

Navigating the Digital Landscape: factors shaping entrepreneurial dynamics in Saudi Arabia

Una mirada por el panorama digital: factores que dan forma a la dinámica empresarial en Arabia Saudita

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Abstract: this paper provides a comprehensive analysis of the factors impacting entrepreneurial intentions, behaviors, innovations, and the sense of self-efficacy in the digital entrepreneurial ecosystem in the Kingdom of Saudi Arabia. By illuminating the roles of the ecosystem, entrepreneurial intention, innovation, and education, the study aspires to provide insights into distinctive dynamics of digital entrepreneurship in this geographical setting. The study employs both qualitative in-depth interviews with subject matter experts and quantitative statistical analysis of survey responses. The Saudi digital entrepreneurial ecosystem is explored qualitatively through 15 in-depth interviews with industry experts and quantitatively with 248 survey responses that allow for hypothesis testing using structural equation modeling. The quantitative data in this study were analyzed using PLS-SEM. The results emphasize the mediating roles of entrepreneurial ambition and innovation, highlighting the key significance of the digital entrepreneurial ecosystem in driving entrepreneurial behavior. Entrepreneurial education is emerging as a powerful element, acting as a moderator in shaping entrepreneurial success. The research provides useful information about the unique characteristics of digital entrepreneurship in Saudi Arabia.

Keywords: entrepreneurship, ecosystem, intention, innovation, digital ecosystem, entrepreneurial education, entrepreneurs, Saudi Arabia.

Resumen: este artículo proporciona un análisis exhaustivo de los factores que impactan las intenciones, los comportamientos, las innovaciones y el sentido de autoeficacia empresarial en el ecosistema empresarial digital en el Reino de Arabia Saudita. Al ilustrar los roles del ecosistema, la intención empresarial, la innovación y la educación, el estudio aspira proporcionar información sobre las dinámicas distintivas del emprendimiento digital en este entorno geográfico. El estudio utiliza tanto entrevistas cualitativas con expertos en la materia como análisis estadístico cuantitativo de las respuestas de la encuesta. El ecosistema empresarial digital saudita se explora cualitativamente a través de 15 entrevistas con expertos de la industria y cuantitativamente con 248 respuestas a encuestas que permiten probar hipótesis utilizando modelos de ecuaciones estructurales. Los datos cuantitativos de este estudio se analizaron mediante PLS-SEM. Los resultados enfatizan los roles mediadores de la ambición empresarial y la innovación, destacando la importancia clave del ecosistema empresarial digital para impulsar el comportamiento empresarial. La educación empresarial surge como un elemento poderoso que actúa como moderador en la configuración del éxito empresarial. La investigación proporciona información útil sobre las características únicas del emprendimiento digital en Arabia Saudita.

Palabras clave: emprendimiento, ecosistema, intención, innovación, ecosistema digital, educación empresarial, emprendedores, Arabia Saudita.

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Introduction

The rise of digital entrepreneurship has become a transformative force in the global economy, reshaping traditional business structures and opening new avenues for innovation and economic growth (Boscán Carroz *et al.*, 2023). In an era marked by rapid technological advancements and digitization, entrepreneurial dynamics are evolving significantly (Witschel *et al.*, 2019). Entrepreneurs now operate without physical constraints, leveraging the digital ecosystem for economic value creation and innovation (Jawad *et al.*, 2021). Saudi Arabia has enthusiastically embraced the digital entrepreneurial revolution, witnessing a surge in digital enterprises and entrepreneurial endeavors (Hervé *et al.*, 2021). This study aims to delve into the heart of the digital entrepreneurial ecosystem, offering a comprehensive analysis of the factors influencing entrepreneurial intentions, behaviors, innovation, and self-efficacy within the Saudi Arabian context.

Understanding the landscape of digital entrepreneurship in Saudi Arabia is crucial, given the nation's ongoing efforts to reduce reliance on traditional oil-dependent industries and foster economic diversification (Witschel *et al.*, 2019). Recognizing the role of digital entrepreneurship in driving economic growth through innovation and technology, the government actively promotes exploring the intricate dynamics within the Saudi digital entrepreneurial ecosystem (Jafari-Sadeghi *et al.*, 2021; Elia *et al.*, 2020). Digital entrepreneurship thrives within a broader ecosystem that encompasses government laws, educational institutions, venture capital, business support networks, and cultural influences (Jawad *et al.*, 2021; Zahra *et al.*, 2023). Investigating these elements collectively is crucial to understanding the drivers of digital entrepreneurial activity in Saudi Arabia.

Beyond the opportunities presented by the digital landscape, the attitudes of individuals and organizations within the ecosystem play a pivotal role in unlocking its revolutionary potential (Aloulou, 2021). Entrepreneurial intentions, signaling the desire and readiness to engage in entrepreneurial activities, are essential precursors for entrepreneurial actions (Hervé *et al.*, 2021).

Therefore, this research focuses on understanding the factors influencing entrepreneurial intentions within the Saudi digital entrepreneurial ecosystem. Additionally, entrepreneurial innovation—the development and implementation of novel solutions in digital ventures—is a central theme, exploring its mediating role between the digital entrepreneurial ecosystem and entrepreneurial behavior (Amit and Zott, 2020; Schmidt *et al.*, 2019). Innovation not only fuels economic growth but also enhances competitiveness and sustainability.

