University of Strathclyde Business School

BEBA Case Study 5

Unexia

‘Reimagining Global Health Finance’

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EXECUTIVE SUMMARY

Global health financing remains a fragmented and inefficient system, with substantial disparities in resource allocation. This report investigates whether decentralised digital technologies, particularly Web3 and blockchain-based models, can provide a more transparent, scalable, and impact-driven approach to global health finance. The study is conducted in partnership with Unexia, a decentralised health finance platform that seeks to revolutionise funding mechanisms by leveraging impact tokenisation, decentralised fundraising ecosystems, and hybrid financial models.

The research adopts a comparative case study approach, focusing on three national contexts: The United Kingdom, Sudan, and the Democratic Republic of the Congo (DRC). The UK represents a structured, tax-based healthcare system facing financial sustainability challenges, whereas Sudan and the DRC exemplify fragile health systems heavily dependent on donor aid and emergency relief, often leaving non-communicable diseases (NCDs) critically underfunded. The findings reveal that current centralised financing models fail to provide equitable, long-term health investment, particularly in conflict-affected regions where healthcare needs are urgent yet inconsistently funded.

A comparative analysis highlights key inefficiencies in traditional health financing, including bureaucratic delays, lack of transparency, and limited scalability. Decentralised finance (DeFi) models offer an alternative, enabling real-time fund tracking, direct peer-to-peer health investments, and automated financial disbursement through smart contracts. The CryptoRelief initiative in India serves as an example of blockchain-driven transparency, demonstrating how Web3 innovations can enhance financial accountability. However, significant barriers to adoption persist, including regulatory uncertainty, technological infrastructure limitations, and digital literacy gaps.

Scenario analysis outlines potential pathways for blockchain integration into global health financing, ranging from incremental hybrid adoption to full decentralisation. The report provides strategic recommendations in short-, medium-, and long-term phases. In the short term, pilot blockchain projects should be implemented in stable developing nations to assess viability. Medium-term strategies should focus on regulatory sandboxes and public-private collaborations, while long-term adoption would necessitate significant investment in governance frameworks and interoperability solutions.

While blockchain presents a transformative opportunity, its feasibility depends on overcoming regulatory and infrastructural challenges. A hybrid approach—integrating decentralised financial mechanisms within existing frameworks—offers the most pragmatic path forward. By redefining health as a measurable investment rather than a sunk cost, decentralised models can contribute to sustainable and equitable global health financing.

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CHAPTER 1: INTRODUCTION

Aim

Health is a global public good, and despite being a fundamental driver of economic and social development, it is often viewed as a sunk cost rather than an investment. Despite the fact that global health is one of the most complex funding systems in the world, it is arguably failing, with the financing of health services fragmented and inconsistent across regions, often failing to provide sustainable investment in areas where it is most needed, WHO (2024). While high-income countries operate structured health financing models, low-income nations frequently find themselves reliant on external aid and short-term funding mechanisms that the World Bank (2023) have shown to lack long-term sustainability.

Non-communicable diseases (NCDs), responsible for approximately 41 million deaths annually, equating to around 71% of all global deaths, remain particularly underfunded, exacerbating health inequalities, WHO (2024). At the same time, healthcare systems in war-torn regions face extreme financial instability, with resources overwhelmingly directed towards emergency response and infectious disease outbreaks. This leaves NCDs – already a leading cause of mortality – largely unaddressed, worsening health inequalities and straining health infrastructures.

This report aims to examine whether the idea of decentralised digital technologies, particularly Web3 solutions, can provide a more effective, transparent, and scalable approach to framing global health as a valuable investment rather than a financial burden.

Background to study

For the purpose of this research, the authors are a team of master's students from the University of Strathclyde, working with our client '*Unexia'*. Unexia is a decentralised global health finance platform that aims to revolutionise health funding by leveraging Web3 technologies, blockchain, and the concept of a tokenised impact investment. Their goal is to create a faster, fairer, and more transparent funding system that can be seen globally as a measure, investment-driven ecosystem.
Whilst Unexia recognises there are a number of major health challenges that are currently being severely underfunded, for the purpose of this research, the authors have chosen to focus on Non-communicable diseases, particularly NCDs in developing countries such as Sudan and the DRC, who are currently battling with extreme levels of war and conflict.

