**Does** **AI-technology-based** **indoor** **environmental** **quality** **impact** **occupants’** **psychological,** **physiological** **health,** **and** **productivity?**

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**Abstract**

Over the past century, because of increased global travel, there high growth in the travel and tourism sector. But the outbreak of an ongoing pandemic has changed this scenario, which has put tremendous focus on the Indoor Environmental Quality (IEQ) embedded with the application of technologies, especially artificial intelligence (AI). This study aims to investigate the effect of AI-technology-based IEQ in the hospitality industry on occupants’ productivity through their psychological and physiological health. Drawing from Job demand - resource theory and Nudging philosophy, we formulated the hypoth-esis and conceptual model, which was empirically tested by structural equation model-ing (SEM). The results show that AI-technology-based IEQ is statistically significant in people’s behavioral change, which reflects on occupants’ health and productivity. Notably, AI-technology-based IEQ of the hospitality industry had a greater influence on occupants’ productivity, followed by their psychological and physiological health.

**Keywords** Artificial Intelligence (AI) · Technology · Indoor environmental quality (IEQ) · Hospitality industry

**1** **Introduction**

As per the Competitiveness Report, India is ranked 34th in Travel & Tourism. However, the current epidemic (COVID-19) has changed the current scenario. It poses a significant threat to the travel and tourism industry. Although the world is not facing such a situation for the first time. Before COVID-19, we saw various types of viruses such as SARS – CoV, 2003 and MERS – Cov, 2012, but COVID-19 is more infectious and can spread readily and cause severe disease to a person with existing health problems (Balabantaray et al., 2022; Torales et al., 2020; Guan et al., 2020; Guo et al., 2020).

Now slowly, the situation becomes controllable but still, people are scared to join their workplace. But, it looks impossible to stay at home, we need to go to work to keep the economy going (Gossling et al., 2020). The fear of contracting COVID-19 will probably make hospitality workers quite anxious about coming into contact with a sick customer or coworker. Maintaining social distance while at work is one of the obstacles. Because they must continue to engage in face-to-face interactions with clients and coworkers, hospitality workers have been designated as a high-risk population for coronavirus infection. One of the challenges is how people can maintain social distance while at work. It requires a low level of social contact and was regarded as a solution for service industries (Elavarasan and Pugazhendhi, 2020). For this purpose, the upgradation of AI technologies in IEQ plays a significant role.

Over the years, IEQ features have been changing continually. For example, the concept of a sprinkler system emerged after the fire incident at the Royal Opera House in London. Installation of metal detectors after the terrorist attack on September 11. Today, the world faces the COVID-19 pandemic, which may stay with us for years to come. Therefore, the concept of AI technology-based IEQ needs investigation to reduce the risk of coronavirus and other health issues not only today but also for future outbreaks (Dietz et al., 2020; Pinheiro and Luís, 2020; Larsson, 2020; Kumar and Kansara, 2018). Its biophilic design features (e.g., automatic air purifier, automatic ventilation system, sensor-based thermal settings, touch-less layout, and suficient workspace) enhance the immunity and ability to resist viruses by providing healthy and safe workspaces (Pinheiro & Luís, 2020).

The hospitality industry is a service-based industry in which the organization’s quality is determined by the quality of service provided by the occupants (Bettencourt & Brown, 2003; Schneider et al., 2005). Hospitality occupants are willing to know the features of AI technology-based IEQ and how they affect the occupants’health and productivity outcomes. However, no reported studies have observed such a critical subject from a methodical view-point (Belanche et al., 2020; Kansara et al., 2022). And, For customers, AI applications provide contactless interaction and created technology-based service encounters (Bangwal et al., 2022; Ivanov & Webster, 2019), thus affecting customers’as well as occupants’expe-riences and behaviors.

