

Adoption of Artificial Intelligence (AI) in Start-ups

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Abstract

The purpose of the study is to provide a literature review of the past literature on the use of Artificial Intelligence (AI) in start-ups, covering major characteristics of current findings, limitations, and prospective study possibilities. It contributes to the collection of knowledge in two ways. It first categorizes the literature primarily on seven parameters to offer a summary of accomplished research attempts: "year," "region," "study technique," "results," "setting," "constraints," and "future research direction." Secondly, it identifies a study need in the published literature and proposes new research possibilities. According to the findings, the previous research has struggled to create a solid theoretical framework in the field. More research is required to validate the proposed "theories," "notions," and "paradigms." In a nutshell, the lack of a comprehensive assessment of the implementation of artificial intelligence in start-up literature leaves a significant void for additional investigation.

Keywords

Artificial Intelligence, AI adoption, Start-ups, Bibliometrics, Literature Review

1. Introduction

Artificial intelligence (AI) reconfigures business, the economy, and culture by converting stakeholder and public perspectives and connections (Loureiro et al. 2020). Artificial intelligence and other disruptive innovations are altering the contest guidelines in industries worldwide. Artificial intelligence possibilities are considered the essential technological advancement in their immense possibilities for adding worth and competitive advantage (Reim et al. 2020).

The term artificial intelligence refers to a broad subject that has been characterized using phrases such as "machine intelligence," "intelligent agents," "intelligent behavior," "intelligent systems," and "algorithms" (AISheibani et al. 2018). Across the whole of origins, the main driver of rapidly increasing living norms has been advanced. Nevertheless, the procedure of creativity can be incredibly disruptive since it yields conventional techniques obsolete (Soni et al. 2020). Technological and inventive start-ups have shown a powerful capacity to evolve and modify to global pandemic episodes and other challenges: one-third have changed their business model, half have gained new customers, and forty-four percent have speeded up product advancement (Di Bernardo et al. 2021). Artificial intelligence technologies have evolved to a degree of effectiveness (Soni et al. 2020) that provides new business functionality with considerable value creation possibility. Artificial intelligence-enabled start-ups abilities assure considerable advantages in increased velocity, reliability, uniformity, expandability, and cost savings.

Today, the research on start-ups and artificial intelligence is relatively thin, and there is still little scientific proof on the topic (Vijai and Wisetsri 2021). Still, the circumstances are encouraging rather than merely optimistic. Innovative technologies may further increase start-up scalability, but more details are required based on the implementation of AI in start-ups. Thus, this study proposes a review on the adoption of artificial intelligence in start-ups. The study's findings allow for the portrayal of some insights and perspectives on the adoption of artificial intelligence and can aid in the development and viability of start-ups. This review addresses the following research question:

RQ1: How have the adoption of artificial intelligence in start-ups been investigated in terms of a "year," "region," "research technique," "context," and "outcomes?"

RQ2: What are the limits of the existing literature?

RQ3: What are the future areas of research for the start-ups adopting artificial intelligence?

The format of the paper includes: "the review of the literature and its limitations;" "methodology;" "research direction for future research;" "results and discussions;" and "conclusion."

2. Literature Review

The advent of artificial intelligence and the possibilities for its advancement in various sectors of society ascertain the assessment of its impacts on long-term development (Di Vaio et al. 2020; Weber and Schütte 2019). To be successful, start-ups concentrating on artificial intelligence must overcome a unique set of obstacles. The current pandemic has speeded up the implementation of new and innovative technology solutions such as artificial intelligence, but multiple obstacles can stymie entrepreneurs' advancement in this space (Young 2022). Artificial intelligence-based value creation has the potential to significantly (Kulkov 2021) alter start-ups. To handle the problem of businesses wasting resources and making incorrect decisions due to a lack of a thorough understanding of production, the machine learning technique is used to make accurate estimates of the customer's favorite products and mixtures (Chen 2022). The introduction of artificial intelligence, manufacturing 4.0, and machine learning, as well as new scientific trends, necessitate a replication of manufacturing practices and their effectiveness in light of the new technological framework (Balamurugan et al. 2019, December). The synthesis of the literature and their respective limitations are shown in Table 1. The dimensions of the past literature are mapped in figure 1.

