

Cloud computing adoption among small and medium enterprises: An SEM-based empirical study in Multan, Pakistan

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ABSTRACT

This research explores the key factors that affect cloud computing adoption by small and medium-sized enterprises (SMEs) in Multan, Pakistan, a region underrepresented in existing research. Drawing on the frameworks of UTAUT and TAM this study examines the roles of perceived usefulness, perceived ease of use, social influence, and facilitating conditions in shaping SMEs' cloud adoption behavior. The study gathered responses from 274 decision-makers within SMEs and employed Structural Equation Modeling (SEM) through the Smart-PLS 4 tool to analyze the data. The findings highlight that perceived usefulness, ease of use, and social influence significantly affect both attitudes and behaviors towards cloud computing adoption. Additionally, attitude plays a crucial mediating role in these relationships. The findings of this study enhance current understanding by shedding light on cloud adoption in emerging markets and offers practical recommendations for stakeholders, including policymakers and service providers to foster cloud adoption among SMEs in similar contexts.

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1. Introduction

Cloud computing has emerged as a transformative technology that is revolutionizing the way businesses operate by offering flexible, scalable, and cost-effective IT solutions (Mohammad & Abbas, 2024; Shetty & Panda, 2021). For small and medium enterprises (SMEs), which often face significant resource constraints, cloud computing provides an invaluable opportunity to access enterprise-level technology without the need for substantial upfront investments in infrastructure (Khayer, Jahan, Hossain, & Hossain, 2021). By leveraging cloud-based services, SMEs can enhance their operational efficiency, reduce costs, and improve their competitiveness, enabling them to scale their businesses more effectively (Shetty & Panda, 2021; Widyastuti & Irwansyah, 2017). This technology empowers SMEs to innovate, streamline operations, and focus on core business activities, making it an essential tool for growth and digital transformation in today's rapidly evolving business landscape (Hussein, Kassim, & Ali, 2022).

In developing countries like Pakistan, SMEs play a crucial role in driving economic growth, creating jobs, and fostering innovation (Nosheen, Omar, & Hashim, 2025). Despite their importance, the adoption of cloud computing among SMEs in developing regions remains limited and inconsistent, largely due to challenges such as inadequate infrastructure, high initial costs, and a lack of awareness or technical expertise (Khayer et al., 2021; Nosheen et al., 2025; Raza, Raza, Saeed, & Arshed, 2014). While as compare to larger cities, SMEs in second-tier cities like Multan face unique barriers that hinder their ability to adopt cloud solutions. These cities often struggle with limited technological readiness and a lack of targeted support, leading to slower and more fragmented adoption (Premkumar & Roberts, 1999). These disparities can lead to

long-term economic consequences, such as inefficient business operations, reduced competitiveness, and missed opportunities for innovation and market expansion, ultimately leaving secondary cities economically marginalized and digitally excluded.

Further recognizing the strategic importance of IT, successive governments in Pakistan have introduced various policies and initiatives to foster the sector's growth. These include the establishment of technology parks, special economic zones for IT, and incentives to attract foreign investment. Additionally, programs like the Prime Minister's Digital Pakistan initiative have aimed to enhance digital literacy and bridge the digital divide. However, the reach and effectiveness of these efforts in addressing the infrastructure and digital readiness challenges of SMEs in second-tier cities remain limited (Shah & Syed, 2018). Moreover, there is a significant gap in research regarding the adoption of cloud computing in these smaller urban areas, particularly concerning the specific challenges and opportunities that SMEs face in such contexts as reported in similar study (Premkumar & Roberts, 1999; Waqar, Gultom, Qureshi, Tanjung, & Almujiabah, 2023). This gap in the literature underscores the call for further inquiry of key drivers that shape the adoption and acceptance of cloud computing across SMEs in emerging cities like Multan.