Self-efficacy, an individual's belief in one's capability to perform tasks and achieve goals, significantly shapes entrepreneurial activities (Shahikh *et al.*, 2023). In the dynamic realm of digital entrepreneurship, self-efficacy influences individuals' propensity for launching and persisting in ventures (Gielnik *et al.*, 2020; Yousaf *et al.*, 2021). Thus, the research investigates the mediating role of entrepreneurial self-efficacy in the relationship between digital entrepreneurial ecosystem and entrepreneurial behavior. The role of entrepreneurial education in shaping intentions, innovation, and self-efficacy is another key focus, aligning with the Saudi government's emphasis on promoting entrepreneurship education (Martínez-Gregorio *et al.*, 2021; Towers *et al.*, 2020).

In summary, this study aims to provide a comprehensive analysis of the Saudi Arabian digital entrepreneurial ecosystem, focusing on its impact on entrepreneurial goals, behaviors, innovation, and self-efficacy. By examining the interaction of these elements, the research contributes to the development and sustainability of the digital entrepreneurial landscape in Saudi Arabia, aligning with the country's vision for economic diversification and technological advancement.

Literature review and hypotheses development

In today's global economy, there is a growing body of study and concern around the digital entrepreneurial environment. Because of the internet's absorption into our everyday lives and the quick progress of technology, the business environment has altered dramatically (Sedej, 2019). Within this framework, entrepreneurship has

assumed a digital aspect that surpasses the boundaries of conventional physical businesses (Volberda *et al.*, 2021). Entrepreneurs today leverage digital technology to launch and expand their companies. The dynamics and interactions among these ecosystems have spawned an interesting area of study (Rippa and Secundo, 2019). An essential component of the ecosystem of digital entrepreneurship is the concept of “intentions.” Understanding the factors that drive individuals to pursue digital entrepreneurship is essential in unpacking the nuances of this ecosystem (Palmié *et al.*, 2022). Several studies have explored motivations, goals, and psychological factors shaping entrepreneurial intentions in the digital domain. These investigations delve into the ambitions of digital entrepreneurs, seeking to uncover what prompts them to embark on their entrepreneurial journey (Liang *et al.*, 2023; Wang *et al.*, 2021). The identification and analysis of these intentions provide a foundational understanding of how digital entrepreneurial ecosystems are structured and function (Martínez-Gregorio *et al.*, 2021).

In parallel, innovation is a driving force in the digital entrepreneurial ecosystem (Palmié *et al.*, 2022). Continuous technical breakthroughs in the rapidly expanding digital ecosystem generate both opportunities and challenges for businesses. This ecosystem’s innovation is not confined to technology advancements; it also includes creative business structures, marketing methods, and problem-solving approaches (Schmidt *et al.*, 2019). The incorporation of innovation into digital entrepreneurship is a complicated phenomenon, and the processes by which innovation is nurtured, distributed, and utilized within these ecosystems are interesting to both scholars and practitioners (Zahra *et al.*, 2023). Furthermore, knowing how to harness innovation for the growth and sustainability of digital companies is an important study subject in this discipline. Education is another pivotal component of the digital entrepreneurial ecosystem (Hervé *et al.*, 2021). As the digital landscape continues to evolve, the acquisition of relevant knowledge and skills has become indispensable for entrepreneurs. Developing skills and abilities in the digital sphere is greatly aided by entrepreneurial education (Wang *et al.*, 2021). Together with informal learning from networks,

mentors, and internet resources, official education programs are included in this dimension. This field’s research investigates how training and education initiatives might improve people’s entrepreneurial potential, which in turn helps digital businesses expand and succeed (Martínez-Gregorio *et al.*, 2021). To improve our understanding of how these ecosystems work and change, we must look at the interactions between education and the other components of the digital entrepreneurial ecosystem.

The holistic analysis of digital entrepreneurial ecosystems involves an intricate interplay between intentions, innovation, and education (Gielnik *et al.*, 2020). Understanding how these components are interconnected and influence each other is essential for comprehending the dynamics of this rapidly evolving field. Researchers in this field use various methodologies to study the subtle interactions among intentions, innovation, and education in the digital entrepreneurial context, ranging from qualitative case studies to quantitative surveys and analyses (Amit and Zott, 2020; Jawad *et al.*, 2021; Sedej, 2019). Their findings shed information on how these ecosystems develop and evolve, as well as what characteristics are critical for long-term survival and growth (Kumar *et al.*, 2020; Martínez-Gregorio *et al.*, 2021). Finally, in the modern economy, the study of digital entrepreneurial ecosystems has arisen as an important research area. To understand the formation and operation of these ecosystems, it is critical to understand how entrepreneurial aspirations, innovation, and education interact. As digital technology continues to transform the corporate environment, research in this field provides important views for entrepreneurs, educators, lawmakers, and other stakeholders (Aloulou, 2021; Elia *et al.*, 2020). This, in turn, enhances knowledge and aids in the development of strategies for developing a healthy digital entrepreneurial sector.

The qualitative phase of this research is instrumental in providing profound insights into the investigated hypotheses, focusing on the impact of the digital entrepreneurial environment (H1) and the mediating role of entrepreneurial intention (H2). Through expert interviews and relevant

literature, we delve into these assumptions, extracting valuable perspectives from key figures in the Saudi Arabian digital entrepreneurial landscape.