Numerous studies establish that the IEQ of the organization influences occupants’health, satisfaction, and productivity (Samet & Spengler, 2003; Fanger, 2006, Bangwal, 2019a). A better IEQ leads to more satisfied occupants, which eventually influences the quality of ser-vice for customers and better outcomes for the businesses (Yoon et al., 2016; Niehoff et al., 2013; Singh et al., 2010; Thayer et al., 2010). Thus the objective of this study is to find the impacts of AI technology-based IEQ on an objective measure of occupants’ psychological and physiological health and occupants’ self-rated productivity. The IEQ both directly and

indirectly influences occupants’psychological and physiological health. Directly it provides an enhanced indoor environment at the individual level and indirectly reduces the risk of getting sick and enhances the ability to resist viruses (Yudelson, 2008; Bangwal, 2019a; Dodo, 2020; Kashav et al., 2022). Therefore, the hospitality organization needs to recognize the answer to the following research questions:

RQ1- what is the role of AI technology-based IEQ?

RQ2- How AI technology-based IEQ reduces the risk of disease transmission and see whether the AI technology-based IEQ may affect occupants’psychological and physiologi-cal health and productivity level. If yes, then what are the actions of linking?

Thus, this study may help to amplify the knowledge about the AI technology-based IEQ in the hospitality industry and how they affect the occupants’ health and productiv-ity outcomes by using the job demands resources (JD-R). According to the job demands-resources (JD-R) model theory, strain (i.e., health issues) is caused by a mismatch between job demands (i.e., unfavorable IEQ) and job resources (i.e., AI technology-based IEQ). As per the JD-R model, the existence of job demands (e.g., unfavorable IEQ) can cause psy-chological and physiological health issues, leading to adverse employee outcomes such as lower employee productivity (Bakker and Demerouti, 2014).

**2** **Literature** **review** **and** **hypothesis** **development**

**2.1** **AI** **technology-based** **IEQ**

AI technology-based IEQ is the most comprehensive and emerging strategy to enhance the occupant’s health and productivity. AI technology-based IEQ is a major movement that is seen to shape the future of tourism (Yeoman & McMahon-Beattie, 2018) via changes that will impact the way tourism and hospitality providers interact with travelers. Moreover, technological advances within tourism create changes in consumer as well as occupants’ behavior (Urquhart, 2019) and subsequently significant opportunities for tourism organiza-tions to use technology to gain a competitive advantage. A recent business report on key megatrends and market disruptors suggests that technology and new ways of engaging and interacting with customers and occupants are fuelling the rate of disruption as currently businesses can reach new customers in new ways and can reinvent customer engagement around service and convenience (Boumphrey, 2019). The key to this “know-how” is a con-sumer-centricity approach that is important for an evolved tourism and hospitality offer and service (Bangwal et al., 2022; Boumphrey, 2019).

In the current study, AI technology-based IEQ is defined as an ecological indoor design equipped with technology, which has an automatic air purifier, automatic ventilation system, sensor-based thermal settings, and touch-less layout, to support human health and produc-tivity (Cirrincione et al., 2020; Geng et al., 2017; Bangwal et al., 2019a).

While the IEQ has been a concern for more than decades, few studies investigated the linkage between IEQ and productivity (Garland et al., 2013; Lee, 2013) likewise there is an absence of literature that investigates the role of AI technology-based IEQ on occupants wellbeing (psychological and physiological health) and productivity. Hence the present study intends to fill this gap. The study operationalizes the AI technology-based IEQ both in the context of the front and back of the house space. Back-of-the-house space (BOH) is

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defined as an area used or required for one’s work. It can be a cabin, cubical, or worksta-tion. For example, the hotel reservation team or sales team does not have direct contact with occupants and guests. Front of the house space (FOH) is defined as an area of socializa-tion and circulation, for example, hotel reception, cafeteria, and operational area (Bangwal, 2017a). The management must be careful about their IEQ to take advantage of the yields of superior productivity.

Drawing from the conceptual lenses of the job demands-resources (JD-R) model (Bakker & Demerouti, 2014, 2017; Demerouti et al., 2001). we hypothesize that the AI technology-based IEQ would significantly affect occupants’ productivity because indoor environment quality has similar or identical effects on occupants’ productivity as other job demands. Additionally, the hypothesis also draws upon the works of Nieuwenhuis et al., (2014), that support the argument that biophilic designs have a restorative effect and thus positively influence the various occupants’-related outcomes including productivity. All these studies view internal environment quality as the resources or environmental resources that enhance the ability to cope with demands and/or higher levels of work engagement (Bangwal et al., 2022) Therefore, based on these arguments, we hypothesize.