Table 1. Synthesis of literature review and limitations

Year	Reference	Database	Aim	Limitations
2019	de Sousa et al. (2019)	Elsevier	This paper investigates AI research as it relates to the government sectors	The study focused on verifying AI research in the government segment instead of a specific field of study or government function.
2021	Dikshit et al. (2021)	Elsevier	The study examines the numerous geo-hazard domains that have profited from traditional machine learning strategies, as well as the future course of action in this field.	The obstacles to gaining a better knowledge of geo-hazards are immense.
2018	Wright and Schultz (2018)	Elsevier	They describe business digitization and present a new structure that combines social contracts theory and stakeholder theory.	NA
2020	Di Vaio et al. (2020)	Elsevier	The purpose is to review the literature on the impact of AI in the creation of a self-sustaining business strategy.	This paper offers useful perspectives for academics and practitioners; however, it has some constraints because it is restricted to an exploratory study of the use of artificial intelligence for a sustainable business model via knowledge management system.
2021	Loureiro et al. (2020)	Elsevier	The study focuses on current studies on AI in the corporate environment and advises a future research agenda.	NA
2021	Schuhmacher et al. (2021)	Elsevier	They explored which AI technologies are being used in pharma research and development, as well as which references of AI-related skills they can tap into.	NA
2015	Dirican (2015)	Elsevier	The purpose of the paper is to confront and explain the potential disruptive impact of the changes on businesses, management functions, and economic theories with futuristic viewpoints that may take place in the near years ahead, primarily in an inventive and forward-thinking manner.	NA

2021	Kumar and Kalse (2021)	Elsevier	The primary goal of the article is to investigate the use of artificial intelligence to establish business operations in Small and Medium Enterprises, as well as the aspects that influence the implementation of artificial intelligence.	NA
2020	Kakani et al. (2020)	Elsevier	With a focus on sustainability, the study explores multiple circumstances and uses cases of Artificial Intelligence (AI) in a wider perspective.	NA
2022	Young (2022)	Elsevier	To be successful, healthcare start-ups concentrating on artificial intelligence must overcome a unique set of obstacles. The current pandemic has speeded up the implementation of new and innovative technology solutions such as artificial intelligence, but multiple obstacles can stymie entrepreneurs' advancement in this space.	NA
2018	Quan and Sanderson (2018)	IEEE Engineering Management Review	The technology manager's note in the study addresses the main elements of the artificial intelligence enterprise environment and describes several management implications. It focuses on the design of artificial intelligence user situations, data consolidation for artificial intelligence, and the development of the artificial intelligence ecosystem.	NA
2020	Cetindamar et al. (2020)	Wiley	The paper proposes using three crucial sources of expertise: publications that represent the arising base of knowledge, patents that reflect the achieved knowledge base, and start-ups that portray the experimental base of knowledge.	The study confines its findings to a single technology, artificial intelligence, ignoring any knowledge synergies that may take place between artificial intelligence and other technologies.
2021	Filieri et al. (2021)	Emerald	The study's goal is to look into the characteristics of AI in hospitality sector.	Despite identifying the supply chain stages and artificial intelligence alternatives in which venture capitalist are making investments, we cannot predict how to value acquirement dynamics will evolve over time.
2021	Baek et al. (2021)	Emerald	The purpose of the paper is to create quality assessment framework that can be applied to start-ups that use artificial intelligence technology.	The survey demonstrated the constraints of quality assessment of artificial intelligence services.
2021	Kulkov (2021)	Emerald	Artificial intelligence-based value creation has the potential to significantly alter global healthcare. The purpose of the article is to	They looked into European start-ups that are evolving artificial intelligence solutions. Design features and themes, on the other

