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Article

Digital Synergy and Strategic Vision: Unlocking Sustainability-Oriented Innovation in Saudi SMEs

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Abstract: This research examines the proposition that enhancing sustainable innovation can be particularly effective when the focus is on strategy, machine learning, and digitalization. The study specifically targets the complex interactions among strategic alignment (SA), sustainability-oriented innovation (SOI), and digital transformation (DT) within small and medium-sized enterprises (SMEs) in Saudi Arabia, particularly within the service sector. A moderated mediation framework was constructed to analyze the influence of SA on SOI, the mediating role of DT, and the moderating effect of strategic orientation (SO). Data were collected through structured surveys from 339 SMEs using a quantitative research design and a cross-sectional methodology. The partial least squares structural equation modeling (PLS-SEM) technique was employed to validate the proposed framework and hypotheses. The results indicate that SA significantly boosts SOI, with DT acting as a strong mediator in this connection. Furthermore, SO moderates the relationships between SA and SOI, SA and DT, and DT and SOI, highlighting its essential role in shaping the dynamics of sustainable innovation. These findings emphasize the necessity of aligning strategic initiatives with digital advancements to foster innovation that achieves a balance among economic, social, and environmental objectives. This study contributes to existing literature by filling the research gap regarding SOI and DT in Saudi SMEs and offers practical insights for SMEs facing sustainability challenges. Future research should delve deeper into digital technology configurations, industry-specific contexts, and cross-national applications to improve the applicability of these findings.

Keywords: digital transformation; innovation; SMEs; sustainability; strategic alignment; machine learning; green innovations; strategic orientation; PLS-SEM



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1. Introduction

Small and medium-sized enterprises (SMEs) are pivotal drivers of economic development, particularly in emerging economies like Saudi Arabia, where they contribute significantly to national income, job creation (Zaki & Shared, 2022), and inclusive growth

through innovation and technology-based products (Čepel et al., 2018). Recognized as engines of regional development, SMEs play an essential role in fostering “*economic growth, job creation, and social cohesion*” (Lewandowska et al., 2021). In Saudi Arabia, SMEs account for approximately 99% of private-sector businesses and contribute around 28% to the national GDP. The Saudi Vision 2030 aims to increase this contribution to 35% by enhancing entrepreneurial activity, supporting digital transformation, and promoting sustainability-driven initiatives (Abdulrab et al., 2021). Despite these opportunities, Saudi SMEs encounter challenges such as limited access to financing, regulatory complexities, and a skills gap in digital capabilities (Al-Mubarak & Busler, 2017).

Beyond traditional economic functions, SMEs have become instrumental in driving sustainability by integrating innovative practices that align with digital transformation and environmental preservation (Garcia-Martinez et al., 2023; Lin et al., 2022). However, the question remains: how does strategic alignment (SA) influence sustainability-oriented innovation (SOI) in Saudi SMEs? This study aims to unravel this critical nexus.

For SMEs to maintain competitiveness and ensure long-term growth, there is an increasing emphasis on SOI—creating solutions that are economically, socially, and ecologically balanced (Gancarczyk & Zabala-Iturriagaitia, 2015). Innovation within SMEs, particularly in developing economies like Saudi Arabia, has the potential to create goods, services, and business models that benefit both society and the environment (Zamberi Ahmad, 2012). However, research exploring the intersection of innovation and sustainability in SMEs remains sparse (Aboradi & Masari, 2018; Alenzy, 2018). While digitalization and strategic innovation provide pathways to sustainability in other business domains (Zaki, 2024), SMEs struggle with resource constraints, inadequate policy support, and a lack of integration between digital tools and sustainability strategies.

Despite its importance, SMEs in Saudi Arabia often face unique challenges in achieving SA due to resource limitations, informal planning processes, and reliance on CEO-driven decision-making (Rajnoha & Lorincová, 2015; Sanders & Meurs, 2018; Street et al., 2017). Addressing these challenges raises another crucial question: how does digital transformation (DT) mediate the relationship between SA and SOI in Saudi SMEs?

Sustainability-oriented innovation represents a transformative approach to innovation, focusing on maximizing profitability while minimizing adverse environmental and social impacts (Harsanto et al., 2022; Wilkerson & Trellevik, 2021; Zaki, 2017). Transitioning from traditional to dynamic, tech-driven processes is essential for SMEs aiming to achieve firm-level sustainability objectives (Rubio-Andrés & Abril, 2024). In Saudi Arabia, green innovation drivers, such as green entrepreneurial skills, capital accessibility, and eco-friendly incentives, align with the nation’s Vision 2030 goals for a sustainable, diversified economy (Almawishir & Benlaria, 2024; Tarifi, 2024). Yet, limited research exists on how SMEs can effectively leverage SA and DT to achieve SOI while addressing the complexities of sustainability.

The rapid advancement of digital technologies has amplified SMEs’ capacity for innovation (Bharathi et al., 2024; Costa Melo et al., 2023). Digital transformation (DT), characterized by interconnected systems, adaptability, and self-organization, offers SMEs a pathway to enhance SOI and address economic, social, and environmental dimensions (Ahmed et al., 2022; Pasqualino et al., 2021; Valdez-Juárez et al., 2024). By mediating the relationship between SA and SOI, DT can unlock new opportunities for SMEs to innovate sustainably. Moreover, understanding how additional drivers like strategic orientation (SO) shape these relationships is critical. This leads to the third key question: how does SO moderate the relationships between SA and DT, SA and SOI, and DT and SOI in Saudi SMEs?

Notably, SO—a managerial construct that shapes an organization’s mindset toward strategic goals and market positioning—is particularly critical for SMEs aiming to achieve long-term sustainability and competitive advantage (Minovic et al., 2016; Sarker & Palit, 2015). An environmentally aligned strategic focus enhances innovation, supports ecological sustainability, and bolsters SMEs’ capacity to remain competitive in evolving markets (Farida & Setiawan, 2022). For instance, an SME’s environmental alignment, reflecting its commitment to environmental protection, has been shown to moderate the relationship between green-oriented innovations and value creation (Nguyen et al., 2020; Tjahjadi et al., 2020). Such strategic focus enhances productivity and efficiency while ensuring sustainability in the industrial context (Felipe Reyes-Rodríguez et al., 2023; Zhang et al., 2023). By integrating strategic alignment, digital transformation, and strategic orientation into a moderated mediation framework, this study seeks to unravel the complexities of achieving SOI in Saudi SMEs.

By addressing the previous interconnected research questions, this study contributes to a deeper understanding of how SMEs can navigate the dual challenges of sustainability and innovation. The findings are expected to provide actionable insights, supporting SMEs in aligning strategic initiatives with sustainable innovation goals in the context of Saudi Arabia’s ambitious Vision 2030.

