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Sustainable human-robot services: ESG, diversity, and attractiveness in job pursuit

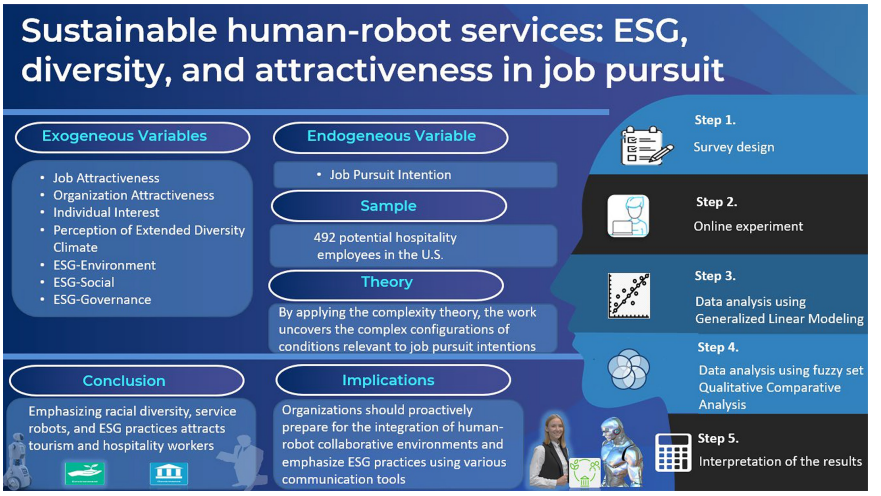
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Graphical abstract



Abstract

Purpose – This study aims to examine how attractiveness factors (job, organization, individual) and environmental, social and governance (ESG) aspects influence job pursuit intentions in hospitality's human-robot collaborative environments. It investigates relationships between these factors and job pursuit intention.

Design/methodology/approach – The study combines mixed methods using generalized linear modeling (GLM) with Student's t distribution and fuzzy-set Qualitative Comparative Analysis (fsQCA).

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Data was collected via online survey from 492 US hospitality job seekers through Amazon's Mechanical Turk (MTurk). The research applies complexity theory to uncover nonlinear relationships and multiple pathways to outcomes.

Findings – GLM results show organization attractiveness, individual interest and perceived ESG environmental and governance factors significantly predict job pursuit intention. Notably, while GLM showed job attractiveness and perceived ESG social factors as insignificant individual predictors, fsQCA revealed their critical roles within specific causal configurations.

Practical implications – Organizations should enhance employer branding and clearly communicate their environmental and governance ESG initiatives. Companies need targeted approaches emphasizing sustainability and governance practices, while preparing employees for human-robot collaboration (HRC) through training programs highlighting growth opportunities rather than job displacement.

Originality/value – This research uniquely examines employee perspectives on HRC in hospitality, addressing a gap focused predominantly on consumer reactions. It integrates attractiveness factors with ESG aspects using complexity theory and fsQCA methodology.

Keywords ESG, Human-robot collaboration, Hospitality services, Attractiveness, Job pursuit intention

Paper type Research paper

可持续人机协作服务：ESG、多样性与求职吸引力

摘要

研究目的 – 本研究考察吸引力因素(工作吸引力、组织吸引力和个体吸引力)以及环境、社会和治理(ESG)因素如何影响酒店业人机协作环境下的求职意愿, 并分析这些因素与求职意愿之间的关系。

研究设计/方法 – 本研究采用混合分析方法, 结合基于Student's t分布的广义线性模型(GLM)与模糊集定性比较分析(fsQCA)。研究通过Amazon Mechanical Turk(MTurk)平台对492名美国酒店业求职者开展在线问卷调查。基于复杂性理论, 本研究进一步揭示各因素与结果变量之间的非线性关系以及产生相同结果的多重作用路径。

研究发现 – GLM分析结果表明, 组织吸引力、个人兴趣以及感知到的ESG环境和治理因素均能显著预测求职意愿。值得注意的是, 尽管GLM结果显示工作吸引力和感知到的ESG社会因素作为单独预测变量并不显著, 但fsQCA分析表明, 它们在特定的因果组态中发挥着关键作用。

实践意义 – 企业应加强雇主品牌建设, 并清晰传达其在环境和公司治理方面的ESG举措。企业需要采取有针对性的策略, 突出自身的可持续发展和治理实践。同时, 应通过相关培训帮助员工为人机协作做好准备, 强调人机协作带来的职业成长机会, 而非将其主要呈现为可能导致工作岗位被取代的威胁。

原创性/价值 – 本研究从员工视角考察酒店业中的人机协作, 弥补了现有研究主要关注消费者反应的不足。研究基于复杂性理论, 将工作与组织等吸引力因素和ESG因素进行整合, 并结合GLM与fsQCA方法, 更全面地揭示影响酒店业人机协作情境下求职意愿的多重机制。

关键词 ESG, 人机协作, 酒店服务, 吸引力, 求职意愿

文章类型 研究型论文

1. Introduction

The hospitality industry has witnessed a substantial increase in the use of service robots, influencing tourists' experiences and evaluations. However, consumer reactions to these robots vary depending on factors such as the robots' appearance, service context and mortality salience induced by the COVID-19 pandemic (Borghi and Mariani, 2021; Liu *et al.*, 2022; Tussyadiah *et al.*, 2020). Travelers' trust in autonomous service robots, shaped by their general attitudes toward technology and propensity to trust, plays a crucial role in their intention to adopt and/or use these technologies in hospitality settings (Tussyadiah *et al.*, 2020). Service robots are becoming an ever more distinctive and popular characteristic in hotel guests' online reviews, surpassing the initial novelty effect, with robot-related

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reviews differing significantly from non-robot-related reviews (Borghi and Mariani, 2021). Consumers and tourists prefer non-humanoid over humanoid service robots while mortality is significant, such as during the COVID-19 outbreak, due to perceived risks to human identity. However, this effect is mitigated by temporal distance (Liu *et al.*, 2022).

Previous studies have mostly focused on end-user perceptions of robots in service settings, leaving a significant gap in understanding employees' perspectives (Ali *et al.*, 2023). Despite the growing presence of robots in the hospitality sector, there is currently a scarcity of scholarly research examining the dynamics between humans and robots within this industry (Ali *et al.*, 2023). This study seeks to fill the research gap by investigating how perceptions of attractiveness, Environmental, Social and Governance (ESG) factors and behavioral intentions are interrelated within the hotel industry.