This research will also focus on developed nations, such as the United Kingdom, who despite having structured and well-funded healthcare systems, still face financial sustainability challenges in managing NCDs effectively. By comparing and critically analysing two very different sets of nations, it is hoped that this research will allow Unexia to better understand some of the challenges they may face in implementing their platform, and it is hoped that it

will contribute in their efforts to improve health investment, financial efficiency, and impact measurement, Dieleman et al, (2020).

Objectives of the Research

After consultation with our case study client, and initial team meetings, the following research objectives were set:

1. To assess the feasibility of decentralised finance in closing funding gaps for non-communicable diseases in low-resource and conflict-affected regions.

2. To compare traditional health financing with blockchain-based models, evaluating their effectiveness, scalability, and applicability across different national contexts.

3. To explore blockchain adoption pathways through scenario analysis, identifying key regulatory, technological, and governance barriers.

4. To develop short-, medium-, and long-term recommendations for integrating blockchain into global health finance while ensuring financial stability and equitable access.

CHAPTER 2: BACKGROUND & LITERATURE REVIEW

A thorough understanding of global health financing challenges and emerging funding models is essential to critically evaluating new approaches such as decentralised finance. The importance of reviewing existing literature has been long emphasised in academic research, with early scholar such as Machlup (1962) recognising that knowledge is cumulative and must be built upon prior studies to develop well-informed, evidence-based conclusions.

Challenges of Global Health Financing

Global Health financing is a complex and fragmented system, heavily reliant on government budgets, donor aid, and private sector investment, OECD (2022). While these mechanisms have facilitated improvements in healthcare access, they often fail to provide sustainable and equitable funding, particularly for long-term health challenges such as non-communicable diseases.

Major health institutions, including the World Health Organisation, The Global Fund, Gavi, and the World Bank, have historically prioritised infectious disease management and emergency response, leaving structured health investments such as NCDs chronically under-financed, Globalisation & Health (2018).

The centralised nature of health financing results in slow fund allocation, lack of transparency, traceability, and often misalignment with long term health priorities, Dieleman et al., (2020). Additionally, out-of-pocket healthcare costs continue to rise, disproportionately affecting low-income populations and exacerbating health inequalities. These inefficiencies highlight the need for innovative financing solutions that prioritise sustainability, efficiency, and impact-driven investment.

The underfunding of NCDs in Developing & Conflict-Affected Regions

As previously highlighted by the WHO (2024), NCDs are responsible for 71% of global deaths, yet they remain severely underfunded, particularly in low-income and conflict-affected regions. Unlike infectious diseases such as Malaria and HIV, which often receive targeted international funding, NCDs are overlooked due to their chronic nature, requiring sustained investment in prevention and long-term management, NCD Alliance, (2023). This funding gap is particularly evident in nations such as Sudan and the DRC, where fragile health systems and ongoings conflicts have further deprioritised NCD care to the extent that very little is known as to the real number of deaths, World Bank (2023).

In Sudan, it is reported that NCDs account for approximately 54% of all deaths, yet brutal conflict has led to the complete collapse of essential health services, with only one-third of hospitals in conflict zones being anywhere close to classified as operational, Dove press

(2023). Similarly, in the DRC, over 90 health facilities in North Kivu alone have been damaged or completely destroyed, all but eliminating access to essential care, WHO Africa (2023).
The structural failure of global health financing has contributed to these gaps, with internationally funding largely directed towards emergency relief and infectious disease response. Without long-term, sustainable investment in NCD prevention and management, these regions will continue to experience rising morbidity and mortality rates, reinforcing these health inequities. Addressing these issues requires innovative, impact-driven financing models that are capable of overcoming traditional barriers, something that Unexia are confident their model has the ability to do.

Are Decentralised Finance Models the answer?

The literature reviewed thus far highlights the significant inefficiencies, lack of transparency, and restricted access to capital that characterise traditional financing models, particularly in underfunded regions. Decentralised Finance presents a transformative alternative, leveraging blockchain technology to create a transparent, scalable, and most importantly traceable model, Turban, Pollard & Wood (2018). By enabling tokenised health investment and decentralised governance, it can shift global health financing from donor-driven aid to outcome-based funding, Geneva Association (2023).

