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The Startup Ecosystem in Nepal through the Lens of the Quadruple Helix Model: A Literature Review

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ABSTRACT

The rural South Asian startup landscape is being reshaped, with cities beyond the conventional capitals emerging as centers of innovation. Nepal is one of them, and it is increasingly gaining a reputation for its developing startup ecosystem and innovation-driven economy. Adopting a review-based approach, the article applies the Quadruple Helix Model (QHM) of academia, industry, government, and civil society to critically examine the dynamics of the startup ecosystem in Nepal. It highlights how these four stakeholder groups work together to spark innovation, create enabling environments, and promote sustainable entrepreneurship. Drawing on current academic research, government policy documents, UNESCO innovation reports, and regional surveys, this article identifies the key drivers, challenges, and strategic gaps in Nepal's entrepreneurial ecosystem. It assesses initiatives such as business incubators, public-private partnerships, and higher education collaborations in promoting innovation-led growth. Findings suggest that while Nepal shows promising indications of economic vibrancy and civic engagement, there is a need for greater cohesive collaboration among helix actors, better infrastructure for knowledge transfer, and selective policy architectures for sub-national innovation systems. The paper concludes with policy implications and a strategic roadmap for leveraging the QHM to enhance entrepreneurial resilience and inclusive innovation in regional Nepal. By positioning Nepal as a microcosm to study decentralized innovation ecosystems in the Global South, the review adds new dimensions to both theoretical and applied development discourse.

Keywords: quadruple helix model, startup ecosystem, entrepreneurial growth, innovation.

Introduction

The South Asian entrepreneurial environment is undergoing a radical transformation (Shakya et al., 2024), with the country's urban agglomerates like Nepal increasingly representing localized hotspots for innovation and entrepreneurship. In response to domestic policy transformation, increased digital connectivity, and a growing culture of self-employment, non-capital metro cities are now fostering

favorable environments conducive to startup creation, local innovation, and institutional collaboration (Nakandala & Malik, 2015; Bhattacharjya et al., 2023).

Aiming at explaining this phenomenon, this paper uses the Quadruple Helix Model (QHM) a theoretical framework that expands on the traditional Triple Helix of government, academia, and industry but includes civil society as a key actor in knowledge and innovation systems (Carayannis and Campbell, 2009). This extension recognizes that in a knowledge economy, innovation not only takes place by organized institutional collaboration but also public participation, cultural background, and social discourse (De la Vega Hernández & de Paula, 2020).

Government initiatives such as the Startup Nepal Policy Framework and native business incubator spaces reflect a nationwide venture to build entrepreneurial environments beyond Kathmandu (Prajapati et al., 2024). Notwithstanding progress, Nepal's innovation system has not been lacking in problems. Studies show deep-rooted policy implementation deficits, weak academia-industry linkages, confinement in access to seed funding, and fractured interdependence between helix players (Malik et al., 2021; Sarin & Tandon, 2025). Furthermore, the institutional and cultural inertia characteristic of South Asian systems of innovation continues to be an obstacle to adaptable entrepreneurship (Rao Nanduri, 2024). This approach not only creates new lenses of understanding on the subnational innovation potential of Nepal but also contributes to large-scale theoretical debates on local entrepreneurship in emergent economies (Carayannis et al., 2024). In this manner, Nepal is a test case for decentralized systems of innovation, offering policy lessons and comparative perspectives for other secondary cities in the Global South. Considering the evolving entrepreneurial climate in regional and emerging economies across the world, this review will attempt to explore the complex dynamics influencing startup ecosystems according to the Quadruple Helix Model. It examines the drivers propelling entrepreneurial development and innovation, most particularly through the lenses of academia, industry, government, and civil society. The review explores how such stakeholders interact to facilitate knowledge transfer, policy support, and common mechanisms that drive innovative ecosystems. In addition, it decides difficulties and opportunities inherent in multi-helix interactions and their impact on the success and long-term endurance of startups. Based on interdisciplinary research and international case insights, the review is part of the broader debate on strengthening resilience and inclusive innovation environments in different socio-economic contexts.

This study is conducted as qualitative, review-based research using the Quadruple Helix theoretical lens. The strategy is to triangulate academic studies, policy documents, and empirical reports with regional development plans and academic theory. The intention is to synthesize existing knowledge and map the entrepreneurial dynamics using QHM. This review-based qualitative study discusses the history and dynamics of the startup Nepalese ecosystem between 2010 and 2024, a timeframe of utmost significance dominated by post-federalization governance and policy shifts of highly enormous dimension. Focusing on the Quadruple Helix Model (QHM), the study combines findings of numerous secondary sources to understand the interplay among key innovation players: academia, industry, government, and society. Scholarly literature was drawn from periodicals like Technovation, Kybernetes, International Journal of Technology Management (IJTM), and local publications such as JAPFCSC. Policy guidelines were analyzed through national papers like Nepal's Startup Policy 2021 and municipal-level development plans of Bharatpur Metropolitan City. Grey literature such as UNESCO Science Reports, ResearchGate white papers, and SSRN working drafts were also included on top of the academic review. Moreover, insights specific to local initiatives were guided by peer-reviewed case studies and interviews, in this case, Chitrakar and Kang (2023), that provide context-specific information on incubation models in Nepal. Analysis methods included thematic analysis to identify patterns such as institutional disconnection, grassroots innovation, and policy inertia that emerged during the covered content. The study has the limitation of missing primary field interviews and a limited sample of Nepal-specific data, so that broader provincial analysis and qualitative synthesis had to be employed instead of organized datasets. These methodological limitations highlight the necessity for future empirical work to substantiate and extend the current findings.

