

From Generation Z to Generation Beta: The Future of Startup Innovation

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Abstract

The entrepreneurial ecosystems are experiencing significant changes brought about by technological advancement, AI, and generational shift. Whereas generation Z constitutes the first digital native generation of entrepreneurs, Generation Beta will appear within contexts characterized by extensive usage of AI, which might lead to a fundamental change in the approach to innovation among startups. In this study, the authors use an inter-generational approach to determine the role played by generational imprinting in the processes of entrepreneurial cognition, innovation orientation, and entrepreneurial ecosystem dynamics. In order to achieve this objective, the authors conduct a sequential explanatory study using a mixed methods design. The survey involved 412 generation Z entrepreneurs in technology industries, with the help of SEM analysis, to identify the effects of digital nativity, AI adoption intensity, sustainability orientation, and startup scalability. or the qualitative approach, interviews with experts along with foresight analysis based on the Delphi methodology are conducted to forecast the characteristics of the Generation Beta, particularly AI-native mindsets, algorithmic capital distribution, and innovation systems combined with governance mechanisms. By combining these two streams, the study offers a framework called the Intergenerational Innovation Transition Framework (ITF) that reflects the shift from digital natives to AI natives in terms of entrepreneurial behavior.

Keywords: Generation Z, Generation Beta, Startup Innovation, AI-Native Entrepreneurship, Entrepreneurial Ecosystems, Generational Imprinting, Mixed Methods.

Introduction

Entrepreneurship has always been associated with the process of technological advancement, institutional evolution, and generational changes. According to the theory of generational cohorts, people born under identical socio-historical circumstances will exhibit cognitive structures, value systems, and behavioral characteristics that affect their engagement in economic and entrepreneurial practices (Mannheim, 1952). Within the scope of entrepreneurship, generational imprints will have an effect on opportunity identification, innovativeness, risk tolerance, and growth strategies (Zhang & Acs, 2018, 2019). In light of the fact that technology continues to revolutionize economics, the study of the role played by generational changes in entrepreneurship becomes crucial.

Members of Generation Z who fall within the age bracket from 1997 to 2012 form the first digital generation of entrepreneurs. Members of this generation grew up using technologies such as smartphones, social media applications, and platform-based economy, hence showing high technological competence and engagement in sustainable innovation activities (Deloitte, 2023; Saeedikiya & Salamzadeh, 2024). At the same time, entrepreneurial environments have undergone major changes due to the emergence of incubators, online venture capital networks, online platforms, and AI-based infrastructures (Drori & Wright, 2018; Crnogaj & Rus, 2023). The rise of generative AI technology has played a critical role in accelerating changes in these entrepreneurial environments by shaping products and decisions, among others (Lee et al., 2023).

As generation z entrepreneurship becomes more and more visible and empirical research becomes more feasible, there comes a need for further exploration of yet another generation of entrepreneurs—generation beta. Expected to appear after 2025, generation beta will have unique characteristics that will differ from any other previous generation, as the environment they are going to grow up in is expected to include ubiquitous AI and automation, an immersive digital environment, climate problems, and constant connectivity. This can lead to a situation where future entrepreneurs do not see AI only as technology but rather a part of their thinking and innovations process.

While much knowledge exists in terms of the relationship between generational entrepreneurship, technological change, and ecosystems, there is still a lack of integration among these areas of study. For instance, past research has focused on the role of generations on entrepreneurship (Zhang & Acs, 2018, 2019), technological innovation and transformation (Yoo et al., 2010; Nambisan, 2017), as well as ecosystems (Stam, 2015; Spigel, 2017). However, there is a need for research that will combine all of these areas in order to determine their influence on the future evolution of entrepreneurial systems.

The current study attempts to fill this gap by exploring the transformation from Generation Z to Generation Beta through a sequential explanatory mixed-method research design. On the one hand, quantitatively, the current study aims to reveal relationships between digital natives, artificial intelligence, sustainability focus, ecosystem digitization, and innovative performance of Generation Z entrepreneurs. On the other hand, qualitatively, expert-based foresight techniques will be used to analyze the future characteristics of Generation Beta entrepreneurs.

In this way, the current study integrates empirical analysis with predictions to develop the Intergenerational Innovation Transition Framework (IITF) that demonstrates the impact of generational imprinting, technology acceleration, ecosystem maturity, and human-AI partnership on startup innovation. The study makes contributions to Generational Imprinting Theory, Digital Innovation Theory, Entrepreneurial Ecosystem Theory, and Human-AI Collaboration research through a foresight analysis of entrepreneurial development. This knowledge is essential for stakeholders who want to make predictions about the future of innovation-based entrepreneurship.

Review of Literature

Generational Imprinting and Entrepreneurial Cognition

Exploring the phenomenon of entrepreneurial behavior necessitates analyzing the socio-historic and technological environments within which entrepreneurial cognition is constructed. According to Generational Cohort Theory, people who share similar socio-historic and technological events in their youth adopt similar worldviews, values, and behaviors (Mannheim, 1952). Building on such a framework, imprinting theory emphasizes that the environment people encounter in their development period forms a lasting cognitive schema that shapes decision-making and strategic action in the future.

In the realm of entrepreneurship research, generational imprinting has become a vital tool for understanding why different generations act differently when it comes to opportunities for entrepreneurship. Zhang and Acs (2018) revealed that age and generational imprinting have a significant impact on entrepreneurial behavior, while Zhang and Acs (2019) went on to prove that cohort effects play a key role in determining the rate at

which entrepreneurs enter the market, their innovativeness, and performance. Most recently, Saeedikiya and Salamzadeh (2024) discovered that the cognitive features of Generation Z entrepreneurs have a marked impact on innovation.

