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Mapping the Risk Landscape: A Bibliometric Analysis of Startup Risk Management Research (1986–2025)

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Abstract: *This study presents a comprehensive bibliometric analysis of research on risk management in startups, based on 399 English-language research articles indexed in the Scopus database. Risk management in startups involves identifying, assessing, and mitigating uncertainties that threaten the survival and growth of early-stage ventures. The objective is to map the evolution of scholarly work from 1986 to 2025, identify dominant themes, authors, and collaborations, and examine the adoption of risk management strategies across various startup sectors. The findings reveal a sharp increase in publications post-2020, driven by heightened awareness of risk in volatile markets. The United States, China, and India emerge as key contributors, with India exhibiting growing international collaboration, particularly with the United States. Thematic analysis shows that most studies focus on financial, operational, and technological risks, with limited exploration into sustainability and ethical risks. Practical implications include the need for contextualized risk frameworks in emerging economies, enhanced interdisciplinary research, and better integration of AI-driven strategies into startup ecosystems. The study provides valuable insights for researchers, policymakers, and startup stakeholders aiming to foster resilient and sustainable entrepreneurial ventures.*

Keywords: *Risk management, Startups, Bibliometric analysis, Strategic risk, Startup ecosystems, Innovation, Entrepreneurial risk.*

1. INTRODUCTION

In recent decades, startups have emerged as key drivers of economic growth, innovation, and job creation across the globe. Characterized by high uncertainty and limited resources, startups inherently operate in volatile environments where managing risks is not only necessary for survival but also critical for sustainable growth. Risk management in the context of startups has, therefore, become a vital area of academic inquiry, attracting growing attention from researchers, policymakers, and practitioners alike.

The unpredictable nature of startup ventures ranging from financial and operational risks to strategic and technological uncertainties necessitates a robust understanding of how such risks are identified, assessed, and mitigated. While traditional risk management frameworks are well-established in large corporations, their applicability in startup ecosystems presents unique challenges due to the lack of structured processes, resource constraints, and rapidly evolving business models. Despite the growing body of literature, the research on risk management in startups remains fragmented, with studies dispersed across various domains such as entrepreneurship, finance, innovation, and strategic management. There is only a limited comprehensive bibliometric analysis that systematically maps the intellectual structure, research trends, and knowledge gaps in this domain.

This study aims to bridge that gap by conducting a bibliometric analysis of 399 peer-reviewed, English-language research articles related to risk management and startups. By employing established bibliometric tools such as VOS viewer and Content analysis, Systematic Literature review, the study seeks to uncover the thematic evolution of the field, identify the most influential authors and institutions, and highlight the major research clusters and collaboration networks. Through this analysis, the study provides valuable insights into the development and direction of scholarly

research in risk management for startups, offering a foundation for future investigations and policy formulation. It also aims to inform practitioners and emerging entrepreneurs about the key areas of focus and strategic considerations in managing risk within entrepreneurial venture.

2. KEY OBJECTIVES OF THE STUDY

- To analyze the growth trajectory of academic research in the field of risk management in startups from 1986 to 2025.
- To identify the most influential authors, countries, and institutions contributing to the field and evaluate their collaboration patterns using co-authorship networks.
- To explore the sectoral distribution of startup-related risk management research across domains such as engineering, business, computer science, and energy.
- To categorize the types of risks (financial, technological, operational, governance, sustainability) most frequently addressed in startup contexts.
- To examine the nature of risk management strategies being adopted or proposed across different startup sectors, with emphasis on practical application in India.

