

Challenges and Prospects of Startups Investing in Artificial Intelligence

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Abstract ;

This study examines the challenges and opportunities for startups investing in artificial intelligence (AI). AI holds transformative potential to improve efficiency, lower costs, enhance customer experience, and support faster decision-making, making it a strategic tool for innovation. Yet adoption is constrained by limited specialized talent, high development costs, and restricted access to reliable data. Despite these barriers, key sectors such as healthcare, education, and finance provide strong opportunities for AI-driven growth. Global investment in AI exceeded \$70 billion in 2019, with startups receiving a large share. Financing options include venture capital, government funding, and angel investors, reflecting global confidence in AI's disruptive role.

Article info

Received 09/09/2025
Accepted 17/10/2025

Keyword:

- ✓ *Artificial Intelligence (AI)*
- ✓ *Startups*
- ✓ *Investments*

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1. Introduction

Amid today's rapidly evolving technological landscape, artificial intelligence (AI) stands out as one of the most transformative forces, reshaping industries and societies at an unprecedented pace. The growing capabilities of AI have not only revolutionized the business world but have also fostered the emergence of a vast number of startups that now occupy the forefront of innovation in this domain.

AI-focused startups have captured the imagination of stakeholders across multiple sectors, given their pivotal role in shaping the technological trajectory of the world. Investors eager to capitalize on AI's transformative potential are venturing into uncharted fields in search of opportunities that yield substantial returns while minimizing inherent risks.

As the AI startup ecosystem matures, it becomes increasingly clear that merely keeping pace with the innovation wave is insufficient for ensuring sustainable success. Visionary investors must therefore adopt strategic approaches that align with the unique challenges and distinctive characteristics of these ventures, while acknowledging the intricate interplay among technology, market dynamics, and regulatory frameworks.

At present, with the advent of the Fourth Industrial Revolution, AI startups have become the focus of significant attention from investors, venture capitalists, and policymakers alike. Nevertheless, the entrepreneurial endeavors of AI-driven ventures are far from seamless, as their investment journeys are replete with both challenges and opportunities that ultimately determine their survival and growth in a fiercely competitive market.

The investment journey of AI startups can be likened to an exploratory odyssey—fraught with risks yet rich with untapped opportunities. Throughout this paper, we seek to demystify the complexities of AI startup investment by examining the diverse strategies these ventures employ to secure funding, forge strategic partnerships, and expand their market presence.

In this context, the present study aims to explore the opportunities and challenges surrounding AI startup investment by addressing the central research question:

In an investment environment laden with risks yet abundant with untapped opportunities, what are the main challenges and prospects that AI startups face in their journey of investing in artificial intelligence technologies?

➤ Significance of the Study

The significance of this study stems from the pivotal role of artificial intelligence (AI) in advancing industrial development within startups, as it serves as a cornerstone for innovation and digital transformation. AI contributes to automation, customization, risk management, customer and supplier evaluation systems, as well as productivity enhancement, thereby enabling startups to achieve a qualitative leap in the global industrial landscape.

Furthermore, the importance of this study lies in the fact that investing in AI technologies represents a strategic step for startups to strengthen their competitiveness, diversify funding sources, build partnerships, and expand their market presence. Accordingly, addressing the subject of AI investment in startups provides valuable insights into both the risks involved and the promising opportunities it offers.

➤ Study Objectives:

The study seeks to achieve a set of objectives, the most significant of which can be outlined as follows:

- To shed light on the complexities of startups' investment journeys in artificial intelligence (AI) and the associated risks they encounter;
- To explore the factors and drivers influencing startups' investment decisions in AI technologies;
- To provide a comprehensive understanding of the dynamics shaping the investment landscape within startups;
- To identify the key challenges that startups face when adopting AI;
- To examine the opportunities offered by these technologies to enhance startups' competitiveness;
- To assess the current state of investment in AI-focused startup projects.

➤ **Study Methodology and Main Themes:**

In order to address the theoretical dimensions of the study, the descriptive–analytical method was employed. This was carried out through a thorough review of books, articles, and prior studies dealing with the subject of startups and artificial intelligence systems. The aim of this approach is to provide well-grounded answers to the central research question. To this end, the present paper has been structured around the following main themes:

2. A Review of Artificial Intelligence and Startups

Artificial intelligence (AI) has emerged as one of the most influential tools in today's business world. Organizations increasingly rely on it for sales forecasting, fraud detection, customer support, and enhancing operational efficiency. The advancement of this technology has brought about a profound transformation in the way companies interact with their clients, with projections indicating that the majority of these interactions will soon take place without direct human involvement. (Jones,, 2018)

2.1 The Theoretical and Historical Background of Artificial Intelligence

Artificial intelligence (AI) is considered one of the most prominent manifestations of digital transformation in the modern era. Since its official emergence in 1955, it has undergone remarkable development, largely driven by advances in computing technologies. This progress has revived fundamental questions regarding the ability of machines to simulate human behavior and rational thought. From its inception, AI has branched into several approaches, most notably narrow AI, which focuses on performing specific tasks with high efficiency, without possessing consciousness or comprehensive awareness.

