

Technological Determinants of Social Media Marketing Adoption in Pakistan Small and Medium Startups: The Moderating Role of Vendor Support

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Abstract

Social Media Marketing (SMM) is considered an important strategic marketing tool for businesses. It has provided cost-effective solution to them, expanded their visibility and increased their revenues. Yet, there is little evidence in literature to suggest that small and medium startups (SMSs) have fully adopted SMM, especially in a developing country like Pakistan. This research has used the Technology-Organization-Environment (TOE) framework and integrate it with Absorption Capacity Theory (ACT) to study the impact of technological factors in SMM adoption. The impact of technological determinants including Technology Complexity (TCOMX), Knowledge (TKNOW), Compatibility (TCOM), Cost (TCOST) and Infrastructure (TINF) on SMM adoption was studied with a moderating role of Vendor Support (VNDS). Quantitative data was collected from 386 SMSs operating in Karachi. The data was analysed using PLS-SEM. The findings of our study revealed that TKNOW and TINF has significant positive impact on SMM adoption is SMSs, while they do not consider TCOMX, TCOM and TCOST to be a significant SMM adoption challenge. Furthermore, the moderating role of VNDS was also checked with a significant impact on the relationship between TCOMX, TKNOW, TCOM and SMM adoption. The research highlights the perception of SMSs towards SMM adoption as results reveal that their technological adoption determinants to be different in comparison to Small and Medium Enterprises (SMEs). Additionally, it also discusses the role of strong technology eco-system in the form of vendor support for overcoming technological barriers. This research contributes to the body of literature by identifying differential nature of SMSs in comparison to conventional organizations and open up possibilities for further studies focusing on startups.

Keywords: Social Media Marketing; SMEs; Small and Medium Startups; Startup ecosystem; Technological factors; Vendor Support

INTRODUCTION

In this era of digitalization, technology has provided ample opportunities for businesses to compete and grow (Zhang et al., 2024). These disruptive yet effective technologies include Enterprise Resource Planning (ERP) Systems, Cloud Computing, Data Analytics, Customer Relationship Management tools, Artificial Intelligence, 5th Generation mobile network (5G), Mobile Development and Digital Marketing. These technologies have revolutionized the way businesses go about their functions as they have improved their manageability, efficiency and eventually boosting their profitability (Afolabi et al., 2025).

The marketing functions across different businesses have incorporated this technological revolution through adoption of digital marketing (Vettriselvan, 2025). Digital marketing is a collection of processes and activities that are facilitated by digital technologies enabling businesses to create, communicate and deliver value to customers (Athaide et al., 2025). Marketing is a dynamic business activity continuously evolving with the emergence of internet (Wei et al., 2025). Marketers today have become more customer-centric in their strategic decision makings that requires timely data collection and response which is possible through digital marketing (Mohapatra et al., 2025). The digital marketing spending globally is expected to surpass USD 700 billion by 2026, with Social media marketing (SMM) taking a major portion of this spending which amounts to USD 235 billion and expected to exceed USD 345 billion within the next five years (Statista, 2025).

Such high expenditures on SMM adoption shows that businesses today are trusting it for reaching out to customers and are transitioning towards SMM from conventional marketing (Huo & Filieri, 2025). Yet the adoption approach of Small Medium Enterprises (SMEs) towards SMM remains reactive and slow (Zhou, 2024). Previous literature has predominantly focused on the SMM adoption challenges for large enterprises (Bartoloni & Ancillai, 2024a), ignoring the barriers in SMM adoption for SMEs, specifically for Small and Medium Startups (SMSs) (Small and Medium Enterprises with less than 5 years of business existence) (SMEDA, 2025).

SMSs are a crucial driver of the global economy making significant contributions (Kumar & Yadav, 2024). They add value to the GDP through job creation and attracting global investments. Further, they contribute uniquely by taking an unconventional approach for solving conventional problems. Due to their unconventional approach, they are termed as the disrupters as they introduce novel business models providing a different direction to the whole industry (Lile et al., 2025). It is not about the volume of their business but the long-term impact they create in the business eco-system.

Globally, the startup eco-system is prone to significant challenges and as a consequence of these challenges, they have a failure rate of 90% (Muthuraman, 2024). Studies have shown that high cash burn plays a significant role in startups going out of business with prominent reasons being ineffective and poor marketing spending (Pathania & Tanwar, 2024). This clearly establishes the need to provide proper guidance to SMSs for effective marketing planning, especially SMM, given its benefits and help them overcome the barriers in its implementation.

SMEs generate 90% of all new employment opportunities in the formal sector (Enaifoghe, 2024). Pakistan's economy is expected to grow by merely 3.5% in financial year 2025-26 lacking steam to accommodate and fulfill rising employment needs. SMEs historically, have a positive impact on economic development of Pakistan, with 1% increase in their output resulting in increase in Gross Domestic Product by 1.7% (Atif et al., 2024). This leads to the argument that Pakistan's economic prosperity is linked to the creation of employment opportunities and increase in growth rate which ultimately is the resultant of increased output of the SMEs. the latter approach by initiating and facilitating the startups and making them competitive via digitalization. The study into the technological challenges face by SMSs in SMM adoption demands attention considering their importance and impact on economic development across various countries globally and Pakistan's lowest position in Startup environment across regional Asian economies.

Globally social media users have soared to 5.42 billion (Statista, 2025), with 66.9 million of them from Pakistan. It is evident that social media platforms provide access to massive untapped audience that has proven benefits as compared to conventional marketing. SMM has overtime become an important tool for startups for building their brand visibility, promoting customer engagement and giving competition to higher end firms (Perera et al., 2024). Despite the strategic importance it has, startups have struggled to effectively adapt and utilize SMM to their benefit (Chyrak et al., 2024a). These barriers are mainly associated with technological challenges such as

its complexity, lack of knowledge, compatibility issues with the existing business system, cost concerns and inappropriate infrastructure (Okoye & Mensah, 2025). Unlike established firms, startups operate with cost constraints, limited expertise and improper structure. These factors collectively make technological adoption decision more uncertain and risk prone for them. Current literature has majorly focused on challenges associated in SMM adoption in either large enterprises or SMEs (Solomon et al., 2024). There is very limited empirical evidence explaining how specific technological challenges influence SMM adoption in SMSs, particularly in an emerging economy like Pakistan with low digitalization initiatives and weak support system.

Additionally, vendor support represents a critical yet unexplored factor that can help SMSs overcome the technological challenges associated with SMM adoption (Ahmed et al., 2025). Vendor support through assistance in SMM implementation, trainings, system standardization and after-sales support could play a significant role in overcoming technological challenges, yet there is insufficient understanding in literature of whether and how vendor support moderates the relation between technological challenges and SMM adoption. This insight could prove critical for SMSs and service providers in providing clear guidance about how external support can be strategically leveraged in facilitating SMM adoption (Chyrak et al., 2024b; Mtjilibe et al., 2024). Keeping in view, it is essential to conduct research that systematically examines the technological challenges faced by SMSs in SMM adoption and how external support from vendors can assist in overcoming these challenges.

Therefore, this research seeks to answer the following questions:

1. How do technological factors (technology complexity, technology knowledge, technology compatibility, technology cost and technology infrastructure) influence Social Media Marketing adoption in Pakistani Small and Medium Startups?
2. What is the moderating role of Vendor Support in the relationship between technological challenges and Social Media Marketing adoption?

For examining the technological determinants involved in SMM adoption, the current research follows technology-organization environment (TOE) framework. Additionally, absorptive capacity theory is used for assessing the moderating role of vendor support between technological determinants and SMM adoption. The current research has theoretical and practical importance in the field of marketing and entrepreneurship as it addresses the research gap in studies related to startups and provides insights relevant to emerging and resource constrained business environments in Pakistan. After discussing the introduction, problem statement and research questions, theoretical background and literature will be reviewed in the next chapter, followed by the methodology part in which quantitative research approach is used. Following that, data analysis and results are presented. In the last part discussion is made on the results along with their theoretical and practical implications, limitations and area of future research.