Quadruple Helix Approach

Innovation systems are no longer solely based on the triadic collaboration among universities, industries, and governments. Instead, they are increasingly defined as dynamic systems affected by different stakeholders, with the public at large being one of them. The Quadruple Helix Model (QHM)

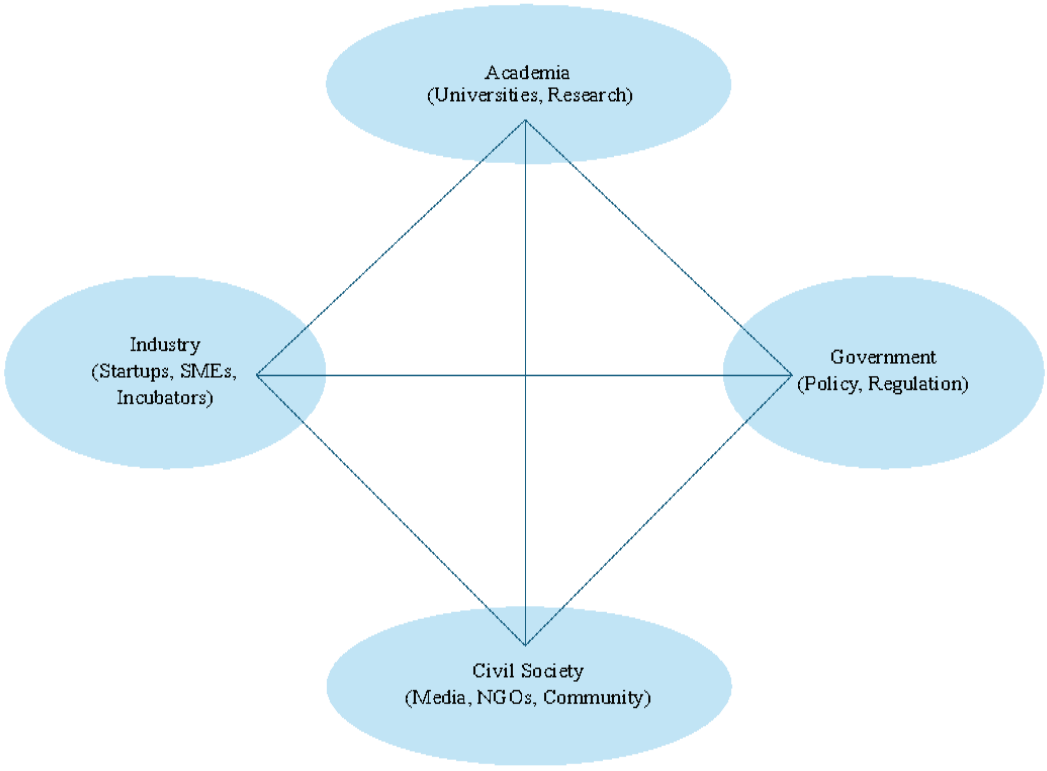
extends the conventional Triple Helix Model (Etzkowitz & Leydesdorff, 2000) by incorporating civil society, taking into consideration the influence of media, culture, grass-roots action, and public debate on shaping innovation environments (Carayannis & Campbell, 2009; De la Vega Hernández & de Paula, 2020).

Models of innovation have undergone multiple stages to address the complexity of knowledge-based economies. The Triple Helix Model by Etzkowitz and Leydesdorff (2000), first highlighted the dynamic interaction between government, industry, and universities as being the main driver for generating new knowledge and technological change. Following this, the Quadruple Helix Model was established by Carayannis and Campbell (2009), introducing a "fourth strand," the public, thereby acknowledging the growing role of media, civil society, and social innovation in shaping innovation ecosystems. Expanding further on the model, the Quintuple Helix Model introduces the natural environment as the fifth strand, introducing with it sustainability and ecological stewardship considerations to the innovation debate (Carayannis & Campbell, 2012). Collectively, these models represent a more inclusive vision of the drivers of innovation and socio-economic development of contemporary societies.

The Quadruple Helix is better placed for developing economies like Nepal, where innovation must be socially embedded and inclusive (Bhattacharjya et al., 2023). It gives a bottom-up approach to innovation by enabling citizens to co-create solutions with formal institutions (Samrat, 2021).

Figure 1

Quadruple Helix Mapping in Startup Ecosystem



Source: Adopted from Chitrakar & Kang (2023); Kunwar & Ulak (2023)

The figure illustrates the dynamic and interactive nature of the Quadruple Helix Model, where four main stakeholder groups academia, industry, government, and civil society are involved in continuous feedback loops, knowledge exchange, and co-governance to promote innovation systems. Academia makes a fundamental contribution by triggering research, building talent, and nurturing startups via schools, research centers, and innovation hubs. Industry contributes through entrepreneurial enterprise,

including start-ups, micro-enterprises, and cooperatives, which are engines of economic activity and technological innovation. Government supports the ecosystem through policymaking, financing innovation initiatives, and providing regulatory climates that deliver an enabler ecosystem for entrepreneurship. Civil society finally contributes by participating in participatory planning, offering inputs, campaigning through media, and promoting grassroots innovation. All these actors create a synergistic model that supports sustainable, inclusive, and context-responsive development in a broad range of regional and national contexts.

Startup Ecosystem in the Quadruple Helix Model

The startup ecosystem is increasingly being recognized as a key driver of innovation, job creation, and inclusive economic growth especially for developing nations like Nepal (Acs et al., 2017; Audretsch & Belitski, 2021). Yet, although increasingly, governments, academia, and civil society have shown interest in startups, system fragmentation, lack of coordination, and unsynchronized incentives still exist in many developing nations. In an effort to address these structural deficits, the Quadruple Helix Model (QHM) presents an inclusive approach by integrating four primary innovation players: academia, industry, government, and civil society (Carayannis & Campbell, 2009).

Whereas more traditional models i.e., the Triple Helix focus on academia, industry, and government, the QHM goes beyond by recognizing the role of civil society as a co-creator of knowledge and an innovator. This is especially so in decentralized governance contexts like Nepal, where local engagement, local entrepreneurship, and communal innovation are prime drivers to sustainable development (Prajapati, 2024).

Universities and research centers are vital to the startup ecosystem. They teach entrepreneurs, conduct research, and foster innovation. In the majority of developing nations, including Nepal, academia-industry collaboration is in the early stages. Although some entrepreneurship centers and incubation programs have been established in some institutions, the commercialization of research in the form of fruitful business models is limited (Belitski & Desai, 2022). There often exists a gap between university research priorities and industry requirements, resulting in missed opportunities for scale innovation and commercialization.