2. Literature Review

This present study, in parallel with the ample review of literature, had angled the connotation of SA with SOI in SMEs, but few had shown success in exhibiting the alignment of a firm’s IT/IS strategy with its inclusive business strategy specifically in Saudi Arabia’s context under the shadow of sustainability or innovation (Klewitz & Hansen, 2014; Zhang et al., 2023). An SME will possibly progress its digital capabilities more resourcefully by releasing some of its strategic goals and responding to vicissitudes in the market when its technology strategy accords faithfully with its larger business objectives (Aramburu et al., 2021; Hirvonen & Majuri, 2020). It is exclusively advantageous for SMEs to grip SOI, as it allows them to create novel products, services, or processes that solve environmental and social issues while supporting company expansion (Dey et al., 2020). Continuous innovation efforts and alignment with strategic goals are compulsory to successfully fit sustainability into corporate operations (Nguyen & Kanbach, 2024). This configuration demonstrates sustainability programs and their involvement in the company’s predominant goals. Additionally, perceiving global environmental standards and regulations is indispensable for certifying the trustworthiness and impression of sustainability initiatives.

To materialize the linkage of backward and forward strategic directives, the role of DT in sustainability-centered activities is in the first stage for promoting organizational success and keeping productivity at a top-notch level (Frey, 2021). Organizations could potentially apply supremacy technology to activate more efficient and effective sustainability activities and practices by carrying out DT, while strategic direction delivers a framework for shaping initiatives to promote sustainability. By developing a mindset that squeezes investigation, knowledge sharing, and sustainable practices, SMEs can effectively leverage their SO and digital capabilities to progress innovative results (Robertson & Lapina, 2023). In fact, lasting sustainable innovation projects must create an innovative culture, accentuating research and cooperation. SMEs could provide new ideas far more quickly because of the digital revolution. Nevertheless, it helps business owners direct and emphasize their efforts while generating contemporary philosophies (Bendak et al., 2020). The experts observed that a company acts decisively and promptly to produce proper output when its IT and business plans work harmoniously (Cho, 2022; Trenkle, 2020). This is especially true when there is much uncertainty. Yayla and Hu (2012) explained that a business will do better if

its IT strategy fits with its overall business plan. This is possible for the business because it has better ways to use technology to help it do business. SMEs might be unable to invest in eco-friendly new ideas because they lack the funds, management skills, or know-how (Chien et al., 2022). SMEs might not have the tools they need to boost their growth in the long run either. Even with all of these issues, there are some good things about SMEs. Since bigger companies are not as quick and adaptable, smaller ones can usually react more quickly to changes in customer needs and government rules. They may also find it easier to work together on sustainability projects since they are close with both users and suppliers. Companies can share knowledge faster to adapt to supply chain disruptions, and influence digital technologies to alleviate the negative influences of pandemic-related supply chain interruptions (Sarwar et al., 2024; Sezer et al., 2023).

2.1. SA Towards DT and SOI

Strategic Alignment (SA) refers to the process of ensuring that an organization's strategic goals, whether business-driven or IT-driven, are closely unified and working in synergy with operational objectives (Canhoto et al., 2021; Li et al., 2016). SA is not a static process; it performs dynamically, reflecting unceasing adaptation and modification as the organization and its environment evolve (Canhoto et al., 2021). Moreover, it enables the members and their intelligence to concentrate their DT energies to the extent that it will impact their business goals and performance. In SMEs, SA is particularly critical due to their limited resources and need for efficiency, requiring continuous adaptation and integration between business strategy and technological transformation (Yousaf et al., 2021). Unlike large firms with rigid hierarchies, SMEs benefit from a more dynamic SA approach, enabling them to leverage digitalization effectively despite financial and structural constraints (Zamberi Ahmad, 2012). In contrast, Strategic Orientation (SO) refers to the long-term vision and strategic mindset that guides a firm's decision-making processes, shaping its competitive stance in the market (Minovic et al., 2016). While SA focuses on the internal alignment of resources and technological adoption, SO determines how SMEs position themselves externally in response to market dynamics, customer preferences, and sustainability imperatives (Farida & Setiawan, 2022). The combination of SA and SO ensures that SMEs not only adopt digital tools but also integrate them strategically to drive innovation and competitive advantage (Felipe Reyes-Rodríguez et al., 2023). Organizations can certify that their digital investments fund their strategic objectives by making straight digital initiatives with strategic significance. When an SME's digital policy is thoroughly associated with its overall business approach, the firm can better leverage technology to support its strategic objectives and respond to market changes (Sampaio & Sampaio, 2024). SA refers to ensuring every department, team, and individual comprehends the vision for DT and their protagonist contribution (Paiva, 2022). This creates an interconnected effort where every deed moves the organization closer to its anticipated digital future. A new modern culture that embraces transformation, investigation, and learning is critical for an efficacious DT (Toth, 2023). SA assists in creating this culture by signifying the importance of the transformation and authorizing employees to contribute their skills (Jonathan, 2021). While SA highlights a clear direction, it must also allow for elasticity as the digital landscape is constantly budding (Jonathan, 2021). By aligning digital transformation (DT) initiatives with strategic priorities, SA helps SMEs ensure that technological investments are purpose-driven and effectively implemented (Sampaio & Sampaio, 2024). When SA is well-defined, SMEs can leverage digital solutions to enhance business operations, promote innovation, and improve sustainability (Paiva, 2022). SO complements this by shaping a firm's vision for transformation, ensuring that digital initiatives align with long-term competitive objectives (Toth, 2023).

In Saudi SMEs, SA plays a pivotal role in driving SOI by enabling firms to integrate digital capabilities into their innovation strategies while maintaining alignment with sustainability goals (Al-Hakimi et al., 2022). Given the constraints SMEs face—including financial limitations, regulatory challenges, and the need for agility (Al-Mubarak & Busler, 2017)—it is crucial to recognize SA and SO as interconnected yet distinct enablers of sustainable innovation. By fostering strategic coherence between SA and SO, SMEs can navigate the complexities of DT while sustaining long-term growth.

This alignment is also vital for confirming that the DT initiatives are accomplished efficiently to realize the desired outcomes (Sarwar et al., 2024). This compatibility will affect digital transformation by following several steps, such as improving alignment, increasing efficiency, boosting agility, making better decisions, and lessening miscommunication. Hence, the first hypothesis is as follows:

H1. *SA has a positive effect on DT.*

Progress and overall performance are retarded by three pillars: inequality, resource depletion, and environmental harm. When a company devises its planning and procedures in line with its available assets and resources and spends its proper time and investment in the right places, the essence of SA and its meaningful application is correctly perceived (Alzahrani, 2019). A strategic management study backs up this knowledge by showing that SA can make people more imaginative. It produces an environment that encourages new ideas when its strategy aligns with its sustainability goals (AlQershi et al., 2020). This is done by incorporating social and environmental factors into its products, services, and processes. Arab SMEs can do better in the market and help the economy grow in a way that will last if they make environmental responsibility a part of their main business goals. Results from real-life experiments show that strategy, unity, and innovation focusing on sustainability are well linked. Companies are more likely to find new ways to solve social and environmental problems if they include sustainability in their overall business plan (Laszlo, 2008). SA and creativity in the sustainable manufacturing sector are linked (Abusalma, 2021). Saudi SMEs face unique problems and chances, so their plans must work together. SMEs in Saudi Arabia can become more competitive and help the country achieve a better economy by making sustainability a part of their whole business plan (Alwakid et al., 2021). When SMEs align their strategic objectives with their modernization efforts, they can more successfully categorize and exploit opportunities in the market to a sustained competitive advantage (Laforet & Tann, 2006).