Complexity theory views the service industry as a complex adaptive system characterized by nonlinear relationships, self-organization and emergence (Olya *et al.*, 2019). This study adopts a dual analytical approach. While generalized linear modeling (GLM) identifies the significant "net effects" of individual factors, it cannot fully capture non-linear interactions. We complement GLM with complexity theory via fuzzy-set qualitative comparative analysis (fsQCA) to uncover asymmetric, configurational pathways showing how these factors combine to drive job pursuit intentions (Barnes, 2022; Olya *et al.*, 2019). Unlike general technology adoption or employer branding, human-robot collaboration (HRC) triggers specific anxieties, such as job displacement and identity threat. It also demands unique organizational signals, including the ethical governance of robots and inclusive human-machine policies. An integrated model that captures both dimensions is needed to understand this setting.

The research questions are as follows: How do attractiveness factors (job, organization and individual) influence job pursuit intentions in human-robot collaborative environments within the hospitality industry? What is the impact of perceived ESG factors on job pursuit intentions in these settings? The aim of this work is to investigate the relationships among job attractiveness, organization attractiveness, individual interest, perceived ESG factors and job pursuit intention in the context of HRC in the hospitality industry using mixed methods. In addition, this study aims to examine the configurational combinations of these factors leading to job pursuit intentions (Figure 1). This research contributes to the current literature in several ways. First, it addresses the study gap concerning the impact of attractiveness and ESG factors on potential employees' job pursuit intentions in the context of HRC in the hospitality industry based on GLM. Second, by applying the complexity theory and using fsQCA, this study uncovers the complex configurations of conditions relevant to job pursuit intentions, providing a more nuanced understanding of the variables affecting job seekers' decisions. Finally, the findings offer practical insights for recruitment strategies in human-robot collaborative settings, contributing to the recognition of job seekers' intentions in the evolving hospitality industry.

2. Theoretical background

2.1 Complexity theory in service

Complexity theory views the service industry as a complex adaptive system characterized by nonlinear relationships, self-organization and emergence (Olya *et al.*, 2019). According to Olmedo and Mateos (2015), complexity theory in hospitality focuses on understanding the dynamic interactions between numerous stakeholders and how these interactions are relevant to the emergence of new patterns and behaviors within the system. Complexity theory also highlights the importance of adaptation and resilience in the face of external disturbances, such as economic crises, natural disasters or global pandemics.

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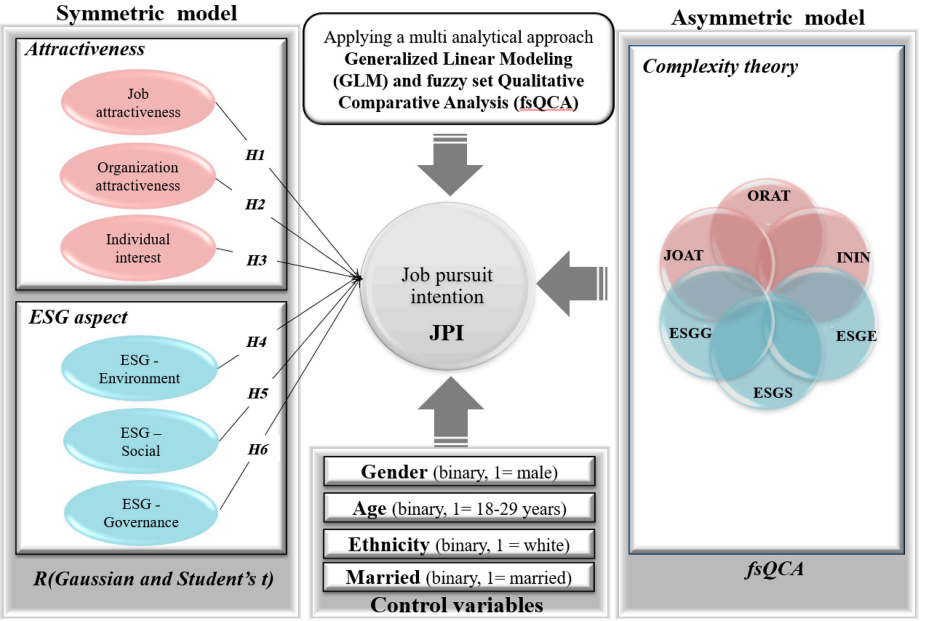


Figure 1. Conceptual framework

Note: JOAT: job attractiveness; ORAT: organization attractiveness; ININ: individual interest; ESGE: ESG-Environment; ESGS: ESG-Social; ESGG: ESG-Governance

fsQCA is a set-theoretic method that allows researchers to recognize the necessary and sufficient conditions for an assigned result, considering the asymmetric and nonlinear relationships among the variables (Ragin, 2008). The method's ability to identify multiple pathways to outcomes makes it particularly suitable for studying complex service systems. In the context of services, fsQCA-based complexity theory explores the combinatorial effects of different factors, for example service quality, customer satisfaction, destination attributes and marketing strategies, on the performance of service businesses or destinations (Olya and Gavilyan, 2017). This approach acknowledges that the success or failure of a service system may alter according to the presence or absence of specific combinations of conditions rather than individual factors (Olya *et al.*, 2019). By employing fsQCA, researchers can uncover the complex configurations of conditions relevant to desired outcomes and identification of multiple pathways to success, recognizing that different combinations of factors may produce similar results.

We use linear hypothesis testing to validate directional influences (*H1–H6*), serving as a necessary baseline. GLM thus establishes the net effect benchmarks, identifying which factors positively or negatively influence outcomes, while fsQCA complements this by uncovering how these factors combine synergistically across diverse configurational pathways, accommodating the nonlinearity inherent in complex service systems. To maintain interpretive discipline and avoid selective emphasis across methods, we establish explicit interpretive criteria specifying when findings from each method are privileged. GLM findings are strictly privileged when evaluating universal, independent linear main effects (*H1–H6*). If a variable is nonsignificant in GLM, its corresponding hypothesis is formally

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rejected. Conversely, fsQCA findings are privileged when uncovering complex, asymmetric synergies and multiple configurational pathways to the outcome. Subsequent fsQCA analysis is not used to "rescue" these rejected hypotheses; rather, it independently identifies whether these variables might still act as necessary, context-dependent configurational elements within specific causal configurations.

2.2 Service robots in hotels

Recent literature highlights that the integration of artificial intelligence and service robots introduces new psychological complexities for the hospitality workforce. The deployment of physical robots can trigger workforce anxieties, such as job insecurity and replacement fears, which significantly influence employee retention, turnover intentions and overall labor stability (Horpynich *et al.*, 2025; Kang *et al.*, 2024). While service robots have the potential to offer rich sensory and cognitive experiences to users in the hospitality industry, they still have limited ability to engage in socio-emotional interactions with customers compared to human employees, leading to recommendations for using robots in collaboration with humans rather than fully automated systems at this stage (Reis *et al.*, 2020). Xu *et al.* (2020) found that while service robots may increase efficiency in hotels, they also pose challenges requiring leaders to consider the roles of robots as well as human employees. While service robots may provide benefits like increased efficiency and reduced costs, employees also believe robots could lead to communication problems with guests and increased unemployment, evoking overall negative attitudes toward the idea of working with robots (Vatan and Dogan, 2021).