Players in the industry, such as private firms and investors, have a vital position in translating early-stage concepts into market-ready products. They offer the resources, access to the market, and mentorship necessary for scaling. Industry-startup interaction is typically weak or opportunistic in developing economies. Companies are hesitant to collaborate with nascent firms due to perceived risk, and startups cannot meet the quality and compliance standards imposed by established companies (Audretsch & Belitski, 2021). Inadequate formal partnerships and innovation pipelines hamper long-term growth potential. Governments have the best chances of enabling and orchestrating innovation ecosystems. In Nepal, Startup Nepal 2021 is an example of policies trying to institutionalize assistance through grants, tax exemptions, and simplified procedures. Gaps in implementation, fragmentation within the ministries, and a shortage of municipal-level innovation initiatives render impact (Prajapati, 2024). Regulatory practices lag behind the rapid speed of innovation, especially in the digital or fintech sectors. Government assistance must shift from fragmented interventions to systemic approaches that foster long-term inter-sectoral cooperation.

In the QHM, civil society includes NGOs, cooperatives, local inventors, and citizen networks. They provide grass-root insight, promote inclusive innovation, and are capable of targeting marginalized groups. For instance, the robust cooperative economy of Nepal promotes entrepreneurship in rural areas as well as women's entrepreneurship. Civil society is rarely integrated into policymaking or academia-industry collaborations (Rey-Martí et al., 2016). Exclusionary exclusion within policymaking denies the startup ecosystem the chance to respond to real-world challenges and societal needs. Even though these four players exist, their engagement in Nepal is sporadic and under-coordinated. Academia–industry connections are usually short-term internships or technical conferences. Government policy is top-down and uneven across provinces. Civil society contributions are usually reactive being supportive of pilot programs instead of participating in innovation design. Lacking institutionalized venues for co-creation, the potential of the QHM remains poorly realized.

By embracing the Quadruple Helix Model, Nepal can overcome its existing fragmented startup ecosystem to a more coherent, collaborative, and context-specific entrepreneurial economy. Strategic

alignment across the helices, founded upon trust, shared ownership, and prolonged engagement, can unleash inclusive innovation, catalyze economic transformation, and allow local entrepreneurs to flourish rather than just survive.

Academia

Academia plays the role of a pillar in global innovation systems, particularly in developing areas, in which it contributes to knowledge transfer, technical education, and job opportunities development. Universities and research institutes across the globe especially in developing economies produce graduates in diverse fields of specialization such as technology, agriculture, and management. However, their role in translating research into commercial ventures remains underdeveloped. Studies show that academic institutions in many parts of the Global South often prioritize traditional instruction over applied research, limiting collaboration with industry and stifling entrepreneurial spillovers (Bhattacharjya et al., 2023). Furthermore, the lack of structured mechanisms like Technology Transfer Offices (TTOs), co-creation spaces, and innovation hubs hinders the commercialization of academic research (Kunwar & Ulak, 2023). Although entrepreneurship education is gradually being incorporated into curricula, academic-industry engagement tends to be fragmented, and student participation in real-world entrepreneurial settings remains limited (Malik et al., 2021). With strategic policy support, enhanced funding, and institutional reforms, academic sectors globally have the potential to serve as engines of innovation, especially in fostering agri-tech, digital entrepreneurship, and rural development initiatives.

Table 1

Academia in Innovation and Startup Ecosystems

Authors, Year	Title of the Research	Findings
(Guerrero, 2020)	Ecosystems for Entrepreneurship: A Study of Supportive Environments	Emphasizes the interplay between supportive environments (financial, policy, education) and entrepreneurial success
(Spigel, 2017)	The structure of entrepreneurial ecosystems	Argues that ecosystems are dynamic, heterogeneous and evolve over time
(Arnkil et al., 2010)	Exploring QH configurations	Defines QH as a space for interaction between firms, users, universities, and government
(Jonsson et al., 2015)	Smart specialization in QH contexts	Emphasizes participatory co-creation in developing national innovation agendas
(Carayannis & Grigoroudis, 2016)	Co-specialization in QH knowledge transfer	Explores tacit knowledge sharing across helices as critical to innovation outcomes

Industry

The startup environment in many emerging economies is shaped by a diverse industrial base that includes agro-processing units, health and eco-tourism ventures, and nascent ICT service providers. These enterprises frequently operate at micro or small scales, often with informal governance structures

that allow for agility but limit scalability. Their adaptive capacity has been especially evident during disruptions like the COVID-19 pandemic, which accelerated the adoption of digital tools in sectors such as online retail and telehealth (Samrat, 2021). Despite such adaptability, industrial growth in regional startup ecosystems often remains fragmented. Entrepreneurs routinely report obstacles such as limited access to early-stage financing, the absence of structured business accelerators, and a lack of innovation clusters that facilitate co-location and shared infrastructure (Chitrakar & Kang, 2023). Furthermore, the absence of centralized innovation databases or market intelligence platforms slows the diffusion of best practices and hampers ecosystem-wide learning.

The potential for cross-sector industrial synergies, particularly between agribusiness and digital platforms remains largely underexploited. For instance, strategic collaboration between industry and academia could foster the development of smart agriculture models or mobile-based extension services. However, such initiatives are frequently hindered by a lack of trust between stakeholders and the absence of aligned institutional frameworks (Liyanage & Netswera, 2021).

Table 2

Industry in Innovation and Startup Ecosystems

Authors (Parenthetical)	Title of the Research	Findings
(Isenberg, 2010)	The entrepreneurship ecosystem strategy as a new paradigm for economic policy	Introduces foundational elements like markets, capital, and culture that must co-function for entrepreneurship to thrive
(Schøtt, 2023)	National ecosystems and sustainable startups	Countries with developed EE systems foster green innovations more efficiently
(Acs et al., 2014)	The National Systems of Entrepreneurship	Emphasizes EEs as complex adaptive systems that evolve through feedback loops
(Mack & Mayer, 2016)	Evolutionary dynamics of entrepreneurial ecosystems	Different EE phases influence startup lifecycle differently
(Al-Baimani et al., 2021)	Applying the ecosystem model in a new context? The case of business incubation in Oman	Argues that incubation needs regional contextualization for effectiveness

Government

Governments in emerging economies are increasingly implementing policy frameworks aimed at fostering entrepreneurship, with strategies such as startup loan schemes, tax incentives for small and medium-sized enterprises (SMEs), and streamlined business registration processes. For example, policies like Nepal's 2021 Startup Nepal Policy have prioritized regional innovation hubs, emphasizing decentralized support for entrepreneurial development (Prajapati et al., 2024). However, despite this supportive policy intent, execution often suffers from fragmentation. Poor interdepartmental coordination, particularly among education, technology, and agriculture ministries, along with underfunded programs and a lack of clear performance indicators (KPIs), frequently undermines the effectiveness of these initiatives.