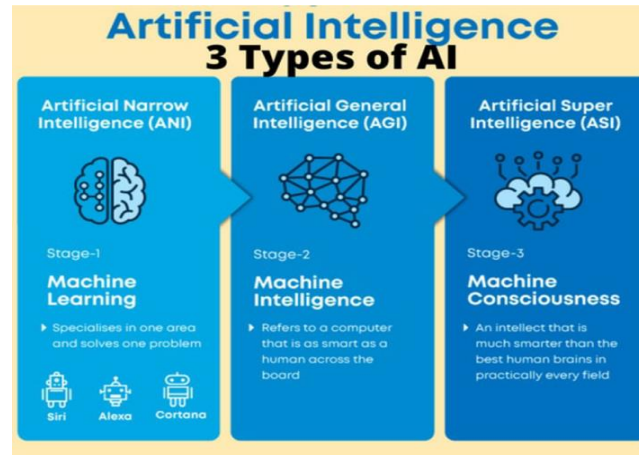
the context of continuous advancement, AI has achieved unprecedented milestones, the most notable being a computer's victory over the world champion in the game of "Go," which was regarded as a turning point in the evolution of this scientific field. Despite such progress, a major challenge remains in fully understanding the learning mechanisms of these systems.

At present, AI applications have become an integral component of numerous industries, in some cases surpassing human performance in terms of accuracy and speed. This raises profound questions about the future—specifically, the point at which machines might attain comprehensive superiority over humans across various domains.

2.2 Types of Artificial Intelligence

Modern artificial intelligence (AI) can be classified (Khan, 2021) into the following categories:

Fig.1. The Three Types of AI: ANI, AGI, and ASI



Source: Hanif Khan, 2021, p2.

➤ **Narrow Artificial Intelligence (ANI):**

This type of AI focuses on performing specific tasks with precision. However, it raises concerns related to privacy and data breaches, thereby necessitating clear legal and regulatory frameworks. At the same time, it offers significant opportunities to support startups by enabling content generation and improving business operations. Despite optimism about its potential, there remain persistent concerns about its long-term impact on the human-machine relationship, particularly in the context of advancing natural language understanding.

➤ **Artificial General Intelligence (AGI):**

From a comprehensiveness perspective, AI can be divided into two forms: the first is Artificial General Intelligence (AGI), which is envisioned to achieve human-like versatile intelligence; the second is Artificial Narrow Intelligence (ANI), which performs a specific task at least as efficiently as humans. The former, AGI, remains far from practical implementation. Achieving AGI entails both utopian and dystopian possibilities, and much of the current debate has reached an intense and critical stage.

➤ **Artificial Superintelligence (ASI):**

Advances in computer vision have strengthened the ability of robots and intelligent systems to achieve visual perception and perform complex tasks, extending into other domains such as natural language processing and speech recognition. Superintelligence poses both technical and ethical challenges, particularly in the absence of effective mechanisms to control it. Although the fundamental aim of AI is not to surpass humans but to support them, the concentration of its development in the hands of a few major corporations, as well as its potential military applications, raises serious concerns regarding its future trajectory and global impact.

2.3 Applications of Artificial Intelligence in Enterprises

Artificial intelligence (AI) represents a powerful lever for enhancing the performance of startups and expanding their competitive capabilities across various domains. It has become a strategic tool in developing marketing systems through data analytics and precise market segmentation, enabling more effective access to target customers. AI also facilitates financial management by providing advanced tools for risk analysis and cash-flow forecasting. In the field of human resources, automated recruitment emerges as an intelligent solution to accelerate screening and selection processes. At the operational level, AI is applied in quality monitoring, inventory

management, and predictive analytics, thereby improving operational efficiency and reducing costs (Kobbacy & Vadera, 2011)

Moreover, intelligent customer support technologies stand out as one of the most prominent applications of AI. They enable continuous and effective interaction with audiences, thereby increasing customer satisfaction and strengthening their loyalty to the brand.

Marketing:

Artificial intelligence contributes to delivering intelligent recommendations, understanding textual content, customizing products, and selecting persuasive techniques. Its applications span multiple aspects such as customer targeting, content generation, and chatbots, thereby supporting the development of more effective marketing strategies.

➤ *Customer Segmentation:*

Artificial intelligence demonstrates a significant capacity to support decision-making, forecasting, and effective resource allocation, particularly in business environments. Techniques such as machine learning are employed to identify profitable customers through the analysis of historical data, while methods such as decision trees and K-means clustering are applied to segment customers according to their behavior and long-term value (LTV). Furthermore, studies have shown that the use of indicators such as the average cost of service (AHP) enhances the accuracy of predicting customers' future behavior (Parvaneh, Abbasimehr, & Tarokh, 2012)

➤ *Predictive Analytics:*

Marketers have faced challenges in effectively leveraging social media posts, despite the ability of AI models to identify unique terms that may exceed human expertise. However, these terms are not always linked to performance indicators, which limits their effectiveness. Social media platforms serve as powerful tools for direct communication and shaping brand image. With the increasing volume of data, issues related to accuracy and reliability have emerged, necessitating the use of advanced machine learning techniques for analysis. Moreover, with the availability of cloud computing, companies can capitalize on these tools, provided they strike a balance between implementation efficiency and the level of investment required to achieve the desired benefits (Danielsson & Uthemann, 2023)

