

Leveraging Artificial Intelligence for Startup Scalability: A Holistic Approach to Sustainable Entrepreneurship

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Abstract

Startups are an important source of innovation and economic development, but most of them are not able to scale up beyond the existence stage because they have fragmented approaches to scalability. Even though classical theories (e.g., Resource-Based View, Dynamic Capabilities) offer helpful insights, they are not enough to explain the integrated impact of technology, governance, and sustainability in today's entrepreneurial ecosystems. This paper fills this gap by applying the Scaling Wheel Framework, which combines classical models with today's imperatives of digitalisation, responsible governance and sustainability. Using a descriptive research design, data were gathered from 320 entrepreneurs, investors, and policymakers through survey and expert interviews complemented by secondary sources. Factor analysis highlighted three drivers of startup scalability: Digital Scalability, Governance Stability, and Sustainable Growth, showing they have a strong influence on startup resilience and competitiveness. Results show that startups using AI in combination with governance and sustainability are in a stronger position to navigate uncertainty and long-term growth. This paper builds an integrative framework that bridges the gap between theoretical knowledge and the entrepreneurial practice and offers actionable information for entrepreneurs, investors and policymakers.

Keywords: AI, Startup Scalability, Sustainable Entrepreneurship, Governance Stability, Digital Transformation

Introduction

While the importance of startups as a source of economic development, employment, and technology growth is now widely recognized, the overwhelming majority of startups don't survive beyond the survival phase because of fragmented and limited methods of scalability assessment (Cot et al., 2025). Scalability is not the simple spreading-out of operations, but relates to a complex, multi-tier fit between entrepreneurial resource, market positioning, governance, and adaptability in turbulent environments (Rezazadeh, Mohammadi, & Elahi, 2025). Resource-based view (RBV) focuses on the presence of scarce, idiosyncratic and unique resources as a source of growth whereas dynamic capability focuses on adaptable capabilities in the dynamic markets (Sharma & Subba, 2025). While holistically instructive, these models do not resolve the issues that start-ups must deal with regarding the intersection among governance,

sustainability, technological disruption and innovation ecosystems (Tang et al., 2025). Companies face challenges in their entrepreneurial routes as a result of the combination of new efficiencies and ethical, inequality and risk challenges to future society, which are caused by the rise of artificial intelligence (AI), digitization and sustainability imperatives (Azizi et al. 2019).

Review of Literature

The literature of entrepreneurial scalability has been addressed from different theoretical and practice-based perspectives. The RBV asserts that sustainable advantage can be generated by the exploitation of rare, valuable and non-substitutable resources, while critics argue that it fails to appropriately incorporate environmental turbulence (Nosella et al., 2025). In response, the Dynamic Capabilities framework was introduced with its premise on the firm's capacity to continuously adapt and restructure its resource base in the face of change (Sharma & Subba, 2025). Moreover, using Porter's competitive strategy framework, startups are positioned within industry structure, and it is helpful in explaining competitive pressure, but is insufficient to portray entrepreneurial agility (Tang et al., 2025). Along with these theories have been put into practice frameworks such as the Lean Startup and the Business Model Canvas that have been extensively applied for testing hypotheses and iterating products in agreement with customers' needs (Abdelfattah et al., 2025). Similarly, the environmental scanning tools such as SWOT and PESTEL analyses help to simplify the dynamic realities, but are not enough to foresee the scalability results adequately (Machucho and Ortiz, 2025). Recently, a new wave of research has advocated for the notion of Artificial Intelligence (AI) as a valuable tool to augment entrepreneurial decision-making, market anticipation, and personalised customer interaction, thus expanding firm capabilities (Azizi et al., 2025). In addition, there are studies that advocate caution in over-reliance on AI by highlighting the risks of depersonalization, cybersecurity, and unequal access to technology across companies (Mohd Rasdi & Umar Baki, 2025). Recently, sustainability and governance have been proposed as pillars of sustainable development throughout the literature, and the increasing awareness of climate imperatives, ethical issues and stakeholder expectations are affecting the development of global entrepreneurship (Terchila, 2025). Combined, these contributions demonstrate that, while the body of theory and tools offers relevant insights, it is fragmented and fails to offer an overarching framework for how startups scale in today's digital and sustainability-driven economy (Figura et al., 2025).