This indicates that entrepreneurial cognition is not only about individual traits but also that it is strongly influenced by the technological and institutional environments in which the entrepreneur grows up. Generation Z entrepreneurs have been brought up in an era where everything around them is very advanced technologically. They are completely different from the preceding generation due to their upbringing in a digitally rich environment.

Digital Innovation Theory and Entrepreneurial Transformation

The Digital Innovation Theory explains how digital technologies innovate and influence entrepreneurship. According to Yoo, Henfridsson, and Lyytinen (2010), digital technology has some unique features like re-programmability, modularity, and re-combinability that disrupt the traditional process of innovation. Unlike other technology types, digital technologies allow adaptation, experimentation, and resource re-combinations across organizational borders.

Extending this theory further, Yoo et al. (2012) emphasize that digital technologies not only affect the products and services produced but also influence the organization of the innovation process itself. Innovations emerge within interorganizational digital ecosystems rather than in organizational contexts. In another study, Nambisan (2017) explains how digital technologies have influenced the emergence of new paradigms of entrepreneurship. Digital entrepreneurship means creation, identification, and exploitation of new entrepreneurial opportunities enabled by digital technologies. Finally, Nambisan et al. (2019) confirm that digital transformation is affecting the nature of entrepreneurial ecosystems and innovations around the world.

Within such a context, the concept of innovation within a start-up enterprise cannot be isolated from digital infrastructure considerations. Digital platforms, cloud computing infrastructure, artificial intelligence algorithms, and data ecosystems are increasingly becoming factors that will determine the ability to recognize opportunities, develop products, gain access to markets, and scale the venture.

Entrepreneurial Ecosystem Theory

Although entrepreneurial competencies still matter, Entrepreneurial Ecosystem Theory holds that the success of entrepreneurship is influenced by a larger institutional context in which the enterprise operates. An entrepreneurial ecosystem is made up of interconnected individuals, institutions, networks, and resources that aid in the establishment and growth of ventures (Isenberg, 2010).

According to Stam (2015), an entrepreneurial ecosystem includes both systemic and framing factors such as financing, leadership, talent, knowledge, services, and institutions. Likewise, Spigel (2017) sees entrepreneurial ecosystems as relational formations that create opportunities and resources through the interaction between entrepreneurs, investors, policymakers, educational institutions, and organizations. Stam and Spigel (2016) stress the role of the interaction between cultural, social, and physical aspects of ecosystems in their effectiveness.

New research trends show a growing importance of technology for developing entrepreneurship ecosystems. The concept of the Digital Entrepreneurial Ecosystem was formulated by Sussan and Acs (2017), who claimed that digital platforms transform entrepreneurship dynamics and the process of value creation. Wurth et al. (2021) also believe that evolving entrepreneurship ecosystems are increasingly based on technology.

It can be concluded that startups' innovations depend on such factors as entrepreneurs' capabilities, ecosystem development, digital infrastructure, availability of venture capital, acceleration networks, and institutional frameworks. Therefore, studying future generations of entrepreneurs should include the study of developing ecosystems.

Sociotechnical Systems Perspective

While research on entrepreneurship frequently addresses either particular entrepreneurs or technological breakthroughs separately, Sociotechnical Systems Theory postulates that both organizational and innovation results are generated through the relationship between socio- and technological system elements. In their pioneering study, Trist and Bamforth (1951) showed that technological systems cannot be comprehended apart from their social context.

Further studies have revealed that organizational effectiveness is based upon the combination of technological capabilities and human systems (Bostrom and Heinen 1977). In more recent literature, Tilson, Lyytinen, and Sørensen (2010) pointed out that digital infrastructure can be considered a sociotechnical system with interactions between technologies, institutions, users, and organizational entities as its characteristic feature.

Artificial intelligence becomes an integral part of modern entrepreneurial ecosystem and, therefore, it is obvious that sociotechnological change plays an important role in the development of entrepreneurial ecosystem. Specifically, decision making, venture governance, innovation processes, and resources allocation are associated with interactions of humans and intelligent systems. Consequently, innovative activities in startups must be seen as a sociotechnological process involving the co-evolution of entrepreneurs, institutions, and digital infrastructure.

Such approach is particularly relevant when discussing the move from Generation Z to Generation Beta, given that AI will play a crucial role in the future entrepreneurial ecosystem.

Human–AI Collaboration Theory and AI-Native Entrepreneurship

Fast advancements in the field of artificial intelligence have led to new debates on the topic of human-machine collaboration. Entrepreneurship theories state that such concepts as opportunity identification, innovations, and strategy making belong to humans only. Recent research findings, however, show that artificial intelligence is beginning to operate as a collaborator and no longer serves as an instrument.

According to Daugherty & Wilson (2018), the greatest economic advantage brought by artificial intelligence lies in collaboration between people and intelligent machines rather than in their mere automation. Likewise, Jarrahi (2018) describes the interaction of a human and artificial intelligence as cognitive augmentations, meaning that both contribute to decision making.

In the realm of entrepreneurship, AI is becoming increasingly important for opportunity recognition, market prediction, consumer analysis, product design, investment assessment, and scaling of enterprises. Lee, Sung, and Jeon (2023) discuss the rising role of generative AI tools in shaping startup formation and innovation. Moreover, the OECD (2023) states that AI could be transforming the entrepreneurial ecosystem, as founder capabilities, governance models, and resource configurations are being reconfigured.

These changes point to a shift from AI-enhanced entrepreneurship towards AI-endowed entrepreneurship. While Generation Z entrepreneurs use AI for making better decisions, future generations might find AI more integrated into their thinking. This could change the nature of entrepreneurial cognition from humans only-based to joint human-AI cognitive capabilities.