➤ *Inventory Management:*

Inventory management refers to the organization and coordination of raw materials, work in progress, and finished goods, excluding fixed assets. Its primary objective is to ensure the continuity of production while minimizing storage costs. Approaches to inventory management range from manual counting—valued for its simplicity and low cost—to Internet of Things (IoT) technologies such as RFID, which enhance efficiency but require human training and operation. Additionally, vision-based systems and robotics have emerged to automate counting with greater precision. With the intensification of industrial competition, the need to improve supply chain performance has grown, fostering the adoption of technologies such as artificial intelligence, artificial neural networks, and bio-inspired algorithms—representing a growing research trend in the field of industrial engineering (Wu & Lu, 2022)

➤ *Quality Control:*

Quality is a fundamental element in the design and production of products in line with customer expectations, representing the effort made to avoid unsatisfactory outcomes. In the field of software, quality refers to design compliance and the absence of defects. It is managed through two key processes:

- **Quality Assurance (QA):** Focuses on preventive measures to ensure that the product meets established standards.
- **Quality Control (QC):** Involves verifying product quality through inspection and testing.

Process improvement further enhances efficiency by relying on quantitative performance analysis. Defect sequencing rules are employed to allocate resources effectively and reduce review and repair costs, while also taking into account the needs of end-users (Santhanam, 2020)

Finance:

Artificial intelligence (AI) has experienced rapid growth that has attracted wide attention, particularly in the financial sector and financial technology (FinTech). The increasing number of events and forums highlights the importance of AI in areas such as smart payments and blockchain. AI is also employed as a tool to understand environmental finance phenomena and to develop effective solutions within the digital economy. Despite its prior success in the financial sector, there is a growing need to apply its latest versions to foster innovation and explore new opportunities. Consequently, an emphasis on deep distributed financial learning and modeling is essential to advancing the development of AI in this sector (Cao, 2021)

2.4 The Concept of Startups

Literally, the term “startup” is of Anglo-American origin, composed of two parts: start, meaning “to begin,” and up, meaning “to grow.” When combined, the term denotes a small idea or initiative that has just begun and is set on a path of growth (Boualchaour, 2018)

Paul Graham, the founder of the Y Combinator business incubator, famously defined a startup in his well-known essay as a company designed to grow rapidly. The recency of its establishment does not, by itself, make it a startup. Nor is it necessary for startups to operate in the field of technology or be financed through venture capital. The sole essential element is growth, and everything else commonly associated with startups follows from that growth.

3. Evaluating New Business Opportunities in the Artificial Intelligence Industry

Artificial intelligence (AI) has become a transformative force, opening new business opportunities across sectors while reshaping economies and societies. It serves not only as a tool for efficiency and cost reduction but also as a catalyst for innovation and new business models. At the same time, AI adoption is constrained by regulatory barriers, data challenges, and ethical concerns that shape its sustainable use. Evaluating these opportunities requires balancing AI’s potential to drive growth and improve quality of life with the risks posed by governance and competition. The following sections explore AI’s role in innovation, the transition from Industry 4.0 to Society 5.0, regulatory barriers, and the competitive race in AI development.

3.1 AI as a Catalyst for Innovation and Transformation

In today’s rapidly evolving technological landscape, the artificial intelligence (AI) industry has emerged as a hub for innovation and transformation, offering unprecedented opportunities for entrepreneurs and businesses. As AI continues to penetrate various sectors—from healthcare and finance to manufacturing and retail—it has generated widespread excitement and curiosity due to its capacity to reshape both our lifestyles and ways of working. The convergence of big data, powerful algorithms, and advanced computational capabilities has opened vast horizons of possibilities, paving the way for groundbreaking projects that exploit AI’s latent potential.

3.2 From Industry (4.0)to Society (5.0)

Some actors have chosen to capitalize on AI's momentum in profitable domains such as data analytics, hyper-automation, and supply chain optimization. However, the true opportunities where AI will leave a significant societal footprint lie not in the "Industry 4.0" paradigm of the 20th century, but rather in the "Society 5.0" vision of the 21st century. While technological progress has accelerated dramatically in recent decades, humanity's pace of adaptation has not kept up. This discrepancy has revealed two sides of technological advancement: on the one hand, daily life has become easier with advances in communication, healthcare, and predictive medicine; on the other, unexpected challenges have arisen, including growing mental health issues, depletion of natural resources, and increasing threats to privacy. Society 5.0 departs from the industrial vision and instead places humans at the center of technological progress and innovation. Within this paradigm, commercial opportunities in AI are those that seek to achieve happiness, fulfillment, and improved quality of life for individuals (Pereira, Lima, & Charrua-Santos, 2020)

3.3 Regulatory Barriers and Data Challenges

Actors aiming to seize emerging business opportunities within the framework of Society 5.0 must consider the prevailing reservations among stakeholders regarding AI's autonomy. AI heavily depends on vast quantities of information—fueled by big data—to train its learning mechanisms and achieve high performance and accuracy. Yet, this capability faces significant barriers due to regulatory restrictions worldwide. For instance, practices such as "pseudo-classification" in both the European Union and the United States limit the volume of data that can be collected. Since AI technologies aim to gather massive amounts of data from any available source, their use under conditions of human bias, restricted access, or manipulated information can undermine results and negatively affect accuracy and performance (Zarsky, 2017)