LITERATURE REVIEW

Social Media Marketing (SMM) Adoption

SMM adoption refers to the usage of social media platforms for promoting businesses and their products and services (Chyrak et al., 2024c). It includes different set of platforms including but not restricted to Facebook, Instagram, WhatsApp, TikTok and LinkedIn. For startups, it is pivotal to have digital presence and social media provides the ideal stage. SMM adoption enables businesses to directly engage with customer through their engaging content, enabling them to create better personalized and impactful marketing campaigns (Sobouti & Karimi Alavijeh, n.d.). Businesses using SMM can effectively communicate their brand value and product offerings, giving them a

competitive advantage (Chatterjee et al., 2024). The interactive nature of social media platforms gives businesses real time feedback, along with its data-analytics features, which enables businesses to better understand the consumer behaviour and preferences and take corrective measures instantly for better targeting (Theodorakopoulos & Theodoropoulou, 2024). Kanellos et al. (2024) researched on the impact of SMM on business outcomes including sales, website orders and traffic and found them to be directly correlated with the scale of marketing campaigns on social media platforms. SMM adoption has resulted in better customer engagement, and helped businesses, especially startups, create a community through engaging post and content (Chyrak et al., 2024d). With time this has resulted in creating brand loyalty and brand equity (Tabelessy, 2024), which is pivotal for Startups.

Theoretical Background

Technology- Organization-Environment (TOE) Framework

The TOE framework was initially proposed by Tornatzky and Fleischer in 1990 in the book “The Process of Technological Innovation”. The book focuses on the whole process that unfolds during technology and innovation adoption, starting from its development till execution (Prakash, 2025). TOE argues that there are three dimensions that have an impact during technology adoption process. These dimensions are technological, organizational and environmental. The technological dimension focuses on the technological factors like complexity, compatibility, cost and infrastructure that can impact technology adoption decision. The organizational dimension focuses on the internal characteristics of the firm including culture, perception and resources that can either facilitate or hinder technology adoption decision. The environmental dimension refers to external variables like competition, customer pressure and external support that plays a significant role in technology adoption. It is important for businesses to thoroughly investigate the impact of these dimensions during technology adoption process to yield the best returns out of this decision (Nagy et al., 2025).

TOE model has been extensively used in literature for studying the impact of different dimension in technology adoption, including e-business adoption (A. Kumar et al., 2025a), ERP system adoption (Islam et al., 2025), cloud computing adoption (Bakar et al., 2024) and RFID adoption (A. Kumar et al., 2025b). As Pakistan lacks digitalization initiatives, the current research solely focuses on technological factors adapted from studies that have applied TOE framework to study SMM adoption decision of SMSs.

Absorptive Capacity Theory (ACT)

Drawing on Absorptive Capacity Theory (ACT) by Cohen and Levinthal (1990), this study argues that the impact of technological determinants on SMM adoption in SMSs is dependent upon the external support and assistance available to them. Although technological determinants like complexity, knowledge, compatibility, cost and infrastructure may have an influence on SMM adoption but the ability of the firm to acquire, assimilate and apply technological knowledge also plays a significant role in successful technology adoption (Ko & Liu, 2019). In this regard, Vendor Support (VNDS), is crucial as it facilitates the learning, reduces uncertainty and provides hands-on guidance and training. With these mechanisms, VNDS enhances the absorptive capacity of the businesses and helps them in better understanding of the benefits, complexities, cost and compatibility challenges related to SMM adoption (Le & Liu, 2024).

Hypotheses Development

Technology Complexity (TCOMX) and Social Media Marketing (SMM) Adoption

Technology Complexity (TCOMX) poses a challenge to businesses as it involves understanding and continuous learning regarding the usability of a technology (Rane et al., 2024). Businesses suffer from imaginary complexity in technology adoption by presuming it to be complex (Alam et al., 2024). This is often the case with Startups when it comes to SMM. Due to complexity perception, individuals responsible for the technology implementation faces psychological barriers, which results in limiting their adoption patterns (FakhrHosseini et al., 2024a). With SMM, complications arise due to lack of exposure in learning and using specific SMM tools (Chyrak et al., 2024e). The frequent changes in user interface of different social media platforms can further amplify the complexity. Additionally, SMM generates big amount of data. Handling vast amount of data and generating meaningful insights from that data can be challenging especially for entrepreneurs who do not have a background in data analytics (Vassakis et al., 2017). For optimum utilization of dataset, continuous training related to advance analytical tools and automation platforms is needed, which eventually ends up creating further complications towards the SMM adoption (Kedi et al., 2024).

H1: There is a significant negative relationship between TCOMX and SMM adoption

Technology Knowledge (TKNOW) and Social Media Marketing (SMM) Adoption

Technology knowledge (TKNOW) refers to the experiences and familiarity one possesses with technology (O'brien et al., 2012). The better the technology knowledge, the higher the chances of successful implementation. Inexperience with technology or lack of TKNOW can be a major hindrance towards its adoption, making its adopters feel stressed and overwhelmed (Douthwaite et al., 2001). Such is the case with lack of SMM knowledge that compels businesses to hold onto their conventional methods, resulting in limited exposure to SMM tools and therefore, businesses not being aware about the appropriate Social media tools they require for customer targeting (Miller, 2012). For those who have prior knowledge about these tools, they then lack the know-how of metrics that can assist them in monitoring and measuring performance (K. Y. Wong et al., 2015). Entrepreneurs and businesses with greater TKNOW are well-prepared to traverse the complications involved with SMM tools (Wasserman, 2012). Being able to leverage these Social Media platforms enables businesses to create effective marketing campaigns strategically in accordance with the business's marketing objectives (Olson et al., 2021). As a result, it is hypothesized that TKNOW positively impacts SMM adoption, helping businesses increase their engagement with customers, ultimately leading towards growth and success.

H2: There is a significant positive relationship between TKNOW and SMM adoption

Technology Compatibility (TCOM) and Social Media Marketing (SMM) Adoption

Compatibility can be defined as the extent to which a change is regarded as consistent with existing values, and experiences of potential adopters (Karahanna et al., 2006). However, this definition is too broad. Compatibility can further be categorized into value compatibility (the suitability of the technology with norms and values of potential adopters) and practical compatibility (the suitability of the technology with current practices of adopters) (FakhrHosseini et al., 2024b). Businesses

need to practice caution when deciding on the integration of technology into business practices (Shwedeh & Alzoubi, 2024). Greater compatibility with business needs would result in a higher diffusion rate and improved results (Żywiołek et al., 2025), however, unfavourable outcomes can occur if businesses fail to position adoption of technology in line with their business model and practices (Kim & Lee, 2024). Not all businesses would find it necessary or appealing to integrate technologies like SMM, as some would be less dependent on it, while others would not yet be prepared for such a change (Bartoloni & Ancillai, 2024b). This leads to the hypothesis that technology compatibility is strongly positively correlated with adoption of SMM.

H3: There is a significant positive relationship between TCOM and SMM adoption

Technology Cost (TCOST) and Social Media Marketing (SMM) Adoption

Technology cost (TCOST) consists of not only the hardware and software expenses, but also includes the costs incurred for staff training, maintenance, and data storage (Stradowski & Madeyski, 2024). There also exists the opportunity cost that comes with the change in working style, often overlooked by businesses, resulting in revenue losses during transition (M. W. Wong & Vongswasdi, 2025). The cost of technology varies business to business and can be classified into two stages, first would be the setting-up of infrastructure from scratch, and the second would be its expansion cost, based on the business's needs and the level of digitalization required (Morris, 2025). This overall cost is significant and adds onto the hesitation towards making this decision as it is often regarded as dead investment. The actual technology cost is usually higher than the initial estimates, resulting in additional investment and cash burn. Therefore, firms need to be certain when opting to invest in technology, especially in the case of startups as they might not be able to afford huge revenue losses, unlike established firms (Coad, 2025). This leads to the hypothesis that there is a negative relationship between technology cost and SMM adoption.