Theoretical Synthesis and Research Gap

The identified literature indicates that innovation among startups can be influenced by generational experiences, technological infrastructure, institutional ecosystem, sociotechnical dynamics, and human-AI collaboration practices. The generational imprinting theory describes the effect that the technological environment has on the formation of entrepreneurial cognition (Mannheim, 1952; Zhang & Acs, 2018; 2019). Digital Innovation Theory shows how digital technologies affect innovation and entrepreneurial opportunities (Yoo et al., 2010; Nambisan, 2017). Entrepreneurial Ecosystem Theory draws attention to the importance of the ecosystem and institutional support system in business success (Stam, 2015; Spigel,

2017). Sociotechnical System Theory focuses on the evolution of human systems and their interrelation with technology (Trist & Bamforth, 1951; Tilson et al., 2010). Human-AI Collaboration Theory discusses how AI becomes incorporated into the entrepreneurial process (Daugherty & Wilson, 2018; Jarrahi, 2018).

However, there are still a number of critical gaps in existing knowledge that need to be addressed. Firstly, current literature is centered on the analysis of generations of entrepreneurs that are currently alive (e.g., Millennials and Gen Z); there is not much research dedicated to the future transition between generations. Secondly, there is little consideration for AI as the imprinting factor influencing the development of entrepreneurship-related skills. Thirdly, there is a lack of frameworks that could incorporate insights from generation, ecosystem, sociotechnical, and human-AI collaboration approaches into one. Lastly, there is limited use of foresight methods in combination with current empirical data on entrepreneurs.

In order to fill these gaps, the author offers to develop the Intergenerational Innovation Transition Framework (IITF) which describes the evolution of startups' innovation potential in the context of generational imprinting, digital innovation, ecosystem development, sociotechnical transformation, and human-AI collaboration. This framework will leverage both the empirical data obtained through interviews with members of Generation Z and projections about members of Generation Beta based on Delphi method.

Conceptual Framework: Intergenerational Innovation Transition Framework (IITF)

The proposed model for this study is the Intergenerational Innovation Transition Framework (IITF), which will enable the investigation of the impact of generation transition, evolution of technology, and the dynamics of entrepreneurial ecosystems on the process of innovation within startups. This research framework is designed based on the theoretical foundations provided by Generational Imprinting Theory, Digital Innovation Theory, Entrepreneurial Ecosystem Theory, Sociotechnical Systems Theory, and Human-AI Collaboration Theory.

According to the theory, belonging to a certain generation cohort influences the entrepreneurial behavior due to the collective sociocultural and technological experience gained during upbringing (Mannheim, 1952). As Generation Z entrepreneurs have been raised in the digital era, their digital fluency and ability to use platforms as well as adapt technologies are significantly higher. Meanwhile, Generation Beta is expected to grow up in the environment where AI is ubiquitous, and thus will experience unique technological imprinting in the form of AI nativity and engagement (Prensky, 2001; Lee et al., 2023).

Technology imprinting will impact entrepreneurial cognition, which includes opportunity recognition, risk perception, decision-making skills, and the capability of collaborating with AI. With the increasing role played by digital technologies within entrepreneurial endeavors, entrepreneurial cognitive activities will be transitioning from technology-enabled decision-making toward AI-enabled and even symbiosis-based entrepreneurial activities (Raisch & Krakowski, 2021).

Innovative orientation, measured through innovation radicalness, experimentation level, speed of innovation, and sustainability incorporation, will be influenced by the cognitive processes of entrepreneurs. Technologies such as digital systems and AI improve the ability of entrepreneurs to develop new products and address society's needs (Yoo et al., 2010; Nambisan et al., 2022).

Entrepreneurial innovation orientation will be moderated by ecosystem interactions, specifically access to accelerators, venture capital networks, digital platforms, and AI systems (Isenberg, 2010; Stam & Van de Ven, 2021). The interaction between an innovation-oriented company and the surrounding environment impacts resource mobilization and scaling potential.

In summary, the proposed model indicates that entrepreneurial outcomes such as venture development, financial success, innovation capacity, and sustainability depend on the interplay between generational imprinting, technological competencies, entrepreneurial cognition, and ecosystem maturity. In this context, the IITF model identifies the movement from Generation Z to Generation Beta as one from digital native entrepreneurs to AI-native entrepreneurs.

Research Methodology

Research Design

The research design for the study is Sequential Explanatory Mixed Methods Design (QUAN -> QUAL -> Integration), used for exploring the change process from Generation Z entrepreneurs into Generation Beta entrepreneurs. The choice of mixed-methods design has been made as it allows integrating evidence that comes from the empirical observations of present entrepreneurial groups as well as forecasts made based on their foresight perspective about the future of the entrepreneurial ecosystem.

Using the sequential explanatory design allows methodological triangulation in the sense that quantitative analysis of the entrepreneurial actions of the present generation is used along with the qualitative foresight analysis of future actions of the other generation.

Quantitative Phase: Generation Z Entrepreneurship Analysis

Sample and Data Collection: In the quantitative part, the attention was paid to the Generation Z entrepreneurs whose ages ranged from 18 to 28, and the focus was on the entrepreneurs who were actively involved in technology-related startups. In total, 412 entrepreneurs have been purposively and snowballed sampled from the startup ecosystem in North America, Europe, and the Asia-Pacific area.

The target population consisted of founders operating in different industries, such as AI and software companies (34%), sustainability and climate technology startups (21%), fintech startups (17%), e-commerce and platforms companies (15%), and others (13%). Nearly 72% of respondents indicated that they incorporated AI technologies into the business process, and 64% claimed that they worked mostly with digital platforms.

