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Evaluating the Role of Social Enterprise Funding in Malaria Treatment Development in Mozambique: Lessons for Addressing Endemic Diseases in Developing Economies

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Abstract

Malaria continues to impose a heavy health and economic burden on Mozambique, a country where traditional financing models have failed to deliver adequate innovation and treatment access. In high-need, low-return settings like Mozambique, private capital remains limited due to low financial incentives, while public funding alone has proven insufficient. This results in a persistent Healthcare Finance Gap that delays intervention rollout and hinders innovation.

This study investigates whether Social Enterprise (SE) funding, particularly when combined with traditional capital in a Blended Finance Model, can narrow this gap. Using Mozambique as a case study, the thesis develops a predictive model analysing malaria mortality from 1980 to 2040 under three scenarios: baseline, historic innovation (e.g. *Goodbye Malaria*), and anticipated vaccine rollout (e.g. R21/Matrix-M). Results show that funding-linked innovation can save up to 161,000 lives by 2040 and reduce malaria related deaths as a percentage of total population from 0,25% in 1980 to 0,02% by 2040.

The study also introduces a Funding Matrix, which maps 12 funder types based on financial expectations, social impact mandates, and blending potential. Findings reveal that over Traditional Funding, SE funders are most impactful in early innovation phases, while blended models—incorporating DFIs, CSR-linked capital, and public donors—offer stability and scale. These insights demonstrate that strategic coordination of funders, rather than volume of investment alone, determines innovation success.

This research contributes to the field by offering a replicable framework for evaluating capital alignment in Healthcare Innovation. It affirms that SE and Blended Finance Models have the potential to transform how endemic diseases are addressed in resource-limited settings, offering strategic direction for both policy and practice.

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Key Terms and Abbreviations

Key Terms

These descriptions are not intended to be definitions, but rather to give context to the meanings as applied in this document. They may carry a narrower or nuanced scope than accepted definitions.

Blended Finance Model: Concerns use of funds sourced from different types of investors.

Corporate Impact Investment: Investment, by Legal Persons, in initiatives that have a positive Impact.

Crowdfunding: Collecting and pooling small contributions from many people [1] through a managed platform.

Developing Country: Countries where HDI values are below 0.550 [2].

Developed Country: Countries where HDI values are above 0.800 [2].

Healthcare Innovation: New or improved approaches that enhance the efficiency, quality, and accessibility of healthcare products or services.[3][4]

Healthcare Innovation Cycle: Staged process of developing, testing, funding, and delivering healthcare solutions, from early research to widespread implementation.

Healthcare Finance Gap: Disparity between capital required for Healthcare solutions and available funding.

High Burden to High Impact: WHO initiative for (11) countries with the highest malaria burden using targeted, country-led, data-driven strategies to maximise reductions in malaria. [5] [6]

Human (individual) Impact Investment: Investment, by Natural Persons, in initiatives that have a positive Impact. This includes Crowdfunding.

Human Development Index: United Nations marker calculated as the geometric mean of normalized indices resulting in an HDI value. [7]

Impact and Impact Investment: Investment in initiatives that have a positive social impact including, but not exclusively, the environment and human well-being [8] [9]. Associated descriptors include ESG, SRI, CSR and CSI [9].

Real Death Percentage: Deaths as a percentage of Population

Social Enterprise: Corporate and Individual Impact Investment which prioritizes impact over profit [9].

Sustainable Development Goals: Impact Investments that generate profits that are reinvested to further achieve its impact objective.[10]

Traditional Investment / Finance: A term derived for this document to refer to investment / financing based solely or predominantly on financial returns.[11] [12]

Abbreviations

ACTs: Artemisinin-based Combination Therapies
ALMA: African Leaders Malaria Alliance
CAGR: Compound Annual Growth Rate
CSI: Corporate Social Investment
CSR: Corporate Social Responsibility
DE: Germany
DFI: Development Finance Institutions
DRC: Democratic Republic of Congo
EIB: European Investment Bank
EPS: Earnings Per Share
ESG: Environment, Social and Governance
EU: European Union
HBHI: High Burden High Impact
HDI: Human Development Index
HU: Hungary
IFC: International Finance Corporation
IFFIm: International Finance Facility for Immunisation
IP: Intellectual Property
IRS: Indoor Residual Spraying
ITNs: Insecticide-Treated Nets
LMIC: Low and Middle-Income Country
mHealth: Mobile Health
NG: Nigeria
NL: Netherlands
OECD: The Organisation for Economic Co-operation and Development
PPP: Public-Private Partnership
R&D: Research and Development
RDTs: Rapid Diagnostic Tests
ROI: Return on Investment
RTS,S: RTS,S/AS01 (Mosquirix) vaccine
SDG: Sustainable Development Goals
SE: Social Enterprise
SA: South Africa
SRI: Socially Responsible Investment
UG: Uganda
UN: United Nations
UNDP: United Nations Development Program
WHO: World Health Organisation
ZW: Zimbabwe

1 INTRODUCTION AND MOTIVATION

1.1 Personal and Academic Motivation

Healthcare Innovation and rollout of healthcare solutions is funded by a combination of private and public sector institutions. Traditionally, private sector investment has been driven by financial incentives to compensate for cost and associated risks. This model has resulted in significant medical advances in high-income countries, where return on investment is strong and risks are contained. However, in Developing Economies [13], where economic constraints and weak purchasing power offer limited market incentives [14][15], this model has resulted in a Healthcare Finance Gap, marked by chronic underinvestment in innovation and treatment rollout [16]. This gap is widely recognized in global health literature. Bump et al., (2016) note the inability of low-income governments to fund essential health services [17], while the Lancet Commission, (Jamison et al., 2013) highlights persistent underfunding of global health R&D and surveillance systems [18]. Supporting the focus of this paper, Moon et al. (2012) observed, that these neglected populations are effectively left out of innovation pipelines – not due to the absence of health needs, but because of the absence of viable commercial return [19]. The result is wide discrepancy in responses to healthcare challenges between Developed and Developing Economies and ultimately perpetuates social and structural weakness in the latter.

In this thesis, the incidence and treatment of malaria, particularly in Mozambique, is used to describe the discrepancy between Developed and Developing Economy responses. Whilst malaria has been largely eradicated in Developed Countries, low HDI ranking (Mozambique has an HDI of 0.461) [7], and limited financial resources have resulted in a Healthcare Finance Gap prolonging innovation and intervention timelines taking a significant toll on the population [20] [21]. According to the WHO (2024) [3], failure to intervene in the current malaria trajectory could result in an additional 112 million cases and over 280,000 deaths across Africa by 2029 (WHO, 2024) [3] with direct and immediate economic costs, as well as indirectly affecting economic development, through lost productivity, reduced labor capacity and diversion of limited capital from other projects (Andrade et al., 2022) [22].

Mozambique is one of the four countries with the highest malaria prevalence and burden [3]. Due to widespread endemic transmission, the entire population remains at risk and accounts for a disproportionate rate of malaria infections and related deaths [3].

To narrow the Healthcare Finance Gap, costs must be reduced and / or available capital increased. Several strategies have been proposed to reduce capital demand. These include frugal innovation approaches and addressing IP restrictions. However, in the context of malaria treatment, such approaches are limited by the complexity of developing antimalarial treatments. As shown by *Ashrad et al.* (2018) [23], most frugal healthcare innovations are basic, small-scale, and are rarely designed for pharmaceutical development. It is further noted that such innovations often lack integration into formal health systems (Tran & Ravaud, 2016) [24]. In addition, the weak legal or political leverage of Developing Countries, like Mozambique, to negotiate reductions in IP-related fees, limits the applicability of low-cost innovation models [25]. As a result, traditional capital-intensive innovation pathways still dominate, and bridging this gap continues to pose a major funding challenge. Equally, Public, NGO and donor funding sources which have traditionally funded Healthcare Innovation and rollout in Developing Economies have proven insufficient to address both current needs and future projections.

In response to the sticky costs and limited existing capital pool, an alternate funding source and application model is required. This thesis highlights the emerging role of SEs as a complementary and potentially transformative funding source, toward reducing the Healthcare Finance Gap. The thesis further considers the use of a Blended Finance Model combining multiple funders with diverse mandates to maximize funding efficacy. By prioritizing social and environmental impact with financial sustainability [10][26], SEs are uniquely positioned to operate in high-need, low-return environments

such as Developing Countries and, as part of a Blended Model, mitigate risk, increase attractiveness and financial returns to Traditional Funders. Malaria and its treatment in Mozambique is used as a basis but, the thesis considers whether these models offer a replicable pathway for addressing other diseases across similarly resource-limited settings [26].

1.2 Background and Context

Malaria remains one of the most persistent and deadly infectious diseases affecting Developing Countries [27] [28]. Historically, it was prevalent across Africa, Europe, the Americas, Australia, China, and India [29], with upper estimates suggesting up to 300 million deaths in the 20th century (Carter & Mendis, 2002) [30]. Today, the disease has been largely eradicated in Developed Countries, yet 95% of the nearly 600,000 malaria-related deaths in 2023 occurred in Developing Countries within the WHO African Region (WHO, 2024) [36]. In Mozambique, the entire population of over 33 million remains at constant risk [3], with more than 275 cases per 1,000 individuals—despite comprising just 0,44% of the global population, the country accounts for 4.2% of all global malaria cases and 3.5% of related deaths (WHO, 2024) [3] [31].

The impact of malaria extends beyond public health. It is a deeply social and economic issue, reducing household income, national productivity, and long-term economic growth. In high-burden countries like Mozambique, malaria perpetuates cycles of poverty, diminishes human capital, and places a continuous strain on public resources [32].

A central barrier to malaria elimination is the Healthcare Finance Gap. While the WHO estimated that $8.3 billion was needed in 2023 to support malaria elimination efforts, only $4 billion was raised (ALMA, 2024) [28]. This annual shortfall is widening, seen by the increase from $2.6 billion in 2019 to $4.3 billion in 2023 [3][28], further it is expected to reach $6.3 billion by 2025 (ALMA, 2024) [28]. Investment shortfalls risk the reversal of decades of progress.