Unexia's model aims to integrate three technological pillars: decentralised project fundraising ecosystems, system-based impact tokenisation, and flexible funding models. It is hoped that this innovative thinking will provide a sustainable funding mechanism that directly links investment to measurable health incomes, Unexia (2025).

CHAPTER 3: METHODOLOGY

Research Approach

The research explores the prospects of decentralized finance (DeFi) models, specifically blockchain-based systems, for enhancing health financing for non-communicable diseases (NCDs) in conflict-affected areas. A mixed-method approach was chosen, integrating comparative case studies, secondary data analysis, and qualitative thematic assessment.

The UK, Sudan, & the DRC were selected to capture a range of healthcare financing schemes, ranging from centralized, tax-funded systems to fragmented, aid-dependent systems. The comparative design allows for a structured evaluation of potential improvements through decentralised models, whilst highlighting to Unexia the range of challenges they may face when attempting to implement their model.

Case Study Design

The study employs a comparative case study approach to assess health financing structures in the UK against those in Sudan and the DRC. The UK represents a developed health system that is facing financial sustainability challenges in the delivery of NCDs within its National Health Service (NHS). On the contrary, Sudan and the DRC are contexts where instability and strife have derailed health infrastructure, leading to over-reliance on donor funding and the underfunding of NCDs (WHO, 2024; World Bank, 2023).

The analysis evaluates four key dimensions: Effectiveness at addressing NCDs, efficiency in resource allocation, scalability to rising demands, and transparency in fund management. By comparing centralised and decentralised models, the research exposes systemic gaps, such as bureaucratic inefficiencies in the UK and aid volatility in Sudan and the DRC, while assessing blockchain's potential role in improving financial sustainability (Dieleman et al., 2020).

Data Collection

Secondary Data forms the foundation of analysis, drawing from global institutions such as the WHO and the World Bank, in addition to peer-reviewed studies on health financing and blockchain applications. A structured literature review categorised data into two key themes: NCD financing gaps in low-income and war-torn zones, and blockchains potential for financial transparency and efficiency.

The study examines blockchain's role in traceability of funds and automating payments via smart contracts, reducing corruption and inefficiencies, (OECD, 2022; Geneva Association, 2023). Additionally, comparative analysis evaluates centralised vs, decentralised financing models in terms of governance, equity, and scalability.

Recurring themes related to governance, equity, and technological feasibility are ascertained through qualitative analysis of secondary data. Centralized systems, such as the NHS in the UK, struggle with decision-making agility, while decentralised systems in the DRC and Sudan face irregular financing and infrastructural deficiencies.

The study evaluates the potential of blockchain to address these inefficiencies by enabling community-driven prioritization of health demands and open resource distribution. To complement this analysis, case studies of decentralised platforms, such as Unexia, are used to examine real-world applications in resource-scarce environments. Additionally, a benchmarking approach is incorporated to compare existing Web3-based health financing initiatives, ensuring the study captures both theoretical potential and practical feasibility (Turban et al., 2018).

Scenario analysis, a strategic planning method pioneered by Herman Kahn in the mid-20th century and later popularized by Pierre Wack at Royal Dutch Shell, provides a structured approach to exploring future uncertainties in complex systems (Bradfield et al., 2005). Initially developed for military and geopolitical applications, scenario planning has since been widely adopted in business, economics, and public policy to assess potential risks and opportunities. In the context of healthcare financing, scenario analysis allows for an examination of alternative funding models, considering the evolving roles of public and private mechanisms, decentralised finance, and emerging technologies.

By comparing centralised and decentralised financing models, this study underscores the transformative potential of blockchain in improving transparency and financial accountability. However, achieving this requires closing infrastructural gaps and securing regulatory buy-in. The study's findings aim to inform policymakers and global health stakeholders on the integration of decentralised finance into health financing models, particularly for marginalised populations most affected by NCDs.

Case Study Limitations

The method acknowledges several limitations. First, reliance on secondary data may compromise real-time operational problems, particularly in Sudan and the DRC, where long-standing conflict disrupts data collection and healthcare service delivery. Second, regulatory ambiguities, such as bans on cryptocurrencies in some African nations, and infrastructural constraints, such as limited internet penetration in rural areas (OECD, 2022), restrict the scalability of blockchain. Finally, disparities in digital literacy and technology adoption can exacerbate health inequities, particularly for vulnerable populations in conflict settings.