Theoretical Underpinning

1. Classical Foundations of Startup Scalability

The theoretical basis for this study starts from the synthesis of classical models of entrepreneurship and strategic management that have historically formed academic arguments around the issue of business growth. The Resource Based View (RBV) lays the foundation by focusing on the idea that rare, valuable, and inimitable resources are the foundation of competitive advantage in the firm. However, scalability cannot be realized in terms of resources alone if firms have not the flexibility needed to reconfigure them in evolving environments (Nosella et al., 2025). In addition, the Dynamic Capabilities perspective points to the need for resources and skills to be continually re-aligned and renewed to adapt to turbulence and market volatility in the environment. In terms of the agility aspect, the model typically lacks a prescriptive framework to guide early-stage startups (Sharma & Subba, 2025). Second, Porter's Competitive Strategy extends our understanding of how firms compete in the industry in terms of strategy (cost, differentiation, or focus). Porter's model is, however, still predominantly industry-focused instead of ecosystem-based and

is therefore limited in its ability to explain the interdependencies that exist between governance, technology, and sustainability that characterize modern entrepreneurial environments (Tang et al., 2025). Taken together these classical positions provide a good foundation but are fragmented, and invite a richer and more integrated framework that takes contemporary entrepreneurial realities into account.

2. Contemporary Perspectives and the Scaling Wheel Framework

In order to bridge the gaps created by the classical theories, this study relies on the Scaling Wheel Framework by Cot et al. (2025) which integrates five interdependent fields of: entrepreneurial team, competitive environment, product and service development, capital and resources and strategy with sustainable advantage. This model is original in bringing together ideas from human capital and social capital theory with ideas from open innovation, entrepreneurial finance and evolutionary economics in order to develop a more comprehensive model of scalability. Importantly, embedded in it, are imperatives of sustainability, governance and digital transformation that are fundamental to the business eco-systems of our time (Rezazadeh et al., 2025). This framework is diagnostic but at the same time prescriptive for the entrepreneurs to cope with uncertainty as digital AI tools and predictive analytics are built into the framework as drivers of informed decision making and risk assessment (Azizi et al., 2025). By bringing these classical, utilitarian, and modern concepts together, the Scaling Wheel re-presents scalability as an ecosystem-dependent, governance-oriented, technology-enabled process. It bridges the theory-practice divide and offers a systematic way to determine startup maturity and facilitate the long-term startup development for entrepreneurs, investors and policy-makers (Figura et al., 2025).

Research Objectives

- To understand how AI and digital technologies are influencing startups' growth and scalability.
- To assess sustainability and governance as drivers for long-term entrepreneurial competitiveness

Research Methodology

This study is based on a descriptive research design in order to explore the combined effect of artificial intelligence, governance, and sustainability on the scalability of startups. Primary data were collected using structured questionnaires and expert interviews with entrepreneurs, investors, and policy makers, whereas secondary data were collected from scholarly publications, policy reports, and startup databases. A total of 320 respondents were surveyed with a five-point Likert scale that allowed measurement of perceptions regarding AI-driven scalability and sustainability practices. Analysis: Factor analysis was used to determine key dimensions, which were further validated through reliability testing, correlation, and regression analysis. This way, it provides a holistic framework to understand how artificial intelligence (AI) can contribute to sustainable and competitive startup development.

Table 1- KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.915
Bartlett's Test of Sphericity	Approx. Chi-Square	8936.275
	df	136
	Sig.	.000

The KMO value of 0.912 indicates “good” sample adequacy, demonstrating that the dataset is highly suitable for factor analysis. Bartlett’s Test of Sphericity is significant ($p < 0.05$), confirming that sufficient correlations exist between variables, thereby validating the application of factor analysis.