Despite these financial and structural challenges, there are promising developments in medical innovation to combat malaria. One such development is honed in on in this paper: the R21/Matrix-M malaria vaccine, which was prequalified by the WHO in 2023 [33]. This vaccine presents a viable solution for high-burden countries [3] [31], being that it provides for a more affordable and scalable alternative to the RTS,S vaccine, with existing production capacity. Additional innovations, including next-generation vector control strategies and enhanced surveillance systems, are also advancing [3] [31] but, for modelling purposes, are excluded from this paper.

The successful development and rollout of these innovations depends not only on scientific progress, but also on bridging the Healthcare Finance Gap through accessible and sustainable financing. This paper investigates the role of SE funding, particularly in the context of a Blended Finance model, in narrowing the Healthcare Finance Gap in developing economies, whereby; malaria treatment and prevention in Mozambique is used as a case study. The paper further aims to identify key success factors that may be extrapolated to inform on broader strategies for addressing other endemic diseases in comparable settings.

1.3 Research Aim and Main Question

Developing Countries, in general, do not offer the financial return to attract profit-driven capital from Traditional Investors resulting in weak Health Innovation and treatment access in these countries. This study examines whether SE funding as part of a Blended Finance Model can help close the Healthcare Finance Gap, thereby accelerating the development of treatments and rollout timelines. The research paper is based on malaria in Mozambique but looks to identify a viable and replicable strategy for tackling other endemic diseases in similarly constrained Developing Countries.

This study is grounded in the premise that SE funding—when strategically aligned within a blended financing model—can overcome capital limitations that hinder Healthcare Innovation in high-need, low-return settings.

The central research question on which this research is based is:

What potential role can Social Enterprise funding, particularly as part of a Blended Finance Model, play in accelerating the development and rollout of malaria treatments in Mozambique, and what lessons can be drawn for addressing other endemic diseases in similarly constrained Developing Economies?

To critically explore this question, four key research aims are identified for this study.
Namely, these are:

- **Descriptive Aim:** To characterize the current landscape of healthcare funding mechanisms in developing contexts, with particular emphasis on how different funders—traditional, blended, and SE-aligned—interact with the Healthcare Innovation Cycle.
- **Analytical Aim:** To evaluate the specific role of SE funding in the development and rollout of malaria treatments in Mozambique, drawing on modelling, funding typologies, and case study data.
- **Comparative Aim:** To assess how SE funding compares with traditional and donor-based funding in terms of rollout speed, stage alignment, and sustainability, using the Funding Matrix as a strategic evaluation tool.
- **Extrapolative Aim:** To identify transferable strategic lessons from the Mozambique case that may inform funding and innovation strategies for other endemic diseases in similarly constrained low-income settings.

1.4 Scope of the Report

This thesis evaluates the role of SE funding for the development and rollout of malaria treatments in Mozambique. It does not consider SE funding in isolation, but explains how it interacts with Traditional Funding sources within a Blended Financing Model and how results can be extrapolated to address other endemic diseases across a wider, Developing Economy Healthcare Finance Gap.

Thematically, the study focuses on funding mechanisms and their impact on treatment development timelines and rollout. While malaria is the core disease of focus, the findings aim to inform strategies that can apply to other endemic diseases in similar Developing Countries. This research relies entirely on secondary data sources and modelling approaches; no primary research, clinical evaluation, or country-to-country comparison is conducted.

Mozambique has been chosen as it is representative of a Developing Country, with a low HDI and features a suitably homogenous population. Additionally, the country has a high malaria burden which has been well documented by the WHO.

2 SCIENTIFIC BACKGROUND

To better understand the structural challenges this paper seeks to address—particularly in the context of malaria in Mozambique—the following chapter offers a scientific overview of malaria's epidemiology, treatment innovation landscape, and the economic toll of underinvestment in health systems.

2.1 The Global Malaria Health Challenge and Developed to Developing World Dilemma

Malaria is an infectious disease caused by protozoan parasites of the genus *Plasmodium*, transmitted to humans through the bites of infected female *Anopheles* mosquitoes [34]. If untreated, infections - particularly *P. falciparum* infections - can rapidly progress to severe complications including cerebral malaria, organ failure, and death [35] [36]. The disease continues to pose a serious and persistent global health threat. In 2023, the burden of the disease increased, with 263 million clinical cases recorded – 11 million increase on the previous year – and approximately 597,000 deaths worldwide (WHO, 2024) [3].

The history of this disease traces as far as 270 BC, and during the 19th and 20th centuries, it was endemic across much of Africa, Europe and North America, resulting in between 150–300 million deaths between 1900 and 2000 (Arrow et al., 2004) [37]. Through major public health interventions malaria was largely, if not fully, eliminated across Developed Countries [29]. Of the current incidence, 94% of cases and 95% of deaths (WHO, 2024) [3] occur in the Developing Countries of the WHO African Region [38], where populations have limited access to healthcare, adequate housing, and preventive tools.

Between 2000 and 2023, sustained intervention efforts prevented an estimated 2.2 billion cases and 12.7 million deaths (WHO, 2024) [39], exemplifying the effectiveness of Medical and Health Innovation when adequately supported. However, such intervention has been skewed toward Developed Countries, highlighting shortfalls, notably a Healthcare Finance Gap in Developing Countries. This can be traced in part to inadequate financial returns to attract Traditional Investment. This market failure is particularly stark in the case of malaria, where healthcare investment is disincentivized by limited purchasing power and weak regulatory frameworks in endemic regions [40]. As a result, the pipeline of both context-appropriate innovation and rollout remains; thin, fragmented and overly reliant on temporary donor support [39].

The virtual eradication of malaria from Europe and the Americas [29] indicates that the disease can be managed. However, its continued and almost exclusive prevalence in the WHO Africa Region points toward resource allocation deficiencies that must be addressed.

2.2 Social and Economic Impact of Malaria

Nobel laureate T.H. Weller observed that, *"a malarious community is an impoverished community"* (Weller, 1993) [40]. This statement underscores the substantial and long-lasting economic and social costs associated with malaria. These burdens are especially acute in low-income, high-burden settings, where the disease not only strains health systems but also perpetuates poverty and deepens inequality. Indeed, the economic returns on elimination are greatest in such contexts, reinforcing malaria's role as both a cause and consequence of underdevelopment. Malaria-endemic countries, whose economies are least able to absorb ongoing depletion of health and productivity, experience GDP losses of up to 1.3% annually (ALMA, 2024) [28]. Conversely, elimination could result in transformative benefits: GDP per capita could rise by nearly 20% (Sarma et al., 2019) [39], and by 2030, considering both direct[1] [41]

[1] Costs including, inter alia, diagnostics, treatment, and prevention (eg., medications, hospital visits, vector control)

and indirect[2] [42] effect, with increased household income, spending, and labor productivity [43], Africa's GDP could be boosted by an estimated $127 billion [44]; given that is it eliminated by 2030 [45].

Malaria traps countries and households in poverty, straining families and diverting national budgets from development priorities [46]. Notably, malaria impact is biased toward children and pregnant women [47]. Whereby, in 2022, children under the age of five accounted for approximately 67% of malaria-related deaths (WHO, 2024) [3], and further in 2022 alone, 12.7 million pregnancies, across 33 high-transmission African countries (Minwuyelet et al., 2025) [48], were exposed to malaria infection, increasing the risk of complications including low birthweight [38]. Thus, beyond immediate treatment costs, malaria weakens human capital, reduces education outcomes, lowers productivity and increases reliance on aid. Eliminating malaria is therefore not only a public health priority but a development strategy.

Several studies have demonstrated the significant economic impact of malaria incidence and its eradication. As a general trend, a 10% reduction in malaria incidence has been associated with a 0.3% increase in GDP growth in low-income countries (Sarma et al., 2019) [39]. Notably, *Sachs and Gallup* (2001) found that between 1965 and 1990, countries with high malaria prevalence experienced 1.3% lower annual economic growth rates and, by 1995, had per capita incomes equivalent to only 33% of those in countries without endemic malaria [40]. Furthermore, *Sarma et al.* (2019) estimated that eliminating malaria in 2017 would have increased median GDP per capita from $1,863 to $2,122 in affected countries [39].

Macroeconomic analysis estimates that meeting malaria targets could yield gains worth 0.17% of GDP across 26 countries, totalling $152 billion (Patouillard et al., 2023) [49]. Low-income countries would benefit most, with GDP rising by up to 0.32% (Patouillard et al., 2023) [49].

2.3 Malaria treatment and innovation landscape

Malaria control relies on three key, phase-based approaches: prevention, treatment, and long-term eradication through innovation [3].

- **Preventative Measures** aim to reduce transmission. These include physical interventions such as ITNs [50], IRS [27], topical insect repellents and chemical strategies such as vaccination [51] and chemoprophylaxis [52].
- **Effective Treatment** after contracting malaria is essential, primarily involving timely administration of antimalarial drugs such as ACTs [53].

The eradication objective, in a dynamic context, requires Medical Innovations resulting in:

- **Health Innovation** toward long-term disease control and elimination. Traditional malaria interventions such as ACTs [54], ITNs, and IRS [55] have been instrumental in reducing malaria incidence. However, the emergence of drug-resistant strains [56] highlights the urgent need for vaccine-based prevention as a scalable and durable strategy for malaria control and eventual elimination [3]. Further, medical innovation in general enables opportunities for innovation in malaria prevention and treatment.

Treatments are often independent but interrelated and ultimate effectiveness generally depends upon integration with existing strategies.

[2] Costs stemming from decreased labor productivity, school absenteeism, and broader disruptions to socioeconomic development

Salient potential innovations include:

- **Drug Innovation:** Example, the compound Ganaplacide (KAF156) [57] to combat drug resistance.
- **Diagnostic Innovation:** RDTs [58] enable quick and reliable detection of malaria antigens, facilitating prompt treatment, especially in resource-limited settings where microscopy is unavailable.
- **Vector Control:** Controlling the mosquito vector is vital in malaria prevention. Gene driven [59] technologies are under development to suppress mosquito populations or reduce their ability to transmit malaria.
- **Health Service Delivery:** Health platforms [60], community-based surveillance systems, drone-assisted supply logistics [61] [62] and digital diagnostic tools [63] extend reach into rural and hard-to-reach areas and enable more responsive, people-centered care.
- **Vaccine Development:** Vaccination, notably R21/Matrix-M, represents a critical component in malaria prevention strategies. Innovations in this area are covered distinctly in the following section.