			investigate the procedure of creating value for start-ups in healthcare.	hand, may differ in other developed and emerging nations.
2021	Chen et al. (2021)	Emerald	The goal of the research is to create a model for the adaptation of AI in the ground of B2B marketing.	Although Web of Science, Scopus, and ABI/inform offer a broad variety of management science peer-reviewed journal articles, they do not involve all reputed and reliable peer-reviewed journal articles.
2020	Warzyńska et al. (2020)	Research .tue.nl	The study's primary goal is to discover what distinguishes Dutch artificial intelligence start-ups.	Artificial intelligence technology and start-ups are still in their infancy.
2017	Batin et al. (2017)	Informati ca	They concentrate on the most effective artificial intelligence implementations for anti-aging and life extension at three anticipated phases of artificial intelligence advancement in the manuscript.	NA
2020	Obschonka and Audretsch (2020)	Springer	They display some observations and a gathering of articles on the position of AI in this evolving field of entrepreneurship study evaluation and implementation.	NA
2019	Cautela et al. (2019)	Unisinob r	The goal is to gain a better comprehension of the transition to artificial intelligence that is taking place in design thinking, more broadly, in innovation practices.	NA
2021, August	Mishra et al. (2021, August)	acm.org	They undertook a review of the existing machine-learning methods that have recently made a contribution to understanding the start-ups needs.	NA
2018	AlSheibani et al. (2018)	PACIS	The work-in-progress article aims to develop a research framework for artificial intelligence implementation at the firm level	NA
2019	Garbuio and Lin (2019)	Sagepub	The study provides a timely and critical assessment of AI-based healthcare start-ups, as well as identifies emerging business strategy themes used by start-ups across the world to carry, AI-powered business solutions.	NA
2021	Di Bernardo et al. (2021)	usf.edu	The article suggests a review of start-ups and artificial intelligence with the goal of laying the groundwork for future research.	NA
2020	Reim et al. (2020)	MDPI	The goal of this article is to offer a deeper comprehension of AI and its importance in business transformation.	Inadequate comprehension of artificial intelligence application execution results in limited business benefits.
2021, July	Singh et al. (2021, July)	IEEE	The study's goal was to glance into the use of AI in health-tech start-ups to deal with COVID-19.	The role of health tech start-ups in tracking COVID-19 instances is critical, not only at the native but also at the international scales.

2020	Maulina et al. (2020)	Research gate	The purpose of the research is to investigate the execution of artificial intelligence technology at start-ups in Indonesia, what hurdles actually impact artificial intelligence execution, and how to conquer extant hurdles linked to artificial intelligence technology in Indonesia.	NA
2022	Chen (2022)	Taylor & Francis	To handle the problem of businesses wasting resources and making incorrect decisions due to a lack of a thorough understanding of production using AI.	NA
2020, December	Radhakrishnan and Chattopadhyay (2020, December)	Springer	In the paper, an endeavor was made to evaluate journal articles and other findings on artificial intelligence adoption in order to comprehend the adoption theories used as well as the conditions that support and impede artificial intelligence adoption.	NA
2019, December	Balamurugan et al. (2019, December)	IEEE	The introduction of artificial intelligence, manufacturing 4.0, and machine learning, as well as new scientific trends, necessitate a replication of manufacturing practices and their effectiveness in light of the new technological framework.	NA
2020	Ambati et al. (2020)	Research gate	The study's goal is to better comprehend the variables that influence the implementation of artificial technologies and techniques in firms from the perspective of employees.	NA
2018	Hussain (2018)	Academia	The paper provides an overview of this AI implementation, and innovation, takes into account the current advancement of this advancement in reality, as well as explores the application's objective of man-made intelligence technology known as Artificial Intelligence.	No one seems to have a response when it comes to Artificial Intelligence generating machines that are smarter than humans.
2019	Lee et al. (2019)	MDPI	The study aims to concentrate on the proactive aspect of using artificial intelligence technology to drive business model innovation.	The primary constraint of their case study was the limited number of cases. Although they performed extensive research and close monitoring to uncover both specific and general aspects of the concerns, the idiosyncratic circumstances of various industries should be taken into account when generalizing their findings.
2017	Chui (2017)	McKinsey and Company	The article focuses on five AI technology systems: "robotics and autonomous vehicles," "computer vision," "language," "virtual agents,"	

		y Global Institute	and "machine learning," which contains "deep learning" and is at the foundation of many latest innovations in other artificial intelligence technologies.	NA
2017	Ransbotham et al. (2017)	Proquest	To comprehend the difficulties and outcomes affiliated with the use of artificial intelligence.	Obtaining advantaged access to data is uninterrupted work as the amounts of data multiplies every few years.
2021	Vijai and Wisetsri (2021)	Research gate	The paper looks into the AI that assists in the settlement of the medical situation in India.	NA
2022	Sestino and De Mauro (2022)	Taylor & Francis	The study seeks to shed light on the occurrence of artificial intelligence business stimulation.	The collection of records they used in their assessment was entirely procured from Scopus: despite its breadth and authority, this selection may have resulted in a partial perspective of the literature.
2020	Chatterjee and Bhattacharjee (2020)	Springer	The goal of the study is to investigate how actors might be able to implement the artificial intelligence in higher education.	NA