H4: There is a significant negative relationship between TCOST and SMM adoption.

Technology Infrastructure (TINF) and Social Media Marketing (SMM) Adoption

A traditional technology infrastructure comprises of facilities, data centres, servers, networking hardware, desktop computers, enterprise application software solutions — the usual hardware and software modules. Due to advancements in technology, firms can benefit from cost reductions and can now set up their IT infrastructure through virtualization by gaining access to cloud servers (Adeusi et al., 2024). The technology infrastructure would vary as per the nature and requirements of the business, supporting growth and performance-oriented measures through zero downtime, improved security and privacy (Chowdhury & Ashfaq, 2024). Despite these advancements, the problem of insufficient technology infrastructure still persists, making businesses indecisive and uncertain towards comprehensive SMM adoption (Haque et al., 2024). Without proper technology infrastructure, oftentimes, firms rely on outsourced functions, resulting in significant costs and quality issues (Singireddy, 2024). Additionally, businesses also struggle to incorporate SMM strategies, limiting their potential to reach and tap into wider customer segments, and mine data effectively, measures essential to maintain a competitive edge (Tsiu et al., 2025). Addressing these infrastructure shortcomings is vital for businesses to maximize the benefits of SMM adoption and ensure long-term growth and competitiveness. Therefore, following hypothesis is proposed:

H5: There is a significant positive relationship between TINF and SMM adoption.

Vendor Support (VNDS) as Moderator between Technological determinants and SMM Adoption

VNDS plays a significant role in technology adoption (George et al., 2024). It is crucial for identification of appropriate technology and its implementation (Ilori et al., 2024). Guided VNDS promotes trust and confidence among the technology adopters and users (Suganthi & Mohamed Jasim, 2025). VNDS helps businesses not only during the implementation phase of the technology, but they provide proper user training and ongoing technical support for optimum utilization (Khanyi et al., 2024). VNDS assists businesses in overcoming challenges to technology adoption arising from lack of knowledge, cost or infrastructure related issues, or concerns related to technology compatibility and complexity. Previous researches identified VNDS to be a major driver for technology adoption. For specific technologies like data analytics and blockchain technology adoption in SMEs, VNDS was found to be an important factor. In context of SMM, research by (George et al., 2024) argued that VNDS is a major enabler of SMM adoption, irrespective of size and nature of business (Chakraborty et al., 2025). Further its importance was endorsed by Liu et al. (2024) in Malaysian and Taiwanese markets. In Pakistani, businesses are gradually adopting SMM, but often their adoption pattern is unplanned and needs guidance. This guidance is critical in manoeuvring the technological complexities arising from different technological determinants. Drawing on Absorptive capacity theory, startups need external knowledge or expertise for successfully navigating through technological challenges in SMM, the following hypotheses are proposed:

H6(a): VNDS moderates the relationship between TCOMX and SMM

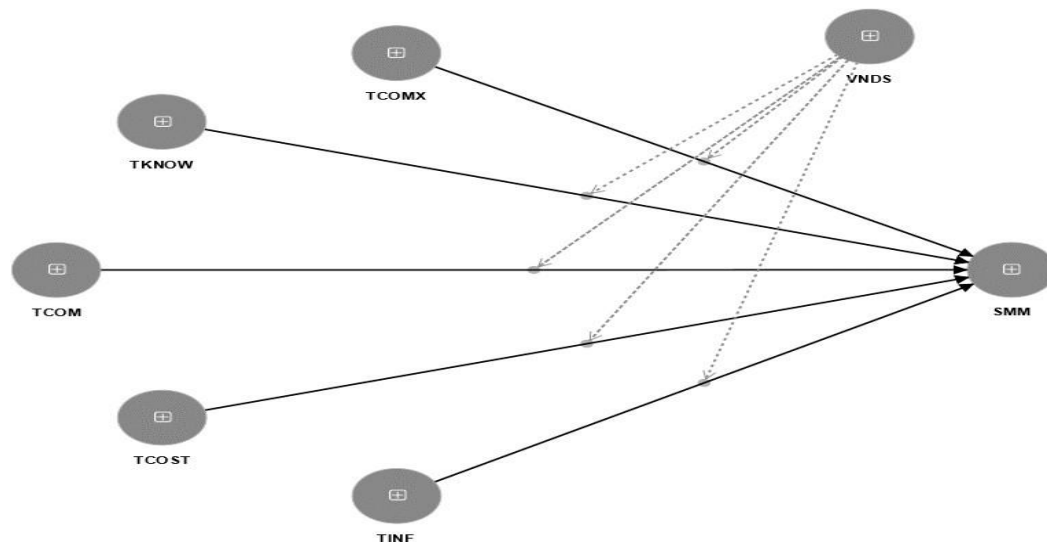
H6(b): VNDS moderates the relationship between TKNOW and SMM

H6(c): VNDS moderates the relationship between TCOM and SMM

H6(d): VNDS moderates the relationship between TCOST and SMM

H6(e): VNDS moderates the relationship between TINF and SMM

Figure 1: Conceptual Model (Source: Author's own work, created through Smart PLS 4)



RESEARCH METHODOLOGY

The quantitative research design is chosen for the current study as it focuses on technological determinants of SMM among startups in Pakistan. Our population consists of startups as that defined by SMEDA in Pakistan. The startups were chosen from the city of Karachi as the city is the economic hub of Pakistan. For data collection, 1000 random startups were selected from the provided list and were sent questionnaires for the research purpose. The questionnaire was sent through WhatsApp on the contact number provided in the dataset. Our target was to collect data from at least 384 startups to minimize margin of error as suggested by (Morgan, 1970). Out of 1000 questionnaires sent, we were able to get responses from 386 startups.

We used survey as our research instrument for data collection as it promotes better engagement among the respondents and is efficient in handling large data sets (Khan, 2024). The survey consists of items measured on Likert scale and were adapted from the literature. The five-point Likert scale was chosen as it provides the respondent with a wide range of option to select the precise answer instead of settling with the approximate one (Memmedova & Ertuna, 2024). Startup owners were the unit of analysis as they are primarily responsible for decisions related to technology adoption, SMM in our case. The participation in research was voluntary and the consent was obtained from the respondents. The confidentiality of the data was maintained and all respondents were assured that their data will be used for research purpose only.

For ensuring content validity, the items in the survey, were all adapted from the literature excluding demographic questions. The constructs, number of items in each construct and their sources are mentioned in table 1.

