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# An integrated adoption model of cloud computing-based human resource management by SMEs in developing countries: evidence from Bahrain

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Despite the increasing awareness of efficient and technology-driven human resource management at almost all levels of analysis in all organizations, more needs to be done regarding small- and medium-sized enterprises in developing country contexts like Bahrain to explore using cloud computing in HRM. This study applies the Technology, Organization, and Environment framework, extended to include individual managerial innovativeness, in examining the factors influencing the adoption of sustainable cloud computing-based HRM. Data were collected through a cross-sectional survey of 280 upper-level managers and human resource specialists across various SMEs in Bahrain. This data was analyzed using structural equation modeling (SEM) with the help of partial least square (PLS) software. The findings indicate that the technological, organizational, and environmental contexts greatly impact the adoption of sustainable cloud computing-based HRM, while individual managerial innovativeness does not. This study has significant implications for any human resource department looking to shift its operation onto a sustainable cloud computing platform in a developing country.

KEYWORDS

**cloud computing, sustainability, human resource management, SMEs, TOE, manager innovativeness, developing countries, structural equation modeling (SEM)**

## 1 Introduction

From the perspective of global business trends, adopting efficient technologies has become a crucial concern in human resource management (HRM; Klumb et al., 2024), especially for small and medium-sized enterprises (SMEs) in developing countries.

Generally, HRM significantly impacts organizational performance regarding employee relations, training, performance appraisal, and welfare (Zebari et al., 2019; Naji et al., 2022). However, a literature gap exists on adopting cloud computing in SMEs' HRM practices in developing economies (Abdullah, I. et al., 2020; Al-Mutawa and Saeed Al Mubarak, 2024).

This becomes a critical gap since cloud computing has many benefits related to operational efficiency, cost savings, and environmental impact. However, most SMEs in developing nations face significant resource barriers, other technological inhibitors, and a need for more awareness or knowledge, which seriously hampers their ability to adopt such innovative solutions (Zidan, 2023; Zuofa et al., 2023; Nazir and Khan, 2024). Against this background, this study seeks to assess the status of the adoption of cloud-based HRM practices in SMEs against the peculiar contextual landscape of developing economies. In this vein, using the Technology-Organization-Environment (TOE; Tornatzky and Fleischer, 1990), this research incorporates the seldom-included human component, particularly management innovativeness, as an important element in determining adoption. The innovative approach of incorporating management innovativeness as a significant enabler for adopting new technologies (Gama and Magistretti, 2025; Rajani et al., 2023) presents a fresh perspective in this area of research, sparking the audience's interest in the study.

Consequentially, this research contributes both at a theoretical and practical level. Theoretically, the study extends the TOE framework by incorporating management innovativeness, giving fine details of factors that may facilitate or inhibit the adoption of cloud-based HRM systems. In practical terms, it deals with the critical operational challenges faced by SMEs in adopting advanced IT solutions and strategies that can be used to overcome such barriers to cloud computing and maximize HRM benefits.

According to Abdullah, P. Y. et al. (2020), the study further researches challenges that conventionally impeded the mainstream adoption of cloud computing such as data recovery, security, reliability, and accessibility. We make such suggestions that we duly consider strategies that can be applied, given the resource constraints of critical drivers in any economy, yet often need help to use advanced technologies. This provides practical solutions to overcome such barriers, making the research highly relevant and applicable to the audience's work.

This research uses the TOE framework to explore the dynamic challenges and opportunities surrounding adopting technologies in SMEs. Past literature has established that HRM functions can solve social and environmental problems and simultaneously create economic value (Al-Dmour et al., 2017; Liza et al., 2021). In this respect, integrating cloud computing with the concept of HRM will create a metamorphosed framework for improving organizational effectiveness. The potential benefits of this research are significant, as it aims to understand in-depth the critical factors that affect the adoption and diffusion of cloud-based HRM systems among SMEs operating in developing countries. As a result, the study is informed by the following research question: What significant factors influence the adoption of cloud-based HRM practices among SMEs in developing countries?

## 2 Literature review

### 2.1 Sustainable cloud computing-based human resource management

Cloud computing is changing the concept of operational business because it is a flexible and cost-effective way of delivering IT services. It can be based on parallel and distributed computing concepts that provide shared access to hardware, software, and potential data in computers or other (LD and Krishna, 2013)In general, sustainable cloud computing signifies cloud-enabled technologies and infrastructures catering to environmental, economic, and social sustainability concerns (Bristy et al., 2023). The central concept behind this approach is minimizing energy usage and optimizing resource allocation to achieve the lowest environmental footprints at higher scalability and efficiency levels of operations (Radhika et al., 2024).

This study, therefore, identifies these factors and develops an integrated adoption model for the successful implementation of sustainable cloud-based HRM in SMEs.

Zhao and Rabiei (2023) evaluated whether it would be feasible to implement a cloud-based HR payroll system within a business. They discovered that the necessary conditions for implementing cloud computing technology in the enterprise were desire, capability, and acceptance. To develop an optimization model for HRM issues, Liu et al. (2022) recommended using cloud edge computing and the Whale Optimization Algorithm. The findings demonstrate that the proposed model outperforms alternative metaheuristics in two distinct scenarios, increasing the amount of human resources provided while decreasing the allocation cost. To help SMEs manage their human resources challenges, Oduh et al. (2018) created and executed a preliminary version of a cloud-based application. A novel framework called Expert Cloud was created by Navimipour et al. (2015) to allow Cloud users to request human expertise and abilities without being aware of their location and to encourage the sharing of HR knowledge, experience, and skills. The findings showed that the Expert Cloud boosts HR performance within the company and increases customer satisfaction.

However, sustainable cloud computing encompasses both the traditional advantages of flexibility and cost-effectiveness and the environmental, economic, and social dimensions of sustainability. In the context of the environment, it involves using cloud computing to minimize power consumption through optimized server use and reduces paper waste by substituting it with digitization of workflow (Bharany et al., 2022). Economically, it allows SMEs to lower operational costs due to no upfront investments in hardware while scaling up the resources to meet demand (Bandara, 2024). Socially, it opens up a wide avenue toward inclusivity, enabling remote employment and providing equal opportunities for training and development through cloud-based enabling platforms (Yenugula et al., 2024). These features make sustainable cloud computing fundamentally different from conventional cloud models and make it a strategic enabler for SMEs in their ambitions to meet global sustainability objectives Johnson and Diman (2017) utilized the TOE model and found that small businesses are more likely to use cloud-based human resource information systems to support ongoing HR operations. Yao and Azma (2022) showed that while cloud privacy and security hurt HR productivity, other factors such as employee skills and knowledge, company financial situation, current IT structure, payment terms, and cloud accessibility have a positive impact on staff efficiency. In a separate study, Dong and Salwana (2022)

conducted a study to investigate whether cloud-based HRM and supply chain management enhance the performance of multinational organizations. The findings supported the notion that cloud-based HRM and supply chain management are essential for improving these organizations' financial, marketing, and collaboration performance.

In recent years, researchers have begun to explore the adoption of green cloud computing by SMEs in emerging economies. For instance, Senyo et al. (2016) explored cloud computing adoption in SMEs in Ghana. The study findings indicated that relative advantage, top management support, and competitive pressure all significantly impact the adoption of cloud computing among SMEs. In a related study, Gupta et al. (2013) investigated cloud computing usage and its adoption by SMEs in Malaysia. Perceived benefit, technological readiness, and external pressure were significant antecedents to adopting cloud computing.

Alshamaila et al. (2013) studied SMEs' adoption of cloud computing in the Middle East. They established that although technological issues are relevant, environmental and organizational contexts are equally crucial. This certainly has implications for Bahrain, where cultural and regulatory reasons could impact any adoption.

Comparative studies show that SMEs in developing economies face similar challenges and drivers in adopting cloud computing technologies (Al-Shboul, 2019; Skafi et al., 2020; Khayer et al., 2021). These include technological readiness, perceived benefits, and security/privacy concerns. However, differences in infrastructure development, regulatory environments, and cultural attitudes toward technology ensure that variations lie. For example, Ghanaian SMEs might have to put up with poor internet connectivity (Dayour et al., 2023), Bahraini firms have the better infrastructure but might face varying regulatory obstacles (AlBenJasim et al., 2023). In the review of related literature, the usage of cloud computing in HRM research was found to be very popular among academics globally (Porkodi and Raman, 2024). Recently, such scope seems to need to be added in studies about sustainable cloud computing-based HRM in the SME environment in developing countries like Bahrain.

Although some studies investigate cloud computing adoption in SMEs, those investigating sustainable cloud-based HRM system contexts remain scant (Maqueira Marín et al., 2022; Ashrafuzzaman, 2024). To the best of the authors' knowledge, no prior study has addressed the issue of sustainable cloud computing-based HRM in an SME environment using the Technology-Organization-Environment (TOE) framework and individual context in developing nations such as Bahrain.

Adding to the list of recent studies from other developing economies, our research enriches the comparative element and broadens the understanding of factors influencing cloud adoption in diverse contexts. Demonstrating similarities and differences in Bahrain and other similar economies strengthens the study's theoretical framework. By incorporating these insights and focusing on the unique context of Bahraini SMEs, this research can inspire further research and contribute significantly to the field.

## 2.2 Cloud computing-based HRM systems in SMEs and their role in sustainability

The rapid growth of cloud computing technology has significantly transformed HRM, particularly for SMEs. Cloud-based HRM systems offer unique benefits such as scalability, cost-effectiveness, and practical solutions, which are crucial for addressing the distinct challenges faced by SMEs (Marler and Fisher, 2013; Strohmeier, 2014). The cloud HRM system refers to various software applications running on remote servers to enable HR functions that range from recruitment, payroll management, performance tracking, and employee engagement (Ardebili et al., 2023). Since these systems are highly scalable and flexible, they can comfortably facilitate SMEs' adaptation to HR processes with zero investment in infrastructure (Herzallah and Ayyash, 2024).These systems are software applications hosted on remote servers and accessed via the Internet, requiring minimal upfront investment in hardware or infrastructure (Bondarouk and Brewster, 2016). Unlike traditional on-premise HRM systems, cloud solutions enable SMEs to become flexible and scalable; resources can be adjusted up or down depending on the organization's needs without an exponential cost increase (Kavanagh and Johnson, 2017). The systems are designed so that updates, which should be performed periodically, are done automatically by the service providers, ensuring that the latest functionality and security features are available for organizations without the need and headache of maintenance (Voermans and Van Veldhoven, 2007; Stone and Deadrick, 2015).