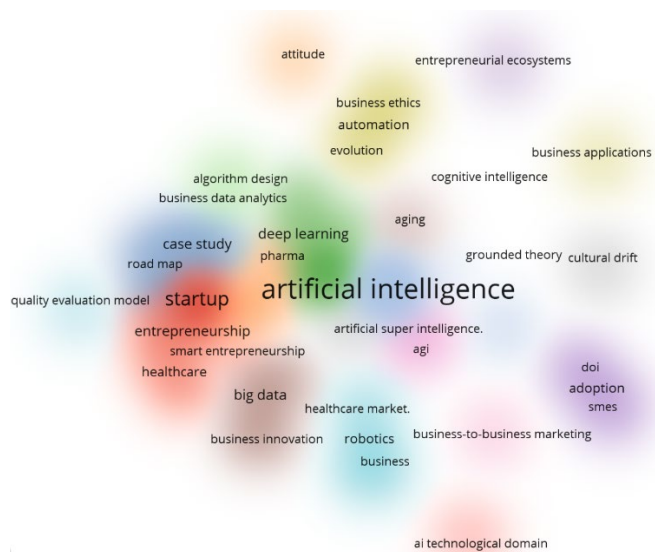


Figure 1. Mapping of dimensions of relevant past literature

3. Methodology

For this literature review, we accumulated 295 pieces of published literature relevant to artificial intelligence from Scopus and Google Scholar databases till the year 2022. From there 40 relevant articles were shortlisted relevant to the adoption of artificial intelligence in Start-ups. We utilized the search terms "Artificial Intelligence," "Implementation of AI in start-ups," "Artificial intelligence readiness," and "Artificial intelligence and Start-ups," in the abstract to guarantee that pertinent articles were incorporated. The following figure 2 depicts the flowchart of the methodology:

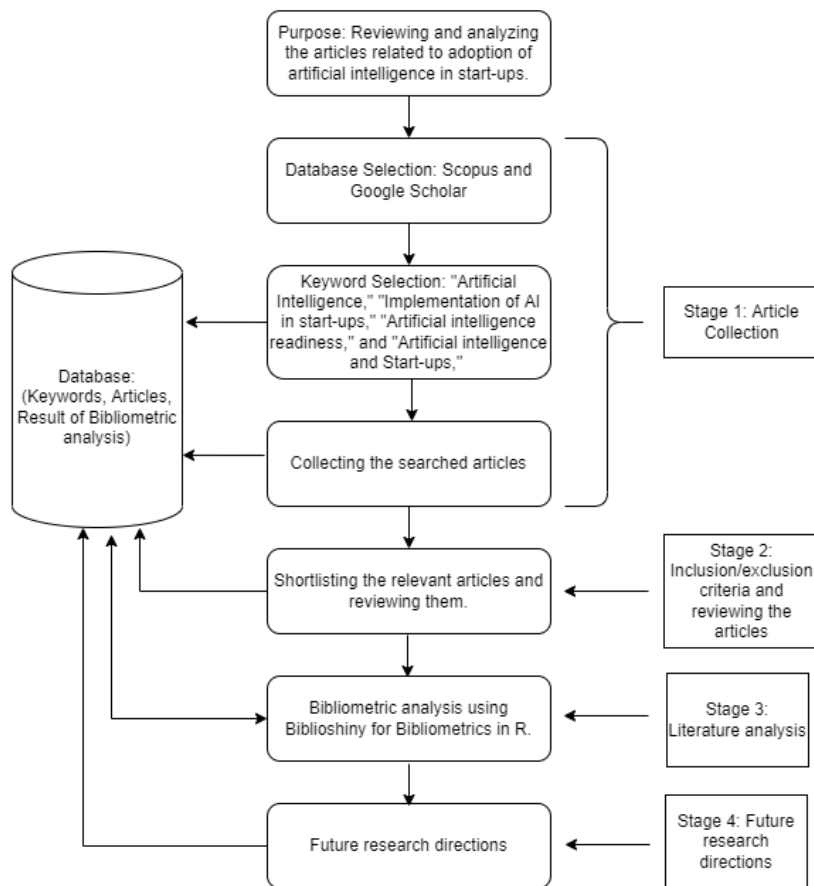


Figure 2. Flow chart of the methodology.

