurveyed before the formal survey. These actions guarantee the good content validity of our measurement model.

As shown in Table 5, the average variance extracted (AVE) of the latent variables in our model minimized at 0.501, which is above 0.5. Therefore, our measurement model boasts an ideal convergent validity [45].

The reliability of the measurement model can be tested by composite reliability (CR) and Cronbach's alpha, a measure of internal consistency. The model is deemed to have an ideal reliability, if both CR and Cronbach's alpha are greater than 0.7 [46]. As shown in Table 5, the minimums of CR and Cronbach's alpha were both above 0.7 (0.762 and 0.76), indicating the good reliability of our measurement model.

The discriminant validity could be tested by comparing the square roots of the AVE of latent variables and the correlation coefficients of these variables. If the former of a latent variable is greater than the latter, the measurement model must have a good discriminant validity [47]. As shown in Table 6, the square roots of the AVE of latent variables in our measurement model were always greater than the correlation coefficients between these variables. This means our measurement model boasts a good discriminant validity.

**5.2. SEM Results.** Based on the reliability and validity tests in the preceding section, this section makes an overall evaluation of the SEM. Two types of evaluation indices were chosen to ensure the rigor of the evaluation: (1) absolute fitness indices such as CMIN/DF, GFI, RMR, and RMSEA and (2) relative fitness indices such as NFI, AGFI, TLL, and CFI. The results of the modified SEM are recorded in Table 7. Obviously, every test index of our model perfectly satisfied the standard for each fitting index. Hence, our theoretical model fits the survey data well.

**5.2.1. Main Effects.** To test the main effects, the path coefficients and their significance are displayed in Figure 2. Only two of our hypotheses on the main effects were falsified: H1-2 (BI IAQ on information adoption) and H7-2 (BI IAQ on PR). The other nine hypotheses were proved valid:

H1-1 BI ICQ ( $\beta = 0.149$ ,  $p < 0.05$ ) significantly promotes UIA; H1-2 BI IAQ ( $\beta = 0.116$ ,  $p > 0.05$ ) does not significantly affect UIA; H2 EP ( $\beta = 0.374$ ,  $p < 0.001$ ), H3 EEOU ( $\beta = 0.235$ ,  $p < 0.001$ ), and H4 PR

TABLE 2: Statistics of the basic information of the samples.

Item	Type	Frequency	Percentage	Valid percentage	Cumulative percentage
Job	Owners	58	12.2	13.7	13.7
	Senior managers	120	25.2	28.4	42.1
	Middle-level managers	172	36.1	40.7	82.7
	Junior managers	73	15.3	17.3	100.0
Working years	<5	41	8.6	9.7	9.7
	6–10	186	39.1	44.0	53.7
	11–20	154	32.4	36.4	90.1
	>21	42	8.8	9.8	100.0
Industry	Construction and real estate	70	14.7	16.5	16.5
	Information transmission and software and IT services	77	16.2	18.2	34.8
	Manufacturing	146	30.7	34.5	69.3
	Others	130	27.3	30.7	100.0
Fixed assets	>10 million yuan	80	16.8	18.9	18.9
	10–20 million yuan	111	23.3	26.2	45.2
	20–50 million yuan	132	27.7	31.2	76.4
	>50 million yuan	100	21.0	23.6	100.0
Enterprise life	<10	78	16.4	18.4	18.4
	11–25	243	51.1	57.4	75.9
	>25	102	21.4	24.1	100.0
Ownership	SOES/collective enterprises	42	8.8	14.0	14.0
	Private enterprises	192	40.3	64.0	78.0
	Foreign enterprises	19	6.3	6.3	84.3
	Joint ventures	47	4.0	15.7	100.0
Number of employees	<300	130	27.3	79.3	79.3
	300–999	178	37.4	42.1	72.8
	1000–1999	79	16.6	18.7	91.5
	>2000	36	7.6	8.5	100.0

( $\beta = -0.212$ ,  $p < 0.001$ ) all significantly affect UIA and jointly explain 68% of the variance in UIA ( $R^2 = 0.68$ ).

