THE IMPACT OF ARTIFICIAL INTELLIGENCE ON VENTURE CAPITAL SOURCING AND DUE DILIGENCE

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ABSTRACT

This paper investigates the transformative influence of Artificial Intelligence (AI) on Venture Capital (VC) sourcing and due diligence processes. Defined within the VC context as technologies simulating human intelligence, encompassing Machine Learning (ML), Natural Language Processing (NLP), and predictive analytics, AI emerges as a potential solution to challenges in traditional manual methods. Recognizing limitations like bias, subjectivity, data overload, ethical problems, and other adverse effects of AI on VC industries, the study emphasizes the need for innovation and its possible adverse effects. The overview of AI technologies in VC details applications underscores the growing importance of innovation's role in automating tasks. Nevertheless, VC firms use AI across their workflow to complement their team's skill set and decision-making, guiding everything from sourcing and due diligence that can expand to portfolio management, exit, and global dimensions. The potential disruptions and opportunities underscore the importance of responsible AI use, ethical considerations, and a prudent approach to leverage technology for informed decision-making and sustainability.

Keywords: *Artificial Intelligence (AI), Venture Capital (VC), Sourcing, Due Diligence, Sustainability*

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INTRODUCTION

This paper addresses how venture capital firms integrate Artificial Intelligence (AI) into their investment processes for sustainability. And where do current opportunities for integration lie? We also examine the challenges (ethical, technical, financial, and societal) that the adoption of AI poses for venture capital firms. In particular, we focus on the role and importance of sourcing and due diligence. Sourcing of VC involves identifying and attracting potential investment opportunities. Effective sourcing ensures that VC firms have a diverse pipeline of startups to evaluate. VC due diligence encompasses the comprehensive examination of a potential investment, including assessing the founding team, market potential, financials, and associated risks. Thorough due diligence is critical for making informed investment decisions.

Schmidt (2019), Scabbio (2022), Bonelli (2022), and Miyamoto et al. (2023) have recently addressed the question of how AI is applied to VC industries in their unpublished master's thesis, Ph.D. dissertation, and conference proceedings but not in any academic finance journal publication yet. One notable exception is Houser and Kisska-Schulze's study (2023), published in the UC Irvine Law Review.

Previous studies discussed the potential benefits of AI adoption on VC's fundraising, due diligence, investment processes, and exit lifecycles. Schmidt (2019) used the interview method with VCs to discuss a few case studies of AI adoption on VCs' decision-making. Scabbio (2022) examines a similar question of the impact of AI adoption on the VC industry in terms of its benefits and some discussions of limitations. Bonelli (2022) expands the related question and asks about the potential causality of AI application on VC's decision-making and vice versa. Houser and Kisska-Schulze (2023) suggest that less than 3% of VC funds go to female-led startup teams and less than 1% to racially diverse founders. They claim that this is especially perverse given that diverse startups, when funded, appreciably outperform male-only founding teams.

Miyamoto et al. (2023) investigate the relationship between the expansion of social recognition of AI and the entry of VC investment into this area and whether VCs that invested earlier in the AI area over-performed their peers. As a result, VC entry into AI has expanded with the growth of social recognition. Still, VCs that invested in the AI area earlier and accumulated AI investment experience do not necessarily have a higher probability of achieving an exit. However, these studies are primarily mute regarding the potential adverse effects of AI on VC industries. This paper uses a few case studies to examine the benefits side on one hand. It stipulates other ethical, opposing, and cost sides of AI adoption in VC industries in the early sourcing and due diligence stages. The incremental contribution of this paper lies in contemplating the adverse effects of AI application on VC industries and costs, including ethical, regulatory, technical, and societal, in addition to its discussion on the benefit sides of sourcing and due diligence. We consider both ethical and adverse effects of AI on VC deal sourcing and due diligence as pivotal because the application of AI to VC and private equity is increasing, with potential ignorance of ethical aspects and a few behavioral biases in conjunction with a lack of human skills, experience, and intuition.

In the context of venture capital (VC), AI is the application of advanced technologies that enable machines to simulate human intelligence, analyze data, and autonomously make informed decisions. AI encompasses various subfields, including machine learning, natural language processing, and predictive analytics, which collectively enhance the efficiency and effectiveness of VC processes, eventually for a sustainable VC segment.

Over the past couple of years, the growth in AI has been extremely rapid; "however, it is only recently that VC investors have started to shift their focus from merely investing in AI companies to understanding AI's potential application to their industry" (Scabbio, 2022). Rimol and Costello (2021) at Gartner, Inc. have estimated that only 5% of VCs and early-stage investors were using AI technologies for decision-making in 2021. They forecast that more than 75% of VCs, PE companies, and early-stage investors will use AI in their decision-making processes by 2025. The findings reveal that AI can be applied to all decision-making steps. However, it is primarily implemented only at the beginning of the value chain, during deal sourcing and due diligence. Over the next few years up to 2030, the market size of AI is expected to grow 788.64% from $207.9 billion to $1,847.5 billion worldwide (see Figure 1 below).

Venture capital firms play a pivotal role in the entrepreneurial ecosystem by providing funding and strategic guidance to early-stage and high-potential startups. These firms invest in innovative businesses with high-growth potential in exchange for equity ownership. The success of VC investments hinges on the ability to identify promising opportunities and conduct thorough due diligence to mitigate risks. VC firm managers (general partners) act as financial intermediaries between investors (limited partners) and startups (portfolio companies). They seek to identify and invest in startups that demonstrate disruptive technologies, scalable business models, and the potential for significant returns (Gompers & Lerner, 2001).

Venture capital is a high-risk industry, with many start-ups failing to generate sufficient returns. AI has emerged as a valuable tool to enhance venture capitalists' decision-making processes and mitigate risks. The integration of AI in venture capital can complement human decision-making, improve success percentages, and contribute to the industry's overall growth, success, and sustainability (Pal, 2024).

Dr. Mohammad Rasouli, a Stanford University AI researcher and Founder and CEO of AIx2, was cited in a Forbes article on venture capital as indicating that AI has the power of "generating unparalleled investment opportunities – commonly referred to as "alpha." (Predin, 2024). Rasouli was mentioned in the article as explaining "how leading firms like Sequoia, A16Z and Tiger Capital are harnessing AI to not only streamline their processes but also to uncover hidden gems in the vast ocean of investment opportunities" (Predin, 2024).

Although venture capitalists understand investments, markets, and associated risks, they still can make unfavorable decisions. Investing in early-stage companies with innovative ideas or products has always carried inherent risks. Therefore, redefining the venture capital model is unnecessary, as it would undermine its essence. Instead, venture capitalism could enhance its capabilities by improving the evaluation of investment opportunities. This is where AI can contribute through data analysis, predictive analysis, portfolio management, due diligence, and deal sourcing. AI can complement human decision-making in this domain for sustainability.

