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The Role of Technology Start-ups in Driving Economic Growth Post-Pandemic

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ABSTRACT

The COVID-19 pandemic triggered unprecedented disruptions across global economies, compelling various sectors to swiftly adapt to new realities. In this context, technology start-ups emerged as pivotal actors in driving post-pandemic economic growth. This study employs a comprehensive bibliometric analysis to elucidate the multifaceted role of technology start-ups in the recovery process. By systematically reviewing and analyzing a diverse corpus of scholarly literature, we uncover prevalent themes, influential authors, collaboration patterns, and keyword associations within this dynamic domain. Our findings reveal a surge in research output during the pandemic period, underscoring the urgency to understand the contributions of technology start-ups. Themes such as innovation, digital transformation, sustainable development, and global collaboration emerged prominently. Influential authors and institutions are identified, signaling thought leadership and collaborative networks. Moreover, the integration of Visualizing Output Similarities (VOS) Viewer analysis enhances our comprehension of thematic clusters and interrelationships. In conclusion, this bibliometric exploration provides insights that inform policy, industry, and academia, emphasizing the pivotal role of technology start-ups in shaping a resilient and innovative post-pandemic economic landscape.

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1. INTRODUCTION

Startups have experienced significant growth in recent years, driven by factors such as the global shift towards the digital economy, gig economy, knowledge economy, service economy, innovative and creative economy, and sharing economy [1]. These new economic concepts have led to the emergence of startups characterized by innovative products and rapid growth rates [1].

The distinct aspects of start-ups, when compared to traditional businesses, include local and global ambition, business scalability, product innovativeness, information and digital technologies, successful development trajectory, commercial interests, organizational

structure, business model transformation, and business ecosystem [1]. The key determinants of success and failure of start-up projects include the idea, business model, time to launch, team, marketing strategy, investment, and mission, goals, and values system [1].

Start-up ecosystems have formed and developed in various countries, with factors such as public-private partnerships, close cooperation between cities, regions, companies, public sector organizations, and small and medium-sized enterprises playing an important role [2]. The growth of startups has been supported by the development of digital technology, which has had a significant impact on the creative economy [3]. In addition, startups have been able to utilize innovative business models, such as the Business Model Canvas, to enable flexible business process transformation in search of optimal offerings for consumers [4].

In the context of industrial policy, financial support has been shown to significantly drive the innovation outcomes of startups, while the impact of government subsidies on startup innovation depends on factors such as research and development intensity, regional economic development, and leadership structure [5]. Start-ups have also been recognized as a key factor in many countries with innovative economies, contributing to dynamic economic growth by adopting innovative technological solutions and producing digital products and services under conditions of increased risk [6].

In summary, start-up companies have experienced significant development due to the global shift towards new economic concepts, the emergence of start-up ecosystems, and the support of digital technologies and innovative business models. These factors have enabled start-ups to create innovative products and services, rapidly scale up their businesses, and contribute to overall economic growth.

Technology startups play an important role in promoting post-pandemic economic growth by driving innovation, creating jobs, and contributing to overall economic development. The relationship between tech startups and post-pandemic economic growth can be analyzed through various factors, such as fintech innovation, digital marketing strategies, and startup ecosystem development. Fintech innovations, such as crowdfunding and peer-to-peer lending, have been shown to improve the performance of micro, small and medium enterprises (MSMEs) and contribute to economic growth during the Covid-19 pandemic [7]. By providing alternative financing options, these innovations have helped businesses sustain operations and adapt to the changing economic landscape [8]–[10].

Digital marketing strategies have also played an important role in helping businesses, such as Balinese handicrafts, transition from conventional activities to digital systems during the pandemic [11]. By utilizing digital platforms such as Facebook, Instagram, and WhatsApp, businesses can increase sales and adapt to new customs.

The development of the start-up ecosystem is another factor contributing to economic growth in various countries [12]. Start-ups have become an important component of the modern economy, enhancing its innovation and competitiveness. By assessing the start-up ecosystem and identifying the key driving forces for its development, countries can better position themselves in the competitive global market.