H5-1 BI ICQ ( $\beta = 0.395$ ,  $p < 0.001$ ) and H5-2 BI IAQ ( $\beta = 0.265$ ,  $p < 0.001$ ) both significantly affect EP and jointly explain 36% of the variance in EP ( $R^2 = 0.36$ ).

H6-1 BI ICQ ( $\beta = 0.271$ ,  $p < 0.001$ ) and H6-2 BI IAQ ( $\beta = 0.411$ ,  $p < 0.001$ ) both significantly affect EEOU and jointly explain 39% of the variance in EEOU ( $R^2 = 0.39$ ).

H7-1 BI ICQ ( $\beta = -0.378$ ,  $p < 0.001$ ) significantly affect PR, but H7-2 BI IAQ ( $\beta = -0.148$ ,  $p > 0.05$ ) does not significantly affect PR.

**5.2.2. Mediating Effect Analysis.** In addition, this paper examines the mediating effects of EP, EEOU, and PR on UIA. Firstly, the constructs of EP, EEOU, and PR were removed from the structural model to observe the relationship of UIA with BI ICQ and BI IAQ. The results show that the path coefficient from BI ICQ to UIA was significant ( $\beta = 0.437$ ,  $p < 0.001$ ) and that from BI IAQ on UIA was also significant ( $\beta = 0.338$ ,  $p < 0.001$ ). Besides, the paths between different variables met the requirements for mediation test.

Next, EP, EEOU, and PR were added to the structural model. After the addition, the direct effect of BI ICQ on UIA weakened, but the path remained significant ( $\beta = 0.149$ ,

$p < 0.05$ ); the direct effect of BI IAQ on UIA became insignificant ( $\beta = 0.116$ ,  $p > 0.05$ ). The mediating effect analysis suggests that EP, EEOU, and PR partly mediate the influence of BI ICQ on UIA; EP and EEOU fully mediate the influence of BI IAQ on UIA; PR has an insignificant mediating effect on the influence of BI IAQ on UIA.

To further investigate the mediating effects of EP, EEOU, and PR, bootstrapping was employed to analyze the mediation process. The bootstrapping results are displayed in Table 8. The mediating effect is supported, if the significance of the indirect effects of BI ICQ and BI IAQ on UIA is nonzero [48]. The results show that all mediating effects were proved, except the mediating effect of H10-2 PR on the relationship between BI IAQ and UIA. Hence, the following hypotheses hold simultaneously: H8-1, H8-2, H9-1, H9-2, and H10-1.

## 6. Discussion

**6.1. Main Findings.** To disclose how BI information quality influences UIA, this paper fully considers subjective factors like EP, EEOU, and PR, objective factors like BI ICQ and BI IAQ, as well as the relationship between subjective and objective factors. It is assumed that BI information quality directly affects UIA; the effect is positive via EP and EEOU and negative via PR. Most of our hypotheses were proved through Amos data analysis.

TABLE 3: Scales.