2.4 Vaccine Innovation

Vaccination plays a critical role in malaria prevention and treatment. The development of malaria vaccines has progressed through a series of phases, driven by both the emergence of resistant parasite strains and by broader advancements in Healthcare Innovation. Notable vaccines include the RTS,S vaccine (introduced in the early 2020s), the R21/Matrix-M (mid-2020s), and the emerging mRNA-based candidates currently in development.

The RTS,S/AS01 (*Mosquirix*) [64] vaccine, developed by *GlaxoSmithKline* [65] in partnership with *PATH* [66] has shown a 39% [67] reduction in malaria cases in clinical trials (PATH, 2012) and pilot implementations resulted in reductions in hospitalizations and clinical burdens; following its introduction mid-2020 [68].

The R21/Matrix-M vaccine, developed by the *University of Oxford* and manufactured by the *Serum Institute of India*, represents a significant advancement in malaria vaccine innovation [69] [70]. Clinical trials have demonstrated approximately 77% efficacy, surpassing the WHO's 75% threshold for highly effective malaria vaccines (Oxford, 2021) [71]. At a cost of roughly US $16 for a full four-dose regimen, R21 delivers an estimated 60% cost reduction (WHO, 2024) [3] compared to, RTS,S. In addition to price and performance, R21 (Serum., 2024) [72] offers greater scalability, with the *Serum Institute* currently having capacity to produce over 100 million doses annually, and plans to expand this capacity further [72]. Importantly, it is designed to be affordably manufactured in Africa, improving supply chain resilience and regional self-sufficiency. As of 2025, R21/Matrix-M is being rolled out (2024) across multiple African countries, including Mozambique, where it has been integrated into national immunization campaigns with support from global health partners [73].

Next-generation opportunities in malaria prevention include mRNA vaccine technology. The examples currently being trialled include the *BioNTech* developed BNT165, targeting *Plasmodium falciparum* [74] [75]. *Sanaria's* PfSPZ vaccine has demonstrated over 90% efficacy (Berry et al., 2025) [76] against controlled human malaria infection [76]. Both of these advanced vaccine platforms pose significant logistical challenges that are particularly difficult to implement in Developing Countries.

2.5 Health Innovation in Developing Countries

Effective Health Innovation must consider the peculiarities of their target market. Environmental factors [77], climate, pathogen evolution, and the capacities of healthcare systems result in differing malaria strains, necessitating vaccines adapted to local epidemiology [78] [79]. Particularly in Developing Countries, limitations in funding, healthcare infrastructure, workforce availability, and fragmented

supply chains challenge both the production and rollout of new treatments [80] [81]. These constraints highlight the importance of market specific solutions, prioritising (in Developing Economies) affordability, scalability, and disease relevance. The R21/Matrix-M vaccine exemplifies this shift, combining high efficacy with low production costs and suitability for mass manufacturing in low-resource settings [82].

In the field of communicable diseases, Developing Countries are increasingly becoming hubs for adaptive health technologies tailored to local needs [83]. These countries are also advancing innovation in health service delivery, increasingly supporting more responsive, people-centered systems by expanding access to care in rural and hard-to-reach areas [84]. However, scaling and sustaining [85] these innovations remain challenging due to financial, infrastructural, and logistical constraints.

Ultimately, Healthcare Innovation in Developing Countries must be viewed not as a downstream transfer of technologies from the Global North, but as a collaborative, need-based process rooted in the realities of local health systems. When tailored to context, Healthcare Innovation holds transformative potential to close the Healthcare Finance Gap, accelerate disease control, and build resilience against future health crises.

2.6 Funding of malaria development treatments and the Healthcare Finance Gap

Despite longstanding global efforts and local innovation, the eradication of diseases in the Developing World – malaria in particular – remains a critical challenge [86] [87]. Low financial returns and high perceived risk discourage traditional investors, including pharmaceutical companies, from committing to solutions for diseases concentrated in low-income countries [88] [89]. This pattern is reflected in recent findings from the *Access to Medicine Index* (2024) [90], which highlights a persistent lack of R&D prioritization for resource-poor settings and limited representation of low-income countries in clinical trials [90]. Voluntary licensing and technology transfer initiatives – important mechanisms to expand access – also remain limited, especially in sub-Saharan Africa [91]. These trends reinforce the notion that commercial incentives continue to fall short in driving investment toward neglected disease solutions.

This, in combination with low public capital bases in Developing Economies – where governments must balance limited resources across pressing needs – creates a Healthcare Finance Gap, with inadequate funding for Healthcare Innovation [92] [93]. This market failure is particularly evident in the development of vaccines and antimalarial drugs, where private R&D spending remains low due to weak market incentives [94] [95].

Malaria is now primarily concentrated in the WHO African Region and funding for treatment is insufficient. The global funding gap grew from US $2.6 billion in 2019 to US $4.3 billion in 2023 (Vitality, 2024) [96], with only US $4 billion secured out of the required US $8.3 billion (ALMA, 2024) [28]. In these countries, domestic underinvestment deepens the challenge, and the funding gap continues to widen [96]. By 2025, an additional US $6.3 billion per year (Vitality, 2024) [96] will be required to meet international targets. Without this, malaria-endemic regions could face 112 million more cases and 280,700 preventable deaths between 2027 and 2029 (RBM, 2024) [28] [97] [98] .

Broadly, to address this gap, cost of development must be reduced and / or the capital base increased.

One potential solution to reducing costs is frugal innovation, being the *"products or services that seek to minimize the use of resources in the complete value chain… while fulfilling or even exceeding certain pre-defined criteria of acceptable quality standards"* (Weyrauch & Herstatt, 2016) [99]. This approach has proven effective in other health fields, such as the Jaipur Foot prosthesis [100] [101]. However, such approaches face limitations in malaria such that; vaccines require advanced biotechnology, strict regulatory oversight, and cold-chain logistics, [102] which make low-cost models difficult to implement [103].

Another cost containment strategy involves reducing the cost of and improving access to existing health technologies through compulsory licensing or tiered pricing. Furthermore it is argued that *"tiered pricing can improve access to essential medicines, particularly when paired with local manufacturing capacity"* (Moon et al., 2011) (p. 2) [32]. China has actively pursued this approach, combining negotiated pricing, local generic production, and strategic public-private R&D investment to reduce medicine costs and expand coverage [102] [104]. However, this model depends on legal infrastructure and geopolitical leverage—resources that countries like Mozambique often lack.

Given the limitations of cost-reduction alone, greater attention is being placed on increasing the capital base for healthcare solutions.

2.7 Social Enterprise and Blended Finance Model

Traditional Finance has shown to be limited in addressing healthcare challenges in low-resource settings, contributing to the persistent Healthcare Finance Gap—most evident in malaria treatment across Developing Economies. This section explores the potential value of SE funding models in contributing to new health financing strategies aimed at narrowing this gap. It further considers how SE funding may be more effective when coordinated with traditional capital through a Blended Finance Model.

2.7.1 Social Enterprise

SEs pursue impact objectives – addressing social or environmental challenges, rather than maximising shareholder value (Bacq & Janssen, 2011) [105]. They apply commercial strategies and fall on a spectrum ranging from purely donation-based models to hybrid structures that reinvest profits back into their mission, rather than generate shareholder value, as a SDG. **Chapter 6s *Funding Matrix*** maps this continuum of SE funder types, ranging from pure charitable donations with no required financial return or defined time horizon, to blended models combining social and financial mandates. These models differ not only in structure but also in how they support distinct stages of innovation, from early-stage R&D to intervention delivery – each aligned with varying risk-return profiles and funder mandates.

SEs also constitute a substantial global capital base with a broad donor infrastructure. At the systems level, this model operates with flexibility and responsiveness, and has wide geographic and sector spread. This enables SEs to scale and adapt rapidly to local needs and dynamic health priorities [106]. The *Schwab Foundation* notes that there are approximately 10 million SEs worldwide, generating more than 200 million jobs and US $2 trillion in annual revenue (World Economic Forum, 2024) [107]. This scale and reach underlines their potential importance in Developing Countries with limited financial resources and underfunded sectors like healthcare – where both market and state actors often underperform.

SEs have been instrumental in facing the malaria challenge in Developing Countries, supporting diagnostics, vaccine development and distribution, health education, and last-mile intervention delivery [105]. Examples include:

- Global partnerships and nonprofit organizations such as the *Medicines for Malaria Venture* [108] and *PATH's Malaria Vaccine Initiative* [109], which have supported vaccine development. Strategic guidance is also provided by the WHO through the *Malaria Vaccine Technology Roadmap* and the *Global Technical Strategy for Malaria 2016–2030*.
- The *Global Fund to Fight AIDS, Tuberculosis and Malaria*, the *U.S. President's Malaria Initiative* and the *Bill & Melinda Gates Foundation* account for nearly all international funding toward malaria research and innovation. In 2024, the *Global Fund* alone approved US$771 million (The

Global Fund, 2024) [110] in health system strengthening and disease control grants for Mozambique [110] [111].
- The *Bayer Foundations Social Innovation Ecosystem Fund*, which targets scalable health and nutrition solutions in Africa. This initiative supports mature SEs beyond proof-of-concept, with programs like the *Social Impact Start-up Academy*, offering accelerator support across Germany, South Africa, and Israel [112].

SEs are a relatively new finance class with diverse actors that face evolutionary challenges – namely conflicting internal mandates, blurred interface boundaries, and issues of accountability. *Bacq and Eddleston* (2016) [113] identify three core internal capabilities essential to SE success: (i) stakeholder engagement, (ii) earned-income generation, and (iii) government alignment [113]. These capabilities enhance legitimacy, financial resilience, and regulatory access—factors that are crucial for SEs operating in high-need, low-return contexts.

Specifically, SEs are *Institutional pluralists* (Drencheva & Chen Au, 2023) [114], operating within multiple institutional frameworks — social, commercial, and public. This enables them to act across systems but may also lead to institutional conflict. For example, commercial efficiency objectives can clash with community-driven health goals. This can lead to *mission drift* where SEs struggle to balance social objectives with financial sustainability – especially in under-resourced settings [115] – resulting in financial pressure and a deviation from their social mission [114]. Successfully navigating this pluralism is essential for SEs delivering healthcare in fragile Developing Economy systems [116]. Further, Ses in healthcare operate across overlapping and potentially conflicting demands, which makes the management of pluralism imperative to their success, as *"Institutional logic provides the inductive research framework… to examine the logics of social enterprise"* (Watson, 2017) [117]. *Bacq, Hartog & Hoogendoorn* (2014) [118] show that founders with purely commercial backgrounds are more likely to prioritize revenue over impact [119], whereas those with hybrid experience in both business and social sectors are better able to maintain mission alignment [120].