This research is intended to explore the key determinants of cloud technology uptake among SMEs in Multan, Pakistan, a city rarely addressed in existing research concerning this topic. By investigating the primary drivers and barriers encountered by SMEs in this region, this work aims to uncover key insights into the unique challenges that shape cloud adoption. To guide this analysis, the study employs the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) and the Technology Acceptance Model (TAM) (Davis, 1989) as its theoretical frameworks. These models provide a comprehensive lens through which the study examines critical constructs like perceived usefulness, perceived ease of use, social pressure, and facilitating conditions. By applying these models in the context of SMEs in Multan, this research uncovers the psychological and contextual factors that shape cloud adoption decisions in emerging markets.

The present study concentrates on several key drivers that shape cloud adoption decisions among SMEs in Multan. Drawing from the UTAUT and TAM models, the research will examine perceived usefulness, which reflects the extent to which individuals believe cloud computing can enhance their business performance (Gupta, Fernandez-Crehuet, & Gupta, 2022), and perceived ease of use, which assesses how user-friendly the technology is (Davis, 1989). Additionally, social influence will be explored to understand how peer pressure, managerial support, and industry norms shape adoption decisions (Ajzen, 1991; Riaz & Awais, 2024). Facilitating conditions, such as access to infrastructure, technical support, and organizational readiness, will also be analyzed to determine how these elements affect the ability of SMEs to implement cloud computing (Venkatesh et al., 2003). Furthermore, the study will investigate the role of attitude as a mediating variable, exploring how it bridges the relationship between the external factors and SMEs' adoption behavior (Ajzen, 1991). By examining these constructs, the research will offer a comprehensive understanding of various contextual elements that influence cloud computing adoption in SMEs.

This study will provide significant contribution to the field by addressing underexplored topic in the literature regarding the use of cloud-based solutions by SMEs, with emphasis in second-tier cities like Multan, Pakistan. Insights gained from this study may assist policymakers, technology vendors, and SME stakeholders, helping them develop targeted strategies to overcome the barriers to cloud adoption. Thus, the study plays a part in achieving the wider goal of enabling SMEs in developing countries to embrace digital technologies and drive sustainable economic growth.

2. Research Method

Literature Review

Cloud computing has emerged as a transformative technology, offering scalable and cost-effective IT solutions, particularly beneficial for small and medium enterprises (SMEs) that often face resource constraints (Khayer et al., 2021; Mohammad & Abbas, 2024). In developing countries like Pakistan, SMEs play a critical role in economic growth, yet their adoption of cloud computing remains limited and inconsistent (A. G. Awan & Hashmi, 2014; Raza et al., 2014). While previous studies have explored cloud adoption in various regions, there is a lack of empirical evidence focusing on SMEs in metropolitan cities such as Multan, where technological readiness, infrastructure, and user attitudes may differ significantly from urban centers. This study aims to fill that gap by examining the factors influencing cloud computing adoption among SMEs in Multan, through the lens of UTAUT and TAM model (Davis, 1989; Venkatesh et al., 2003).

Specifically, the study investigates the impact of perceived usefulness, perceived ease of use, social influence, and facilitating conditions on cloud adoption behavior, with attitude serving as a mediating variable. The findings are expected to offer valuable insights for policymakers, technology vendors, and SME stakeholders aiming to enhance cloud adoption in emerging markets.

Hypothesis Development

The adoption of cloud computing technologies among small and medium enterprises (SMEs) is significantly influenced by individual perceptions and organizational factors, as explained by the relevant literature (Khayer et al., 2021; Shetty & Panda, 2021). Perceived usefulness (PU) is a core determinant, referring to the extent to which users believe that cloud computing will enhance their job performance. Numerous studies have found that higher PU not only shapes positive attitudes toward adoption but also directly enhances the intention to use the technology (Park & Park, 2020). Similarly, perceived ease of use (PEU), defined as the degree to which cloud computing is seen as free of effort, plays a pivotal role in fostering favorable attitudes and increasing behavioral intention (Davis, 1989). When technology is intuitive and user-friendly, users are more likely to develop a positive disposition toward its use, leading to greater adoption intent, especially among SMEs.