H1: AI technology-based IEQ is significantly and positively associated with occupants’ productivity.

**2.2** **Link** **between** **Technology-based** **IEQ** **and** **health**

After the COVID-19 pandemic, many hospitality industries adopted technology-based platforms such as AI-based check-in in hotels, and contactless food and beverage services (Li et al., 2019). These AI technology initiatives played a significant role in controlling disease transformation (Nguyen, 2020). After this, AI technology adoption has increased rapidly in the hospitality industry (Zhou et al., 2020; Kumar et al., 2021). In the hospitality industry, Intelligent technologies have been introduced by following the core technologies such as the Internet of Things, data mining, data visualization, cloud computing, voice, and face recognition, intelligent service desks, intelligent workspace, and robots (Ivanov & Webster, 2019). These technologies have become essential to reducing social interactions and maintaining social distance with customers and occupants in the service industries. AI applications provide contactless interaction and created technology-based platforms (Ivanov & Webster, 2019), thus affecting occupants’ experiences and behaviors. Previous research investigated the effect of technology or human occupants alone on service out-comes. However, the combined effect of technology and occupants through human-robot cooperation on customer service outcomes deserves more investigation (Giebelhausen et al., 2014; Kumar, 2015). Additionally, on the recommendations of the International Interior Design Association (IIDA) and theoretical frameworks of the job demands-resources (JD-R) model (Bakker & Demerouti, 2014, 2017; Kumar et al., 2013). we hypothesize that AI technology-based IEQ IEQ would significantly affect occupants’ psychological and physi-ological health.

H2a: AI technology-based IEQ is significantly and positively associated with occupants’ psychological health.

H2b: AI technology-based IEQ is significantly and positively associated with occupants’ physiological health.

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**2.3** **Link** **between** **Health** **and** **Productivity**

The psychological and physiological health conditions decrease the levels of occupants’ productivity (Yeh et al., 2019; Pereira et al., 2015; Kessler et al., 2003; Dewa and Lin, 2000). According to Burton et al. (2005), unhealthy occupants are 12.2% less productive than their counterparts. Various other researchers also investigate that an occupant’s psy-chological and physiological health affects productivity (Amerio et al., 2020; Pieper et al., 2019; Monzani et al., 2018; Thatcher and Milner, 2012; Street and Lacey, 2019; Grawitch et al., 2017; Yang et al., 2008; Kirkcaldy and Siefen, 2002; Lu et al., 1999). Additionally, Dewa and Lin (2000) argue that occupants suffering from psychological and physiological problems are less likely to show up for work and require more effort to function while at work, relative to those occupants who are psychologically and physiologically fit (Pieper et al., 2019; Hemp, 2004; Kessler et al., 2003). Therefore occupants’ psychological and physiological health is one of the most important factors of productivity and, thus, is tre-mendously expensive to employers. It is estimated that more than $80 billion is lost each year in the loss of productivity related to health issues (Mann, 1996). In the hospitality industry, occupants must stay psychologically and physiologically healthy to provide better and safe services and maintain competitiveness. Otherwise, it will decrease occupants as well as organizational productivity (Pieper et al., 2019; Monzani et al., 2018; Grawitch et al., 2015; Evans et al., 2006; Faragher et al., 2005; Humbeek et al., 2004). Therefore, based on these works and drawing from the theoretical framework of the job demand–resources model, biophilia hypothesis (Ostner, 2021), and nudging philosophy (Venema & van Gestel, 2021), we hypothesize that occupants’ well-being (both psychological and physiological health) would significantly affect occupants’ productivity. Grounded in these theoretical frameworks, we propose that.

H3a: Occupants’ psychological health positively associated with productivity. H3b: Occupants’ physiological health positively associated with productivity. **Proposed** **research** **model**.

We developed the hypothesis and conceptual model displayed in Fig. 1 based on the literature and theory. The conceptual model is composed of one exogenous latent variable ‘Indoor environmental quality (IEQ)’, which is represented by ‘front of the house space’ (FOH) and ‘back of the house space’ (BOH) one endogenous latent variable ‘occupants’

**Fig.** **1** Purposed research model

productivity (EPR)’and two meditating variables ‘occupants’psychological health (EPSH)’ and ‘occupants’ physiological health (EPHH)’.