By systematizing human resources management in SMEs, cloud-based HRM applications empower owners and professionals with real-time tracking and automation features (Lee and Lee, 2024). For instance, they automate recruitment and onboarding, reducing time-to-hire and improving the candidate experience (Johnson et al., 2016). They efficiently track and manage applicants, enabling performance management and timely feedback in line with organizational objectives (Strohmeier, 2014). Payroll and benefits administration is also automated, minimizing errors and ensuring compliance with tax laws (Marler and Boudreau, 2017). This level of control and empowerment is a significant benefit of cloud-based HRM systems.

The capabilities of these systems include extensive data management and analytics methodologies (Namperumal et al., 2022). Cloud environments protect the security of employee information that is kept therein, thus making access to and managing such data easier (Awaysheh et al., 2021). Advanced analytics let SMEs identify trends in the workforce, informing strategic decisions in talent management and organizational development (Conte and Siano, 2023). These systems enhance compliance and security since they have built-in features that help SMEs check their adherence to labor laws, thus minimizing legal risk (Strohmeier, 2014).

Despite robust security measures, concerns related to data breaches and data privacy persist in cloud HRM systems (Du Plessis and De Wet Fourie, 2016). Features in HRM systems, such as self-service portals, also help employees access their personal information, leave applications, and benefit enrollment, leading to increased transparency and satisfaction (Martin and Reddington,

2010). The integrated communications within cloud-based HRM systems enable collaboration and connectedness among the workforce, which is helpful for SMEs in building an integrated organizational culture (Berglund, 2023). This reassurance and confidence in data management are significant benefits of cloud-based HRM systems.

Such adoption of cloud-based HRM systems contributes to the sustainability of SMEs in terms of environmental, economic, and social dimensions (Lopes de Sousa Jabbour et al., 2018). From an environmental perspective, these systems reduce paper usage by digitizing records and workflows, reducing waste, and aiding conservation accordingly (Sanjeev et al., 2024). The consolidation of server usage in cloud computing reduces energy consumption compared with individual on-premise systems, increasing energy efficiency and reducing carbon emissions associated with IT infrastructure (Thaqi et al., 2024). This point is supported by several authors, such as Yenugula et al. (2024) and Columbres and Victoriano (2024).

Economically, cloud-based HRM is cost-effective since it saves money that would be used in capital expenditures like hardware and maintenance, which SMEs can utilize in other areas of their core business activities (Zhao and Rabiei, 2023). It operationalizes efficiency in human resources through the automation of processes, thereby increasing productivity due to reduced administrative burdens (Fawehinmi et al., 2024). The scalability of cloud solutions offers support for sustainable business growth since it allows the operations of SMEs to expand without high additional costs (Natrajan et al., 2024).

Promoting social sustainability, cloud-based HRM systems offer virtual work access, enabling employees to work anytime and from anywhere (Porkodi and Raman, 2024). These systems also support talent development through online training and development modules, fostering continuous learning and career advancement. Moreover, they facilitate inclusive practices, expanding the talent pool and promoting diversity and inclusion within the organization (Lopes de Sousa Jabbour et al., 2018).

Finally, HRM systems based on cloud computing present SMEs with one of the most effective tools to enhance operational efficacy in furthering sustainability objectives.

Implementation of these systems enables SMEs to achieve competitive performance by promoting environmental stewardship, economic resilience, and social responsibility (Yenugula et al., 2024). Integrating a cloud-based HRM system into organizational strategies denotes its importance in developing a sustainable future in business and society in general.

# 3 Theoretical foundations

## 3.1 Technology-organization-environment (TOE) model

The authors notice that the TOE framework of Tornatzky and Fleischer (1990) might summarize the assumed factors into a more excellent picture, adding a deep theoretical perspective to this study. More importantly, the framework was meant to link the information system innovation adoption decisions to contextual considerations to make it suitable for cloud computing as an innovative industry (Chau and Tam, 1997; Yaseen et al., 2023).

The TOE framework proposes three contextual factors: technological, organizational, and environmental decisions within SMEs. It involves relevant internal and external technologies to the firm. Traditionally, it encompasses such factors as relative advantage, complexity, compatibility, and technological readiness (Tornatzky and Fleischer, 1990; Oliveira and Martins, 2010). Initially, the TOE framework focuses on the technological factors of IT infrastructure characteristics and technological competence. In our study, we have also included relative advantage, complexity, and compatibility because, according to Rogers (2003), those are critical in the context of cloud computing adoption.

The organizational context is affected by the company's features, such as its size and the degree of bureaucratization, decentralization, and complexity of its management structure. It includes factors like top management support, organizational readiness, and firm size (Alshamaila et al., 2013; Rahayu and Day, 2015). These factors influence the firm's capacity to adopt and implement new technologies (Salah and Ayyash, 2024).

The environmental context refers to the external environment in which the firm operates and is composed of industry characteristics, market structure, competitors, suppliers, customers, and regulatory environment (Zhu et al., 2006; Rahayu and Day, 2015). Although the original TOE framework includes industry characteristics, market structure, and regulation, our study focused on competitive and trading partner pressure. Specifically, in the context of the adoption of sustainable cloud computing-based HRM by SMEs, these factors have been identified as the most immediate environmental factors (Low et al., 2011).

The TOE framework or other models have been used in previous studies on the adoption of information technology and information systems at the corporate level (Oliveira and Martins, 2010; Aboelmaged, 2014; Ali et al., 2015; Min et al., 2015; Alkhalil et al., 2017). Instead of emphasizing a particular viewpoint, the framework provides a comprehensive view of the many facets of an organization (Nkhoma et al., 2013). As a result, we decided to base our research model on the TOE framework. This choice was made after taking into account a variety of considerations. First of all, prior research has generally recognized the TOE as a trustworthy paradigm for analyzing the adoption of cloud computing (Oliveira et al., 2014; Tashkandi and Al-Jabri, 2015; Senyo et al., 2016; Al-Hujran et al., 2018; Asiaei and Rahim, 2019; Hiran and Henten, 2020). The TOE framework emphasizes the background of technology while also considering organizational and environmental factors.

The TOE model provides a valuable basis for this study's understanding of various factors that affect the adoption and implementation of green cloud computing in SMEs. The original TOE constructs already include a wide range of factors, and we have selected certain factors in each context that are most relevant to our research.

Thus, in this study relative advantage, complexity, and compatibility factors in the technological context, as they directly affect cloud computing technologies' perceived usefulness and ease of use. As Rogers (2003) puts it, the relative advantage is the degree to which an innovation is perceived as being better than the idea it

supersedes- a significant factor in assessing new technologies such as sustainable cloud computing-based HRM systems. Complexity refers to the degree to which an innovation is perceived as complicated to understand and use; this might be a potential barrier in the adoption process. Compatibility represents how consistent the innovation is with the potential adopters' existing values, past experiences, and needs.

In this study, within an organizational context, we focused on top management support, technology readiness, and organization size. Top management support allows for adequate resources to be provided within the supportive atmosphere necessary for innovation. According to Khayer et al. (2020), top management support will provide the appropriate resources for innovation to develop and facilitate an enabling environment for innovation to take place. Technology readiness reflects the firm's infrastructural and human resource capabilities (Khayyam et al., 2024). This study considers organization size because larger firms are more able to adopt new technologies than smaller firms (Shahzad et al., 2024).

In the context of the environment, we have included competitive and trading partner pressures. Competitive pressure forces firms to adopt new technologies to be more competitive (Kwarteng et al., 2024). The pressure from trading partners is essential because SMEs often depend on their partners, and alignment with partners aids adoption (Benhayoun et al., 2021). Although the TOE framework does include other factors, such as industry characteristics, market structure, and regulations, we focused on the most immediately relevant factors for SMEs in Bahrain.

Justification of these factors and realization of the exclusion of others have captured the TOE framework so that its application suits the context of sustainable cloud computing-based HRM adoption among Bahraini SMEs. This kind of selective inclusion can allow for a more focused analysis of the most pertinent factors of such adoption in our context.

Individual-related factors will help in understanding the attitudes and perceptions of people and their capacity for behavior change about the acceptance of cloud computing-based sustainable HRM in SMEs. These might also benefit firms by helping them design more specifically tailored approaches to promoting adoption and addressing potential barriers. On the other hand, TOE does not disregard factors that relate to the personal characteristics of managers and employees (Ghobakhloo and Tang, 2013; Rahayu and Day, 2015). As a result, the individual context has been added to the original TOE framework, represented by the factor of managerial perceived innovativeness because it could play a significant role in SMEs. After all, decision-making is often within their centralized power (Al-Qirim, 2007).

Although we understood the wide array of factors present within the original TOE framework, we have identified and justified a certain number of those factors in each context, which will most suit our study on the adoption of sustainable cloud-based computing HRM in Bahrain's SMEs. The approach provides a theoretically sound and practically relevant research model that captures the essential elements driving the adoption decisions within the particular context of the study, with interests shared by our fellow researchers in the field of HRM and sustainable computing.

# 4 Research model and development of hypotheses

The TOE framework, frequently used to predict how SMEs will accept new technologies, serves as the foundation for the research model developed for this study. The TOE asserts that the aspects that have the largest effects on adopting cloud computing include technological, organizational, and environmental factors. The eight variables listed below were hypothesized to determine whether they directly influence SMEs' decisions to implement sustainable cloud-based HRM. However, this study expanded the TOE by adding individual context based on a literature review to enhance its predictive power. Moreover, these factors were deemed important in predicting SMEs' acceptance of sustainable cloud computing-based HRM. Figure 1 outlines the research model.

