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The Future of Widespread AI Adoption in Drug Discovery: a Comparative Analysis of the United States and the United Kingdom

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Comparative Analysis of AI-Driven Drug Discovery between UK and US

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POLICY BRIEF

KEY RECOMMENDATIONS

- Increase funding and sustained investment from public and private sectors to ensure long-term support for AI-driven drug discovery.
- Regulatory bodies must develop comprehensive and adaptable guidelines that keep pace with AI advancements, streamline processes, and foster innovation.
- Foster collaboration across academia, industry, and government to improve data quality, interdisciplinary research, and commercialization of AI-driven drug discoveries.

Executive Summary

AI-driven drug discovery is revolutionizing the biotechnology sector by speeding up drug development processes and cutting associated costs. The United States is leading in this field due to its significant financial investments and flexible regulatory frameworks, which enable a faster initiation and completion of projects compared to other countries, like the United Kingdom. On the other hand, the UK is encountering challenges such as lower investments and regulatory uncertainties, which hinder its ability to effectively incorporate AI into drug discovery.

A comparative analysis of the US and UK shows significant areas where the UK falls short. This highlights the need to address these differences by increasing investment and establishing clear, flexible regulatory guidelines. These measures are vital for the UK to enhance its competitive edge and succeed globally. Addressing these shortcomings will enable the UK to better utilize AI-driven drug discovery, leading to greater contributions to global healthcare innovation.

Introduction

The emergence of AI in drug discovery comes at a time of rapid advancements in biotechnology and a growing global demand for innovative healthcare solutions. Both the United States and the United Kingdom recognize the potential of AI to transform this industry, and they have made significant investments and launched strategic initiatives to foster AI-driven developments. The UK's National AI Strategy aims to position the country as a global hub for AI innovation, with substantial funding dedicated to AI research and development (UK Government, 2021). Similarly, the US has witnessed substantial investments in AI from the government and private sectors, leading to progress in healthcare and biotechnology.

Conventional methods for discovering new drugs are known for being slow, expensive, and having high failure rates. These inefficiencies cause delays in developing and making new, effective treatments available, which poses a significant obstacle in meeting urgent health needs. AI-driven drug discovery reduces the financial burden on healthcare systems and pharmaceutical companies by streamlining processes and minimizing costly failures.

The primary issue pointed out in this brief is the restrictive regulatory frameworks and limited investments that are hindering the widespread adoption and effective implementation of AI-driven drug discovery in the United Kingdom compared to the rest of the world, particularly in comparison with the US. Despite being global leaders in biotechnology, both countries face challenges in creating a supportive environment for AI innovations in this field. This brief aims to thoroughly analyse the regulatory and investment landscapes in these two nations over the past five years, analyse the differences and presenting strategic recommendations for the UK.

Key Findings and Results

The investigation indicates that the United States surpasses the United Kingdom in facilitating the integration of AI into drug discovery. This is evident in the notably higher volume and frequency of AI-driven projects initiated and completed. This advantage can be directly attributed to the more adaptable regulatory frameworks, substantial investment levels, and robust collaboration between regulatory bodies, research institutions, and industry stakeholders (Figure 1).

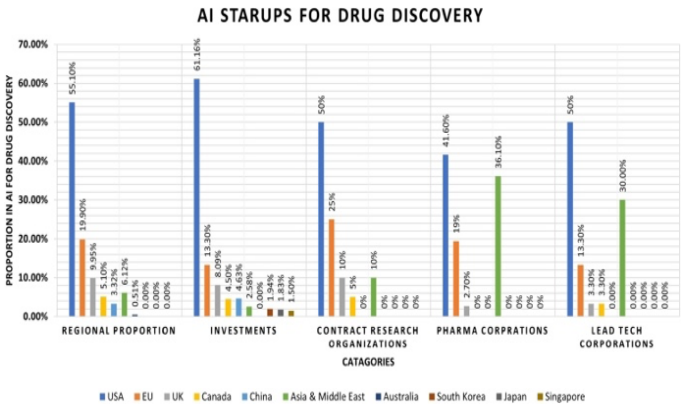

Figure 1: Statistics of AI-based drug discovery startups (Qureshi et al., 2023). In adopting AI-based solutions for drug discovery, the United States leads 55.10% of firms, followed by the European Union and the United Kingdom with 19.50% and 5.90%, respectively.