3.4 The Competitive Race in AI Development

Given the current immaturity of AI, the race to secure competitive advantage in this field will be divided among different categories of actors. On the one hand, some will concentrate their efforts on adapting innovations to diverse regulatory frameworks, achieving rapid growth as a result. On the other hand, there are environments where AI's boundaries can be explored with fewer restrictions, fostering innovation and pushing technology to its limits. Finally, some actors will accelerate progress toward the next stage of AI, where complex training processes with high accuracy and exceptional performance can be generated from minimal inputs, approaching the capabilities of the human brain. (Zarsky, 2017)

4. Motivations for the Adoption of Artificial Intelligence in Startup Enterprises

The importance of artificial intelligence (AI) lies in its ability to support the success of startups by identifying opportunities, developing innovative business models, and providing effective solutions that meet customer needs. AI enables entrepreneurs to leverage technologies such as big data and the Internet of Things (IoT) to analyze markets, deliver innovative services, and redesign traditional models in alignment with technological advancements. Among the most significant drivers and reasons that make the adoption of AI in startups an imperative are the following:

4.1 Enhancing Operational Efficiency (Fostering Innovation and Seizing Opportunities):

Artificial intelligence (AI) serves as a pivotal force in the digital transformation of startups, opening new business opportunities and enabling entrepreneurs to design innovative business models aligned with market demands. The significance of these technologies lies in providing analytical and forecasting tools that enhance firms' competitiveness. Nevertheless, entrepreneurs

face the challenge of adapting traditional approaches to AI applications in order to improve performance and drive innovation. Studies have shown that these technologies support entrepreneurial activities and contribute to the emergence of new business models. AI also offers advanced analytical capabilities that allow startups to better understand consumer behavior and predict future needs, thereby strengthening their ability to make well-informed strategic decisions.

4.2 Improving Performance:

Startups today face rapidly evolving technological challenges, which drive them to adopt innovative solutions both to keep pace with this swift progress and to enhance their overall performance. Artificial intelligence (AI) stands out as one of the most effective tools available to address these challenges, playing a central role in boosting productivity and providing strategies capable of adapting to continuous change. This is reflected through several key dimensions (Kerzel, 2020):

✓ Enhancing Operational Efficiency and Streamlining Processes

Artificial intelligence (AI), particularly automation and machine learning, contributes to improving the operational efficiency of startups by streamlining routine tasks, thereby accelerating processes, reducing costs, and increasing productivity. Entrepreneurs can replace repetitive functions with intelligent algorithms capable of executing tasks with greater efficiency

✓ Data Analytics and Effective Marketing

Artificial intelligence (AI) enables startups to analyze vast amounts of data to better understand market trends and consumer behavior, thereby granting entrepreneurs the ability to accurately forecast changes and design strategies that align with such expectations. In this context, AI contributes to the development of effective marketing strategies that ultimately enhance the overall performance of the enterprise.

✓ Inventory Management and Market Forecasting

Artificial intelligence (AI) technologies play an active role in enhancing inventory management by predicting demand levels and customer trends. This, in turn, supports more effective planning, reduces waste, and increases the operational efficiency of the enterprise.

4.3 Supporting Management and Decision-Making

Artificial intelligence (AI) technologies are powerful tools that contribute effectively to supporting the decision-making process within startups, offering advanced capabilities in data analysis, forecasting, and strategy formulation. This significance is manifested in several key dimensions :

✓ Assisting in Providing Accurate Forecasts

The core function of artificial intelligence (AI) technologies lies in transforming vast amounts of raw data into accurate predictions that enable entrepreneurs to gain deeper insights into their environment and make more effective decisions. According to research, decision support systems have become essential tools upon which entrepreneurs rely to perform multiple tasks, including identifying investment opportunities, allocating financial and human resources, managing potential risks, and continuously analyzing data. These capabilities clearly contribute to improving the quality of decision-making processes within startups (Battisti, Agarwal, & Brem, 2021).

✓ ***Creating a Competitive Advantage***

With the continuous increase in the volume of data handled by startups, reliance on predictive data analytics provided by AI technologies has grown substantially. These advanced analytical methods support decision-making by delivering precise and timely insights that help entrepreneurs respond effectively to market changes. Research indicates that AI can provide startups with a genuine competitive advantage by integrating customer preference analysis with industry benchmarks, thereby strengthening the enterprise's ability to make well-informed, data-driven strategic decisions. This, in turn, enhances performance and broadens the firm's impact within the market (Mi, Liu, Yuan, Shao, & Zhong, 2023)

✓ ***Reducing Uncertainty***

Decision-making under conditions of uncertainty represents a significant challenge and risk that may lead to undesirable outcomes. To address this situation, AI technologies are employed to analyze data and reduce the scope of uncertainty. This type of assessment assists decision-makers in identifying uncertain factors that have a substantial impact on final outcomes, thereby enabling them to allocate resources more effectively (Dellermann, Lipusch, Ebel, Michael Popp, & Marco Leimeister, 2017)

4.4 Marketing

Artificial intelligence (AI) is a vital tool for market analysis and strategic marketing decision-making. Research has shown that machine learning algorithms assist companies in predicting customer behavior, identifying the most demanded products in the market, and estimating appropriate pricing. These algorithms analyze past sales data and provide recommendations regarding which products should be prioritized or discontinued, thereby enabling firms to utilize their resources more effectively (Soni, Sharma, Singh, & Kapoor, 2019) The contribution of AI to marketing management can be summarized as follows:

✓ ***Dynamic Pricing and Real-Time Optimization***

Artificial intelligence (AI) assists enterprises in implementing dynamic pricing, which involves automatically adjusting prices according to supply and demand, thereby contributing to increased profitability. For instance, Amazon employs this technique to adjust product prices based on market dynamics and customer interests, with prices rising as demand increases and falling when it decreases.