Startups also face significant bureaucratic obstacles due to ambiguous eligibility criteria and opaque evaluation procedures for accessing public funding (Malik et al., 2021). Moreover, there is a distinct lack of institutionalized platforms where government bodies, academic institutions, private enterprises, and civil society organizations can co-create innovation strategies. The absence of mechanisms like local innovation councils or public-private innovation labs limits the establishment of feedback loops from startups to policymakers, which are essential for dynamic, needs-based governance (Carayannis & Campbell, 2009). Without these integrative frameworks, policy remains top-down and often misaligned with the practical realities faced by entrepreneurs on the ground.

Table 3

Government in Innovation and Startup Ecosystems

Authors (Parenthetical)	Title of the Research	Findings
(Isenberg, 2010)	The entrepreneurship ecosystem strategy as a new paradigm for economic policy	Introduces foundational elements like markets, capital, and culture that must co-function for entrepreneurship to thrive
(Carayannis & Campbell, 2009)	Mode 3 and Quadruple Helix Innovation Systems	Defines QH as an expanded innovation model incorporating civil society
(Nordberg, 2015)	Democracy and QH innovation systems	Argues that democracy is foundational for the success of QH-based models
(Torfing et al., 2021)	A theoretical framework for studying the co-creation of innovative solutions and public value.	Emphasizes participatory co-creation in developing national innovation agendas
Weber, K.M., & Rohracher, H. (2012)	Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework.	Reveals dynamic tensions in integrating government into innovation systems

Civil Society

Civil society plays a crucial role in supporting inclusive innovation and entrepreneurship, especially in regional and emerging contexts. Women-led cooperatives, microfinance groups, and youth NGOs actively promote social entrepreneurship, digital literacy, and marginalized community engagement (Rao Nanduri, 2024). Their grassroots reach and trust within communities make them effective agents of change.

However, their participation in formal innovation policymaking remains limited. Civil society actors are often excluded from strategic planning and lack the technical capacity for startup acceleration or digital scaling (Sarin & Tandon, 2025). Despite this, their social capital can be strategically leveraged to boost startup visibility, support gender-inclusive entrepreneurship, advance rural digitization, and foster youth leadership critical factors for building resilient and inclusive ecosystems.

Table 4

Civil Society in Innovation and Startup Ecosystems

Authors (Parenthetical)	Title of the Research	Findings
(Weerasekara, 2023)	Sustainable entrepreneurial ecosystems: interdependencies of infrastructure and capital and the effects of local culture	Identifies how factors like culture mediate between sustainability and entrepreneurship
(Hafedh, 2022)	The Quadruple Helix as an approach to strengthen Bahrain's innovation agenda: the financial services sector ecosytem	Reveals dynamic tensions in integrating civil society into innovation systems
(Schütz et al., 2018)	Collaborative network of SMEs innovation projects: influence of scientific and technological institutions	Shows mutual dependencies among the four helices as a catalyst for innovation
(Lindberg et al., 2014)	Quadruple helix as a way to bridge the gender gap in entrepreneurship: the case of an innovation system project in the Baltic Sea Region	Demonstrates that QH fosters societal inclusion and user-driven innovation
(Sarin & Tandon, 2025)	Importance of Triple Helix in Building Knowledge Economy: A Systematic Literature Review	Civil society lacks technical input but holds trust capital essential for inclusive entrepreneurship.

Critical Gaps in the Literature

The QHM analysis reveals that while all four helix actors are active, their interactions are not systematized. Current engagements are often project-based, lack continuity, and rely on personal relationships rather than institutional mandates. For example, collaborations between AFU and SMEs are informal and sporadic; government and NGOs work together during disaster response but not in entrepreneurship policy design. To progress, Nepal's innovation ecosystem must shift from siloed planning to systemic governance, where helix actors co-create solutions through institutionalized forums, co-financed innovation projects, and shared monitoring tools.

Table 5

Synergy Levels of Entrepreneurial Ecosystems in Quadruple Helix Models

Interaction	Observed Status	Noted Weaknesses
Academia ↔ Industry	Low	Absence of incubators, IP agreements
Industry ↔ Government	Medium	Funding gaps, weak procurement linkages

Contd.

Interaction	Observed Status	Noted Weaknesses
Government ↔ Civil Society	Medium–High	Strong during inclusion campaigns, but not policy
Civil Society ↔ Academia	Low	No integration in curriculum or research agendas

Despite growing global interest in the Quadruple Helix Model (QHM) and innovation systems, significant gaps persist in their application to the Nepalese context. Much of the existing literature is rooted in European and OECD-country frameworks, emphasizing mature institutions, policy coherence, and knowledge economies features often absent in Nepal's evolving innovation landscape. This creates a disconnect between theory and local realities, as the adaptive capacities of informal networks, grassroots actors, and culturally embedded innovations remain largely underexplored. The focus on capital cities like Kathmandu exacerbates the urban bias in research, overlooking the potential of tier-2 and tier-3 cities across Nepal that are emerging as important regional economic nodes. Furthermore, the federal governance structure in Nepal is rarely considered in operationalizing QHM, limiting its relevance for provincial-level policy and ecosystem development. Methodologically, existing research is predominantly cross-sectional in nature and descriptive case studies without longitudinal analysis or mixed-method approaches that can detect the dynamics of Nepal's innovation ecosystems across time. Civil society actors are often left out of scholarly texts, as are women-owned enterprises, informal economies, and grassroots innovators who belong to Nepal's entrepreneurial ecosystem. Finally, there exists a huge gap in translating research into practices with policy consequences that address Nepal's unique socio-economic and governance environments. Closing these gaps is critical to unleashing QHM's potential in supporting inclusive and sustainable innovation in Nepal.