3. SYSTEMATIC LITERATURE REVIEW AND CONTENT ANALYSIS OF RISK MANAGEMENT IN STARTUPS

Table No 1: Table showing major literature review of risk management in startups

S.No	Title	Author(s)	Year	Objective	Major Findings	Recommendations
1	Risk Management of Startups of Innovative Products	Bielialov T.	2022	To explore risk types and management practices in innovative product startups.	Identified key risk dimensions (technological, market, financial) and recommended tailored risk frameworks.	Develop context-specific risk tools for early-stage firms, especially in tech sectors.
2	Mapping Risks Faced by Startup Investors: An Approach Based on the Apriori Algorithm	Silva Júnior et al.	2023	To identify and map high-risk patterns experienced by startup investors using association rules.	Investor risks cluster around economic downturns and startup maturity.	Use pattern recognition and AI to flag high-risk profiles for investors early.
3	Framework of Goal-driven Risk Management in Software Development Projects Using the Socio-technical Systems Approach	Singh N.	2024	To develop and validate a goal-based risk framework for software startups.	Balanced technical and strategic risk through goal alignment; validated via SEM.	Implement hybrid risk models in agile development environments.
4	Corporate Governance and Risk Management: A Bibliometric Mapping for Future Research Agenda	Singhania S., Singh R.K., Singh A.K., Sardana V.	2022	To map the literature linking governance structures and risk management.	Identified a shift toward ESG, stakeholder governance, and accountability.	Embed governance and ethical risk indicators in startup boards.
5	Perspectives on Integrating Risk Management and	Liu H., Wu S., Zhong C., et al.	2024	To review literature linking	Sustainable practices positively affect financial	Train startups on green risk metrics; promote ESG risk literacy.

S.No	Title	Author(s)	Year	Objective	Major Findings	Recommendations
	Sustainability for Financial Performance			risk management and sustainability.	performance; MSMEs underexplored.	
6	A Bibliometric Analysis of Sustainability and Risk Management	Anonymous	2021	To identify research clusters on sustainability and risk.	Found dominant themes: blockchain, social equity, engineering resilience.	Integrate tech and social risk dimensions into startup strategy.
7	Artificial Intelligence in Risk Management within Construction Projects	Zong H., Yi W., Antwi-Afari M.F., Yu Y.	2024	To explore AI-enabled risk mitigation in high-risk projects.	AI supports proactive risk identification, especially NLP and ML tools.	Deploy AI risk engines in dynamic, resource-constrained startup settings.
8	Digital Transformation in Startups: A Bibliometric Analysis	Baier-Fuentes H., Merigó J.M., Amorós J.E., Gaviria-Marín M.	2023	To map the evolution of digital innovation in startups.	Risk areas include cybersecurity, scalability, and infrastructure failures.	Build digital transformation plans with embedded cyber-risk assessment.
9	Approaching Emergent Risks: AI in Financial Organisations	McGee F.	2024	To examine risk management for AI in financial services.	Revealed limited preparedness for AI-related uncertainties.	Develop AI governance frameworks and ethical AI policies.
10	A Survey on Enterprise Financial Risk Analysis via Big Data	Zhao Y., Du H., Li Q., et al.	2022	To explore financial risk analytics using Big Data.	Documented rise of AI/ML tools for real-time risk prediction.	Startups should adopt real-time analytics dashboards for liquidity and market risk.

4. RESEARCH METHODOLOGY

This study employs a bibliometric analysis approach to examine global research trends on risk management in startups. A total of 399 peer-reviewed research articles published in English were retrieved from the Scopus database, covering the period from 1986 to 2025. The search was limited to research articles only, ensuring a focus on scholarly contributions. VOS viewer software was used to visualize co-authorship networks, country collaborations, keyword co-occurrence, and thematic clusters. Descriptive statistics were applied to analyze publication trends, leading authors, journals, institutions, and subject areas. The study also included a qualitative assessment of selected highly cited articles to explore the nature of risks and the adoption of risk management strategies across different startup sectors.

Data Source and Search Strategy

The Scopus database was chosen as the primary data source due to its comprehensive indexing of peer-reviewed literature and multidisciplinary coverage. A structured search was conducted using the keywords**:**"risk management" AND "startups", limiting the results to: Document type**:** Research articles only, language: English and Time frame: 1986 to 2025.This search yielded a total **of** 399 research articles relevant to the field.