Integrating AI technologies into VC processes marks a transformative shift, revolutionizing how venture capital firms source and conduct due diligence on potential investments (Bogoslaw, 2023). AI brings unprecedented capabilities to analyze vast amounts of data, automate repetitive tasks, and extract meaningful insights, thereby enhancing the speed, accuracy, and objectivity of decision-making in the dynamic landscape of venture capital. This paper explores the multifaceted impact of AI on VC, examining its role in reshaping traditional methodologies and the ethical and financial burden its use may have on investments. Recently, VCs have not just been investing in software; they have started building their own. The first use can be found in emerging startups.

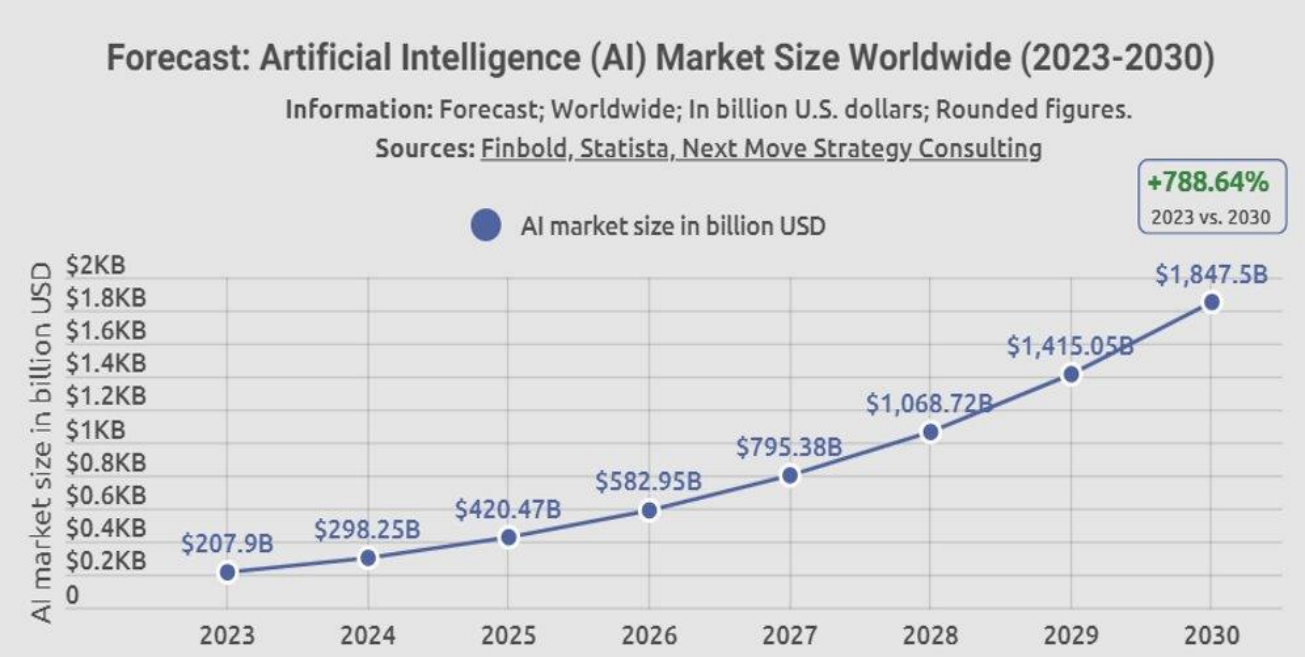
However, ethical examination of AI usage in the VC area is scarce. The Markkula Center for Applied Ethics and its Institute for Technology, Ethics, and Culture (ITEC) at Santa Clara University released a survey report (December 20, 2023), *Ethics in the Age of AI*, which surveyed 3,000 Americans aged 18+ about AI and ethics, and discovered the sample's areas of concern in terms of technology's impact on humanity.

The survey report suggests that the rapid advancement of technology, specifically AI, has made many users wary of its consequences. Two-thirds of Americans surveyed are concerned with AI's impact on the human race. Eighty-six percent believe technology companies should be regulated, with 82% caring whether AI is ethical. Seventy percent of Americans believe AI companies should temporarily stop developing the technology to allow time to consider its impact on society. In addition, half (51%) of Americans do not trust companies that are creating AI.

Ethics Center Senior Director of Leadership Ethics Ann Skeet and Director of Technology Ethics Brian Green, both co-authors of *Ethics in the Age of Disruptive Technologies: An Operational Roadmap*, offered words of advice to both technologists and users to ease these fears. "AI companies are currently engaged in a heated race to develop superior technology," said Green. "Sometimes, this means that companies are not stopping to think about the full ethical implications of what they are creating or the impact on the general public. However, the survey results speak for themselves–the general public cares about ethics in technology, particularly concerning AI." Skeet suggests plenty for leaders to pay attention to in these findings. "People do not trust AI companies or believe the companies developing AI are thinking about ethics. This might explain why so many believe in AI regulation and the government's role in providing it. Leaders can take this opportunity to build trust with key stakeholders by using ethics as they build their AI systems and their corporate cultures."

The survey results and the statements of Green and Skeet (2023) suggest the growing importance of AI usage's ethical and other adversarial effects in VC. We consider both the ethical and adverse effects of AI in the VC to be pivotal in future AI adoption in the venture capital and private equity area (see Section IV for our analysis).

Figure 1: The Artificial Intelligence market size forecast worldwide (2023-2030)
(Source: Finbold, Statista, Next move strategy consulting).



The paper proceeds as follows: Section II presents VC and traditional sourcing and due diligence. Section III briefly illustrates the usage of AI in VC sourcing and due diligence using a few case studies. Section IV discusses AI's ethical and adverse effects in VC industries and related costs, and Section V presents future innovation trends. Section VI concludes.

VENTURE CAPITAL AND TRADITIONAL SOURCING/DUE DILIGENCE

Explanation of the Traditional Methods Used by VC Firms

Venture capital firms traditionally rely on a combination of manual processes and human expertise to vet potential investment opportunities. Traditional sourcing and due diligence elements include networking and referrals, pitch meetings, market research, and financial analysis. VC firms often leverage personal and professional networks to discover investment prospects.

Recommendations from trusted sources play a crucial role in bringing potential startups to the attention of venture capitalists. Entrepreneurs typically pitch their business ideas in person with VC representatives. These sessions allow investors to assess the business model, the competence of the founding team, and the market potential. Manual research is conducted to understand industry trends, market dynamics, and the competitive landscape. This process

involves studying reports, attending conferences, and staying informed about the latest developments in relevant sectors. VC firms manually analyze financial statements, projections, and historical performance to assess potential investments' financial health and growth prospects. This often involves comprehensively evaluating revenue models, cost structures, and potential risks.