Latent variables	Measurement items
BI Information Content Quality (BI ICQ)	(1) The BI information of my enterprise is complete
	(2) The BI information of my enterprise is accurate and close to reality
	(3) The BI information of my enterprise is consistent
	(4) The BI information of my enterprise is properly ranged
	(5) The BI information of my enterprise is not distorted, biased, or erroneous
	(6) The BI information of my enterprise is up-to-date and timely
	(7) The BI information of my enterprise is easy to understand
BI Information Access Quality (BI IAQ)	(1) The BI information of my enterprise is easy to access
	(2) The BI information of my enterprise is easy to acquire
	(3) The BI information of my enterprise is easy to maintain
	(4) The BI information of my enterprise is not compatible with interactive access
	(5) The BI information of my enterprise is quick to process and deliver
Expected Performance (EP)	(1) I can finish work tasks more quickly by making effective use of the BI information of my enterprise
	(2) I can save work time by making effective use of the BI information of my enterprise
	(3) I can improve work quality by making effective use of the BI information of my enterprise
	(4) I can improve work efficiency by making effective use of the BI information of my enterprise
Expected Ease-of-Use (EEOU)	(1) It is easy and not time-consuming to acquire, analyze, and understand the BI information of my enterprise
	(2) It often takes a lot of time to supplement or re-collect the BI information of my enterprise
	(3) It is easy to learn how to acquire and process the BI information of my enterprise
Perceived Risk (PR)	(1) The BI information of my enterprise is often insufficient or distorted, causing losses to my work
	(2) The BI information of my enterprise is often unavailable or unqualified, which impedes the progress and task fulfilment in my work
	(3) The BI information of my enterprise is often inadequate or untrustworthy, which requires me to devote time and efforts to supplementation or re-collection
	(4) The BI information of my enterprise is often not easy to acquire or not in line with my work habit, which brings me mental pressure
UIA	(1) The BI information of my enterprise helps me a lot at work
	(2) In future, I'm willing to make continuous use of the BI information of my enterprise at work
	(3) In future, I'm willing to make frequent use of the BI information of my enterprise at work
	(4) I'm in favor of and willing to adopt the BI information of my enterprise

TABLE 4: Factor loadings and cross loadings

Items	Factor loadings and cross loadings					
CQ1__1	<b>0.651</b>	0.177	-0.107	0.191	0.148	0.096
CQ1__2	<b>0.696</b>	0.163	-0.114	0.108	0.293	0.063
CQ1__3	<b>0.703</b>	0.220	-0.187	0.089	0.179	0.047
CQ1__4	<b>0.682</b>	0.172	-0.134	0.082	0.070	0.110
CQ1__5	<b>0.710</b>	0.186	-0.131	0.233	0.018	0.114
CQ1__6	<b>0.692</b>	0.164	-0.157	0.149	0.148	0.145
CQ1__7	<b>0.694</b>	0.119	-0.047	0.086	0.154	0.146
AQ1__1	0.234	<b>0.702</b>	-0.198	0.153	0.122	0.124
AQ1__2	0.197	<b>0.795</b>	-0.091	0.096	0.064	0.092
AQ1__3	0.246	<b>0.725</b>	-0.064	0.105	0.067	0.165
AQ1__4	0.288	<b>0.646</b>	-0.037	0.154	0.276	0.094
AQ1__5	0.120	<b>0.666</b>	-0.108	0.120	0.218	0.158
PR1__1	-0.121	-0.172	<b>0.802</b>	-0.128	-0.153	0.020
PR1__2	-0.164	-0.029	<b>0.776</b>	-0.154	-0.150	0.027
PR1__3	-0.176	-0.053	<b>0.799</b>	-0.028	-0.161	-0.020
PR1__4	-0.137	-0.146	<b>0.734</b>	-0.086	-0.031	-0.102
PE1__1	0.205	0.064	-0.158	<b>0.706</b>	0.227	0.096
PE1__2	0.179	0.185	-0.136	<b>0.755</b>	0.115	0.069
PE1__3	0.159	0.148	-0.076	<b>0.722</b>	0.217	0.024
PE1__4	0.131	0.118	-0.052	<b>0.754</b>	0.144	0.121
IA1__1	0.212	0.194	-0.209	0.157	<b>0.700</b>	0.202
IA1__2	0.240	0.170	-0.115	0.251	<b>0.703</b>	0.113
IA1__3	0.216	0.141	-0.122	0.213	<b>0.710</b>	0.097
IA1__4	0.171	0.197	-0.213	0.250	<b>0.604</b>	0.204
EE1__1	0.265	0.264	-0.047	0.154	0.116	<b>0.714</b>
EE1__2	0.098	0.095	0.062	0.075	0.179	<b>0.801</b>
EE1__3	0.165	0.175	-0.091	0.068	0.133	<b>0.755</b>

TABLE 5: AVE, CR, and Cronbach's alpha values of measurement variables.