CHAPTER 4: FINDINGS AND RESULTS

As portrayed throughout this report, health is often viewed as a cost rather than an investment, something that Unexia are trying to tackle. The evidence from Lancet (2021) suggests that every dollar spent on global health generates nearly eighteen dollars in economic returns. Innovative finance techniques such as tokenised and decentralised impact investing models, offer an opportunity to shift this perspective by linking financial returns to measurable health outcomes. Blockchain-based financing mechanisms may enhance transparency, accountability, and long-term investments in underserved health areas, such as NCDs. Unexia's model seeks to move beyond donor-driven funding toward a sustainable, incentive-based financial ecosystem. This chapter evaluates these emerging models against traditional financing structures.

Comparative Analysis Results

Health financing structures in the UK and conflict-affected nations such as Sudan and the DRC differ significantly. The NHS operates a tax-funded model, ensuring universal coverage but facing rising costs, slow disbursement, and bureaucratic inefficiencies. Contrastingly, Sudan and the DRC rely on fragmented, aid-dependent financing, where funding is unpredictable and prioritizes infectious diseases over NCDs, leaving these regions highly vulnerable to external shocks (WHO, 2023).

Aspect	UK	Sudan / DRC	Blockchain Benefits
Governance	Centralised so government regulated	Currently fragmented & largely donor-driven	Decentralised governance
Funding Stability	Tax-based, but facing financial strain	Unpredictable, reliant on external aid	Smart contracts ensure stable, automatic disbursement
Transparency	Bureaucratic delays, limited tracking	Opaque processes, high risk of fund mismanagement	Immutable blockchain ledger for real-time financial tracking
Resource Allocation	Allocations controlled by government priorities	Aid primarily directed to infectious diseases, again neglecting NCDs	Direct funding to target health needs tokenisation

Scalability	Constrained by public budgets	Highly volatile, dependent on fluctuating aid	Borderless and flexible financial ecosystem

While the UK grapples with financial sustainability, Sudan and the DRC lack stable governance and infrastructure, making traditional financing models difficult to implement. Decentralized finance (DeFi) and blockchain-based solutions could address these inefficiencies by reducing administrative burdens (UK) and enabling direct, transparent funding flows (Sudan/DRC). However, infrastructural and regulatory barriers must be resolved before these systems can be effectively deployed. Figure 1, below, summarises the key differences between these models and the potential benefits of a blockchain-based approach such as the model Unexia are proposing.

Figure 1: Comparative Analysis of Health Financing Models

Challenges in Traditional Health Financing

Traditional health financing models face systematic inefficiencies, particularly in fund allocation, disbursement speed, and financial sustainability. Centralised systems such as the UK's NHS struggle with bureaucratic delays and rising healthcare costs, leading to long wait times and resource constraints, OECD (2023). In contrast, aid-dependent models in Sudan and the DRC suffer from funding instability, with over 70% of health financing in conflict-affected regions reliant on unpredictable donor aid (WHO, 2023).

A key challenge is NCD underfunding, as international aid overwhelmingly prioritizes infectious diseases, leaving chronic illnesses overlooked. For instance, only 1-2% of global health funding is directed toward NCD prevention and treatment, despite NCDs being responsible for over 75% of global deaths (Global Health Observatory, 2022). *Figure 2*, right, visually highlights this imbalance, demonstrating how global health investments remain heavily skewed toward infectious diseases at the expense of NCD management.

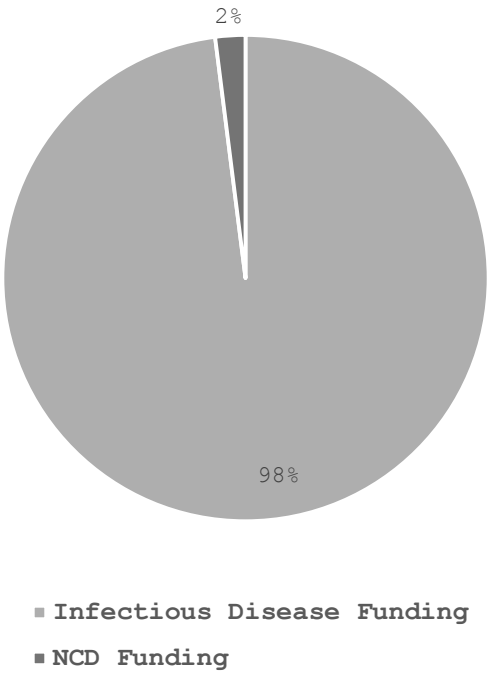

Figure 2: Imbalance in Health Financing

These challenges underscore the urgent need for alternative financing solutions that improve efficiency, transparency, and equitable resource distribution, paving the way for decentralized blockchain-based models.