Challenges and Limitations of Manual Processes

While traditional methods have been effective, they have inherent challenges and limitations, such as limited ability to scale, bias and subjectivity, and data overload. Manual processes are time-consuming, restricting the investments a VC firm can explore within a given timeframe. This can result in missed opportunities and reduced competitiveness. Whether they are centered around personal experiences, industry trends, or the entrepreneurs' reputation, human judgment is susceptible to biases, which can result in suboptimal investment decisions. The volume of available information for analysis has increased exponentially, making it challenging for human analysts to process and extract relevant insights efficiently. This data overload can lead to oversight and hinder effective decision-making.

In addition, the traditional methods of valuing and selecting investments in the VC industry are often flawed and can lead to misaligned incentives and distorted valuations. This is where AI may be beneficial. By harnessing the power of AI, VCs can revolutionize their investment strategies, making them more efficient, accurate, and aligned with the goals of investors and startups (Nadel, 2023).

The Need for Innovation in Sourcing and Due Diligence

Recognizing the challenges posed by manual processes, there is a growing recognition within the venture capital industry of the need for sourcing and due diligence innovation (Nanalyze, 2021). The dynamic nature of the startup ecosystem, coupled with advancements in technology, has paved the way for integrating AI and ML into traditional VC practices. These technological advancements aim to address the limitations of manual methods, enhance efficiency, and provide a more data-driven and objective approach to decision-making in the venture capital landscape. In the subsequent sections, we will delve into how AI is revolutionizing the sourcing and due diligence processes for VC firms.

Overview of AI Technologies in VC

In the realm of VC, AI unfolds a spectrum of applications, including Machine Learning (ML), Natural Language Processing (NLP), predictive analytics, and Robotics Process Automation (RPA).

Machine Learning helps analyze vast datasets, combing through startup databases and social media to pinpoint trends and potential investments. It streamlines due diligence by automating the scrutiny of financial and legal data, aids in portfolio management, and provides insights into future trends and risks. Natural language processing takes center stage in parsing

unstructured data and extracting sentiment from news articles and social media to inform investment decisions. It automates report generation, organizes information, and keeps professionals abreast of market trends and emerging technologies. Predictive Analytics aids in estimating future success, generating financial forecasts, and evaluating risks during due diligence. Robotics Process Automation enters the scene to automate repetitive tasks, enhancing operational efficiency. It tackles data entry, validation, and extraction from various documents. RPA also streamlines portfolio management and routine communication, elevating overall efficiency within VC firms. By harnessing these AI technologies, VC firms bolster their decision-making prowess, operational efficiency, and competitive edge in the ever-evolving investment landscape.

Use of AI in Sourcing

Sourcing is one of the critical aspects of VC that has the potential to be impacted by the implementation of AI. Several innovative firms prominently exemplify the integration of AI into sourcing strategies. Signalfire, for instance, employs the Beacon platform, a real-time data system powered by AI, to meticulously analyze market trends and identify potential investment sectors. This platform scrutinizes over 10 million data sources, including academic publications, patent registries, and social networks, offering valuable insights into companies that outperform and activities of note. Similarly, Blossom Capital adopts a data-centric approach to venture investment, leveraging AI to cover cities often overlooked by conventional methods. Their models prioritize visionary founders, robust teams, and category-defining products, aiming to identify exceptional startups before they gain widespread recognition.

Automation plays a pivotal role in the screening processes of venture capital firms. For instance, Connetic Ventures has developed Wendal, an innovative tool that automates the pre-screening process, taking 8 minutes to provide comprehensive information essential for decision-making. This automated approach expedites the screening process and mitigates human bias, contributing to a remarkable 42% of portfolio companies being led by women or minorities. Additionally, 645 Ventures utilizes the 645 Voyager platform, a comprehensive software system, for automated deal sourcing and screening. With features like potential co-investor analytics, automatic tracking of diligence work, and a benchmarking tool, the platform streamlines the screening process. It enhances efficiency in documenting changes in a company's performance over time.

In AI-powered deal sourcing platforms, Daphni stands out as a VC-as-a-Platform, supported by the collaborative community "Daphnipolis." This platform serves as a deal-flow management system, allowing community members to evaluate startup applications collaboratively. Furthermore, Dorm Room Fund's VCWiz, functioning as a combination of a VC directory and CRM tool, showcases the power of AI in aiding founders throughout the fundraising process. Its ability to analyze social graphs assists founders in identifying suitable investors and establishing connections with them. While not explicitly labeled as an AI-driven platform, Backed.vc is developing a technology platform to address inefficiencies in the

European venture market. The platform fosters collaboration and talent sharing, aligning with a technology-driven ethos for efficient deal sourcing.

Illustrative case studies further underscore the success of AI-driven sourcing strategies. EQT Ventures relies on Motherbrain, a proprietary software platform employing convolutional neural networks, to review time-series data about millions of startups. Motherbrain was pivotal in identifying investments like the German software virtualization company AnyDesk, providing EQT Ventures with a competitive advantage through early identification.

These instances collectively highlight the transformative impact of AI in venture capital, ranging from market trend analysis and automated screening to the development of collaborative platforms, ultimately redefining the landscape of deal sourcing and evaluation.

Use of AI in Due Diligence

As we examine AI's use in the investment process, we see that its impact stretches beyond research and sourcing. AI-driven predictive models leverage historical financial data to forecast future performance, providing investors valuable insights for assessing potential risks and returns. The efficiency gains are further amplified as AI generates thorough due diligence reports by synthesizing and analyzing extensive datasets, saving time and significantly reducing the likelihood of human errors.

It is crucial to emphasize that, despite the advancements in AI, human analysts remain integral to the diligence process (Avidor, 2023). They play a pivotal role in processing and interpreting the data, enabling informed decision-making. While AI expedites the evaluation of opportunities, it does not replace the nuanced analysis performed by human experts. Instead, it empowers analysts to explore a broader range of potential investment opportunities while channeling one of the most precious resources: time.

Much like how AI helps companies optimize their operations, it plays a transformative role for VC firms. By incorporating AI in analyzing potential investments, market trends, and economic indicators, VC firms gain insights into how external factors might influence a company's financial health. This augments the research conducted by analysts and complements the expertise held by management, providing a more comprehensive understanding of investment opportunities.

