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Impact of Ecological Innovation, Entrepreneurial Mindset, and Green Entrepreneurial Orientation on Entrepreneurial Self-Efficacy and Digital Entrepreneurial Intention in the Context of Saudi Arabia

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ABSTRACT

This study conducts an examination of the impact of ecological innovation, entrepreneurial mindset, and green entrepreneurial orientation on entrepreneurial self-efficacy and digital entrepreneurial intention in the context of Saudi Arabian. Green entrepreneurial orientation enhances entrepreneurial self-efficacy and supports business models committed to advancing models of sustainable innovation, digitally enabled by technologies that are in line with national environmental and economic objectives. The insights offer valuable directions for policymakers, educators, and support organizations aiming to advance sustainable digital entrepreneurship in Saudi Arabia, emphasizing a holistic approach that combines ecological innovation, strategic green focus, and enabling digital capabilities to foster entrepreneurial self-efficacy and intention. The findings provide important implications for policymakers, educators, and support organizations seeking to promote sustainable digital entrepreneurship in Saudi Arabia through a comprehensive approach by integrating ecological innovation, strategic green orientation, and facilitating digital capabilities that encourage entrepreneurial self-efficacy and intention

1. Introduction

Saudi Arabia is at a pivotal moment in its social and economic development, as focused efforts to reduce the Kingdom's dependence on oil have begun under Vision 2030. This initiative aims to build a more diverse, sustainable, and technologically driven economy [27]. This ambitious national blueprint aims to unleash new growth and innovation, building a knowledge-based economy through responsible environmental stewardship. In this visionary framework, it becomes a priority to cultivate an environmentally sustainable entrepreneurship ecosystem in Saudi Arabia. This is based on the eco-innovation-entrepreneurial mindset, green entrepreneurial orientation, entrepreneurial self-

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efficacy, and digital entrepreneurial intent relationships [14]. The intersection of these dimensions shapes Saudi entrepreneurs' involvement in emerging green opportunities, their confidence to innovate, and digital technologies utilization for sustainable enterprise development [13].

At its root, ecological innovation is the development and subsequent application of new ideas, processes, products, or services that would impact less on the environment and improve resource productivity [6]. For Saudi Arabia, ecological innovation goes beyond technological renovations to systemic change in keeping with global sustainability needs. Ecological innovation is central to advancing clean energy, waste avoidance, circular economy principles, and sustainable urbanization in the business world, especially as Saudi Arabia works to meet international environmental obligations and shrink its carbon footprint [40]. Illustratively, some of the national mega-projects such as NEOM, The Line, or the Red Sea Development demonstrate how ecological innovation is geared to be integrated within futuristic smart cities that are almost completely dependent on renewable energy along with heavy use of AI and digital infrastructure [19]. Real challenge is to get entrepreneurs to think systems-wide regarding ecological sustainability (which equals economic sustainability) and all the creativity this will probably unleash in dealing with environmental challenges given the jobs required as we access some expanding market criteria of green products [26]. More closely related is the entrepreneurial mindset, a psychological and behavioral attitude that prepares individuals to observe, assess, and capture opportunities in an unpredictable environment. In a Saudi economy changing rapidly, leading towards green and digital poles it is impossible to succeed without the entrepreneurial mind that treasures innovation in performance, ability to adapt, take risks, and be proactive [23]. Entrepreneurs with a mindset like this are more likely to view environmental problems as business opportunities than hindrances. They demonstrate adaptive capacity and strategic foresight, which would prove invaluable in order to address the challenges that come along with innovating ecologically in an economy previously reliant on oil [47].

The Vision 2030 of Saudi Arabia speaks clearly to the need for a conducive entrepreneurial ecosystem, supported by building human capital and installing enabling ecosystems that foster such mindsets [57]. With a greater understanding of how these cognitive traits influence behavior, entrepreneurship education, incubators, and accelerators, as well as government support programs, have turned their attention to trying to promote an entrepreneurial mindset, as this way of thinking can serve almost anyone with an idea and the means to implement it at the grassroots level. In this context, the consideration of green entrepreneurial orientation in Saudi Arabia seems particularly pertinent as the government continues to introduce a broad range of incentives and regulatory frameworks, while market demand is getting stronger for more sustainable means [22]. Entrepreneurs who adopt this orientation are more than simply responding to policy signals; they are leading and advocating for environmental sustainability in their own strategic vision. This spirit of proactiveness is fitting with global sustainability trends and would be further supported by the reputation capital internationally that Saudi entrepreneurs could build themselves up as pioneers in green innovation. It cultivates a stronger, more direct link with consumer demand for sustainable brands [9].