Dimensions	Items	Unstandardized coefficient	Standard error	T-value	p value	Standardized coefficient	Cronbach's alpha	CR	AVE
BI ICQ	CQ1__1	1				0.679	0.875	0.875	0.501
	CQ1__2	1.060	0.080	13.226	***	0.735			
	CQ1__3	1.034	0.078	13.285	***	0.739			
	CQ1__4	0.966	0.080	12.072	***	0.662			
	CQ1__5	1.099	0.083	13.184	***	0.732			
	CQ1__6	1.117	0.084	13.239	***	0.736			
	CQ1__7	0.953	0.078	12.173	***	0.668			
BI IAQ	AQ1__1	1				0.744	0.842	0.843	0.519
	AQ1__2	1.034	0.071	14.552	***	0.775			
	AQ1__3	0.995	0.072	13.749	***	0.726			
	AQ1__4	0.907	0.068	13.343	***	0.704			
	AQ1__5	0.883	0.072	12.280	***	0.646			
EP	PE1__1	1				0.718	0.809	0.809	0.515
	PE1__2	1.084	0.086	12.613	***	0.741			
	PE1__3	1.009	0.082	12.246	***	0.709			
	PE1__4	0.952	0.078	12.144	***	0.701			
EEOU	EE1__1	1				0.769	0.756	0.759	0.512
	EE1__2	0.872	0.083	10.545	***	0.707			
	EE1__3	0.750	0.072	10.441	***	0.668			
PR	PR1__1	1				0.819	0.833	0.835	0.560
	PR1__2	0.932	0.061	15.282	***	0.760			
	PR1__3	0.900	0.059	15.216	***	0.757			
	PR1__4	0.763	0.059	12.930	***	0.646			
BI UIA	IA1__1	1				0.768	0.818	0.819	0.531
	IA1__2	0.954	0.071	13.503	***	0.738			
	IA1__3	0.911	0.070	13.110	***	0.710			
	IA1__4	0.888	0.069	12.880	***	0.696			

TABLE 6: Square roots of AVE and correlation coefficients of variables.

Dimensions	ICQ	IAQ	EP	EEOU	PR	UIA
ICQ	0.7078					
IAQ	0.6580	0.7204				
EP	0.5610	0.5170	0.7176			
EEOU	0.5420	0.5880	0.4260	0.7155		
PR	-0.4720	0.3980	-0.4070	-0.2010	0.7483	
UIA	0.6600	0.6270	0.6930	0.5810	-0.5200	0.7286

Note: the diagonal numbers are square roots of AVE; the other numbers are the Pearson correlation coefficients between different dimensions.

TABLE 7: Fitness index values of our conceptual model.

Fitness index	CMIN/DF	RMR	RMSEA	GFI	IFI	CFI	TLI	AGFI
Test value	1.155	0.030	0.019	0.940	0.990	0.990	0.989	0.928
Reference value	<3	<0.08	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9

Note: CMIN/DF, RMR, RMSEA, GFI, IFI, CFI, TLI, and AGFI are short for chi-square/degree of freedom, root mean square residual, root mean square error of approximation, goodness of fit index, incremental fit index, comparative fit index, Tucker Lewis index, and adjusted goodness of fit index, respectively.

First, BI ICQ has a significant relationship with UIA, indicating that BI ICQ can directly affect UIA. Thus, H1-1 is proved valid. It is believed that, as BI gets more complete, accurate, timely, and understandable, the information will leave users a better first impression (more positive and more comfortable), and the willingness of UIA will be directly improved. In other words, BI ICQ is positively correlated with UIA.

Second, EP, EEOU, and PR have a significant relationship with UIA, indicating that these three factors directly bear on UIA. Thus, H2-4 are well established. It is believed that the users can perceive how BI information help with their work; the less the efforts required to realize the same job performance, the more likely the UIA [8]. In the meantime, the information adoption will be greatly affected by information uncertainty and the perception and evaluation of risk [49].