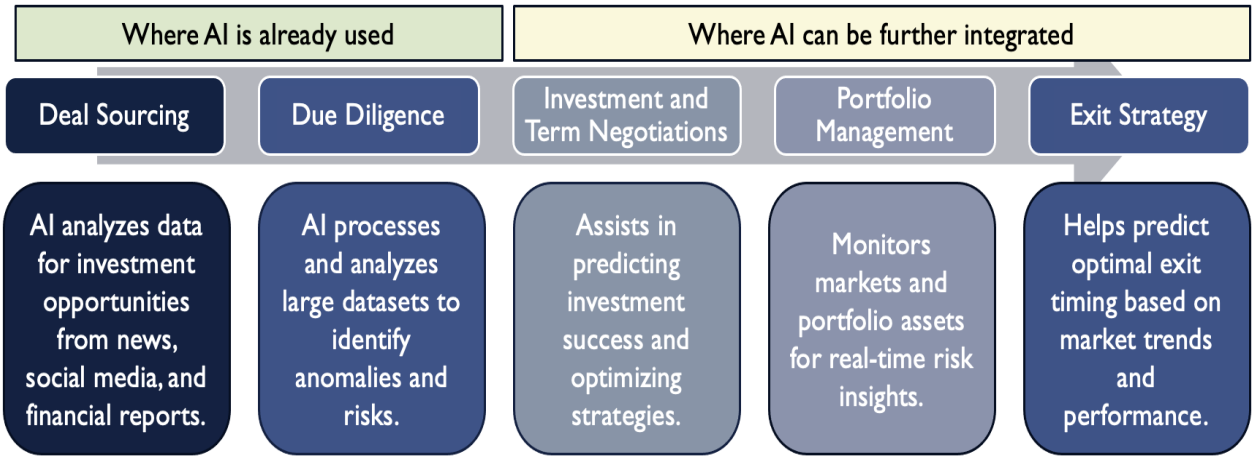
In valuation, AI's impact on risk assessment is noteworthy. AI tools can detect irregularities and patterns indicative of financial fraud, thereby enhancing the reliability of financial statements and reports. Additionally, AI algorithms assess creditworthiness by meticulously analyzing financial statements, transaction data, and other relevant information. This streamlined evaluation process contributes to more informed investment decisions.

Where Can AI be Applied

In contrast to the considerable strides in implementing AI in VC sourcing and due diligence, its penetration into investment and term negotiations, portfolio management, and exit strategy remains relatively limited. The current landscape emphasizes leveraging AI for the early stages of VC instead of through the actual investment execution process. Investment and term

negotiations, which involve complex and nuanced interactions, often necessitate a level of human judgment and negotiation skills that AI has yet to replicate fully. Similarly, while AI significantly enhances risk assessment and portfolio management efficiency, the strategic decision-making involved in ongoing portfolio optimization and exit strategy formulation continues to rely heavily on human expertise. The intricacies of negotiation dynamics, the fluidity of market conditions, and the need for adaptability in managing portfolios through various growth stages present challenges that AI has not comprehensively addressed. As the VC landscape continues to evolve, it remains to be seen how AI will further integrate into these later-stage aspects of the investment lifecycle (see Figure 2).

Figure 2: The comparison between where AI is already used and where AI can be further integrated



THE ADOPTION OF AI IN VC: CASE STUDIES

Case 1: InReach's DIG

At InReach, a London-based VC firm founded in 2015, it all starts with the proprietary software solution DIG (Smith, 2017). This deal-flow platform constantly searches for and stitches together traces and signals from a host of APIs / websites (more than 300 sources). From there, company data is scored by their ML component. This helps predict the probability of whether InReach would be interested in talking to the company about an investment opportunity. These systems do not particularly tell InReach associates whether they should invest but instead determine whether they want to go deeper and find out more. From here, InReach uses emailhunter.io and Clearbit to find the best email to reach their target company. InReach has consistently made efforts to raise funds to make its DIG platform more efficient and faster. Their objective is not to automate the decision-making process for investing in startups but to use technology to make this process far more scalable, efficient, and informed.

As of December 2017, InReach's platform identified 95,000 startups across Europe. Although InReach has already experienced success with its platform, it still believes there is a lot left to prove. In 2017, Shopify acquired one of its portfolio companies, Oberlo, for about $15M. When they invested in Oberlo in 2016, very few people knew that the company existed, but they found it thanks to their unique data-driven approach.

Case 2: EQT Ventures' Motherbrain

Another firm revolutionizing AI-driven sourcing is EQT Ventures, with its proprietary platform Motherbrain (McGlashan, 2023). This cutting-edge system seamlessly integrates decision intelligence into every facet of EQT's deal-making process, setting new standards for efficiency and strategic acumen in the realm of VC. It uses data and machine learning to find startups that are potential investment opportunities based on the criteria lists that EQT sets. Motherbrain analyzes around 50 million companies worldwide, trying to find needles in a haystack. Overall, Motherbrain has an impressive track record, enabling 15 profitable investments for EQT (see Figure 3).

Three AI-driven investments have become unicorns (a privately held startup valued at over $1 billion), and Workday has acquired one. Time and time again, management has emphasized how these companies would not have been identified without Motherbrain. In 2021, Peakon became the world's first exit by an AI-driven investment after being acquired by Workday for $700M. EQT had initially led a $6.62M Series B round in 2017 after sourcing Peakon through the Motherbrain platform.

Moreover, EQT does not simply stop at sourcing and diligence, as Motherbrain is expanding beyond those two stages to help venture portfolios find talent, metrics, benchmarks, and track competitors. Recently, EQT launched SiRE, a simulation-informed revenue model. SiRE is designed on the central assumption that revenue development will likely repeat historical patterns for similar companies at a similar stage. Each future revenue point is initially obtained by sampling from the comparable revenue stats from similar firms. The platform is trained based on a proprietary dataset of revenue trajectories from EQT's portfolio companies and other data they have collected through nearly three decades of investing; SiRe can be used in two ways. First, they can quickly evaluate the revenue potential when assessing a prospective investment. This gives them a simple indication of the likelihood of potential breakouts based on the data the company has given EQT. Second, when receiving revenue predictions from management, it can assess the likelihood of the company performing according to the project plan. For example, in August 2021, EQT received data from a company with approximately $10M in revenue, growing 150% year-over-year. Their revenue prediction model predicted with 95% confidence that the company would end up with revenue between $29M and $40M 12 months later (see Figure 4).

When receiving the data, they were delighted to find out that the company ended up with $30M. (McGlashan, 2023). In the long run, Motherbrain is expected to be the backbone of the investment cycle. The EQT Ventures team has a 98 percent engagement rating with Motherbrain. Alexandra Lutz, the head of Motherbrain, asserts, "I want to say that within the next two years, our support will extend to encompass all EQT investment advisory professionals."

Case 3: SignalFire

SignalFire, a pioneering venture capital firm based in San Francisco, has adeptly introduced AI to transform its venture capital processes, establishing itself as a leader in integrating technology into investment strategies (AI Lab, 2023). At the heart of this innovation is Beacon AI, an AI investment and strategic tool in which SignalFire has invested over $10 million and will likely double that investment in the coming years. Beacon AI is a testament to the firm's commitment to leveraging advanced technology for strategic decision-making and investment screening.