In Saudi Arabia, a country with a supportive but challenging entrepreneurship ecosystem where government support is strong, entrepreneurial self-efficacy plays an even larger role in predicting the likelihood of venture creation and persistence as it appears that regulatory barriers, social norms, and market uncertainties are plentiful. This self-efficacy to start-up relationship shows a strong and positive correlation with both increased levels of entrepreneurial intentions and actual start-up activities [33]. Saudi entrepreneurs who have a strong sense of self-efficacy are more interested in environmentally focused innovation, using digital technology, and continuing to operate after experiencing failure. This said, given the socio-cultural background of Saudi Arabia that values career

stability nesting in its fabric, it is important for any educational and support programs to be geared towards normalizing entrepreneurship within the heart of this society by promoting entrepreneurship as a probable future career as well as an area focus in enhancing entrepreneurial self-efficacy [24]. The interrelationships between ecological innovation and entrepreneurial mindset, green entrepreneurial orientation, entrepreneurial self-efficacy and digital entrepreneurial intention, suggests a dynamic model based to understand entrepreneurship in Saudi Arabia. Ecological innovation is the natural manifestation of the "what" and "why" sustainable business imperatives. The psychological and cognitive "how" that powers opportunity recognition and pursuit under uncertainty is provided by the entrepreneurial mindset [46]. Such entrepreneurial orientation is a translation of the strategic commitment to environmental practices. The confidence and persistence needed to bring green entrepreneurial ambitions to light stem from entrepreneurial self-efficacy that provides a foundation for digital entrepreneurial intention as an instrumental focus on technology-driven business formation [46]. It requires educators to conduct curricular reforms that introduce ecological and digital entrepreneurship early in entrepreneurial education. This understanding reinforces the importance for entrepreneurs to develop adaptive mindsets, in combination with ecological innovation and digital tools, in response to competition, sustainability requirements, and global market dynamics [42].

In conclusion, the ecosystem that Saudi Arabia provides for its venture ambitions is on a fast pace of evolution, wherein ecological innovation, entrepreneurial mindset, and green entrepreneurial orientation conduct jointly impact upon entrepreneurial self-efficacy and digital entrepreneurship intention. These factors together affect the perception of entrepreneurs and utilization of opportunities for sustainable development, combining the technology blended with environmental goals [2]. Examining how they interact with the distinct socio-economic and cultural factors in Saudi Arabia should help identify frameworks to support robust digital entrepreneurship on local terms, enabling success from economic diversification locally and positioning itself as a major global actor in innovative green digital business. As such, the future of entrepreneurship in Saudi Arabia is anthropogenic, a convergence of ecology, innovation, and mindset transformation enabled by digital [34].

2. Literature Review

2.1 Theoretical Underpinnings

To explore theoretically the impact of ecological innovation, entrepreneurial mindset, and green entrepreneurial orientation on entrepreneurial self-efficacy and digital entrepreneurial intention in Saudi Arabia, Social Exchange Theory (SET) provides an effective lens for examination [31]. SET assumes that social behavior is an exchange process in which individuals view relationships in terms of costs and benefits. Ecological innovation, mindset, and green orientation can also be specified as resources being exchanged in the networks and ecosystems of entrepreneurs [62]. The ecological innovation and green practices delivered to society from the entrepreneurial side are accompanied by returns such as perceived favorable image, market opportunities of the consumers, and the shareholders' support, which enhances individual entrepreneurs' new venture initiation confidence to enhance their self-belief entrepreneurial self-efficacy [38]. While entrepreneurial mindset with risk orientation and adaptability is promoted by mutual knowledge sharing, mentorship, and continuous support to the circles of the entrepreneurship community, it ultimately leads to increasing intention of participating in digital ventures. The theory highlights the circular process in these interactions entrepreneurs deliver sustainable and innovative actions which, at the same time that are rewarded by social and economic gains, strengthen their self-efficacy beliefs, reinforcing

digital entrepreneurial intentions [58]. Understanding the relationship between entrepreneurs, policy, and platforms in Saudi Arabia with an emphasis on sustainability and technology transformation as outlined by Vision 2030, SET illustrates how the symbiotic interactions that exist among entrepreneurs, government policies, and digital ecosystems can amplify a virtuous cycle reinforcing green digital entrepreneurship bolstered by greater confidence to innovate [3].