Individuals who interacted with a service robot designed to closely resemble a human hotel receptionist experienced heightened feelings of anxiety, fear and unease. These negative emotional responses were more intense compared to those reported by people who interacted with service robots that had a more machine-like or semi-human-like appearance (Kang *et al.*, 2023). Hotel frontline staff generally prefer room service robots with physical capabilities over concierge robots with cognitive skills. This preference is attributed to the perceived advantages and higher level of trust associated with robots having physical affordances (Ali *et al.*, 2023).

Understanding employee reactions requires looking beyond the robots themselves to the broader organizational system. Complexity theory suggests that the introduction of such technology fundamentally alters the workplace ecosystem. This study integrates Attractiveness (functional appeal) with ESG (ethical sustainability) to explore how these constructs interact as configurational conditions within the unique, nonlinear context of HRC.

HRC activates unique psychological mechanisms absent in traditional workplaces. Robot "colleagues" trigger job insecurity and replacement anxiety that intensify rather than diminish with exposure, while also activating identity threats by challenging team membership conceptualizations (Savela *et al.*, 2021). These mechanisms elevate ESG signals as proxies for ethical technology deployment, fundamentally reconfiguring how attractiveness factors combine to shape job pursuit intentions.

2.3 Attractiveness

Attractiveness is defined as a quality or set of qualities that make a person appealing or desirable to others, often based on physical attributes, personality traits or cultural norms (Langlois *et al.*, 2000). In addition, job attractiveness is the degree to which a job or organization is perceived as desirable by potential applicants, based on factors such as compensation, work environment, growth opportunities and alignment with personal values and goals (Chapman *et al.*, 2005). Job pursuit intention refers to a person's willingness to

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pursue a job opportunity, submit an application or attend a job interview with a specific organization (Nolan *et al.*, 2013). Job attractiveness was discovered to have both direct and indirect positive influences on job seekers' intent to apply for the job (Van Hooft *et al.*, 2006). Job attractiveness also has a positive and significant impact on job pursuit intention (Highhouse *et al.*, 2003). Within the unique context of HRC, these conventional dimensions of attractiveness are evaluated against specific psychological threats, such as replacement anxiety and job insecurity. Unlike intangible, software-based AI, HRC involves embodied, physical robots sharing the same workspace as human employees. This physical copresence uniquely amplifies concerns regarding physical safety, tangible workspace dynamics and human-machine role boundaries. A highly attractive job must therefore provide sufficient functional and psychological appeal to offset the perceived physical and spatial risks of working alongside robots. This leads to the first hypothesis:

H1. Job attractiveness has a positive effect on employees' job pursuit intention for collaboration with service robots.

Organization attractiveness is the extent to which a prospective employee views an organization as an appealing place to work, considering factors such as the company's reputation, culture, values and benefits (Highhouse *et al.*, 2003). Highhouse *et al.* (2003) found a strong correlation between organization attractiveness and job pursuit intention, suggesting that the more attractive a company is perceived to be, the more likely individuals are to pursue employment opportunities there, which subsequently predicts actual job pursuit behavior. Chapman *et al.* (2005) found a significant positive relationship between organizational attraction and job pursuit intentions, corroborating their hypothesis. Boğan *et al.* (2020) also confirmed the findings of previous studies (Chapman *et al.*, 2005; Highhouse *et al.*, 2003), revealing that organization attractiveness positively influences job pursuit intention. Within an HRC environment, this general organization attractiveness is further nuanced; it heavily depends on how prospective employees perceive the organization's overarching technological culture and its ethical commitment to integrating robots while continuing to value human workers. The following hypothesis is therefore proposed:

H2. Organization attractiveness has a positive effect on employees' job pursuit intention for collaboration with service robots.

The "interest stage" is when a consumer's emotional response to a product or service is activated, leading to curiosity and a desire to learn more about the company's offering(s) (Kang, 2022). Individual interest is a relatively consistent and long-lasting tendency to focus on specific objects and events and to participate in certain activities (Renninger and Hidi, 2016). When people first notice a promotional video about Hyperloop, they are likely in the attention phase: as the promotional video captures their interest, they may transition to the interest stage, developing a desire to gain more knowledge about the technology (Kang, 2022). Visitor groups "countryside and outdoor friends" and "safari riders," who showed interest in various tourism services related to outdoor activities and the countryside, had an equally high intention to revisit the park and the province compared to other visitor groups (Sievänen *et al.*, 2011). Applying this to the HRC context, where service robots represent a significant technological shift, capturing a job seeker's individual interest is critical. A job seeker's positive interest in human-machine collaboration can effectively reduce technology-induced apprehensions, thereby driving their intention to join a robot-integrated workplace. This leads to the following hypothesis:

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H3. Individual interest has a positive effect on employees' job pursuit intention for collaboration with service robots.

2.4 Environmental, social, and governance sustainability aspects

ESG refers to a framework that assesses an organization's actions and influence across environmental, social and governance dimensions, often used by investors to assess sustainability and ethical practices (Kim *et al.*, 2024b). In the travel and service industry, ESG factors significantly influence market value, with the Governance factor having the most important impact, suggesting that stockholders benefit from including ESG information into their investment decisions, allowing for greater awareness and reduced risk (Ionescu *et al.*, 2019). ESG factors in service are particularly significant due to the industry's reliance on environmental resources, labor-intensive nature and integration with local communities, making companies in this sector more vulnerable to ESG risks; consequently, service businesses are gradually adopting sustainable practices to mitigate these risks and enhance stakeholder value (Dogru *et al.*, 2022). ESG factors significantly influence tourists' behavioral intentions in the service context.

In the hospitality and service context, ESG practices are vital for managing natural resources and human capital effectively, focusing on areas such as food waste management, community engagement and treating employees fairly (Back, 2024). ESG factors significantly influence the behavioral intentions of space tourists through enhanced perceptions of sustainability, particularly when combined with AI trust and benefits, which differentiates the three types of space service in terms of their sustainability perceptions and preferences (Kim *et al.*, 2024b). Moving beyond general corporate social responsibility, ESG factors function as critical organizational signaling mechanisms specifically tailored to the HRC context. Because HRC inherently involves physical hardware rather than just software algorithms, its environmental and social footprints are highly tangible. Job seekers rely on ESG signals as heuristic cues to evaluate whether organizations will manage human-robot transitions ethically. Environmental commitment signals responsible management of the robotic hardware's energy consumption and lifecycle, social responsibility indicates a genuine concern for worker welfare and physical workplace safety amidst automation fears and governance transparency, suggests ethical decision-making regarding physical autonomy and human-robot role allocation. These arguments lead to the following three hypotheses:

H4. The perceived ESG Environmental aspect has a positive effect on job pursuit intention for collaboration with service robots.