Measurement Instruments: In order to collect data, a structured survey questionnaire has been developed and tested for reliability and validity, utilizing existing measures used in previous entrepreneurship studies. Four independent constructs were measured in the survey questionnaire, namely:

- **Digital Nativity (DN):** indicating how deeply the entrepreneurs have been immersed in digital surroundings.
- **Artificial Intelligence Adoption Intensity (AIAI):** representing the degree of use of artificial intelligence in entrepreneurship.
- **Innovation Radicalness (IR):** indicating how radical the entrepreneurial innovations are compared to other market offerings.
- **Sustainability Orientation (SO):** showing how important factors of sustainability were in the entrepreneurs' actions.

All items used in measuring the variables had five-point Likert scale format ranging from strongly disagree (1) to strongly agree (5).

Data analysis: SPSS and AMOS were used for analyzing the quantitative data collected in this study. The first step involved conducting exploratory factor analysis while the second one entailed confirming factor analysis.

The relationships amongst the constructs were studied using the method of Structural Equation Modeling (SEM). The structural model considered the impact of digital nativity on AI usage, innovation radicalness, and firm scalability. Additionally, the mediation effect of digital ecosystems was analyzed, whereas the moderation effect of sustainability orientation on innovation outcomes was also tested.

Assessment of Reliability and Validity: To assess the reliability and validity of the measurement model, standard measures were used. The internal consistency reliability of the scales was measured using Cronbach's Alpha and Composite Reliability coefficients. The Cronbach's alpha values ranged from 0.81 to 0.89 for all constructs.

CFA results showed that the model fit was good, as the values exceeded the recommended levels (CFI = 0.94, TLI = 0.92, RMSEA = 0.05). The convergent validity was supported by AVEs greater than 0.50, whereas discriminant validity was proven by the comparison of AVEs and inter-construct correlations.

Qualitative Phase: Generation Beta Foresight Analysis

Participant Selection

This section describes the qualitative analysis designed to assess possible entrepreneurial traits of Generation Beta using expert-driven foresight research. Expert selection involved a total of 24 experts chosen for their knowledge and experience in areas such as entrepreneurship, venture capital, artificial intelligence, technology forecasting, and startup ecosystem development.

Data Collection Procedures

The research involved a modified approach to the Delphi method for creating informed forecasts about future entrepreneurial ecosystems. Two iterative Delphi rounds were held to promote consensus among experts on future developments in terms of the entrepreneurial environment and AI innovation patterns.

Interviews were carried out after the completion of the Delphi rounds to gain insights into changes that may arise concerning the cognitive aspect, management, funding, and processes of entrepreneurship. Moreover, a scenario planning activity was conducted to assess potential future developments of AI-based entrepreneurship and ecosystem evolution.

Analysis of Qualitative Data

Thematic analysis and grounded theory principles were used to conduct an analysis of qualitative data. Codes were created during the open coding phase to identify recurrent themes in expert narratives. Codes were then combined into themes using axial coding and selective coding methods.

To increase analysis rigor, cross-impact analysis was carried out to establish interrelationships between the themes identified and evaluate how technologies, institutions, and cognition might interact within future entrepreneurial eco-systems. The reliability test resulted in a Kappa value of 0.87, which shows that there is coding agreement among the coders.

Integration of Quantitative and Qualitative Findings

In the last phase, the integration of quantitative and qualitative findings was done using the joint display matrix. The integration of results made it possible to compare the results of empirical findings for Generation Z entrepreneurship with predictions based on expert knowledge about Generation Beta entrepreneurship.

The resulting framework is the Intergenerational Innovation Transition Framework (IITF), that conceptualizes start-up innovations as a dynamic relationship among generational imprinting, digital innovation capabilities, ecosystem maturity, sociotechnical transition, and human-AI symbiosis. The integration of results has also made it possible to identify convergent, complementary, and emerging findings related to the future evolution of entrepreneurial ecosystems.

Ethical Considerations

The research strictly followed all existing rules regarding ethical practices in research at every stage of data gathering and analysis. The participation in this study was completely voluntary and informed consent was sought from all study participants before data gathering. Anonymity was assured by data anonymization techniques, and withdrawal was explained as one of the rights of the participants at any stage of the research.

As the topic of research was related to artificial intelligence and future entrepreneurship, the importance of ethics related to AI governance, algorithmic decision making, and responsible innovation had to be considered. Every finding was stated objectively, and foresight forecasts were discussed as possible scenarios for the future.

Quantitative Findings: Generation Z Entrepreneurship

Descriptive Analysis

Demographic and venture attributes for the Generation Z entrepreneurs (n=412) in the sample are presented in Table 1 below. The study involved the use of 58.0% male respondents, 40.0% female respondents, and 2.0% non-binary respondents. In respect to industries represented by the ventures, AI & software accounted for 34.0%, sustainability & climate technology ventures made up 21.1%, fintech 17.0%, e-commerce & platforms 15.0%, and other emerging technology sectors 12.9%. Further, 72.1% of the respondents indicated that artificial intelligence was integrated within the businesses, while 64.1% had platform business models.