Figure 3: EQT's Motherbrain Platform.

Beacon AI's capabilities are extensive and multifaceted. It plays a crucial role in identifying high-potential, early-stage startups and exceptional future founders, which traditionally required comprehensive human judgment and research. The AI tool sifts through a massive database encompassing over 80 million companies, utilizing machine learning to detect patterns and insights that would be nearly impossible for human analysts to discern. This enables SignalFire to uncover investments that promote the highest returns, a critical advantage in the competitive venture capital landscape. Beyond its role in investment decision-making, Beacon AI is also a dynamic resource for companies within SignalFire's portfolio. It acts as a powerful tool for expediting crucial functions like hiring. With access to a comprehensive database of 600 million professionals across 80 million companies, Beacon AI can swiftly identify candidates

that align with a company's specific needs, significantly outpacing traditional recruitment methods. Beacon AI conducts in-depth competitive analyses and market research and generates lead lists with efficiency and speed unattainable by human teams. This aspect is invaluable for startups devising their go-to-market strategies, providing them with insights and data that would otherwise take substantial time and resources to compile.

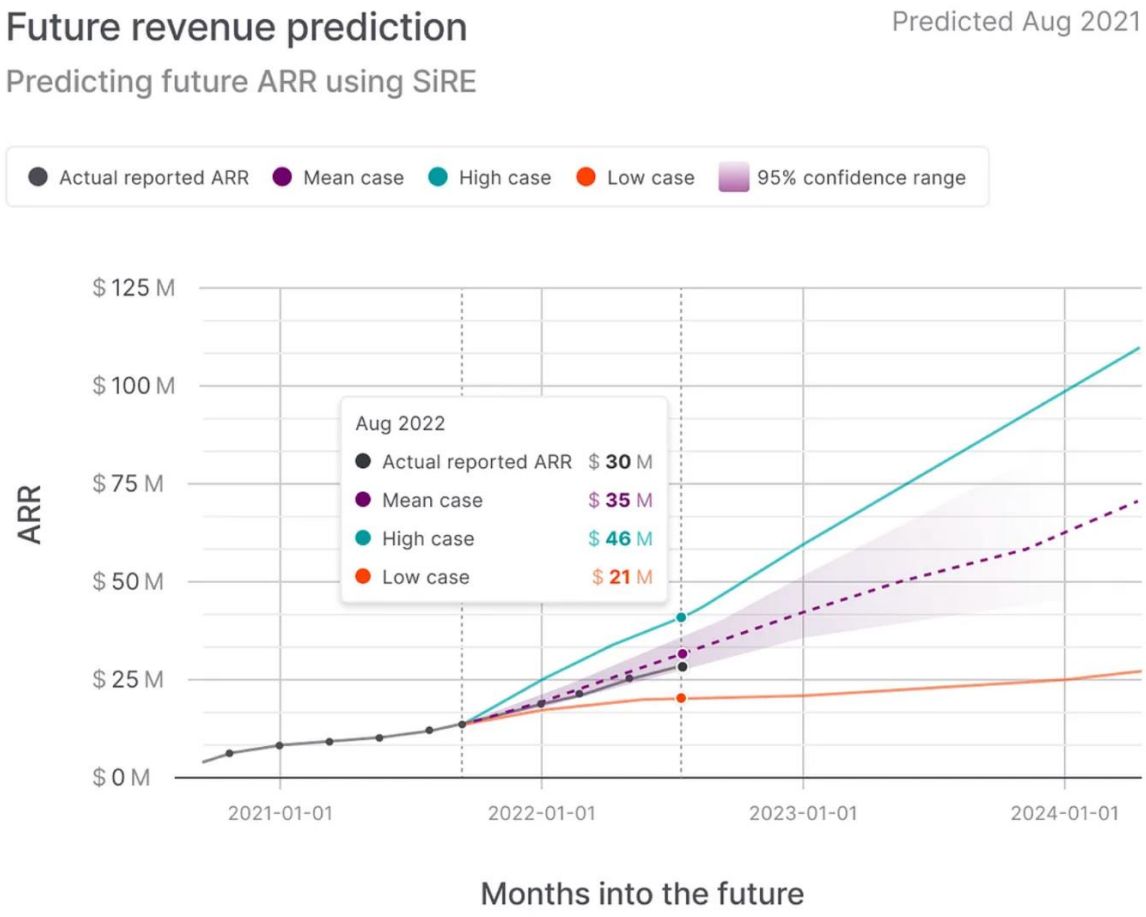
SignalFire co-founder and chief architect Matt Welsh has lauded Beacon AI as "an amazing way to find talent that goes way beyond LinkedIn searches." This innovative approach saves time and ensures that startups can focus on strategic and creative aspects of their businesses rather than getting entangled in the minutiae of operational tasks. Moreover, Beacon AI has a unique capability in customer acquisition for portfolio companies. It can effectively cross-reference a company's ideal customer profile with its vast talent database to generate sales leads. This functionality streamlines the sales process, potentially accelerating a startup's growth trajectory.

Case 4: Wokelo in the more extensive investment space

Wokelo, a Seattle-based startup founded in 2022, is revolutionizing the due diligence process for mergers and acquisitions using AI. Co-founded by former management consultants Siddhant Masson and Saswat Nanda, Wokelo employs AI to swiftly generate detailed due diligence reports covering company overviews, news insights, funding summaries, product launches, industry landscapes, and more. The AI-driven platform aims to streamline the time-consuming aspects of due diligence, enabling professionals to focus on high-level analysis and critical thinking. With $1.5 million in pre-seed funding, Wokelo targets venture capital and private equity firms, large corporations, and investment banks as its initial customers, boasting early adopters like Guggenheim Partners, Seven Seven Six, Tata Group, Sage Collective, and Snocap. In a competitive landscape, Wokelo stands out by concentrating on private markets and leveraging AI for more profound insights from various data sources.