H5. The perceived ESG Social aspect has a positive effect on job pursuit intention for collaboration with service robots.

H6. The perceived ESG Governance aspect has a positive effect on job pursuit intention for collaboration with service robots.

This study proposes a comprehensive and integrated research model, including the relationship between job attractiveness, organization attractiveness, individual attractiveness, ESG aspects and job pursuit intentions as shown in Figure 2.

3. Methods

3.1 Measurements

This research uses multi-item constructs in its survey instrument. The questionnaire comprises seven constructs and 28 items. Four items for job attractiveness for potential

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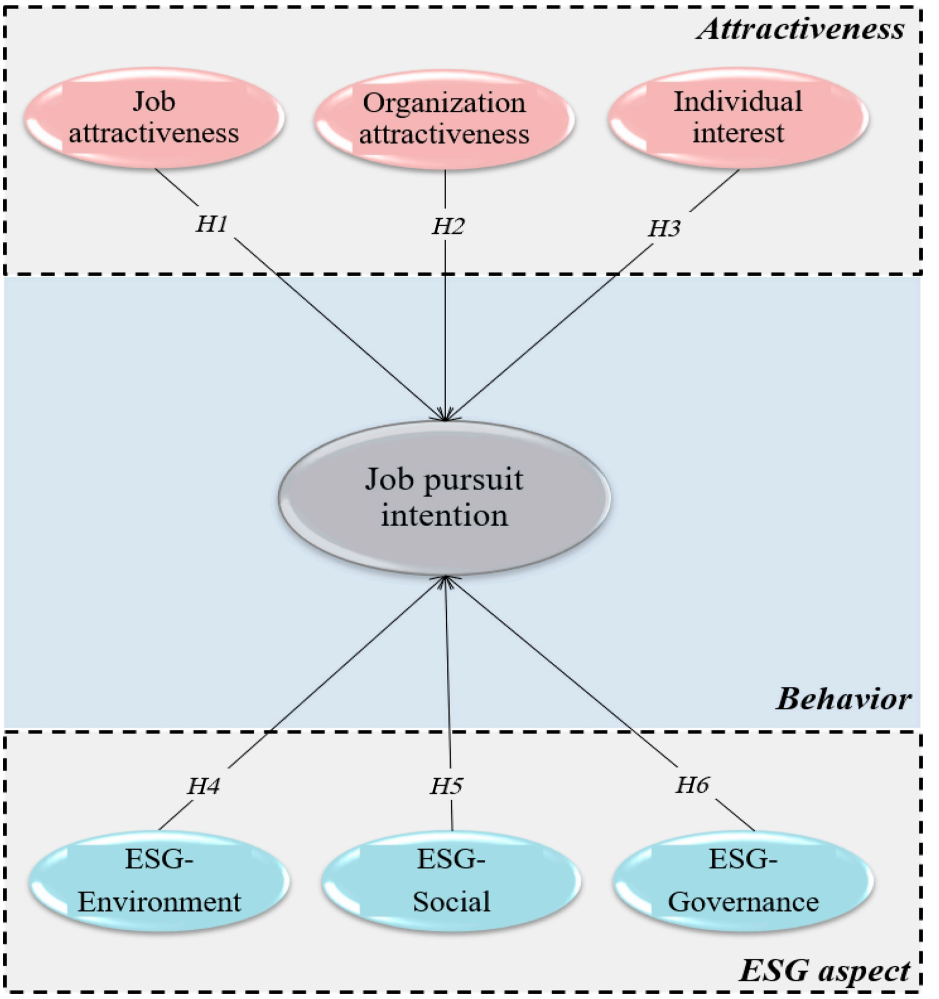


Figure 2. Research model

hospitality workers were drawn from established literature (Van Hooft *et al.*, 2006). Organization attractiveness is assessed using four questions adapted from Highhouse *et al.* (2003) and individual interest for potential hospitality workers with four items from Kang (2022). Perceived ESG_Environmental (four items), Perceived ESG_Social (four items) and Perceived ESG_Governance (four items) related to the hospitality workforce were adaptedfrom Kim *et al.* (2024b) and other relevant studies. To ensure these operationalizations captured the distinct HRC context rather than generic employer attractiveness or CSR, all relevant measurement scales were explicitly anchored with the framing. The inclusion of this framing was based on the premise that an organization's ethical and inclusive management of its workforce (human and robot) is conceptually linked to its broader responsible management of environmental resources, reflecting an overall corporate sustainability ethos.

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A seven-point Likert scale is used, with response options ranging from (1) strongly disagree to (7) strongly agree. In addition, the questionnaire includes general inquiries and explores participants' views on the UN's 17 Sustainable Development Goals (Kim *et al.*, 2024a). It covers topics such as hospitality career aspirations, preferred areas within the industry, personal innovativeness and current or past work experience in hospitality. The survey also gathers demographic information, including monthly family income, occupation, residence, education level, gender, age and marital status.

3.1.1 Content validity, pilot test, and pre-test. The measurement items were primarily developed in English for US respondents, based on existing research. Three English-fluent academic experts evaluated the questionnaire's validity, resulting in the deletion of one question about perceived ESG_Environmental and one question about perceived ESG_Social aspects to better represent the constructs. For a pilot test, three graduate students adapted the questionnaire for online survey platforms, adjusting instructions, common questions and overall language. A native English speaker then edited the revised survey, refining items, correcting grammar and removing redundant terms. A pretest was conducted with 50 American participants (25 white and 25 non-white) who were either pursuing careers, currently employed or had previously worked in the hospitality sector. Based on the pretest feedback, the researchers improved question quality and ensured commitment to accurate survey responses (see Supplement A for more information).

3.2 Data collection

The US was chosen for data collection due to its racial workforce diversity and widespread adoption of customer-facing robotic technologies in businesses (Kang *et al.*, 2023; United States Bureau of Labor Statistics, 2023). We used Amazon's Mechanical Turk (MTurk) to access a diverse pool of US job seekers, a method validated for recruitment research when rigorous quality controls are used (Landers and Behrend, 2015). To ensure sample validity, we implemented a strict multi-stage screening process on the initial 2,756 respondents. First, IP verification removed non-US participants ($n = 1{,}624$). Second, to validate industry relevance, a mandatory screening question ("Would you be interested in pursuing a career in the hospitality industry?") excluded those lacking genuine intent ($n = 412$). Finally, attention checks (e.g. describing the poster content) and manipulation checks removed disengaged respondents ($n = 228$). This rigorous filtering resulted in 492 valid responses (17.8% retention), ensuring a high-quality sample of committed hospitality job seekers. The survey was conducted in two phases: the first, from April 28 to May 3, 2024, targeted non-white participants (e.g. Black, Asian, Hispanic, Middle Eastern or Multiracial), while the second, from May 5 to May 7, 2024, focused on white participants.