## 4.1 Technological context

This study's technological environment includes compatibility, relative advantages, and complexity. The relative advantage significantly impacts whether new information system innovations are adopted. According to Rogers (2003) relative advantage refers to the extent to which a technological component is believed to help businesses more. The effect of relative advantage on the adoption of technology in firms has been investigated in detail in earlier research (Thong, 1999; Lee, 2004). Their findings found that when organizations understand an innovation's relative advantage, adoption is more likely to occur (Alshamaila et al., 2013). Berman et al. (2012) claim that for innovative tools to be adopted, they must be easy to manage and use. As cloud computing is a relatively new technology, some organizations may not have the necessary confidence or technological enablers, such as high-speed communication networks, to support it. Adoption times are consequently prolonged (Dwivedi and Mustafee, 2010). Second, complexity refers to how difficult it is for SMEs to understand and use cloud computing. Contrary to other aspects of the technology, complexity has been found to have a negative link with the likelihood of adoption despite being a substantial influence on the decision to accept a new technology (Gutierrez et al., 2015). Lastly, the level of perceived fit between the new technology and the organization's values and needs is referred to as compatibility (Rogers, 2003). Cloud computing, for example, allows companies to stay up-to-date with technology without disrupting their existing legacy IT systems (Sultan, 2011; Gupta et al., 2013). Consequently, factors such as complexity, compatibility, and relative advantage contribute to adopting sustainable cloud computing-based HRM in SMEs. Therefore, it is hypothesized that:

**Hypothesis 1:** Technological context has a significant impact on SME's adoption of cloud computing-based HRM.

## 4.2 Organizational context

In this study, the organizational context is defined as certain factors of an organization's structure that could affect the adoption

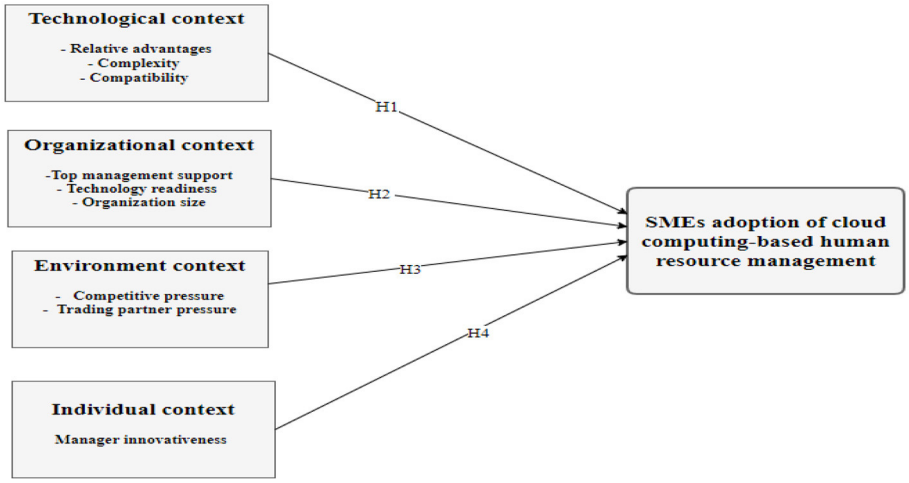


FIGURE 1
A model of cloud computing-based HRM in SMEs.

of sustainable cloud computing-based HRM. The study focuses, in particular, on three organizational factors: top management support, technology readiness, and organization size, which are considered to be significant predictors of SMEs' adoption of sustainable cloud computing-based HRM. One aspect of the organizational context that this study highlighted as potentially influencing SMEs' adoption of sustainable cloud-based HRM is top management support. The decision of an organization to adopt new technology is heavily influenced by the backing of top management (Yigitbasioglu, 2015). A lack of leadership support decreases the chances of adopting an innovation like cloud computing. Hence, the degree of support SMEs receive from their senior executive manager has an important effect on the extent to which cloud technology is adopted. Top management's inability to see the potential advantages of cloud computing deters them from implementing it (Khayer et al., 2020). Technology readiness, on the other hand, refers to how much a firm's technical capabilities, systems, and infrastructure can support SMEs in their adoption of sustainable cloud computing (Zhu et al., 2006). Technology infrastructure and IT personnel are both essential components of technology readiness (Zhu et al., 2004) and both are crucial if SMEs want to integrate e-business into the value chain fully (Natario et al., 2010). The size of the firm is another element of organizational context that has been connected to e-commerce adoption by SMEs. This is a consequence of the connection between a firm's size and its ability to offer particular resources, including both financial and human resources (Rahayu and Day, 2015). As a firm grows, its capacity to provide specific resources rises, making adopting cloud computing more likely. Furthermore, SMEs with strong top management support, high technology readiness levels, sufficient resources, and infrastructure are more likely to embrace and effectively execute sustainable cloud-based HRM. Therefore, it is hypothesized that:

**Hypothesis 2:** Organizational Context has a significant impact on SMEs' adoption of cloud computing-based HRM.

## 4.3 Environment context

The adoption of sustainable cloud computing-based HRM by SMEs is influenced by external influences including competitive and trading partner pressure. Competitive pressure is the degree of rivalry between businesses in the particular sector in which the company operates (Thong and Yap, 1995). Incentives to adopt pertinent new technologies include the competitive pressure a firm must deal with (Majumdar and Venkataraman, 1993; Alshamaila et al., 2013). Further, many SMEs rely on their business associates to complete IT design and implementation duties (Pan and Jang, 2008). According to reports, pressure from trading partners is a key driver of IT adoption (Chong et al., 2009; Amini et al., 2014). On the other hand, SMEs are more likely to embrace sustainable cloud computing-based HRM practices when they are up against the firm competition or work with partners who share their values in this area. If SMEs want to keep their competence and prosperous business relationships, they must stay abreast of market developments and their partners' expectations. Therefore, it is hypothesized that:

**Hypothesis 3:** Environment Context has a significant impact on SMEs' adoption of cloud computing-based HRM.

## 4.4 Individual context

While the technological, organizational, and environmental contexts have been the primary focus of this study, we have also expanded our investigation to include the area of individual contexts, particularly managerial innovativeness, as a determinant factor for adopting sustainable cloud computing-based HRM systems in SMEs. This is supported by the argument that management actions often have a significant impact on strategic decisions made inside SMEs, as demonstrated by foundational publications like Cloete et al. (2002). Fink (1998) and other earlier studies have shown that small commercial firms with creative

managers at the helm have a higher possibility of effectively implementing information systems. Similar to this, Al-Qirim (2007) showed how the chief executive officer's creativity had a big influence on how e-commerce technology was incorporated into the SME sector in New Zealand.

Using this fundamental research as our guide, we propose that the degree of managerial innovativeness may have a considerable impact on SMEs' tendency to adopt sustainable cloud computing-based HRM solutions. This builds on prior research by claiming that managers in the world of SMEs with a high level of innovativeness may be more receptive to evaluating, appreciating, and ultimately embracing disruptive technology such as sustainable cloud computing-based HRM systems. Such managers would probably be more aware of the long-term strategic advantages of this technology, such as cost-effectiveness, scalability, and sustainability, making them more open to adoption. However, it's important to understand that managerial innovativeness in this context is not a standalone concept; rather, it probably interacts with the other organizational, technical, and environmental aspects mentioned in this research. For instance, adopting sustainable cloud computing-based HRM may still be significantly hampered for a creative manager working in a company that is technologically immature or not aligned with sustainable principles.

As a result, it is important to take managerial innovativeness into account as one of several interconnected factors that influence the choice to embrace a new technology. A more nuanced understanding of the obstacles to and enablers for the adoption of long-term cloud-based HRM systems in SMEs might be gained by recognizing the synergy between managerial innovativeness and these other decisive elements. As a result, we claim that SMEs with innovative managers would be more likely to explore implementing sustainable cloud computing-based HRM. As a result, it is assumed that:

**Hypothesis 4:** Individual Context have a significant impact on SMEs' adoption of cloud computing-based HRM.

# 5 Methodology

## 5.1 Research context

With a focus on Small and Medium Enterprises (SMEs) in Bahrain, the current inquiry is placed within the dynamic field of cloud computing-based Human Resource Management practices. Bahrain was specifically chosen as the research location because it provides a unique scenario for examining how cloud computing, and HRM interact within the context of a growing economy. The dynamics of the global market and local government are having an increasing influence on Bahrain's SMEs. They are a very ideal subject for in-depth examination and inquiry due to the confluence of factors.

## 5.2 Data collection and sampling

Our research used a quantitative cross-sectional design. The main participants targeted for data collection were senior managers and HR specialists. This was undertaken because they are individuals who generally possess an influential say in organizational decisions about the implementation of technology.

Convenience sampling was a deliberate method of accelerating data collection. This non-probability technique is efficient and practical in getting hold of large numbers of participants in the shortest time possible. Two hundred eighty participants were used, constituting 25 small and medium enterprises from diverse sectors and organizations of different sizes. Their selection was guided by proximity to ensure willingness to participate and achieve a representative sample across different industries and firm sizes. We compared the key demographic characteristics of our sample to the larger SME population in Bahrain using the data from the Bahrain Ministry of Industry, Commerce, and Tourism (2021). Our sample represents the overall SME population in Bahrain in terms of industry distribution and organizational size.

The sample size determination was informed by power analysis to ensure that there would be adequate statistical rigor for the testing of hypotheses. According to Albusaidi et al. (2024), a power analysis in research helps identify a minimum sample size needed to detect the effect size of interest at the needed levels of confidence to establish the reliability and robustness of the study findings. The targeted population was that of SMEs in Bahrain. However, given the diversity and variety of these enterprises, the findings can also be generalized to other SME setups in developing countries. This increases the general applicability of this research and, hence, its relevance even more.

## 5.3 Measurement

Data collection was based on online adapted questionnaires from previously conducted research studies (Ahmad et al., 2018; Ayyash, 2022, 2023), tailored to the particular contextual features of SMEs in Bahrain. In our research, the 5-point Likert scale operationalized the variables. Therefore, with this scale, we could measure technical preparedness, organizational size, competitive pressure, and pressure from trade partners for the first time from our research. Table 1 below explains the measuring constructs used in this investigation.

## 5.4 Statistical approach

Data analysis was performed by applying Partial Least Squares Structural Equation Modeling with the SmartPLS software. The justification for the use of PLS-SEM is that it is applicable in exploratory research and when the model involves several constructs and indicators (Hair et al., 2019). The approach or way PLS-SEM goes about doing things is to maximize the explanation of variance in dependent constructs. Logically, this fits within the purpose of this study in identifying those factors that influence adoption. Further, PLS-SEM can efficiently handle sample sizes that are small (Chin, 1998), and our sample size is 280; hence, it is suitable for our study. Besides, PLS-SEM does not impose strict normality assumptions on the data; hence, it is appropriate for real-world data that may not meet the criteria of normality distribution perfectly (Hair Jr et al., 2021).