US Investments and Regulatory Support for AI-Based Drug Discovery

The United States currently holds an undisputed position at the forefront of AI-driven drug discovery, backed by substantial investments and targeted funding. The $2.1 billion secured by AI start-ups in the first half of 2021 alone (Qureshi et al.,2023) serves as compelling evidence of their definite belief in AI's capacity to transform the landscape of drug discovery. This considerable financial commitment has played an integral role in preserving the United States' competitive advantage in the field of biotechnology.

Public sector investments, particularly those by the National Institutes of Health (NIH), are critical for advancing large-scale research and development. These funds enable groundbreaking innovations that private funding alone cannot achieve. Furthermore, big companies such as Google and DeepMind, among others, are significantly investing in AI start-ups like Insilico Medicine, Deep Genomics, and Healx (Qureshi et al., 2023). These investments are crucial, as venture capital is the lifeblood of these AI start-ups. Without this financial support, these companies would struggle to scale their technologies and bring transformative AI applications to market.

Recent financing data reveals that most companies which received substantial funding in the past few years are US-based (Table 1). Relay Therapeutics, Atomwise, Valo Health, Insitro, Recursion, Insilico Medicine, and XtalPi have all secured significant investments to advance their AI-driven initiatives.

Regulatory bodies play a crucial role in supporting AI-driven drug discovery. The US Food and Drug Administration has been at the forefront by adapting its regulations to accommodate and promote the use of AI in drug development. The FDA has reported a noticeable increase in drug and biological application submissions incorporating AI/ML components, with over 100 submissions reported in 2021, indicating the growing demand for AI in the field. The FDA proactively takes progressive steps, such as initiatives like the Digital Health Innovation Action Plan, which provides a framework for integrating digital health technologies, including AI, into the drug discovery process (FDA, 2024). It continuously adapts its regulations to make the process easier and more efficient, ensuring that AI innovations can be quickly and safely integrated into drug development.

Moreover, the Biden-Harris Administration's commitment to advancing responsible AI systems that are ethical, trustworthy, and safe further bolsters this effort. The fiscal year 2023 President’s Budget Request included substantial funding requests for AI R&D, as part of a broad expansion of federally funded R&D to advance key technologies and address societal challenges (National AI R&D Strategic Plan, 2023).

The US also leads in Contract Research Organizations (CROs), hosting 50% of the world's CROs. These organizations provide specialized research services that enable pharmaceutical companies to integrate AI technologies into their drug discovery processes, further solidifying the US’s position

Date	Company	Headline
July 2020	Relay Therapeutics	Relay raises $460 million in an IPO
August 2020	Atomwise	Atomwise raises $123 million in a series B financing round co-led by B Capital Group and Sanabil
March 2021	Valo Health	Valo Health closes its series B financing round at $300 million, including a $110 million investment from Koch Disruptive Technologies
March 2021	Insitro	Insitro raises $400 million in a series C financing round led by Canada Pension Plan Investment Board
April 2021	Recursion	Recursion raises $436 million in an IPO
June 2021	Insilico Medicine	Insilico Medicine raises $225 million in a series C financing round led by Warburg Pincus
August 2021	XTalPi	XTalPi raises $400 million in a series D financing round co-led by OrbiMed Healthcare Fund Management and HOPU Investments
October 2021	Exscientia	Exscientia raises $510 million from a $350 million IPO and a concurrent $160 million private placement led by SoftBank
December 2021	BenevolentAI	BenevolentAI announces it will merge with Amsterdam-listed Odyssey Acquisition in a deal that is expected to raise around €390 million

Table 1: Recent financings for companies engaged in AI-based small-molecule drug discovery (Chino and Kirkpatrick, 2022)

UK investments and regulatory support for AI-based Drug discovery

The UK government is fostering an environment helpful to AI innovation through initiatives like the Industrial Strategy Challenge Fund and the AI Sector Deal, allocating millions in funding to support AI research and development (UK Government, 2023). However, the private sector's contributions, while significant, still remain much lower the scale and impact compared to the United States. Companies like BenevolentAI and Exscientia are at the forefront, with BenevolentAI securing a merger deal expected to raise around €390 million in December 2021, and Exscientia raising $510 million from a $350 million IPO and a concurrent $160 million private placement in October 2021 (Chino and Kirkpatrick, 2022).

In a significant boost, the UK government announced a £100 million investment aimed at accelerating the use of AI in life sciences (UK Government, 2023). AI's potential to boost the UK's biopharma sector is evident, with estimates suggesting AI could add up to £630 billion to the UK economy by 2035. This includes substantial contributions from the healthcare and pharmaceutical sectors, where AI-driven drug discovery can expedite development timelines and bring innovative treatments to market more efficiently (WellcomeTrust, 2023).