Initially, 2,756 panel members participated. During screening, 1,624 were excluded due to being outside the US or having non-US Internet Protocol (IP) addresses. Another 412 were removed for lack of interest in hospitality careers, leaving only those interested in the field. After eliminating 228 participants who failed the manipulation check, 492 qualified participants remained.

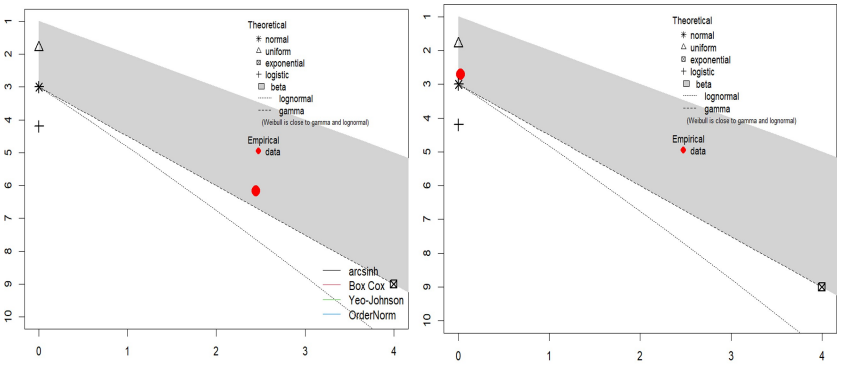
The 492 valid participants (267 white; 225 non-white) were shown a job recruitment poster for a fictional "XYZ Hotel" (see Supplement A and B). The poster included a color photo of diverse staff and service robots, along with text describing available positions, contact information and a webpage. To ensure engagement, the poster was displayed for 25 s before participants could proceed. An attention check question followed, asking participants to describe the poster's content. All participants received US $2.50 as compensation.

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3.3 Data analysis

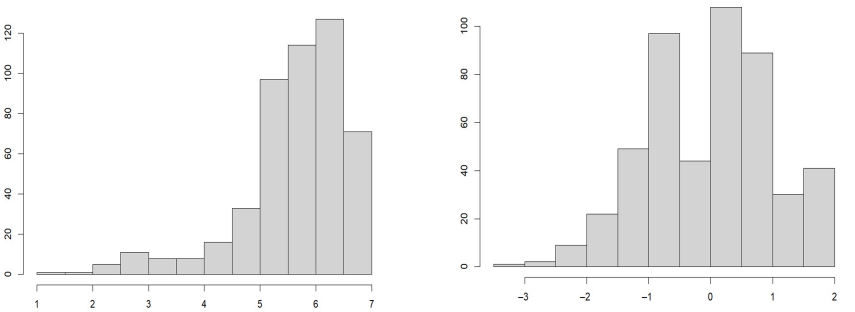
As a first step, variable distribution was examined. The dependent variable, job pursuit intention, was positively skewed and leptokurtic [see Figure 3(a)]. A comparison of various transformations (including Box-Cox, Yeo-Johnson and arcsinh) found that an ordered quantile normalization transformation (OrdNorm) was the best at achieving approximate normality [see Figure 3(b)]. Histograms of the raw and transformed variable are shown in Figure 4(a) and (b). Following typical practice, all other scalar variables were centered and scaled.

The research model was tested using GLM with five control variables, gender (binary with 1 = male), age (binary, 1 = 18–29 years; see below for justification), ethnicity (binary, 1 = white), married (binary, 1 = married) and income (scalar variable). The binary coding of age reflects the empirical structure of the sample rather than an arbitrary analytical decision. Inspection of the raw age distribution revealed that 96.3% of respondents were concentrated in just two categories: 18–29 years (n = 163, 33.1%) and 30–39 years (n = 311, 63.2%), with only 14 respondents aged 40–49 (2.8%) and four aged 50 or older (0.8%). Retaining age as a



(a) Cullen and Frey graph (raw data) **(b)** Cullen and Frey graph (transformed data)

Figure 3. Cullen and Frey graphs for raw and transformed dependent variable



(a) Histogram of raw data **(b)** Histogram of ordered quantile normalization transformation

Figure 4. Histograms of raw and transformed dependent variable

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continuous or fine-grained categorical variable would have produced statistically unreliable estimates for the older groups given these very small cell sizes. Collapsing the three oldest categories into a single reference group was therefore the most defensible specification given the data. The model was tested using the glmmTMB package in R (Brooks *et al.*, 2017), which allows for a very large variety of different statistical distributions. The method has been used in various studies in tourism in the past (e.g. Barnes, 2022). The approach allowed the testing of the research model using two error distributions to evaluate the best fit with the data set: Gaussian and Student's t error distributions. The glmmTMB software package is based on maximum likelihood estimation. We evaluated model fit using standard metrics: the Corrected Akaike Information Criterion (AICc), the Akaike Information Criterion (AIC) and the Log-Likelihood. For each version of the research model we applied a number of rigorous diagnostic tests using DHARMa and performance (Lüdecke *et al.*, 2021): variance inflation factors (VIFs) to examine multicollinearity, a nonparametric dispersion test for the assessment of over-dispersion, a Kolmogorov–Smirnov test for evaluating the fit of the error distribution, simulation analysis to evaluate the presence of heteroskedasticity and an assessment to find significant presence of outliers.

First a Gaussian model was tested. The Gaussian model was not found to have satisfactory diagnostic results. The model was found to be heteroskedastic using DHARMa diagnostic tests in R, with a test for location of quantiles via qgam showing $p < 0.001$. However, dispersion was not an issue (simulated dispersion $= 1.002$, $p = 0.992$). An asymptotic one-sample Kolmogorov–Smirnov test found that $D = 0.045$ and $p = 0.270$, indicating that the distribution was a good fit. Further, a DHARMa outlier test based on exact binomial test with approximate expectations found that outliers were not a significant problem (8 outliers at margins, $p < 0.065$).

A Student's t model was then tested. We clarify that while the dependent variable was pre-transformed to approximate marginal normality, the Student's t error distribution was explicitly required to address the conditional non-normality and persistent residual heteroskedasticity that the Gaussian model failed to resolve. Student's t provides a more flexible model that can better fit to heavy tailed or non-normal but bell-shaped variance within the residuals. The fitted Student's t had a df = 7.641. The Student's t model diagnostics suggested a strong fit with the data set (see Figure 5). The Kolmogorov–Smirnov test showed a strong fit to the error distribution ($D = 0.034$ and $p = 0.626$). Outliers and dispersion were less than the Gaussian model (4 outliers, exact binomial test indicated $p = 0.800$; dispersion $= 1$, $p > 0.999$). Most importantly, heteroskedasticity was no longer a problem, with a qgam test showing $p = 0.996$. The Student's t model was tested for possible multicollinearity problems. All the VIF values were below 10, indicating multicollinearity was not a concern. To address potential measurement overlap caused by embedding the human-robot diversity context directly into the ESG items, we also formally assessed discriminant validity. Following the Fornell and Larcker (1981) criterion, the square root of the average variance extracted (AVE) for every construct, specifically between the three ESG dimensions was strictly greater than their inter-construct correlations. This confirms that respondents empirically distinguished between the constructs, successfully mitigating concerns of empirical confounding despite the overlapping item framing.