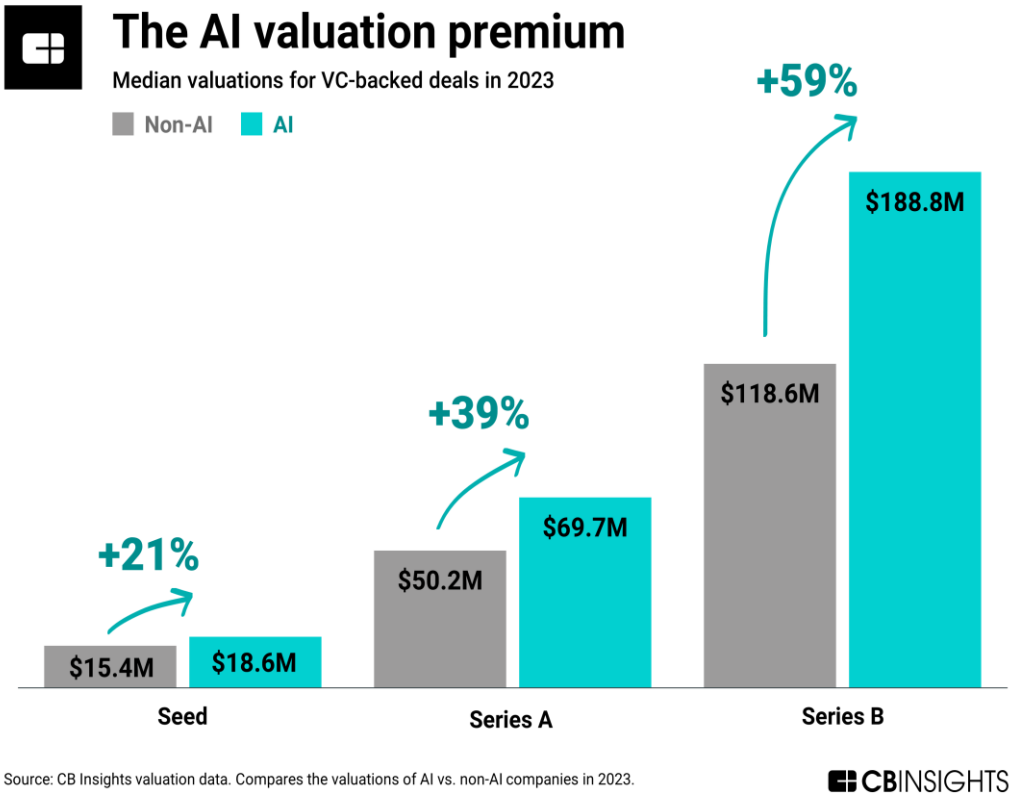
Wokelo signifies a paradigm shift for venture capitalists, offering faster decision-making, efficient opportunity identification, and a more nuanced understanding of risks. This move toward AI-driven due diligence reflects the broader trend of venture capital firms leveraging advanced technologies to optimize operations and make well-informed investment decisions in a rapidly evolving market.

Figure 4: Future revenue prediction of EQT over time.



From the above few case studies, it seems evident that AI will add more value premium when VC-backed firms are valued. Figure 5 (from CB Insights, 2024) shows the AI value premium increases from a 21% value increase of seed financing for VC-backed deals to the additional round progresses up to 39% - 59% increases of the AI valuation premium. AI startups are commanding a premium. Valuations for early-stage AI companies in 2023 were substantially higher than non-AI startups. This also holds true into the mid-stages — AI startups raising Series B rounds notched valuations over 1.5x higher than their counterparts.

Figure 5: The AI valuation premium



ADVERSE EFFECTS OF AI INTEGRATION

Ethical and Other Adverse Considerations

As AI emerges as a pivotal tool in decision-making, concerns about biases and challenges have gained prominence. The inherent biases in training data and algorithms can perpetuate societal biases. Understanding and addressing these challenges is crucial for fostering equitable and effective AI-driven decision-making processes.

How these models are trained is crucial. VCs are faced with the critical decision to develop AI software in-house or rely on third-party solutions. While many VCs have chosen to build their AI models, a growing trend involves subscribing to specialized AI deal scouting platforms like Specter and Harrmonic.ai. Until now, the availability and adoption of third-party AI software options for VCs remain limited. Wokelo is the newest noteworthy player seeking to disrupt this landscape. Over the next couple of years, we project a significant growth in the number of AI options for VCs.

The introduction of AI represents a significant shift in ethics within the Venture Capital industry. The main ethical problems facing AI usage within venture capital stem from the lack of regulation and privacy, programmable biases, and job displacement. The absence of comprehensive regulatory frameworks has allowed for the unchecked development and deployment of AI technologies, raising concerns about the potential misuse of sensitive data and the infringement of individual privacy rights. Additionally, programmable biases within AI algorithms can perpetuate and even exacerbate existing social inequalities, as these systems may unintentionally discriminate against certain demographic groups. When further analyzing the integration of AI in investment decisions, ethical considerations that demand careful examination are raised. Investors must grapple with ethical dilemmas to ensure that AI deployment aligns with responsible and fair practices within the investment landscape. Many different ethical and other adverse concerns arise from using AI in investing.

First, there could be a hiring bias. AI algorithms trained on historical hiring data may inherit biases in the hiring process, potentially perpetuating discrimination. Recognizing and mitigating these biases is crucial to promoting diversity and inclusion within the workforce. To make matters worse, AI applications are reducing the necessity of a human labor workforce.

Second, ESG (Environmental, Social, Governance) rating bias is possible. AI models evaluating ESG factors may inadvertently incorporate biases, impacting the accuracy and fairness of ESG ratings. Addressing these biases is essential to ensure investment decisions align with ethical and sustainable practices. Third, there is also a geographic bias. Algorithms might inadvertently favor or disadvantage certain geographic regions, impacting the distribution of investments. Ensuring geographic neutrality is vital to avoid reinforcing disparities and to foster a globally equitable investment approach. Fourth, there might be a particular industry concentration. AI models may exhibit biases towards specific industries, leading to an overconcentration of investments in certain sectors. Diversifying investment portfolios and refining algorithms can help mitigate these biases and reduce industry-specific risks.

Fifth, there is a possible overemphasis on short-term metrics. AI models focused on short-term performance metrics may neglect long-term sustainability. Striking a balance between short-term gains and long-term stability is critical for responsible investment decision-making. Sixth, there is data privacy concerns as well. Using vast datasets in AI-driven investment decisions raises privacy concerns. Implementing robust data protection measures is imperative to safeguard sensitive information and ensure compliance with privacy regulations. Seventh, there might be overreliance on AI predictions. Blind reliance on AI predictions without human oversight can lead to misguided decisions. Balancing AI insights with human judgment is essential to avoid overreliance and to maintain a nuanced understanding of complex market dynamics. Ninth, there is risk of herd mentality. If multiple investors rely on similar AI models, there is a risk of herd mentality, where market trends become exaggerated. Encouraging diversity in investment strategies can help mitigate the risk of following trends blindly.