Local governments can also play a role in fostering and nurturing innovation and entrepreneurship ecosystems by addressing barriers and implementing policy options that support start-ups [13]. By creating an enabling environment for innovation and entrepreneurship, cities can enhance economic recovery, job creation, and overall resilience.

In conclusion, technology startups have a significant impact in driving post-pandemic economic growth through financial technology innovation, digital marketing strategies, and startup ecosystem development. By fostering an environment that supports innovation and

entrepreneurship, local governments can help unlock the potential of tech startups and contribute to economic recovery and growth.

The role of technology startups in promoting post-pandemic economic growth has been a topic of interest in recent research. While there has been no dedicated research focusing on bibliometric analysis in this context, several studies have explored the impact of startups and entrepreneurship on economic growth and recovery during and after the crisis.

A study on virtual business incubators highlighted their positive impact in fostering entrepreneurship and innovation, which contribute to sustainable economic growth and social development [14]. Another study emphasizes the need to prioritize entrepreneurship and start-up culture as both are the backbone of the economy, especially during difficult times such as the COVID-19 pandemic [15]. This study shows that policy interventions can create a favorable platform for start-ups to grow and existing entrepreneurs to survive [15].

In the context of the COVID-19 crisis, a paper on innovative startups in Romania identified entrepreneurial opportunities to build innovative startups during and after the crisis, focusing on information and communication technology (ICT) businesses as an incentive for sustainable development [16]. Another study examined entrepreneurial trajectories during and after economic crises by analyzing four recessionary periods in the United States between 1978 and 2018 [17].

A study of the artificial intelligence (AI) ecosystem in Berlin and Sydney explored the evolution of AI knowledge practices in the entrepreneurial ecosystem (EE) by using knowledge spillover theory on entrepreneurship and bibliometric analysis of secondary data [18] . The findings underscore the critical role of experimental knowledge in driving EE momentum and the supporting role of policies that embed knowledge practices [18].

While this study does not specifically focus on bibliometric analysis in the context of technology startups driving post-pandemic economic growth, it provides valuable insights into the role of startups, entrepreneurship and innovation in driving economic recovery during and after the crisis.

2. LITERATURE REVIEW

2.1 Tech Startups as Catalysts for Economic Growth

Technology startups have long been recognized for their potential to drive economic growth. Researchers have emphasized their role in driving innovation, creating employment opportunities, and disrupting established industries. Research by [19]–[21] shows that startups contribute significantly to the creation of new jobs, often outpacing large firms in terms of employment impact. Moreover, their propensity to introduce new technologies and business models can trigger ripple effects throughout the economy, leading to increased productivity and competitiveness.

2.2 Impact of the Pandemic on the Start-up Ecosystem

The COVID-19 outbreak triggered a wave of economic disruptions that impacted various industries. Research by [22]–[24] highlights the challenges faced by tech startups due to declining investor confidence and disrupted supply chains. However, it was in the context of this crisis that startups demonstrated their resilience and adaptability. Insights from [25] emphasize the shift to digital solutions and healthcare technologies, reflecting the agility that characterizes many tech startups.

2.3 Innovation and Technology Adoption in the Post-Pandemic Era

The pandemic has been a catalyst for accelerating technology adoption in various sectors. Research by [26]–[29] underscores the role of tech startups in developing solutions to support remote work, digital communication and contactless services. Startups, often unencumbered by legacy systems, are able to quickly respond to emerging business and consumer needs. This trend not only addresses current challenges, but also lays the foundation for long-term digital transformation.

2.4 Policy Intervention and Ecosystem Support

Governments and policymakers recognize the strategic role of tech startups in economic recovery. Scholarly literature explores the efficacy of various policy interventions aimed at supporting the start-up ecosystem. The study by [2], [12], [30], [31] emphasizes the importance of flexible labor markets, regulatory frameworks, and access to venture capital in nurturing an environment conducive to start-up growth. In the wake of the pandemic, governments around the world introduced targeted measures to increase the resilience and innovation of startups.