H2. *SA has a positive effect on SOI.*

2.2. DT Towards SOI

For SMEs, going digital has become a big part of their business plan and move towards being more eco-friendly in the last few years (Rassool & Dissanayake, 2019). As technology changes so quickly, SMEs are quick to accept digital tools and platforms that help them be creative, connect with customers, and run their businesses more efficiently (Jayeola, 2015; Nwaiwu, 2018). A business must change a lot in how it works and how it creates value for customers because of the widespread use of digital technology. A big part of getting SMEs to align their strategies is helping them go digital. These people are helped by projects that give them the tools to do new things that are good for the world (Canhoto et al., 2021). These trades can use digital change to come up with new ideas that are better for the environment (Kraft et al., 2022). This helps them make sure that their business goals and their goals for survival are the same. As a business goes digital, it becomes easier for employees to work together and talk to each other. DT may affect the relationship

between SA and innovation that focuses on sustainability. SMEs can work together to protect the environment (Friedman et al., 2000). They can do this by using digital tools and platforms to connect departments and encourage people from different roles to work together (Kraft et al., 2022).

SMEs can use big data to learn what customers want, how the industry works, and how it impacts the environment (Mory-Alvarado et al., 2023). This can help them make products and services that are good for the environment and make more money (Williams & Schaefer, 2013). SMEs need to be able to quickly adjust to changes in the market and customer tastes because business today moves quickly (Udayana et al., 2021). Through opportunities and the availability of data-driven insights, interrelated systems, and adaptive capabilities, DT can develop an SME's aptitude for sustainable innovation, which is the capability to progress innovations that create economic, social, and environmental value (Shashi et al., 2018). This, in turn, permits SMEs to plan and devise sustainable products, processes, and commercial models (Klewitz & Hansen, 2014; Shashi et al., 2018). DT can act as an implementor, empowering SMEs to more effectually parallel their strategies with SOI efforts (Alt & Puschmann, 2012). Correspondingly, SMEs with a strong SO have a greater chance to influence digital technologies for sustainable innovation, thus magnifying the positive effects on performance (Zahra et al., 2006).

SEMs can quickly adapt to new trends and possibilities when they go digital. This gives them an edge in the market and lets them come up with new ideas that help them meet their environmental goals (Fonseca & Lima, 2015). As time goes on, the market tries to adapt to the changes from the consumer side and technological advances. Then, the owners from the SME sectors proactively scale up selling. By accepting DT, understanding the demands and needs of the customer side, keeping the management and team agile, and fostering strategic collaborations, SMEs and MSMEs can hold themselves up as survivors and leaders in their industries (Farida & Setiawan, 2022). Understanding how DT and SO interact with SA and SOI is vital for controlling managerial decisions and resource allocation in SMEs functioning in dynamic and undefined environments. So, the next hypothesis is as follows:

H3. *DT has a positive effect on SOI.*

2.3. DT as a Mediator

The mediating role of DT in the association between sustainability and innovation in Saudi SMEs is a vital facet of this research. DT can meaningfully and positively mediate the relationship between the intention to recycle fintech and a bank's sustainable performance in Saudi Arabia (Aldaarmi, 2024). By leveraging digital technologies, SMEs can progress and plan sustainable products, processes, and business models that underwrite the country's economic modification goals and environmental sustainability purposes (Satar et al., 2024; Tarifi, 2024). In fact, DT can catalyze the expansion of sustainable business models and performance in GCC countries, bringing them into line with their comprehensive sustainability goals (Bocken, 2023). In practice, these activities can encompass data-driven understandings to optimize resource use, decrease waste, and develop innovative, sustainable products and services. In the GCC countries, digital-driven proliferation is pervasive and significant for their long-term, sustainable development that is no longer fully in need of oil revenues (Aidrous et al., 2021). DT enables GCC countries to demonstrate their financial prudence and transition toward more sustainable, technology-driven growth (Aidrous et al., 2021; Touati & Ben-Salha, 2024). Moreover, DT can correspondingly augment the SA of SMEs with their sustainability goals, empowering them to better respond to market dynamics and customer requirements (Aldaarmi, 2024; Satar et al., 2024). The mediating role of DT is imperative in the Saudi framework, where the government has emphasized

the need for DT to encourage economic diversification and sustainable development. For instance, the Vision 2030 plan aims to include digital technologies to enhance the country's attractiveness and sustainability (Satar et al., 2024). By understanding the mediating role of DT in the connection between sustainability and innovation, scholars can better classify the key factors underwriting SOIs' achievement in Saudi SMEs.

H4. *DT mediates the relationship between SA and SOI.*

2.4. *SO as a Moderator*

As SA, which is the arrangement between a firm's IT strategy and overall business strategy, is assessed as being one of the indispensable requisites for efficacious DT (Jonathan, 2021). When an organization's digital ingenuities are closely united with its wide-ranging strategic goals and priorities, it can leverage technology more effectively to support its objectives (AlNuaimi et al., 2022). On the other hand, SO is defined by a group's overall tactics and mindset in the direction of its strategic goals, market standing, and competitive advantage (AlNuaimi et al., 2022). It encompasses the administration's morals, culture, and any significance that guide its strategic decisions and accomplishments. A sturdy SO can augment the impact of SA on DT by nurturing an innovative and implication-based culture that emphasizes DT initiatives and developing digital capabilities (Butt et al., 2024; Jonathan, 2021). SO evaluates innovation and experimentation, which encourages workers to think creatively and take intended risks, leading to more effective DT initiatives (AlNuaimi et al., 2022). A vibrant SO, also encompassing dimensions like sustainability, innovation, and digital conversion, can reinforce the effect of SA on a firm's capability to transform digitally (Yu et al., 2022). This SO affords a framework for prioritizing and controlling the organization's digital ingenuities in line with its all-encompassing objectives. Thus, the moderated hypothesis can be stated as follows:

H5. *SO moderates the relationship between SA and DT.*

Organizations can efficiently transform their long-term planning and schemes into lasting innovations and, thus, they also ensure sustainable goals and a competitive advantage (Kramer, 2024). How well these long-term strategic goals are turned into long-lasting innovations will depend on how the company plans its strategies. Businesses focusing on a clear vision and identifying what they want to accomplish are more likely to invest in sustainable innovation projects as they comprehend how these enterprises will aid them in attaining their goals. Numerous sustainable innovation ventures, such as energy efficiency or waste reduction, can bring about noteworthy cost saving and enhanced operational efficiency (Van Der Merwe, 2002). A company's strategic direction meaningfully influences its ability to adapt to market fluctuations and develop innovative solutions. By bringing innovation into line with strategic goals, nurturing a creative working environment, harmonizing short-term and long-term objectives, highlighting and emphasizing data insights, hiring employees with novel virtues like agility, and engaging stakeholders, businesses can progress competitively and flourish in today's dynamic market (Alenzy, 2018). This is because technology changes quickly, and so do customer tastes. When these things happen, a strategic company can respond by funding new ideas that are good for the environment. Companies with a clear goal are more likely to monitor how technology changes and develop new goods and services to meet market needs (Bolden-Barrett, 2017). They will also be more likely to find new ways to grow their business. Strategic direction changes how people work and think, which changes how well the company can develop new ideas that will last (Salimova et al., 2014). Companies that work hard to involve all parties can better find green new ideas. They can better solve social and environmental problems by

using their stakeholders' knowledge, experience, and resources, and asking for their views during creation (Adams et al., 2019). Another important thing for SMEs in Saudi Arabia is their strategy orientation. This affects how well their plans are aligned with new environmentally friendly ideas. If a business focuses on strategy, it is more likely to turn that strategy into activities and actions that lead to long-term growth. Companies in the long term, should embrace new concepts, adapt quickly to environmental changes, and involve everyone to achieve their strategic goals and tackle social and environmental issues. In fact, SO requires balancing and fixing a vision, keeping up-to-date with markets and doing data analysis of market research, engaging strategy and merging it with customer-oriented and market-oriented activities, engaging employees with stakeholders and, finally, evaluating and measuring several metrics for estimating performance (Abdulrab et al., 2021; Alenzy, 2018). The moderating effect of SO can enable a better understanding of how SMEs can develop in a good way for the environment and how to promote more of these kinds of philosophies to be used in the Saudi business world. Enabling an organization's diverse strategies, its aims, methods, resources, and goals, to work together as a single unit is the defining characteristic of SA (Abdulrab et al., 2021). When groups are linked correctly, they can focus their efforts, make the most of their resources, and quickly adapt to changes in the outside world. When a company aligns its strategies, it can reach its goals more quickly and efficiently, greatly enhancing its performance and giving it a big edge over its competitors.

In this digital age, digital change is one of the most important things that affects how well strategies fit together. Digital tools, like the *Internet of Things*, *cloud computing*, *AI*, *big data analytics*, and more, can help businesses make smarter choices, get things done faster, and give customers a better experience (Baimukhamedova & Baimukhamedov, 2022). Companies that go digital get the skills and tools they need to ensure their plans align with their goals (Alenzy, 2018). By establishing strategic interlinks and schemes with internal and external stakeholders, colleges, and universities, companies can adapt to fluctuating societal and economic circumstances, eventually moving forward to ensure long-term growth and sustainability. Salimova et al. (2014) stated that higher education institutions can better adapt to societal and economic changes by cooperating with businesses, government activities, and supplementary educational institutions. Digital technology, for instance, lets companies instantly collect and analyze huge amounts of data. This helps them make better business choices and quickly adapt to changes in their environment. SMEs must invest in their employees' skills, experience, and education to do well in the market. Thereby, they will be able to gain an edge through smart innovation. By investing in and developing their human capital, manufacturing SMEs can speed up the implementation of strategic innovation projects and improve their competitive performance (AlQershi et al., 2020).

H6. *SO moderates the relationship between SA and SOI.*

SO acts as moderation in the nexus of DT and SOI in SMEs of Saudi Arabia. Several studies have indirectly or directly described this nexus, concluding that SO towards digitalization can meaningfully influence an SME's aptitude to transform digitally and revolutionize its sustainability (Fan et al., 2023; Huang & Lau, 2024; Pan et al., 2021). For instance, Fan et al. (2023) revealed that digital SO under corporate dynamism had an imperative impression on innovation output, whereas executive compensation and equity incentives positively moderate the association between DT and innovation output. This onset suggests that a firm's SO toward digitalization can increase its capability to innovate sustainably by leveraging digital-based knowledge. Another study on green sustainability observed that SO in the direction of digitalized transformation can enhance the overall quality of green innovation (Pan et al., 2021). This study also postulated that managerial

digital knowledge, understanding, and regional intellectual property fortification positively moderate the relationship between DT and green innovation quality. Furthermore, a study by Huang and Lau (2024) examined that SO can also bolster a firm's environmental performance and that this effect is more noticeable in turbulent, tech-oriented environments. It is clear that SO works with digitized transformation to enhance its capability to innovate sustainably by leveraging digital technologies, enlarging the knowledge and proficiency of its executives, and adapting to shifting environmental conditions. Hence, the final hypothesis is as follows:

H7. *SO moderates the relationship between DT and SOI.*

3. Materials and Methods

This study adopts a quantitative research design to examine the relationship between SA and SOI within a moderated mediation framework in the context of SMEs in Saudi Arabia. To achieve this goal, a conceptual framework was developed (Figure 1) and subsequently validated using Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS-SEM is frequently employed to validate these types of frameworks (e.g., Zaki, 2024; Zaki & Elnagar, 2025; Zaki & Shared, 2023).

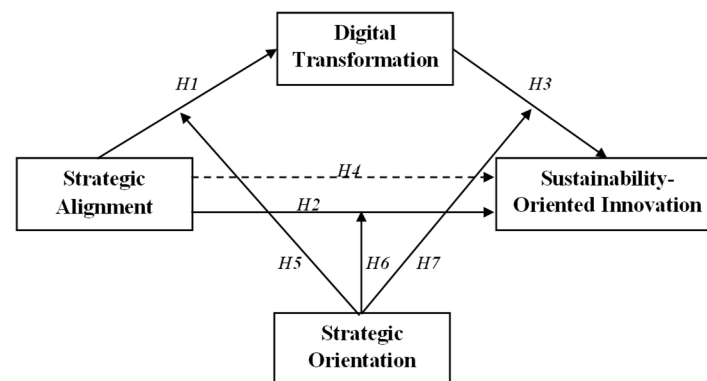


Figure 1. Conceptual framework.

3.1. Sample and Data Collection Tool

A cross-sectional approach was employed to collect data from SMEs operating in the logistics and services sectors of Saudi Arabia. These sectors were chosen for their high significance, ranking just below the manufacturing and trade sectors in terms of employment contribution (Al-Hakimi et al., 2022). The study focused on managers within SMEs, utilizing a convenience sampling method. A total of 450 structured surveys were distributed, yielding 339 valid responses for analysis, resulting in a strong response rate of 75%, which is considered relatively high (Baruch & Holtom, 2008).

The sample featured a diverse demographic profile. Among the respondents, 280 were male and 59 were female. In terms of tenure, 111 participants had less than 10 years of experience, while 228 had over 11 years. Respondents' ages were distributed as follows: 10 individuals were aged between 20 and 29 years, 90 were between 30 and 39, 210 were aged 40 to 49, and 29 were aged 50 or older. Educational qualifications included 154 individuals with a bachelor's degree and 185 with postgraduate qualifications.