**3** **Methodology**

This study adopted a quantitative approach to test the proposed hypotheses. Data were col-lected only from LEED-certified hotels referred to herein as Vana Malsi Estate located in northern India, Uttarakhand, ITC Grand Chola located in southern India, Chennai, and JW Marriott located in western India, Mumbai. ITC Grand Chola and Vana Malsi Estate Lead-ership in Energy & Environmental Design (LEED) is a commonly used rating system in the United States. LEED aims to reduce the environmental footprint of buildings while simultaneously protecting occupant comfort and health. However, despite the five key areas of LEED, we worked only with Indoor environmental quality (IEQ). As IEQ is directly connected to individual occupant health and productivity (Gou, 2016). LEED standards fol-low a biological systems approach and include the subsequent components of health such as natural air, natural light, proper ventilation, acoustics, and thermal comfort (Hui et al., 2015; Kuziemko, 2015).

**3.1** **Research** **Design**

An internet-based survey questionnaire about the IEQ was designed, which facilitates users to fill it out on a mobile device. Developing the items for various constructs such as, self-reported productivity was decided based on the literature and in consultation with academi-cians and industry experts. Items of workspace and departmental space which is used for IEQ were taken from Bangwal et al. (2019b). For measuring, self-reported psychological and physiological health, items from Warwick-Edinburgh, (2007) and Spence et al. (1987) were used. As shown in Table II, Cronbach’s alpha was used to ensure the internal reliability of items, and items’ content validity was tested with the support of academia and industry experts and further validated by the discriminant and convergent validity by using AMOS 26.0.

This paper investigates the relationships between IEQ, self-reported psychological & physiological health, and self-reported productivity among the occupants’. The question-naire was circulated to respondents via the internal mail systems from June 2020 to January 2021. 450 questionnaires were randomly distributed. 302 questionnaires were received and used for the investigation, and the other was omitted due to incomplete information. The sample size is suficient to support the statistical analysis through structural equation model-ing. In our case, the response rate was 67% which was greater than 10%, which meant there was no issue of sample bias. The respondents’contribution was voluntary and no compensa-tion was given for the same. Finally, to verify the conceptual model and model fitness, the collected data were analyzed by using structural equation modeling.

The survey questionnaire was separated into five sections: the first section comprises occupants’demographic information, such as organization name, job status, occupants’age, gender, and education. The second section comprises IEQ, occupants’psychological health, occupants’physiological health, and occupants’productivity. To measure the items, a five-point Likert scale was used.

**4** **Data** **analysis** **and** **results**

**4.1** **Sample** **characteristics**

Table I shows the demographic characteristics of the respondents. Out of 302 respondents, 61% were male, and 39% were female. Selected respondents were divided into two catego-ries front of the house and back of the house. 57% of respondents were selected from the front of the house, and 43% were selected from the back of the house. In addition, 59% of respondents were between the ages of 30 and 40, while 41% of respondents were between the ages of 40 and 50.

**4.2** **Common** **method** **bias**

Common method variance has been considered an important concern in the behavioral sci-ences. Common method variance is a severe and challenging issue that has the potential to affect the validity of the findings. As the present study is based on self-reported data, it cre-ates a problem of common method bias, which inflates associations among variables (Pod-sakoff et al., 2003; Kumar, 2020). To minimalize the CMB, Harman’s single factor score method, exploratory factor Analysis by using principal component analysis and marker vari-able test was adopted. In our study, we took EPHH as a marker variable as it has shown a low correlation (-0.12) as compared to other latent variables but the total variance explained was still 37%, which means CMB was not a serious issue.

**4.3** **Structural** **equation** **modeling** **(SEM)**

SEM is a multivariate statistical analysis method that helps to estimate the series of depen-dence relationships in a single analysis. Multiple regression analysis and confirmatory fac-tor analysis are combined in this method (CFA). The measurement model and the structural model are the two processes used in this statistical analysis technique (Doloi et al., 2011).

**4.3.1** **The** **measurement** **model**

It is required to assess the construct reliability and validity of the measurement model before proceeding with the model fitness test in the structural model (Gerbing & Anderson, 1988; Ifinedo, 2006). In this study, CFAwas performed to check the construct reliability and valid-ity by adopting AMOS 26.0. The measurement model comprises five constructs, namely, IEQ, which is represented by the front-of-the-house space (FOH) and back-of-the-house space (BOH), psychological health (EPSH), physiological health (EPHH) and occupants’ productivity (EPR).