Interviewee 1, a Chief Executive Officer / Founder of a Technology Startup, emphatically states, "I firmly believe that the environment in which we function has a substantial influence on the behavior and expansion of our company". This sentiment is echoed by Interviewee 7, an E-commerce Founder, who highlights the distinct and unparalleled nature of the Saudi Arabian ecosystem, shaping elements such as e-commerce platforms, payment gateways, and customer involvement. These expert responses strongly align with H1, supporting the notion that the digital entrepreneurial environment significantly influences digital entrepreneurial behavior. This resonates with existing literature on entrepreneurial ecosystems, emphasizing the external environment's impact on entrepreneurial activities (Cao and Shi, 2021; Shwetter *et al.*, 2019).

The venture into H2, examining the mediating role of entrepreneurial intention, unfolds through insights from Interviewee 3, a Venture Capitalist, who likens entrepreneurial intention to the fuel for the ecosystem. Similarly, Interviewee 6, a Startup Incubator Manager, sheds light on their role in shaping entrepreneurial intentions and guiding behavior within the ecosystem. The expert responses coalesce to support H2, emphasizing that entrepreneurial intention acts as a catalyst, translating ecosystem opportunities into tangible actions. This aligns with existing research underscoring the pivotal role of intention in driving entrepreneurial behaviors (Fragoso *et al.*, 2020; Al-Jubari *et al.*, 2019; Feola *et al.*, 2019).

In summary, the qualitative analysis of expert interviews robustly supports both H1 and H2, laying the foundation for subsequent quantitative analysis within the context of the Saudi digital entrepreneurial ecosystem.

The exploration then extends to H3 examining the mediating role of entrepreneurial innovation. Academic Researcher (Interviewee 2) emphasizes, "At the heart of entrepreneurship is innovation," corroborated by Interviewee 10, the Chief Technology Officer (CTO) of a Tech Startup, highlighting access to cutting-edge technologies and expertise.

These responses reinforce H3, asserting that entrepreneurial innovation significantly mediates the relationship between the digital entrepreneurial ecosystem and digital entrepreneurial behavior. The qualitative data accentuates the central role of innovation in shaping entrepreneurial activities within the Saudi digital ecosystem, aligning with the broader literature on innovation as a competitive advantage (Distanont and Khongmalai, 2020; Ferreira *et al.*, 2020; Hwang *et al.*, 2020).

Moving to H4, the exploration of entrepreneurial self-efficacy as a mediating factor involves insights from Interviewee 12, an Angel Investor, and Interviewee 14, a Digital Marketing Manager. Both stress the importance of individuals possessing a high degree of self-efficacy to initiate entrepreneurial activities within the dynamic ecosystem. This aligns with established literature on self-efficacy's role in influencing entrepreneurial intentions and behaviors (Shaikh *et al.*, 2023; Udayanan, 2019), supporting H4's assertion that entrepreneurial self-efficacy significantly mediates the relationship between digital entrepreneurial ecosystem and digital entrepreneurial behavior.

In conclusion, the qualitative analysis supports both H3 and H4, enhancing our understanding of the dynamics within the Saudi Arabian digital entrepreneurial ecosystem and setting the stage for forthcoming quantitative research.

The investigation then expands its focus to H5, H6, and H7, collectively exploring the moderating role of entrepreneurial education. Interviewee 9, a University Professor, emphasizes the pivotal role of education in shaping entrepreneurial intentions, a sentiment echoed by Interviewee 13, a Tech Incubator Manager, highlighting how education enhances individuals' understanding of the ecosystem. These responses corroborate H5, asserting that entrepreneurial education significantly moderates the relationship between digital entrepreneurial ecosystem and entrepreneurial intention. The qualitative findings align with previous research emphasizing education's influence on entrepreneurial inclinations (Tomy and Pardede, 2020; Ratten and Usmanij, 2021).

H6 explores the moderating role of entrepreneurial education in relation to entrepreneurial innovation. Insights from Interviewee 6, a

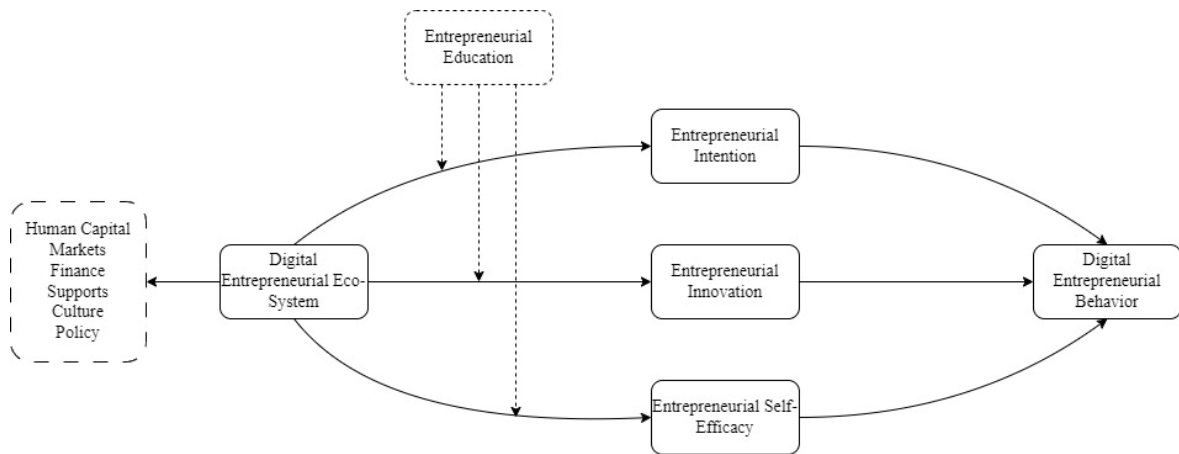
Startup Incubator Manager, and Interviewee 4, a Digital Marketer, highlight education’s role in fostering innovative thinking and encouraging innovative strategies. This supports H6, emphasizing that entrepreneurial education significantly moderates the relationship between the digital entrepreneurial ecosystem and entrepreneurial innovation. The qualitative data underlines the importance of education in equipping individuals with the knowledge and skills to drive innovation within the entrepreneurial context, aligning with established research (Shu *et al.*, 2020; Bauman and Lucy, 2021).