✓ ***Customer Relationship Management (CRM)***

AI-powered Customer Relationship Management (CRM) systems contribute to the precise collection and analysis of customer data, enabling a deeper understanding of their preferences and needs. This analysis supports the delivery of personalized customer experiences, thereby strengthening customer loyalty to the enterprise and encouraging continuous engagement with the brand .

5. Challenges and Opportunities in Startups' Adoption and Investment in Artificial Intelligence

Startups investing in AI face major challenges, including high financial costs, technical skill shortages, and complex regulatory demands such as data protection compliance. Ethical issues like privacy and algorithmic bias, alongside intense market competition and shifting consumer preferences, add further pressure. Addressing these challenges requires strategic planning, responsible innovation, and adaptability to ensure sustainable growth (Guechi, 2023)

5.1 Financial Challenges

Startups in the field of artificial intelligence (AI) face significant financial difficulties that hinder their development, most notably the need for substantial funding to cover research and development expenses and advanced technological infrastructure. Marketing expenditures and the recruitment of specialized talent in fields such as data science and engineering also impose heavy burdens that require flexible budgeting. Moreover, achieving a return on investment in AI projects often takes considerable time, which affects liquidity and increases risk. Market volatility further necessitates the constant reassessment of financial plans (Danielsson & Uthemann, 2023)

To address these challenges, startups must seek a balance between investment in technology and human capital, adopting a cautious strategic approach to ensure long-term financial sustainability. Collaboration with experienced investors or integration into business incubators can enable startups to overcome financial constraints, thereby enhancing their capacity for innovation and growth in a rapidly changing environment.

5.2 Technical Challenges

Startups in the field of artificial intelligence (AI) face fundamental technical challenges that hinder the effective implementation of their strategies, most notably weak technological infrastructure and a shortage of specialized skills. Advanced infrastructure—encompassing cloud storage, big data systems, and analytical tools—is a prerequisite for running AI models efficiently. However, limited resources and high costs create obstacles for these firms in establishing flexible and high-performance working environments.

Equally important is the shortage of technical expertise, as startups struggle to attract professionals who combine competencies in programming, deep learning, and data analytics, amid intense competition for talent. This human capital gap restricts the ability of startups to execute innovative projects, resulting in a slowdown in technological progress. Consequently, investing in infrastructure development and providing specialized training programs constitutes a strategic step toward strengthening the capabilities of startups, enabling them to overcome these technical barriers and achieve excellence in a highly competitive digital environment (Brozović, 2019)

5.3 Regulatory Challenges

Startups operating in the field of artificial intelligence (AI) encounter complex regulatory challenges intertwined with the rapidly changing nature of technology. These challenges encompass legal requirements, internal policies, and market dynamics, which necessitate effective alignment between organizational structures and business strategies. Compliance with data protection regulations—such as the General Data Protection Regulation (GDPR)—stands out as one of the most significant hurdles, given AI's reliance on massive datasets. This requires startups to establish strict privacy policies, supported by training and awareness programs. (Humerick, 2018)

The shortage of qualified professionals in this area also poses a substantial obstacle to the effective execution of projects. Therefore, adopting a flexible regulatory vision that supports talent acquisition and development, while fostering a collaborative and knowledge-sharing work environment, becomes essential.

Overall, regulatory challenges in the AI sector demand a comprehensive strategic response focused on building adaptable structures and strengthening legal compliance, thereby ensuring the sustainability of innovation and growth in a fast-changing digital environment.

5.4 Ethical Challenges

Ethics represent one of the core dimensions confronting startups in the field of artificial intelligence (AI), as this fast-evolving technology raises concerns related to privacy, bias, and transparency. Responsible use of AI requires the development of strategies that ensure respect for ethical principles, particularly when collecting and analyzing personal data. Privacy concerns necessitate the creation of secure environments that safeguard individual information while adhering to principles of transparency and the right to data access.

Algorithmic bias constitutes another critical challenge, as imbalanced datasets may lead to unfair or discriminatory outcomes. Addressing this issue requires diversifying data sources and developing interpretable algorithms that enable the continuous detection and correction of deviations (Mittelstadt, 2019)

To cope with these challenges, startups are advised to adopt clear ethical frameworks, such as establishing specialized committees to review technology use and collaborating with experts and stakeholders to ensure that ethical considerations are integrated into all stages of innovation. Such an approach not only strengthens public trust in AI but also ensures the sustainable and responsible use of this transformative technology.

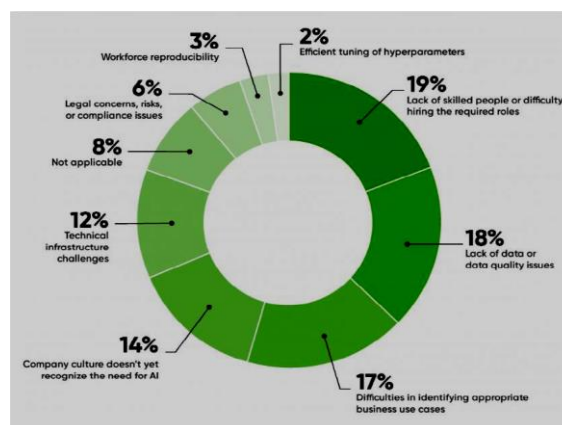
5.5 Market Challenges

Market challenges represent some of the most significant obstacles faced by startups in the field of artificial intelligence (AI), as the rapidly evolving competitive environment necessitates continuous adaptation to shifting market conditions. One of the key difficulties is the intensification of competition, particularly with the entry of large corporations that invested early in AI technologies, making it difficult for startups to penetrate the market without clear product or service differentiation. Thus, innovation in delivering added value and building a loyal customer base becomes a decisive factor for success.