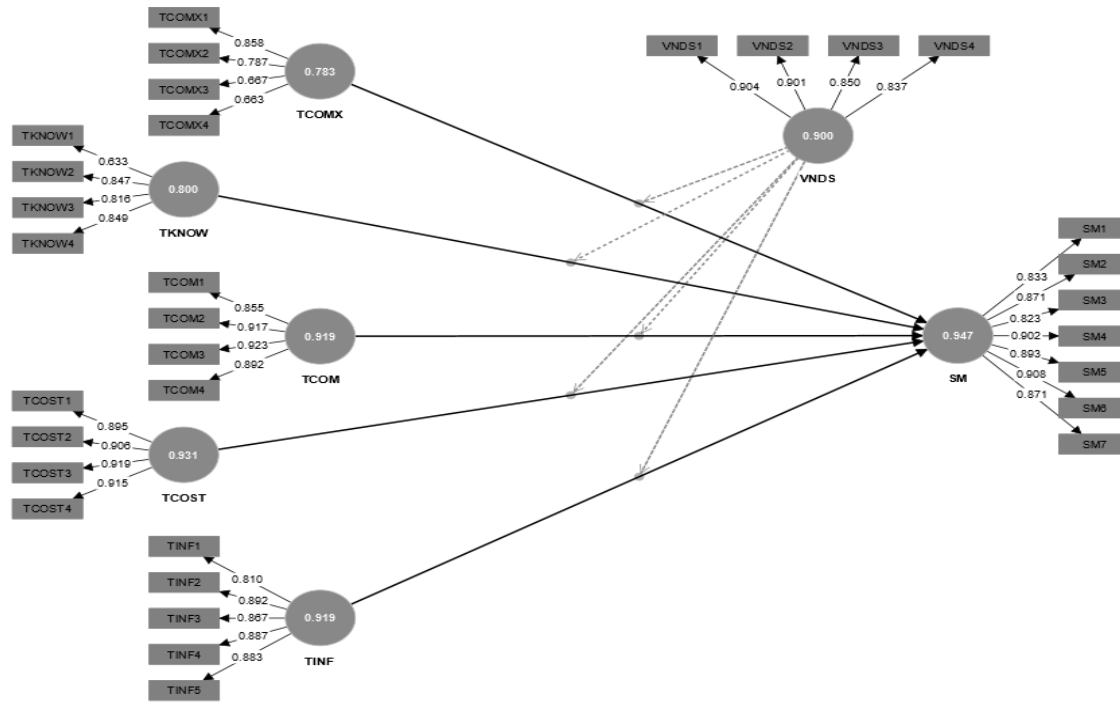
Table 1: Constructs, Number of Items and Sources

S No.	Construct Name	Number of Items	Sources
1	Social Media Marketing Adoption (SMM)	7	(Bruce et al., 2023)
2	Technology Complexity (TCOMX)	4	(Lian et al., 2014; Maduku, 2021)
3	Technology Knowledge (TKNOW)	4	(Bostancioğlu & Handley, 2018)
4	Technology Compatibility (TCOM)	4	(Kuo & Lee, 2011)
5	Technology Cost (TCOST)	4	(Maduku, 2021)
6	Technology Infrastructure (TINF)	5	(Jabbouri et al., 2016)
7	Vendor Support (VNDS)	4	(Ali Abbasi et al., 2022)

RESULTS AND ANALYSIS

For examining the impact of technological determinants on SMM, PLS-SEM was used through Smart PLS 4. The use of Smart PLS 4 adds value by providing a comprehensive understanding of the complex relationship between the studied variables and it has been successfully used in previous studies of similar nature (Cheah et al., 2024).

Fig. 2



After data collection, the data analyses process went through two stages, testing of measurement model and structural model as suggested by (Hair et al., 2012). Initially, for ensuring the reliability and validity of the instrument, the model was checked for factor loading. As suggested by (Hair et al., 2012), the items with values less than 0.500 were excluded before proceeding further. During our analyses, all the items measures had factor loadings greater than 0.708, hence no significant cross loading was reported. The next step was to check for reliability through Cronbach alpha (CA) and Composite reliability (CR). The CA and CR values were greater than the accepted threshold of 0.7, this confirms the reliability of our research instrument. The validity was checked through Average Variance Extracted (AVE) and all values were above the threshold of 0.5. The results for the factor loadings CA, CR and AVE are reported in table 2.

Table 2: Factor loadings CA, CR and AVE

Items	Factor Loading	Cronbach Alpha	Composite Reliability	Average Variance Extracted
SMM1	0.833	0.947	0.942	0.760
SMM2	0.871			
SMM3	0.823			
SMM4	0.902			
SMM5	0.893			
SMM6	0.908			
SMM7	0.871			
TCOM1	0.855	0.919	0.935	0.805
TCOM2	0.917			
TCOM3	0.923			
TCOM4	0.892			
TCOMX1	0.858	0.783	0.912	0.560
TCOMX2	0.787			
TCOMX3	0.667			
TCOMX4	0.663			
TCOST1	0.895	0.931	0.955	0.826
TCOST2	0.906			
TCOST3	0.919			
TCOST4	0.915			
TINF1	0.810	0.919	0.936	0.754
TINF2	0.892			
TINF3	0.867			
TINF4	0.887			
TINF5	0.883			
TKNOW	0.633	0.800	0.832	0.626
TKNOW2	0.847	0.900	0.952	0.763
TKNOW3	0.816			
TKNOW4	0.849			
VNDS1	0.904			
VNDS2	0.901			
VNDS3	0.850			
VNDS4	0.837			

The next step was to check for discriminant validity which was done through HTMT ratio of correlations and the Fornell-Larcker criterion. For HTMT, Yusoff et al. (2020) suggested a threshold of 0.85 and during the analysis, all the values reported were less than the mentioned cut-off value, establishing discriminant validity for the measured constructs. The result of both HTMT and Fornell-Larcker criterion are reported in table 3 and 4.

Table 3: Discriminant Validity- Heterotrait–Monotrait ratio (HTMT)

	SMM	TCOM	TCOMX	TCOST	TINF	TKNOW	VNDS
SMM							
TCOM	0.426						
TCOMX	0.138	0.215					
TCOST	0.167	0.323	0.165				
TINF	0.366	0.559	0.168	0.285			
TKNOW	0.465	0.519	0.215	0.188	0.413		
VNDS	0.263	0.383	0.167	0.378	0.487	0.139	

Table 4: Discriminant Validity- Fornell-Larcker criterion

	SMM	TCOM	TCOMX	TCOST	TINF	TKNOW	VNDS
SMM	0.872						
TCOM	0.416	0.897					
TCOMX	0.160	0.205	0.748				
TCOST	0.166	0.296	0.132	0.909			
TINF	0.366	0.518	0.168	0.266	0.868		
TKNOW	0.425	0.443	0.195	0.158	0.357	0.791	
VNDS	0.264	0.358	0.132	0.348	0.452	0.134	0.874

Following measurement model, the structural model was tested for examining the relationship between variables. The data was analysed through Smart PLS 4 using bootstrapping sample size of 5000. Our H1 hypothesized that there is a significant negative relationship between TCOMX and SMM and this hypothesis was rejected with a t-statistics of 0.942 and p-value of 0.346, suggesting that for startups complexity does not work as a barrier in technology adoption. H2 proposed that TKNOW has a significant positive impact on SMM and this hypothesis is accepted with a t-statistics of 7.392 and p-value of 0.000. This shows that prior knowledge about the technology plays a critical role in its adoption. H3 in our research suggested that TCOM has a significant positive relationship with SMM and this hypothesis as rejected with a t-statistics of 1.356 and a p-value of 0.175. This shows startups do not consider technology compatibility as a barrier in its adoption. Our H4 hypothesized that TCOST has a significant negative relationship with SMM and it was rejected with a t-statistics of 0.38 and a p-value of 0.704 suggesting that startups are willing to invest and spend on SMM and they consider this as an important investment rather than a cost. H5 in our research suggested that TINF has a significant positive impact on SMM and it was accepted with a t-statistics of 2.027 and a p-value of 0.043. This shows that startups consider availability of appropriate infrastructure as a key determinant before investing in SMM. For the hypotheses related to the moderating of VNDS between the relationship of technological determinants and SMM, VNDS has found to be positively moderating the relationship between TCOMX and SMM (H6a) with a t-statistics 1.963 of and p-value of 0.049 suggesting that vendor support does help startups in coping with technology complexity relating to SMM. The moderating role of VNDS between TKNOW and SMM (H6b) was also significant, with a t-statistics of 3.710 and p-value of 0.000. This suggest that proper vendor support amplifies the SMM as internal capabilities complements well with the external support of vendors. Our H6c proposed that VNDS moderates the relationship between TCOM and SMM and this was accepted

showing a strong negative moderating effect with a beta coefficient value of -0.217, t-statistics of 4.931 and p-value of 0.000. This shows that strong support from vendors reduces the technology compatibility concerns for startups. Moreover, the moderating role of VNDS on TCOST and SMM was insignificant (H6d) and the same was observed for the moderating role of VNDS between TINF and SMM (H6e). In addition, the Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI) was also assessed for checking overall fit of the model. Our results showed SRMR value of 0.049, lower than 0.10 threshold as suggested by Ringle, while value for NFI was reported at 0.936, which is above 0.9 as recommended by Kline for a good fit. The SRMR and NFI values confirm the model's good fit. The results of the hypotheses are summarized in table 5 and further discussed in the next section.