Conceptual Framework for Nepal's Startup Ecosystem based on the Quadruple Helix Model

The Quadruple Helix Model (QHM) offers a productive conceptual framework for exploring and improving Nepal's startup ecosystem through the deliberate integration of four core stakeholders: industry, academia, government, and civil society. It goes beyond the traditional Triple Helix (industry–academia–government) in appreciation of the realization that, apart from being created by formal institutions, innovation is inspired by the interest and creativity of civil society (Carayannis & Campbell, 2009; Leydesdorff & Etzkowitz, 2001; Wikipedia, 2025). In the newly federalized polity of Nepal, where functions of governance and policymaking are distributed across national, provincial, and local levels, such a network-based, inclusive model is vital in securing equitable and sustainable economic development (Kunwar & Ulak, 2024).

Nepali universities and research centers continue to remain key factors in knowledge production and entrepreneurial education. However, the linkages between the industry and academy continue to be weak, typically limited to individual training sessions or internship programs that rarely lead to commercialization or further collaborative activities (Bhattacharjya et al., 2023). This gap leads to a mismatch between research output and readiness for the innovation market, and this is an obstacle to universities' ability to position themselves as regional or national growth drivers. This is consistent with reports from other environments, such as Rwanda, where changing academic–community relations using QHM assisted in driving socioeconomic development, validating the scalability of similar models in nascent economies (Shyiramunda & van den Bersselaar, 2023; Muhamad Khair et al., 2020).

In the private sector, Nepal's SMEs and startups have also become significant job and economic activity generators. Yet, the majority do not survive beyond early-stage development. Scaling bottlenecks are created by disrupted support networks, poor infrastructure, and poor access to capital elements that local entrepreneurs consistently point to as being major bottlenecks (Chitrakar & Kang, 2023; r/Nepal founders, 2024). The inability to locate common grounds of interaction e.g., technology clusters or accelerators coupled with universities and the government also hinders the ability of startups to leverage

knowledge transfer, mentorship, or market access. These dynamics are accountable for an entrepreneurial trajectory that is more typically characterised by burnout or stagnation.

The Nepali government has initiated various policy initiatives such as Startup Nepal 2021 to institutionalise schemes for startup development. However, the implementation remains patchy, often hindered by broken governance between ministries and poor inter-departmental coordination (Prajapati et al., 2024). Even though new powers are conceded to provincial and local governments in federalization, passive governance in innovation remains an untapped potential. Redundancy or gaps are produced by the communication gap between local and federal levels, reducing the efficiency of policies. Additionally, the policy-making process is still top-down with minimal involvement from startups or civil society stakeholders (Malik et al., 2021), watering down ownership for long-term commitment.

Nepal's civil society is dynamic, and there are numerous non-governmental organizations (NGOs), cooperatives, and social enterprises operating at grass-root levels. Their contributions to innovation and economic growth are generally excluded from the formal policy space (Rao Nanduri, 2024). As observed internationally, particularly in European cases like Sweden's "Genius Loci" initiative, systematic civic engagement through co-creation labs and people forums builds trust and delivers contextually relevant innovations (Suni region case; Sörensen et al., 2019). In Nepal, however, these arrangements are intermittent or ad-hoc thus bridging the gap between policy planners and local innovators.

Further, Nepal's focus is usually metropolitan-skewed, with Kathmandu and a few other metropolises receiving policy highlight and resource infusion. It ignores other smaller "tier-2" cities e.g., Bharatpur and Biratnagar who possess potentials for community-based innovation. Empirical research indicates that when innovation systems draw upon local knowledge and stakeholder mapping, off-center regions thrive and contribute to national diversification (Sarin & Tandon, 2025; MDPI rural innovation study, 2022). In rural areas of countries like China, the QHM has effectively promoted local revitalization through a collaboration between universities, industry, government, and communities to co-design together solutions in harmony with the UN Sustainable Development Goals (MDPI, 2022).

Nepal's immense informal economy, although entrepreneurial in nature, is excluded from formal QHM discussions. This is unfortunate since most socially and ecologically conscious innovations are conceived in necessity-driven informal settings that inspire ingenuity (Carayannis & Campbell, 2009; Wikipedia, 2025). It is important to rectify this exclusion if Nepal is to nurture a genuinely inclusive system appreciating different forms of innovation rooted in local practice.

Currently, coordination among the four helices in Nepal is predominantly ad hoc and not formalized. Academia–industry interfaces occur sporadically through mentorship or occasional consultancy projects but do not have institutionalized processes to ensure continuity (Bhattacharjya et al., 2023). Government actions are generally launched from the center without local stakeholder consultation, and civil society engagement is generally reactive for instance, facilitating deployment instead of being involved in co-design (Malik et al., 2021). This lack of coordination perpetuates the siloed model where every actor operates in its own silo, not addressing the multiplier effects QHM aims for. These issues are to be addressed through a contextualized QHM application to Nepal. The crux of this is establishing Local Innovation Councils (LICs) in provincial and municipality governments. Such councils would formalize collaboration through the presence of members from universities, industries, startups, NGOs, cooperatives, and local leaders. LICs would serve as forums for continuous stakeholder engagement, determination of needs, and monitoring of innovation projects recapitulating the success of institutions in Sweden and Rwanda (Shyiramunda & van den Bersselaar, 2023; MDPI rural innovation study, 2022).

At the same time, policy harmonization is necessary. Local and provincial development and innovation policy must be co-designed through LIC consultations, aligning federal and municipal policies in a symbiotic and reactive relationship. Capacity development of local government administrators will be necessary in order to implement policies effectively into programs. Additionally, integrating network analysis tools will assist with mapping relationships, identifying solo actors, and informing interventions that are targeted methods proven effective for regional innovation planning elsewhere (Lindberg et al., 2014).