2.2 Ecological Innovation

Ecological innovation plays a critical role in shaping entrepreneurial self-efficacy and digital entrepreneurial intention in Saudi Arabia's growing entrepreneurial ecosystem. With the Kingdom making headway with Vision 2030, ecological innovation is now seen as a key force transitioning towards financially viable business models in line with other program areas and environmental sustainability objectives [40]. It includes developing and deploying new green technologies, practices, and products to reduce the adverse effects of human activity on the environment and improve resource efficiency. These kinds of developments create new business opportunities for entrepreneurs, which in turn encourage entrepreneurs to develop the self-assurance and skills necessary to operate in a green manner increasing their entrepreneurial self-efficacy enabling them confidently execute entrepreneurship activities [32].

These entrepreneurs engaging ecological innovations tend to identify both environmental problems and natural opportunities with which they co-evolve, crucial for digital entrepreneurship orientations development. Saudi Arabia is among the fastest-growing digital ecosystem countries, and in this context, ecological innovation is increasingly being coupled with digital entrepreneurship enabling scalable and efficient green ventures with the help of various technologies that the Kingdom has access to [30].

Additionally, Saudi Arabia's policy incentives, knowledge-sharing culture, and rapidly rising market demand for sustainable solutions enable further ecological innovation in the green sector [49]. All these factors each increase the effectiveness of entrepreneurial self-efficacy that makes entrepreneurs more knowledgeable and motivated enough to innovate and sustain their businesses during environmental and economic changes. As such, ecological innovation helps to promote entrepreneurial confidence and digital entrepreneurship intention as well, making Saudi Arabia a leading global player in sustainable entrepreneurship [36].

H1: Ecological innovation significantly impacts entrepreneurial self-efficacy.

2.3 Entrepreneurial mindset

In this fast-evolving entrepreneurial landscape of Saudi Arabia, the role of the entrepreneurial mindset is critical; both for developing entrepreneurial self-efficacy and digital entrepreneurial intention. This includes all attitudes, cognitive structures, and behavioral types like curiosity, being proactive, risk-taking, and adaptability that allow someone to see business opportunities where other people are not seeing them in periods of higher levels of uncertainty [18].

The adoption of digital technologies into business models is prompted by an entrepreneurial mindset, and such prompts may augment digital entrepreneurial intention. Thus, Saudi Arabia is investing heavily in digital infrastructure as well as supportive policy for entrepreneurship and entrepreneurs who are more inclined to use digital platforms and tools for innovative, sustainable scale. The mindsets and self-efficacy along with digital intention aligns well to coincide with the Kingdom's shift towards a knowledge economy, creating an environment where young

entrepreneurs feel empowered and are motivated to engage in more digitally driven and sustainable entrepreneurial activities [2].

Saudi Arabia-based empirical studies, however, emphasize the necessity of educational programs and enabling environments in fostering an entrepreneurial mindset that acts as driving forces behind any knowledge and resources to be translated into entrepreneurial intentions and activities. The results also point to likely considerations due to gender differences in the influence of entrepreneurial mindset and self-efficacy on their intention, indicating that interventions might need to be adapted [55]. Entrepreneurial mindset, in sum, constitutes the underlying psychological and behavioral functions that support the structure of these elements, enhancing entrepreneurial self-efficacy and digital entrepreneurial intention, manifesting a strong influence on Saudi Arabia's objectives in reframing entrepreneurship towards sustainability and technology adoption conferences [21].

H2: An entrepreneurial mindset has a significant impact on entrepreneurial self-efficacy.

2.4 Green Entrepreneurial Orientation

In Saudi Arabia's entrepreneurial ecosystem, Green Entrepreneurial Orientation (GEO) proved to have the significant influence on entrepreneurial self-efficacy and digital entrepreneurial intentions. GEO stands for green entrepreneurial orientation and indicates the entrepreneur's strategic focus on environmental sustainability through eco-friendly practices, continuous innovation towards green products/services and sustainable development commitment [9]. In Saudi Arabia, this orientation is heavily in line with the nation's Vision 2030 agenda around economic diversification through sustainable and innovation-led entrepreneurial activity. By doing that, GEO is stimulating entrepreneurs to actively investigate and perform upon green market opportunities, embodying not only environmental responsibility but also differentiation as a competitive advantage [11].