Table 1 Sample Characteristics of Generation Z Entrepreneurs (N = 412)

Variable	Category	Frequency	Percentage (%)
Gender	Male	239	58.0
	Female	165	40.0
	Non-binary	8	2.0
Sector	AI/Software	140	34.0
	Sustainability/Climate-tech	87	21.1
	Fintech	70	17.0
	E-commerce/Platform	62	15.0
	Other Emerging Technologies	53	12.9
AI Integration	Yes	297	72.1
Platform-based Model	Yes	264	64.1

It is clear from the descriptive statistics that Generation Z entrepreneurs have a high level of digital immersion. The average rating of Digital Nativity was 4.42 (SD = 0.61) measured on a scale of one to five, implying that there is a high level of incorporation of digital technology into entrepreneurial activities. Over 80% of respondents stated that digital technologies, such as the internet and social networks, and data algorithms were instrumental in helping identify potential entrepreneurial opportunities. These results imply that for Generation Z entrepreneurs, opportunities are now detected using data-driven methods rather than market observations.

Furthermore, the study results underscore the importance of artificial intelligence technologies in current entrepreneurship practices. As noted, the mean score for AI Adoption Intensity is 4.18 (SD = 0.67), thus implying a high frequency of adopting AI technology within entrepreneurial practices. More specifically, 61% of interviewees reported utilizing AI technology in product/service creation; meanwhile, 54% use AI technologies to aid them in decision-making; moreover, 47% make use of AI in investor analysis and fundraising. Hence, artificial intelligence has gone beyond its operational purposes and turned into a strategic asset in the process of innovation and entrepreneurship.

All in all, based on the descriptive data, one may describe members of Generation Z as highly digitalized, technology-driven, and innovation-oriented entrepreneurs operating within AI-oriented entrepreneurial environments. It should be concluded that the observed prevalence of AI adoption and platform-based entrepreneurship indicates an emerging role of digital technologies in the entrepreneurial process.

Structural Model Results and Hypothesis Testing

Measurement Model Assessment

Prior to hypothesis testing, the reliability and validity of the measurement model were assessed using Cronbach's alpha, Composite Reliability (CR), Average Variance Extracted (AVE), and Confirmatory Factor Analysis (CFA). As shown in Table 2, all constructs exceeded the recommended thresholds for

internal consistency and convergent validity (Cronbach's $\alpha > 0.70$, CR > 0.70 , and AVE > 0.50), indicating satisfactory psychometric properties.

Table 2 Measurement Model Reliability and Validity

Construct	Items	Cronbach's α	Composite Reliability (CR)	AVE	Factor Loadings Range
Digital Nativity (DN)	5	0.84	0.87	0.59	0.71–0.83
AI Adoption Intensity (AIAI)	6	0.89	0.91	0.63	0.74–0.88
Sustainability Orientation (SO)	5	0.83	0.86	0.56	0.69–0.81
Innovation Radicalness (IR)	5	0.85	0.88	0.60	0.73–0.84
Startup Scalability (SS)	4	0.81	0.85	0.58	0.70–0.82

Loadings ranged between 0.69 to 0.88, indicating that the constructs were satisfactorily captured by the indicators. In other words, there is confirmation about the reliability and validity of the proposed measurement model, thus providing a solid basis for further structural analysis. A correlation analysis was carried out to ascertain discrimination validity, as well as to determine any possible connections between the study variables. From Table 3 below, it is clear that there was a strong and positive correlation between all the study constructs. AI Adoption Intensity showed the highest correlation with Innovation Radicalness ($r = 0.57$, $p < 0.001$). On its part, Startup Scalability had a positive relationship with Innovation Radicalness ($r = 0.61$, $p < 0.001$).

Table 3 Correlation Matrix

Construct	DN	AIAI	SO	IR	SS
DN	1				
AIAI	0.52***	1			
SO	0.41***	0.46***	1		
IR	0.48***	0.57***	0.44***	1	
SS	0.39***	0.50***	0.47***	0.61***	1

*** $p < 0.001$

Structural Model Evaluation and Hypothesis Testing

Structural Equation Modeling (SEM) was employed to examine the proposed relationships among Digital Nativity, AI Adoption Intensity, Sustainability Orientation, Ecosystem Digitalization, Innovation Radicalness, and Startup Scalability. The model demonstrated satisfactory fit to the observed data, as evidenced by the fit statistics presented in Table 5 ($\chi^2/df = 2.14$, CFI = 0.94, TLI = 0.92, RMSEA = 0.05, SRMR = 0.04). These values indicate an acceptable to excellent model fit, supporting the adequacy of the proposed structural framework.

Table 4 Model Fit Indices

Fit Index	Value	Threshold	Interpretation
χ^2/df	2.14	< 3	Acceptable
CFI	0.94	> 0.90	Good Fit
TLI	0.92	> 0.90	Good Fit
RMSEA	0.05	< 0.08	Excellent Fit
SRMR	0.04	< 0.08	Good Fit

The SEM demonstrates strong explanatory power and robust structural validity.

The results of hypothesis testing are summarized in Table 4. Hypothesis 1 proposed that Generation Z entrepreneurs exhibit greater digital platform dependency as a consequence of their digital nativity. The results revealed a significant positive relationship between Digital Nativity and Platform Dependency ($\beta = 0.48$, $p < 0.001$), supporting H1. This finding suggests that Generation Z entrepreneurs are deeply embedded within platform-based ecosystems, where venture creation, customer engagement, and market expansion are increasingly mediated through digital infrastructures.

Hypothesis 2 examined the relationship between AI Adoption Intensity and Innovation Radicalness. The findings indicate a strong positive effect ($\beta = 0.52$, $p < 0.001$), providing support for H2. Startups with higher levels of AI integration reported faster product development cycles and greater innovation novelty, suggesting that artificial intelligence functions as a strategic enabler of entrepreneurial innovation.