TABLE 1 Measurement of the study.

| Constructs | Measuring items | Source |
|---|---|---|
| Compatibility | Our beliefs and culture are well-suited to the cloud-based HRM solution | Al-Qirim, 2007; Ghobakhloo et al., 2011 |
| | Our company is well-suited to the new circumstances introduced by cloud-based HRM solutions | |
| | We have a common ground with regard to cloud-based HRM solutions law | |
| | Our customer base is suited to cloud-based HRM solutions | |
| | The way we like to work may easily be integrated with cloud-based HRM solutions | |
| Relative advantage | Cloud-based HRM solutions opens up new possibilities | Al-Qirim, 2007; Pearson and Grandon, 2005 |
| | With the help of cloud-based HRM solutions, we can get some jobs done much more rapidly | |
| | Increased output is possible thanks to cloud-based HRM solutions | |
| | We may spend less time looking for materials thanks to cloud-based HRM solutions | |
| Complexity | The skills required to use cloud-based HRM solutions are too complex for our employees | Premkumar and Roberts, 1999 |
| | It will be quite challenging to integrate cloud-based HRM solutions into our present working procedures | |
| | The integration and skill set required for implementing cloud-based HRM solutions pose significant challenges for our organization | |
| Top management support | When integrating cloud-based HRM solutions, our top management is prepared to take chances | Abed, 2020 |
| | Most likely, our senior management will see the adoption of cloud-based HRM systems as strategically crucial | |
| | Our company's senior management believe that using cloud-based HRM solutions is a crucial strategy for gaining an edge over competitors | |
| Technology readiness | Our company has the financial resources to implement long-term cloud-based HRM solutions | Grandon and Pearson, 2004 |
| | Our firm offers the necessary technical tools for creating long-lasting cloud computing-based HRM systems | Grandon and Pearson, 2004 |
| | Our company has a robust internet connection, which is crucial for the efficient implementation of long-term cloud computing-based HRM solutions | Molla and Licker, 2005 |
| | The transition to sustainable cloud computing-based HRM is facilitated by the widespread access of computer systems among our workforce | Molla and Licker, 2005 |
| | Our staff's computer literacy enhances our ability to adopt long-term cloud-based HRM solutions | Molla and Licker, 2005 |
| Organization size | The size of our organization enables us to adopt cloud computing-based HRM solutions readily | Developed by authors |
| | Our large scale makes it easier to allocate resources for implementing cloud computing-based HRM | |
| | The extent of our organization positively influences the feasibility of adopting cloud computing-based HRM systems | |
| Competitive pressure | If we don't implement sustainable cloud computing-based HRM, we fear our clients will turn to competitors | Nguyen et al., 2022 |
| | To maintain a competitive edge, we believe adopting sustainable cloud computing-based HRM is strategically essential | |
| | Implementing sustainable cloud computing-based HRM is a strategic necessity for us to remain competitive in the market. | |
| | Had sustainable cloud computing-based HRM not been implemented, our organization would face competitive disadvantages | |
| Trading partner pressure | Most of our business partners have asked to adopt sustainable cloud-based HRM | Abed, 2020 |
| | Most of our business partners have advocated for adopting sustainable cloud-based HRM | |
| | Most of our business partners are quite educated about ethical cloud computing-based HRM techniques | |
| | Many of our vendors and business associates already use HRM strategies based on sustainable cloud computing | |
| Managerial Innovativeness | Typically, I am among my friends' first to adopt new technology when it emerges. | Damerji and Salimi, 2021 |
| | I typically don't need assistance from others while learning new high-tech goods or services. | |
| | I follow technical advancements in the fields I'm interested in. | |

*(Continued)*

TABLE 1 (Continued)

| Constructs | Measuring items | Source |
|---|---|---|
| SMEs' adoption of sustainable cloud computing-based HRM | I intend to implement sustainable cloud computing-based HRM when the opportunity arises in my organization. | Davis, 1989; Venkatesh et al., 2012 |
| | I expect my organization to start using sustainable cloud computing-based HRM shortly. | |
| | I intend to regularly integrate sustainable cloud computing-based HRM into my organization's operations. | |
| | My organization will always prioritize the use of sustainable cloud computing-based HRM systems. | |
| | I plan for my organization to frequently utilize sustainable cloud computing-based HRM | |
| | I imagine sustainable cloud computing-based HRM becoming a standard practice in my organization. | |

TABLE 2 Instruments descriptive statistics.

| Variables | Minimum | Maximum | Mean | Variance | Standard deviation |
|---|---|---|---|---|---|
| Technological context | 1.00 | 5.00 | 3.605 | 0.759 | 0.812 |
| Compatibility | 1.00 | 5.00 | 3.462 | 1.274 | 1.083 |
| Complexity | 1.00 | 5.00 | 3.842 | 0.572 | 0.687 |
| Relative advantages | 1.00 | 5.00 | 4.700 | 0.689 | 0.768 |
| Organizational context | 1.00 | 5.00 | 4.631 | 0.877 | 0.882 |
| Technology readiness | 1.00 | 5.00 | 4.308 | 0.258 | 0.398 |
| Top management support | 1.00 | 5.00 | 4.733 | 0.568 | 0.684 |
| Organization size | 1.00 | 5.00 | 4.568 | 0.671 | 0.756 |
| Environmental context | 1.00 | 5.00 | 3.785 | 0.879 | 0.907 |
| Competitive pressure | 1.00 | 5.00 | 4.845 | 0.857 | 0.734 |
| Trading partner pressure | 1.00 | 5.00 | 4.708 | 0.358 | 0.498 |
| Individual context | 1.00 | 5.00 | 4.733 | 0.768 | 0.784 |
| Manager innovativeness | 1.00 | 5.00 | 4.768 | 0.771 | 0.756 |
| SEMs adoption of cloud computing based HRM | 1.00 | 5.00 | 4.785 | 0.779 | 0.807 |

## 5.5 Instruments descriptive statistics

The research performed a statistical analysis on a comprehensive basis to identify the key drivers of the adoption of cloud computing-based HRM systems in SMEs in Bahrain. The descriptive data analysis will help to gain an in-depth understanding of the multidimensional trends revealed by the HR executives and senior managers in Bahrain. Table 2 has been presented in its entirety to illustrate all the measurement constructs used in the underlying study.

The average score of 3.605 within the technological context denotes a modest level of technical readiness among the surveyed firms. Moving our attention to the environmental context, we can see that the average competitive pressure value of 4.845 is noticeably different from the others. Comparatively speaking, the average compatibility score found in the technology domain is 3.462.

Regarding each measure, the standard deviations reveal how much agreement or disagreement there was among the participants (Al-Tahitah et al., 2023). The lowest standard deviation of technology readiness has a value of 0.398, meaning that participants highly agreed upon the readiness of their firm to adapt to new technologies. Compatibility, in particular, explains a higher standard deviation of 1.083, hence showing that respondents have varied perceptions about how the cloud computing-based HRM system fits their existing systems.

This low variability in technology readiness could suggest that large SMEs in this sample view their technological infrastructure and capabilities as similar, which may influence their readiness to adopt. The higher variability in compatibility may suggest that the respondents have different opinions on whether cloud-based HRM systems are compatible with current practices, which could influence decisions on adoption.

Also, this is supported by a high mean value of competitive pressure, which is 4.845; it identifies that SMEs are under considerable pressure from competitors with respect to the adoption of cloud computing-based HRM systems. The standard deviation for competitive pressure is 0.734, which represents moderate agreement among participants.

These descriptive statistics support our theoretical framework and hypotheses that environmental factors like competitive pressure may be of vital importance for the diffusion of cloud computing-based HRM systems among SMEs in Bahrain.

The descriptive statistics in Table 2 show that SMEs in Bahrain perceive the technological and organizational contexts as favorable

for adopting cloud computing-based HRM systems. The mean score of the technological context is 3.605, with a standard deviation of 0.812, indicating it is moderately favorable. This is also reflected in consistent perceptions of technological readiness as measured by the low variability in technology readiness (mean = 4.308, SD = 0.398).

Means of 3.462 and 3.842 and standard deviations of 1.083 and 0.687, respectively, demonstrate that compatibility and complexity are not only different but also manageable in infrastructure complexity. The very high scores in Relative Advantages indicate the recognized benefits of strong leadership support for innovation adoption. Organization Size also has a positive effect on the rate of adoption, with the mean value being 4.568, showing that the larger the SME, the more capable it feels of implementing new technologies.

The high mean scores in Competitive Pressure, 4.845, and Trading Partner Pressure, 4.708, underscore the importance of environmental and individual factors in the adoption process. The moderate consensus of these factors across one another reinforces their significance as external forces. Moreover, Individual Context and Managerial Innovativeness retain high means of 4.733 and 4.768, respectively, indicating strong personal attitudes and managerial support in championing technological advances. The overall high intention to adopt cloud-based HRM systems with reasonable consistency is a strong indicator of the will and readiness of SMEs in Bahrain to embrace these systems.

These findings bring out the fact that even though there is uniform high technological readiness, the strong facilitators in adopting a cloud computing-based HRM system are mainly environmental pressures and individual leadership. By 'environmental pressures,' we refer to the competitive and partner-driven factors that influence an organization's technological decisions. This leads to a favorable environment for technological advancement in these organizations.

# 6 Data analysis

## 6.1 Analysis of bootstrapping

Bootstrapping is a resampling technique used to estimate the reliability and significance of path coefficients in structural equation modeling (SEM). In this analysis, bootstrapping helps evaluate the relationships between different constructs, such as Technological Context, Organizational Context, Environmental Context, Individual Context, and SMEs' adoption of cloud computing-based human resource management.

The diagram presents path coefficients and *t*-values (represented by numbers near each path). Figure 2 shows the strength and significance of the relationships. For example, significant paths (typically those with *t*-values above 1.96) indicate strong relationships between constructs. This method allows for a robust analysis of the model by providing confidence intervals and standard errors for each path, enhancing the validity of the findings. Bootstrapping ultimately supports the stability of the model's results, confirming that observed relationships are not due to sampling error alone.

## 6.2 Measurement model

The measurement model in this study was evaluated using Smart-PLS's partial least squares (PLS) implementation to confirm the reliability and validity of the framework (Hair Jr et al., 2021; Alastal et al., 2024). Two main types of validity—convergent and discriminant—were assessed as part of the measurement model evaluation. Convergent validity ensured that items within each construct were strongly correlated, verified by outer loadings above 0.7, AVE values above 0.5, and CR values exceeding 0.7 (Hair et al., 2021). Discriminant validity confirmed that each construct was empirically distinct, meeting the Fornell-Larcker criterion and cross-loading standards. Structural Equation Modeling (SEM) was applied to illustrate the theoretical framework and depict relationships among constructs, including Technological, Organizational, Environmental, and Individual Contexts and their influence on SMEs' adoption of cloud computing-based HRM.