Entrepreneurs adopting GEO are more likely to enhance their entrepreneurial self-efficacy the belief in their ability to create and manage ventures oriented towards the environment. This effectiveness is further enhanced with the support of enabling institutions in Saudi Arabia, like government policies and incentives that encourage clean energy, waste reduction, and sustainability standards that reduce the barriers of green entrepreneurship as well as provide green entrepreneurs with resources tailored to their needs [22]. This confidence enables entrepreneurs to endure the uncertainties of the newness of the fields in which they operate and know that it will be worth it even if what they do proves impossible itself [12].

The advanced digital infrastructure and the new environment of fostering digital innovation in Saudi Arabia provide a fertile ground for green tech entrepreneurs to introduce sustainable and eco-friendly digitally enabled solutions and services [7]. This synergy makes businesses by digital entrepreneurs more willing to utilize digital platforms and tools for growth in a sustainable way and hence merges environment and technology innovation.

Green entrepreneurial orientation in this context serves as a strategic and psychological underpinning for enhancing the entrepreneurial self-efficacy, which engenders digital entrepreneurial intention that in turn facilitates the transformation of Saudi Arabia toward a sustainable and digital economy [41].

H3: Green entrepreneurial orientation has a significant impact on entrepreneurial self-efficacy.

2.5 Entrepreneurial self-efficacy

Within the context of Saudi Arabia, entrepreneurial self-efficacy (ESE) significantly impacts digital entrepreneurial intention being central to the construct of mental readiness that determines an individual's confidence in their capacity to execute entrepreneurial tasks successfully [33]. Entrepreneurial self-efficacy, in the context of Saudi Arabia's changing economic landscape, is significantly influenced by Vision 2030 objectives for diversification and digital transformation. It has a positive relationship with the intentions of starting up new ventures among prospective entrepreneurs. High self-efficacy in individuals increases entrepreneurship intention. This factor means faith in one's abilities to meet challenges, take risks, and mobilize resources; therefore, it is a direct antecedent of an entrepreneurship culture. Such confidence is paramount in a country where entrepreneurship is slowly but certainly emerging as an equally, if not more, secure career option than regular 9 to 5 jobs, especially among the youth and womenfolk [22].

The combined impact of self-efficacy and digital intention signals a willingness to adapt in a world navigating through social transformation and economic change. In addition, entrepreneurial self-efficacy is a mediator between different psychological preconditions including risk propensity, internal locus of control, and self-confidence and entrepreneurial intention [8]. Studies shows that in Saudi Arabia, these psychological variables are quite weak to produce strong entrepreneurial intention without being combined with a great sense of self-efficacy. This underscores the importance of creating environments that develop the skills, reduce fear of failure, and increase experiential learning for self-efficacy [4]. Gender differences in the relationship between entrepreneurial self-efficacy and entrepreneurial intentions is also established to enhance the effectiveness of specific methods for diverse entrepreneur groups. Overall, entrepreneurial self-efficacy represents a foundational element for both general and digital entrepreneurial intentions within Saudi Arabia's socio-economic transformation towards a knowledge-based, innovative economy [54].

H4: Entrepreneurial self-efficacy significantly impacts digital entrepreneurial intention.

3. Methodology

The methodology for this study employs a quantitative research design to examine the impact of ecological innovation, entrepreneurial mindset, and green entrepreneurial orientation on entrepreneurial self-efficacy and digital entrepreneurial intention in Saudi Arabia. Data were collected using a structured survey questionnaire from 200 SMEs in Saudi Arabia, who were selected through purposive sampling. The survey instrument comprised validated scales in the context of Saudi Arabia and measured constructs based on ecological innovation, an entrepreneurial mindset, green entrepreneurial orientation, entrepreneurial self-efficacy, and digital entrepreneurial intention. Statistical techniques were used to analyze the collected data to assess relationships between the variables, ensuring a valid and reliable examination of the theoretical model behind Saudi Arabia's Vision 2030 and sustainability aspirations within Saudi Arabia's unique socio-economic environment. The proposed model of study is depicted in Figure 1.