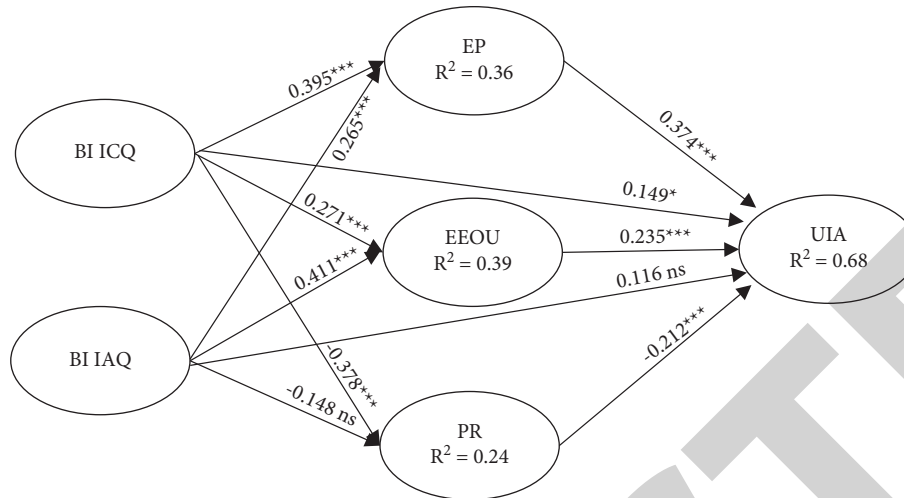


FIGURE 2: Results of our model. Note: \*\*\*, \*\*, and \* represent  $p < 0.001$ ,  $p < 0.01$ , and  $p < 0.1$ , respectively; ns means the influence is insignificant.

TABLE 8: Mediating effect test results of standardized bootstrapping.

Path	Effect	Standard error	Bias-corrected 95% CI			Percentile 95% CI		
			Lower	Upper	$p$ value	Lower	Upper	$p$ value
stdIndA1	0.148	0.061	0.059	0.309	0.001	0.053	0.285	0.002
stdIndA2	0.064	0.032	0.016	0.147	0.013	0.003	0.128	0.040
stdIndA3	0.080	0.028	0.036	0.146	0.000	0.031	0.138	0.001
stdIndB1	0.099	0.050	0.028	0.225	0.002	0.024	0.214	0.003
stdIndB2	0.097	0.049	0.022	0.226	0.011	0.012	0.209	0.023
stdIndB3	0.031	0.023	-0.004	0.090	0.088	-0.007	0.084	0.129

Note: stdIndA1: BI ICQ → EP → UIA; stdIndA2: BI ICQ → EEOU → UIA; stdIndA3: BI ICQ → PR → UIA; stdIndB1: BI IAQ → EP → UIA; stdIndB2: BI IAQ → EEOU → UIA; stdIndB3: BI IAQ → PR → UIA.

The analysis results support our hypotheses that EP and EEOU are positively correlated with UIA, while PR is negatively correlated with UIA. It was learned that the influence of EP ( $\beta = 0.374$ ,  $p < 0.001$ ) on BI UIA is far greater than that of EEOU ( $\beta = 0.235$ ,  $p < 0.001$ ) and PR ( $\beta = -0.212$ ,  $p < 0.001$ ). That is, BI users would first satisfy EP and then consider EEOU and PR.

Third, BI ICQ is significantly correlated with EP, EEOU, and PR, respectively. This means BI ICQ can directly influence EP, EEOU, and PR, which validates H5-1, H6-1, and H7-1. It is believed that BI information content is an important source of user decision-making. The decisions largely depend on the validity of the information content. The higher the BI ICQ, the better the job performance, and the lower the analysis difficulty and use burden [50]. Moreover, a high BI ICQ promises a very low information uncertainty in the eyes of the users. It was learned that BI ICQ had a positive effect on EP ( $\beta = 0.395$ ,  $p < 0.001$ ), which is greater than that on the other two factors; BI ICQ had a negative effect on PR ( $\beta = -0.378$ ,  $p < 0.001$ ), which is only weaker than that on EP; BI ICQ had a positive effect on EEOU ( $\beta = 0.271$ ,  $p < 0.001$ ), which is smaller than that on the other two factors.