Figures 2 and 3 demonstrate how the PLS algorithm calculated path coefficients and how bootstrapping analysis was used to validate the significance of these paths. Bootstrapping, a resampling technique, provides confidence intervals and standard errors for each path, supporting the robustness and validity of the model's findings by ensuring that observed relationships are not due to sampling error alone. Significant paths, with *t*-values above 1.96, indicate strong relationships between constructs, thus enhancing the validity of the proposed model.

## 6.3 Convergent validity

In the measurement model evaluation, we evaluated important factors such as outer loadings (OL), Cronbach's alpha (CA), composite reliability (CR), average variance extracted (AVE), Variance Inflation Factor (VIF), and validity. Each indicator of each factor should be greater than or above its threshold value to meet the requirements with respect to the reliability and validity of the measurement model.

CA is a measure of internal consistency reliability, meaning the extent to which the set of items relate to each other. A high level of CA indicates that the items measure the same underlying construct. According to Nunnally and Bernstein (1994), a CA score of 0.70 or greater is acceptable. Similarly, CR is a measure of internal consistency for a set of items; however, it considers the actual loadings of the indicators and, hence, is a better estimate of reliability in PLS-SEM. The threshold value for CR is 0.70 or higher to reflect good reliability (Hair et al., 2019). Our findings showed that for each construct, the values of CA and CR are presented in Table 3; all constructs show values of CA and CR >0.70, which indicates that the internal consistency reliability is good. Further, all AVE values were >0.50, thus indicating satisfactory convergent validity.

According to Mohammad et al. (2024); Hair et al. (2019), the CR was calculated to infer internal consistency, which should be at least 0.70. According to the indications of Henseler et al. (2015), the AVE value of a construct was evaluated for its appropriateness; thus, the value had to be >0.50 to reach convergent validity.

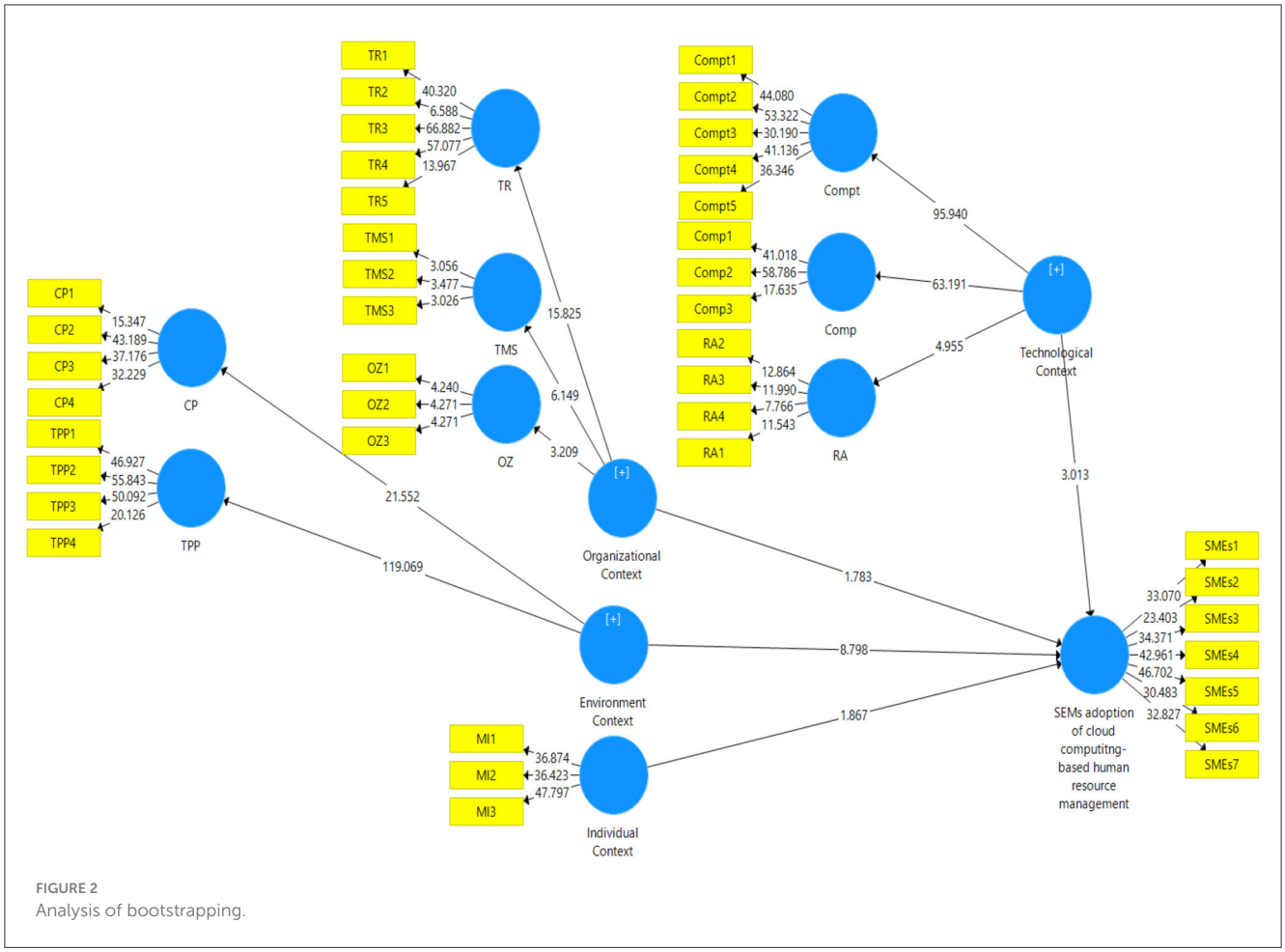


FIGURE 2
Analysis of bootstrapping.

Alzoraiki et al. (2024) suggested that new items having recently been developed should have a loading factor of more than 0.5; items that are established should have at least affected the loading factor of 0.6, and items demonstrating <0.6 but with $R^2 > 0.1$ should be preferred; and Falk and Miller (1992) endorsed this for items.

It is also worth noting that all the constructs had correlation coefficients exceeding 0.50, reflecting their high reliability in capturing the contextual factors without appreciable influence on the hypotheses posed. More empirical evidence capable of supporting such a conclusion that there is sufficient convergent validity, as in Table 3, is that all constructs had AVE values greater than the cutoff threshold value of 0.50.

## 6.4 Discriminant validity

In order to find indicators with significant connections to one construct and those with high loadings across several constructs, the authors looked at cross-loadings (Milhem et al., 2024). This research sought to ascertain if the indicators loaded on a particular latent variable more heavily than they did on other latent variables in the same row. As a result, it suggests that indications or objects should be loaded more heavily on the principal construct than on other constructs. Table 4 shows that all latent indicators in each row have stronger loadings on their respective constructions than on other constructs. These findings show each concept to be significantly one-dimensional.

## 6.5 Common method bias (CMB)

Common Method Bias (CMB) is the term for the phenomena that occurs when differences in answers can be attributed to the intrinsic characteristics of the measuring tool, as opposed to the tool's intended accurate representation of the genuine inclinations of the subjects. Harman's approach was employed in this study to assess the existence of the CMB. The results of the research showed that one single factor only explained 31.098% of the total variation, suggesting that the CMB had little effect on the data that we have.

## 6.6 Structural model (path analysis)

It is a statistical "method used to explain the directed relationships among variables." Several linear regression, canonical correlation analysis, factor analysis, discriminant analysis, and many more complex sets of models are usually applied in a multivariate analysis of variance and covariance analyses such as MANOVA, ANOVA, and ANCOVA, among the models in the field of statistical analysis (Tabachnick et al., 2013). After estimating

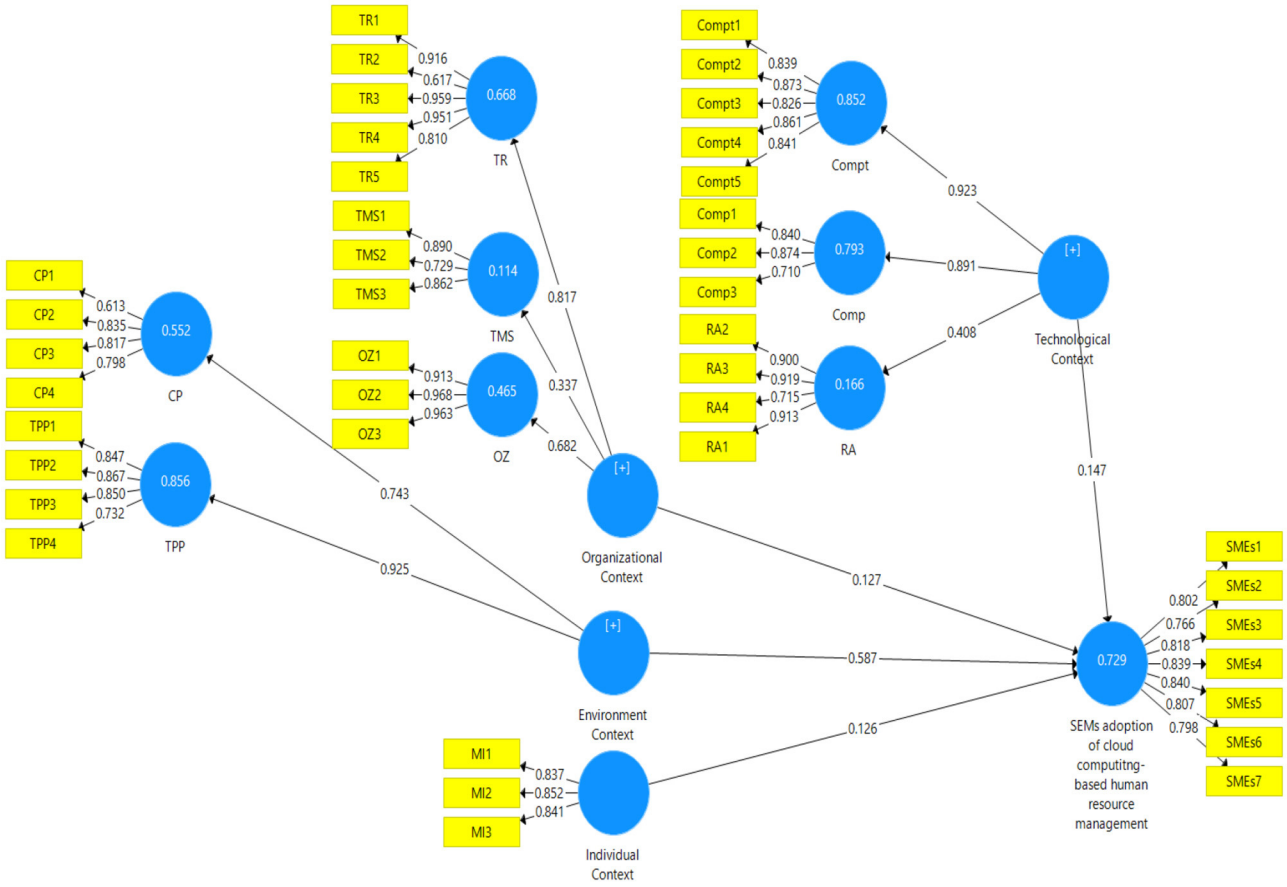


FIGURE 3
Displays the outcomes of the structural model, including the R-squared $R^2R^2$ values.