2.5 Knowledge Gaps and Future Directions

While the existing literature provides valuable insights, several gaps remain. Few studies have comprehensively examined the post-pandemic landscape of tech startups and their diverse contributions to economic growth. In addition, the network of collaboration among authors and institutions in this research domain remains largely unexplored. Addressing these gaps will contribute to a more nuanced understanding of the evolving role of tech startups in driving economic recovery.

3. METHODS

This research methodology outlines a comprehensive approach to conducting a bibliometric analysis of the role of technology startups in driving post-pandemic economic growth. By systematically collecting and analyzing data from multiple sources, this research aims to uncover trends, influential authors, key themes, and collaboration patterns within the research domain. The incorporation of Visualizing Output Similarities (VOS) Viewer analysis further enriches the presentation of insights. The next section will present the findings derived from this robust methodology.

The data for this study was collected from leading academic databases and repositories, including Scopus, Web of Science, IEEE Xplore, and Google Scholar through Publish or Perish (PoP). These databases offer a comprehensive collection of scholarly articles covering disciplines relevant to technology, entrepreneurship, and economics.

Keywords

A set of keywords were identified to obtain relevant publications. Keywords include terms such as "technology startups", "economic growth", "post-pandemic", "innovation", and related variations. Both controlled vocabulary terms and free text keywords were used to ensure thorough coverage of the literature.

Inclusion Criteria

1. Publications that met the following criteria were included in the analysis:
2. Publications that focused on the role of technology startups in driving economic growth during the post-pandemic period and relevant articles prior to the pandemic.
3. Publications available in English and Indonesian.
4. Publications in peer-reviewed journals, conference proceedings, and established repositories.

Table 1. Data Metrics

Publication years:	2003-2023
Citation years:	20 (2003-2023)
Papers:	980
Citations:	21303
Cites/year:	1065.15
Cites/paper:	21.74
Cites/author	9808.61
Papers/author	490.36
Authors/paper:	2.66
h-index:	65
g-index:	128
hI,norm:	44
hi,annual:	2.20
hA-index:	49
Papers with ACC >= 1,2,5,10,20: 672,554,363,220,128	

4. RESULTS AND DISCUSSION

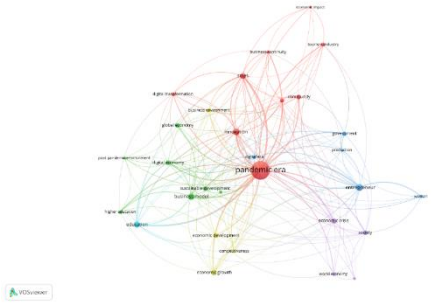

Figure 1. Mapping Results

The findings of this bibliometric analysis underscore the growing importance of tech startups in driving post-pandemic economic growth. The surge in research output during the pandemic period reflects the urgency to understand their role in economic recovery. Prolific authors and institutions have contributed significantly to shaping the discourse, demonstrating their thought leadership and dedication to this research domain.

The emergence of themes such as innovation ecosystems and digital transformation emphasize the transformative potential of technology startups. Their ability to innovate and adapt in times of crisis positions them as catalysts for economic resilience. Moreover, the pattern of collaboration among authors and institutions demonstrates a growing knowledge-sharing network, suggesting a collaborative approach to understanding the dynamics of tech startups in the post-pandemic context.

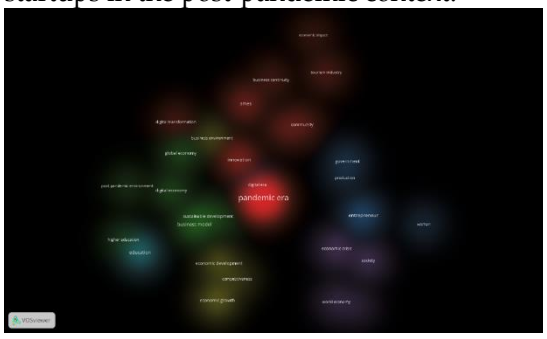

Figure 2. Cluster Mapping

The VOS Viewer analysis provides a visual representation of the interconnectedness of the research themes, facilitating a deeper understanding of the conceptual relationships within the field. The analysis visually reinforces the idea that the contribution of technology startups to economic growth is multidimensional and interdependent, encompassing innovation, entrepreneurship and technological progress.