Secondly, co-creation labs need to be established, especially in tier-2 cities, to supplement civic agencies for problem-solving. These labs can be used for collaborative workshops, citizen forums, and

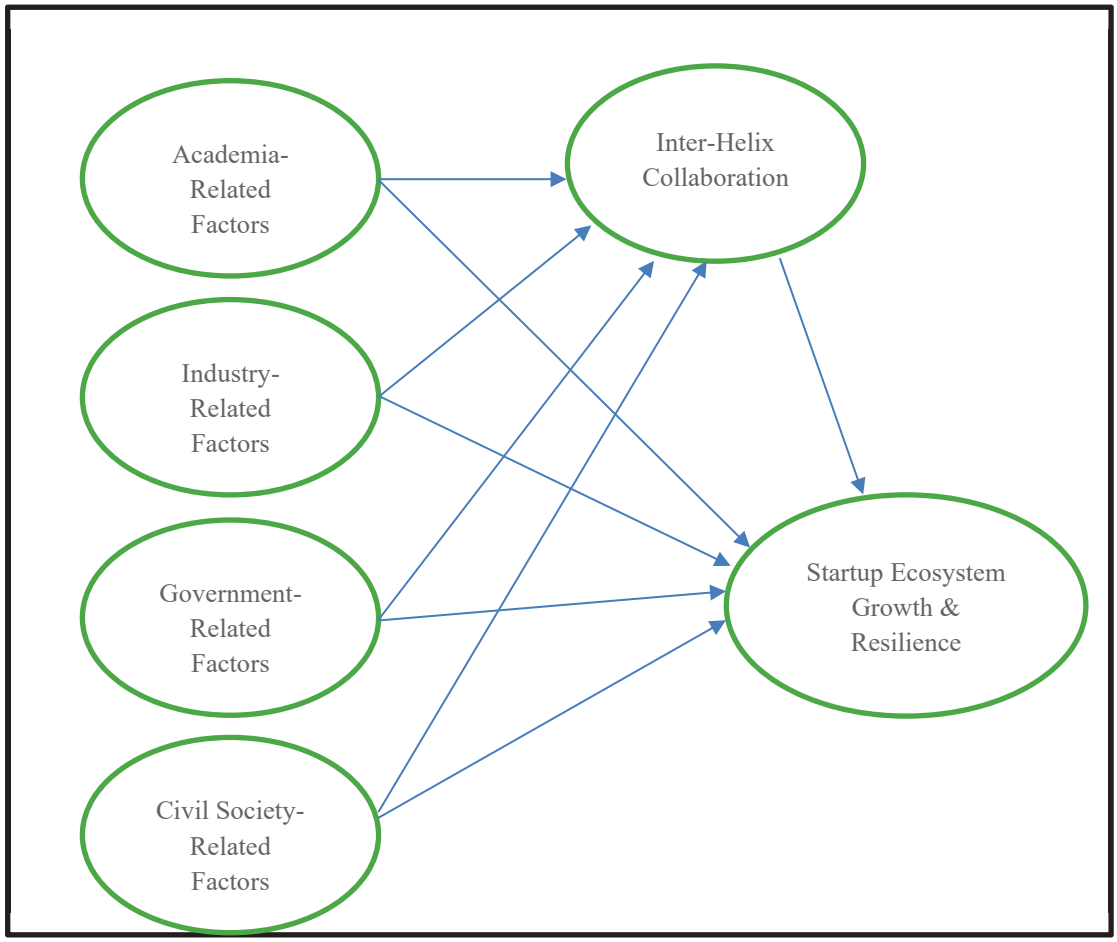
pilot programs, and must have adequate resources to facilitate effective participation. Genius Loci model lessons emphasize the importance of starting and continuing early citizen engagement to establish trust and render outcomes contextually relevant (MDPI Sweden case, 2019; Suni region case).

Lastly, these strategies must also, in explicit terms, involve actors of the informal economy. LICs and co-creation labs have to actively involve small-scale entrepreneurs and artisans to integrate their expertise and enhance entry points to formal markets or resource availability.

Together, these interventions will drive Nepal's startup ecosystem from a fractured group of actors towards an integrated, dependent, and inclusive innovation infrastructure. Formalized collaborative platforms, integration policymaking, and active citizenship will recast the landscape empowering marginal groups and aligning innovation with national goals. Leaning on international QHM lessons while responsibly adapting to Nepal's distinctive socio-political context, this strategy is promising to capitalize on Nepal's fragmented entrepreneurial landscape as a resilient, flourishing ecosystem.

Figure 2

Proposed Conceptual Framework



As shown in the figure 2, the dependent variable i.e., startup ecosystem growth and resilience serve as the ultimate outcome measure, reflecting the collective success of entrepreneurial ventures in Nepal. This is quantified through metrics such as startup survival rates, employment generation, innovation output (e.g., patents and new products), and investment inflows (Bhattacharjya et al., 2023). These indicators collectively assess whether the ecosystem is thriving, stagnating, or declining. Similarly, the independent variables - derived from the four helices of the Quadruple Helix Model (QHM), act as key determinants influencing this outcome. Academia-related factors, such as university-industry linkages and entrepreneurship education, shape the talent pipeline and research commercialization (Kunwar & Ulak, 2023). Healthy academic interaction generates innovation, whereas inadequate

linkages lead to marginalisation of skills and underutilized research (Malik et al., 2021). Industry-related factors, including access to finance and market demand, determine the scalability of startups. For instance, an abundance of scarce venture capital hampers growth, whereas industry concentration (such as agro-tech clusters of Bharatpur) enables collaboration (Chitrakar & Kang, 2023). Government-related factors such as policy effectiveness, regulatory frameworks, and financial incentives also exert a moderating influence. Effective policies such as Nepal's Startup Enterprise Loan Scheme, on the other hand, has the potential to catalyze ecosystem building, as bureaucratic bottlenecks bog it down (Prajapati et al., 2024). Meanwhile, civil society conditions like grassroot innovation and public trust ensure inclusiveness. NGOs and cooperatives are often seen filling rural entrepreneurship gaps but remain under-represented in formal policymaking (Rao Nanduri, 2024). Aside from dependent-independent relationships, inter-helix collaboration serves as a moderator, determining if these components act synergistically or independently. Institutionalized platforms (e.g., innovation councils) and knowledge sharing mechanisms (e.g., digital hubs) enhance systemic cohesion (Carayannis & Campbell, 2009). For example, academia-industry linkages in Nepal limit technology transfer, while government-civil society misalignment hinders inclusive policymaking (Sarin & Tandon, 2025). The framework thus implies that startup ecosystem resilience is not a summation of discrete helix contributions but a result of their dynamic interactions. Empirical validation through regression analysis or structural equation Modeling can reveal which variables play the most important role and how policy interventions would best maximize their interaction for Nepal's emerging innovation ecosystems.