Beyond individual perceptions, social influence (SI) and facilitating conditions (FC) also significantly contribute to cloud computing adoption. SI refers to the degree to which an individual perceives that important others such as peers, managers, or industry actors, expect them to use the technology. Prior research has shown that social norms and peer behaviors significantly affect both the attitude and actual intention of peoples (Ajzen, 1991; Awais, Fatima, & Awan, 2022; Riaz, 2025). Additionally, FC, such as access to necessary infrastructure, IT support, and organizational readiness, are essential enablers of adoption. These conditions can reduce the perceived risk and complexity associated with cloud computing and positively influence users' attitudes and behavioral intentions (Hussein et al., 2022). Taken together, these variables provide a robust structure to understand the psychological and contextual factors shaping cloud computing adoption among SMEs. Based on the above literature, we propose the following hypotheses.

H1a, b: PU is a significant positive predictor of attitudes and behavior toward cloud computing adoption.

H2a, b: PEU is a significant positive predictor of attitudes and behavior toward cloud computing adoption.

H3a, b: SI is a significant positive predictor of attitudes and behavior toward cloud computing adoption.

H4a, b: FC are significant positive predictor of attitudes and behavior toward cloud computing adoption.

Attitude as Mediator

Attitude plays a central role in various theories such as the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1977), Theory of Planned Behavior (TPB) (Ajzen, 1991), and TAM model (Davis, 1989). These theories posit that a user's attitude toward a technology their overall evaluation of using it, is a significant predictor of their behavioral intention or actual use. In the context of cloud computing, a positive attitude reflects the user's confidence, trust, and willingness to engage with cloud technologies. Prior studies have shown that users who perceive cloud computing as beneficial and aligned with their needs tend to develop favorable attitudes, which in turn strongly influence their intention to adopt it (Hassan, Bhatti, Shujaat, & Hwang, 2022). This is particularly relevant in SMEs, where individual attitudes often have a disproportionate effect due to lean organizational structures and resource limitations.

Moreover, attitude serves as a crucial mediating variable between key antecedents such as perceived usefulness, perceived ease of use, social influence, and facilitating conditions and the peoples behavior toward adaptation (Ma & Luo, 2024). Mediation better captures the causal pathway between external factors and intention to adopt cloud computing. When users perceive cloud computing as useful, easy to use, socially endorsed, and supported by adequate infrastructure, these factors first shape a positive internal disposition (attitude), which then drives behavioral intention. Several empirical studies confirm that the influence of these antecedents on adoption behavior is often indirect, operating through the mediating mechanism of attitude (Davis, 1989; Ma & Luo, 2024). This highlights the psychological bridge that attitude forms between external perceptions and actual usage behavior of peoples. So based on the above literature, we propose the following hypotheses.

H5: Attitude toward cloud computing has a significant positive effect on behavior to use cloud computing.

H6a: Attitude mediates the effect among perceived usefulness and behavior to use cloud computing.

H6b: Attitude mediates the effect among perceived ease of use and behavior to use cloud computing.

H6c: Attitude mediates the effect among social influence and behavior to use cloud computing.

H6d: Attitude mediates the effect among facilitating conditions and behavior to use cloud computing.

Research Design and Questionnaire Development

This study adopts a quantitative research design, and data was collected through structured questionnaire, to examine the determinants of cloud computing adoption among SMEs in Multan, Pakistan. Questionnaire was divided in two portions, first part for demographic information, and second part for study constructs. Based on UTAUT and TAM theory this study investigates the effects of perceived usefulness, perceived ease of use, social influence, and facilitating conditions on behavioral intention to use cloud computing in SMEs, with attitude toward cloud computing adoption acting as a mediating variable. To measure these constructs, items were adapted from previously validated scales. All items were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to capture the degree of agreement with each statement. Items and their source papers are presented in **Table 2**, and conceptual framework of this study is presented in **Figure 1**.