Can blockchain models bridge these gaps?

Health financing inefficiencies, including slow disbursement, donor dependency, and lack of transparency, highlight the need for alternative funding models. As discussed in the comparative analysis, both centralised and aid-dependent systems face structural barriers to efficient and equitable health financing. Web3 technologies and blockchain-based finance offer a solution by shifting from institution-led funding to decentralised, community-driven investment models.

Blockchain's smart contracts automate fund distribution, reducing delays and corruption (OECD, 2023). Decentralised finance allows peer-to-peer investments, bypassing inefficiencies in traditional aid systems. Immutable blockchain ledgers ensure real-time fund tracking, addressing fund misallocation, a key issue highlighted in the challenges of traditional financing. Web3-based solutions could redirect funding toward NCD care, ensuring financial support is allocated based on measurable health impact (Global Health Observatory, 2022).

The CryptoRelief initiative in India illustrates this potential. Using smart contracts, it provided transparent, real-time fund tracking, minimizing mismanagement. This model demonstrates how Web3-powered decentralized funding can improve financial accountability in global health financing.

Despite this promise, challenges remain. Regulatory uncertainty, technological limitations, and adoption barriers pose significant obstacles to scaling blockchain in health financing. The next section critically examines these barriers and the feasibility of implementing blockchain-based solutions globally.

Barriers to Implementation

While blockchain offers transformative potential in health financing, its real-world adoption faces significant challenges. Regulatory uncertainty remains a major barrier, as many governments lack clear policies on decentralised finance, hindering widespread adoption (Zhang & Li, 2023). Technological infrastructure limitations, particularly in developing nations, further impede implementation, with limited internet access and inadequate digital systems creating barriers (Kouhizadeh & Sarkis, 2023). Additionally, organisational resistance arises due to the need for significant cultural shifts within healthcare institutions, where stakeholders may be reluctant to adopt new technologies (Mercy, 2022).

If Governments fail to establish interoperability frameworks, blockchain-based models may struggle to integrate into existing health financing systems. Addressing these barriers requires regulatory reforms, infrastructure development, and extensive stakeholder education to fully realise blockchain's potential in enhancing global health financing.

CHAPTER 5: DISCUSSION

This chapter critically evaluates the feasibility of blockchain-based health financing, considering its strengths, limitations, and real-world implementation challenges. By analysing Unexia's model within the broader context of decentralized finance, the discussion explores key factors affecting adoption. A scenario-based analysis outlines potential future trajectories, followed by strategic recommendations for integrating blockchain into global health financing.

Evaluating blockchains feasibility

Blockchain presents a transformative opportunity for health financing, offering transparency, efficiency, and decentralised fund allocation. However, the feasibility of Unexia's model varies across different national contexts, shaped by capacity constraints, governance structures, and comparative effectiveness against traditional systems. Capacity challenges pose a fundamental barrier. While blockchain improves financial traceability and transaction speed, its success depends on stable internet access and digital literacy, both of which remain limited in conflict-affected regions such as Sudan and the DRC (Kouhizadeh & Sarkis, 2023).

Governance concerns also complicate implementation. Decentralised financing models rely on community-led decision-making but ensuring equitable resource distribution in politically unstable nations is difficult. Without regulatory oversight, financial power may become concentrated, limiting fair access. Finally, comparative effectiveness remains uncertain. Donor-backed systems, despite inefficiencies, maintain institutional legitimacy and structured allocation mechanisms. Proving that blockchain can achieve equal or superior health outcomes is key to long-term adoption. Despite these challenges, blockchain's impact depends on how global stakeholders navigate these barriers.

Scenario Analysis

While 5 possible scenarios for blockchain adoption in health finance are outlined in Figure 3, below, this section highlight the three pathways most likely to shape its future impact.