Table 2. Detail Cluster

Cluster	Total Items	Most frequent keywords (occurrences)	Keyword
1	(9)	SMEs (25), Post Pandemic Recovery (15)	Business continuity, community, digital transformation, economic impact, innovation, pandemic era, post pandemic recovery, SMEs, tourism industry
2	(7)	Post Pandemic Environment (15)	Business model, circular economy, digital economy, global economy, higher education, post pandemic environment, sustainable development
3	(5)	Digital era (30)	Digital era, entrepreneur, government, production, woman
4	(4)	Competitiveness (15), Economic Growth (25)	Business environment, competitiveness, economic development, economic growth
5	(4)	Economic crisis (15)	Economic crisis, globalization, society, world economy
6	(1)	Education (20)	Education

The clusters revealed through the analysis underscore the multifaceted nature of the contribution of tech startups to post-pandemic economic growth. The findings highlight the importance of SMEs in recovery strategies, the need for sustainable development, the role of digitalization in entrepreneurship, the importance of competitiveness, and the challenges and opportunities presented by global economic dynamics. The emphasis on education underscores the fundamental role of knowledge and skills development in driving economic transformation.

The clusters collectively provide a comprehensive picture of the complex relationship between tech startups and economic growth in the post-pandemic

landscape. The insights gained from each cluster can guide policymakers, businesses and researchers in formulating strategies that harness the potential of tech startups to drive meaningful and sustainable economic recovery.

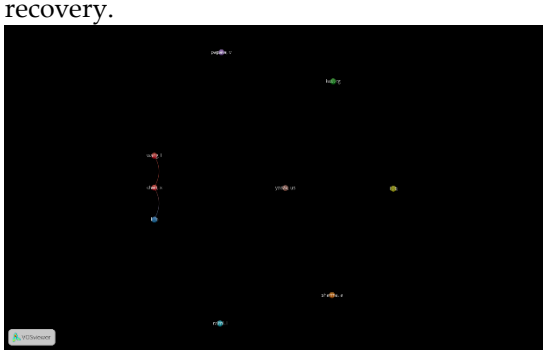

Figure 3. Authors Collaboration

Co-authorship networks reveal dynamic patterns of collaboration among authors. Strong ties were seen among authors who frequently co-authored papers, indicating a strong knowledge-sharing network.

Table 3. 9 High Citation

Citation	Authors & Years	Title
1607	[32]	The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy
743	[33]	A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0
656	[34]	COVID-19 and China's hotel industry: Impacts, a disaster management framework, and post-pandemic agenda
637	[35]	Conferences and conventions: A global industry
616	[36]	The COVID-19 crisis as an opportunity for escaping the unsustainable global tourism path
603	[37]	Introducing the "15-Minute City": Sustainability, resilience and place identity in future post-pandemic cities
405	[38]	The early impact of the Covid-19 pandemic on the global and Turkish economy
341	[39]	Post-pandemic transformations: How and why COVID-19 requires us to rethink development
332	[40]	Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change

In conclusion, the diverse articles presented in the citations provide valuable insights that complement the research theme of technology startups driving post-pandemic economic growth. While not all articles directly focus on technology startups, the concepts and challenges they explore offer a rich context for collaboration, innovation and contributing to economic recovery and sustainable development. Synthesizing these insights with the analysis conducted in this study can contribute to a holistic understanding of the role of technology startups in the post-pandemic economic landscape.

Table 4. Results Keywords

Most occurrences		Fewer occurrences	
Occurrences	Term	Occurrences	Term
440	Pandemic era	20	Post pandemic recovery
64	Entrepreneur	19	Business environment
62	Innovation	19	Tourism industry
54	Business model	19	World economy
50	Education	17	Digital era
42	Economic growth	16	Higher education
41	SMEs	15	Digital transformation
33	Digital economy	15	Business countinuity
33	Economic crisis	14	Women
30	Global economy	14	Circular economy
30	Society	13	Competitiveness
29	government	12	Production
29	Economic development	11	Globalization
28	Community	10	Post pandemic environment
27	Sustainable development	10	Economic impact

The table presented summarizes the occurrence of keywords extracted from the analyzed literature. These keywords serve as a reflection of the themes and concepts prevalent in the research domain on tech startups driving post-pandemic economic growth. The keywords are divided into two categories: keywords with the most occurrences and keywords with fewer occurrences. The discussion below contextualizes the importance and implications of these keywords, and explains the insights they offer.