In addition, fluctuating demand poses an ongoing challenge, as consumer preferences shift quickly due to factors such as increased technological awareness or privacy-related concerns. This compels startups to adopt flexible marketing strategies and develop products that align with changing market expectations, highlighting the importance of balancing technical and commercial dimensions (Dellermann, Lipusch, Ebel, Michael Popp, & Marco Leimeister, 2017)

Overall, the success of startups in this domain depends on their ability to absorb market transformations, anticipate changes, and employ AI technologies in ways that ensure differentiation and sustainability in a highly competitive environment.

Fig.2. Obstacles to the Adoption of AI Applications in Institutions Worldwide



Source: Meriem Guechi, 2023, p13

6. Prospects and Opportunities for Startup Investment in Artificial Intelligence

Investment opportunities in artificial intelligence (AI) represent one of the most vital areas for startups, given the vast potential these technologies offer in enhancing efficiency and fostering innovation. AI enables the analysis of massive volumes of data with accuracy and speed, supporting decision-making processes grounded in reliable insights. Through machine learning, intelligent analytics tools help identify market trends and improve customer experiences more effectively. Moreover, AI can serve as a powerful ally for startups in their pursuit of success and sustainable growth, particularly through investment in:

6.1 Innovation and New Product Development

Innovation and the development of new products constitute a cornerstone for the success of startups in competitive market environments, relying on a precise understanding of market needs and the delivery of creative solutions that address these demands. Market research serves as a critical tool for identifying gaps that can be effectively exploited.

In this context, artificial intelligence (AI) acts as a catalyst for innovation through techniques such as data analytics and machine learning, which provide accurate insights into customer behavior and emerging trends. AI also contributes to accelerating design and evaluation processes, thereby supporting continuous product quality improvement. By leveraging AI, startups can deliver customized solutions that enhance customer engagement and strengthen brand competitiveness. Consequently, integrating innovation with intelligent technologies represents a strategic pathway toward achieving sustainable growth and excellence in modern markets.

6.2 Market Expansion and Access to New Customer Segments

Expanding into new markets and reaching broader customer segments represents a key challenge for startups. The use of artificial intelligence (AI) offers a strategic advantage in this regard, as it facilitates the understanding of customer behavior through big data analytics. AI can examine behavioral patterns across social media platforms and product interactions, enabling the design of precise and effective marketing strategies. It also empowers startups to deliver personalized services that meet customer needs by leveraging predictive insights and advanced analytics. Moreover, AI enhances the ability of startups to expand into new markets by improving user experience and supporting digital commerce. Analyzing past purchasing data helps identify seasonal and cultural patterns that influence buying decisions, thereby contributing to more accurate customer targeting and a diversified customer base. Through these capabilities, AI becomes a central driver of competitive differentiation and sustainable growth in emerging markets (Brozović, 2019)

6.3 Leveraging Artificial Intelligence to Understand Customer Behavior

Artificial intelligence (AI) is a fundamental tool for understanding customer behaviors and analyzing behavioral trends through machine learning techniques. It provides accurate insights into customer preferences and purchasing patterns. AI-powered systems collect data from multiple sources, enabling enterprises to adapt to shifts in customer behavior. Predictive analytics further allows companies to adjust their strategies to meet evolving customer needs, thereby enhancing loyalty and long-term engagement (Brozović, 2019)

6.4 Delivering Personalized Services through Data

Personalizing services through data analytics is a strategic tool for startups to strengthen customer engagement and enhance loyalty. By leveraging artificial intelligence (AI) technologies,

enterprises can analyze purchasing data and customer preferences to deliver tailored services such as recommendation models and customized promotional offers. These strategies help improve the customer experience, thereby increasing opportunities for market expansion and boosting competitiveness

Global applications highlight the transformative role of AI in personalization. **Netflix** employs machine learning algorithms to recommend movies and series based on individual viewing histories, significantly enhancing user satisfaction and retention. **Amazon** leverages AI-powered recommendation engines that analyze customer behavior and purchasing trends to suggest relevant products, driving sales and customer loyalty. Similarly, **Alibaba** uses predictive analytics to provide customized promotional campaigns aligned with seasonal and regional consumer preferences, improving market penetration and competitiveness. These examples demonstrate how AI-driven personalization not only optimizes customer experiences but also empowers startups to achieve sustainable growth in dynamic markets (Brozović, 2019)

7. Success Strategies for Artificial Intelligence Investment in Startups

In light of the multiple challenges faced by startups when investing in artificial intelligence (AI) technologies, there is a pressing need to adopt well-designed strategies that enable them to overcome such obstacles and maximize the benefits offered by these technologies. The most notable proposed strategies can be summarized as follows:

7.1 Smart Financing Strategy

A smart financing strategy is a critical element for the success of startups, particularly in their early stages, as it enables them to achieve financial gains, strengthen their market position, and improve their communication capabilities. However, the attractiveness of financing options is not static but evolves over time depending on various factors, such as the company's milestone achievements, the composition of investors, and prevailing market trends. Accordingly, it becomes essential to periodically review and adapt the financing strategy to ensure the sustainability of positive outcomes. In this regard, alternative funding sources to venture capital can be considered suitable solutions within the framework of a smart financing strategy. To address challenges related to financial decision-making, financial leaders can leverage AI capabilities by designing a knowledge-based decision support system that relies on advanced algorithms aimed at assisting decision-makers in developing processes and enhancing the efficiency of financing decisions (Rasouli, Chiruvolu, & Risheh, 2023) This approach is built on the integration of a range of modern technologies, including machine learning, knowledge-based systems, natural language processing, and big data analytics. With its intensive reliance on data, such a smart system is expected to elevate the strategic performance of the enterprise. It processes multi-source inputs through precise algorithmic mechanisms, followed by the generation of clear quantitative and textual reports that support decision-making. Moreover, process automation and advanced financial data analytics contribute to improving the efficiency of financing procedures and providing accurate, actionable recommendations that enhance team performance and guide the enterprise toward well-informed, evidence-based investment decisions.

7.2 Partnership and Collaboration Strategy

Strategic partnerships represent a cornerstone for strengthening the ability of startups to scale and achieve sustainable growth. By building collaborative relationships with other entities, startups can leverage shared resources such as knowledge, funding, and infrastructure, thereby facilitating entry into new markets. These partnerships are more than mere business agreements; they are

grounded in unified strategic objectives aimed at fostering innovation and enhancing operational efficiency, ultimately boosting competitiveness.

When seeking to develop effective strategic partnerships, startups should devote particular attention to selecting the right partners whose vision and goals align with their own. This requires careful market analysis and a thorough assessment of the added value each partner can contribute. Such partnerships must also remain flexible in order to adapt to the rapid changes in the market, including technological shifts and evolving consumer behavior. Moreover, strategic partnerships enable access to cutting-edge innovations, allowing startups to harness AI and data analytics to improve performance.

Additionally, strategic partnerships facilitate global market entry by fostering collaboration with international organizations that possess diverse local and cultural expertise. This reduces the risks associated with geographic expansion and enhances the likelihood of success in new environments. In this context, strategic partnerships serve as an effective tool for building robust support networks that empower startups in their journey toward growth and excellence within a rapidly changing global business environment (Rasouli, Chiruvolu, & Risheh, 2023)

7.3 Regulatory and Ethical Compliance Strategy

The recognition of risks in artificial intelligence (AI) technologies, combined with extensive debates on ensuring their compliance with ethical and legal standards, as well as ongoing research activities, has led to the establishment of mechanisms for clarifying and monitoring the functioning of AI systems (Pistilli, Ferrandis, Jernit, & Mitchell, 2023)

This set of interrelated elements is initially referred to as **AI governance**, a continuous framework that encompasses principles, standards, tools, and socio-technical documents regulating the development, use, and integration of AI systems into human institutions. This section aims to highlight AI governance from three key perspectives: ethical charters, legal instruments, and technical documentation.

As AI's role in technological advancement continues to grow, academia, industry, and governments have intensified their efforts to promote its beneficial applications. At the same time, harmful uses have emerged from untrustworthy developers. To counter these risks, ethical guidelines have been established as fundamental prerequisites for adopting AI projects, supported by legal initiatives designed to regulate the safe and responsible use of AI (Wu & Lu, 2022)

8. Evaluating Current Investment in Artificial Intelligence Startups

Investment in AI-based startups has witnessed rapid growth, reflecting global confidence in the transformative potential of artificial intelligence and its role in driving innovation. Nevertheless, these ventures face financial, regulatory, and technical challenges that require substantial capital and innovative funding strategies. This section explores global investment trends, the most prominent financing channels, and the pivotal role of governments and large corporations in supporting this vital sector.

8.1 Global Investment Trends and Challenges in AI Startups

Artificial intelligence (AI) has emerged as a transformative force, positioning AI-based startups at the forefront of technological innovation. However, funding such ventures presents unique challenges due to the significant capital required for technology development and talent acquisition (Kelnar, 2019). Global private investment in AI surpassed \$70 billion in 2019, with more than \$37 billion directed toward startups, \$34 billion into mergers and acquisitions, and additional billions in IPOs and minority stakes. Between 2014 and 2019, nearly 15,798

investments were made in AI startups, averaging \$8.6 million per project, while annual global investment grew from \$1.3 billion in 2010 to almost \$40.5 billion in 2018, marking a compound annual growth rate of 48% (Brynjolfsson, et al., 2019)

Since 2015, AI startups have consistently attracted more capital than traditional software firms, underscoring their rising appeal to investors. The United States continues to dominate in both funding volume and number of AI startups, though Europe is witnessing significant momentum, with one in six AI startups entering the growth stage and securing average funding above \$8 million.