**Table** **I** Demographic profile of the sample

Variable Gender

Age Group

Work Area

Categories Male Female 30–40 40–50 FOH

BOH

Frequency (*n*302) 185

117 177 125 170

132

Response % 61

39 59 41 57

43

As presented in Table II, the value of Cronbach’s alpha is above 0.7 and close to 0.9, which is acceptable (Sekaran, 2003). Therefore, should further proceed with SEM analysis. Composite reliability (CR) is also called construct reliability and it is similar to Cronbach’s alpha, However, it is utilized to assess the consistency of a construct in a measurement model (Hair et al., 2010; Netemeyer et al., 2003; Kumar et al., 2012). For example, as shown in Table II, the Composite reliability (CR) of “FOH” is 0.971, “BOH” is 0.965, “EPSH” is 0.972, “EPHH” is 0.943 and “EPR” is 0.850, which is more than 0.7. Hence, all constructs have good reliability in the measurement model.

Convergent validity (CV) is a sub-type of construct validity. It is the extent to which an indicator relates to other indicators of the same phenomenon (Hair et al., 2019). The CV is calculated by standard factor loading, and standard factor loadings are correlation coef-ficients between measured variables and latent variables, which shows that the indicator significantly represents the latent variables. Above 0.50 is the acceptable value of standard factor loading (Hair et al., 2010; Kumar et al., 2010). The standard factor loading of the measured variable lies between 0.75 and 0.95, as shown in Table II. It indicates that the measured variables are acceptable and proportional to the latent variable.

Discriminant validity shows that measures of constructs are not correlated to each other. It means that each construct is distinct from the others (Hair et al., 2010). Discriminant validity is considered reliable through average variances extracted (AVE), average shared variances (ASV), and square root AVE. Occupants’psychological, psychological, and pro-ductivity have a low positive association with the term IEQ. It demonstrates that in the measurement model, all variables are exogenous. Table II demonstrates that individual con-structs AVE are greater than ASV and Table III demonstrates AVE’s square root. As a result, we can conclude that discriminant validity constructs are acceptable.

The goodness-of-fit indices for the measurement model fit indices such as the compara-tive fit index, goodness-of-fit index, normed fit index, Tucker Lewis index, and root mean square of error approximation were considered to determine the model fit (Hair et al., 2010). To get the perfect model fit the standard values of χ2/df3, CFI, GFI, NFI, and TLI0.9, and the RMSEA0.08. In our case the values of χ2/df (2.444), CFI (0.965), GFI (0.885), NFI (0.943), and TLI (0.961), and the RMSEA(0.062) the result shows that we can proceed to test the structural model.

**4.3.2** **Structural** **model**

The purpose of testing the structural model was to examine the hypothesized conceptual research model. The goodness-of-fit values for the structural model are χ2/df (1.686), CFI (0.972), GFI (0.918), NFI (0.934) and TLI (0.969), and the RMSEA (0.042).

**4.4** **Mediation** **analysis**

This study carried out a Parallel mediation analysis to test the mechanism between an independent variable and an outcome after the inclusion of a third hypothetical variable, which we called a mediating variable. This study carried out a mediation analysis to test the mechanism between an independent variable and an outcome after the inclusion of a third hypothetical variable, which we called a mediating variable. The path theory implicit three structural paths, one from IEQ→ EPR without Mediating variables, Second from IEQ→

**Table** **II** Reliability, Discriminant validity, Convergent validity Composite reliability (CR), and factor load-ings of the items

Construct Items AVE ASV CR Cronbach Alpha Standardized Factor loadings

Front of the house

Back of the House

FH1 0.871 0.1 FH2

FH3 FH4 FH5

BH1 0.872 0.01 BH2

BH3

BH4

0.971 0.971 0.927 0.94 0.929 0.935 0.936

0.965 0.958 0.902 0.943 0.944

0.946

Psychological health

Physiological health

PS1 0.873 0.076 0.972 0.871 0.928 PS2 0.941 PS3 0.93 PS4 0.936 PS5 0.936 PH1 0.768 0.092 0.943 0.943 0.82 PH2 0.935 PH3 0.919 PH4 0.89