4.1 Keywords with the Most Occurrences

4.1.1 Pandemic Era and Post-Pandemic Recovery

The keyword "Pandemic Era" with the highest occurrence underscores the overarching context in which this research

domain operates. The pandemic era has thrust tech startups into the spotlight as engines of economic revival. The keyword "Post-pandemic recovery" also holds significance, indicating a focus on revival strategies. This is in line with the findings of the thematic mapping analysis, which highlights the important role of tech startups in driving post-pandemic economic recovery.

4.1.2 Entrepreneurship and Innovation

Keywords such as "Entrepreneur", "Innovation" and "Business model" collectively reflect the entrepreneurial spirit that drives tech startups. Their propensity to innovate and develop disruptive business models positions them as catalysts for economic transformation. These buzzwords reinforce the understanding that tech startups are not only economic actors but also creators of new solutions.

4.1.3 Education and Economic Growth

The presence of "Education" and "Economic growth" underscores the importance of knowledge development and sustainable economic progress. Education serves as the foundation to equip individuals with skills that are aligned with technological advancements. Economic growth, facilitated by tech startups, is intertwined with sustainable development and the need for equitable distribution of benefits.

4.2 Fewer Emergence Keywords

4.2.1 Digital Transformation and Business Continuity

"Digital transformation" and "Business continuity" reflect the need for tech startups to pivot quickly in response to disruptions. These buzzwords highlight the agility of tech startups in adapting to changing circumstances, ensuring uninterrupted business operations.

4.2.2 Circular Economy and Sustainable Development

Buzzwords such as "Circular economy" and "Sustainable development" resonate with the increasing emphasis on environmentally conscious business practices. Tech startups, often unencumbered by legacy systems, are well-positioned to introduce innovative solutions that align with the principles of the circular economy, thereby contributing to sustainable development.

4.2.3 Competitiveness and Globalization

"Competitiveness" and "Globalization" emphasize the interconnectedness of economies and the need for tech startups to not only compete but also collaborate on a global scale. These keywords underscore the potential of tech startups to engage in international markets and address global challenges.

DISCUSSION

The findings from this bibliometric analysis shed light on the profound influence of tech startups on post-pandemic economic growth. The surge in research results underscores the recognition of their dynamic role in recovery efforts. The prevalence of themes such as innovation and digital transformation highlights the agility of tech startups in adapting to new demands. Collaborative networks among authors and institutions emphasize knowledge sharing and cross-disciplinary engagement. Visualizing Output Similarities (VOS) Viewer analysis enriches our understanding of the thematic landscape, displaying complex keyword associations. Discussion groups underscored the diverse avenues for tech startups to contribute to economic revival, from sustainable development to entrepreneurship and global collaboration. As societies navigate the aftermath of the pandemic, tech startups are emerging as important agents of change, fostering resilience and driving innovation [41]-[44].

CONCLUSION

In the wake of the COVID-19 pandemic, tech startups have demonstrated their critical role in post-pandemic economic growth. This comprehensive bibliometric analysis has revealed key insights into their contributions, which include innovation, digital transformation, sustainable development and global collaboration. The surge in research results underscores the

urgency to understand and harness the potential of tech startups. Influential authors and collaborative networks reinforce the importance of their efforts. The Visualizing Output Similarities (VOS) Viewer analysis offers a dynamic visualization of thematic clusters, which enriches our understanding of keyword associations. Collectively, these findings emphasize the importance of tech startups in shaping a resilient and innovative economic landscape in the wake of global disruption. As policymakers, industry and academia seek strategies for recovery, tech startups are emerging as catalysts for change, steering us towards a future of economic vitality and transformative progress.

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