BI IAQ has a significant relationship with EP and EEOU, respectively. That is, BI IAQ can directly influence users' EP

and EEOU, which supports H5-2 and H6-2. It is believed that a high BI IAQ can greatly lighten the use burden of users and create the feeling of efficiency and convenience, thereby affecting user EEOU. This result agrees with Huang et al. [51], who held that IS acquisition efficiency helps to weaken the use burden. Meanwhile, a high BI IAQ, coupled with interactive access to BI information, allows users to solve work problems more pertinently and inspires their learning and work [11], thereby affecting EP. It was learned that BI IAQ had a positive effect on EEOU ( $\beta = 0.411$ ,  $p < 0.001$ ), which is greater than that on the other two factors; BI IAQ had a positive effect on EP ( $\beta = 0.265$ ,  $p < 0.001$ ), which is only weaker than that on EEOU.

Fourth, BI ICQ has a significant indirect effect on UIA via EP, EEOU, and PR. Hence, H8-1, H9-1, and H10-1 hold. BI IAQ can significantly and indirectly affect UIA via EP and EEOU, evidence to H8-2 and H9-2.

Comparing the multiple mediating effects, the indirect influence from BI ICQ over UIA is the most significant via EP: the path effect is 0.148 and SE = 0.061; the indirect influence is less significantly via EP and EEOU, and these two paths have comparable effects: 0.099, SE = 0.050 vs. 0.097, SE = 0.049; the indirect influence via PR ranks the third, with 0.080, SE = 0.028; the smallest indirect influence takes place via EEOU, with 0.064, SE = 0.032.

Judging by the total mediating effect of each mediator variable between dependent and independent variables, the EP has the largest total mediating effect of BI ICQ-UIA and BI IAQ-UIA, followed in turn by EEOU and PR.

Fifth, BI IAQ ( $\beta = 0.116, p > 0.05$ ) does not have a significant direct impact on information adoption, which does not support H1-2. The main function of BI is to assist user decision-making with information. The information content is an important reference for decision-making. That is, the content quality is particularly important to users. At the initial contact with business information, the users are most concerned about ICQ. If ICQ leaves them a good first impression, the users will adopt the information, even if they do not perceive IAQ so well at the beginning.

BI IAQ ( $\beta = -0.148, p > 0.05$ ) has a negative impact on PR, but the impact is not significant. This result does not support H7-2. For BI users, a poor IAQ will cause some waste to time and energy and bring inconvenience to information access. However, it will not lead to serious decision errors or work losses. That is why a low IAQ will not greatly impact PR.

**6.2. Management Suggestions.** Based on the above results, this paper puts forward several management suggestions for enterprises to enhance BI information quality and promote UIA.

First, further optimize BI information content, leaving users a good initial impression of ICQ. The information content is an important reference for user decision-making. The users are particularly sensitive to and concerned about ICQ. In this age of online big data, the users face a huge amount of data, which are more complex than ever before. To encourage users to adopt information at the first sight, BI must keep pace with the times. More mature BI systems should be built with enhanced capability of data integration and analysis, such that the users can have a positive, comfortable first impression of ICQ.

Second, to satisfy user's performance demand, we need to integrate cloud computing to present users more complete and comprehensive information. The information being mined must be more timely, more precise, and more applicable to the specific problem, and truly help users with their work. It is necessary to provide personalized design of BI information access and improve intelligent interactive access of the information. For instance, natural language could be incorporated to BI, allowing users to perform visual interactions like interpersonal communication. Besides, the information should be acquired and processed more quickly to satisfy various work needs, thereby enhancing user EP. While improving BI information quality, the users should improve their sensitivity and judgement of information and learn how to recognize useful information. This is the way to further elevate user EP and promote UIA.