Despite these promising developments, 2024 has seen a slowdown in major AI investments in the UK's drug discovery sector. The only major funding in the recent past has been £35 million funding for LabGenius. LabGenius plans to use the funds to advance its ML-driven drug discovery platform and develop a pipeline of multispecific antibodies for the treatment of solid tumors (BusinessCloud, 2024). This highlights a critical gap in sustained and widespread financial support, which is necessary to maintain the UK's competitive edge.

The UK has also been proactive in establishing a regulatory framework that supports AI innovation while ensuring safety and efficacy. The Medicines and Healthcare Products Regulatory Agency (MHRA) is adapting regulations to accommodate AI technologies and developing guidelines for AI-based medical devices and software to meet rigorous standards for safety and performance (UK BioIndustry Association, 2022). However, the regulatory landscape is still evolving, and there is a critical need for more comprehensive and clear guidelines to prevent regulatory ambiguities.

The UK government introduced the National AI Strategy, outlining a comprehensive approach to harnessing AI's potential. This strategy emphasizes creating a regulatory environment that fosters innovation while protecting public safety and highlights the need for international collaboration to set global standards for AI regulation (UK Government, 2023).

Furthermore, the UK is taking steps to create global AI standards. In January 2022, the Alan Turing Institute, the British Standards Institution (BSI), and the National Physical Laboratory (NPL) formed a partnership to shape global technical standards for AI. This action is part of the UK's National AI Strategy, aiming to improve privacy standards for any data used by AI technology and reduce biases that may arise from data (UK Government, 2023).

In response to recent AI regulations, the government has committed over £100 million to support AI innovation and regulation, establishing a central function to drive coherence in regulatory approaches and investing in technical expertise for regulators. This strategy aims to make the UK a global leader in safe AI development and deployment (NTIA, 2024).

Implications/Recommendations

In order to strengthen the UK's AI-driven drug discovery landscape, it is crucial to address several key areas. While the UK has made notable progress in funding AI initiatives, it is essential to provide sustained and increased financial support. The recent decrease in investments highlights a gap that needs to be filled. Consistent funding is necessary to maintain momentum in long-term AI-driven projects, and both the public and private sectors must enhance their financial commitments to ensure strong support for the entire lifecycle of AI innovations.

The constantly changing landscape of AI technologies demands well-defined and thorough regulatory guidelines. Although there has been progress, unclear regulations present challenges. Regulatory organizations such as the MHRA need to establish flexible regulations that can keep up with technological advancements and simplify procedures to avoid delays. Clear guidelines will foster an environment conducive to AI innovation, guaranteeing the safe and efficient integration of new technologies into drug discovery.

It is also crucial to have effective collaboration between academia, industry, and government. Integrated efforts can improve data quality, interdisciplinary research, and ethical standards in AI applications. Formal partnerships that bring together various stakeholders can enhance knowledge sharing and resource pooling, accelerating the development and commercialization of AI-driven drug discoveries. Strengthening these collaborations will ensure that academic research translates into practical, commercial applications.

Promoting international standards is another crucial area. The UK should take the lead in creating and implementing global AI standards by collaborating with international bodies such as the FDA and Health Canada. Ensuring that these standards are accepted internationally will facilitate global way and enhance competitiveness in AI-driven drug discovery. Harmonizing regulations with global standards will assist UK innovations in meeting international safety and efficacy benchmarks, thus making it easier for them to enter the market.

Leveraging the UK's existing strengths, such as its robust research institutions and innovative biotech companies, is essential. Utilizing the strong academic-industry interface will enhance the commercialization potential of AI-driven research, ensuring that cutting-edge discoveries become viable market products.

It may be useful to develop specialized infrastructure, such as AI research hubs and innovation centers. These centers will provide the necessary resources and environment for start-ups and established companies to collaborate and innovate. Investing in such infrastructure will not only enhance research capabilities, but also attract global talent and partnerships, thereby further strengthening the UK's position in AI-driven drug discovery.

Therefore, to progress in AI-driven drug discovery landscape, the UK needs to address investment gaps, enhance regulatory clarity, and ensure strategic initiatives that lead to actionable outcomes. By focusing on these areas, the UK can enhance its competitive edge and significantly contribute to global healthcare advancements.

Acknowledgment & contact details

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