Additionally, unlike traditional public health agencies, SEs often lack formal accountability to national oversight bodies, which can undermine trust among donors, governments, and beneficiaries. To protect SE sustainability and safeguard long-term purpose, effective governance structures are critical [121]. *Bacq and Eddleston* (2018) [113], propose that governance should be stewardship-oriented, emphasizing long-term vision, shared decision-making, and transparency.

The WHO African Region – and Malaria-endemic regions more broadly – are characterised by volatile health systems and contested or resource-scarce health environments [122]. This highlights the need to enhance resilience in volatile funding and policy environments [123].

The long-term success of SEs in healthcare also depends on their financial architecture and the enabling ecosystem [124]. Many rely on models such as cross-subsidization, tiered pricing, or reinvestment of surpluses to maintain operations without compromising access. However, financial sustainability is also contingent on external enablers, including supportive regulation, Impact Investing platforms, and adequate digital infrastructure. In Developing Countries like Mozambique, donor-backed blended finance and coordinated public-private partnerships play a vital role in reinforcing SE viability and scale. These partnerships are especially important given that sustainable social business models depend on collaborative value creation across all stakeholders to align operational design with both financial and social objectives (Yunus, Moingeon, & Lehmann-Ortega, 2010) [125].

However, the WHO has identified several structural weaknesses common to LMIC health systems — including under-resourced facilities, limited human capital, weak accountability, and poor integration [126]. SEs must often operate within these same constraints, which can limit their scalability and sustainability. Moreover, SEs frequently operate outside of national procurement systems and are often absent from strategic innovation platforms, limiting their ability to scale or influence broader health policy framework [127].

While SEs alone may not close the Healthcare Finance Gap, their capacity for agile, impact-driven investment makes them a vital component of broader Blended Finance strategies—particularly in contexts like Mozambique where traditional finance falls short.

2.7.2 Blended Finance Model

Traditional and SE funders have differing but complementing mandates. Traditional Investors tend to prioritize financial returns, while SEs—even under SDG objectives and hybrid models—are driven by social outcomes. Neither represents sufficient scale to meet healthcare capital demand alone, especially in low-income contexts like malaria treatment in Mozambique. This gap reflects the broader Healthcare Finance Gap. However, the complementarity of mandates presents an opportunity, which is explored in this paper: SE and Traditional Funders can be combined under a Blended Finance Model to expand the funding base and increase investment alignment [128] [129].

This approach aligns with the WHO's framework for health system strengthening, which emphasizes cross-sectoral collaboration, decentralized delivery, and innovative financing mechanisms to overcome access and infrastructure challenges [130].

In malaria control, blended finance enables SEs to complement public and private interventions, especially where expected returns are too low to attract conventional investors. SEs can shoulder early-stage, impact-first roles—de-risking innovation for traditional capital and accelerating development pipelines [129].

The SE mechanisms explored in Mozambique demonstrate how blended finance can support innovation in other resource-constrained settings. These models are particularly effective for diseases requiring affordability, community distribution, and rapid adaptability.

However, the SE sector remains fragile. As of 2023, just three donors—the *Global Fund*, *Gates Foundation,* and *PMI*—account for the majority of malaria innovation financing [131]. In April 2025, foreign aid withdrawals caused widespread disruptions in malaria-endemic regions [132] [133], threatening to reverse decades of progress [134].

Blended finance offers stabilization by diversifying capital sources and distributing risk across actors with different mandates and expectations; as evidenced in the *Funding Matrix*. It also aligns capital demand with funder priorities, creating more durable and strategic innovation pipelines. Incorporating SEs into blended models can also allow financial returns to flow toward Traditional Funders—creating incentives for engagement in low-return disease spaces.

Mozambique's *Fundo da Malária* [135], launched in 2020, exemplifies a successful hybrid model. It raised over US$8 million from private donors to fund IRS, logistics, and malaria education [135] [136]. Although legally structured as a foundation, its operational model reflects blended finance principles and aligns closely with SE strategies.

3 APPROACH

This thesis applies a qualitative, multi-phase case study design to evaluate how SE funding has influenced the development and distribution of malaria treatments in Mozambique. The aim is to extract lessons that may be applicable to addressing other endemic diseases in developing economies. The research is grounded in literature review, secondary data analysis, modelling, and funding matrix development. All research was conducted under the Faculty of Economics and Business between April and July 2025 as part of the Bachelor's Research Project in Biomedical Engineering.

3.1 Research design and Phases of Research

The study follows a mixed-methods research design, combining theoretical frameworks and applied analysis to assess SE funding's role in Healthcare Innovation. The approach includes four main methods: literature review, secondary data analysis, modelling and forecasting, and funding matrix development. The design allows for in-depth investigation within the single case of Mozambique, while enabling the extraction of generalizable insights for other Developing Countries.

The research process was structured into five overarching phases, each building on the previous to achieve a comprehensive evaluation of SE funding in malaria treatment development.

Phase 1: *Foundational Literature and Conceptual Framing*
This phase established the theoretical basis for the study. A comprehensive literature review was conducted to define key terms such as SE, Blended Finance, Healthcare Innovation, and the Healthcare Finance Gap. The review also mapped historical investment models and the economic dynamics that exclude Developing Countries from health innovation pipelines. Key scientific, economic, and policy concepts were integrated into the **Key Terms and Abbreviations** section to ensure clarity, consistency and a clear scope.

Phase 2: *Scientific Background and Problem Contextualisation*
This phase focused on situating malaria within the broader context of global health inequities. It included an analysis of malaria's pathology, treatment options, and its burden in Mozambique. WHO statistics and economic modelling from secondary sources were used to show the economic and public health implications of delayed malaria treatment innovation, helping to frame the rationale for alternative funding approaches.

Phase 3: *Predictive Modelling and Timeline Mapping*
Historical and projected malaria data from the *Global Burden of Disease* and WHO were compiled to create an innovation timeline. Three predictive scenarios were modelled: baseline (no intervention), intervention with traditional funding (e.g. *Goodbye Malaria initiative*), and enhanced intervention including SE-supported vaccine rollout (e.g. R21/Matrix-M). This allowed quantification of treatment delays and preventable deaths under each funding model.

Phase 4: *Funding Matrix and Strategic Capital Alignment*
A central analytical tool—the Funding Matrix—was developed in this phase. It classified 12 funder types along a continuum from traditional to impact-first capital. Each funder was analysed across criteria such as return expectations, social impact mandates, investment timelines, and innovation stage alignment. Quantitative indicators (e.g., EPS, ROI targets, lending rates) were used to contextualise how these funders interact and how SEs fit within a blended model. Comparative tables and real-world illustrations, including the IFFIm vaccine bonds model, further supported the matrix logic.

Phase 5: *Synthesis, Strategic Discussion, and Extrapolation*
The final phase integrated findings into a strategic framework. **Chapter 6** provided a thematic discussion of SE funding's systemic potential, backed by peer-reviewed literature. Key lessons from

the Mozambique case were extrapolated to other endemic diseases and regions in **Chapter 7**. Strategic recommendations were made for institutionalising blended finance, supporting SE ecosystems, and re-aligning innovation finance globally.

3.2 Data sources and selection criteria

The study relies exclusively on secondary data obtained from a range of credible academic and institutional sources. To ensure a rigorous and comprehensive review, a combination of peer-reviewed literature, global health data repositories, economic databases, and policy documents was consulted. Academic search tools and databases used for literature retrieval included *Scopus*, *JSTOR*, *Google Scholar, PubMed,* and the *Web of Science*, which provided access to recent and high-impact journal articles on social enterprises, healthcare innovation, and development finance. For statistical and economic data, sources such as the *World Bank, International Monetary Fund*, and WHO were utilized, along with relevant national health strategy documents from Mozambique and regional reports from *UNDP*, *Vitality Health International*, and *OECD*.

The selection of data sources was guided by criteria of relevance, reliability, and accessibility. Emphasis was placed on literature published after 2010 to reflect current practices and trends in global health innovation and financing. Preference was given to sources that presented clear methodologies, regional specificity to Sub-Saharan Africa, and data relevant to both health and economic outcomes. Reports and databases that included disaggregated information on funding types, health treatment timelines, and intervention outcomes were prioritized to support the comparative and modelling aspects of the study.

While all efforts were made to prioritise high-quality and peer-reviewed sources, many studies on SE funding remain descriptive or case-based, limiting the strength of comparative analysis. Moreover, global health reports often aggregate funding mechanisms, making it difficult to isolate the specific effects of SEs with precision.

3.3 Limitations of the study

This study, while comprehensive in its conceptual and analytical scope, is subject to several limitations. Firstly, it does not include primary data collection such as interviews, field observations, or stakeholder surveys. As a result, the research is limited in its ability to capture the local realities of Mozambique's healthcare landscape or the lived experiences of those implementing or benefiting from SE interventions.

Secondly, although the analysis draws from a range of credible secondary sources—including the WHO, Global Fund, Gavi, and peer-reviewed journals—there is a lack of disaggregated data that clearly isolates the specific impact of SE funding. Many contributions from philanthropic organisations or CSR-linked investments are grouped under broader development finance categories, making it difficult to determine SE-specific influence with precision.

Thirdly, the predictive model used to estimate the impact of delayed or accelerated treatment rollout is based on conservative assumptions and the best available data. It assumes that past intervention performance is representative of future outcomes—yet real-world changes, such as new variants or evolving treatment efficacy, could alter disease trajectories. Additionally, it assumes a steady rate of population growth, which may not reflect future demographic shifts influenced by migration, fertility, or mortality trends. While care was taken to ensure realistic scenario construction, the model cannot account for unforeseen disruptions such as political instability, pandemics, or logistical failures. As such, the projections represent plausible, rather than definitive, outcomes.

In addition, the research is geographically limited to a single case study—Mozambique. This was a deliberate choice due to the country's high malaria burden, the availability of relevant data, and recent

innovations such as the R21/Matrix-M vaccine. However, findings may not be fully generalisable to other disease contexts or national settings without careful contextual adaptation.