We used fsQCA to examine how various factors impact job pursuit intention in the US. Unlike approaches that assume linear relationships, fsQCA acknowledges that changes in input variables may not always result in predictable outcome changes (Kim *et al.*, 2024a, 2024b). This method helps uncover complex interactions among factors influencing job pursuit intention. Using fsQCA 3.0 software (Chung *et al.*, 2025), we analyzed how job attractiveness, organization attractiveness, individual interest,

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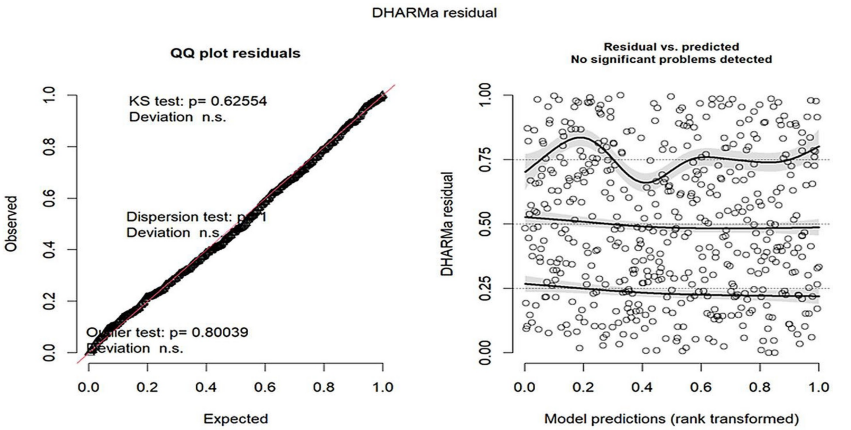


Figure 5. DHARMa residual diagnostic tests for Student's t model

perceived ESG_Environmental, perceived ESG_Social and perceived ESG_Governance affected job pursuit intention among US hospitality job seekers. To transform the raw data into fuzzy sets, we used the direct method of calibration. Following established guidelines (Ragin, 2008), we used three qualitative anchors based on the data distribution: the 95th percentile represented the threshold for full membership (fuzzy score ≥ 0.95), the 50th percentile served as the crossover point of maximum ambiguity (fuzzy score = 0.5) and the 5th percentile indicated the threshold for full nonmembership (fuzzy score ≤ 0.05). This approach allowed us to identify sufficient combinations of factors leading to job pursuit intention and necessary conditions for these intentions to occur, providing a more nuanced understanding of variable interactions influencing job seekers' decisions.

fsQCA is a research approach that integrates qualitative and quantitative techniques to identify the essential and adequate circumstances that lead to a particular result or outcome (Ragin, 2008). The process involves data calibration, truth table construction, consistency and coverage assessment, logical minimization and result interpretation (Ragin, 2008). To ensure validity, researchers can use robustness tests and triangulation, and maintain theoretical grounding (Ragin, 2008).

Supplement B reveals consistently high mean scores (5.587–5.874) across all seven constructs measuring perceptions of HRC in hospitality services. Moderate standard deviations (1.101–1.366) indicate reasonable consensus despite individual variations, confirming overall positive attitudes toward working in human-robot collaborative hospitality environments.

4. Results

4.1 Profile of samples

As shown in Supplement C, the sample consists of 492 US hospitality job seekers who are predominantly male (61.6%), aged 30–39 (63.2%), White (54.3%) and married (86.8%), with most holding university degrees or higher (77.6%) and demonstrating high personal innovativeness (87.0%).

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4.2 Hypothesis testing using GLM

The results of testing the research models and related hypotheses can be found in Table 1, which displays the results of testing the Gaussian and Student's t models. Here, we focus on the Student's t model estimates, since the Student's t model provides a much better fit to the data and strong validation results in our earlier tests:

- *Job attractiveness (H1):* For job attractiveness ($\beta = 0.01$, SE = 0.07), the predictor does not have a statistically significant effect on job pursuit intention ($p > 0.05$).
- *Organization attractiveness (H2):* For organization attractiveness ($\beta = 0.26$, SE = 0.06) the predictor has a highly statistically significant positive effect on job pursuit intention ($p < 0.001$).
- *Individual interest (H3):* For individual interest ($\beta = 0.30$, SE = 0.06), the predictor has a highly statistically significant positive effect on job pursuit intention ($p < 0.001$).
- *Perceived ESG_Environmental (H4):* For the perceived ESG factor relating to the environment ($\beta = 0.15$, SE = 0.05), the predictor has a statistically significant positive effect on job pursuit intention ($p < 0.01$).
- *Perceived ESG_Social (H5):* For the perceived ESG factor relating to social aspects ($\beta = 0.05$, SE = 0.05), the predictor does not have a statistically significant effect of job pursuit intention ($p > 0.05$).
- *Perceived ESG_Governance (H6):* For the perceived ESG factor relating to governance aspects ($\beta = 0.16$, SE = 0.05), the predictor has a statistically significant positive effect on job pursuit intention ($p < 0.01$).
- *Control variables:* Gender has a significant positive effect on job pursuit intention (male = 1, $\beta = 0.09$, SE = 0.04, $p < 0.05$), although not a younger age (18–29 years),

Table 1. Results of hypotheses test

Predictors	Gaussian model Estimates	Student's t model Estimates
(Intercept)	−0.03 (0.09)	−0.03 (0.08)
Job attractiveness (*H1*)	0.01 (0.06)	0.01 (0.07)
Organization attractiveness (*H2*)	0.28 *** (0.06)	0.26 *** (0.06)
Individual interest (*H3*)	0.30 *** (0.06)	0.30 *** (0.06)
Perceived ESG Environment (*H4*)	0.11 * (0.05)	0.15 ** (0.05)
Perceived ESG Social (*H5*)	0.04 (0.05)	0.05 (0.05)
Perceived ESG Governance (*H6*)	0.16 ** (0.05)	0.16 ** (0.05)
Gender (male)	0.11 * (0.05)	0.09 * (0.04)
Age (18–29 years)	−0.08 (0.05)	−0.06 (0.05)
Ethnicity (white)	0.04 (0.05)	0.06 (0.05)
Married	−0.06 (0.07)	−0.08 (0.07)
Income	0.01 (0.02)	0.03 (0.02)
Observations	492	492
R^2	0.413	0.429
AIC	707.653	697.583
AICc	708.415	698.464
log-Likelihood	−340.827	−334.792

Note(s): *$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

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white ethnicity, married marital status or the level of household income, all of which have nonsignificant effects on job pursuit intention.