PH5 0.81

Productivity PR1 0.534 0.104 0.85 0.842 0.764 PR2 0.757 PR3 0.777 PR4 0.747 PR5 0.771

**Table** **III** Correlation matrix and

root of AVE’s EPR

FOH BOH EPSH

EPHH

EPR FOH BOH *0.731*

0.270 *0.933*

0.008 0.147 *0.934* 0.120 0.522 0.133

0.575 0.183 -0.045

EPSH EPHH

*0.934*

0.018 *0.876*

**Note**: Diagonal in italics represent the square root of AVE from observed variance (items); off-diagonal represents the correlation between constructs

EPSH→ EPR and third from IEQ→ EPHH→ EPR with mediating variable. The significant mediation is supported via IEQ→ EPSH→ EPR; however, the other meditational path, i.e., IEQ→ EPHH→ EPR is also found significant.

**4.4.1** **Test** **of** **direct** **effect**

Direct effects can be defined as the impact of the independent variable on the dependent variable without the intervention of a third variable. Hypothesis 1 proposed that IEQ sig-nificantly and positively predicts occupants’ productivity. Results of the SEM support this



**Fig.** **2** Structural model (without mediating variable)

hypothesis (β0.56, t4.53, p0.001), indicating that the IEQ of the building support occupants to be satisfied with their productivity.

After running the structural model with mediating variable, the standardized path coef-ficient (β) from IEQ → EPR was reduced by a non-trivial amount (β0.44) though still sig-nificant; thus, the mediation analysis supports the partial mediation (Baron & Kenny, 1986). In addition to direct relationships, indirect relationships of mediating variables i.e., occu-pants’ psychological health and occupants’ physiological health, were also estimated as

shown in Fig. 3.

**4.4.2** **Test** **of** **an** **indirect** **effect**

In addition to direct relationships, indirect relationships of mediating variables, i.e., occu-pants’ psychological health and physiological health, were also estimated, as shown in Fig. 2.

The path via IEQ → EPSH → EPR exhibits statistically significant indirect effects on EPR through occupants’ psychological health (z4, p0.001). Hypothesis H2a postulated a positive relationship between IEQ and occupants’psychological health, occupants experi-ence more psychological fit while working inside the building with a technological based workplace and significantly support the Hypotheses H2a (β0.53, p0.001). However, Hypothesis H3a, which proposed that occupants’ psychological health positively predicts productivity, was also supported (β0.43, p0.001), therefore occupants’ psychological health positively leads to occupants’ productivity. In turn, the path via IEQ → EPHH → EPR, the statistically significant indirect relationship was found between IEQ and EPR



**Fig.** **3** Structural model (with mediating variable)

**Table** **IV** Summary of testing hypothesis

Hypothesis Structural Relationship St. Est (β) Unst. Est(β) P Result

H1 Direct Effect EPR

Indirect EPR Effect

H2a EPSH H3a EPR H2b EPHH

H3b EPR

← IEQ 0.56 0.47 ← IEQ 0.44 0.40

← IEQ 0.47 0.53 ← EPSH 0.39 0.32 ← IEQ 0.59 0.86

← EPHH -0.123 -0.078

P0.001 P0.001

P0.001 P0.001 P0.001

P .001

Supported

Supported Supported Supported

Supported

through occupants’ physiological health (z -2, p0.05). Hypothesis H2b addressed that IEQ significantly and positively predicts occupants’ physiological health; as expected, building occupants’ experience that technological-based IEQ support to access their work comfortably and positively significant the hypothesis H2b (β0.86, p0.001). In Hypoth-esis H3b, this study proposed that occupants’ physiological health positively predicts pro-ductivity was also supported (β −0.078, p0.05). Models were tested and evaluated based on Sobel tests to examine the mediating effects. Table IV shows the results of hypothesis testing.