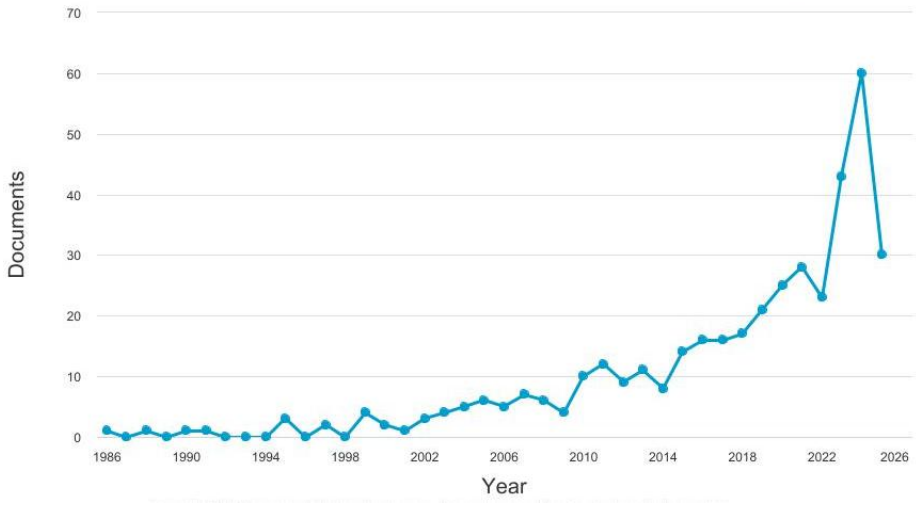
Qualitative Content Review

A subset of highly cited and recent articles was also selected for in-depth qualitative review. This helped to classify: Types of risks discussed (financial, operational, technological, ethical), Sectoral focus (fintech, agritech, sustainability, software), Risk management strategies proposed or adopted, Geographic and institutional focus, especially with regard to India. This mixed-method approach ensured both quantitative mapping and contextual understanding of risk management trends in the startup domain.

5. ANALYSIS AND DISCUSSION

Documents per Year

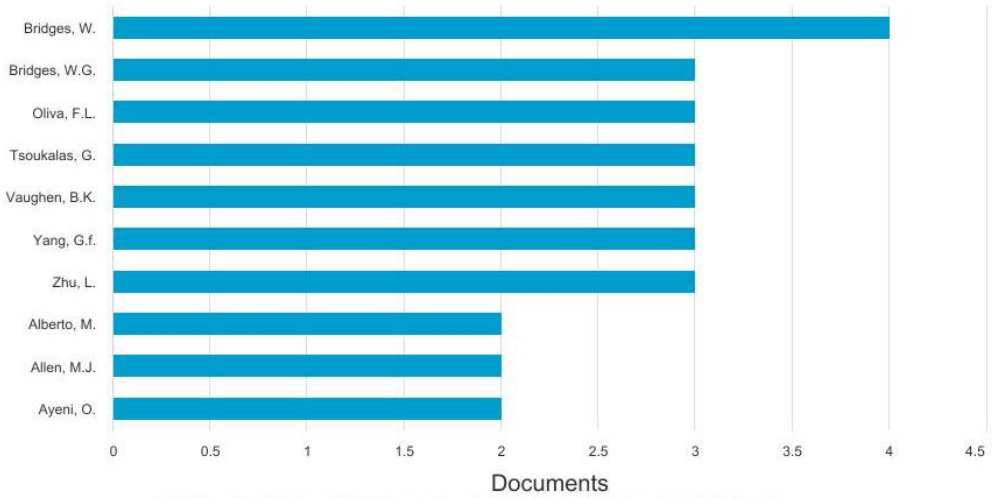
Figure 1: Figure showing documents per year



The graph illustrates the annual publication trend of research articles related to risk management in startups from 1986 to 2025**,** based on data indexed in Scopus**.** Several key observations emerge from this visual. A significant spike is observed post-2019, with publication counts rising steeply. The number of documents nearly doubled between 2021 and 2023, peaking at over 60 articles in 2024.This surge may reflect the post-pandemic focus on business resilience, digital transformation, and increased startup vulnerability in uncertain environments prompting scholars to examine risk more closely. The consistent rise from 2006 onward reflects a maturing research field**,** while the surge after 2019 highlights how external shocks like COVID-19 can catalyze scholarly focus on risk in startups.