Hypothesis 3 proposed that Sustainability Orientation moderates the relationship between Digital Nativity and Startup Scalability. The interaction effect was positive and statistically significant ($\beta = 0.27$, $p < 0.01$), supporting H3. The results indicate that entrepreneurs who combine digital competencies with sustainability-driven objectives achieve stronger growth outcomes, investor interest, and market legitimacy.

Hypothesis 4 examined the mediating role of Ecosystem Digitalization in the relationship between entrepreneurial characteristics and venture performance. The indirect effect was significant ($\beta = 0.31$, $p < 0.01$), supporting H4. Entrepreneurs operating within digitally mature ecosystems characterized by AI-enabled accelerators, online venture capital platforms, and advanced innovation infrastructures demonstrated superior scalability compared with those in traditional entrepreneurial environments.

Table 5 Structural Model Path Coefficients

Hypothesis	Path	Standardized β	t-value	p-value	Result
H ₁	DN $\rightarrow$ Platform Dependence	0.48	9.12	<0.001	Supported
H ₂	AIAI $\rightarrow$ IR	0.52	10.34	<0.001	Supported
H ₃	DN $\times$ SO $\rightarrow$ SS (Moderation)	0.27	4.21	<0.01	Supported
H ₄	Ecosystem Digitalization $\rightarrow$ SS (Mediation Effect)	0.31	5.02	<0.01	Supported

Mediation Analysis and Explained Variance

To provide additional evidence to the mediation relationships, the bootstrapping analysis with 5,000 samples was conducted. According to the findings presented in Table 6 below, both indirect effects can be considered statistically significant, as the confidence interval does not cover the null value of 0. Hence, the Ecosystem Digitalization and Innovation Radicalness are proven to be critical mediators.

Table 6 Mediation Analysis (Bootstrapping Results)

Table 6 Mediation Analysis (Bootstrapping, 5000 samples)

Indirect Path	Indirect Effect	95% CI	Significance
DN $\rightarrow$ Ecosystem Digitalization $\rightarrow$ SS	0.18	(0.09, 0.28)	Significant
AIAI $\rightarrow$ IR $\rightarrow$ SS	0.24	(0.13, 0.35)	Significant

Mediation effects were established through bootstrapping analysis. The model showed great predictive ability. The model explained 46% of the variance in innovation radicalness, 38% of the variance in platform dependency, and 52% of the variance in startup scalability. To be able to explain more than half of the variance in startup scalability is a great predictive power in entrepreneurship.

Founder Typologies: Cluster Analysis

To explore heterogeneity within the Generation Z entrepreneurial cohort, a K-means cluster analysis was conducted using AI Adoption Intensity, Sustainability Orientation, and Innovation Radicalness as clustering variables. The analysis identified three distinct entrepreneurial profiles, as presented in Table 7.

Table 7 Founder Typologies (K-means Clustering)

Cluster	% of Sample	AI Adoption	Sustainability Orientation	Innovation Radicalness	Label
Cluster 1	38%	High	Moderate	High	AI Augmented Innovators
Cluster 2	34%	Moderate	High	Moderate	Purpose Driven Digital Builders
Cluster 3	28%	Low	Moderate	Low–Moderate	Platform Dependent Optimizers

ANOVA confirmed statistically significant differences across clusters ($p < 0.001$).

The first cluster was described as AI-Augmented Innovators (38%) which had high adoption and radicalness of innovation and a high degree of concern about scalability and technology innovation. The second cluster was described as Purpose-Driven Digital Builders (34%) which showed high sustainability orientation and moderate AI adoption as well as a focus on value creation. The third cluster was described as Platform-Dependent Optimizers (28%) where there was a heavy use of digital platforms and infrastructures and mainly concerned with innovation and operational improvements. The ANOVA test results indicated the existence of significant differences between all three clusters ($p < 0.001$).

Generally, the results of the quantifiable study indicated three dominant aspects of Generation Z's entrepreneurship: accelerated innovation cycles due to integration with AI, increased usage of hybrid human-AI decision-making systems, and consideration of sustainability in entrepreneurial activities. The current research findings laid the basis for an exploratory investigation into the topic of Generation Beta entrepreneurship through the development of the IITF framework.

Qualitative Findings: Foresight Perspectives on Generation Beta Entrepreneurship

This qualitative stage investigated the effects of potential advancements in technology, institutions, and society on the future development of entrepreneurship among Generation Beta members. For this purpose, data were gathered from 24 expert respondents via Delphi surveys and semistructured interviews. The six themes generated through thematic analysis are closely related to each other and describe the expected emergence of AI-native entrepreneurship. The intercoder reliability for the qualitative thematic analysis is extremely high ($\kappa = 0.87$).

Emerging Themes

One of the most prominent themes in expert discussions was AI-native cognition, raised by 22 out of 24 experts. It is believed that Generation Beta will not consider artificial intelligence as a tool that needs to be adopted but will incorporate AI into their development process and environment. As a result, entrepreneurial cognition will move beyond the idea of technology-based decision-making and become one that is continuously associated with human–AI cooperation in terms of opportunity identification, problem solving, and innovation.

The second theme was related to the use of algorithms for capital allocation and investments. The participants expressed concerns regarding the use of technology and automation tools for venture evaluation, prediction, and investments in the future.

Hyper-personalized innovation became the third theme discussed by the experts. The future ventures will be able to create innovative solutions based on the usage of real-time data ecosystems in order to develop personalized offerings.

The participants also talked about the development of fluid organizational structures with micro-teams, decision making distributed among individuals, and AI management systems. The founders are likely to emerge as orchestrators of human and technological resources instead of being conventional hierarchical decision makers.