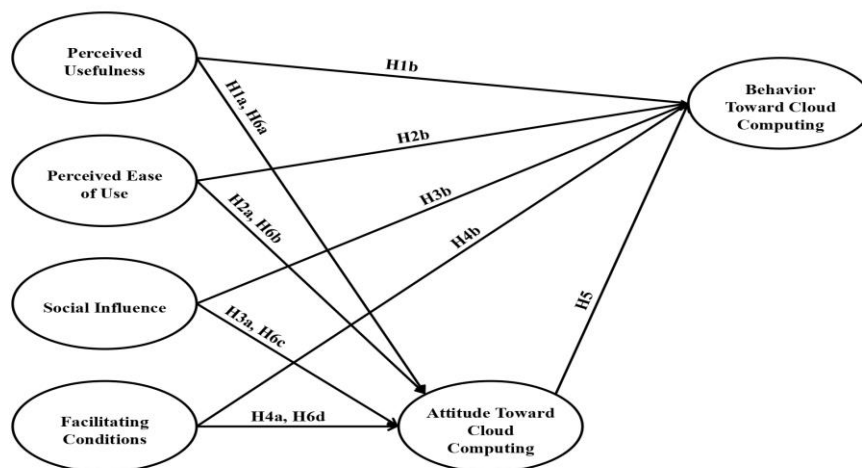


Figure 1. Conceptual framework

Data Collection and Analysis

For this study we collected data using a survey method, through convenience sampling technique targeting decision-makers and IT personnel from different SMEs in Multan. A total of 274 valid responses were collected, which satisfies the sample size requirements for study (Hair, Risher, Sarstedt, & Ringle, 2019). The data were analyzed using Smart-PLS 4, software in different stages (Hair Jr et al., 2021). First, the measurement model was assessed to evaluate construct reliability and validity, including composite reliability, average variance extracted (AVE), and discriminant validity. Second, we applied the structural model to check the hypothesized relationships between constructs. Third, PLS Predict was conducted to check the model's predictive relevance by using out-of-sample prediction performance. Although convenience sampling was used, we ensured diversity across SME size and sectors to improve representation. Furthermore, the use of PLS Predict provided evidence of the model's predictive relevance beyond the sample, supporting the external validity of both the measurement and structural models.

3. Result and Discussion

Demographic Profile of Respondents

The respondent profile presents a diverse group of individuals based on gender, age, marital status, education, and income. A majority of the respondents are male (73%), while 27% are female. In terms of age distribution, the largest group falls within the 21-30 age range (41%), followed by the 31-40 age range (28%), with smaller proportions in the other age categories. Regarding marital status, most respondents are single (56%), while 44% were married. In terms of education, the respondents are predominantly university educated (55%), with a smaller proportion holding a college degree (34%) and high school diploma (11%). The income distribution shows that the majority of respondents earn between 26,000 to 50,000 PKR (38%), followed by those earning between 51,000 to 100,000 PKR (28%), then 20% in the 101,000 to 150,000 PKR range, and 9% earning 151,000 PKR and above, only 4% earn 25,000 PKR or below. Further detailed results are presented in Table no 1.

Table 1. Demographic information of respondents

Characteristics	Items	Frequency	Percentage
Gender	Male	200	73
	Female	74	27
Age	20 and below	25	9
	21-30	112	41
	31-40	77	28
	41-50	41	15
Marital Status	51 and above	19	7
	Married	121	44
Education	Single	153	56
	High School	30	11
Income in PKR	College	93	34
	University	151	55
	25,000 and below	11	4
	26,000–50,000	106	38
	51,000–100,000	77	28
	101,000–150,000	55	20
	151,000 and above	25	9

Measurement Model

Measurement model analysis was taken on smart-pls to ensure the reliability and validity of research items and variables being taken in theoretical model. The measurement model results indicate a well-fitting and reliable model for examining cloud computing adoption among SMEs. As shown in Table 2, all item loadings exceeded the 0.80 threshold, confirming strong indicator reliability, with acceptable VIF values, all below 3, indicating no multicollinearity issues (Hair et al., 2019).