8.2 Financing Options and Government Support for AI Startups

Investment options for AI startups largely mirror those of other ventures—bank loans, government funding, venture capital (VC), crowdfunding, and angel investors. Yet, due to the unique requirements of AI, traditional sources such as bank loans and crowdfunding are less common, while VC and angel investment remain primary drivers of growth (Kelnar, 2019). Generative AI illustrates this dynamic vividly: in the first five months of 2023 alone, it secured \$12 billion in funding, growing at a CAGR of 74% between 2017 and 2022 (Micheal, et al., 2023). Governments are also taking a proactive stance; for instance, the Dutch government launched the Strategic Action Plan for AI (SAPAI) in 2019, collaborating with 65 companies to foster innovation

.Beyond direct capital, governments provide tax incentives, interest-free loans, incubators, and accelerators, thereby creating an ecosystem conducive to growth (Petković & Jambal, 2023).

8.3 The Role of Large Corporations and Diverse Funding Channels in AI Startup Growth

In addition to government and VC support, large corporations play a pivotal role in the AI ecosystem. Firms such as Intel, Google, and Johnson & Johnson increasingly prefer minority equity investments over full acquisitions, enabling startups to retain independence while benefiting from corporate backing (Block, Colombo, Cumming, & Vismara, 2018).

Major technology platforms—Google, Amazon, IBM, and Microsoft—further drive innovation by offering infrastructure, development environments, and ready-to-use AI services widely adopted by developers worldwide (Kelnar, 2019)

. Conversely, self-funding, crowdfunding, and traditional bank loans remain uncommon for AI startups due to the capital intensity and risk profile of the sector. Overall, the continued rise in AI startup investments reflects growing confidence in the transformative potential of AI across industries. By navigating diverse funding channels and leveraging stakeholder support, AI startups are well-positioned to sustain growth and advance innovation in today's fast-evolving entrepreneurial ecosystem

9. CONCLUSION

Artificial intelligence (AI) represents a strategic cornerstone for fostering innovation and driving growth within startups. By adopting AI technologies, entrepreneurs can enhance operational efficiency and elevate customer experience in ways previously unattainable. The added value of these technologies lies in their capacity to process big data and extract patterns, enabling startups to gain deeper insights into market dynamics and evolving customer needs, thereby making strategic decisions that strengthen their competitiveness. Beyond automation and process optimization, AI also facilitates the creation of entirely new business models. Through technologies such as machine learning and deep learning, startups are able to deliver innovative

solutions and services that exceed customer expectations and contribute to advancing sustainable development goals.

As the world embraces the transformative potential of AI, it is clear that AI-driven ventures are leading the wave of technological innovation. Nevertheless, financing such projects presents unique challenges due to the significant capital required for technology development and talent acquisition. These challenges necessitate access to specialized technical expertise, coupled with adherence to legal and ethical standards—particularly in areas such as data protection and algorithmic transparency.

Accordingly, AI should not be regarded as a mere complementary tool to traditional operations but rather as a transformative force reshaping the future business landscape. Startups must therefore prepare to strengthen their human capital and enhance their technological strategies, not only to improve organizational performance but also to build an innovation-driven and technology-oriented economy.

Investments in AI have grown significantly worldwide. According to the AI Index Report 2019, global private investment in AI exceeded \$70 billion in that year alone, with over \$37 billion directed toward startups, \$34 billion invested in mergers and acquisitions, \$5 billion in initial public offerings, and nearly \$2 billion in minority stakes.

Regarding funding options, AI startups largely rely on sources similar to those of other entrepreneurial ventures, including bank loans, government funding, venture capital, crowdfunding, and angel investors. However, studies indicate that the unique nature of AI companies makes traditional sources, such as bank loans and crowdfunding, less common, while venture capital and angel investment stand out as more prominent channels compared to other software or high-tech ventures.

Overall, the increasing levels of investment in AI startups reflect a strong confidence in the transformative potential of this technology and its broad impact across industries worldwide. By understanding the current funding landscape and leveraging the support of diverse stakeholders, AI startups are well positioned to continue growing and driving innovation within today's fast-evolving entrepreneurial ecosystem.

Recommendations and Suggestions

- ✓ **Enhancing AI Integration in Practical Applications:** Efforts should be directed toward embedding AI technologies more deeply in key sectors such as healthcare, education, and finance, in order to maximize the benefits of advanced analytics and intelligent decision-making.
- ✓ **Expanding the Use of Machine Learning and Deep Learning:** It is recommended to invest in the development of more advanced learning models to effectively process big data and extract patterns that contribute to providing practical, value-added solutions.
- ✓ **Addressing Ethical and Social Issues:** Clear policies must be adopted to ensure transparency and fairness in algorithms, alongside the development of regulatory frameworks that govern the responsible use of AI.
- ✓ **Promoting Multistakeholder Collaboration for Ethical Inclusion:** Governments, civil society, and the private sector should be engaged in designing AI policies and frameworks to ensure public trust and equitable use.
- ✓ **Investing in AI for Sustainable Development:** AI should be employed to address environmental challenges such as climate change and natural resource management, while fostering innovation in technologies that enhance efficiency and reduce waste.

- ✓ Allocating Funding for Advanced Research and Technologies: Supporting research and development projects in AI is essential for keeping pace with global challenges and opening new avenues for international collaboration.
- ✓ Focusing on Education and Human Capacity Building: Specialized AI curricula and expanded vocational training programs are needed to create skilled professionals capable of driving innovation in this field.
- ✓ Empowering Institutions to Adapt and Innovate: Small and emerging enterprises should be empowered with AI tools and technologies to enhance their flexibility and foster innovation in a rapidly changing environment.

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