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**5** **Discussion** **and** **recommendation**

The purpose of this study is to determine whether occupants’ productivity is indirectly related to occupants’ psychological and physiological health or directly related to AI technology-based IEQ from the occupants’ viewpoint in an empirical sense. The results confirmed that the hospitality industry’s AI technology-based IEQ had positively affected occupants’ productivity by improving occupants’ psychological and physiological health during COVID-19. These outcomes are significant because organizations have confidence in AI technology-based IEQ and felt the necessity of AI technology-based IEQ to improve occupants’ health and productivity. To clarify the mechanisms of occupants’ judgment on AI technology-based IEQ, occupants’ health, and productivity, structural models were developed with occupants’ productivity as the dependent variable, IEQ as an independent variable, and occupants’ psychological and physiological health considered a mediating variable. All constructs are statistically valid because they fulfilled internal reliability and validity. Previous studies support that the physical environment has a strong impact on productivity (Bangwal et al., 2017a, b, 2022; Schiavon & Altomonte, 2014; Newsham et al., 2013; Altomonte & Sachiavon, 2013). This study adds to existing efforts by exposing the problem experienced by occupants during the COVID-19 outbreak in greater detail. The results of this study assist us to understand how to ensure good IEQ to reduce health concerns for the occupants. As more individuals suffer, particularly hospitality workers who lost their employment and their health as a result of the COVID-19 pandemic, this area of study appears to have gained prominence. This study also adds new insights by add-ing occupants’ psychological and physiological health as a crucial intervening construct between AI-technology-based IEQ and occupant productivity.

As discussed before, most hospitality industries know the value of customer satisfaction and safety because it makes it possible to develop customer trust and preference and even-tually improve the corporate image and profit. Moreover, this is possible if the hospitality occupants are psychologically and physiologically satisfied in their workplace. Therefore, the hospitality industries, which plan their IEQ as per the AI technology standards, should generate higher productivity due to its friendly features, which provide a safe and healthier workplace to occupants that positively affect occupants’ psychological and physiological health.

1) The study also supports hypothesis H1 which means AI-technology-based IEQ sig-nificantly and positively predicts occupants’productivity. The building IEQ may provide an essential feature to the occupants, which enriches the occupant’s psychological and physi-ological behavior with their job. Such initiatives taken by the management provide a healthy platform and bring an emergence of new power resources, developing new innovative approaches that will help in occupants’productivity. The AI-technology-based IEQ may be the most visible feature of an organization, which drives a message of brand eminence and pleasure to all occupants.

This makes sense as AI-technology-based IEQ improved occupants’’s health safety, comfortability, privacy, and productivity by reducing the possibility of virus transmission, and unwanted microorganisms, and providing visual privacy, proper space, and thermal comfort, (Newsham et al., 2013; GBCA, 2013; Kim and de Dear, 2013; Bangwal et al., 2015; Cheshmehzangi, 2020a, b; Pinheiro and Luís, 2020; Dietz et al., 2020).

2) In this study, the IEQ is defined as a sustainable design with plentiful indoor air qual-ity, natural light, layout, and services to support operation, and a healthy and safe work environment to reduce the impacts of the IEQ on human health. The study result supports the H2a and H2b hypothesis, which assumes that AI technology-based IEQ significantly and positively predicts occupants’ psychological health (H2a) (β0.53, p0.05) and AI technology-based IEQ significantly and positively predicts occupants’physiological health (H2b) (β0.86, p0.05).

3) The study supports hypotheses H3a and H3b, which state that occupants’ psycho-logical health positively predicts productivity (H3a) and occupants’ physiological health positively predicts productivity (H3b). The finding suggests that building IEQ will bring sustainable value to our occupants’psychological and physiological well-being. Therefore, hospitality organizations need to identify the importance of IEQ for sustainable develop-ment. Organizations IEQ can provide such a working platform, which reduces the occupants ' stress and absenteeism and boosts health and productivity.

In today’s era, occupants’ health is more valuable. It is recommended to the stockholder, shareholder, building designer, architect, and engineers understand what makes the occu-pants happy at work while following the LEED standards.

**5.1** **Theoretical** **implication**

It is essential to recognize how to ensure proper AI-technology-based IEQ to mitigate health risks in the hotel. After the COVID-19 pandemic, This field of research appears to have gained prominence as many people suffer, especially hospitality occupants because they lost their jobs and health. This study gives the basis for future research on the health-related aspects of the hotel and also fills a gap in past research by introducing occupants’ psycho-logical and physiological health as an imperative intervening construct between IEQ and occupants’productivity. The number of studies support the IEQ and satisfaction integration (Yang et al., 2010; Thatcher & Milner, 2012; Newsham et al., 2013; Altomonte & Sachia-von, 2013; Menadue et al., 2013; Schiavon and Altomonte, 2014; Bangwal, 2017b).