Finally, while strong associations are demonstrated between SE involvement and improved innovation timelines or treatment coverage, the study does not establish causality. Multiple interacting factors—including global donor priorities, public sector reforms, and broader economic trends—may also contribute to observed health outcomes. These limitations do not undermine the validity of the findings but rather highlight the need for further research, particularly involving primary data collection and multi-country comparative analysis to strengthen the evidence base.

4 CASE STUDY: MALARIA INNOVATION IN MOZAMBIQUE

Building on the theoretical framework and methodological approach established in the preceding chapters, the next section applies this research to the real-world context of Mozambique. As a high-burden, low-resource setting, Mozambique exemplifies the challenges that traditional funding models face in closing the Healthcare Finance Gap. Accordingly, it provides a suitable case study to evaluate whether SE funding, operating within a Blended Finance Model, can accelerate treatment innovation and rollout in a measurable way. This section examines historical patterns, current initiatives, and future projections using secondary data and modelled scenarios to assess the tangible contributions of SEs.

Historically, malaria was widespread across many regions that are now classified as developed, including Europe, North America, Australia, China, and India [38]. Until the mid-20th century, it posed a major public health threat in these areas. Through the deployment of extensive public health infrastructure, coordinated vector control programs, and well-funded national eradication efforts, these countries successfully eliminated malaria between the 1940s and 1970s [137]. This achievement was largely enabled by strong state capacity and access to substantial financial and technical resources.

In stark contrast, malaria remains highly concentrated in Developing Countries, where such resources remain scarce. The WHO African Region currently accounts for 95% of global malaria-related deaths (WHO, 2023) [138]. While environmental and transmission differences explain some of this regional disparity, the most defining factor is a persistent gap in innovation and financing. Countries like Mozambique continue to face a cycle of high disease burden and underinvestment in long-term, scalable solutions.

Mozambique is among the four countries with the highest malaria burden globally. Despite representing 0.44% of the world's population, it accounted for 4.2% of global malaria cases and 3.5% of malaria-related deaths in 2023 (WHO, 2023) [138]. The disease is hyperendemic, with stable, year-round transmission across the country. According to WHO data, 100% of Mozambique's 33 million population live in areas where incidence exceeds 275 cases per 1,000 individuals (WHO, 2023) [138]. Although progress has been made, the pace of intervention remains insufficient to meet international targets. As the World Malaria Report 2023 [138] highlights, global inequities in access to prevention, diagnosis, and treatment continue to undermine malaria control efforts.

Mozambique is particularly well-suited for case study analysis for several reasons:

- Its population is relatively homogeneous across HDI indicators.
- It has concentrated population clusters—particularly in the southern coastal provinces—which intensify transmission while also allowing for geographically targeted intervention tracking [139].
- It actively participates in global malaria initiatives and maintains high data transparency, working with the WHO, the Global Fund, and the President's Malaria Initiative to share detailed health data over time [139].
- Mozambique is one of 11 countries prioritized under the WHO HBHI strategy, collectively accounting for about 70% (WHO) of the global malaria burden [140].
- There is strong visibility into the country's intervention history, including:
    - Distribution of ITNs and implementation of IRS campaigns.
    - Nationwide access to artemisinin-based combination therapies ACTs.
    - Participation in the *Goodbye Malaria* initiative, a cross-border IRS strategy[141].
    - A limited pilot rollout of the R21/Matrix-M vaccine, supported by Gavi and UNICEF, beginning in 2024 [142].

These characteristics not only justify Mozambique as a compelling case study but also provide the necessary foundation for modelling how innovation and financing trends have historically shaped—and could continue to shape—malaria outcomes.

The following section applies this analysis by introducing a predictive model that simulates how different funding approaches, including SE-led innovations, can alter Mozambique's malaria trajectory.

5 Mozambique: Malaria Trends and Modelling a Health Innovation Cycle

This section analyses historic malaria related deaths in Mozambique and uses these to develop a predictive model to describe the impact of Healthcare Innovation on future rates. The key purpose of this model is threefold. First, it offers a structured analysis of how past interventions influenced malaria mortality trends. Second, it projects the potential impact of upcoming innovations. And third, it serves as a foundation for assessing how funding, particularly SE funding as forming part of a Blended Finance Mix, can be strategically aligned with Healthcare Innovation Cycles to maximize health outcomes.

The analysis considers three scenarios: (1) a baseline based on historical data; (2) a historic innovation trend reflecting the 2013 *Goodbye Malaria* intervention [141] [143]; and (3) a new innovation trend assuming the anticipated deployment of a new vaccine. To ensure meaningful comparisons, the model applies data smoothing and CAGR calculations to account for anomalies such as climate-related surges and COVID-19-related disruptions.

Malaria treatment, prevention, and innovation are multidimensional, involving complex interactions between different interventions. For simplicity and analytical focus, the model isolates a single innovation in each period: the 2013 *Goodbye Malaria* initiative [144] and the associated rollout of the IRS strategy for historic trend analysis, and the R21/Matrix-M vaccine with predicted rollout in 2026 for future innovation. By framing innovation as a dependent variable—shaped by the presence or absence of timely funding and coordination—this model highlights the structural relationship between financing mechanisms and health impact.

5.1 Model Assumptions

This predictive model applies the following salient assumptions:

- **Systemic stability:** The healthcare system and broader external conditions (eg. political, infrastructural, and demographic factors) remain relatively stable during the projection period.
- **Isolated innovation impact:** Innovation is treated as the sole independent variable influencing mortality.
- **Comparability of Interventions**: The IRS-based *Goodbye Malaria* campaign (2013) and the projected R21/Matrix-M vaccine rollout (2026) are assumed to have a broadly comparable profile in terms of implementation scale, coverage, and operational efficacy.
- **Rollout-Based Mortality Attribution**: Deaths are counted from the point of treatment rollout. Lead times associated with development or pre-deployment logistics are excluded.
- **Data Smoothing Validity**: The smoothing approach applied to anomaly periods (1998–2007 and 2019–2021), based on linear interpolation, is assumed to be appropriate and justified for trend modelling.

5.2 General Trend Analysis; Absolute Malaria Mortality Rates

5.2.1 Baseline

As a baseline, malaria-caused mortality in Mozambique was analysed over the period 1980 to 2023. As shown in ***Figure 1***, this period reflects a general downward trend in deaths, corresponding with the progressive rollout of malaria remedies.

During this period, and after smoothing between the years 1998 to 2007 (as explained in ***Section 5.2.2***), two distinct trends are visible. From 1980 to 1990, malaria-related deaths increased by an average 1,4% per annum. Thereafter they declined by an average 1,4% per annum.

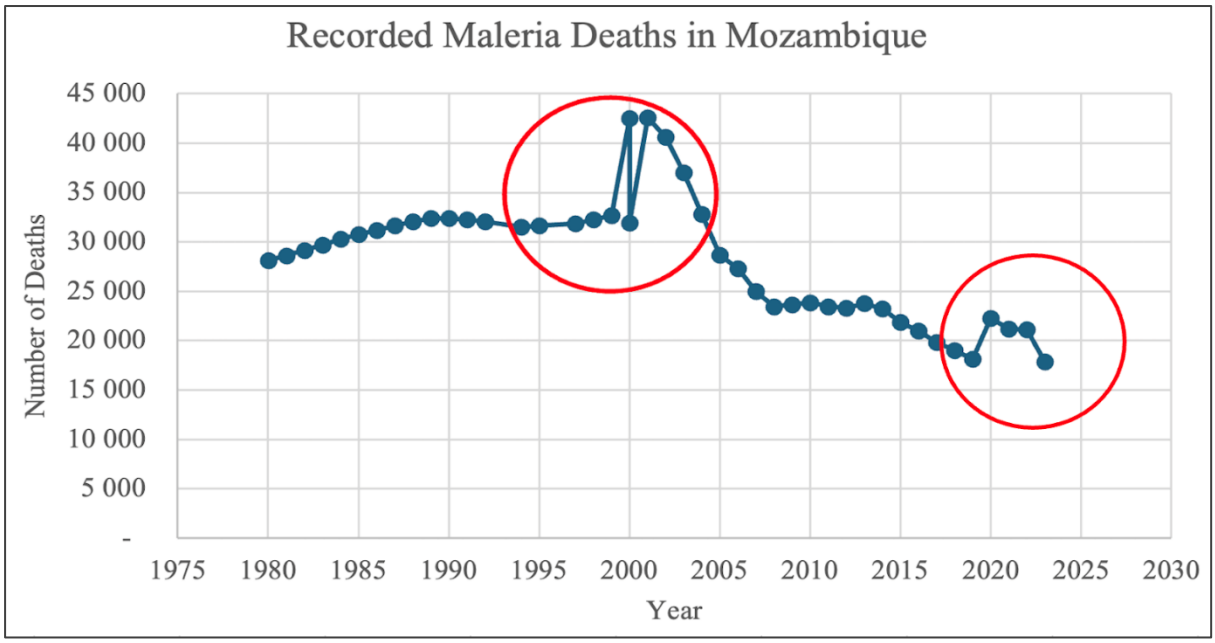

Figure 1. **Mozambique Malaria Mortality (1980 – 2023)**

5.2.2 Anomalies and Smoothing

During the period 1980 to 2023, two major anomalies were identified. These are demarcated by the red circles in ***Figure 1*** above:

- **1998–2007 Spike:** This corresponds to widespread El Niño-induced flooding in Mozambique, including the 2000 floods [145] [146], which created ideal breeding conditions for mosquitoes and overwhelmed local healthcare capacity. Hospital admissions and infection rates surged during this time [147]. This resulted in above trend deaths calculated at **53,423** over this period.
- **2019–2021 Spike:** This spike aligns with the COVID-19 pandemic, which severely disrupted malaria control efforts. Lockdowns and healthcare strain resulted in delayed distribution of ITNs, reduced access to diagnostics, and lower treatment coverage. The WHO reported a 100.1% increase in malaria deaths, and malaria cases reported by community health workers surged by over 50% in key months [148] [149].

To maintain a consistent and interpretable trend, these two periods were smoothed using linear interpolation [150] between reliable data points on either side (1997 and 2008; 2018 and 2022). This method helps to prevent outlier events from distorting the broader trends that the model aims to capture.