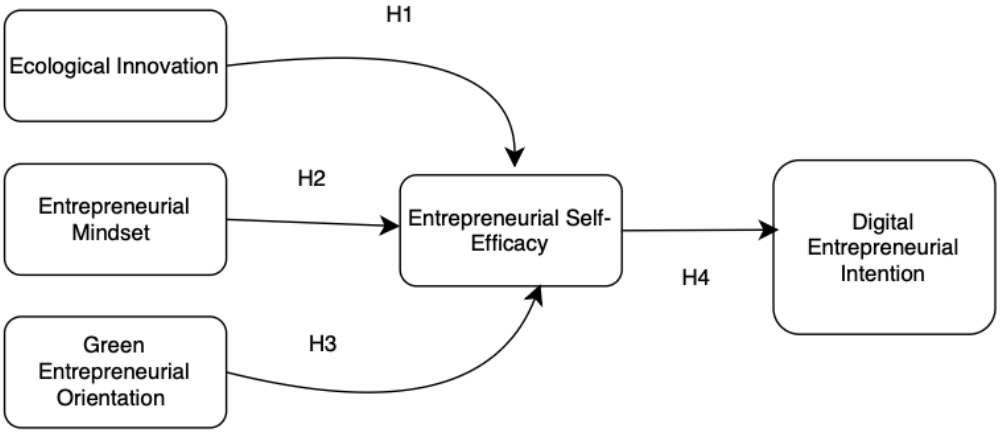

Fig. 1. The proposed model

4. Results

To evaluate the model using Smart PLS, convergent validity, internal consistency, and discriminant validity were verified. Convergent validity was measured by examining the average variance extracted (AVE) and the outer loadings of the indicators. Internal consistency was confirmed through composite reliability (CR) values. Initial steps included evaluating the convergent validity of the variables, which shows the degree to which multiple indicators of a construct converge, sharing a high proportion of variance. This was measured primarily by AVE, with a threshold of 0.5 for acceptable convergence values. Furthermore, the AVE values exceed 0.5, thereby confirming sufficient convergent validity. Moreover, factor loadings, demonstrating the correlation between the items and respective constructs, surpassed the minimum threshold of 0.5, supporting the convergent validity.

The study also examined internal consistency, which scales the homogeneity of items for each construct. Composite reliability values ranged above the accepted minimum thresholds of 0.6 to 0.7, demonstrating strong reliability and consistency of the measurement scales. In general composite reliability values between 0.6 and 0.9 are considered acceptable. The measurement model of the study is illustrated in Table 1.

Table 1
The measurement model

		Loadings	Cronbach's alpha	Composite reliability	Average variance extracted
Ecological Innovation			0.925	0.928	0.769
	EI 1	0.857			
	EI 2	0.913			
	EI 3	0.866			
	EI 4	0.867			

	EI 5	0.882			
Entrepreneurial Mindset			0.861	0.888	0.781
	EM 1	0.864			
	EM 2	0.901			
	EM 3	0.886			
Green Entrepreneurial Orientation			0.824	0.829	0.598
	GEO 1	0.809			
	GEO 2	0.855			
	GEO 3	0.562			
	GEO 4	0.743			
	GEO 5	0.858			
Entrepreneurial Self-Efficacy			0.937	0.939	0.798
	ESF 1	0.926			
	ESF 2	0.89			
	ESF 3	0.875			
	ESF 4	0.907			
	ESF 5	0.868			
Digital Entrepreneurial Intention			0.857	0.878	0.698
	DEI 1	0.872			
	DEI 2	0.778			
	DEI 3	0.885			
	DEI 4	0.803			

Discriminant validity in the study was examined using the heterotrait-monotrait (HTMT) ratio. Discriminant validity confirms if a construct is truly distinct from other constructs within the model. Although literature does not suggest a universally agreed-upon threshold for discriminant validity, most of scholars agree that an HTMT value of 0.90 or below is deemed desirable and acceptable and the outcomes are highlighted in Table 2.

Table 2
HTMT value

	Digital Entrepreneurial Intention	Ecological Innovation	Entrepreneurial Mindset	Entrepreneurial Self-Efficacy	Green Entrepreneurial Orientation
Digital Entrepreneurial Intention					
Ecological Innovation	0.802				
Entrepreneurial Mindset	0.578	0.631			
Entrepreneurial Self-Efficacy	0.786	0.886	0.515		
Green Entrepreneurial Orientation	0.794	0.64	0.526	0.617	

The results of investigation on the influence of ecological innovation, entrepreneurial mindset, and green entrepreneurial orientation on entrepreneurial self-efficacy and digital entrepreneurial intention in Saudi Arabia suggest additional insights into such relationships, including one remarkable finding; that is, where it was unexpectedly found that there was no significant relationship among entrepreneurial mindset and entrepreneurial self-efficacy as depicted in Table 3.