Documents per Author

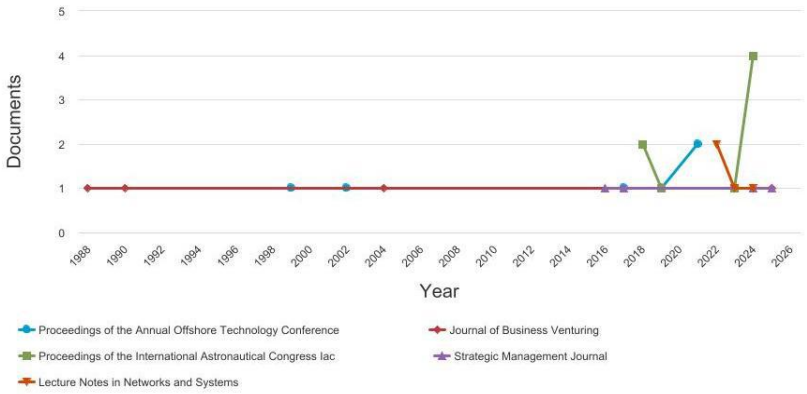
Figure 2: Documents per Author



Bridges, W. leads the list with 4 publications, making him the most prolific individual contributor to research on risk management in startups. A cluster of authors have each contributed 3 documents, indicating a sustained engagement in the domain: Bridges, W.G. **,** Oliva, F.L.**,** Tsoukalas, G.**,** Vaughen, B.K.**,** Yang, G.F.Zhu, L**.**Authors such as Alberto, M.**,**

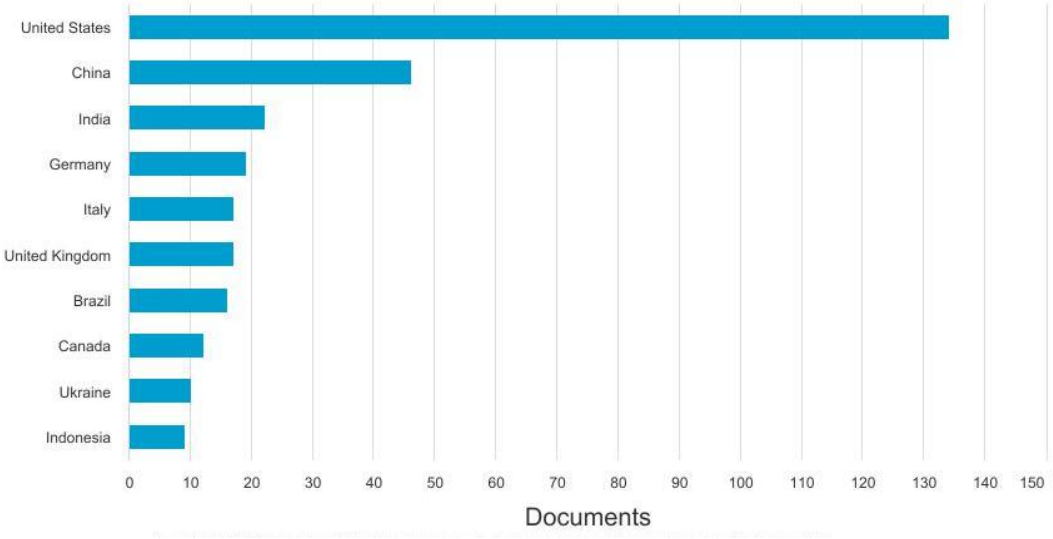
Allen, M.J., and Ayeni, O. have each published 2 documents, marking them as consistent but emerging contributors in this research area.

Figure 3 : Documents per Journal



Journal of Business Venturing journal appears as an early and consistent contributor, with publications spanning multiple decades. While it does not show a high document count in any single year, its long-term presence signifies a foundational role in advancing the intersection of entrepreneurship and risk. In Strategic Management Journal, **a** few articles are observed in the post-2015 period**,** suggesting occasional but significant contributions. The chart indicates that risk management in startups is a multidisciplinary field**.**

Figure 4 : Documents per Country



The United States stands out as the clear leader, contributing over 130 documents, which is more than double that of the second-ranked country. This dominance reflects the country's strong entrepreneurial ecosystem, robust research funding, and early focus on startup risk due to its leadership in venture capital and innovation**.** With around 60 publications**,** China is the second-largest contributor**.** This trend corresponds to China's policy-driven support for startups, increasing investment in R&D, and a surge in academic interest in entrepreneurial risk and innovation policy**.** India is Emerging Powerhouse, ranks third, contributing 22 articles**.** The country's rising startup ecosystem, supported by government initiatives like Startup India, and a growing number of business and management research institutions, likely drive this engagement.