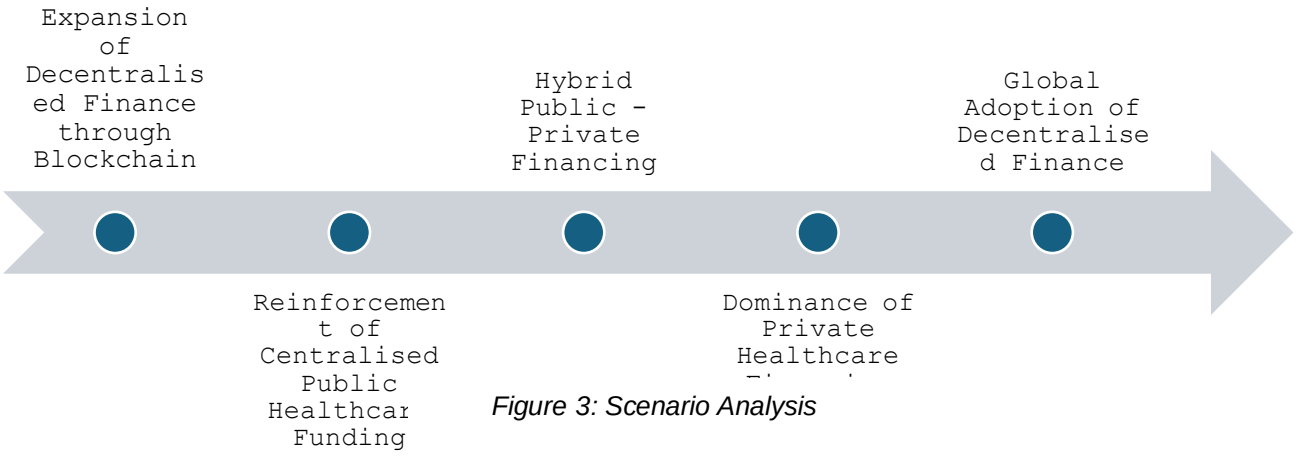

Figure 3: Scenario Analysis

One potential outcome is the hybrid public-private model, where blockchain improves fund transparency, but governments retain financial oversight, requiring policy coordination to ensure effective implementation. Another possibility is full blockchain adoption, where

decentralized health financing becomes the global standard, necessitating substantial infrastructure investment and clear regulatory frameworks.

Alternatively, the market-driven private healthcare model could see private investment scaling blockchain-based financing, but without safeguards, healthcare inequities may deepen, limiting access for low-income populations. The feasibility of these scenarios depends on proactive policy strategies, which are outlined in the next section.

Strategic Recommendations

In the **short term** (1-3 years), blockchain pilot programs should be introduced in stable developing nations before expanding into conflict-affected regions. Partnerships with WHO, The Global Fund, and national governments will aid in regulatory adaptation, while policy reviews should assess blockchain's alignment with existing health finance frameworks.

In the **medium term** (3-7 years), a hybrid public-private model should be adopted, integrating regulatory sandboxes to refine governance structures and Decentralized Autonomous Organizations (DAOs). In the **long term** (7+ years), blockchain should be fully integrated into global health finance, with tokenized investment marketplaces ensuring sustainable, impact-based health funding.

CHAPTER 6: CONCLUSION

Decentralisation presents a transformative opportunity for global health financing but does not serve as an all-encompassing solution. While traditional systems offer stability and regulatory oversight, decentralised finance enhances transparency, efficiency, and direct investment in health outcomes. The most realistic path forward is a hybrid funding model, integrating blockchain innovations with existing financial frameworks to ensure scalability and regulatory alignment.

Unexia's framework demonstrates how decentralised financing can address NCD funding gaps, particularly in underfunded regions. However, significant barriers remain, including regulatory uncertainty, technological infrastructure limitations, and governance challenges. Ensuring fair fund distribution and preventing market speculation will be critical to blockchain's success in health finance.

Future research should explore scalability, governance, and infrastructure requirements. Partnerships with organisations like WHO and the World Bank will be essential to bridge the gap between innovation and policy regulation. Additionally, investments in financial literacy and digital accessibility will support broader adoption.

Ultimately, a balanced approach—integrating the strengths of both centralised and decentralised models—can redefine global health finance. By shifting the perception of healthcare from an expenditure to an investment, innovative financial models can create sustainable and equitable healthcare solutions worldwide.

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