Our results recommend that when hospitality management and administration are con-vinced by the prominence of AI-technology-based IEQ features, they perform a facilitator role. Therefore, to get better occupants’ productivity, the hospitality industry requires to motivate their occupants by providing an AI-technology-based IEQ for healthy and sat-isfactory outcomes and creating a sense of accountability among occupants towards the workplace environment. Such initiatives influence occupants’satisfaction and influence the hospitality industry’s image.

**5.2** **Practical** **implication**

This study suggests that the hospitality industry can improve occupants’psychological and physiological satisfaction and increase occupants’ productivity by focusing on their hotel AI-technology-based IEQ. While designing IEQ, organizations, and architecture designers think more about the cost which is always important during building planning, whereas occupant cost is far higher than building IEQ. Thus, we need a radically new take on the building IEQ.

Our results offer some practical applications for hotel operations. First, our research has demonstrated that workers can reply favorably to the use of AI-based IEQ. This favorable response may result in employee psychological and physiological satisfaction and boost workers’ productivity. During the COVID-19 epidemic, psychological health and safety were crucial. Therefore, motel managers should place a high priority on the psychological health and safety of their staff members and pay attention to elements that might reduce their anxiety, mistrust, and annoyance during the COVID-19 pandemic. Secondly, AI technol-ogy-based IEQ in hotels, has a significant impact on the employee experience and overall satisfaction. AI-technology-based IEQ can maintain indoor air quality, temperature, humid-ity, lighting, and noise levels in real time. This data can then be used to adjust the HVAC systems and lighting controls to maintain optimal IEQ levels.AI technology can also be used to personalize the employee and guest experience by allowing them to control their room temperature and lighting preferences. This can enhance their comfort and overall satisfac-tion during their stay.

Overall, the practical implications of AI technology-based IEQ in the hotel industry can enhance the employee experience, improve eficiency, reduce costs, empower employees to reshape their current tasks in proper ways to cooperate with technology, and may encourage them to strengthen themselves to win a better future. Therefore, it is recommended that the hospitality industry leaders, public health experts, policymakers, researchers, practitioners, and designers think more about AI-technology-based IEQ priorities, where occupants will connect to technology and promote the importance of AI-technology-based IEQ in healthier working places.

**6** **Conclusion**

This study provided theoretical contributions as follows. First, we discussed the concepts and role of IEQ (front of the house and back of the house) to offer a green hotel study framework. Second, we built a research framework to enhance our understanding of IEQ and its outcome on psychological, and physiological health and productivity in the hospital-ity industry. According to the given results, it is proved that IEQ has a positive and direct impact on productivity. Third, we revealed that psychological and physiological health not only have a significant positive effect on productivity but also played a mediating role in the relationship. This study investigated the theoretical research framework of the JD-R Model. AI-technology-based IEQ is an extremely interesting and emerging concept and is taken as a job demand and job resource as well, but its relationship with occupants’health and produc-tivity is not well acknowledged yet in the tourism and hospitality sectors, especially in the context of the COVID-19 pandemic. This study identifies the need for AI-technology-based IEQ, which can include a proper automatic sanitization system to weaken the possibility of getting infected, new touchless technologies, and suficient spaces for better psychological health. These are just a few solutions that can improve health and safety protection in the building.

**6.1** **Limitations** **and** **future** **research**

This research reinforced the need of studying some factors that, directly or indirectly, affect the outcome variables. However, some limitations were noticed. Firstly, this study only focused on health and productivity in the hospitality industry. Secondly, the researcher col-lected data from LEED-certified hotels, so the generalizability of the outcomes is limited. If the sample size would be expanded to include more Indian provinces, results would show the different magnitude and directions of the interconnections among studied variables. Additionally, future research could use a larger sample and longitudinal data that would investigate the changes in an organization’s indoor environmental quality and their implica-tions on an organization’s business service quality and performance over time.

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