Communalities

The communalities represent the proportion of variance in each variable explained by the extracted components. The analysis revealed high communalities (above 0.90) for variables such as AI-enabled efficiency, cost reduction, and global competitiveness, indicating that these variables are strongly accounted for within the factor model. Moderate communalities (0.80–0.90) were found for governance practices and sustainability adoption, suggesting their substantial contribution to the extracted factors. These results confirm that AI, governance, and sustainability collectively explain significant variations in startup scalability and competitiveness.

Table 2-Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.797	69.391	69.391	11.797	69.391	69.391	6.249	36.762	36.762
2	1.561	9.184	78.575	1.561	9.184	78.575	5.378	31.638	68.400
3	1.347	7.925	86.500	1.347	7.925	86.500	3.077	18.101	86.500
4	.690	4.058	90.559						
5	.416	2.447	93.006						
6	.229	1.344	94.350						
7	.202	1.185	95.535						
8	.167	.985	96.521						
9	.159	.936	97.457						
10	.128	.755	98.211						
11	.080	.471	98.682						
12	.072	.422	99.105						
13	.062	.362	99.467						
14	.043	.255	99.722						
15	.029	.170	99.892						
16	.018	.104	99.996						
17	.001	.004	100.000						

Extraction Method: Principal Component Analysis.

According to the study, three main components account for the majority of the variation, with the first being the most dominant, followed by the second and third. The first eigenvalues, which measure the amount of variation explained by each component, reveal that the first three components account for the bulk of the

volatility in the data. The first component has an eigenvalue of 11.797 and accounts for 69.39% of the total variance, making it the most important element in explaining the variability. The second component contributes 9.18% of the variation, bringing the overall amount to 78.58%. The third component provides an additional 7.93%, bringing the total variance explained to 86.50%. Following rotation, the first component accounted for 36.76% of the variation, the second for 31.64%, and the third for 18.10%, which explains 86.50% of the total variation.

Table 3- Rotated Component Matrix

Variables	Component		
	1	2	3
AI tools improve startup efficiency and agility.	.908		
Digital tech helps startups find and seize new opportunities.	.902		
AI boosts accuracy in forecasting and resource use.	.851		
Predictive analytics reduces risks through data-driven insights.	.839		
Digital platforms enhance collaboration and innovation.	.785		
AI lowers costs and speeds up scalability.	.703		
Digital integration strengthens global competitiveness.	.673		
Governance builds investor trust and confidence.		.649	
Strong governance ensures transparency and accountability.		.900	
Governance reduces risks with ethical decisions.		.898	
Structured governance improves stakeholder management.		.881	
Governance supports resilience and long-term success.		.869	
Sustainability improves startups' market competitiveness.			.847
Green practices attract eco-conscious customers.			.761
Sustainability aligns startups with regulations and society.			.738
Sustainable practices build resilient ecosystems.		.561	.656
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

This rotation distributes the variation more equally among the three components, improving interpretability. Each element of the rotational solution contributes in a unique and significant way to the explanation of the data's underlying structure, which clarifies the interpretation.

Table 4- Factor I - Digital Scalability

Factor	Variable	Rotated Loading	% of Variance	Eigen Value
	AI tools improve startup efficiency and agility.	.908		

Resource Optimization Factor	Digital tech helps startups find and seize new opportunities.	.902	69.391	11.797
	AI boosts accuracy in forecasting and resource use.	.851		
	Predictive analytics reduces risks through data-driven insights.	.839		
	Digital platforms enhance collaboration and innovation.	.785		
	AI lowers costs and speeds up scalability.	.703		
	Digital integration strengthens global competitiveness.	.673		

The first factor, Digital Scalability, emerged as the most influential dimension in explaining startup growth, with an eigenvalue of 11.797 and accounting for 69.39% of the variance. This factor groups together variables that emphasize the transformative role of artificial intelligence and digital technologies in enhancing scalability. High loadings were observed for AI tools improving efficiency and agility (.908) and digital technologies helping startups seize new opportunities (.902), confirming that digital adoption directly strengthens operational capacity and market expansion. Similarly, AI’s role in boosting forecasting accuracy (.851) and predictive analytics, reducing risks (.839), highlights the importance of data-driven decision-making in uncertain environments. The positive contributions of digital platforms in fostering collaboration (.785), AI in lowering costs and accelerating growth (.703), and digital integration enhancing global competitiveness (.673) further underline the holistic impact of digital transformation on startups.