Tenth, we also could have some algorithmic complexity barrier. Complex algorithms may challenge understanding and interpreting decision-making processes. Striving for transparency in algorithmic operations is essential to build trust among investors and stakeholders. There is already some evidence from Pitchbook's Hodgson (2023) that technology

may be better at investing. In an experiment in 2020, the Harvard Business Review built an investment algorithm and tested its performance against the returns of 255 angel investors. The results: The algorithm reported an internal rate of return of 7.26% compared to 2.56% for the angels. While the Harvard Business Review found that the algorithm outperformed humans, the results were markedly lower when compared against an elite group of experienced angel investors. The latter achieved an average IRR of 22.75%. There will likely be fewer VCs in the future, and the ones that survive will be the best performers enhanced by AI's capabilities. But who knows? In a decade, founders may pitch ChatGPT or Bard for capital instead of a fellow human.

Eleventh, there is a lack of AI regulation in VC industries. There is no regulation of AI adoption in VC industries. Thus, monitoring the adverse AI effects of protecting data privacy, short-termism, and various ESG reporting biases is hard. Twelveth, there is a lack of human interaction. Because AI technology can be widely applied in VC decision-making without human experience, enhancing human value judgment on VC's fundraising, due diligence and monitoring, investment processes, and exit procedures is crucial. Each VC lifecycle requires a human VC's value judgment, cooperation among VCs, skills, intuition, reliability, and experiences. The ability to look beyond numbers and find the potential for disruptive ideas is a uniquely human skill—at least for now. How well AI could adapt to unexpected events or rapidly changing market conditions, like the downturn we are currently experiencing, also remains to be seen (Hodgson, 2023).

Gompers et al. (2020) find that VC's skills and experiences are essential in VC's investment decision-making. Gompers, Kaplan, and Mukharlyamov (2016) suggest that private equity firms also emphasize the importance of experience. Khanna and Mathews (2022) study competition for startups among VCs with heterogeneous skills. VCs with established skills face two impediments. First, less established VCs compete aggressively for new startups to develop a reputation. Second, startups value reliability in their VCs, which imposes a higher cost on established VCs because they have better outside options. As a result, startups "over-experiment" by excessively partnering with less established VCs, which crowds out established skills and reduces social welfare. Kim and Lee (2022) find that VCs generally value entrepreneurs' education and industry experience in making investment decisions.

Mitigating various risks associated with AI in investment involves a multifaceted approach. Establishing clear ethical guidelines, promoting diversity in AI development teams, and implementing ongoing audits of algorithms can help uncover and rectify biases. Additionally, fostering collaboration among industry stakeholders and policymakers is essential to create a framework that ensures responsible and transparent AI use in investment decisions.

Cost of AI adoption

Given the rapid growth of this new and exciting technology, companies have been quick to incorporate AI into their strategic vision. However, as companies do this, one of the key hurdles is the cost of buying/developing, implementing, and maintaining these new AI systems. Especially given that AI systems are one of the only technologies with linearly improved

performance by adding more computer power, the costs can increase quickly when firms work to optimize performance (Peeler, 2023).

When companies want to implement an AI model within their business, a common first step is to decide whether to purchase an AI model outright or develop it in-house. There are many benefits to building your in-house AI models, such as more flexibility, security, and privacy, given that they are designed for your firm. However, for many businesses, the high cost of GPU computing power is prohibitive, making outsourcing to another firm more attractive. For those looking to outsource, the costs range from relatively low to low usage via API cloud service or local implementations on servers for open-source LLMs. With that being said, several drawbacks arise with adopting 3rd-party software. Firstly, these costs ramp up rapidly when attempting to scale as immense system resources and computing power are required to serve enterprise-grade needs. All outsourced models will likely need to pay fees for licensing, cloud infrastructure, and implementation. To accurately plan for these upfront costs, it is vital to carefully forecast the exact uses and total number of users interacting with AI systems to prevent over-investment. Finally, firms lack a competitive advantage since all the VCs would search for deals from the same pool of opportunities and benefit from an identical algorithm. Whether a company should design or outsource its AI is very situation-dependent, but both methods can lead to a beneficial model.

Once the model is operational, costs shift to regular system maintenance costs and costs associated with training the model with new data. For VCs, in particular, these models will need to be fed a large set of data to make recommendations accurately and counteract the prior biases of the VC firm. VC investment strategies also change over time depending on the partner's decision. Thus, the model will also need to be retrained whenever a major shift in investment strategy occurs. Large AI systems also draw a significant amount of power to run the arrays of GPUs. The business will bear the power cost when an AI model is developed and run in-house. If the model is sourced from a third party that provides computing power, this cost will be included in their fee.

Guido & Bornstein (2023) and Heath (2023) suggest that given the heavily confidential nature of most of the data that VC firms use, bringing in contract AI consultants would likely not be feasible without strong legal protections. Given this, VC firms should instead dedicate an employee or team (depending on the size and complexity of the model) to maintain and retrain the model. While added headcount is a significant cost for firms, a skilled AI staff member can quickly become a value multiplier, improving the initial investment's ROI. Additionally, the cost of acquiring data for the model to use in training can grow exponentially as the firm needs change. Setting up data privacy guardrails and legal safeguards can also be a significant upfront and ongoing cost.

Lastly, one of AI's hidden costs is overinvestment. With the surge in its popularity, many firms feel that they need to “jump on the bandwagon” of AI so as not to miss out on the potential opportunities that could come from being AI-enabled. However, firms must evaluate whether the implementation of AI aligns with their long-term strategy. If the firm does not truly need an AI model, the implementation could divert valuable resources away from more important projects with higher ROI.

While AI has significant cost and ethical considerations, VC firms have seen the benefits outweigh the costs. Obviously, however, some future theoretical and empirical studies should examine more rigorous benefits-cost analyses of AI adoption in VC industries. VC firms with the financial capacity to develop in-house AI investment tools – like SignalFire – typically demonstrate a more profitable long-term trajectory. Such success can be quantitatively linked to the efficiency and effectiveness of AI in investment strategies (Vusser, 2023; Zhou, 2023). These firms, leveraging AI, can reduce the duration and depth of the initial negative phase in the J-curve, typically characterized by early-stage investment losses (Bahmani-Oskooee & Ratha, 2004). A J-curve depicts a trend that starts with a sharp drop and is followed by a dramatic rise. The trendline ends in an improvement from the starting point. By harnessing AI's predictive analytics and data-driven insights, these firms are more likely to identify and invest in high-potential startups earlier and more accurately. This strategic advantage enables them to experience a steeper and earlier upswing in the J-curve, resulting in higher returns on investment over time.

Houser and Kisska-Schulze (2023) focus on the disruption of VC and suggest that despite the massive dollars invested each year by VC firms, more than two-thirds of the companies they fund will provide zero return. More problematic, less than 3% of VC funds go to female-led startup teams and less than 1% to racially diverse founders. While many argue that this underrepresentation will work itself out over time, these numbers have remained stagnant for over 30 years. This is especially perverse given that diverse startups, when funded, appreciably outperform male-only founding teams.