Table 2. Items, source papers, outer loadings, and VIF

Constructs	Items	Statement	Source	Loadings	VIF
Perceived Usefulness	PU1	Cloud computing will increase my productivity	(Hassan et al., 2022)	0.864	1.780
	PU2	Cloud computing will improve my performance		0.904	2.232
	PU3	Cloud computing services are useful in my job		0.806	1.806
Perceived Ease of Use	PEU1	Cloud computing has user friendly interface	(Wu, 2011)	0.875	1.998
	PEU2	It is easy to learn using cloud computing		0.883	2.180
	PEU3	It is easy to make use of the cloud computing		0.867	1.985
Social influence	SI1	Mass media affects me for using cloud computing	(Wu, 2011)	0.885	2.057
	SI2	Expert opinions affect me to use cloud computing		0.857	1.859
	SI3	Word-of-mouth affects me to use cloud computing		0.833	1.711
Facilitating Conditions	FC1	I have necessary resources to use cloud computing	(Venkatesh et al., 2003)	0.845	1.685
	FC2	I have proper knowledge to use cloud computing		0.852	1.765
	FC3	I have proper infrastructure to use cloud computing		0.844	1.741
Attitude	ATT1	Using cloud computing in my job is a good idea	(Hassan et al., 2022)	0.911	2.617
	ATT2	Using cloud computing in my job will be pleasant		0.903	2.648
	ATT3	Overall I like the idea of using cloud computing		0.859	1.972
Behavior	BEH1	I plan to use cloud computing in the future	(Jeyaraj, Dwivedi, & Venkatesh, 2023)	0.868	1.939
	BEH2	I am willing to use cloud computing in the future		0.867	1.884
	BEH3	I am likely to use cloud computing in the future		0.869	2.048

Table 3 confirms the reliability and internal consistency of the constructs, with Cronbach's alpha and composite reliability (CR) values all exceeding the threshold of 0.80, indicating strong reliability. Specifically, the Cronbach's alpha values range from 0.803 for Facilitating Conditions to 0.871 for Attitude, while the composite reliability values range from 0.803 to 0.875. Furthermore, the Average Variance Extracted (AVE) values surpass the 0.70 threshold for all constructs, ranging from 0.717 to 0.795, which demonstrates good convergent validity (Hair Jr et al., 2021). These results highlight that the measurement model exhibits both internal consistency and convergent validity, ensuring that the constructs are accurately and reliably measured across the sample.

Table 3. Constructs reliability and validity

Constructs	Mean	SD	Cronbach's alpha	CR	AVE
ATT	4.255	0.887	0.871	0.875	0.795
BEH	3.889	0.986	0.836	0.838	0.753

Constructs	Mean	SD	Cronbach's alpha	CR	AVE
FC	4.350	0.965	0.803	0.803	0.717
PEU	4.399	0.865	0.847	0.848	0.766
PU	3.339	1.143	0.824	0.851	0.738
SI	4.173	0.938	0.821	0.824	0.737

Discriminant validity is supported via HTMT ratios as presented in Table 4, with all construct values below the 0.85 cutoff. Furthermore, model fit indices found acceptable values, with SRMR = 0.062 indicating a good model fit. Overall, the structural model satisfies all key validity and reliability criteria, supporting the robustness of the proposed framework.