Table 5: Hypotheses Assessment Summary

Hypothesis	Relationship	T statistics (O/STDEV)	P values	Result
H1	TCOMX -> SMM	0.942	0.346	Rejected
H2	TKNOW -> SMM	7.392	0.000	Accepted
H3	TCOM -> SMM	1.356	0.175	Rejected
H4	TCOST -> SMM	0.380	0.704	Rejected
H5	TINF -> SMM	2.027	0.043	Accepted
H6a	VNDS x TCOMX -> SMM	1.963	0.050	Accepted
H6b	VNDS x TKNOW -> SMM	3.711	0.000	Accepted
H6c	VNDS x TCOM -> SMM	4.931	0.000	Accepted
H6d	VNDS x TCOST -> SMM	0.656	0.512	Rejected
H6e	VNDS x TINF -> SMM	0.045	0.964	Rejected

DISCUSSION

Our study examined the relationship between diverse technological factors and SMM adoption with a moderating role of VNDS. The findings revealed that a distinct adoption pattern among SMSs as compared to SMEs as internal knowledge and infrastructure mattered more as compared to perceived technological barriers. Additionally, VNDS moderates relationship between specific technological determinants and SMM.

The results show that technological complexity (H1) does not have a significant effect on SMM adoption. These findings are in contrast with the existing literature ((Chyrak et al., 2024a; Kedi et al., 2024), where majorly studies are done in context of large enterprises and SMEs. The findings suggest that social media platforms are no longer perceived as difficult to understand or operate by firms especially SMSs in the case of this research. With time, social media technologies have become increasingly user-friendly, supported by intuitive interfaces, automated features, and widespread informal learning through platforms like YouTube. Additionally, the user support option integrated through AI chatbots has helped users to overcome complexities in real time. As a result, complexity has diminished as a barrier, particularly in contexts where firms and individuals are already frequent users of social media in their personal lives.

In contrast, technological knowledge (H2) showed a strong and significant relationship with SMM adoption and this is line with the previous studies conducted by (Olson et al., 2021). Businesses with greater digital knowledge are better able to comprehend and explore features across different

social media platforms. This helps them create successful campaigns, and analyse performance indicators for prompt decision making. These findings validate the claim that internal capabilities are still crucial for technology adoption, especially in SMM contexts where targeting and strategic usage are more important than accessibility. The result is in line with TOE-based explanations and absorptive capacity, which highlight knowledge as a crucial facilitator of technological use.

It was found that technological compatibility (H3) was not a significant factor leading to SMM adoption, indicating that adoption of SMM is independent of alignment with current organizational systems or procedures. These results are consistent with earlier research by (Bartoloni & Ancillai, 2024a). As SMM can be used without formal structures, businesses, especially startups, can experiment and change without having to make significant operational adjustments. Startups can experiment with SMM adoption because they have the flexibility that minimizes their compatibility issues.

Similarly, our findings reveal that SMM adoption is not greatly impacted by technology cost (H4). These results completely contradict earlier research conducted by (Coad, 2025; Morris, 2025). The low cost of social media platforms, where entrance hurdles are low and investment can be adjusted to business capability and resources, is apparent in these results. Establishing a social media presence before engaging on day-to-day operations is a standard practice for startups as it gives them a cost-efficient way to start their promotion. Updates on SMM platforms are also quite convenient as a number of websites offer free content creation including AI plugins. Because SMM does not a large initial investment like traditional marketing platforms do. Due to this, SMM adoption decisions are less influenced by cost factors.

Technological infrastructure (H5), however, shows a significant positive effect on SMM adoption. Technology infrastructure, its quality and availability have an important impact on SMM adoption in SMSs. Startups find it simpler to use social media platforms for marketing purposes when they have access to dependable internet, suitable digital devices, and basic technological tools. Startups may efficiently develop, manage, and react to social media content with the help of a basic operating workspace, sufficient technology (such as laptops and cell phones), and dependable internet connectivity. Startups frequently restrict their usage of social media platforms or only adopt SMM at a basic level when physical infrastructure is inadequate or unstable, which lowers SMM's overall efficacy. In addition to lowering operational challenges, a strong infrastructure also enables startups to conduct uninterrupted web marketing.

The moderating analysis provides deeper insight into how vendor support shapes these relationships. Vendor support significantly moderates the effects of technological complexity (H6a), technological knowledge (H6b), and technological compatibility (H6c) on SMM adoption. This indicates that that external support mechanisms play a complementary role in the adoption process. Vendor support helps reduce the negative implications of perceived complexity as it offers guidance, training, and problem-solving support. This helps in lowering cognitive and operational barriers. Vendor support also strengthens the positive impact of technological knowledge. This shows that firms with existing digital capabilities are better able to absorb, apply, and benefit from external expertise. Additionally, technological compatibility was insignificant on its own, its interaction with vendor support became significant. This suggests that compatibility concerns gain importance when vendors actively assist firms in integrating SMM with marketing practices and workflows. Vendor support does not moderate the relationships involving technological cost (H6d) and technological infrastructure (H6e). This indicates that vendor involvement cannot further reduce cost-related concerns that are already minimal in SMM adoption, nor can it compensate for deficiencies in basic technological infrastructure.

Theoretical Implications

This study contributes to the technology adoption and social media marketing literature by demonstrating that traditional technological barriers; such as complexity, compatibility, and cost, no longer play a decisive role in SMM adoption. This suggests that social media marketing should be conceptualized as a normalized digital capability rather than a complex innovation. The strong effects of technological knowledge and infrastructure reaffirm the importance of internal capabilities and foundational resources, extending the TOE framework by aligning it with absorptive capacity theory. Furthermore, the selective moderating role of vendor support advances theory by showing that external support mechanisms do not uniformly influence adoption; instead, they amplify internal knowledge and reduce implementation-related challenges. This positions vendor support as a capability-enhancing mechanism that bridges firm-level resources and technology utilization outcomes.

Policy Implications

The findings suggest that policies aimed at promoting SMM adoption in Pakistan should move beyond cost-focused incentives toward a capability-driven ecosystem approach. Policymakers should prioritize digital skill development through applied training programs. They should focus on strengthening digital infrastructure to address structural constraints. Additionally, they should formalize SMSs–vendor collaborations to facilitate knowledge transfer and reduce adoption uncertainty. For this government can initiate programs for providing skills needed for SMM adoption. Rather than treating digital vendors solely as service providers, policy frameworks should integrate them as ecosystem partners who support startups in effectively adopting and leveraging social media marketing. Such a coordinated approach can enhance digital competitiveness, particularly among resource-constrained Pakistani startups.

CONCLUSION

The above study examined the technological challenges that are faced by Small and Medium Startups in Pakistan and focused on the moderating role of vendor support in overcoming these challenges. The findings suggest that in startups, SMM adoption is primarily due to technological knowledge and infrastructure that startups have. They also reveal that conventional technological barriers like, cost, complexity and compatibility no longer impact SMM adoption in startups. These findings point to a move toward capability-based explanations of the adoption of digital marketing, where perceived technological difficulties are less significant than internal knowledge and fundamental resources. Additionally, it was discovered that vendor support strengthens knowledge-driven technology adoption and lowers ambiguity surrounding technology adoption, which is a selective but significant function. This study has certain drawbacks despite its benefits. The study's primary focus is on technology aspects; a more thorough understanding of adoption dynamics might be obtained by including organizational and environmental components. Since the empirical context is restricted to Pakistani startups, comparative studies across countries or industries may be undertaken in the future to improve generalizability.