the model, one can use structural equation modeling to assess the variable relationships. Hair et al. (2006) explain that "the structural model provides a complete and comprehensive description of the relationships and covariances between the multiple variables being studied." The model allows the researcher to develop detailed and rich portrayals of the complex processes within their subject area. Exogenous and endogenous factors, generally called independent and dependent variables, correspondingly relate to one another, as the study results indicate. In general, a structural model's overall fit must be considered the relevant factor since its postulated estimations with their coefficients, dimensions, route, and significance must be considered (Hair et al., 2006).

Therefore, the present study's purpose was to research the combined effect of technological context, organizational context, environmental context, and individual context on the adoption of cloud computing-based human resource management by SMEs using PLS-SEM. From this unique setting of research, a research model has been developed. The text is given with the hypothesis model presented in Figure 2. This will provide the statistical significance of the hypothesis model with the *T*-value using the bootstrapping method shown in Figure 3. The bootstrapping approach utilizes random sampling and replacement processes to create similar resamples to the actual data. The method followed in the present study is bi-functional; it evaluates the reliability of data and allows an estimation of the probable relevance and imprecision of the path coefficient (Chin, 1998).

## 7 Discussion

The goal of the current study is to further our understanding of how technology is adopted, in particular, how HRM systems built on environmentally friendly cloud computing are integrated into SMEs. Our study of the effects of organizational, technical, and environmental variables on the adoption of sustainable technology in Bahrain seeks to advance existing understanding. The TOE framework, for example, is one existing framework that this inquiry draws upon.

Our research findings are consistent with other studies in terms of the original hypothesis (H1) that technical considerations significantly impact the pace of adoption. The results of this study corroborate other studies by Al-Sharafi et al. (2023) and Qasem et al. (2021), which underlined the influence of technology on organizational behaviors linked to adoption. The statistically significant *P*-value of 0.004 and the Beta-Value of 0.147 add to the body of data supporting this prior research. As it focuses on the comparatively unknown area of sustainable cloud computing-based HRM in SMEs, with a special emphasis on developing

TABLE 3 The results of the analysis for convergent validity and reliability.

| Constructs | Items | OL | CA | CR | AVE | VIF |
|---|---|---|---|---|---|---|
| **Technological context** | Compt1 | 0.839 | 0.98 | 0.990 | 0.891 | 2.134 |
| | Compt2 | 0.873 | | | | 2.356 |
| Compt | Compt3 | 0.826 | 0.902 | 0.928 | 0.719 | 2.045 |
| | Compt4 | 0.861 | | | | 2.287 |
| | Compt5 | 0.841 | | | | 2.176 |
| Comp | Comp1 | 0.840 | 0.734 | 0.851 | 0.658 | 1.654 |
| | Comp2 | 0.874 | | | | 1.732 |
| | Comp3 | 0.710 | | | | 1.498 |
| RA | RA1 | 0.913 | | | | 2.456 |
| | RA2 | 0.900 | | | | 2.389 |
| | RA3 | 0.919 | 0.889 | 0.922 | 0.750 | 2.567 |
| | RA4 | 0.715 | | | | 1.789 |
| **Organizational context** | TR1 | 0.916 | 0.802 | 0.854 | 0.747 | 2.789 |
| | TR2 | 0.617 | | | | 1.234 |
| TR | TR3 | 0.959 | 0.915 | 0.933 | 0.740 | 3.012 |
| | TR4 | 0.951 | | | | 2.945 |
| | TR5 | 0.810 | | | | 2.098 |
| TMS | TMS1 | 0.890 | 0.788 | 0.868 | 0.689 | 2.045 |
| | TMS2 | 0.729 | | | | 1.567 |
| | TMS3 | 0.862 | | | | 1.876 |
| OZ | OZ1 | 0.913 | | | | 2.678 |
| | OZ2 | 0.968 | | | | 3.045 |
| | OZ3 | 0.963 | 0.944 | 0.964 | 0.899 | 2.987 |
| **Environmental context** | CP1 | 0.613 | 0.886 | 0.907 | 0.673 | 1.345 |
| | CP2 | 0.835 | | | | 1.789 |
| | CP3 | 0.817 | 0.766 | 0.853 | 0.595 | 1.654 |
| CP | CP4 | 0.798 | | | | 1.567 |
| TPP | TPP1 | 0.847 | 0.834 | 0.895 | 0.682 | 2.034 |
| | TPP2 | 0.867 | | | | 2.178 |
| | TPP3 | 0.850 | | | | 2.045 |
| | TPP4 | 0.732 | | | | 1.876 |
| **Individual context** | MI1 | 0.837 | 0.798 | 0.881 | 0.711 | 1.789 |
| MI | MI2 | 0.852 | | | | 1.876 |
| | MI3 | 0.841 | 0.854 | 0.897 | 0.637 | 1.834 |
| **SEMs adoption of cloud computing-based HRM** | SMEs1 | 0.802 | | | | 1.567 |
| | SMEs2 | 0.766 | | | | 1.456 |
| | SMEs3 | 0.818 | 0.913 | 0.930 | 0.657 | 1.678 |
| | SMEs4 | 0.839 | | | | 1.789 |
| | SMEs5 | 0.840 | | | | 1.834 |
| | SMEs6 | 0.807<br>0.798 | | | | 1.745 |

RA, Relative advantages; Comp, Complexity; Compt, Compatibility; TMS, Top management support; TR, Technology readiness; OZ, Organization size; CP, Competitive pressure; TPP, Trading partner pressure; MI, Manager innovativeness.

TABLE 4 Discriminate validity.

| | CP | Comp | Compt | EC | IC | OZ | OC | RA | SEMs | TMS | TPP | TR | TC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CP | **0.771** | | | | | | | | | | | | |
| Comp | 0.372 | **0.811** | | | | | | | | | | | |
| Compt | 0.46 | 0.695 | **0.848** | | | | | | | | | | |
| EC | 0.743 | 0.608 | 0.687 | **0.688** | | | | | | | | | |
| IC | 0.455 | 0.534 | 0.591 | 0.564 | **0.843** | | | | | | | | |
| OZ | −0.11 | 0.18 | 0.247 | 0.101 | 0.168 | **0.948** | | | | | | | |
| OC | 0.049 | 0.27 | 0.332 | 0.254 | 0.264 | 0.612 | **0.669** | | | | | | |
| RA | 0.115 | 0.217 | 0.247 | 0.177 | 0.154 | 0.075 | 0.548 | **0.866** | | | | | |
| SEMs | 0.481 | 0.597 | 0.672 | 0.631 | 0.755 | 0.324 | 0.37 | 0.146 | **0.811** | | | | |
| TMS | 0.021 | 0.205 | 0.141 | 0.109 | 0.113 | 0.362 | 0.337 | 0.054 | 0.137 | **0.83** | | | |
| TPP | 0.504 | 0.607 | 0.669 | 0.625 | 0.767 | 0.164 | 0.298 | 0.174 | 0.831 | 0.128 | **0.826** | | |
| TR | 0.156 | 0.225 | 0.255 | 0.266 | 0.226 | 0.136 | 0.617 | 0.685 | 0.245 | 0.172 | 0.275 | **0.86** | |
| TC | 0.443 | 0.791 | 0.723 | 0.634 | 0.605 | 0.25 | 0.413 | 0.408 | 0.683 | 0.189 | 0.686 | 0.364 | **0.891** |

The bold values in the table represent the square root of the Average Variance Extracted (AVE) for each construct. These values are used to assess discriminant validity, ensuring that each construct is distinct and explains more variance in its own indicators than in other constructs. Values in bold are placed along the diagonal of the table.

TABLE 5 Hypothesized testing results.

| Hypotheses | Path | Beta-Value ($n = 280$) | ST | *T*-Value | | *P*-Values |
|---|---|---|---|---|---|---|
| H1 | Technological context -> SEMs | 0.147 | 0.051 | 2.869 | 0.004 | Significant |
| H2 | Organizational context -> SEMs | 0.127 | 0.054 | 2.378 | 0.018 | Significant |
| H3 | Environment context -> SEMs | 0.587 | 0.066 | 8.938 | 0.000 | Significant |
| H4 | Individual context -> SEMs | 0.126 | 0.065 | 1.936 | 0.053 | Non-significant |

countries like Bahrain, the present study offers a unique point of view. The argument made is that the focus should go beyond only technology development and include the idea that these technologies are superior to conventional HRM strategies and sustainable.

Regarding our second hypothesis (H2), the empirical data supports the findings reached by Qasem et al. (2020) and Khayer et al. (2020), as shown by a Beta-Value of 0.127 and a *P*-Value of 0.018. This earlier research emphasized the importance of organizational internal elements. Our research's contribution is distinguished by its sophisticated viewpoint. By highlighting the critical importance of top management support and technology preparedness in the particular context of Bahraini SMEs, we further explore the topic in our study. It is proposed that these organizations serve as more than just catalysts for developing sustainable HRM systems based on cloud computing; rather, they may be seen as necessary prerequisites. We can better understand this phenomenon by developing a nuanced understanding of the influence of organizational context on technology adoption. This will help us implement effective managerial practices within SMEs.