The Student's t model explains 42.9% of the variance in job pursuit intention and had a better AIC, AICc and Log Likelihood than the Gaussian model (Gaussian: AIC = 707.653, AICc = 708.415 and LogLik = −340.827; Student's t: AIC = 697.583, AICc = 698.464 and LogLik = −334.792).

4.3 Fuzzy-set qualitative comparative analysis

Table 2 presents the results of fsQCA for the full sample, identifying the sufficient causal configurations that predict job pursuit intention. The overall solution exhibits excellent explanatory power and reliability, with a total coverage of 0.922 and a consistency of 0.974, well above the recommended thresholds. Among the four identified configurations, Solution 1 (S1: JOAT*ORAT*ININ*ESGE*ESGS*ESGG) emerges as the overwhelmingly dominant pathway. S1 demonstrates that the synergistic combination of high job attractiveness, organization attractiveness, individual interest and strong perceptions across all three ESG dimensions is sufficient to drive job pursuit intentions. This comprehensive configuration accounts for a substantial majority of cases, evidenced by its massive raw coverage of 0.913 and an exceptionally high consistency of 0.995. Figure 6 visually corroborates the sufficiency of this primary pathway through an XY scatter plot. The plot illustrates a clear asymmetric relationship, with the vast majority of data points densely concentrated above the diagonal line, confirming that when this combined configuration is strongly present, high job pursuit intention reliably occurs.

These configurational findings offer critical theoretical insights that complement the GLM results, highlighting the strength of the dual-analytical approach. While the GLM analysis indicated that job attractiveness (JOAT) and perceived ESG-Social factors (ESGS) lacked independent predictive power, the fsQCA results decisively establish their indispensable roles as interdependent elements within the dominant causal recipe (S1). This reveals that in the context of HRC, potential employees do not evaluate ethical social practices or functional job appeal in isolation. These factors must co-occur synergistically alongside strong organizational branding, personal interest and environmental and governance commitments to effectively attract applicants. Although the analysis generated three alternative pathways (S2, S3 and S4) featuring the negation of several conditions, these configurations exhibit negligibly low unique coverage scores (≤0.001), indicating they represent marginal empirical instances rather than substantive strategies. Ultimately, S1 stands as the definitive, holistic configuration required to attract talent to robot-integrated hospitality workplaces.

Table 2. Sufficient causal configurations on job pursuit intention

The full sample (Coverage: 0.922; Consistency: 0.974)	Raw coverage	Unique coverage	Consistency
S1: JOAT*ORAT*ININ*ESGE*ESGS*ESGG	0.913	0.771	0.995
S2: ~JOAT*~ORAT*~ININ*~ESGS*~ESGG	0.146	0.001	0.899
S3: ~JOAT*~ORAT*~ININ*~ESGE*~ESGG	0.146	0.000	0.900
S4: ~JOAT*~ORAT*~ININ*~ESGE*~ESGS	0.146	0.001	0.898

Note(s): ~: Negation; JOAT: job attractiveness; ORAT: organization attractiveness; ININ: individual interest; ESGE: perceived ESG_Environmental; ESGS: perceived ESG_ Social; ESGG: perceived ESG_ Governance

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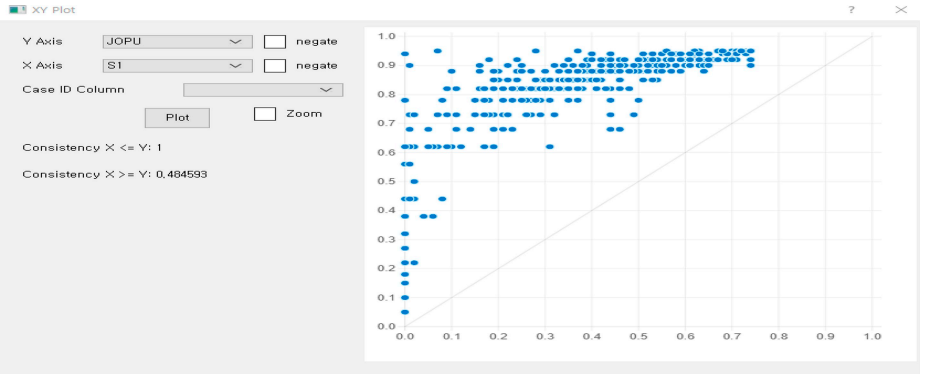


Figure 6. The best sufficient solutions for predicting job pursuit intention via fsQCA

Note: Full sample configuration: Solution 1 (JOAT*ORAT*ININ*ESGE*ESGS*ESGG); JOAT: Job attractiveness; ORAT: Organization attractiveness; ININ: Individual interest; ESGE: Perceived ESG_ Environmental; ESGS: Perceived ESG_ Social; ESGG: Perceived ESG_ Governance

5. Discussion and conclusions

5.1 Conclusions

The present study adds to the current body of knowledge by examining the relationships between attractiveness factors (job, organization and individual), perceived ESG factors (Environmental, Social and Governance) and job pursuit intention in the context of HRC in the hospitality industry. The results from the GLM analysis show that organization attractiveness, individual interest and perceived ESG Environmental and Governance factors significantly predict job pursuit intention. These findings are consistent with prior studies that have found a strong association between organization attractiveness and job pursuit intention (Boğan *et al.*, 2020; Chapman *et al.*, 2005; Highhouse *et al.*, 2003). The substantial impact of individual interest on job pursuit intention aligns with the results of Sievänen *et al.* (2011), who found that higher levels of interest lead to greater intention to pursue a particular activity or destination. The significant influence of perceived ESG Environmental and Governance factors on job pursuit intention is in line with the growing importance of ESG factors in the hospitality industry (Dogru *et al.*, 2022; Ionescu *et al.*, 2019; Kim *et al.*, 2024b). This finding emphasizes the relevance of sustainability and ethical practices in shaping job seekers' intentions in the evolving hospitality industry.