4. Analysis

The three fields plot shown in Figure 3 depicts three elements i.e., sources, authors, and title. Starting with the sources, followed by the authors, and then each author is connected to the title, these three aspects are displayed with grey links that illustrate their interactions with one another. The number of articles linked with each component is indicated by the size of each rectangle in each list. The word cloud in Figure 4 visualizes the most commonly used words in publications on Artificial intelligence and Start-ups. “Artificial Intelligence” was the most often used term, followed by “startup” and “system”. The word cloud shows words in different sizes based on how many times they occur. The word arrangement is a little haphazard, but the most important words are in the center to make them more obvious due to their enormous size. A thematic map based on centrality and density was also created, separated into four topographical zones (Figure 5). By mapping the connection between one term and another through spatial mapping, a conceptual structural map (Figure 6) was created, comprising a depiction of the contextual structure of each term that occurred frequently in research articles on artificial intelligence and startups.

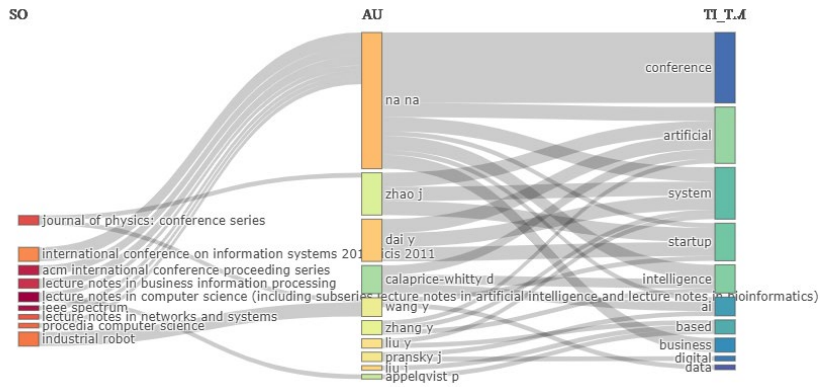


Figure 3. Three fields plot of Scopus database

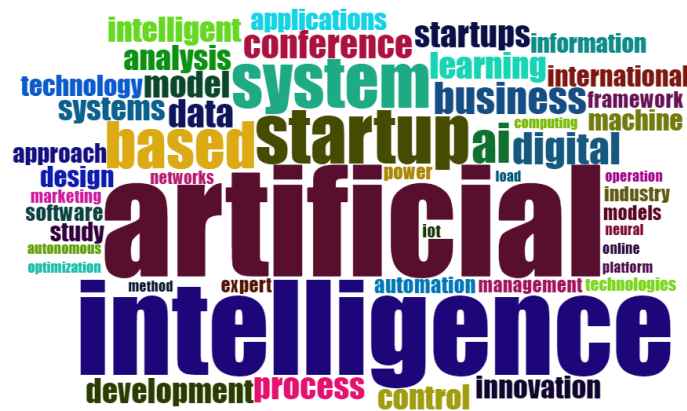


Figure 4. Word Cloud of Scopus database

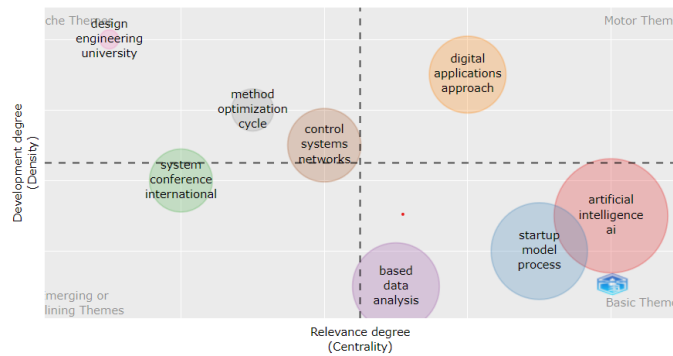


Figure 5. Thematic map of Scopus database

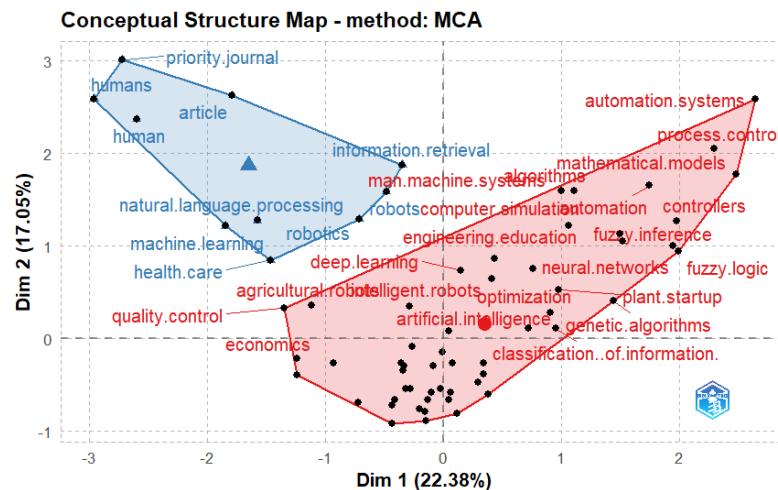


Figure 6. Conceptual structure map of Scopus database

5. Future Research Directions

In future studies, it is suggested that the utilization of artificial intelligence in specific areas or functional areas be thoroughly explored (de Sousa et al. 2019). Successive occurrences would become the standard in the coming years due to the obvious change in climate and boost in anthropogenic actions. As a result, it is very important to work towards better planning geo-hazards after an incident has happened at various time scales and can be very well supplemented with physical models (Dikshit et al. 2021). Wright and Schultz (2018) initiate a discussion about the advantages and ethical concerns of digitization, capturing the attention of the behavioral and social literature, which was not yet addressed the ethical dimension of the latest automation. It may be worthwhile to conduct quantitative studies to investigate the knowledge management system procedures used by the organizations in order to comprehend how they can inspire the incorporation of artificial intelligence and whether this generates new value and knowledge (Di Vaio et al. 2020). A systematic analysis demonstrates how the implications of AI for firms have progressed over the past few decades. Such efforts may aid researchers in the future in guiding their own literature reviews based on their areas of AI