5.2.3 Historic Innovation Trend

In 2013, the *Goodbye Malaria* initiative, a cross-border IRS strategy [141] was rolled out in Mozambique. This intervention had a pronounced impact on malaria-caused mortality. After adjusting for the COVID-19 anomaly period (2019-2021), as explained in ***Section 5.2.2***, two distinct trends in absolute malaria related death rates can be observed:

- **2013–2017:** Deaths declined at a CAGR of –4.89%, illustrating the aggressive early impact of targeted interventions.
- **2018–2022:** The rate of decline slowed considerably, with a CAGR of –0.31%, likely indicating intervention saturation or diminishing marginal returns; rate is tapered here.

5.3 Population Growth and Amended Mortality Rates

5.3.1 Population Growth

The malaria-related death trends observed under **Section 5.2** are absolute. During the period 1980 to 2024, as evidenced in ***Figure 2***, Mozambique's population nearly tripled — from approximately 12 million to over 36 million (Worldbank, 2019) [151]. This rapid growth has a material effect on the real measure of malaria related deaths relative to the national population, even before accounting for the intervention-linked fluctuations modelled later in this section.

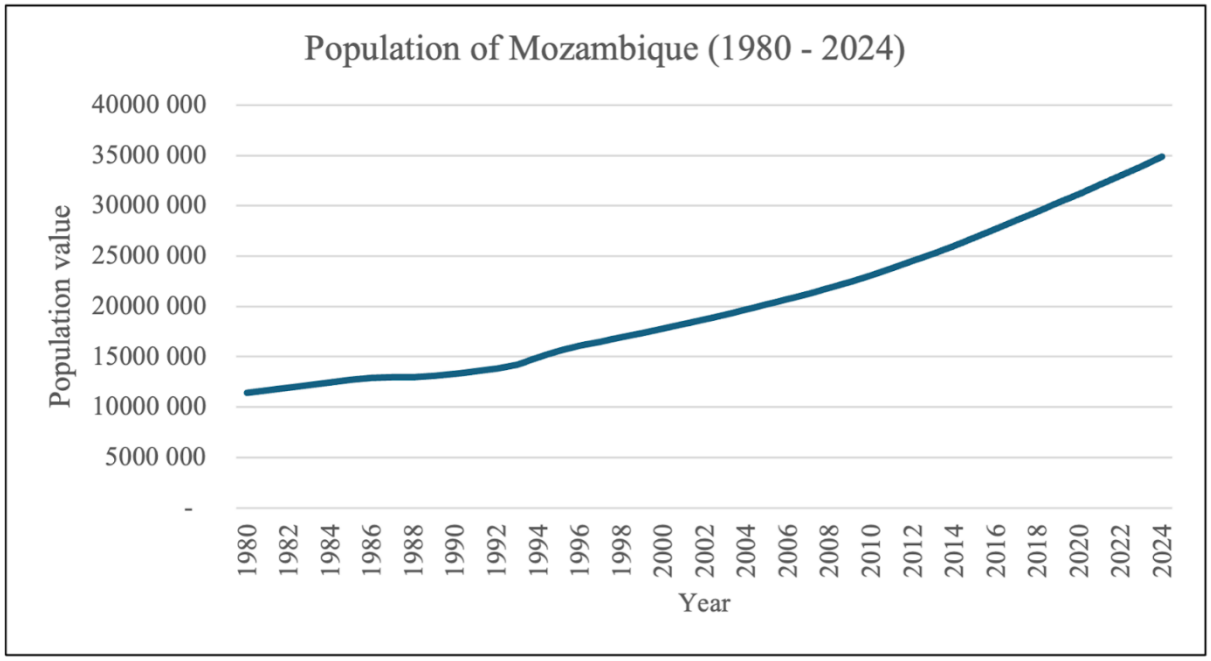

Figure 2. Population Growth in Mozambique (1980 - 2024)

In malaria-endemic countries like Mozambique, disease transmission is heavily influenced by demographic and spatial factors—particularly in rural and peri-urban regions where healthcare infrastructure, diagnostic coverage, and vector control are limited [138]. As the population increases, so does the pool of individuals at risk, especially in underserved regions. Without a proportional scale-up of prevention and treatment capacity, the health system becomes overburdened, disease control efforts lose traction and malaria remains entrenched.

Public health capacity in Mozambique has not kept pace with population growth. Documented challenges—including healthcare workforce shortages, drug stock outs, and uneven distribution of ITNs

and diagnostic tools—have persisted across multiple periods [152]. These constraints, which can be linked to capital shortfalls, explain why, despite global financing mechanisms and regional malaria programs, the country has continued to experience high malaria mortality rates well into the 2000s.

In summary, the overall trend in malaria deaths must be viewed through the lens of population pressure. ***Figures 1 and 2*** together illustrate that changes in mortality cannot be solely attributed to outbreaks or policy failures—they are also a function of scale.

5.3.2 Real Mortality Rate Trends

Population growth materially affects the perceived effectiveness of malaria interventions. ***Figure 3*** below overlays the smoothed malaria related deaths with population growth from 1980 to 2024. This figure illustrates how a rapidly increasing population can obscure the real impact of treatment progress. Raw values used can be found in ***Table A.*****1 in Appendix A.**

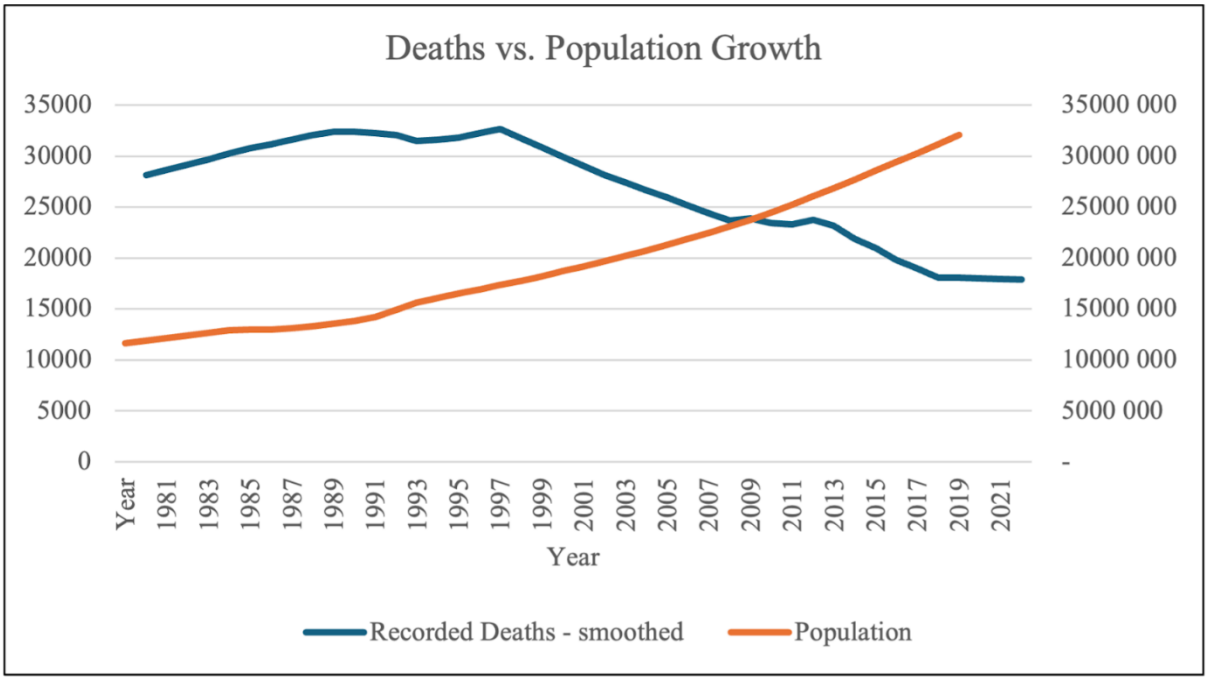

Figure 3. Population Growth and Malaria Related Deaths in Mozambique (1980 - 2023)

Taking into account population growth, the real changes in mortality rates are measured as a percentage of the total population. The results across phases show the following patterns:

- **Baseline, increasing rate:** In absolute terms, malaria related deaths increased from 1980 to 1990 by 1,4% per annum; but, the Real Deaths Percentage was decreasing throughout the period 1980 onwards, with increases recorded in 1987 and 1988 only.
- **Baseline, decreasing rate:** In absolute terms, malaria related deaths decreased from 1991 to 2012, allowing for smoothing by 1,4% per annum; but, the Real Deaths Percentage decreased for a longer period from 1980 and by a greater rate of an average 2,8% per annum.
- **Historic Innovation, sharp decreasing rate:** In absolute terms, from 2013 to 2017, smoothed deaths declined by an 4,89% per annum; but, the Real Deaths Percentage declined by an average 7,29% per annum.
- **Historic Innovation, slowed decreasing rate:** In absolute terms, from 2019 to 2022, smoothed absolute deaths declined by an 0,31% per annum; but, the Real Deaths Percentage declined by an average 3,97% per annum.

As an overall measure, annual absolute death rates declined by an average 1,05% per annum between 1980 and 2022 but, Real Death Rates declined by an average 3,51% per annum. Thus, when including population growth, the real impact of treatment over the period is 3,3 times the impact.

For extended visualisation of deaths relative to population trends, see ***Figures B.1 and B.2*** in **Appendix B.**

5.4 Use of CAGR, Population Change and Predictive Logic

To model the progression of malaria mortality over time, the CAGR was used. CAGR represents the average annual rate of change over a specific period, accounting for compounding effects. It is widely used in public health and financial modelling for its ability to:

- Smooth irregular, year-to-year fluctuations.
- Reflect the long-term, compounded impact of an intervention.
- Provide a clear and consistent rate for future projections [153].

These observed trends, described under ***Section 5.2.3*****,** for the Historic Innovation, which captures the impact of the IRS strategy as implemented by The *Goodbye Malaria* initiative, are used to inform the projections for New Innovation scenarios. The New Innovation scenario assumes that the R21/Matrix-M vaccine is introduced in 2026 and produces a similar impact pattern: an initial sharp decline over four years (– 4.89%), followed by a tapering reduction (– 0.31%) as uptake plateaus.