The SMEs themselves also varied in characteristics. Most firms (186) employed between 1 and 50 individuals, while 149 firms had more than 51 employees. Regarding the roles of the respondents, 130 held CEO positions, while 209 were in other managerial roles. Additionally, 63 firms had been in operation for 20 years or more, while 276 were less than 20 years old.

3.2. Measures

The survey instrument was systematically designed and consisted of 20 items aimed at capturing four primary constructs. All items were measured using a 5-point Likert scale. The SA construct was assessed using four items adapted from [Yayla and Hu \(2012\)](#). DT was measured through five items derived from [Ngo et al. \(2023\)](#). The moderating variable, SO, was evaluated using six items ([Weinzimmer et al., 2012](#)). Finally, the dependent variable, SOI, was assessed using five items adapted from [Dey et al. \(2020\)](#).

3.3. Dealing with Bias

Various methodologies were applied to assess the anticipated Common Method Variance (CMV), notably employing Harman's single-factor method through exploratory factor analysis with no rotation, revealing a singular dimension that explained 32.6% of the variance, thereby suggesting that CMV is not a significant issue ([Podsakoff et al., 2012](#)).

4. Results

4.1. Descriptive Statistics

The information presented in Table 1 indicates the skewness and kurtosis values, which confirm that there are no deviations from normality among the variables. Therefore, it can be inferred that all variables exhibit a normal distribution.

Table 1. Descriptive statistics ($n = 339$).

Constructs	Mean	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
SA	3.5671	1.06697	−0.949	0.132	−0.280	0.264
SOI	3.0153	0.97070	−0.223	0.132	−0.929	0.264
DT	2.8926	0.91782	−0.200	0.132	−1.014	0.264
SO	2.3127	0.75144	−0.585	0.132	−1.014	0.264

4.2. Structural Equation Modelling and Hypotheses Test

Before testing the hypotheses, the outer measurement model was established and carefully evaluated. Unlike CB-SEM, which relies on commonly used fit indices, PLS-SEM employs a distinct structural equation modeling approach where such indices may not be available or suitable ([Nart et al., 2019](#)). The evaluation of a PLS-SEM model's fit involves specific criteria: factor loadings (λ), Cronbach's alpha (α), and composite reliability (CR) should all exceed 0.70 to establish internal reliability. Additionally, the average variance extracted (AVE) should be greater than 0.50 to demonstrate convergent validity. For discriminant validity, the AVE of each construct must be higher than its squared inter-construct correlations ([Hair et al., 2020](#)).

The results, as outlined in Table 2, show that the model achieves satisfactory convergent validity, with AVE values supporting the assessment. To address critiques of the Fornell–Larcker criterion for discriminant validity, the Heterotrait–Monotrait ratio (HTMT) was also examined. As shown in Table 3, all HTMT values are below the threshold of 0.90, confirming the model's discriminant validity. Furthermore, Table 4 indicates that the factor loadings for each item within its respective construct are higher than the cross-loadings with other constructs, further validating the discriminant validity of the model.

Figure 2 and Table 5 illustrate the findings regarding the hypothesized relationships between SA and DT.

Table 2. Reliability, item loadings and validity.

Constructs	Items	Loading	Cronbach's Alpha	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
DT	DT01-Our organization is focused on the digital transformation of all feasible processes.	0.723	0.774	0.846	0.525
	DT02-We gather extensive data from various sources to inform our strategies.	0.752			
	DT03-We strive to strengthen the connectivity among different business operations through the use of digital technologies.	0.708			
	DT04-Our goal is to improve the customer experience by leveraging digital solutions.	0.702			
	DT05-We aim to facilitate seamless information exchange through digital means.	0.736			
SA	SA01-The strategic plan includes comprehensive action plans and strategies that align with the organization's business objectives.	0.834	0.865	0.908	0.712
	SA02-Key strategic investments are prioritized based on their anticipated effect on business performance.	0.817			
	SA03-The strategic goals and objectives are adjusted in response to the evolving aims of the organization.	0.854			
	SA04-Strategic opportunities are recognized to aid in advancing the organization's strategic direction.	0.863			
SOI	SOI01-Our organization develops products aimed at minimizing resource consumption.	0.773	0.815	0.871	0.574
	SOI02-Our organization creates products focused on reuse, recycling, and recovery.	0.744			
	SOI03-Our organization designs products to lower emissions.	0.797			
	SOI04-Our organization implements green supply chain management practices, including sustainable procurement, manufacturing, and marketing.	0.713			
	SOI05-Our organization adheres to environmental management system certifications.	0.760			
SO	SO1-There is a collective understanding of the company's future aspirations.	0.860	0.912	0.943	0.732
	SO2-Our strategic goals are well-defined.	0.841			
	SO3-The organization's objectives align with our mission, vision, and overall strategy.	0.871			
	SO4-Our focus on immediate objectives does not detract from our long-term vision.	0.850			
	SO5-We possess a robust strategic plan.	0.831			
	SO6-The company implements regular and efficient planning processes across all levels.	0.880			

Table 3. Discriminant validity—Heterotrait–Monotrait ratio (HTMT).

Constructs	DT	SA	SOI	SO
DT				
SA	0.510			
SOI	0.826	0.670		
SO	0.559	0.715	0.530	

Table 4. Discriminant validity—Fornell–Larcker criterion.

Constructs	DT	SA	SOI	SO
DT	0.724			
SA	0.421	0.844		
SOI	0.661	0.566	0.758	
SO	0.504	0.659	0.483	0.804

Hypothesis 1: The relationship between SA and DT is both significant and positive, evidenced by a path coefficient (β) of 0.179. This indicates a substantial positive influence of SA on DT. The *t*-value of 7.283, coupled with a *p*-value of 0.000, confirms the statistical significance of this relationship, suggesting that SA has a considerable enhancing effect on DT.

Hypothesis 2: SA also demonstrates a significant and strong positive effect on Strategic Organizational Innovation (SOI), with a path coefficient (β) of 0.164. A *t*-value of 8.496 and a *p*-value of 0.000 further emphasize the strength of this relationship, indicating that effective SA initiatives are vital for driving SOI within SMEs.

Hypothesis 3: The connection from DT to SOI is also characterized as positive and significant, with a path coefficient (β) of 0.393. The *t*-value of 13.426 and a *p*-value of 0.000 indicate that DT plays a significant role in enhancing SOI, thereby underscoring the importance of innovation for corporate sustainability.

Additionally, the structural model assessment reveals insights through the evaluation of R^2 , F^2 , Q^2 , and Variance Inflation Factor (VIF) values concerning the relationships between model factors. The R^2 value of 0.608 indicates that SA and DT account for 60.8% of the variance in SOI, signifying strong predictive power. The F^2 value of 0.396 suggests a large effect size, highlighting SA's significant contribution to SOI. The Q^2 value of 0.567 illustrates the model's predictive relevance, affirming that SA positively affects SOI. Furthermore, all VIF scores exceeding 3.521 indicate no serious issues with multicollinearity.