interest (Loureiro et al. 2020). Kakani et al. (2020) review provides a one-stop-shop for multi-disciplinary information entailing artificial intelligence and foresight methods in the agriculture and food sectors. Cetindamar et al. (2020) research concentrates solely on artificial intelligence among digital technologies, but numerous ecosystems with varying entrepreneurial possibilities may coexist in distinct classifications of digital technologies. In the long run, and from a scientific point of view, it will be interesting to see if the monetary and market-oriented success of the businesses under consideration can be linked to the beginning or late investment in artificial intelligence technologies (Weber and Schütte 2019). Other entrepreneurial factors, such as personality characteristics, demographic factors, and digital capacities, could be investigated in prospective research to elucidate their conception and growth possibilities (Fileri et al. 2021). Researchers may be interested in comparing the composition and themes of start-ups and innovative companies using a layout lens (Kulkov 2021). Prospective research should use case studies or empirical studies as the primary research method to verify the effect of AI adoption on B2B marketing and, as a result, enhance the compelling functionality of artificial intelligence studies (Chen et al. 2021). The analysis of start-ups could supplement the analysis of incumbents who are commercializing design thinking-supporting apps and services (Cautela et al. 2019). Mishra et al. (2021, August) offer the suggested study work's prospective road map in order to anticipate and suggest the vital characteristics that enhance the sustainability of novel start-up projects. The future study could compare start-ups in the same industry, focusing on those that use artificial intelligence and those that do not, to see if there is a distinction in terms of economic achievement, consumer perspectives, and business model quality (Di Bernardo et al. 2021). The paper emphasizes the significance of comprehending the position of the industrial ecosystem. Prospective research should be conducted to determine what areas of expertise each ecosystem actor is affiliated with, as well as the maturity level that each position must accomplish in order to effectively advance with artificial intelligence initiatives (Reim et al. 2020). Prospective research should concentrate on the trails of the evolvement of artificial intelligence in combating the COVID-19 pandemic (Singh et al. 2021, July). Machine learning will undoubtedly be used more extensively in the long term in a variety of fields (Chen 2022). Hussain (2018) suggests that further research in this area should be feasible because

such artificial intelligence systems can produce extremely inspiring and profitable results. Future research should also demonstrate various types of evolving business model archetypes (Lee et al. 2019).