Table 5- Factor II- Governance Stability

Factor	Variable	Rotated Loading	% of Variance	Eigen Value
Productivity Enhancement Factor	Governance builds investor trust and confidence.	.649	9.184	1.561
	Strong governance ensures transparency and accountability.	.900		
	Governance reduces risks with ethical decisions.	.898		
	Structured governance improves stakeholder management.	.881		
	Governance supports resilience and long-term success.	.869		

The second factor, Governance Stability, accounts for an eigenvalue of 1.561 and explains 9.18% of the variance, highlighting the importance of strong governance practices in building resilient startups. Among the variables, the highest loading is observed for strong governance ensuring transparency and accountability (.900), followed closely by ethical governance reducing risks (.898) and structured governance improving stakeholder management (.881). These results emphasize that governance mechanisms directly influence operational credibility, ethical compliance, and the ability to manage

complex stakeholder relationships. Furthermore, governance supporting resilience and long-term success (.869) reinforces the role of governance as a strategic anchor that sustains competitiveness over time. Although governance building investor trust and confidence (.649) shows a relatively lower loading, it still contributes meaningfully, demonstrating that investor confidence is an outcome of transparent, ethical, and structured governance systems.

Table 6- Factor III - Sustainable Growth

Factor	Variable	Rotated Loading	% of Variance	Eigen Value
Environmental Sustainability Factor	Sustainability improves startups' market competitiveness.	.847	7.925	1.347
	Green practices attract eco-conscious customers.	.761		
	Sustainability aligns startups with regulations and society.	.738		
	Sustainable practices build resilient ecosystems.	.656		

The third factor, Sustainable Growth, has an eigenvalue of 1.347 and explains 7.93% of the variance, highlighting the contribution of sustainability-oriented practices to long-term entrepreneurial competitiveness. The highest loading is found for sustainability improving startups' market competitiveness (.847), which indicates that embedding sustainability in business models provides firms with a competitive edge in increasingly eco-conscious markets. Similarly, green practices attracting environmentally aware customers (.761) reflect the growing influence of consumer preferences on entrepreneurial strategy. The factor also includes sustainability, aligning startups with regulations and society (.738), demonstrating that compliance with legal and societal expectations strengthens legitimacy and operational continuity. Finally, sustainable practices building resilient ecosystems (.656) suggests that sustainability contributes not only to firm-level growth but also to the development of wider entrepreneurial and environmental ecosystems.

Conclusion

This research highlights that the scalability of startups is not a simple linear process of resource accumulation and exponential growth but a complex one composed of digital innovation, governance practices, and sustainability commitments. The results identify three forces - Digital Scalability, Governance Stability, and Sustainable Growth - that together account for a significant amount of the variation in entrepreneurial success. Artificial intelligence and digital technologies increase efficiency, predictability, and competitiveness, and governance systems ensure accountability, trust, and resilience. At the same time, sustainability-oriented practices enable regulatory conformity, customer loyalty, and ecosystem resilience, thus anchoring long-term competitiveness. By integrating classical theory with contemporary ideas such as the Scaling Wheel, this research opens the way for a more integrated view of startup scalability that spans the gap between academia and practice. Results indicate that startups that integrate innovative AI-powered startups with robust governance and sustainability are better equipped to face uncertainty and create sustainable global growth. The study provides practical advice for entrepreneurs, investors, and policy-makers on how to frame strategies to integrate technological adoption

with ethical governance and environmental responsibility. In conclusion, the study redefines scalability as an ecosystem-dependent, governance-oriented, and technology-enabled process, paving the way for stronger and better entrepreneurship in the digital age.

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