Table 4. Discriminant validity (HTMT ratios)

	ATT	BEH	FC	PEU	PU	SI
ATT						
BEH	0.585					
FC	0.723	0.445				
PEU	0.666	0.515	0.832			
PU	0.327	0.531	0.158	0.134		
SI	0.689	0.703	0.696	0.694	0.363	

Structural Model

Hypothesis Testing (Direct Effects)

The structural model results for direct effects, presented in Table 5, reveal that most hypothesized relationships are statistically significant. Perceived usefulness has a strong and significant effect on both attitude ($\beta = 0.144$, $p = 0.002$) and behavior ($\beta = 0.280$, $p = 0.000$) which support H1a, and H1b. Perceived ease of use also positively impacts attitude ($\beta = 0.198$, $p = 0.032$) and behavior ($\beta = 0.156$, $p = 0.015$), support H2a, and H2b. Similarly, social influence significantly affects both attitude ($\beta = 0.249$, $p = 0.009$) and behavior ($\beta = 0.350$, $p = 0.000$) confirming H3a and H3b. Facilitating conditions significantly predict attitude ($\beta = 0.311$, $p = 0.000$) supporting H4a, but do not have a significant direct effect on behavior ($\beta = -0.086$, $p = 0.177$) which reject H4b. Lastly attitude toward cloud computing significantly influences behavior ($\beta = 0.180$, $p = 0.005$), confirming H5.

Table 5. Path coefficients (direct effects)

Hypothesis	Relation	β	STD	t-values	p-values	Results	VIF
H1a	PU→ATT	0.144	0.046	3.149	0.002	Significant	1.113
H1b	PU→BEH	0.280	0.049	5.746	0.000	Significant	1.153
H2a	PEU→ATT	0.198	0.093	2.139	0.032	Significant	2.116
H2b	PEU→BEH	0.156	0.064	2.430	0.015	Significant	2.193
H3a	SI→ATT	0.249	0.096	2.603	0.009	Significant	1.793
H3b	SI→BEH	0.350	0.065	5.377	0.000	Significant	1.914
H4a	FC→ATT	0.311	0.089	3.506	0.000	Significant	2.050
H4b	FC→BEH	-0.086	0.064	1.349	0.177	Not Significant	2.240
H5	ATT→BEH	0.180	0.064	2.797	0.005	Significant	1.959

Furthermore all VIF values for inner model remain below the threshold of 3.0, indicating no multicollinearity concerns (Hair Jr et al., 2021). These results support most of the proposed direct hypotheses, particularly highlighting the influence of perceived usefulness, perceived ease of use and social influence on attitude, and adoption behavior. Further path coefficients results are also shown in Figure 2.

Mediation Effects

The mediation analysis results presented in Table 6 confirm that attitude toward cloud computing adoption significantly mediates the relationship between all four independent variables and behavioral intention. Specifically, a significant indirect effect on behavior through attitude is found for perceived usefulness ($\beta = 0.026$, $p = 0.045$) confirming H6a, perceived ease of use ($\beta = 0.036$, $p = 0.027$) confirming H6b, social influence ($\beta = 0.045$, $p = 0.041$) confirming H6c, and facilitating conditions ($\beta = 0.056$, $p = 0.030$) confirming H6d. These results strongly support the proposed mediation hypotheses and underscore the critical role of attitude as a mediator between external perceptions and adoption behavior. The results highlight that even though direct relationships between certain independent variables and adoption behavior may not always be strong or significant, attitude serves as a vital intermediary. By shaping individuals'

attitudes through perceptions of usefulness, ease of use, social influence, and facilitating conditions, these external factors ultimately drive adoption behavior. These insights provide valuable guidance for organizations aiming to enhance cloud computing adoption, especially within the context of SMEs, where fostering positive attitudes can significantly influence the decision to adopt such technologies.