Finally, H7 explores the moderating role of entrepreneurial education in relation to entrepreneurial self-efficacy. Insights from Interviewee 8, a Tech Consultant, and Interviewee 12, an Angel Investor, underscore how education boosts self-efficacy and instills confidence. This aligns with H7, asserting that entrepreneurial education significantly moderates the relationship between the digital entrepreneurial ecosystem and entrepreneurial self-efficacy. The qualitative findings

support the notion that education plays a crucial role in enhancing individuals’ confidence and competence within the entrepreneurial landscape (Bux and Van Vuuren, 2019; Yousaf *et al.*, 2021).

The hypotheses collectively form a comprehensive framework, encapsulating critical factors influencing behaviors, intentions, and innovative capacities within the Saudi Arabian digital entrepreneurial ecosystem. H1-H7, supported by qualitative insights, pave the way for rigorous quantitative analysis, contributing to a deeper understanding of this dynamic landscape. The intricate interplay of the digital entrepreneurial environment, individual intentions, creativity, self-efficacy, and the transformative impact of entrepreneurial education in the Saudi Arabian context represents a rich avenue for further exploration and research (see figure 1). The qualitative study serves as a crucial step, providing qualitative insights and perspectives that set the stage for robust quantitative validation and a more nuanced comprehension of Saudi Arabia’s digital entrepreneurial ecosystem.

Figure 1
Conceptual model



Methodology

The research design of this study employed a mixed-methods strategy, incorporating both qualitative and quantitative data analysis. The study aimed to conduct a thorough analysis of the digi-

tal entrepreneurial environment in the Kingdom of Saudi Arabia in depth. This section provides a description of the data collection, sampling, and analysis procedures employed. The qualitative phase involved conducting semi-structured interviews with 15 industry experts to establish a

fundamental understanding of the digital entrepreneurial ecosystem and formulate prospective study hypotheses (refer to Table 1). These experts were selected for their knowledge and experience in digital entrepreneurship in Saudi Arabia. Each face-to-face interview had a duration of 45-60 minutes. Open-ended questions were formulated to extract detailed information on the ecosystem. These questions aimed at understanding and optimizing factors that contribute to the creation of a conducive entrepreneurial ecosystem fostering innovation, growth, and sustainability for startups and entrepreneurs. The topics covered included entrepreneurial goals, innovative behaviors, and the value of education. The specialists were purposefully selected based on their expe-

rience and involvement in Saudi Arabia's digital entrepreneurship ecosystem. This allows for a wide range of opinions and insights from various stakeholders. The interviewees were requested to share their experience navigating the local entrepreneurial ecosystem and elaborate on the role of educational support and entrepreneurial education in business development. The qualitative data from the interviews were transcribed and subjected to thematic examination. A systematic coding procedure was employed to identify recurring themes, patterns, and crucial insights. The data from this qualitative phase were used to develop research hypotheses, which were subsequently tested in the quantitative phase.

Table 1
Respondents Profile for Qualitative Part

| Respondent ID | Gender | Age | Educational Background | Occupation/ Expertise | Years of Experience | Role in Digital Entrepreneurship |
|---------------|--------|-----|--------------------------------|---------------------------|---------------------|------------------------------------|
| R1 | Male | 40 | Ph.D. in Business | Entrepreneur | 15 years | Founder/CEO of a Tech Startup |
| R2 | Male | 35 | M.Sc. in IT | Academic Researcher | 10 years | Researcher and Educator |
| R3 | Male | 45 | MBA in Entrepreneurship | Venture Capitalist | 20 years | Investor and Mentor |
| R4 | Female | 38 | B.Sc. in Computer Science | Digital Marketer | 8 years | Marketing Strategist |
| R5 | Male | 55 | Ph.D. in Technology Management | Government Official | 25 years | Policymaker in Digital Economy |
| R6 | Female | 30 | BBA in Entrepreneurship | Startup Incubator Manager | 5 years | Incubator and Ecosystem Builder |
| R7 | Female | 42 | MBA in Finance | E-commerce Entrepreneur | 18 years | Online Retail Business Owner |
| R8 | Female | 33 | M.Sc. in Data Science | Tech Consultant | 7 years | Technology Advisor |
| R9 | Male | 48 | Ph.D. in Innovation | University Professor | 12 years | Academic and Researcher |
| R10 | Male | 28 | B.Sc. in Computer Engineering | Tech Startup CTO | 6 years | Chief Technology Officer |
| R11 | Female | 37 | MBA in Marketing | E-commerce Executive | 16 years | Senior Management in Online Retail |
| R12 | Male | 50 | B.Sc. in Finance | Angel Investor | 22 years | Early-Stage Investment |
| R13 | Male | 34 | M.Sc. in Entrepreneurship | Tech Incubator Manager | 9 years | Incubation and Support |
| R14 | Female | 29 | MBA in Strategy | Digital Marketing Manager | 6 years | Marketing and Branding |

| Respondent ID | Gender | Age | Educational Background | Occupation/ Expertise | Years of Experience | Role in Digital Entrepreneurship |
|---------------|--------|-----|--------------------------------|-----------------------|---------------------|----------------------------------|
| R15 | Male | 43 | Ph.D. in Technology Management | Tech Policy Advisor | 17 years | Government Tech Policy Expert |