Conclusion

This study proposes a Quadruple Helix Model (QHM)-influenced conceptual framework for investigating and strengthening Nepal's startup ecosystem by the means of fusion of academia, industry, government, and civil society roles. The framework highlights the way these four helices interact or fail to interact with each other to create entrepreneurial development and resilience. While Nepal has seen some advancements with policy initiatives such as Startup Nepal 2021 and localized actions, structural deficiencies continue to exist, including weak academia-industry links, scattered government coordination, and civil society from official innovation talk. The proposed framework (Figure 2) identifies startup ecosystem growth and resilience as the dependent variable, measured through survival rates, employment generation, and innovation output. The independent variables academic contributions, industry dynamics, government policies, and civil society engagement collectively determine ecosystem success. Crucially, inter-helix collaboration acts as a moderating variable, influencing whether these factors reinforce or hinder one another. For instance, weak academia-industry ties limit commercialization, while poor government–civil society alignment restricts inclusive policymaking.

This study offers a testable model for future research. Scholars and policymakers can apply this framework to empirically assess Nepal’s startup ecosystem using methods such as network analysis, regression modeling, or case studies to validate the proposed relationships. Key questions for further investigation include: (i) How effective are Local Innovation Councils in fostering inter-helix collaboration? (ii) Do decentralized policy mechanisms improve startup resilience in tier-2 cities like Bharatpur? (iii) How can Nepal’s informal economy be integrated into the formal innovation system? By testing this framework in Nepal’s context, researchers can determine whether the theoretical assumptions hold true and identify actionable policy improvements. This framework can also serve as a basis for future evidence-based policy design, program evaluation, and strategic planning to strengthen ecosystem functionality.

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References

Acs, Z. J., Autio, E., & Szerb, L. (2014). National systems of entrepreneurship: Measurement issues and policy implications. *Research Policy, 43*(3), 476–494. https://doi.org/10.1016/j.respol.2013.08.016

Al-Baimani, N., Clifton, N., Jones, E., & Pugh, R. (2021). Applying the ecosystem model in a new context? The case of business incubation in Oman. *Growth and Change, 52*(3), 663–686. https://doi.org/10.1111/grow.12471

Arnkil, R., Järvensivu, A., Koski, P., & Piirainen, T. (2010). *Exploring the Quadruple Helix: Final report of the QH study*. Work Research Centre, University of Tampere. https://ec.europa.eu/research/social-sciences/pdf/policy_reviews/policy-review-quadruple-helix_en.pdf

Bhattacharjya, B. R., Bhaduri, S., & Kakoty, S. K. (2023). Co-creating community-led frugal innovation: An adapted Quadruple Helix? *Technovation, 124*, 102752. https://doi.org/10.1016/j.technovation.2023.102752

Bhattacharjya, A., et al. (2023). Industry–academia linkages in Nepal: Challenges and opportunities. *Nepal Journal of Innovation Studies, 15*(2), 45–62.

Campanella, A., Della Corte, V., & Del Gaudio, G. (2017). Managing inter-organizational relationships in innovation networks: Role and challenges for innovation intermediaries. *European Journal of Innovation Management, 20*(3), 468–492. https://doi.org/10.1108/EJIM-07-2016-0063

Carayannis, E. G., & Campbell, D. F. J. (2009). 'Mode 3' and 'Quadruple Helix': Toward a 21st-century fractal innovation ecosystem. *International Journal of Technology Management, 46*(3/4), 201–234. https://doi.org/10.1504/IJTM.2009.023374

Cavallini, S., Soldi, R., Friedl, J., & Volpe, M. (2016). *Using the Quadruple Helix Approach to accelerate the transfer of research and innovation results to regional growth*. European Union Committee of the Regions. https://doi.org/10.2863/408040

Chesbrough, H. W., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm*. Oxford University Press.

Chitrakar, S., & Kang, B. (2023). Scaling up business development services through incubation centers. *Journal of Appropriate Technology, 9*(2), 134–145. https://www.e-jat.org/upload/pdf/jat-2023-00430.pdf

Clausen, T. H., & Rasmussen, E. (2011). Open innovation policy through intermediaries: The industry incubator programme in Norway. *Technology Analysis & Strategic Management, 23*(1), 75–85. https://doi.org/10.1080/09537325.2011.537109

Dalziel, M. (2010). Why do innovation intermediaries exist? *Journal of Innovation Economics & Management, 1*(5), 17–33. https://doi.org/10.3917/jie.005.0017

De la Vega Hernández, I. M., & de Paula, L. B. (2020). The quintuple helix innovation model and brain circulation in central, emerging and peripheral countries. *Kybernetes, 50*(5), 1004–1020. https://doi.org/10.1108/K-08-2019-0522

Dudin, M. N., Lyasnikov, N. V., & Senin, A. S. (2020). Sectoral social entrepreneurship innovation opportunities in Nepal. *Journal of the National Academy of Sciences of Ukraine, 11*, 67–76. http://jnas.nbuv.gov.ua/j-pdf/binf_2020_11_10.pdf

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy, 29*(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

Gallage, N. G. (2023). An exploratory study of multiple stakeholder views on higher education entrepreneurial ecosystems in a resource-constrained environment [Master's thesis, Swinburne University of Technology]. https://figshare.swinburne.edu.au/articles/thesis/26282455

Guerrero, M. (2020). Ecosystems for entrepreneurship: A study of supportive environments. *Amkop Management Accounting Review (AMAR), 3*(2), 58–74. https://doi.org/10.37531/amar.v3i2.1512

Hafedh, H. A. (2022). *The Quadruple Helix as an approach to strengthen Bahrain's innovation agenda: The financial services sector ecosystem* [Doctoral thesis, University of Sheffield]. Isenberg, D. J. (2010). How to start an entrepreneurial revolution. *Harvard Business Review, 88*(6), 40–50.