Table 5. Results of structural model.

Paths	Beta	T Statistics	<i>p</i> Values	Decision
H1. SA → DT	0.179	7.283	0.000	Supported
H2. SA → SOI	0.164	8.496	0.000	Supported
H3. DT → SOI	0.393	13.426	0.000	Supported
Mediating Effect				
H4. SA → DT → SOI	0.191	6.737	0.000	Supported
Moderating Effects				
H5. SO × SA → DT	0.190	3.611	0.000	Supported
H6. SO × SA → SOI	0.003	2.347	0.019	Supported
H7. SO × DT → SOI	0.097	2.820	0.005	Supported

In relation to the moderation analysis, Figure 3 demonstrates that SO enhances the positive association between SA and DT, with coefficients of $\beta = 0.190$, $t = 3.611$, and $p = 0.000$, thereby supporting (H5). Additionally, SO also fortifies the positive relationship between SA and SOI, indicated by $\beta = 0.003$, $t = 2.347$, and $p = 0.019$, which confirms (H6).

Furthermore, SO strengthens the positive connection between DT and SOI, as evidenced by $\beta = 0.097$, $t = 2.820$, and $p = 0.005$, thus validating (H7).

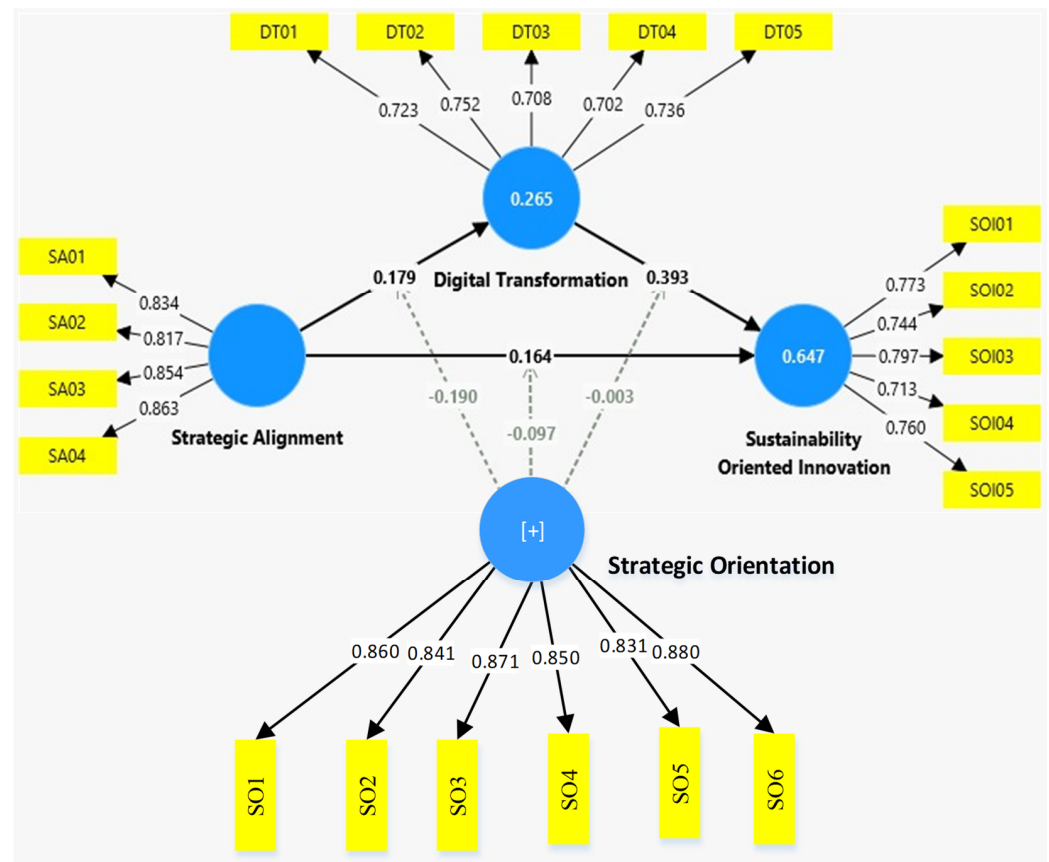


Figure 2. Structural model.

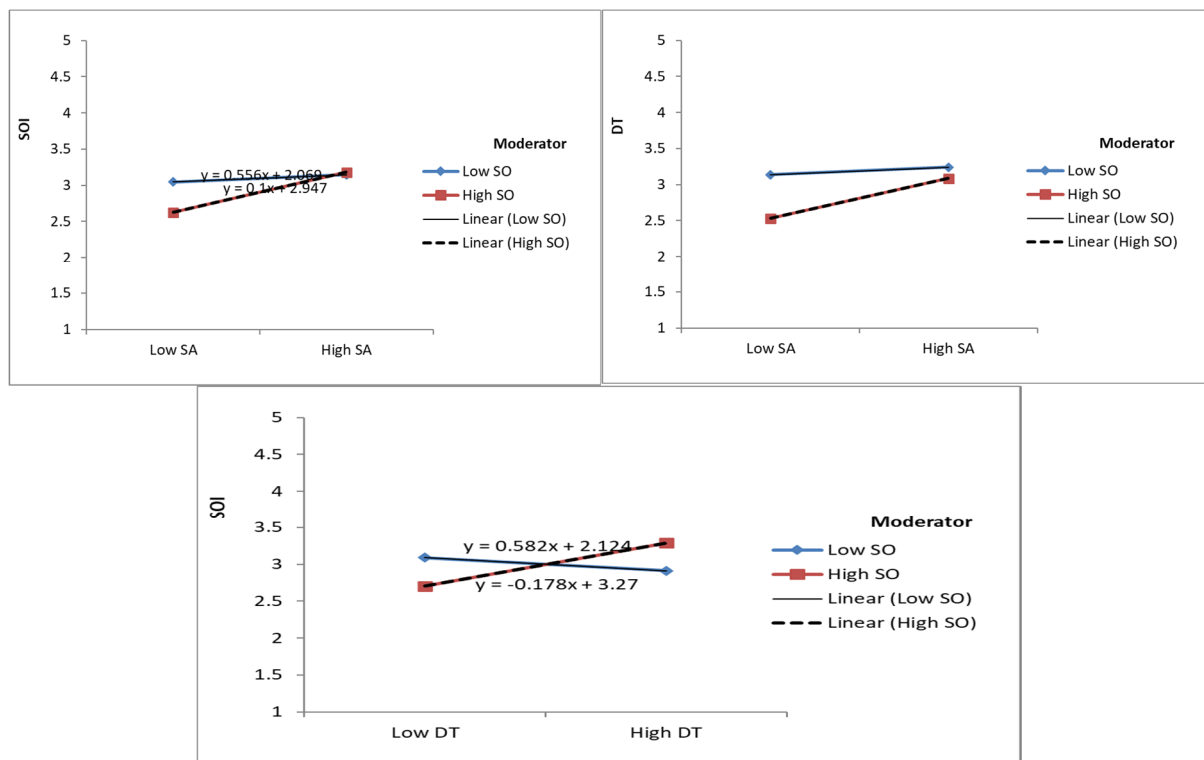


Figure 3. The moderating influences.