During the quantitative phase, data was collected from 248 participants in Saudi Arabia actively engaged in digital entrepreneurship or possessing substantial knowledge about entrepreneurial activities. A structured questionnaire, aligned with qualitative hypotheses, was electronically distributed with instructions for timely completion. Non-probabilistic convenience sampling was employed to ensure participant accessibility. Respondents received the questionnaire through various online platforms and digital entrepreneurial organizations. PLS-SEM software was used to analyze the gathered data, utilizing descriptive statistics for sample characterization. Hypothesis testing, which employed inferential statistical methods like regression analysis, assessed relationships between variables derived from the qualitative phase. The integration of qualitative and quantitative data in the final analysis resulted in a comprehensive understanding of the Saudi digital entrepreneurial ecosystem.

Results and discussion

As a gauge of internal consistency, Cronbach’s Alpha shows how strongly the elements within each construct correlate with one another. The findings demonstrate the validity and consistency of the measurement scales employed in this investigation. The Cronbach’s Alpha value for digital entrepreneurial conduct is 0.760. This implies a moderate degree of internal consistency among the items measuring digital entrepreneurial behavior, suggesting that the items taken together offer a trustworthy measure of this construct. Likewise, the Cronbach’s Alpha rating of 0.836 for the digital entrepreneurial environment indicates great internal consistency, meaning that the items used to evaluate the ecosystem’s characteristics are very consistent.

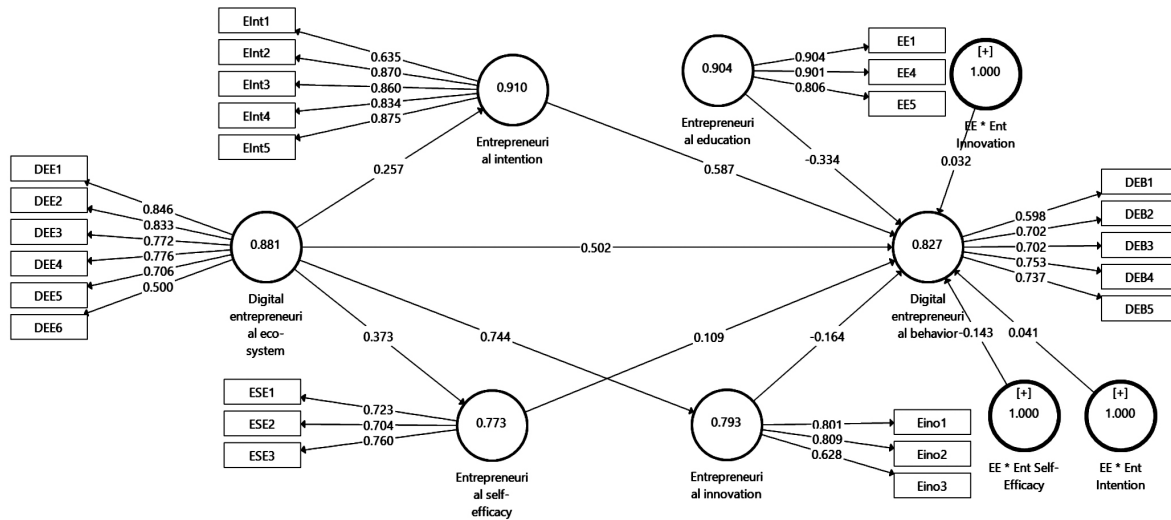
With a Cronbach’s Alpha score of 0.843, entrepreneurial education has a high degree of internal consistency. This shows that there is substantial agreement among the questions assessing the

educational components, indicating that this construct is a reliable measure within the context of the study. Additionally, the Cronbach’s Alpha value of 0.875 for entrepreneurial intention demonstrates the great internal consistency of the items and their reliability in gauging people’s attempts to pursue entrepreneurship in the digital environment. With a modest amount of internal consistency, entrepreneurial innovation has a Cronbach’s Alpha grade of 0.704. Although the items measuring the construct are trustworthy, there may be potential for improvement in terms of consistency among items measuring creative activities. While the construct’s items are trustworthy, there may be potential for improvement in terms of consistency among items measuring creative activities. Finally, with a Cronbach’s Alpha score of 0.798, entrepreneurial self-efficacy demonstrates good internal consistency, showing a solid agreement among the questions testing individuals’ conviction in their talents within the entrepreneurial setting. These results show that the assessment scales utilized in this study are typically trustworthy and appropriate for capturing the many elements of the digital entrepreneurial environment, individual entrepreneurial education, innovative practices, entrepreneurial ambitions, and self-efficacy. This solid foundation of measurement reliability paves the way for the subsequent quantitative analysis, enabling a thorough examination of the relationships and hypotheses proposed in this research within the Saudi Arabian digital entrepreneurial ecosystem.

The composite reliability assesses the proportion of variation caught by the items within a construct (see figure 2), whereas the AVE assesses the proportion of variance captured by the items within a construct. Factor loadings for the construct of digital entrepreneurial behavior range between 0.598 and 0.753, signifying a high level of correlation between the items and the construct. The composite reliability for digital entrepreneurial activity is 0.827, indicating good internal consistency, and the AVE is 0.507, indica-

ting that its elements explain more than 50% of the variance in this construct. The factor loadings in the digital entrepreneurial ecosystem range from 0.500 to 0.846, indicating a reasonably strong connection between the items and the construct.