The VC industry operates under an antiquated model of investing in founders with demographics reflecting those of VC partners (white men control 93% of VC funds, and only 0.2% of VC partners are Black or Latina women). While anti-discrimination law is intended to create a level playing field for all, the VC field operates outside this regulatory scheme. In addition to its lack of diversity, ironically, it also has a technology problem. Despite the incredible advances in artificial intelligence (AI) and the industry's focus on tech startups, many VC firms fail to incorporate data analytics and machine learning to guide their decision-making, relying instead on "gut instinct." Houser and Kisska-Schulze (2023) explore the current state of the VC industry through the lens of behavioral law and economic theory, revealing the field's intransigence and the heuristics and biases infecting its decision-making.

Using insights gained from this analysis, Houser and Kisska-Schulze (2023) suggest that disruption is possible through a combination of policy and legal initiatives and leveraging technological advances. They conclude by offering a novel multipronged solution comprising carrots (incentives), sticks (penalties), and AI to motivate behavioral change within the VC industry and stimulate a true meritocracy where gender and racially diverse startups are equitably funded and innovation flourishes.

FUTURE TRENDS AND INNOVATIONS

Future trends in exploring emerging AI technologies within the venture capital VC landscape indicate a progression toward more advanced predictive analytics embedded in AI

models. These advancements are poised to enhance forecasting capabilities, encompassing market trends, startup success, and a broader spectrum of investment opportunities by incorporating diverse data sources. Additionally, NLP is anticipated to be pivotal in due diligence processes, adeptly analyzing unstructured data from diverse sources like news articles and social media. This trajectory suggests that future AI tools will excel in extracting valuable insights from textual information, thereby contributing to more comprehensive due diligence processes. The increasing complexity of AI systems underscores the importance of transparency in decision-making, potentially making Explainable AI (XAI) a critical component in the VC landscape. XAI could provide essential insights into the decision-making processes of AI models, cultivating trust among investors and stakeholders.

Looking towards the future, predictions for the evolving role of AI in reshaping the VC landscape envision heightened personalization in deal sourcing. AI is anticipated to tailor recommendations based on individual investor preferences, risk appetite, and historical investment patterns, facilitating a more efficient and targeted matchmaking process between investors and startups (Predin, 2024). Furthermore, integrating AI with blockchain technology holds promise for streamlining smart contracts in the VC ecosystem. This integration can potentially automate various facets of deal execution, including legal processes, fund distribution, and compliance, thereby reducing associated time and costs. Additionally, the emergence of AI-driven Environmental, Social, and Governance (ESG) investing is foreseen. AI's analytical capabilities can scrutinize vast datasets related to a company's environmental impact, social responsibility, and governance practices, enabling VC investments to align more closely with sustainable goals.

As we consider potential disruptions and opportunities, the transformative impact of AI on traditional due diligence methods becomes apparent. AI's role in automating and enhancing data analysis while boosting efficiency may challenge traditional reliance on human intuition and judgment in decision-making. Moreover, AI's influence could extend to the growth of secondary markets for VC, providing predictive analytics and data-driven insights that create new avenues for buying and selling shares in private companies. This, in turn, introduces liquidity into the historically illiquid VC market. However, the growing reliance on AI in VC also raises ethical considerations and regulatory challenges, demanding a prudent approach to address issues such as algorithmic bias, data privacy, and the responsible use of AI.

AI's efficiency in the venture capital industry appears in many ways: it significantly streamlines processes like deal sourcing, portfolio management, and due diligence. AI algorithms can quickly and easily analyze vast amounts of data, focusing heavily on macro and micro trends and insights to assist investment decision-making (Bicanic et al., 2023). This capability is particularly beneficial in risk management, where AI’s predictive analytics can assess potential risks and returns with a higher degree of precision. By providing a more comprehensive understanding of investment scenarios, AI enables venture capitalists to make more informed decisions, reducing the likelihood of costly investment errors, and enhancing the sustainability of future success.

Despite its advantages, AI's integration into venture capital is challenging. On average, the AI algorithm was found to outperform the average VC by 29% (Nunes, 2022). Key concerns

include ensuring the quality and diversity of data to avoid biases in decision-making. Ethical concerns and maintaining the delicate balance between AI-driven analytics and human judgment are also crucial. AI algorithms, while powerful, may lack the nuanced understanding that human experience brings to the table. Therefore, a hybrid approach that combines AI's analytical prowess with human expertise and intuition is essential for optimal decision-making in venture capital. AI's role in venture capital is poised for significant growth. It is expected to revolutionize further aspects such as deal sourcing, evaluation, and risk assessment. However, navigating the ethical challenges associated with AI integration, such as privacy concerns and algorithmic biases, will be crucial for the sustainable growth of AI in this field. While challenges remain, particularly in data integrity and the balance between technology and human insight, the potential for AI to further revolutionize the industry is immense (Vusser, 2023; Zhou, 2023, Szkutak, 2024). As AI continues to evolve, its integration into venture capital promises to bring about more informed investment strategies and a more dynamic industry.

CONCLUSION

The integration of AI into VC processes has revolutionized sourcing and due diligence. AI addresses limitations in traditional methods, offering scale, automation, and valuable insights. By delving into AI technologies, including ML, NLP, predictive analytics, and RPA, we have unraveled the multifaceted ways in which AI is reshaping traditional VC practices. Our collective effort has brought insightful case studies, ranging from InReach, EQT, and Signalfire to Wokelo, exemplifying the tangible benefits and successes observed in adopting AI in VC. As contributors, we believe that our detailed analysis sheds light on the current landscape and serves as a guide for the future trends and innovations anticipated in the VC domain.

This paper's value proposition lies in its synthesis of diverse perspectives, extensive research, and the incorporation of case studies that highlight real-world applications of AI in VC. Whether they are venture capitalists, tech enthusiasts, or industry professionals, the paper comprehensively explains how AI revolutionizes the VC landscape. Our emphasis on challenges, ethical considerations, and future trends provides a holistic view, encouraging thoughtful reflection and strategic decision-making.

This paper provides a valuable preliminary analysis of navigating the dynamic intersection of AI and Venture Capital. We consider it to contribute to the ongoing dialogue on the future of VC practices and set the stage for continued exploration and innovation in this rapidly evolving landscape. As we conducted our research, we discovered that firms using AI within their diligence/sourcing typically build an in-house platform with a robust tech stack. Nevertheless, a common theme we found is not only in the platform but in its combination with humans. VC firms use it across workflow to complement their team's skillset and decision-making, guiding everything from sourcing and due diligence that can expand to portfolio management, exit, and global dimensions pointed out by Fernandes & Leonard (2023) in other future studies. We also recognized that AI and human expertise have become powerful tools for optimizing operations across the VC workflow and sustainable VC and venture success.

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