Jimenez, D. R., Roig-Tierno, N., & Tur, A. M. (2024). Conceptual structure of innovation systems: A systematic approach through qualitative data analysis. *Review of South Asian Business and Entrepreneurship (ROSA), 1*(2), 23–35. https://www.scienceasset.com/journal/rosa/pdfs/ROSA1-2.pdf

Jonsson, S., Westerlund, M., & Holmström, J. (2015). Exploring extended innovation networks: A pilot study of public sector procurement in the EU. *Journal of Public Procurement, 15*(1), 90–115.

Khadria, B., & Mishra, R. (2023). Technological transformation and the role of frugal innovations in entrepreneurship development in India. *The Journal of Entrepreneurship, 32*(1), 15–32. https://doi.org/10.1177/09713557231201116

Kunwar, R. R., & Ulak, N. (2023). Understanding the triple helix model and capitalization of knowledge. *Journal of APF Command and Staff College, 6*(1). https://nepjol.info/index.php/JAPFCSC/article/view/57573

Leydesdorff, L., & Etzkowitz, H. (2001). The transformation of university–industry–government relations. *Electronic Journal of Sociology, 5*(4).

Lindberg, M., Lindgren, M., & Packendorff, J. (2014). Quadruple Helix as a model for innovation studies: The case of gender innovation in the health sector. *International Journal of Innovation and Regional Development, 5*(1), 79–97.

MacGregor, S. P., Marques-Gou, P., & Simon-Villar, A. (2010). Gauging readiness for the quadruple helix: A study of 16 European organizations. *Journal of the Knowledge Economy, 1*(3), 173–190.

Mack, E., & Mayer, H. (2016). The evolutionary dynamics of entrepreneurial ecosystems. *Urban Studies, 53*(10), 2118–2133. https://doi.org/10.1177/0042098015586547

Madichie, N. O., & Agu, A. G. (2023). The role of universities in scaling up informal entrepreneurship: A triple helix perspective. *Industry and Higher Education, 37*(4), 385–398. https://doi.org/10.1177/09504222221101548

Mai, T. (2022). Ecosystems and entrepreneurial perception: Mapping the landscape. *Journal of Entrepreneurial Innovation, 12*(1), 45–63.

Malik, A., Sharma, P., Pereira, V., & Temouri, Y. (2021). From regional innovation systems to global innovation hubs: Evidence of a quadruple helix from an emerging economy. *Journal of Business Research, 134*, 530–541. https://doi.org/10.1016/j.jbusres.2021.05.015

Malik, S., et al. (2021). Strategic policy making and stakeholder engagement in Nepal's startup initiatives. *Journal of Policy Studies, 10*(4), 78–95.

Mishra, A. K. (2024). Exploring entrepreneurial success factors in Nepal. *New Perspective: Journal of Business and Economics, 7*(1), 45–56. https://nepjol.info/index.php/npjbe/article/view/70019

Nakandala, D., & Malik, A. (2015). South Asia chapter in the UNESCO science report. In *UNESCO science report: Towards 2030*.

Nordberg, M. (2015). Toward a democratic innovation system: A Quadruple Helix model. *Science and Public Policy, 42*(5), 661–673.

Prajapati, V. P., Dhodi, R. K., & Verma, K. (2024). Exploring the impact of triple helix and innovation workshops on Uttarakhand's tourism industry. *International Journal of Technology, Policy and Management, 24*(1), 63–82. https://doi.org/10.1504/IJTP.2024.140955

Rao Nanduri, A. (2024). Catalysing livelihoods through community entrepreneurship: The role of NGOs in the quintuple helix innovation model. *SSRN Working Paper*. https://ssrn.com/abstract=5124412

Rayamajhi, S. (2024, May 27). Accelerating Nepal's startups. *Nepal Institute for Policy Research*. https://nipore.org/accelerating-nepals-startups/

Republica. (2024, May 19). Govt introduces 'National Startups Policy, 2080' to boost entrepreneurial growth with tax waivers. *My Republica*. https://myrepublica.nagariknetwork.com/news/govt-introduces-national-startups-policy-2080-to-boost-entrepreneurial-growth-with-tax-waivers/

Samrat, R. (2021). How the Triple-Helix Model of Innovation is changing the Indian COVID-19 fight? *Vestnik Kemerovskogo Gosudarstvennogo Universiteta*. https://cyberleninka.ru/article/n/how-the-triple-helix-model-of-innovation-is-changing-the-indian-covid-19-fight

Sapkota, K. R. (2021). Evaluate the outputs, outcomes, and impact of third mission initiatives and social impact programs of King's College (Nepal) [Master's thesis, Tampere University]. https://trepo.tuni.fi/bitstream/handle/10024/131610/SapkotaKaushal%20.pdf

Sarin, V., & Tandon, N. (2025). Importance of Triple Helix in building knowledge economy: A systematic literature review. *International Journal of Technology and Globalisation.*

Schøtt, T. (2023). National ecosystems and sustainable startups. *Global Entrepreneurship Monitor Insights, 24*(2), 34–50.

Schütz, F., Heidingsfelder, M. L., & Schraudner, M. (2018). Co-shaping the future in quadruple helix innovation systems: Uncovering public preferences toward participatory research and innovation. *She Ji: The Journal of Design, Economics, and Innovation, 4*(2), 128–146. https://doi.org/10.1016/j.sheji.2018.04.002

Shakya, S., Devkota, N., & Paudel, U. (2024). Startups and consumer behavior: Purchasing intentions toward products and services of new startups in Kathmandu Valley. *Economic Journal of Development Issues, 37*(2), 154–170.

Shrestha, R. K. (2024). Mapping the entrepreneurial ecosystem of Nepal: Post-COVID implications. In *Innovation and development in Nepal* (pp. 61–75). Springer. https://doi.org/10.1007/978-981-97-6560-7_4

Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice, 41*(1), 49–72. https://doi.org/10.1111/etap.12167

Stam, E., & Spigel, B. (2016). Entrepreneurial ecosystems. *Utrecht School of Economics Discussion Paper Series, 16–13*.

Weerasekara, M. (2023). Interdependent nature of sustainable ecosystems. *Sustainable Entrepreneurship Review, 5*(2), 103–119.