Figure 2
Estimated model



The entrepreneurial education construct demonstrates substantial factor loadings, with values ranging from 0.806 to 0.904, signifying a strong relationship between the items and the construct. The composite reliability for entrepreneurial education is outstanding at 0.904, showing high internal consistency, and the AVE is 0.760, indicating that this construct's components capture a considerable part of the variation. The construct of entrepreneurial intention has factor loadings ranging from 0.635 to 0.875, indicating a strong relationship between the items and the construct. The composite reliability is 0.910, suggesting good internal consistency, and the AVE is 0.672, indicating that the items explain a significant percentage of the variance in this construct. Factor loadings for entrepreneurial self-efficacy range from 0.704 to 0.760, indicating a moderate relationship between the items and the construct. The composite reliability is 0.773, signifying good internal consistency, and the AVE is 0.532, suggesting that a significant portion of the variance in this construct is accounted for by its items. Lastly, the entrepreneurial innova-

The composite reliability is high at 0.881, highlighting the reliability of the construct's measurement, and the AVE stands at 0.560, indicating that a substantial portion of the variance in this construct is accounted for by its items.

tion construct demonstrates substantial factor loadings, with values ranging from 0.628 to 0.809, signifying a strong relationship between the items and the construct. The composite reliability for entrepreneurial innovation is 0.793, reflecting good internal consistency, and the AVE is 0.563, indicating that a substantial proportion of the variance is captured by this construct's items. These findings collectively affirm the reliability and validity of the measurement scales used in the study, underscoring their suitability for examining the relationships and hypotheses within the Saudi Arabian digital entrepreneurial ecosystem.

Table 2 reports model fitness statistics, including Q^2_{predict} , RMSE (Root Mean Square Error), and MAE (Mean Absolute Error). These statistics are crucial for assessing the predictive performance of a model. The Q^2_{predict} value of 0.088 suggests that the model has some predictive ability, indicating that it can explain a proportion of the variance in the data. The RMSE of 0.063 represents the average prediction error, indicating how well the model's predictions align with the actual data, with lower values being more favor-

table. Additionally, the MAE of 0.076 represents the absolute average prediction error, providing another measure of prediction accuracy. While these statistics indicate some predictive capability in the model, it is essential to interpret the values

within the context of the specific research and its objectives. Further analyses and comparisons with other models or benchmarks are typically needed to evaluate the overall predictive performance comprehensively.

Table 2
Model fitness

| Q ² prediction | RMSE | MAE |
|---------------------------|-------|-------|
| 0,088 | 0,063 | 0,076 |

Table 3 shows the R-Square values for the model's major variables, revealing the proportion of variance in each construct that can be explained by the model. The R-Square values represent the model's goodness-of-fit for each variable. Digital entrepreneurial behavior has a significantly high R-Square of 0.617 in this table, indicating that the model explains a significant amount of the variance in this construct. This implies that the model captures and accounts for a considerable percentage of the diversity in digital entrepreneurial activity in the Saudi Arabian setting. Nevertheless, we find significantly lower R-Square

values when we examine entrepreneurial creativity, entrepreneurial intention, and entrepreneurial self-efficacy. These variables indicate that there is some limitation in the model's ability to explain the variance in these constructs, with R-Square values of 0.554, 0.066, and 0.139, respectively. This could suggest that additional external or unmeasured factors, not part of the model, could also have a major impact on these variables. In order to increase the model's ability to explain these constructs, more research and possibly the addition of new variables are required, as these R-Square values demonstrate.

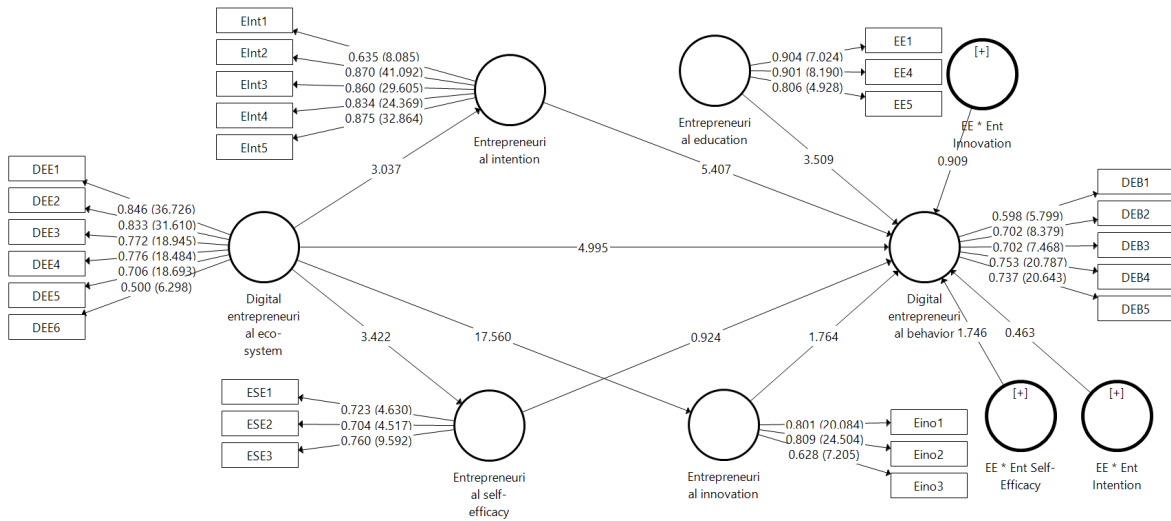
Table 3
R-Square

| Variable | R square |
|----------------------------------|----------|
| Digital entrepreneurial behavior | 0,617 |
| Entrepreneurial innovation | 0,554 |
| Entrepreneurial intention | 0,066 |
| Entrepreneurial self-efficacy | 0,139 |