A Beta-Value of 0.587 and a *P*-Value of 0.000 show that the findings in our study strongly support our third hypothesis (H3). Large data strongly suggests that environmental influences have a large impact, a noteworthy point that Low et al. (2011) also noted. Our work stands out for its thorough analysis of the Bahraini setting, where environmental constraints like market rivalry and social sustainability standards appear to have a notably strong influence. By showing that environmental concerns in developing countries like Bahrain have the potential to function as influencing variables in supporting the adoption of sustainable technology, the current study builds on the research done by Low et al. (2011).

A *P*-value of 0.053 indicates that the findings of our investigation did not support the fourth hypothesis (H4) with regard to statistical significance. This result contradicts the assertions made by Nassoura and Hassan (2021) and Alshamaila et al. (2013). The aforementioned discrepancy provides an intriguing avenue for further research. The aforementioned claim spurs academics to reconsider whether established frameworks, like the TOE model, are adequate for fully encapsulating the complex dynamics of technology adoption in developing nations. The empirical data we have acquired suggests that in collaborative societies like Bahrain, the value of management inventiveness and skill sets may be lowered. This discovery casts doubt on the generally held belief that ideas that have been created and tested largely in Western contexts may be used everywhere.

Finally, the current study aims to add to and improve the body of literature by adding sophisticated viewpoints and actual data gained from the particular setting of a developing country. The current study highlights the complex factors that go into technology adoption, especially when it comes to sustainable

cloud computing-based HRM systems in SMEs. Our research offers a comprehensive assessment of the interactions between sustainability, the SME sector, and geographic location in line with relevant literature on the adoption of technology. Individuals' nuanced contributions not only add to the body of existing knowledge but also provide an impetus for future scientific projects aimed at improving our understanding of how technology is adopted in diverse circumstances. The specific features of our research fill important gaps in the corpus of existing knowledge and lay the groundwork for further research that might lead to the development of thorough and contextually appropriate theoretical frameworks. Overall, the research results, in summary in Table 5, highlight the significant role technology, organizational, and environmental forces play in the implementation of cloud HRM systems.

# 8 Implications of the study

## 8.1 Theoretical implications

Our study offers a wide range of significant implications in the area of theoretical contributions that go beyond the simple affirmation of preexisting frameworks. Our main point is that current theoretical frameworks, including the Technology-Organization-Environment framework, must be updated or expanded in light of the adoption landscape in emerging nations. The limitations of existing adoption theories are highlighted by the actual data from the study on small and medium-sized firms (SMEs) in Bahrain. As a result, this calls for academics to examine and even modify these models to fit the regional context. In order to meet particular economic and socio-cultural situations, it is crucial to construct localized and complex adaptations of these frameworks, as stated in the aforementioned statement.

Our finding of the decreasing importance of individual management innovation in Bahraini SME's adoption of technology has important theoretical implications as well. The existing corpus of information, which predominantly focuses on the significance of management or individual agencies in adoption choices, considerably diverges from this discovery. Due to the large disparity shown in this domain, an academic study has been conducted about the incorporation of regional and organizational cultural characteristics as moderating or mediating variables. Future theoretical studies should focus on how cultural elements could perhaps encourage the distribution or modification of decision-making authority from a centrally located management body to a more distributed or decentralized agency.

The investigation of environmental variables and their function as influencing elements in the adoption trajectory is given considerable attention in our study. We highly support the enhancement of present theoretical frameworks by including factors that explicitly take into account these environmental catalysts in light of our study findings, which highlight the tremendous effect of competitive forces and market sustainability dynamics. When doing research on SMEs in emerging economies, this element is very important. External variables have the potential to have a large, sometimes disproportionate impact in certain situations.

A challenging theoretical issue raised by the disconfirmation of the fourth hypothesis (H4) is whether existing frameworks like the TOE model can be used widely. When compared to earlier studies, our research results show inconsistencies, which calls for a comprehensive reevaluation and possible model improvement. This is especially relevant to their capacity to thoroughly address the complex patterns of technology adoption in scenarios encompassing various economic and cultural circumstances.

The current study acts as a spur for the development of ideas on the adoption of technology. It fervently supports the inclusion of factors that are unique to organizational and geographic contexts. By offering a thorough examination of the complex interaction between technology advances, organizational structures, and environmental variables in determining the patterns of adoption behaviors, the current study adds to the body of scholarly literature. Notably, this study illuminates a situation that has received less attention, namely SMEs operating in emerging markets like Bahrain.

## 8.2 Managerial implications

From a management standpoint, the findings of our inquiry offer a wealth of complex insights that go beyond what is currently known, particularly in the area of SMEs in developing countries like Bahrain adopting new technologies.

The available empirical data provide solid support for the idea that technical compatibility is vital for aiding a successful adoption process. It is imperative that those in leadership roles pay serious attention to how possible technologies match the existing systems and procedures in place, especially those in charge of making strategic decisions within their businesses. It is important to give the issue of alignment the status of a strategic objective rather than just an operational detail. The achievement of a high degree of compatibility not only makes the adoption process go more quickly but also helps to maximize return on investment, successfully achieving the organization's two goals.

Our analysis further emphasizes the critical need for senior management assistance throughout the technology adoption lifecycle. Our research suggests that top-level management support is, in fact, a necessary condition for the effective execution of a specific project, in contrast to earlier perspectives that saw managerial support as beneficial but not essential. The aforementioned finding has important ramifications for management choice-making since it shows that long-term commitment and support from top-level executives are not only preferred but also absolutely essential. Therefore, to secure the crucial support needed for this goal, businesses must place the highest priority on executive education and sensitization activities that focus on the deployment of sustainable cloud computing-based HRM systems.

Additionally, it has been established that the environmental context, particularly the impact of market forces related to sustainability, has a substantial role in influencing adoption behaviors. Managers must be acutely aware of the external competitive environment and the rising importance of sustainability as a differentiator in the marketplace. Organizations may gain market share by purposely linking

their technology adoption plans with sustainability goals rather than being exclusively led by normative demands to adopt sustainable practices.

Our research underlines complex inter-relationships amongst technological, organizational, environmental, and individual factors. This then underlines the importance of managers taking holistic views when considering any adoption landscape. Too narrowly focusing on one factor or another will likely yield less than optimal outcomes. Sometimes, a manifestly superior technology faces unfavorable deployment in management figures or other influences at play. Only when an all-inclusive and multi-disciplined plan has been developed for the variables relevant to the technology impact realignment is it considered optimal for deployment.

The study offers managers an impressively rich and detailed insight into the landscape of technology adoption. It highlights the numerous considerations that need to be made during strategic judgments. From our findings, a multidimensional approach becomes necessary in an effort to achieve competitive advantage and sustainable organizational resilience through effective technology adoption.

## 8.3 Practical implications

The present study will comprehensively address the adoption of technology in terms of the adoption of sustainable cloud computing-based Human Resource Management (HRM) systems amongst small and medium-scale enterprises in emerging economies.

Through the digitization of HR processes, for instance, cloud-based HRM systems minimize paper and physical resource usage, thereby directly reducing or minimizing their contribution to environmental degradation and increasing ecological sustainability. In addition, these systems encourage remote working and flexibility in work arrangements, thus reducing carbon emissions produced during daily movement to and from work. From a social perspective, increased transparency and inclusiveness in human resources support the equity and diversity of employees in the workplace, accordingly satisfying corporate social responsibility objectives.

In-depth research conducted through the present study provides valuable information, though it has significant practical implications for several stakeholders comprising executives of organizations and operational workforces.

The study's main point of focus is the importance of filling in an intensive review of infrastructure. This assessment will determine the compatibility between the proposed sustainable HRM systems and the prevailing organizational structures. To realize this objective, SMEs are advised to use tested methods such as PESTLE (Political, Economic, Social, Technological, Legal, and Environmental) studies. By doing so, companies can avoid potential roadblocks in the operationalization and integration stages by addressing issues in advance, thus making overall implementation more effective and affordable. The most influencing factor is the alignment of advanced planning with the strategic importance of technology compatibility, as depicted in our case study.

Our research findings also emphasize the organizational environment as being of particular significance and the need for businesses to implement and invest in specialist staff training initiatives and programs that would start building capacity. In this respect, the actual development of technical skills should not be the sole focus of such projects; instead, it should address a broad spectrum of other issues, including but not limited to organizational preparation and management of change. Specialized modules must be designed to manage such complex and unique sustainable cloud computing-based HRM systems. The addition of such modules will be specially designed to handle the complexity involved, ensuring smooth transitioning from both a technological and human resources perspective. Addressing and closing the knowledge and skill gaps will minimize any potential barriers to such a system's successful deployment and usage.

The direct contribution of sustainable cloud computing-based HRM systems to environmental objectives has been reducing $C0_2$ emissions by better exploiting the servers and reducing energy use compared to traditional IT infrastructure. These systems digitize previously paper-based processes, hence minimizing the usage of paper and contributing to the minimization of paper waste. By enabling virtual work and collaboration, the need for travel is reduced, hence reducing the environmental footprint of SMEs.

Socially, these systems have improved inclusion and equity by offering flexible work environments to employees and the ability to train and develop from home. They enhance workforce engagement and satisfaction through smooth HR processes in areas like payroll, benefits management, and performance appraisals. Further, they enable SMEs to align their operations with broader societal sustainability expectations and enhance their reputation as socially responsible organizations.

Our findings also indicate that environmental issues, particularly sustainability, affect the SMEs. Given such a reality, it is opportune for enterprises to consider undertaking comprehensive sustainability audits, either internally or with external experts. In undertaking such audits, an organization has a unique opportunity to play two roles. On one hand, internally, these audits help an organization's ecological effects to be quantified and understood, which improves their grasp of the issue. On the other hand, these audits can increase a company's market position externally in a competitive environment that prioritizes environmental responsibility. The practice of such audits can have a twin advantage: first, a competitive edge, and second, serving as a proactive outlet vis-à-vis consumer bases, regulatory authorities, and possible business partners since there is now a growing stakeholder focus on sustainable business practices.

The question of sustainable technology for SMEs has to be effectively communicated proactively in the present market environment, where increasing emphasis is placed on sustainability. A proactive communication strategy could allow differentiation and pass on some stringent trade and regulatory requirements by serving as a unique selling proposition. Hence, the said growth brings new opportunities for business partnerships and market expansion.

Below, the results of our research project shed a multidimensional light on the problems created around the effort to establish sustainable HRM systems in less developed countries. This treasure trove of insights furnishes managers

with conceptual perspectives, and intervention means to effectively translate such concepts and further a more sustainable and competitive corporate world. Organizations seeking to advance their strategic positioning concerning short-term and long-term success are well served by considering these valuable outcomes.