Table 3
Hypotheses of Study

		Original sample	Sample mean	Standard deviation	T statistics	P values	Decision
H1	Ecological Innovation -> Entrepreneurial Self-Efficacy	0.768	0.765	0.049	15.734	0	Significant
H2	Entrepreneurial Mindset -> Entrepreneurial Self-Efficacy	-0.014	-0.013	0.047	0.301	0.763	Insignificant
H3	Green Entrepreneurial Orientation -> Entrepreneurial Self-Efficacy	0.123	0.127	0.049	2.524	0.012	Significant
H4	Entrepreneurial Self-Efficacy -> Digital Entrepreneurial Intention	0.722	0.725	0.032	22.223	0	Significant

Ecological innovation becomes a robust and strong predictor of entrepreneurial self-efficacy and digital entrepreneurship intention. The ambitious targets set as part of Saudi Arabia's Vision 2030

initiative, including the aim to derive half of its electricity from renewable resources by 2030, are fostering the progress and adoption of green technologies and eco-friendly business practices [29]. Entrepreneurs involved in ecological innovation enjoy direct support from institutions and policy interventions related to green technology markets, leading them to believe that they are capable of creating sustainable startups. This external push, along with real opportunities, seems to be a strong foundation for entrepreneurial courage and effort in implementing digital into business models [60]. Within the socio-political ecosystem in Saudi Arabia, with a firm commitment to sustainability and green industries, this offers fertile ground where ecological innovation is in line with national priorities, thus enhancing the entrepreneurial self-efficacy by producing tangible returns and stakeholder acceptance. It is this relationship between ecological innovation and entrepreneurial confidence which is key in altering the traditional thought process of businesses towards sustainability [39].

Conversely, the no significant association between an entrepreneurial mindset and entrepreneurial self-efficacy hints at an interesting counter-theoretical assumption. Traditionally, an entrepreneurial mindset, defined by innovativeness, proactiveness, risk-taking, and adaptability to changes, is believed to strengthen entrepreneurs' self-efficacy in pursuing opportunities [10]. On the other hand, this means that having a general entrepreneurial mindset would not be enough to increase self-efficacy in a Saudi context without favorable contextual conditions like institutional support, cultural approbation, or real-life positive experiences. In the Kingdom, however, entrepreneurship is still being institutionalized as a mainstream career option, and traditional employment has been the route of choice for many years and so even if entrepreneurial attitudes do translate into a willingness to start entrepreneurial businesses, this still does not necessarily equate with confidence in becoming an entrepreneur [45]. Likewise, perceived barriers due to greater regulatory complexity or evolving market conditions or social norms may inhibit the movement from mindset through to self-efficacy and warrant more tangible enabling mechanisms. This gap highlights the need to situate psychological constructs, i.e., mindset, in socio-economic contexts and implies that though fostering a certain type of mindset may help an entrepreneur overcome their low confidence towards being an entrepreneur, such interventions equally need ecosystem development support to create a more conducive environment for building entrepreneurs' self-efficacy [24].

On the other hand, green entrepreneurial orientation has a significant positive influence on entrepreneurial self-efficacy and digital entrepreneurial intention. The national green growth strategy and the emerging market for greenness is an increasingly key driver of a strategic approach to the profitability of environmental business sustainability [5]. Entrepreneurs are well aligned with governmental initiatives, expanding consumers' needs for green products and legitimation in the market. This combination of external affirmations with internal tactical commitment is probably enhancing self-efficacy through concrete pathways for venture success and differentiation [30]. Additionally, this orientation not only affects confidence in green entrepreneurial activities but also motivates the adoption of digital technologies as facilitators of environmental innovations. The Kingdom's fast-growing digital infrastructure (AI, 5G, Cloud Computing) establishes the foundation on which digitally enabled green entrepreneurship can flourish while supporting scaling operations, improving back-office efficiency, and customer engagement [36]. Thus, in the digital economy, green entrepreneurial orientation stands on the immediate relation between environmental values digital entrepreneurship bolstering the intentionality of digital proactive actions for sustainability [26].

The ripple effect on digital entrepreneurial intention seems to be an interesting point of this study. Ecological innovation and green entrepreneurial orientation are linked to a mindset, a self-assuredness that makes entrepreneurs go digital [16]. In light of Saudi Arabia's rapid digitization and huge investment in high technology, digital entrepreneurship is ideally placed to innovate across a

range of sectors, including smart energy, circular economies, and sustainable services. The digital entrepreneurial intention here is receptive to the use of technology not only for economic benefits but also for promoting environmental stewardship, representing what we suggest as a sustainable and digital innovative entrepreneurial paradigm [44]. Entrepreneurs with high self-efficacy are more likely to continue seeking solutions, developing and brainstorming new market opportunities for them incorporate digital solutions as a competitive advantage [56].