A thorough summary of the route analysis results is given in Table 4, which also offers insights into the links and hypotheses that were investigated in the research. Each hypothesis is evaluated based on its original sample statistics, standard deviation, T statistics, and associated P-values. These statistics are vital in determining the significance and direction of the relationships in the model. H1, which posits that the digital entrepreneurial ecosystem significantly influences digital entrepreneurial behavior, shows a strong positive relationship with a T statistic of 5.034 and a highly significant P-value of 0.000. This

supports the hypothesis that the digital entrepreneurial ecosystem plays a substantial role in shaping entrepreneurial behavior in the context of the study. H2, focusing on the mediating role of entrepreneurial intention in the relationship between the digital entrepreneurial ecosystem and digital entrepreneurial behavior, exhibits a positive relationship with a T statistic of 3.032 and a significant P-value of 0.001. This result affirms that entrepreneurial intention serves as a mediating factor in connecting the ecosystem with entrepreneurial behavior (see figure 3).

Figure 3
Structural model



H3, which relates to the mediating role of entrepreneurial innovation, has a negative connection with a T statistic of 1.856 and a P-value of 0.032. This indicates that entrepreneurial innovation does play a mediating role in this relationship, but the negative sign of the association warrants additional examination. The hypothesis H4, which claims that entrepreneurial self-efficacy mediates the association between the digital entrepreneurial environment and digital entrepreneurial activity, demonstrates a positive relationship with a T statistic of 1.112 and a P-value of 0.133. Although not statistically significant, it indicates a favorable influence, suggesting that entrepreneurial self-efficacy may have a role, albeit not as much as expected. H5, H6, and H7 focus on the moderating role of entrepreneurial education. With T statistics of 1.850 and 0.459, respectively, and corresponding P-values of 0.323

and 0.032, H5 and H7 show negative correlations. This implies that the correlations are moderated by entrepreneurial education, with H7 showing a more pronounced influence. With a T statistic of 0.919 and a P-value of 0.179, H6, on the other hand, demonstrates a favorable link but is not statistically significant, despite having a beneficial impact. The statistical results for each hypothesis are summarized in Table 8, providing insight into the importance and strength of the linkages between the digital entrepreneurial environment, self-efficacy, education, intention, innovation, and digital entrepreneurial behavior. These findings contribute to a nuanced understanding of the complex dynamics within the Saudi Arabian digital entrepreneurial ecosystem, enabling researchers and practitioners to make informed decisions and interventions in this context (refer to Table 4).

Table 4
Path analysis

| | Original Sample | Standard Deviation | T Statistics | P Values |
|--|-----------------|--------------------|--------------|----------|
| H1. Digital entrepreneurial ecosystem significantly influences the relationship of digital entrepreneurial behavior. | 0,502 | 0,100 | 5,034 | 0,000 |
| H2. Entrepreneurial intention significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. | 0,151 | 0,050 | 3,032 | 0,001 |
| H3. Entrepreneurial innovation significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. | -0,122 | 0,066 | 1,856 | 0,032 |
| H4. Entrepreneurial self-efficacy significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. | 0,041 | 0,037 | 1,112 | 0,133 |
| H5. Entrepreneurial education significantly moderates the relationship of digital entrepreneurial ecosystem and entrepreneurial intention. | 0,041 | 0,089 | 0,459 | 0,323 |
| H6. Entrepreneurial education significantly moderates the relationship of digital entrepreneurial ecosystem and entrepreneurial innovation. | 0,032 | 0,035 | 0,919 | 0,179 |
| H7. Entrepreneurial education significantly moderates the relationship of digital entrepreneurial ecosystem and entrepreneurial self-efficacy. | -0,143 | 0,077 | 1,850 | 0,032 |

Integrating insights from expert interviews and statistical survey analysis, the study comprehensively examines factors impacting digital entrepreneurial behavior, intentions, creativity, self-confidence, and the role of entrepreneurial education. The qualitative phase, through expert interviews, provided valuable insights into the functioning of Saudi Arabia’s digital entrepreneurship ecosystem, emphasizing its critical role in shaping tactics, practices, and behaviors (Ratten and Usmanij, 2021). The unique nature of the Saudi ecosystem, influencing technological aspects, business models, and customer engagement strategies, aligns with the notion that local contexts significantly impact entrepreneurial adaptation (Yousaf *et al.*, 2021).

Expert interviews highlighted the importance of entrepreneurial intention, bridging the gap between ecosystem opportunities and actual behavior, echoing prior research on its pivotal role (Distanont and Khongmalai, 2020). The mediating role of entrepreneurial innovation, critical for entrepreneurial success (Wang *et al.*, 2021), and the significant impact of entrepreneurial educa-

tion on equipping individuals with necessary knowledge and skills align with existing literature (Martínez-Gregorio *et al.*, 2021).