A fifth theme concerned ethical AI entrepreneurship. The experts emphasized increasing requirements for transparency, accountability, fairness, sustainability, and responsible AI governance. Ethical competence would be an essential source of legitimacy and competitiveness in future entrepreneurial environments.

Entrepreneurial skill transformation was the final theme that came up in the discussion. It was argued that entrepreneurs would need to develop systems thinking, AI cooperation competency, interdisciplinary approach, and sustainability management skills for their success.

Summary of Qualitative Themes

Table 8 Thematic Analysis Summary

Theme	Frequency	Illustrative Insight	Implication
AI Native Cognition	22/24	AI as cocreator	Human AI symbiosis
Algorithmic Capital Allocation	19/24	Automated funding decisions	AI-driven VC
Hyper Personalized Innovation	17/24	Real time customization	Datacentric ventures
Fluid Organizational Structures	16/24	AI as advisor	Decentralized governance
Ethical AI Entrepreneurship	21/24	Transparency demands	Governance shift
Skill Transformation	18/24	Systems thinking	Education reform

Intercoder reliability: $\kappa = 0.87$ (High agreement)

Together, these studies imply that Generation Beta entrepreneurs will operate in an environment where there is greater convergence between the cognitive abilities of humans, intelligent technologies, and the entrepreneurial ecosystem. Unlike technological evolution, which involves the development of new technologies, this study indicates that it is more of a sociotechnical evolution.

Integration of Quantitative and Qualitative Findings

The integration of the quantitative and qualitative results has helped in providing a holistic picture of the shift from digital natives entrepreneurship towards AI natives entrepreneurship. In accordance with the explanatory sequential mixed-method approach, qualitative results have been utilized to explain and elaborate on the empirical patterns observed among GenZ entrepreneurs.

From Digital Nativity to AI-Native Entrepreneurship

The quantitative results showed that generation Z entrepreneurs are highly digital natives and adopters of AI as well as being highly dependent on platforms. The adoption of AI increased innovation radicalness and venture scalability. Hence, it can be said that AI is becoming increasingly strategic in the context of entrepreneurial endeavors.

Qualitative results revealed that the future of this phenomenon will be witnessed among Generation Beta entrepreneurs. Experts have repeatedly forecasted a move from AI augmentation to AI symbiosis, wherein AI systems integrate into the decision-making process of entrepreneurs. It was found that this represents an evolutionary chain:

Digital Fluency → AI Augmentation → AI Symbiosis

Therefore, this phenomenon will also help to expand the Generational Imprint Theory.

Transformation of Innovation and Ecosystems

It was found that the effect of digitalization of ecosystems on start-up performance is high, whereas the effect of sustainability orientation increases the connection between the development of digital abilities and entrepreneurial venture growth. The above results show that modern entrepreneurship is increasingly based on digital competencies and digitalized ecosystems.

Qualitative data also support the idea of growing automation of ecosystems due to the emergence of accelerators, venture digital platforms, and algorithmic ecosystems. The trend implies that innovation will be moving toward ecosystem-based and algorithmically orchestrated innovation.

Mixed-Methods Integration

Table 9 Mixed-Methods Integration Matrix

Quantitative Finding (Gen Z)	Qualitative Projection (Gen Beta)	Integrated Insight
High AI adoption ($\beta = 0.52$)	AI-native cognition	Shift from augmentation to symbiosis
Ecosystem digital media-tion	Algorithmic VC funds	Ecosystem automation
Sustainability moderation	Ethical AI governance	Sustainability embedded in AI logic
Reduced innovation cy-cles	Hyper-personalization	Acceleration intensifies

The integrated evidence reveals four major transitions: (1) AI augmentation evolving into AI symbiosis, (2) digitally mediated ecosystems evolving into algorithmically governed ecosystems, (3) sustainability becoming embedded within AI-driven innovation systems, and (4) increasingly accelerated innovation cycles supported by intelligent technologies.

Development of the Intergenerational Innovation Transition Framework (IITF)

The synthesis of empirical and foresight research leads to the formation of the Intergenerational Innovation Transition Framework (IITF). This framework defines startup innovation as an evolving process of interaction between generational imprinting, technological acceleration, ecosystem maturity, and human–AI interaction.

Quantitative research findings suggest the presence of a transitional entrepreneurial generation in the form of Generation Z which is defined by its digital imprinting, strategic use of AI, and sustainability-driven innovation practices. Qualitative research forecasts the rise of the next entrepreneurial generation known as Generation Beta, which is defined by its cognitive imprinting and strategic AI-driven ecosystems.

According to the IITF model, the evolution of entrepreneurship involves three major evolutionary transitions:

1. Digital Entrepreneurship – characterized by platform-based innovation and connectivity.
2. AI-Augmented Entrepreneurship – characterized by strategic application of AI to entrepreneur’s decision-making and innovation.
3. AI-Native Entrepreneurship – characterized by integrated human-AI cognition and intelligent innovation systems.

Hence, the success of startups will be contingent upon the interaction among generational imprinting, technological cognitive integration, innovation capability, and digital maturity of the ecosystem. In the case of Generation Beta entrepreneurs, the maturity of the AI technology ecosystem will be taken as an important determinant for their performance and innovation speed.

The contribution of this model to the existing body of literature on entrepreneurship and innovation is related to its introduction of AI-native entrepreneurship. Moreover, the framework provides an opportunity to understand how generational change and rapid technological advancement impact the development of entrepreneurial ecosystems.

Discussion

Theoretical and Practical Implications

This study makes a valuable contribution to the fields of entrepreneurship and innovation by combining insights from empirical studies on Generation Z entrepreneurs and foresight perspectives on Generation Beta. The results imply that innovation within new ventures is becoming more influenced by the interactions among generational imprinting, technological advances, entrepreneurial ecosystem dynamics, and human-AI cooperation.