Goodbye Malaria's IRS strategy and R21/Matrix-M vaccine differ in approach. However, it is assumed that the impact of the IRS strategy carries a predictive value for the vaccine, or other newly introduced solutions because there are material limitations that are consistent across both treatments and equally dampen the efficacy of such a solution. For example, capacity restrictions in capital infrastructure and human resources place a ceiling on any treatment and this ceiling has the effect of narrowing discrepancies in efficacy. Under these conditions, the ceiling for efficacy may be the extraneous limitations and not the solution. Further, the overall environment, which affects results, is consistent. Notably, weather patterns and geographic conditions which support malaria outcrops are consistent across treatments. Finally, malaria has proven to evolve in response to treatments. This implies that tapering will occur, across a wide range of solutions.

5.5 Rationale for Applying a Slowed Rate

From 2013 to the present, a new trend in malaria mortality has emerged. The most recent reliable data extends to 2022, and when smoothed, the average annual, absolute reduction in malaria-related deaths during the period 2008–2022 is calculated at just 0.31%. This marks a notable slowdown compared to the 1–2% annual reductions observed in earlier decades. The reduced rate reflects both the saturation of existing interventions and the disruptive impact of the COVID-19 pandemic, which delayed the distribution of ITNs, impeded diagnostics, and reduced treatment access [154].

Given that further substantial mortality reductions would have required sustained and novel interventions, this slowed rate is assumed to represent a new baseline under current health system conditions and available treatment options.

Importantly, this deceleration aligns with the S-curve model of innovation adoption—a widely documented phenomenon in global health. According to this model, the impact of an innovation follows a sigmoid trajectory: an initial slow uptake is followed by a period of rapid growth, before eventually plateauing as the intervention reaches its saturation point or operational limits [155] [156].

This pattern has been observed across various domains, including vaccine adoption and disease control campaigns in low- and middle-income countries [157]. For example, childhood immunization efforts against measles [158] and polio [159] in sub-Saharan Africa saw dramatic initial declines in mortality, but progress plateaued in later years as logistical and accessibility barriers mounted [160]. Mozambique's malaria trajectory mirrors this trend: a sharp reduction in mortality following The *Goodbye Malaria* initiative, followed by a stabilizing effect in recent years.

Thus, applying a 0.31% annual decline serves both a strategic and empirical purpose. It reflects recent observed trends and aligns with established innovation life cycle theory, offering a grounded and conservative basis for future projections.

5.6 Rationale for Predictive Modelling

To effectively evaluate the potential role of SE funding in addressing malaria mortality in Mozambique, a predictive model was developed to simulate the effects of past and future interventions on mortality outcomes [138]. Rather than simply assessing historical trends, the model offers a forward-looking framework to test how different combinations of financing—traditional, philanthropic, and SE-based—might alter the trajectory of malaria-related deaths [161]. These projections provide insight into the extent to which innovation and strategic financing can mitigate the compounding effects of demographic expansion on malaria burden.

This approach aligns with the paper's core objective: to determine whether SE funding, when strategically blended with traditional models, can deliver high-impact outcomes in low-return environments. It is particularly relevant in developing regions, where conventional financial incentives often fail to stimulate adequate investment. In such settings, predictive modelling offers a framework for strategic resource allocation—highlighting where returns are likely to be measured in public health outcomes rather than financial gain.

Mozambique offers a unique opportunity to retrospectively assess the effect of past SE interventions, such as *Goodbye Malaria*, and to simulate the potential of future innovations, like the R21/Matrix-M vaccine [141]. Additionally, the model provides a way to define realistic public health goals. It sets measurable targets for mortality reduction under different innovation scenarios, allowing stakeholders to better prioritize and coordinate resources.

Ultimately, the model functions both as an analytical tool and a policy planning resource. It quantifies the number of lives at risk under different funding approaches—an essential consideration when assessing interventions in highly vulnerable populations, including children under the age of 5 and pregnant women.

5.7 Model Development and Predictive Analysis

To assess the potential impact of innovation and funding mechanisms on malaria mortality in Mozambique, a predictive model was developed using historical and current malaria death data. In this model, malaria-related deaths serve as the primary outcome variable, providing a measurable indicator of intervention effectiveness over time.

The model relies primarily on WHO data due to its global standardization and methodological consistency. To construct a comprehensive historical baseline, data from 1980 to 1999 were drawn from the *Global Burden of Disease* Results Tool [161], while data from 2000 to 2022 were sourced directly from the WHO [162]; raw values are found in ***Appendix A, Table A.1***. Projections extend through to 2040 and are based on three distinct intervention scenarios based on intervention presence and strength.

It is important to acknowledge that malaria outcomes are shaped by a wide range of dynamic and often unpredictable factors—including socioeconomic fluctuations, environmental disruptions, and health system resilience. Developing Countries tend to have high population growth rates and a predictive model should thus include a feedback loop to population growth. This model adopts a simplified structure in which innovation is treated as the primary independent variable. While this allows for targeted analysis, it also necessitates a careful consideration of underlying assumptions and limitations. The model specifically uses absolute numbers and excludes population growth in the predictive model. To accommodate for population growth, a feedback loop as a measure of deaths (or other variable) as a proportion of the total population (or identified demographic sector) can then be applied. This allows for population growth, which varies by country to be isolated.

5.8 Model Structure: Three Scenarios

To explore how different innovation timelines and funding strategies may influence malaria mortality, the model simulates three distinct scenarios. Each reflects a different level of intervention intensity, allowing for comparative analysis of their projected health outcomes. These scenarios are:

- **Baseline (Pre-Intervention Deaths)**: representing the relatively consistent path of malaria mortality from 1980 to 2013, before the introduction of large-scale interventions;
- **Historic Innovation Trend (Current Intervention Deaths)**: reflecting the impact of the 2013 Goodbye Malaria initiative, which mobilized targeted funding and treatment strategies to reduce malaria deaths in the country; and
- **New Innovation Trend (Pending Intervention Deaths)**: projecting the potential effect of the upcoming R21/Matrix-M vaccine, assumed to be introduced in 2026, and requiring substantial funding and rollout coordination similar to that of the *Goodbye Malaria* initiative, where funding is assumed available.

5.9 Results

Table 1 presents the malaria-related deaths in Mozambique under three scenarios, alongside population data and the Real Death Percentage, for context. To complement this, ***Figure 3***, the penultimate figure of this chapter, visually synthesises the model's core projections. It captures the comparative impact of three different innovation trajectories – making it a central reference point for interpreting the results. For detailed yearly data and repeatability, refer to ***Table 1.A*** **in Appendix A.**

Table 1. **Historic and Projected Malaria Mortality Under Three Scenarios (1980-2040)**

Maleria Related Deaths in Mozambique					
Year	**Population**	**Pre-Intervention**	**Current Intervetion**	**Pending Intervention**	**Deaths as a % Population**
1980	11 413 587	28 118			0,25%
1985	12 680 065	30 787			0,24%
1990	13 303 459	32 410			0,24%
1995	15 594 830	31 819			0,20%
2000	17 768 505	29 960			0,17%
2005	20 211 114	25 909			0,13%
2010	23 073 723	23 455			0,10%
2015	26 843 246	23 015	20 963		0,08%
2020	31 178 239	22 624	17 986		0,06%
2025	35 834 558	22 280	17 711		0,05%
2030	41 141 009	21 940	17 441	13 782	0,03%
2035	47 233 250	21 606	17 175	13 572	0,03%
2040	54 227 642	21 276	16 913	13 365	0,02%
Lives Saved			114 067	47 343	
Total Saved				161 410	

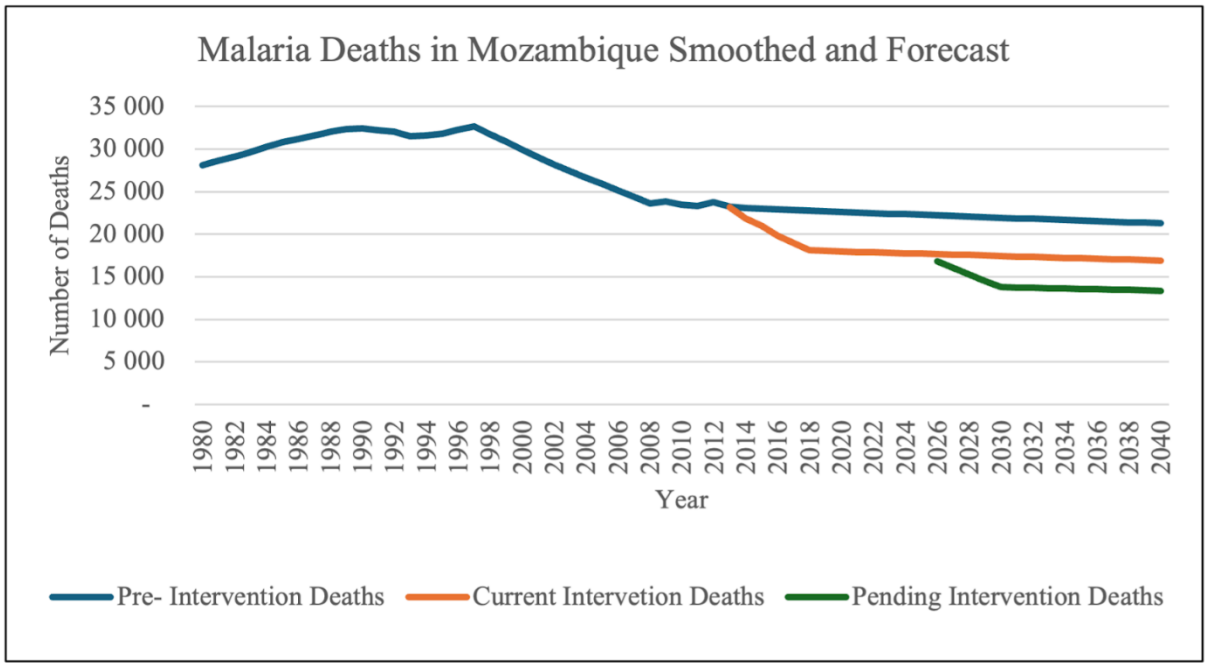

Figure 3. **Historic and Projected Malaria Mortality Under Three Scenarios (1980-2040)**

By 2040, the model yields the following projected malaria-related outcomes:

- **Baseline (Pre- innovation):** 21,276 malaria related deaths
- **Current Innovation Trend:** 16,913 malaria related deaths
- **Pending Innovation Trend:** 13,365 malaria related deaths

These results demonstrate a clear, quantifiable relationship between timely innovation and malaria mortality reduction. The *Goodbye Malaria* initiative serving as the Current Intervention, is projected to avert **114, 067** deaths by 2040. The New Intervention, modelled on the R21/Matrix-M vaccine rollout,

contributes an additional **47,343** lives saved, bringing the total projected lives saved to **161, 410** by 2040.