5. Discussion and Conclusions

This study examined the direct and aligned relationship among SA, DT and SOI through the lens of SA theory. Our findings highlight the crucial role of SA in facilitating both DT adoption and SOI development in SMEs. While examining these relationships, we discovered that SO has a significant positive impact on SA, DT, and SOI, further reinforcing its role as a moderator that strengthens the interplay among these variables. Our research contributes to the literature by empirically demonstrating these relationships and offering new insights into how SMEs can navigate digital transformation while maintaining sustainability-driven innovation.

Firstly, our findings confirm that SA positively influences DT and SOI in SMEs, a relationship also supported in prior research on digital transformation in SMEs across different regions. Studies in European SMEs by [Clohessy and Acton \(2019\)](#) have shown that aligning digital initiatives with business strategy enhances innovation and performance, echoing our results in Saudi SMEs. Similarly, research on Chinese manufacturing SMEs by [Li et al. \(2016\)](#) indicates that firms with strong SA frameworks are better equipped to leverage DT for sustainability-driven innovation. However, unlike China, where government-driven incentives play a strong role in driving DT in SMEs ([Xie et al., 2022](#)), Saudi SMEs face different institutional challenges, such as financial constraints and digital infrastructure limitations. This suggests that, while SA is universally beneficial, the degree of its effectiveness may be contingent on contextual factors, such as national policies and industry-specific regulations. Research on the impact of DT on SMEs in Saudi Arabia is a relatively new endeavor. To grow a business, whether it is large or small, adoption of DT cannot bring a fruitful result if that DT does not align with their strategic goals. SMEs can more effectively use technology to focus on innovation, advancing operational efficiency, and boosting competitiveness in this modern digital age by aligning their strategic goals with DT enterprises ([AlQershshi et al., 2020](#)). This research's results are consistent with [Salimova et al. \(2014\)](#) who also found that SA helps the department, team, and individual members of the organization, as well as their intelligence, to focus their DT efforts on the areas that will have the greatest impact on their accomplishments and company objectives. Similarly, the study has validated the beneficial effects of SA on innovations founded on sustainability. The collaboration between functions such as SA and SOI are crucial for achieving balanced and sustainable development in enterprises. According to [Abusalma's \(2021\)](#) real-world observations, there is a strong correlation between creativity and SA in manufacturing. In line with [Laszlo \(2008\)](#), it is thought that if businesses incorporate sustainability into their entire business plan, they will be more likely to come up with innovative solutions that may align with their socially and environmentally related strategic issues. Hence, H1 and H2 are supported.

Secondly, our study corroborates existing research that emphasizes the link between DT and SOI. Previous studies on the impact of digitalization on sustainability-oriented innovation in European service SMEs ([Loebbecke & Picot, 2015](#)) found that firms that integrate digital solutions into their strategic objectives demonstrate higher levels of sustainability-focused innovation. Likewise, research in Latin American SMEs ([Gómez & López, 2024](#)) underscores how DT adoption improves resource efficiency and innovation capacity. However, unlike the Latin American context, where financial constraints often hinder DT adoption, Saudi SMEs benefit from strong government initiatives like Vision 2030, which actively promote digitalization and sustainability transitions ([Abdulrab et al., 2021](#)). For enterprises, governments, and financial institutions alike, tools such as DT and SOI can facilitate the investigation of uncertain future scenarios and are essential in tackling this complex challenge ([Pasqualino et al., 2021](#)). [Farida and Setiawan \(2022\)](#) talked about how important DT and SOI materialization are for managing managers' decisions and the distribution of

resources in SMEs that work in uncertain and changing environments. This study's third hypothesis is fully supported by this belief as well. Therefore, H3 is supported.

Thirdly, our results confirm the mediating role of DT in the relationship between SA and SOI. This finding aligns with prior research in European and North American firms (Piacentini & Della Ceca, 2017; Vnoučková & Urbancová, 2020), which emphasize that firms that effectively integrate digital strategies with their broader sustainability goals are more likely to foster innovation. However, unlike SMEs in the U.S., which often rely on market-driven mechanisms for DT integration (Nejati et al., 2014), SMEs in emerging economies like Saudi Arabia face additional structural challenges, including digital skill shortages and infrastructure gaps, which may limit the full realization of DT's intermediary role. Therefore, this research's analytical results address this gap and enhance the current body of literature by justifying H4.

Lastly, another main contribution of the current study lies in the findings of hypotheses H5, H6, and H7, which examine the moderating influence of SO. The finding that SO enhances the relationship between SA, DT, and SOI is consistent with research on SO's role in manufacturing SMEs in Asia (Butt et al., 2024; Jonathan, 2021) and service-oriented SMEs in Europe (Fonseca & Lima, 2015). However, our results provide unique insights into how Saudi SMEs leverage SO to optimize DT initiatives in sustainability-driven contexts. Unlike European SMEs, which often operate in more digitally mature environments, Saudi SMEs must navigate evolving regulatory frameworks and resource constraints, making SO a particularly critical enabler in this setting.

Consistent with previous research, this study found that SO positively mediates the relationship between SA and SOI. AlQershi et al. (2020) believed that proper SO can speed up the implementation of strategic innovation projects and improve their competitive performance. These findings provide evidence in support with hypothesis H6. Moreover, it is evident that SO utilizes digitized transformation to improve its capacity for sustainable innovation through the utilization of DTs, the expansion of knowledge and expertise among its executives, and the ability to adapt to changing environmental circumstances. So, the findings of H7 positively indicate that SO serves as a valuable asset for organizations, contributing to both DT and SOI.

Theoretically, our study enriches the literature on strategic alignment by demonstrating its direct impact on digital transformation and sustainability-oriented innovation within SMEs. It extends previous research by showing how SO strengthens these relationships. Practically, the findings provide valuable insights for SME managers in emerging economies, particularly in the Middle East, where digital transformation and sustainability are increasingly prioritized. Policymakers can use these insights to design more effective support mechanisms for SMEs, ensuring that digital transformation strategies align with sustainability goals. Comparatively, our research highlights both universal and context-specific factors influencing SME digitalization, emphasizing that, while strategic alignment is beneficial across different markets, its effectiveness is shaped by industry conditions, national policies, and resource availability.

6. Implications

6.1. Theoretical Implications

In businesses and at the federal level, it is crucial to combine digital technology, sustainable innovation, SA, and SO. Along with increasing market share and the expansion of organizations, it facilitates the creation of new markets. Inappropriate SA and SO practices can push businesses into harsh competition and lower output. The goals of a company are closely aligned with SA and SO initiatives, which are frequently implemented in response to competition and are viewed as a means of achieving both immediate and

long-term financial gain. Therefore, there may be more profound effects on performance when SA and SO are in compliance with DT and SOI for the strategic choice formulation process in enterprises. Due to these reasons, we tried to determine the relationships between them. However, the present study suggests that, among other things, three aspects (SA, DT, and SOI) of business strategy have a significant impact on technological growth and business sustainability. This suggests that businesses should view their operations as more innovative, and that managers and policymakers should prioritize encouraging this kind of innovation to ensure that businesses operate as efficiently as possible.