Third, to satisfy user's demand for EEOU, we should develop mobile apps and WeChat apps, integrate search techniques, and streamline BI information acquisition. The goal is to enable users to acquire useful information anywhere anytime. The ease of maintenance of the information

should also be increased, so that the users can acquire and use information without paying much efforts and pursue a better performance. Sort out structured and unstructured information more effectively, making information orderly and consistent. Moreover, we should strengthen the global visualization and visual analysis functions of BI information, a guarantee of the intuitive understanding and utilization of the information. Then, the users will face little burden or obstacle in comprehension and adoption and have a much higher EEOU. Furthermore, the users should be provided trainings on information quality and skills to promote their EEOU, which in turn boosts UIA.

Fourth, to satisfy user's PR, we must consider the influence of PR on UIA and minimize the user PR of BI information quality. For one thing, we must concentrate our energy on ICQ improvement, prevent insufficient or distorted information, keep BI information stable, and guard against the information loss caused by utilization. In addition, we need to increase the precision and visualization of BI information and display the information intuitively to the users. Then, the users will be certain about the information, save time and energy in information utilization, and have a lower PR. If so, UIA is bound to increase. For another, user guidance and training should be provided to enhance their risk judgement accuracy and improve their knowledge background and structure for information screening and analysis.

**6.3. Contributions.** By exploring the causes and effects, this paper identifies the key factors in BI information activities. Amidst complex big data and complicated user demands, the main contribution of this research is to deeply investigate the action mechanism of BI UIA from the angle of information quality, based on the existing IS success model and information adoption model.

- (1) This is the first empirical study on BI UIA. From the angles of BI ICQ and BI IAQ, three dimensions, namely, EP, EEOU, and PR, of perceived benefits and perceived losses were considered simultaneously [10, 23, 28]. Both positive and negative effects of these dimensions on BI information quality were examined. On this basis, the authors discussed the relationship between BI information quality and user perception and the joint effect of the two factors on BI UIA.
- (2) This paper extends the research scope of the relationship between information quality and user perception. Previously, researchers merely focused on the relationship between information quality and perceived benefits, overlooking that between information quality and perceived losses. Some scholars tried to substitute perceived losses with other dimensions, e.g., replacing PR with perceived trust. However, perceived trust can only reduce PR, rather than fully substitute PR. It is this research that truly establishes the relationship between information quality and PR.

- (3) Based on the theories on IS and technology acceptance, as well as the literature of information adoption, this paper probes deep into BI UIA and stresses user attitude and perception [18, 52] rather than functional benefits, providing the panorama of IS success. Traditionally, researchers in the field of IS merely focus on the functional benefits brought by technology. The lack of diverse perspectives has evoked confusion and criticism. In the era of big data, questioning this focus is the first step to full understanding and implementation of BI success. To solve the problem, it is necessary to take views and dimensions other than functional benefits.

**6.4. Limitations and Future Directions.** There are three limitations of this research: First, this paper mainly tackles the antecedents of UIA. The future research could further explore the effects of BI UIA on corporate decision-making and performance.

Second, this research relies heavily on the data of corporate self-reports. To obtain more robust results, objective data need to be introduced to future research.

Third, the research results might not be universal, because the authors only utilized the data on Chinese enterprises. In future, our model needs to be tested again with the data on enterprises from other countries.

## 7. Conclusions

In the era of big data, BI has gained popularity and attracted the attention of various scholars. By integrating the information from multiple ISs, BI provides useful information to users and helps to boost corporate competitiveness. Many previous studies on BI are limited to technology, system features, or quantitative descriptions. There is little report on the behaviors of BI users. To better understand BI user behaviors, this paper probes deep into BI UIA through field survey and in-depth discussion and predicts how UIA is influenced by subjective factors like EP, EEOU, and PR and objective factors like BI ICQ and BI IAQ. In addition, the authors studied how BI information quality associates with EP, EEOU, and PR and works with them to affect UIA. The results show that BI ICQ directly affects UIA and indirectly affects the latter via EP, EEOU, and PR; BI IAQ does not have a significant directly impact on UIA, but can indirectly affect the latter via EP and EEOU. Our research opens a new perspective into BI research and reminds enterprises to focus on information quality and user factors in BI implementation and management.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this study.

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