Table No 2: Documents per Country

COUNTRY/TERRITORY	No of Documents
United States	134
China	46
India	22
Germany	19
Italy	17
United Kingdom	17
Brazil	16
Canada	12
Ukraine	10

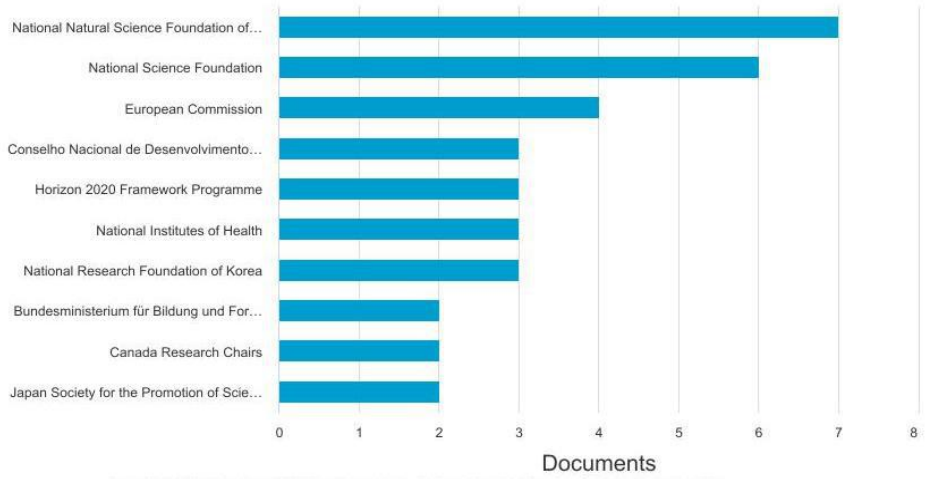
Table No 3: Documents in different Subject Area

SUBJECT AREA	No
Engineering	169
Business, Management and Accounting	100
Computer Science	86
Energy	78
Decision Sciences	42
Earth and Planetary Sciences	39
Social Sciences	36
Environmental Science	35

Engineering accounts for the largest share of publications.This indicates a strong focus on technical risks, product innovation, system reliability, and infrastructure-based startups such as energy, manufacturing, or aerospace.It also reflects the rising relevance of risk modeling and simulation tools in engineering-driven startup environments.Business, Management & Accounting (12.7%), This subject area contributes significantly, emphasizing core themes like entrepreneurial risk, financial risk management, strategic decision-making, and venture capital uncertainty. The presence of this category reaffirms the managerial lens through which risk in startups is traditionally analyzed.

Funding Sponsors

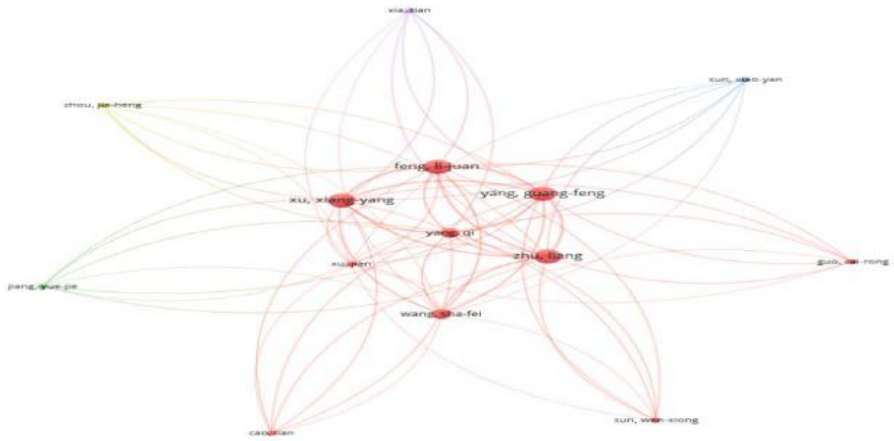
Figure No 5:Major Sponsors



National Natural Science Foundation of China (NSFC) – Leading Funder .With 7 sponsored documents**;** NSFC is the top funding sponsor**.** This reflects China's growing investment in innovation and entrepreneurial research**,** particularly around technological and engineering risks in startups. National Science Foundation (USA**),** as a premier US research funder, NSF's involvement highlights the strategic importance of startup risk research in U.S. policy and academia, especially in STEM-driven ventures. European Commission funded 5 documents, pointing to strong support from EU-level initiatives, especially under Horizon 2020 **and** innovation policy frameworks**.**

Co citation by authors

Figure 6: Network Visualisation of Co citation by authors



This visualization illustrates the collaborative relationships among authors based on co-authored publications indexed in Scopus. Key elements include clusters (color-coded groups), node size (publication volume), and link strength (collaborative intensity).Yang Guang-feng**,** Feng Li-juan**, and** Xu Xiang-yang are central nodes in the network, indicating:High publication output, Strong collaborative links across multiple clusters and most ikely leading large research teams or working across institutions.The visualization shows 6 clusters**,** each representing a tightly knit author group:

- **Cluster 1 (Red)** – Largest cluster; includes central figures like *Yang Guang-feng* and *Xu Xiang-yang*, showing high co-authorship density.
- **Cluster 2 (Green)** – Includes *Jiang Xue-jie*, showing a more isolated collaboration group.
- **Cluster 3 (Purple)** – Includes *Xia Jian*, appearing as a small and independent research group.
- **Cluster 4, 5, 6** – Smaller clusters (yellow, blue, and light pink), showing isolated or emerging collaborations, such as *Zhou Jie-heng*, *Sun Xiao-yan*, and *Xia Tian*.

Co citation by countries

Figure 7: Network Visualisation of Cocitation by countries

The United States is the most central and connected node, reflecting its dominant role in international collaborations. It has visible co-authorship links with: India (within the same green cluster) United Kingdom**,** Italy**,** and Germany (across clusters).This shows the U.S. functions as a bridge between different regional academic communities. India, an emerging partner**.** India's collaboration appears mainly with the United States, indicating a strategic bilateral academic partnership in this field. The relatively smaller node size suggests India is still growing in output and global engagement**.**

Table No: 4 Table Showing Type of Risks and Risk Management Strategies adopted

Author(s)	Year	Startup Sector	Type of Risks	Risk Management Strategy
Khan & Kothari	2020	General startups	Financial/control risk	Risk controls in finance; emphasis on systematic monitoring
Raju & Mittal	2023	Venture capital-backed startups	Investment & valuation risk	Structural VC criteria to reduce evaluation risk
Malpani & Ghosh	2022	CSR-focused startups	Reputational & compliance risk	CSR integration as mitigation strategy
Sundaram, Shetty & Palakkeel	2022	Accelerator-backed startups	Loss aversion & failure risk	Accelerators' support in loss protection
Suresh et al.	2024	Agritech startups	Market, tech, data analysis risk	Data-driven decision models compare India & Japan
Indian fintech study (MDPI)	2022	Fintech startups	Market/return volatility	GARCH-M modeling for risk-return prediction
Gopinath (Mumbai-Pune)	2021	Regional startups	Operational & strategic risk	Analytical Hierarchy Process to identify critical factors
Indian RegTech overview	2025	RegTech startups	Compliance & fraud risk	AI/ML compliance automation tools
Saxena (OHS predictive)	2024	Safety-tech/startups	Occupational health & safety risk	Machine learning–based predictive analytics
Surana et al. (incubators)	2020	Incubator-supported startups	Systemic & developmental risk	SDG-targeted incubation strategy

Implications of the Study

The sharp increase in publications from 2020 onward indicates growing global scholarly interest in startup risk management, especially after the COVID-19 pandemic, when risk exposure became more visible. The United States, China, and European nations dominate the research landscape, both in volume and in international collaborations. This suggests an imbalance in global knowledge creation. India shows notable but still limited academic presence. Its co-authorship link with the U.S. highlights emerging international partnerships but also signals a need for stronger local institutional initiatives. Risk management in startups spans a wide range of sectors—from engineering and business to computer science and sustainability. However, this fragmentation may result in a lack of integrated models. Most studies focus on financial, technological, and operational risks, while areas such as ethical risks (e.g., AI), sustainability**,** and social impact remain underexplored.

6. RECOMMENDATIONS

For Researchers: Encourage cross-domain research combining engineering, management, and sustainability to create comprehensive risk frameworks for startups. Conduct studies specific to regional risks faced by startups in India, such as regulatory uncertainty, infrastructure gaps, or digital divide issues. Build case studies and longitudinal analyses based on Indian startup ecosystems (e.g., Bengaluru, Hyderabad, Kochi) to enrich global literature with diverse perspectives.

For Policymakers & Incubators: Promote collaboration between universities and startups through funded incubators and innovation missions (e.g., Atal Incubation Centres).Provide support for publication platforms that amplify voices

from emerging economies and allow wider dissemination of regional risk insights. Create targeted research grants through national funding bodies (e.g., DST, DBT, NITI Aayog) for startup risk-related projects.

For Startup Founders: Use insights from academic models (e.g., goal-driven risk frameworks, AI-based predictions) to enhance decision-making and investor readiness. Encourage founders and team members to undergo training on risk identification, assessment, and mitigation strategies aligned with global best practices.

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