Contrary to expectations, job attractiveness and perceived ESG social factors have insignificant effects on predicting job pursuit intention in this study. This finding differs from previous research that has found a positive association between job attractiveness and job pursuit intention (Highhouse *et al.*, 2003; Van Hooft *et al.*, 2006). However, fsQCA revealed that these same factors are indispensable components of the dominant causal configuration. Theoretically, this specific synergy emerges because the physical integration of robots inevitably triggers profound workforce anxieties regarding job security, identity threat and shifting human-machine dynamics. Under such uncertainty, standalone functional perks (job attractiveness) or isolated social initiatives (ESG-Social) are perceived as insufficient to mitigate psychological risks. Rather, prospective employees evaluate employers holistically. Job attractiveness and ESG social commitments only translate into job pursuit intentions when structurally reinforced by strong organizational branding, personal interest and robust environmental and governance safeguards. This comprehensive configuration signals that

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the organization is executing a responsible technological transition, treating human-machine integration as an ethical organizational shift rather than a mere operational upgrade. These synergistic pathways offer hospitality leaders practical guidance for building a transparent, sustainable and human-centric workplace as service automation expands. Ultimately, this study answers a critical question for the industry's future: as hospitality services increasingly automate, relying solely on traditional job perks is no longer sufficient to attract talent. If organizations fail to frame HRC within a robust ESG and ethical governance framework, they risk alienating a workforce anxious about technological displacement. By adopting the synergistic strategies identified here, hospitality leaders can build human-centric employer brands that turn the challenge of automation into a competitive recruitment advantage.

5.2 Theoretical implications

This study contributes to the current literature on HRC in the hospitality industry by examining the relationships between attractiveness factors, perceived ESG aspects and job pursuit intention from the perspective of potential employees. The findings extend current knowledge. The research addresses a research gap by focusing on potential employees' perceptions and intentions regarding HRC. While previous studies have mainly explored consumers' attitudes toward service robots (Ali *et al.*, 2023; Borghi and Mariani, 2021; Tussyadiah *et al.*, 2020), this research sheds light on the variables affecting job seekers' decisions in a human-robot collaborative environment.

Integrating attractiveness factors and ESG aspects: The research model incorporates both attractiveness factors (job, organization and individual) and perceived ESG aspects (Environmental, Social and Governance), providing a comprehensive framework for understanding job pursuit intention in the setting of HRC. The significant effects of organization attractiveness, individual interest and perceived ESG Environmental and Governance factors on job pursuit intention highlight the significance of considering these elements in future research.

Applying complexity theory and fsQCA, this study uncovers the complex, asymmetric relationships driving job pursuit intentions. A core methodological contribution lies in demonstrating the complementary value of combining GLM and fsQCA. While GLM found variables like job attractiveness and perceived ESG social factors to be insignificant in isolation, fsQCA successfully revealed their critical roles within specific causal configurations. Theoretically, this finding explicitly challenges traditional linear recruitment models, which assume job attractiveness independently drives applicant intentions. Rather, it suggests that in HRC workplaces, where robot coworkers trigger unique automation anxieties, job seekers evaluate employers holistically. Functional job appeal alone is insufficient; it only translates into pursuit intentions when synergistically combined with strong organizational branding and ethical ESG signals that assure a responsible technological transition. These findings demonstrate the value of identifying synergistic interactions to produce desired outcomes in hospitality research (Olya *et al.*, 2019; Olya and Gavilyan, 2017).

5.3 Practical implications

This work offers a number of valuable practical contributions for the hospitality industry, particularly in the context of HRC and the increasing importance of ESG factors and job seeker intentions. These insights can assist organizations in developing effective tactics for attracting and retaining talent in the strategic planning of businesses. Given the significant impact of organization attractiveness and individual interest on job pursuit intention, hospitality organizations should focus on enhancing their employer brand and showcasing

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the unique opportunities and experiences they offer to potential employees. This can be achieved through targeted recruitment campaigns, engaging social media presence and highlighting the company's values, culture and growth prospects. By aligning organizational attributes with individual interests and aspirations, companies can attract top talent and foster a motivated workforce.

As perceived ESG Environmental and Governance factors significantly influence job pursuit intentions, organizations must move beyond generic sustainability claims. To effectively signal both ESG commitment and organization attractiveness, recruitment messaging should explicitly intertwine robotic integration with environmental and governance initiatives. For example, job advertisements can highlight how energy-efficient robots reduce the hotel's carbon footprint (Environmental) while operating under transparent, ethical guidelines that prioritize human oversight (Governance). Specific messaging strategies, such as stating, "Our eco-friendly service robots handle routine tasks, empowering our human team to focus on creative guest experiences under transparent, ethical management", leverage proven priorities to effectively attract prospective applicants who value responsible technological transitions.

To alleviate robot-induced anxieties, organizations must also strategically frame HRC as an "employee empowerment" tool rather than a mere cost-cutting or efficiency measure. Recruitment materials and training programs should explicitly state that robots are adopted to elevate human roles. By emphasizing that robots take over physically demanding or repetitive tasks to improve human employee well-being and safety, organizations can transform potential replacement anxiety into an attractive opportunity for career growth. Recruitment materials should therefore move beyond generic employer branding toward targeted, human-centric ESG messaging.

5.4 Limitations and future research

Our work has several limitations. First and most prominently, our ESG measurement items embedded the context of human-robot diverse climates directly into their wording. While formal discriminant validity tests confirmed that the ESG dimensions were treated as empirically distinct, this shared framing risks common method variance and conceptual overlap. Future research must use strictly separated item wording to avoid any potential for an overarching "ethical employer" halo effect. Second, it relies on a single-shot, cross-sectional survey, which inherently prevents the establishment of definitive causal inferences. Third, the study used a single, specific poster-based stimulus in the US to contextualize the human-robot collaborative environment. This may limit the external validity and generalizability of the findings across different types of recruitment materials or cultural contexts. Fourth, relying on a broad screening question (i.e. general "interest in hospitality careers") does not perfectly guarantee that respondents are genuine job seekers with specific labor-market knowledge. The low retention rate (17.8%) and the use of a quota-based two-phase collection also introduce the risk of unobserved self-selection bias and representativeness issues. In particular, we cannot address whether the final sample differs systematically from those excluded beyond the stated screening criteria, which could potentially affect the stability of our model estimates. Fifth, we measured job pursuit intention, which, while a strong proxy, may not fully capture actual job pursuit behavior. The study considers a limited set of factors. Future research should address these limitations by using multiple data collection methods, exploring different cultural contexts, investigating actual job pursuit behavior, expanding the range of factors examined and using experimental or longitudinal designs. Finally, the binary coding of age as a control variable (see Methods for the sample-distribution rationale) may involve some information loss. Future studies

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recruiting broader age ranges should retain continuous or multi-category age measures where the sample permits.

Measuring novel constructs in HRC contexts is also notoriously difficult due to the lack of established scales. Future studies must develop psychometrically rigorous scales by engaging with best practices in scale development (e.g. DeVellis, 2017; Hinkin, 1998) and explore alternative theoretical frameworks, such as Sociotechnical Systems Theory or the Job Demands-Resources (JD-R) model adapted for AI collaboration, to better capture the multidimensional impact of robot integration on employee perceptions.

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Supplementary material

The supplementary material for this article can be found online.

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