The results of the study have important practical and policy implications for the Saudi entrepreneurial ecosystem. First, the development of entrepreneurial self-efficacy should center around practical experiences from the engagement with green business practices and ecological innovation, as these have the most positive effect on confidence and intention [26]. This will involve incentivizing the creation of new sustainable businesses, including offering training in green technologies and facilitating access to networks and funding for eco-innovation. Second, although nurturing an entrepreneurial mindset is a key element of transformation, it must also be accompanied by structural enablers that translate mindset into confidence to act such as mentorship, market exposure, simplified regulation, and the creation of success stories about green entrepreneurs that challenge cultural perceptions about entrepreneurship [2]. A double-pronged approach of development plus ecosystem strengthening is needed as well. Digital technologies must remain an integral part of ecological and green entrepreneurship, with a focus on public sector investments in infrastructure access, digital skills training, and innovation hubs designed to help synergize green goals with digital enablement [20].

5. Implications of The Study

5.1 Theoretical Implications

Firstly, the study contributes to broader theoretical guidance and insights regarding the key role of ecological innovation as more than a technical/operational factor but also as an important enabler of entrepreneurial confidence and intention, particularly in sustainable contexts. Ecological innovation can be somewhat of a spark plug for boosting entrepreneurial self-efficacy as it offers real options and institutional endorsement, while also riding alongside national sustainability targets such as those embedded within Saudi Arabia's Vision 2030 [59]. In doing so, it extends the literature on entrepreneurial self-efficacy to highlight the role of context-specific ecological innovations. Secondly, findings problematize prevalent assumptions lying within entrepreneurial mindset theories, for merely possessing an entrepreneurial mindset is inadequate to considerably increase one's entrepreneurial self-efficacy in certain socio-cultural and institutional settings such as Saudi Arabia. This nuance contributes to theoretical advancement by demonstrating the bounds of psychological constructs divorced from ecosystem realities. Overall, these findings suggest that, though entrepreneurial mindset traits like innovativeness and risk-taking are important for entrepreneurs, they may need structural and contextual support like policy frameworks, resource opportunity structures, and socio-cultural validation to translate into concrete entrepreneurial confidence [37]. Thirdly, green entrepreneurial orientation (GEO), a powerful theoretical construct that connects strategic intent and psychological empowerment. The great potential influences of GEO on both entrepreneurial self-efficacy and digital entrepreneurial intention highlight its strategic posture in influencing internal beliefs with external actions toward sustainability goals on the side of entrepreneurs [37]. From the perspective of theory, GEO is considered an environmental value and a strategic asset that will certainly improve the loyalty and support among stakeholders with boosted confidence and willingness to digitally innovate [61]. These findings contribute to the theory on entrepreneurial orientation with a more thorough knowledge of value-based strategic orientations

as well as what motivates them in green entrepreneurship. Fourthly, entrepreneurship theory development can ably forge deep, multiple-layered theoretical frameworks incorporating environmental, psychological, as well as technical dimensions of entrepreneurial behavior simultaneously by integrating ecological innovation GEO driven decision making digital entrepreneur intention nexus significantly [28].

Taken together, this analysis extends entrepreneurship theory by locating ecological innovation and green strategies as situational antecedents affecting entrepreneurial self-efficacy and digital intentions in a specific socio-economic and cultural background [38]. These finding questions the generalizability of entrepreneurial mindset on self-efficacy and underlines the importance of enabling institutional environments. This study extends the strategic embodiment of green entrepreneurial orientation as an imperative cognitive-practical anchor in sustainable and digital entrepreneurship. These theoretical implications underscore the need for more integrative, context-specific, and sustainability-focused models of entrepreneurship that are capable of explaining and advising on entrepreneurial behaviors in Saudi Arabia and other emerging economies experiencing environmental and digital transformation [48].