REFERENCES

- Adeusi, O. C., Adebayo, Y. O., Ayodele, P. A., Onikoyi, T. T., Adebayo, K. B., & Adenekan, I.
- O. (2024). IT standardization in cloud computing: Security challenges, benefits, and future directions. *World Journal of Advanced Research and Reviews*, 22(3), 2050–2057. <https://doi.org/10.30574/wjarr.2024.22.3.1982>
- Afolabi, A. I., Chukwurah, N., & Abieba, O. A. (2025). Harnessing machine learning techniques for driving sustainable economic growth and market efficiency. *International Journal of Multidisciplinary Research and Growth Evaluation*, 6(2), 277–283. <https://doi.org/10.47191/etj/v10i02.22>
- Ahmed, A., Rashid, S., Saad, N. M., Rana, M. W., Khoso, I. A., & Ahmed, Z. (2025). The tech advantage: exploring technological determinants of social media marketing adoption in Pakistani small and medium startups. *Journal of Innovation and Entrepreneurship*, 14(1), 23. <https://doi.org/10.1186/s13731-025-00470-3>
- Alam, S. S., Ahmed, S., & Kokash, H. A. (2024). Interplay of perceived organizational and external e-readiness in the adoption and integration of augmented reality and virtual reality technologies in Malaysian higher education institutions. *Education and Information Technologies*, 29(11), 13735–13761. <https://doi.org/10.1007/s10639-023-12428-7>
- Ali Abbasi, G., Abdul Rahim, N. F., Wu, H., Iranmanesh, M., & Keong, B. N. C. (2022). Determinants of SME's social media marketing adoption: competitive industry as a moderator. *Sage Open*, 12(1), 21582440211067220. <https://doi.org/10.1177/21582440211067220>
- Athaide, G. A., Jeon, J., Raj, S. P., Sivakumar, K., & Xiong, G. (2025). Marketing innovations and digital technologies: A systematic review, proposed framework, and future research agenda. *Journal of Product Innovation Management*, 42(1), 144–165. <https://doi.org/10.1111/jpim.12741>
- Atif, M., Altaf, Y., Gul, S., & ul Hassan, S. W. (2024). IMPACT OF INNOVATION ON PAKISTAN'S GDP: THE MEDIATING ROLE OF SME GROWTH. *Journal of Research in Economics and Finance Management*, 3(2), 55–67. <https://doi.org/10.5281/zenodo.16354077>
- Bakar, M. R. A., Razali, N. A. M., Ishak, K. K., Ismail, M. N., & Sembok, T. M. T. (2024). Adoption of industry 4.0 with cloud computing as a mediator: Evaluation using TOE framework for SMEs. *JOIV: International Journal on Informatics Visualization*, 8(2), 554–563. <https://doi.org/10.62527/joiv.8.2.2205>
- Bartoloni, S., & Ancillai, C. (2024a). Twenty years of social media marketing: A systematic review, integrative framework, and future research agenda. *International Journal of Management Reviews*, 26(3), 435–457. <https://doi.org/10.1111/ijmr.12360>
- Bartoloni, S., & Ancillai, C. (2024b). Twenty years of social media marketing: A systematic review, integrative framework, and future research agenda. *International Journal of Management Reviews*, 26(3), 435–457. <https://doi.org/10.1111/ijmr.12360>
- Bostancıoğlu, A., & Handley, Z. (2018). Developing and validating a questionnaire for evaluating the EFL 'Total PACKage': Technological Pedagogical Content Knowledge (TPACK) for English as a Foreign Language (EFL). *Computer Assisted Language Learning*, 31(5–6), 572–598. <https://doi.org/10.1080/09588221.2017.1422524>
- Bruce, E., Shurong, Z., Ying, D., Yaqi, M., Amoah, J., & Egala, S. B. (2023). The effect of digital marketing adoption on SMEs sustainable growth: Empirical evidence from Ghana. *Sustainability*, 15(6), 4760. <https://doi.org/10.3390/su15064760>

- Chakraborty, D., Behl, A., Golgeci, I., & Nazrul, A. (2025). Understanding Blockchain Adoption in SMEs: A Mixed-Method Study of Digital Transformation, Resilience, and Senior Leadership Support. *IEEE Transactions on Engineering Management*. <https://doi.org/10.1109/TEM.2025.3556371>
- Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2024). Antecedents and consequence of social media marketing for strategic competitive advantage of small and medium enterprises: Mediating role of utilitarian and hedonic value. *Journal of Strategic Marketing*, 32(8), 1106–1125. <https://doi.org/10.1080/0965254X.2021.1954070>
- Cheah, J.-H., Magno, F., & Cassia, F. (2024). *Reviewing the SmartPLS 4 software: the latest features and enhancements*. Springer. <https://doi.org/10.1057/s41270-023-00266-y>
- Chowdhury, T. K., & Ashfaq, S. (2024). High-Performance Computing Architectures To Strengthen Cloud Infrastructure Security. *American Journal of Interdisciplinary Studies*, 5(03), 1–42. <https://doi.org/10.63125/9hr8qk06>
- Chyrak, I., Koziuk, V., Siskos, E., & Darvidou, K. (2024a). Comprehensive framework for social media marketing (smm) strategy for effective business activity. *Socio-Economic Relations in the Digital Society*, 4(54), 39–58. <https://doi.org/10.55643/ser.4.54.2024.584>
- Chyrak, I., Koziuk, V., Siskos, E., & Darvidou, K. (2024b). Comprehensive framework for social media marketing (smm) strategy for effective business activity. *Socio-Economic Relations in the Digital Society*, 4(54), 39–58. <https://doi.org/10.55643/ser.4.54.2024.584>
- Chyrak, I., Koziuk, V., Siskos, E., & Darvidou, K. (2024c). Comprehensive framework for social media marketing (smm) strategy for effective business activity. *Socio-Economic Relations in the Digital Society*, 4(54), 39–58. <https://doi.org/10.55643/ser.4.54.2024.584>
- Chyrak, I., Koziuk, V., Siskos, E., & Darvidou, K. (2024d). Comprehensive framework for social media marketing (smm) strategy for effective business activity. *Socio-Economic Relations in the Digital Society*, 4(54), 39–58. <https://doi.org/10.55643/ser.4.54.2024.584>
- Chyrak, I., Koziuk, V., Siskos, E., & Darvidou, K. (2024e). Comprehensive framework for social media marketing (smm) strategy for effective business activity. *Socio-Economic Relations in the Digital Society*, 4(54), 39–58. <https://doi.org/10.55643/ser.4.54.2024.584>
- Coad, A. (2025). “The company I keep is not corporate enough”: exploring the specificities of University startups. *The Journal of Technology Transfer*, 1–31. <https://doi.org/10.1007/s10961-025-10228-4>
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152. <https://doi.org/10.2307/2393553>
- Douthwaite, B., Keatinge, J. D. H., & Park, J. R. (2001). Why promising technologies fail: the neglected role of user innovation during adoption. *Research Policy*, 30(5), 819–836. [https://doi.org/10.1016/S0048-7333\(00\)00124-4](https://doi.org/10.1016/S0048-7333(00)00124-4)
- Enaifoghe, A. (2024). Enhancing small and medium enterprises (SMEs) in a globalized and innovative economy: challenges and opportunities. *Int. J. Business, Econ. Soc. Dev.*, 5(2), 130–138. <https://doi.org/10.46336/ijbesd.v5i2.655>
- FakhrHosseini, S., Chan, K., Lee, C., Jeon, M., Son, H., Rudnik, J., & Coughlin, J. (2024a). User adoption of intelligent environments: A review of technology adoption models, challenges, and prospects. *International Journal of Human–Computer Interaction*, 40(4), 986–998. <https://doi.org/10.1080/10447318.2022.2118851>