6. Discussion

In this investigation, 40 published journal and conference papers were evaluated. They investigated the artificial intelligence application in start-ups and the importance of the adoption of artificial intelligence technologies in various firms. Past research shows that incorporating artificial intelligence in start-ups will enhance their start-up operations and will reduce their failure rates. The findings of the literature review are as follows:

- Although it includes laws and moral considerations, the studies examined are primarily concerned with displaying solutions to practical problems. It was discovered that the method to be used for implementing the remedies displayed is determined by the type of issue in each scenario.
- Machine learning could be used in a variety of hazards, exposure, and impact scenarios. The studies also anticipate which areas will see a rise in the use of machine learning.
- Technological advancement in digitization significantly boosts efficiency.
- The prevailing and anticipated disruptive effects of artificial intelligence and robotics on business and economics in the early phases of the "Space Economy" would be in the coming years.
- Some of the main benefits of digitization, intelligent systems, and data analysis using artificial intelligence algorithms include increased profitability, cost and time efficiency, reduced human error, quicker management decisions, consumer preferential forecasting, and increased sales.
- The main discoveries are that throughout the pandemic episodes, artificial intelligence can be utilized to keep social distance, undertake business operations from a safe location, improve customer delivery, create business for start-ups, and provide an edge over its competitors.
- A system perspective is required for artificial intelligence to be more effectively used in start-ups. Customer communication and comprehension of client needs are important aspects of ecosystem management.
- Start-ups, on the other hand, are entering an age of artificial intelligence-powered revolutionary innovation, defined by connectivity, intelligence, and customization rather than internet-based or human-driven services.
- Start-ups must determine whether building solutions on existing artificial intelligence platforms is the best way to achieve their value creation goals.
- Start-ups should evolve unique skills and attain a definite level of maturity when using artificial intelligence as a precursor for digitalization through business model innovation.
- The obstacles arise during the implementation of artificial intelligence so that the actors can progressively pertain to the artificial intelligence requirements and minimize the impacts that arise as a result of the project's execution.
- The obstacles of artificial intelligence implementation in the start-ups can be influenced by variables entailing employees, such as job loss risk and opposition to implementation, as well as any other problem with technology migration
- Preliminary proof implies that artificial intelligence can provide an actual benefit to early adopters and be a strong disruptive force.
- Start-ups must sketch out that computers and humans can complement each other's abilities to gain a competitive advantage if artificial intelligence is to become a significant aspect of future strategies.

7. Conclusion

Due to the importance and significance of artificial intelligence, particularly among start-ups, we recognized and synthesized the academic, scientific, and professional basics that launch, support, and complement the artificial intelligence application core concepts, processes, and approaches. The study shows that entrepreneurs have a better chance of deploying artificial intelligence. This shows that academics have started to recognize the importance of artificial intelligence in the development of start-up operations. The advantages are especially rewarding for a start-up because they typically have scarce resources, so any chance to digitize, enhance, standardize, and relieve the work process is greatly appreciated. Artificial intelligence-powered inventive remedies offer precise, insightful information about customer wants and needs, enabling these rapidly growing start-ups to rapidly make transformations to their established portfolio of products and services or create new ones that meet customer anticipations. Evidently, wiser start-ups that adopt artificial intelligence-led advancement will be able to react to upcoming events in a fast and effective manner while not impeding their expansion procedure. The discovery of numerous viewpoints linked to the phenomenon, as well as the application of AI to other service sectors, are two potential research paths that will necessitate creative effort from relevant study practitioners and academicians. Many published research falls short to

reveal the study's constraints or suggestions for future areas of research, which is one of the most serious weaknesses in the current literature. This makes future studies into overcoming the constraints to permitting artificial intelligence in start-ups unfeasible. Generally, there haven't been a lot of studies on the adoption of artificial intelligence in start-ups, which leaves a lot of scope for future research.

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