5.2 Practical Implications

From a policy standpoint, the results underscore the need for ensuring that the Saudi government continues to support ecological innovation as a critical mechanism to improve entrepreneurial self-efficacy and digitalization. Targeted subsidies, grants, and incentives for green technologies and sustainable business models can substantially reduce the barriers to ecological innovation for entrepreneurs [41]. This not only supports sustainable business practices but also acknowledges that environmental startups are legitimate businesses, which reinforces the idea within entrepreneurs that this sector is achievable and within their reach. These include developing green entrepreneurship programs such as incubators, accelerators, etc. to provide a friendly mechanism for environmental protection, together with increasing the support of entrepreneurial self-efficacy through strengthening institutional supports as well. By including environmental norms for licenses and commercial growth, green businesses get a systemic competitive advantage in the market. Further expansion of the digital infrastructure by policymakers and harmonization between digital and green policies for digitally enabled sustainable entrepreneurship in Saudi Arabia is needed, crucial for the country's economic diversification from oil-based revenues [52].

Entrepreneurship education and capacity building should therefore involve beyond general entrepreneurship mindset orientation to target specific ecological innovation as well as green entrepreneurial orientation in curriculum design and training [51]. Similarly, universities should integrate sustainability and digital literacy across the curriculum, ensuring that future entrepreneurs have both broad knowledge and awareness plus the specific knowledge, skills, and confidence to pursue green ventures [53]. Though, with the addition that only its direct effect on self-efficacy was found non-significant and influence of self-efficacy on entrepreneurial capability in a way that this type of ‘attitude’ corresponds to future competency and it should be metabolized by practical ways such as green incubators, mentorship programs, real-world ecological innovation projects, etc., to make effective entrepreneurial mindset. In training programs, hands-on experience with green technologies and digital tools in incubation facilities combined with exposure to successful actors for sustainable business models is required to have the opportunity to develop self-efficacy through demonstrated performance [50]. This focused knowledge, combined with the practical skills necessary to see these opportunities in action, is what allows entrepreneurs to appreciate and exploit these dual economic and ecological opportunities inherent in the Saudi market.

The green entrepreneurial orientation as a strategic posture would require developing business ecosystems to provide supportive networks that enable knowledge sharing, collaboration, and market access for green entrepreneurs [17]. While both ecological innovation and green orientation had significant direct effects on digital entrepreneurial intention, which indicates that environmentally oriented startups are part of digital entrepreneurship [35]. Therefore, business strategies should be adapted to foster environmentally friendly businesses through technology adoption. This means making affordable, scalable digital tools such as AI, IoT, and cloud computing solutions an accessible option to help lower emissions in agriculture via resource optimization; monitor and track environmental parameters while also improving business efficiency and innovation [21]. Digital capacity-building policies, particularly for youth and women, will increase the number of digitally savvy entrepreneurs in green business. The provision of incentives for entrepreneurs experimenting with digital solutions to address environmental challenges will also help bridge the divide between green innovation and digital transformation in Saudi Arabia. Such integration is crucial to remaining competitive in today's world economy that sanctions sustainability and technical innovation [51].

In conclusion, the results indicate that holistic ecosystem development needs to be performed. Even an entrepreneurial mindset is not sufficient to ensure either confidence or intent: it needs to be coupled with opportunity, skills, and institutional support as well as digital preparedness. To succeed in this, cooperation is needed between stakeholders, including government agencies, educational institutions, industry bodies, and financial institutions, to create an ecosystem where ecological innovation, green strategic orientation, and digital capacity emphasize each other, which results in entrepreneurial self-efficacy and intentions [43]. An integrated approach that goes beyond the psychological preparedness of entrepreneurs to operationally equipping and structurally supporting them for success in resilient digital businesses.

5.3 Limitations and Future Research

The present study also has some practical implications for future research, by it sheds light on the contributions of ecological innovation, entrepreneurial self-efficacy, and digital entrepreneurial intention in Saudi Arabia, with an emphasis on creative forces, while also identifying limitations. Firstly, purposeful sampling was used, so the findings may not be generalized to all entrepreneurs in Saudi Arabia, as they may not fully represent the entrepreneurs. Furthermore, the cross-sectional nature of the study does not permit temporality in interpretation to ascertain cause-and-effect relationships or lasting effects. In this study, self-reported data may have led to biases like social desirability bias or inaccuracies in self-assessment, which lie at the hand of entrepreneurs who might be encouraged by national policy to engage in ecological and digital entrepreneurship and thus overreport their entrepreneurial self-efficacy and intentions. Secondly, the study does not allow for the full complexity of socio-cultural factors and institutional constraints linked to entrepreneurship in Saudi Arabia gender norms, regulatory environment, or market maturity for green innovations.

Contribution of Authors

Ali Raza carried out the research, wrote, and revised the article. Jati Kasuma Ali and Ali Raza conceptualized the central research idea and provided the theoretical framework. Awang Rozaimie designed the research and supervised the research progress.

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Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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