- FakhrHosseini, S., Chan, K., Lee, C., Jeon, M., Son, H., Rudnik, J., & Coughlin, J. (2024b) User adoption of intelligent environments: A review of technology adoption models, challenges, and prospects. *International Journal of Human-Computer Interaction*, 40(4), 986–998. <https://doi.org/10.1080/10447318.2022.2118851>
- George, O. O., Dosumu, R. E., & Makata, C. O. (2024). Strategic vendor relationship management: A conceptual model for building sustainable partnerships in competitive marketing ecosystems. *Journal of Frontiers in Multidisciplinary Research*, 5(1), 112–118. <https://doi.org/10.54660/IJFMR.2024.5.1.112-118>
- Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. *Long Range Planning*, 45(5–6), 320–340. <https://doi.org/10.1016/j.lrp.2012.09.008>
- Haque, R., Senathirajah, A. R. bin S., Khalil, M. I., Qazi, S. Z., & Ahmed, S. (2024). A structural path analysis Bangladeshi SMEs' sustainability through social media marketing. *Sustainability*, 16(13), 5433. <https://doi.org/10.3390/su16135433>
- Huo, W., & Filieri, R. (2025). Social media marketing and purchase intention: the mediation of customer-based brand equity and adoption preparedness. *European Journal of Marketing*, 59(12), 2886–2927. <https://doi.org/10.1108/EJM-10-2023-0783>
- Ilori, O., Nwosu, N. T., & Naiho, H. N. N. (2024). Third-party vendor risks in IT security: A comprehensive audit review and mitigation strategies. *World Journal of Advanced Research and Reviews*, 22(3), 213–224. <https://doi.org/10.30574/wjarr.2024.22.3.1727>
- Islam, M. S., Islam, M. I., Mozumder, A. Q., Khan, M. T. H., Das, N., & Mohammad, N. (2025). A Conceptual Framework for Sustainable AI-ERP Integration in Dark Factories: Synthesising TOE, TAM, and IS Success Models for Autonomous Industrial Environments. *Sustainability (2071-1050)*, 17(20). <https://doi.org/10.3390/su17209234>
- Jabbouri, N. I., Siron, R., Zahari, I., & Khalid, M. (2016). Impact of information technology infrastructure on innovation performance: An empirical study on private universities in Iraq. *Procedia Economics and Finance*, 39, 861–869. [https://doi.org/10.1016/S2212-5671\(16\)30250-7](https://doi.org/10.1016/S2212-5671(16)30250-7)
- Kanellos, N., Karountzos, P., Giannakopoulos, N. T., Terzi, M. C., & Sakas, D. P. (2024). Digital Marketing Strategies and Profitability in the Agri-Food Industry: Resource Efficiency and Value Chains. *Sustainability (2071-1050)*, 16(14). <https://doi.org/10.3390/su16145889>
- Karahanna, E., Agarwal, R., & Angst, C. M. (2006). Reconceptualizing compatibility beliefs in technology acceptance research. *MIS Quarterly*, 781–804.
- Kedi, W. E., Ejimuda, C., Idemudia, C., & Ijomah, T. I. (2024). Machine learning software for optimizing SME social media marketing campaigns. *Computer Science & IT Research Journal*, 5(7), 1634–1647. <https://doi.org/10.51594/csitrj.v5i7.1349>
- Khan, M. M. (2024). Optimizing web surveys in research: methodological considerations and validity aspects. *International Journal of Research and Scientific Innovation*, 11(4), 75–105. <https://doi.org/10.51244/IJRSI.2024.1104007>
- Khanyi, M. B., Xaba, S. N., Mlotshwa, N. A., Thango, B., & Matshaka, L. (2024). A Roadmap to Systematic Review: Evaluating the Role of Data Networks and Application Programming Interfaces in Enhancing Operational Efficiency in Small and Medium Enterprises. *Sustainability*, 16(23), 10192.

<https://doi.org/10.3390/su162310192>

Kim, B.-J., & Lee, J. (2024). The mental health implications of artificial intelligence adoption: the crucial role of self-efficacy. *Humanities and Social Sciences Communications*, 11(1), 1–15. <https://doi.org/10.1057/s41599-024-04018-w>

Ko, W. W., & Liu, G. (2019). How information technology assimilation promotes exploratory and exploitative innovation in the small-and medium-sized firm context: the role of contextual ambidexterity and knowledge base. *Journal of Product Innovation Management*, 36(4), 442–466. <https://doi.org/10.1111/jpim.12486>

Kumar, A., Singh, R. K., & Swain, S. (2025a). Adoption of technology applications in organized retail outlets in India: A TOE model. *Global Business Review*, 26(6), 1482–1505. <https://doi.org/10.1177/09721509211072382>

Kumar, A., Singh, R. K., & Swain, S. (2025b). Adoption of technology applications in organized retail outlets in India: A TOE model. *Global Business Review*, 26(6), 1482–1505. <https://doi.org/10.1177/09721509211072382>

Kumar, D., & Yadav, A. K. (2024). The role of startups in driving technological advancement in the Indian economy. *Journal of Social Review and Development*, 3(Special 1), 15–19. Retrieved from <https://dzarc.com/social/article/view/453>

Kuo, R.-Z., & Lee, G.-G. (2011). Knowledge management system adoption: exploring the effects of empowering leadership, task-technology fit and compatibility. *Behaviour & Information Technology*, 30(1), 113–129. <https://doi.org/10.1080/0144929X.2010.516018>

Le, B. T., & Liu, X. (2024). *Driving Social Sustainability and Resilience of SMEs Amidst Turbulence: The Role of Information Technology and Dynamic Capabilities*.

Lian, J.-W., Yen, D. C., & Wang, Y.-T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management*, 34(1), 28–36. <https://doi.org/10.1016/j.ijinfomgt.2013.09.004>

Lile, S., Ansari, S., & Urmetzer, F. (2025). Rethinking disruptive innovation: Unravelling theoretical controversies and charting new research frontiers. *Innovation*, 27(3), 394–416. <https://doi.org/10.1080/14479338.2024.2313197>

Liu, X., Yu, Y., Song, G., & Fu, X. (2024). Green innovation drives globalization: a longitudinal case study of Angel Yeast's evolution from a start-up to a world-class manufacturer. *Journal of Evolutionary Studies in Business*, 9(2), 35–61. <https://doi.org/10.1344/jesb2024.44244>

Maduku, D. K. (2021). Antecedents of mobile marketing adoption by SMEs: Does industry variance matter? *Journal of Organizational Computing and Electronic Commerce*, 31(3), 222–249.

Memmedova, K., & Ertuna, B. (2024). Development of a fuzzy Likert scales to measure variables in social sciences. *Information Sciences*, 654, 119792. <https://doi.org/10.1016/j.ins.2023.119792>.

Miller, M. (2012). *B2B digital marketing: Using the web to market directly to businesses*. Que publishing.