Quantitative analysis supported hypotheses, confirming the substantial impact of the digital entrepreneurial ecosystem on behavior (H1) and its mediation by entrepreneurial ambition (H2). While the unexpected negative correlation in the mediating influence of entrepreneurial innovation (H3) requires further exploration, a positive but statistically non-significant association supported the mediating role of entrepreneurial self-efficacy (H4). The moderating influence of entrepreneurial education (H5, H6, H7) showed mixed findings, indicating varying strengths of the moderating effect.

Conclusions

This study presented a thorough evaluation of the digital entrepreneurial ecosystem in the Kingdom of Saudi Arabia, incorporating insights from both qualitative expert interviews and quantitative studies. The study has helped us better understand the complex factors that shape digital

entrepreneurial behavior, intentions, innovation, self-efficacy, and the transformative significance of entrepreneurial education in this setting. The findings demonstrate the importance of the digital entrepreneurial ecosystem in directing entrepreneurial actions and behaviors, highlighting the importance of local ecosystems in developing digital entrepreneurship. Furthermore, the findings highlight the significance of entrepreneurial ambition and innovation as mediating elements in linking the digital entrepreneurial ecosystem to entrepreneurial behavior.

Digital entrepreneurial ecosystem significantly influences digital entrepreneurial behavior. The behavior of digital entrepreneurs is significantly influenced by the digital entrepreneurial ecosystem, which, through its effects on resource accessibility, technological infrastructure, regulatory frameworks, collaboration opportunities, market dynamics, cultural attitudes, talent availability, and global connectivity, plays a crucial role in shaping their strategies and actions. In an enabling ecosystem, entrepreneurs are more inclined to display innovative, adaptive, and growth-oriented behavior, capitalizing on the favorable conditions to pursue ambitious ventures and navigate challenges effectively. Entrepreneurial intention significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. Entrepreneurial intention plays a pivotal role as a mediator in connecting the digital entrepreneurial ecosystem with digital entrepreneurial behavior. It achieves this by aligning objectives with actions, serving as a source of motivation, impacting the inclination towards risk-taking, directing decision-making processes, molding the utilization of resources, enabling adaptive responses to changes in the ecosystem, fostering a commitment to long-term goals, and functioning as a precursor to entrepreneurial actions.

Entrepreneurial innovation significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. Entrepreneurial innovation plays a crucial role as a mediator in connecting the digital entrepreneurial ecosystem with digital entrepreneurial behavior. It serves as a catalyst for change, directs the effective utilization of technological resources, propels market differentiation, elevates problem-solving

capabilities, promotes disruptive strategies, advocates for agility and adaptability, facilitates value creation, harnesses collaboration opportunities, and cultivates a culture that embraces risk-taking and experimentation. Entrepreneurial self-efficacy significantly mediates the relationship of digital entrepreneurial ecosystem and digital entrepreneurial behavior. Entrepreneurial self-efficacy influences digital entrepreneurial behavior by instilling confidence in individuals. When entrepreneurs believe in their ability to navigate the challenges of the digital ecosystem, they are more likely to take proactive steps, make decisions, and engage in entrepreneurial activities. Entrepreneurial education significantly moderates the relationship between digital entrepreneurial ecosystem and entrepreneurial intention. Entrepreneurial education equips individuals with a better understanding of the digital entrepreneurial ecosystem. This heightened awareness enables them to recognize and interpret opportunities within the ecosystem, influencing the strength of their entrepreneurial intentions.

Entrepreneurial education not only imparts knowledge but also develops practical skills necessary for entrepreneurial endeavors in the digital realm. Individuals with enhanced skills may feel more confident and capable of translating opportunities within the digital entrepreneurial ecosystem into concrete entrepreneurial intentions. Entrepreneurial education often addresses risk perception and management. Individuals who have undergone entrepreneurial education may approach the uncertainties within the digital entrepreneurial ecosystem with a more informed and strategic mindset, influencing their willingness to take entrepreneurial initiatives. Entrepreneurial education significantly moderates the relationship between digital entrepreneurial ecosystem and entrepreneurial innovation. Entrepreneurial education significantly moderates the relationship between digital entrepreneurial ecosystem and entrepreneurial self-efficacy. Entrepreneurial education may foster networking skills and collaboration abilities. Entrepreneurs with a strong network and collaborative mindset may be more adept at leveraging opportunities within the digital entrepreneurial ecosystem, thereby influencing their intentions to engage in entrepreneurial activities.

The study makes theoretical contributions by enhancing understanding of the Saudi Arabian digital entrepreneurial ecosystem, emphasizing entrepreneurial intention and innovation as mediating elements. Another contribution that this study makes is the boundary condition of entrepreneurial education. It is important to understand the role of moderators while exploring ecosystems and this study suggests that one such moderator is entrepreneurial education. Practical implications suggest the need for tailored educational programs to support digital entrepreneurs and inform strategic decisions for governments and entrepreneurs. Insights into the significance of digital entrepreneurial elements provide a basis for advancing the global digital economy. Policy should focus on fostering entrepreneurial education and providing support for innovation so that new businesses can survive in the ecosystem.

Limitations of this study include the narrow focus on Saudi Arabia, limiting generalizability. Future research should conduct comparative studies across diverse entrepreneurial settings globally. Measurement challenges suggest the need for improvements in scales for variables such as entrepreneurial innovation and self-efficacy. Expanding geographical reach for comprehensive knowledge and further investigating the impact of entrepreneurial education are recommended. Investigating factors influencing entrepreneurial innovation and self-efficacy offers promising avenues. Given ongoing changes in the digital ecology, it is essential to track and evaluate the digital entrepreneurial landscape over time.

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