Table 6. Mediating effects

Hypothesis	Relation	β	STD	t-values	p-values	Results
H6a	PU→ATT→BEH	0.026	0.013	1.982	0.045	Significant
H6b	PEU→ATT→BEH	0.036	0.020	2.255	0.027	Significant
H6c	SI→ATT→BEH	0.045	0.025	1.991	0.041	Significant
H6d	FC→ATT→BEH	0.056	0.026	2.166	0.030	Significant

In conclusion, the results from the structural and mediation model analyses support most of the hypothesized relationships, with attitude playing a significant role as a mediator in cloud computing adoption. Perceived usefulness, perceived ease of use, and social influence have significant direct effects on both attitude and behavior, while attitude mediates these effects on adoption behavior. Facilitating conditions, although not having a direct effect on behavior, significantly influence attitude and indirectly affect behavior through attitude. This underscores the importance of facilitating conditions in shaping users' perceptions, which in turn drive adoption behavior. Overall, the findings highlight the critical role of attitude as a psychological factor as mediator and suggest that improving users' perceptions of usefulness, ease of use, social influence, and facilitating conditions can enhance cloud computing adoption among SMEs.

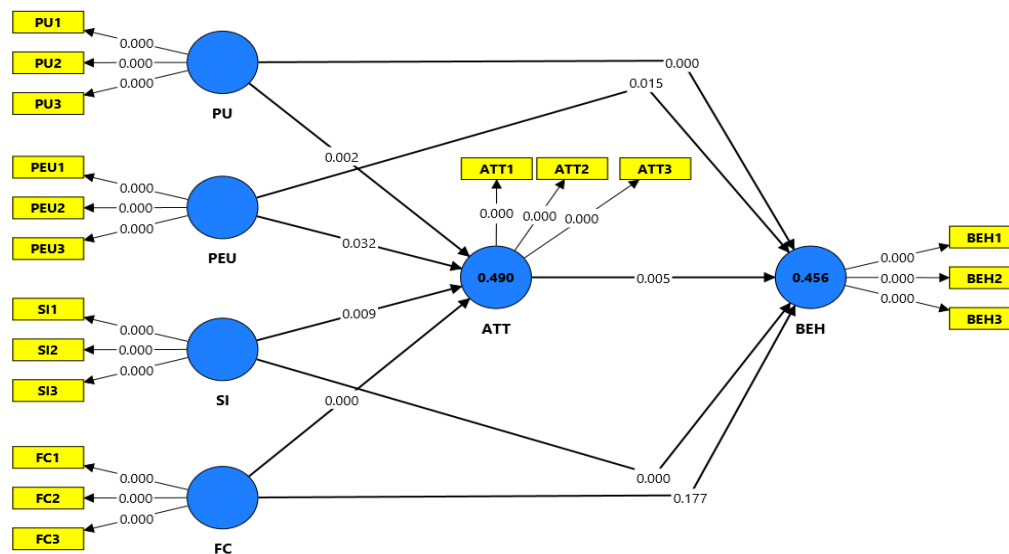


Figure 2. Structural model

PLS Predict

The predictive validity of the model was assessed using PLS Predict, and the results, shown in Table 7, indicate that the PLS-SEM model outperformed both linear regression (LM) and naïve (IA) benchmarks across all indicators. For each item under Attitude and Behavior, the PLS-SEM RMSE and MAE values were consistently lower than those of the LM and IA models, confirming superior predictive accuracy. Additionally, all $Q^2_{predict}$ values were well above zero, suggesting meaningful predictive relevance (Shmueli et al., 2019). As summarized in Table 8, the latent variable prediction metrics further support this, with $Q^2_{predict}$ values of 0.454 for Attitude and 0.417 for Behavior, both indicating strong out-of-sample predictive power (Shmueli, Ray, Estrada, & Chatla, 2016). These results validate the model's ability to reliably predict cloud computing adoption behavior in similar SME contexts.

Table 7. PLS predict

	$Q^2_{predict}$	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE	IA_RMSE	IA_MAE
ATT1	0.425	0.631	0.489	0.657	0.501	0.832	0.665
ATT2	0.321	0.789	0.570	0.805	0.592	0.958	0.744
ATT3	0.323	0.724	0.561	0.750	0.574	0.880	0.680

	Q ² predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE	IA_RMSE	IA_MAE
BEH1	0.333	0.836	0.642	0.861	0.658	1.024	0.821
BEH2	0.328	0.757	0.595	0.772	0.596	0.923	0.716
BEH3	0.272	0.874	0.694	0.881	0.706	1.025	0.820