Mohapatra, A. G., Mohanty, A., Mohanty, S. K., Mahalik, N. P., & Nayak, S. (2025). Personalization and customer experience in the era of data-driven marketing. *Artificial Intelligence-Enabled Businesses: How to Develop Strategies for Innovation*, 467–511. <https://doi.org/10.1002/9781394234028.ch26>

- Morgan, K. (1970). Sample size determination using Krejcie and Morgan table. *Kenya Projects Organization (KENPRO)*, 38(1970), 607–610.
- Morris, K. (2025). *Infrastructure as Code: Designing and Delivering Dynamic Systems for the Cloud Age*. “O’Reilly Media, Inc.”
- Mtjilibe, T., Rameetse, E., Mgwenya, N., & Thango, B. (2024). Exploring the Challenges and Opportunities of Social Media for Organizational Engagement in SMEs: A Comprehensive Systematic Review. Available at SSRN 4998542. <https://doi.org/DOI:10.20944/preprints202410.1438.v1>
- Muthuraman, S. (2024). Investigating Oman’s environment for startup opportunities. *Edelweiss Applied Science and Technology*, 8(6), 5254–5260. <https://doi.org/10.55214/25768484.v8i6.3149>
- Nagy, A., Tumiwa, J., Arie, F., László, E., Alsoud, A. R., & Al-Dalahmeh, M. (2025). A meta- analysis of the impact of TOE adoption on smart agriculture SMEs performance. *Plos One*, 20(2), e0310105. <https://doi.org/10.1371/journal.pone.0310105>
- O’Brien, M. A., Rogers, W. A., & Fisk, A. D. (2012). Understanding age and technology experience differences in use of prior knowledge for everyday technology interactions. *ACM Transactions on Accessible Computing (TACCESS)*, 4(2), 1–27. <https://doi.org/10.1145/2141943.2141947>
- Okoye, C. F., & Mensah, K. E. (2025). Challenges and prospects of technology adoption by small and medium enterprises in Rivers state, Nigeria. *Ayden Energies Journal*, 13(2), 1–15. <https://doi.org/https://doi.org/10.5281/zenodo.15389229>
- Olson, E. M., Olson, K. M., Czaplewski, A. J., & Key, T. M. (2021). Business strategy and the management of digital marketing. *Business Horizons*, 64(2), 285–293. <https://doi.org/10.1016/j.bushor.2020.12.004>
- Pathania, A., & Tanwar, S. (2024). Decoding startup failures in Indian startups: Insights from interpretive structural modeling and cross-impact matrix multiplication applied to classification. *Journal of Entrepreneurship, Management and Innovation*, 20(2), 93–116. <https://doi.org/10.7341/20242025>
- Perera, W., Nimeshi, G. K. S., Ranwala, R. S., & Panditharathna, K. M. (2024). The role of digitalization during the pandemic: Small entrepreneurs in Sri Lanka. *Sri Lanka Journal of Marketing*, 10(1). <https://doi.org/DOI:10.4038/sljmuok.v10i1.166>
- Prakash, C. (2025). Evaluating the TOE Framework for Technology Adoption: A Systematic Review of Its Strengths and Limitations. *International Journal on Recent and Innovation Trends in Computing and Communication*, 13(1).
- Rane, N., Choudhary, S. P., & Rane, J. (2024). Acceptance of artificial intelligence technologies in business management, finance, and e-commerce: factors, challenges, and strategies. *Studies in Economics and Business Relations*, 5(2), 23–44. [0.48185/sebr.v5i2.1333](https://doi.org/10.48185/sebr.v5i2.1333)
- Shwedeh, F., & Alzoubi, H. M. (2024). Artificial Intelligence (AI) Integration into the Decision Support Systems of Health Care Centers. *International Scientific Conference Management and Engineering*, 165–176. https://doi.org/10.1007/978-3-031-90131-7_19
- Singireddy, J. (2024). AI-Driven Payroll Systems: Ensuring Compliance and Reducing Human Error. *American Data Science Journal for Advanced Computations (ADSJAC)* ISSN: 3067-4166, 2(1). <https://doi.org/10.5281/zenodo.15878466>

- Sobouti, H., & Karimi Alavijeh, M. R. (n.d.). Brand Relationship Quality Through Social Media Marketing, Digital Content Marketing, and Emotional Customer Engagement. *Digital Content Marketing, and Emotional Customer Engagement*. <http://dx.doi.org/10.2139/ssrn.4989280>
- Solomon, O. H., Allen, T., & Wangombe, W. (2024). Analysing the factors that influence social media adoption among SMEs in developing countries. *Journal of International Entrepreneurship*, 22(2), 248–267. <https://doi.org/10.1007/s10843-023-00330-9>
- Statista. (2025). *Social media advertising and marketing worldwide – statistics & facts*. https://www.statista.com/topics/1538/social-media-marketing/?srsltid=AfmBOoprqL6N3zGvvjG78Pgj1LJ00SSQy_BfRW7M-W62f5xGsITjgpTc#statisticChapter
- Stradowski, S., & Madeyski, L. (2024). Costs and benefits of machine learning software defect prediction: Industrial case study. *Companion Proceedings of the 32nd ACM International Conference on the Foundations of Software Engineering*, 92–103. <https://doi.org/10.1145/3663529.366383>
- Suganthi, A., & Mohamed Jasim, K. (2025). Exploring the Antecedents of Users’ Intention on Virtual Tours and Video Walkthroughs in Rental Accommodation Apps—An Integrated PLS-SEM-ANN-NCA Approach. *Journal of Internet Commerce*, 24(1–2), 89–129. <https://doi.org/10.1080/15332861.2025.2497970>
- Tabelessy, W. (2024). Brand Love: Mediating Effect of the Relationship Between Social Media Marketing, Brand Loyalty and Brand Equity iPhone Brand Smartphone in Ambon City. *International Journal of Integrative Research*, 2(5). <https://doi.org/DOI:10.59890/ijir.v2i5.1928>
- Theodorakopoulos, L., & Theodoropoulou, A. (2024). Leveraging big data analytics for understanding consumer behavior in digital marketing: A systematic review. *Human Behavior and Emerging Technologies*, 2024(1), 3641502. <https://doi.org/10.1155/2024/3641502>
- Tsiu, S. V, Ngoben, M., Mathabela, L., & Thango, B. (2025). Applications and competitive advantages of data mining and business intelligence in SMEs performance: A systematic review. *Businesses*, 5(2), 22. <https://doi.org/10.3390/businesses5020022>
- Vassakis, K., Petrakis, E., & Kopanakis, I. (2017). Big data analytics: applications, prospects and challenges. *Mobile Big Data: A Roadmap from Models to Technologies*, 3–20. https://doi.org/10.1007/978-3-319-67925-9_1
- Vettriselvan, R. (2025). Harnessing innovation and digital marketing in the era of industry 5.0: resilient healthcare SMEs. In *The Future of Small Business in Industry 5.0* (pp. 163– 186). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-7362-0.ch007>
- Wasserman, N. (2012). *The founder’s dilemmas: Anticipating and avoiding the pitfalls that can sink a startup*.
- Wei, F., Xie, B., & Chen, M. (2025). Digital financial inclusion, e-commerce development and entrepreneurial activity. *International Review of Financial Analysis*, 97, 103806. <https://doi.org/10.1016/j.irfa.2024.103806>
- Wong, K. Y., Tan, L. P., Lee, C. S., & Wong, W. P. (2015). Knowledge management performance measurement: measures, approaches, trends and future directions. *Information Development*, 31(3), 239–257. <https://doi.org/10.1177/0266666913513278>
- Wong, M. W., & Vongswasdi, P. (2025). Building legacy through brand change: Insights from multigenerational family businesses. *Organizational Dynamics*, 54(1), 101078.

<https://doi.org/10.1016/j.orgdyn.2024.101078>

Yusoff, A. S. M., Peng, F. S., Abd Razak, F. Z., & Mustafa, W. A. (2020). Discriminant validity assessment of religious teacher acceptance: The use of HTMT criterion. *Journal of Physics: Conference Series*, 1529(4), 042045. <https://doi.org/10.1088/1742-6596/1529/4/042045>

Zhang, Y., Pang, J., & Li, H. (2024). Research on the influence of digitalization on competitive advantage of manufacturing enterprises. *Managerial and Decision Economics*, 45(5), 3316–3334. <https://doi.org/10.1002/mde.4201>

Zhou, F. (2024). Utilizing social media platforms to foster entrepreneurial communication among start-up communities. *Profesional de La Información*, 33(5). <https://doi.org/10.3145/epi.2024.ene.0525>

Żywiółek, J., Mathiyazhagan, K., Shahzad, U., Zhao, X., & Saikouk, T. (2025). Enhancing cognitive metrics in supply chain management through information and knowledge exchange. *The International Journal of Logistics Management*, 36(7), 200–221. <https://doi.org/10.1108/IJLM-04-2024-0243>