This study makes important contributions to the integration of SA research with the literature on DT, SOI, and SO. This research also contributes to the existing research on SA and SO by incorporating digital technology and sustainable innovation as important factors affecting performance (Cragg et al., 2002; Kindermann et al., 2021; Venkatraman et al., 1993). Prior studies on alignment have examined investments in IT and cyber security, while neglecting the significance of digital innovation (Anthony Byrd et al., 2006; Cragg et al., 2002; Pesce & Neirotti, 2023). Furthermore, the research on SO has encompassed DT, but it has thus far neglected the aspects of green and sustainability considerations. Consequently, we offer crucial and constructive connections that contribute to the study of SA as a whole and specifically highlight the risks of misalignment. It is also important to note that our research points to DT as a positive mediator in the relationship between SA and SOI. As technology is changing so quickly and the environment is changing so quickly, businesses may find it difficult to match their digital initiatives with sustainability goals (Yousaf et al., 2021). In the event that DT and SO are not aligned, this could lead to unsustainable practices or the ineffective utilization of resources. A disproportionate emphasis on DT utilization may also contribute to a reduction in digital innovation within companies. Furthermore, putting too much focus on digital technology could cause a company to overlook other important facets like organizational culture, corporate strategy, and employee relations (Stonehouse & Konina, 2020). Moreover, an excessive focus on DT as a means of aligning strategies can create a misleading feeling of safety, causing companies to overlook potential disruptive threats, such as cyber threats and other external factors, and, consequently, fail to adjust their mindset to new realities (Bolden-Barrett, 2017; Mustofa et al., 2024). As a result, the process of learning can be hindered, valuable resources can be squandered, and the progress of digital innovation can diminish.

The relationship between SOI and SA was studied, and the mediating and moderating effects of DT and SO were tested in this study. Based on the results, the relationship in question satisfies the requirements for mediating and moderating set forth by Baron and Kenny (1986), and Jamil et al. (2024).

We demonstrate a strong commitment to the advancement of SO research. Conventional methods of SO fail to consider the profound influence of DT on SOI. In order to address this deficiency, we integrate the concepts of DT and SOI into a SA framework. This framework offers a thorough understanding of how companies can effectively align or misalign their SO with DT in order to achieve efficient innovation. Academics have long stressed the importance of a comprehensive framework that combines theories of ventures, sustainability, and creativity to tackle the intricacies of modern business settings (Klewitz & Hansen, 2014; Schaltegger & Wagner, 2011). To close this gap, this study suggests a broad framework that permits better comprehension of the complicated connections among these important factors. By establishing a connection between sustainability and startup orientations with digital innovation, we offer valuable insights into how companies can effectively utilize SO to promote innovation in the digital era.

6.2. Practical Implications

SME managers play a critical role in ensuring that businesses leverage digital technologies efficiently while embedding SOI into their core strategies. In Saudi Arabia, where economic diversification and sustainability are key objectives of Vision 2030, SMEs must develop actionable strategies to remain competitive and contribute effectively to national growth. This study highlights three key areas—SA, DT, and SO—that SME managers must prioritize to enhance long-term success.

1. Implementing SA for sustainable innovation

To strengthen SA, SME managers must align digital initiatives with sustainability goals. This requires integrating SOI into business models, ensuring that digital solutions contribute to resource efficiency, waste reduction, and green product development. Managers should:

- Develop sustainability-driven strategic roadmaps that link business objectives with digital transformation and eco-friendly innovation.
- Align leadership commitment with sustainability goals by fostering a culture that prioritizes environmental responsibility in decision-making.
- Leverage government incentives and grants under Vision 2030 to finance sustainable innovation initiatives and green technology adoption.

2. Accelerating DT to drive competitiveness

DT is a critical enabler of SOI, allowing SMEs to enhance efficiency and market adaptability. To accelerate digitalization, managers should:

- Invest in cloud computing, AI-driven analytics, and IoT solutions to optimize operational efficiency and sustainability-driven business models.
- Enhance workforce digital literacy through targeted training programs that focus on sustainability, digital strategy, and innovation.
- Establish digital ecosystems and partnerships with technology providers and universities to co-develop smart, sustainable solutions.

3. Strengthening SO for long-term growth

A well-defined SO enhances an SME's ability to integrate innovation into its strategic vision. Managers should:

- Foster an innovation-driven culture by encouraging experimentation, cross-functional collaboration, and knowledge sharing on sustainability and digital innovation.
- Strengthen collaboration with industry leaders and policymakers to stay informed on regulatory trends and sustainability best practices.
- Incorporate customer-centric innovation strategies that align product development with evolving market expectations for sustainable goods and services.

4. Enhancing policy and institutional support for SME growth

Policymakers play a crucial role in ensuring that SMEs have access to the necessary tools, incentives, and resources to drive digital transformation and sustainability. This study underscores the importance of the following: 1—Expanding financial support programs to facilitate SMEs' investments in green and digital technologies. 2—Providing regulatory frameworks that encourage sustainable business models while reducing bureaucratic barriers to digital adoption. 3—Establishing industry-specific digital transformation roadmaps to guide SMEs in key sectors like hospitality, retail, and manufacturing.

By implementing these targeted strategies, SMEs in Saudi Arabia can overcome barriers to digitalization and sustainability, enhancing their ability to create jobs, boost economic contributions, and support national sustainability goals.

6.3. Limitations and Future Research

Like all research, this study has certain limitations. One limitation lies in quantifying SOI and DT using primary sources, given the scarcity of research on these constructs in the Saudi SME context. Future studies could enhance this by incorporating both primary and secondary sources as more literature emerges. Additionally, we did not examine specific digital technologies, leaving room for future research to explore digital technology configurations and their role in fostering digitally sustainable innovation. The study also did not differentiate between various types of firms, which could be addressed by investigating how firm characteristics influence the relationship between digital innovation and its precursors across different enterprise categories. For example, entrepreneurial firms may thrive in dynamic environments, while SO-focused firms might excel in stable conditions. The borderline 10% significance observed in this study underscores the need for caution in interpreting strategic approaches to sustainability and digital innovation, suggesting replication with larger samples or additional factors influencing these relationships. Furthermore, the study's findings may not fully apply outside Saudi Arabia, as differences in industry structures, regulations, and economic conditions, along with social conventions and institutional disparities, can influence organizational behavior toward innovation and sustainability. To improve generalizability, future research should account for industry-specific and contextual factors, exploring models in varied national and industrial settings. Lastly, the correlation between a firm's headquarters' geographical location and national regulations warrants further exploration, as such regulations play a crucial role in shaping sustainability initiatives.

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