### 8.3.1 Implications of cloud-based HRM systems on sustainability

The cloud-based HRM system dramatically contributes to environmental sustainability by saving energy and reducing carbon emissions. Cloud computing consolidates an organization's IT infrastructure; hence, SMEs do not need separate servers, saving energy resources spent in operating and cooling the servers. Based on empirical research, Radhika et al. (2024) highlighted that energy consumption decreased by 30% when firms shifted from on-premises-based systems to cloud-based ones. In this way, it directly contributes to environmental concerns in energy utilization faced by resource-constrained SMEs.

Another critical outcome of cloud human resources management systems is reducing paper waste. Digitizing HR processes, such as payroll, employee records, and recruitment workflows, can help SMEs reduce paper use. According to Dong and Salwana (2022), organizations adopting a cloud-based HRM solution reduced paper consumption by 70%, showcasing the ecological benefits of the digital transformation of operational workflows.

Besides, cloud computing contributes to carbon footprint reduction by improving server utilization and reducing dependence on personal, power-consuming IT infrastructures. For example, Aldossary and Alharbi (2021) found that organizations with cloud systems reduced their IT-related $CO_2$ emissions by 20%. These findings indicate the potential for cloud technology to enable SMEs to pursue environmentally conscious operations without sacrificing efficiency.

Furthermore, cloud systems enhance efficiency in the resources applied because of scalability. Resources applied through the cloud tend to scale up and down depending on changes in business demand; this reduces IT resource over-provisioning, as noted by Prasad et al. (2023), and further develops the sustainability merits present in cloud adaption.

Quantitative data presented above rely on existing studies, but it is important to recognize that certain percentages represent general trends rather than specific, universally applicable data. More empirical research is needed to develop more nuanced and context-bound evidence regarding what implications cloud-based HRM systems have for sustainability, particularly for SMEs operating within emerging markets.

### 8.3.2 Implications of cloud-based HRM systems on cost reduction

One of the most tangible benefits of cloud-based HRM systems for SMEs is cost efficiency, brought by the absence of major upfront investments in IT infrastructure. Empirical studies confirm that the application of cloud-based HRM solutions leads to a 35% reduction in infrastructure costs, thus eventually providing financial flexibility for an SME to use elsewhere (Maqueira Marín et al., 2022; Abdalla et al., 2024).

Automation also enhances operational efficiency by reducing the administrative load on HR teams. For example, the study of Praba et al. (2025) shows a 25% reduction in operational costs due to streamlined processes such as payroll automation, performance management, and recruitment tracking. Automation frees HR teams to devote time to strategic initiatives rather than routine administrative tasks.

Apart from this, scalability is another advantage for SMEs when using cloud-based HRM systems. The pay-as-used pricing model helps the business pay only for the resources used, thus not wasting money on redundant resources. According to this model, it shrinks 40% of the annual IT expenses, which is a critical benefit for small businesses operating in a tight financial situation (Huang et al., 2020).

The last point is the ability to offer work from home because of cloud systems, thereby further reducing costs since allowing employees to work from home reduces costs associated with office maintenance, utility compensations, and travel compensation. For example, it has been found by Yenugula et al. (2024) that the facilitation of work from home through a cloud-based approach results in SMEs saving, on average, 20% annually, an actual practical demonstration of the monetary benefit of using such technology.

The above quantitative findings point to general trends supported by existing literature; however, they cannot show the full variety of financial situations that SMEs may face in different contexts. Further empirical research is needed to provide more accurate and context-specific evidence regarding the cost-saving effects of cloud-based HRM systems, especially in different economic and operational settings.

## 9 Limitations and future research

The study, like all empirical research, has its limitations. First, the research is confined to SMEs in Bahrain, which may limit the generalizability of the findings to other contexts or larger enterprises. Second, the study focuses specifically on the adoption of sustainable cloud computing-based HRM systems, leaving out other forms of technology or sustainability measures that may also be relevant. Third, while the study utilizes the TOE framework, it may not capture all the variables or influences that are specific to the Bahraini context or the domain of cloud computing-based HRM. Lastly, the non-significant result regarding the role of individual context in technology adoption might be due to the limitations of the research design or measurement instruments, rather than an accurate reflection of real-world phenomena.

The study highlights the critical contribution of adopting sustainable cloud computing-based HRM systems in SMEs to achieving the SDGs. By integrating such systems, SMEs can achieve most of the environmental, economic, and social sustainability objectives. For example, environmental benefits, such as carbon emissions reduction and minimal use of paper, fall directly under SDG 13 (Climate Action) and SDG 12 (Responsible Consumption and Production; Ure, 2024). By promoting remote work, digital collaboration, and energy-efficient IT infrastructure, SMEs contribute to reducing their ecological footprint.

Economically, this study's findings have shown how the cost-effective cloud computing solutions adopted by SMEs enable them to manage their resources well. These also ensure alignment with SDG 8 (Monaco, 2024) through enhanced productivity and long-term financial viability for SMEs. Cloud computing is, in turn, scalable; therefore, such growth by SMEs can be absorbed without exponential increases in costs. This will ensure that sustainable economic growth is developed.

These systems socially endorse inclusive practices, such as training from a distance and acquiring different types of talents, directly contributing to SDG 4 (Quality Education) and SDG 5 (Gender Equality; Leal Filho et al., 2023; Saini et al., 2023). Automation and transparency in HR processes contribute to employee satisfaction and engagement, building equitable workplaces that foster long-term social sustainability. These insights underline the transformative role of cloud computing in enabling SMEs to contribute toward larger societal goals while enhancing organizational resilience meaningfully.

Given these limitations, several avenues for future research emerge. To address the issue of generalizability, future studies could expand the geographic scope to include SMEs in other developing countries or even compare them with those in developed nations. Comparative research could also be conducted across various sectors to see if the findings hold in different industry contexts.

Other areas that further research could pursue might include an even more refined examination of how different contributions of cloud-based HRM systems contribute to the realization of sustainability goals. For instance, these could provide quantifications of reduced energy use or carbon emissions as made possible through these systems or explore their role in workforce development and equity enhancement. This can add further empirical evidence toward the development of links between technological innovation and sustainable development.

In terms of theoretical advancement, there is a need for models that are specifically tailored to the SME context in developing countries. For example, incorporating cultural variables or organizational ethos could provide a more nuanced understanding of the technology adoption process. This could also include the creation or modification of frameworks to incorporate environmental catalysts as major factors, especially in contexts where external pressures significantly affect technology adoption decisions. Further research could delve deeper into the non-significant findings related to individual contexts. Qualitative studies could be employed to explore this in detail, aiming to understand why managerial innovativeness may not be a significant factor in Bahraini SMEs and whether this is a cultural or organizational phenomenon. Additionally, longitudinal studies could be immensely beneficial. Tracking the adoption process over an extended period could yield insights into how attitudes and challenges evolve, providing a more dynamic understanding of technology adoption within SMEs. This would be valuable for both scholars and practitioners aiming to facilitate smoother adoption processes in similar contexts. Finally, while our study offers valuable insights into the adoption of sustainable cloud computing-based HRM in Bahraini SMEs, there is much that future research could build upon to deepen our understanding of technology adoption complexities in developing countries.

## 10 Conclusion

The Technology-Organization-Environment framework, the fundamental theoretical framework that served as the research's direction, must be reviewed in light of the study's findings. This framework was used to investigate the complex factors affecting the adoption of sustainable cloud computing-based Human Resource Management systems inside Small and Medium-sized Enterprises (SMEs) in Bahrain. The adoption of this theoretical framework gave rise to a rigorous intellectual framework that made it possible to evaluate all of the components of technology, organizations, and the environment. Additionally, by using a structured data-theoretical technique, the study was given the analytical rigor needed for a thorough investigation of these areas. As a result, the TOE framework served as both a conceptualization tool for our research questions and an interpretive framework for our empirical findings.

A thorough investigation was carried out using the precise use of Partial Least Squares Structural Equation Modeling (PLS-SEM), which produced notable findings that both verify and call into question pre-existing academic frameworks. Contrary to popular opinion, our data showed that the degree of individual management innovation did not have a statistically significant influence on the adoption of technology. This departure from accepted ideas denotes a change in the dominant viewpoints in this area of research. In sharp contrast, the study's findings revealed that when it comes to influencing methods for technology adoption, external environmental factors and technology readiness play a dominant and significant impact. The aforementioned findings add to the body of research by emphasizing the value of taking contextual considerations into account when putting general ideas like the TOE framework into practice.

The study findings offer a strong foundation for scholarly debates and real-world applications about the critical importance of sustainability in HRM. The study underlines that sustainability has changed from being an ethical issue to an imperative need for enterprises. As a result, this publication serves as a useful tool for human resources specialists and organizational leaders who want to include sustainable practices in their operational strategy.

However, it is important to recognize the limitations of our study, which principally result from its constrained geographic reach and use of a convenience sample approach. The current study makes a significant contribution to filling the knowledge vacuum that exists in the area of technology adoption in emerging countries. Although some restrictions were faced over the course of this study project, it is vital to acknowledge them. These limits, in turn, point to possible areas that demand more research and development in subsequent studies. This specific line of research has the potential to be expanded in the future to include new cultural, geographical, or industrial situations. These investigations would significantly improve the overall generalizability and applicability of the results we have so far discovered.

Our study adds significantly to the ongoing scholarly conversation in a number of ways. The focus of the current study is

on how SMEs that operate in emerging economies specifically relate to the TOE framework. The framework's theoretical applicability and usefulness in this particular context are improved by this expansion. This resource also provides ideas that have been supported by empirical evidence, which helps us understand the complex processes that affect the adoption of sustainable technology on a more complex level. As a result, it is a useful tool for decision-makers in government and industry, providing them with important information. Further scholarly inquiry into the complex web of factors that influence the process of technology innovation and adoption within different organizational settings is encouraged by the discovery of unanticipated patterns and connections in this context.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

## Author contributions

MM: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing. MMA: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Visualization, Writing – original draft. AA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. QA: Conceptualization, Methodology, Project administration, Resources, Writing – original draft. MA: Conceptualization, Project administration, Resources, Supervision, Writing – original draft. NA: Funding acquisition, Investigation, Project administration, Supervision, Writing – review & editing. SA: Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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