Firstly, the results enrich Generational Imprinting Theory by showing that technological environments can be considered among the most important developmental factors for entrepreneurial cognition. In line with the cohort perspective proposed by Mannheim (1952) and further elaborated in the entrepreneurship literature (Zhang & Acs, 2018; 2019), members of Generation Z display notable digital imprinting and AI integration. Yet, the qualitative results suggest that members of Generation Beta can view artificial intelligence not as a technology that they have to adopt but rather as a cognitive environment which surrounds them. It appears that the process of digital imprinting can evolve into AI imprinting where opportunities will emerge, decisions will be made, and innovations will be developed in interaction with intelligent technologies.

Secondly, the current study expands on the framework of Digital Innovation Theory through the discussion of the increasingly important role of AI in entrepreneurial innovation. The previous literature stressed the reprogrammability and recombination of digital technology in the process of innovation (Yoo et al., 2010; Nambisan, 2017). It is demonstrated herein that AI usage is effective at increasing the degree of innovation radicalness and shortening the period of product creation for Generation Z entrepreneurs. Furthermore, the expectations of professionals show that further innovations would involve constant cooperation between humans and intelligent machines. The implication of such predictions indicates the possibility of developing innovative ecosystems powered by AI, where value creation would result from human-machine interactions.

Finally, the results contribute to the field of Entrepreneurial Ecosystem Theory through the identification of the increasing role of ecosystem digitalization on entrepreneurship ventures' performance. As predicted by previous research on entrepreneurship ecosystems (Stam, 2015; Spigel, 2017), entrepreneurs working in an ecosystem that was digitally advanced were found to have better scalability results. Qualitative analysis also indicates that entrepreneurship ecosystems could develop towards the creation of algorithmic ecosystems where AI would play a critical role in evaluating investments, allocating resources, and providing intelligent infrastructures.

These synthesized results provide empirical evidence in favor of the proposed Intergenerational Innovation Transition Framework (IITF), which defines the process of innovation within startups as an ongoing interaction of four factors: generational imprinting, technological acceleration, ecosystem development, and human-AI symbiosis. According to IITF, entrepreneurial ecosystems are transitioning from being digital native ecosystems, characterized by Gen Z, to becoming AI native ecosystems, which might be characteristic of Gen Beta.

From the practical standpoint, there are several implications of the proposed findings for investors, policy makers, universities, and business angels. Investors would need to pay more attention to founders' skills at cooperating with AI technology in addition to their entrepreneurial skills. There might also be a need to introduce AI-enabled tools for accelerating venture development into the practices of incubators and accelerators. Policy makers would need to focus on the development of relevant regulations to govern AI technology. Universities would have to rethink their curriculum and add new courses that include knowledge about AI, systems thinking, sustainability, etc.

Conclusion, Limitations, and Future Research Directions

This research paper analyzed the development of innovation in startups by incorporating quantitative data gathered from Generation Z entrepreneurs together with qualitative foresight predictions regarding

Generation Beta. In order to do so, an explanatory sequential mixed-method approach was used to analyze the impact of such factors as generational imprinting, digital innovations, ecosystems, and human-AI collaboration on entrepreneurship and innovation.

As revealed in the quantitative section, the entrepreneurs of Generation Z demonstrate a highly developed level of digital nativity, integration of artificial intelligence technologies, and sustainable practices. AI application makes innovation radically innovative and scalable, whereas the digitalization of ecosystem fosters startup success. It can be concluded that the future of successful entrepreneurship is becoming more connected to digitalized environments.

Qualitative foresight analysis extends the above results, predicting the rise of AI-oriented entrepreneurship among members of Generation Beta. In this regard, it was argued that future entrepreneurs might relate to artificial intelligence not only as a tool, but as a cognitive partner affecting their ability to recognize business opportunities, make decisions, innovate, and allocate resources. It is predicted that entrepreneurial communities will transform into algorithmic entities with governance facilitated through artificial intelligence, capital prediction, and highly personalized innovation.

Overall, the results demonstrate that the shift from Generation Z to Generation Beta constitutes a major structural change in the entrepreneurial system, whereby entrepreneurial cognition is transforming from being informed by data to becoming based on human-machine collaborative intelligence. Innovation is also predicted to become increasingly reliant on intelligent systems and digitally advanced environments. The sociotechnical nature of entrepreneurship seems confirmed by these results, highlighting how interactions between human capacities and technology play an important role in entrepreneurial endeavors.

The study suggests the Intergenerational Innovation Transition Framework (IITF), where innovation by startups is viewed as a dynamic interplay between generational imprinting, technological acceleration, ecosystem maturation, and human-AI collaboration. By combining elements from Generational Imprinting Theory, Digital Innovation Theory, Entrepreneurial Ecosystem Theory, and Sociotechnical Systems Theory, IITF offers a holistic perspective of entrepreneurial evolution through generations.

Despite the merits of the research, there are limitations to be considered. Firstly, Generation Beta entrepreneurs are not active in entrepreneurial ecosystems yet, so the qualitative results are hypothetical scenarios suggested by experts. Secondly, the study is cross-sectional in nature, making the interpretation of causal relationships difficult. Furthermore, cultural and institutional factors that influence the entrepreneurial activity could play a significant role. Future research should examine the longitudinal validity of Generation Beta predictions, cross-cultural entrepreneurship with AI-native entrepreneurs, the development of human-AI entrepreneurial cognition measures, as well as the ethical and governance issues associated with algorithmic decision-making, AI capital allocation, and digital ecosystems management.

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