Table 8. PLS predict (LV summary)

	Q ² predict	RMSE	MAE
ATT	0.454	0.750	0.563
BEH	0.417	0.772	0.606

Discussion

This research provides meaningful understanding of the key factors driving cloud computing adoption among SMEs in Multan, Pakistan, through using an integrated model based on UTAUT and TAM. The findings show that perceived usefulness, perceived ease of use, and social influence significantly impact both attitude and behavior toward cloud computing, consistent with prior research (Davis, 1989; Ma & Luo, 2024; Venkatesh et al., 2003). This confirms that SME decision-makers interest towards cloud computing solutions when they see distinct advantages clear benefits, find the system user-friendly, and perceive that important stakeholders endorse the technology. While facilitating conditions positively influence attitude, but not behavior implies that infrastructure and support alone are insufficient; adoption is more likely when users are internally motivated or socially encouraged. This highlights the enabling, but not decisive role of external conditions in adoption behavior. A notable direct impact of attitude on behavior reinforces its central role on how technology adoption choices are made, especially in contexts like SMEs where personal beliefs often influence organizational outcomes. Furthermore, the strong effect of social influence reflects the collectivist and peer-oriented decision taking culture common in Pakistani SMEs, where technology choices are often validated through informal networks and social norms. Thus, social influence becomes a key driver of adoption, especially when institutional or infrastructural support is limited.

Additionally, the mediation analysis revealed that attitude acts as a critical psychological mechanism linking all four independent variables to behavioral intention. This emphasizes the importance of cultivating positive user attitudes through organizational support, peer influence, and awareness-building initiatives. The strong predictive validity of the model, demonstrated through PLS Predict results, suggests that the framework not only aligns closely with the data but also holds practical potential for forecasting future adoption behavior. These results carry significant consequences for practice, cloud service providers and policymakers aiming that to increase adoption among SMEs their efforts should extend beyond merely enhancing technical infrastructure but also on shaping user perceptions and attitudes through targeted training and communication strategies (T. M. Awan & Awais, 2023). In summary, this research advances the understanding of cloud adoption in emerging markets by demonstrating the interplay between cognitive perceptions, social factors, and internal attitudes, thereby offering a holistic perspective that is both theoretically grounded and practically actionable.

4. Conclusion

This study concludes that cloud computing acceptance among SMEs in Multan, Pakistan is significantly influenced due to the factors such as perceived usefulness, ease of use, social influence, and facilitating conditions, with attitude playing a key mediating role. The findings validate the integrated UTAUT, and TAM models, and highlight the key role of both technical and psychological aspects in shaping adoption behavior. The strong predictive performance of the model further reinforces its applicability in similar SME contexts. Overall, this research offers theoretical contributions to the technology adoption literature and practical guidance for stakeholders aiming to enhance cloud adoption in emerging markets. Future research should explore cloud computing adoption across diverse regions and sectors to enhance generalizability, including comparisons between urban and rural, users and non user SMEs. Also user satisfaction in this domain should be explored as satisfaction contributing to the growth and competitive advantage of a institute as reported (Aman, Aziz, & Abbas, 2023). Further longitudinal research may reveal more nuanced understanding of how adoption behavior undergoes transformation over. Additionally, incorporating external variables such as trust, training, data privacy, or cost sensitivity may offer a more comprehensive understanding. As these factors, including concerns about data security and affordability, could significantly impact the willingness of SMEs to adopt cloud technologies. By considering these variables in future models, researchers can capture the broader range of challenges SMEs face, particularly in developing regions where these concerns are often more pronounced. Researchers are also encouraged to apply mixed-method

approaches that will capture both quantitative patterns and qualitative insights for richer contextual interpretation. By deepening our understanding through identifying what motivates cloud adoption, this study paves the way for more informed strategies that empower SMEs to embrace digital transformation in an increasingly competitive and technology-driven world.

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