It is notable that, due to the steep population growth in Mozambique, by 2040, the Real Death Percentage is forecast to drop to **0,02%** by 2040, compared to **0,25%** in 1980. Thus, although, in absolute terms, malaria is not eliminated, under the model, its impact on the overall population is severely reduced. Further, under the model, only a single treatment is considered. With additional funding, it is possible that a basket or solutions could be applied to greater effect. This is beyond the scope of this thesis.

This modelling analysis underscores the central research of this paper: that well-timed health innovations, when coupled with strategic funding models such as SE or blended finance, can significantly alter disease trajectories in high-burden settings. By simulating real-world trends and projecting future outcomes, the model provides convincing evidence that the timing and structure of financing—not just the technology itself—are critical to success. In Mozambique's case, the data suggest that SE funding mechanisms can save significant lives when effectively aligned with innovation cycles, reinforcing the potential of alternative financing approaches to bridge persistent health equity gaps.

To contextualize these projections within a broader financial strategy, the next chapter introduces a matrix framework for evaluating how different capital types align—or misalign—with Healthcare Innovation Cycles.

6 FUNDING MATRIX AND THE STRATEGIC ALIGNMENT OF CAPITAL

Building upon the modelling insights in the previous chapter, the following section introduces a strategic framework to understand how diverse financing models interact with the Healthcare Innovation Cycle. The Funding Matrix serves as an analytical bridge—connecting empirical mortality trends with the structural mandates of different capital types.

This section presents ***Figure 4***, The Funding Matrix, developed as a core analytical tool in this research paper. It evaluates how various financing models interact with the Healthcare Innovation Cycle, specifically in the context of malaria treatment in Mozambique. The matrix positions 12 distinct funder types along a finance–impact continuum, ranging from profit-maximizing traditional investors to impact-first SE funders. Between these two poles lie blended and hybrid models, such as DFIs, impact investors, and CSR-linked capital. This continuum framework provides a nuanced understanding of how funder mandates, return expectations, time horizons, and risk aversion influence their respective roles in enabling—or inhibiting—innovation in low-income settings.

This section proceeds by examining funder types across the continuum, analyzing their alignment with innovation stages, and visualizing their contribution to blended funding strategies. The matrix was constructed by evaluating each funder according to a defined set of functional variables:

- **Financial return expectations**: the effective cost of capital committed to funding a healthcare solution. Capital cost can be expressed in multiple manners depending on the funding source. Thus, for example, for Private Equity investors, their financial return over the investment period as expressed by time horizon. And for debt, the cost of capital is the interest rate charged by a high street bank.
- **Social impact orientation**: describes the importance that investors in the category place upon social returns.
- **Investment time horizon**: represents the period that an investor intends committing their capital to a project. It is notable that under Institutional Investors the time horizon is short because such investors prefer publicly traded, liquid securities which allows them to exit an investment at short notice. This does not affect the underlying project because this is a secondary market and capital raised in the primary issue accrues to the investee

Broad Category	Traditional Financiers			Blended / Variable Models					Social Enterprise			
Funder Type	**Private Equity / Venture Capital**	**Commercial Banks**	**Corporate (For-Profit)**	**Public Stock / Institutional Investors**	**Managed Funds with fractional CSR mandate**	**Government (via Sovereign Bonds)**	**Sovereign Wealth / Government Investment**	**Development Finance Institutions**	**Impact Investment Funds**	**Corporate Investment (CSR-driven)**	**Philanthropic Organization**	**Individuals / Crowdfund**
Description	Mobilise Funds, for an equity position, with capital gain objective.	Typically secured. Capital and interest payments.	Businesses develop and commercialize profitable solutions	Public investors, take passive positions in traded securities.	Fraction invested into Impact. E.g. Insurance and pension funds	States raise capital toward state-wide objectives	State-managed funds for strategic macro-economic investments	Public-private investors typically developing country focus	Funds managed under impact-oriented mandates	Corporates contributing through CSR-linked investments,	NGOs and global institutions focused on impact spend	Individual donors via platforms *(eg. GoFundMe)* — large aggregate
Time Horizon	Typically medium-term	Medium- to long-term	Typically medium-term but long term for deep innovation	High liquidity allows short term positions	Typically medium- to long-term	Long-term	Medium- to long-term	Medium- to long-term	Medium to long-term	Long-term	Long-term	Medium-term to indefinite
Financial Return Requirement	High	High; interest and capital payment	High; ROI and shareholder EPS	High; based on stock value and dividends	Medium; without materially impacting fund returns / reserves	Low; capital cost structural evolution and wellbeing objective	Medium; strategic but moderate ROI	Medium; 5–10%, often catalytic funding	Medium where SDG but flexible considering impact	Low to Medium – CSR mandates, may require SDG or cost recovery	None – purely impact-driven but increasingly, SDG is a consideration	None – emotional or moral motivation, often one-off
	20–30% ROI targets [163][164]	Prime rate + risk premium (MZ effective 18%)	By Company R&D risk est. 15%	7% plus but, country risk can add 5% [167]	5–10% BUT LMIC Impact can be <2%	In developing eg. MZ coupon ~11,3% [169]	~6% plus but, country risk ~5%		~3–7% with high social impact	Depend on regulation & Tax SDG ~3–7%	Depends on donor & impact. SDG ~3–7%	Impact consideration
Mandate Type	High-growth, scalable innovation	Profit, low risk, capital protection	Shareholder profit, intellectual property protection	Financial performance only	Capital preservation, ESG-aligned	Public services through financial markets	Strategic growth and national interest	Development + financial sustainability	Blend of Impact mandates + modest returns	Social obligation, community impact	Public health improvement; UN SDGs	Personal concern, moral appeal, viral reach
Blending Potential	High - require de-risking instruments	Low – need strong guarantees	Medium to High,	Low – limited to profitable health firms	Low – cautious unless ESG-aligned	High – can back long-term rollout strategies	Medium – via PPPs or infrastructure	High – natural partner for SEs & governments	High – can co-fund innovation with traditional models	Medium – used in education or health program access	High – can de-risk interventions	Medium – gap-filling
Best Fit Allocation	Biotech / health tech innovation	Infrastructure / procurement	Innovation / R&D / early product development	Publicly traded healthcare firms	Large-scale infrastructure or PPPs	Rollout / education / supply chains	Strategic infrastructure / co-financing	Innovation / early-stage & scale-up	Innovation + education, depending on mandate	Community outreach incl. education, rollout	Education / delivery in underserved regions	Small-scale rollout / emergency campaigns
Representative Figures / Metrics	>$2B in African health VC (2020–2024) [165]		Pfizer R&D spend >$10B/year [166]		Pension ROI: ~5–10% [168]	MZ bonds: $900M issued in 2025 at 5,8% - effective 11,3% [170]	2024, MZ raised $158.8M SWF based on gas reserve [171]	IFC: $3.8B in African health (2015–2023) [172]		CSR spend est. €200M/year in African health by MNCs. [173]	Gates Foundation malaria spend: ~ $1.2B (2000–2020) [174]	Crowdfunding raised $1.3B for health globally (2023 est.) [175]

Figure 4. **The Funding / Investor Category Matrix[3]**

[3] In Developing Countries, many sources of funding lack a direct in-country presence and therefore adopt a Fund of Funds approach, where returns are significantly influenced by intermediary performance. This makes it difficult to make categorical statements about the returns of DFIs, Impact Investment Funds and Philanthropic Organizations. Similarly, Corporate Investments in these regions are often outsourced for the same reason. To better understand how these funding bodies operate in Mozambique and comparable contexts, input on real-world return rates was provided by Jonathan Fenster – founder of Alchemy Private Equity Fund and an active operator on the continent.

For illustrative purposes, ***Table 2*** presents the prime lending rate (%) by representative countries and economic categories, as of **March 2025**, highlighting the financial conditions that health innovators face. These figures offer insight into the cost of borrowing and underscore one of the structural barriers to financing innovation in high-burden regions. The values were taken from *Trading Economics* [176].

Table 2. **Prime Lending Rates in Selected African Countries (as of March 2025)**

Country	ZW	ZA	DRC	UG	MZ	NG	Africa Relevant	NL	DE	HU	EU Average
Prime Lending Rate (%); March 2025	46.51	11.0	25.0	20.3	18.5	18.0	20.5	2.9	2.3	6.5	3.9

Across the European Union (EU), the average prime lending rate is relatively low at 3,9% per annum (European Central Bank, 2023) [177], with national rates ranging from 2.3% in Germany (DE) to 7.5% in Hungary (HU). By contrast, the average rate across the primary malaria-affected African countries (shaded pink in Table 2) is materially higher – averaging 20.5% – with the highest recorded in Zimbabwe (ZW) at 43.7% per annum. In Mozambique (MZ), the lending rate remains high at 18.5% (Faife, 2025) [178], reflecting challenging financial conditionals for early-stage health initiatives.

In such high-burden, low-income countries, commercial lending conditions are often prohibitive for early-stage health innovation. The elevated cost of capital poses a critical barrier for scaling health interventions, particularly those with delayed or non-monetizable returns – such as vaccines, diagnostics, or preventative campaigns.

These criteria capture both economic and mission-driven behaviour, enabling structured comparisons of funders with differing motivations and risk profiles. The matrix ***(Figure 4)*** offers a unified framework to clarify how return expectations shape funder behaviour and provides guidance on how various capital types can be strategically combined in blended finance models to overcome structural funding gaps — particularly in high-burden, low-income countries such as Mozambique.

A primary differentiator among funder types is the relationship between their financial return objectives, social mandates, and risk tolerance. Traditional capital providers—such as private equity, venture capital, commercial banks, and institutional investors—contribute a significant share of global health investment volume, but are structurally constrained in their capacity to engage with high-risk, early-stage innovation. For example, private equity alone contributes an estimated 25% of total mapped capital, yet typically seeks returns of 20–30%, and shows low blending potential. These actors tend to participate only at the late stages of the pipeline—such as commercialization and infrastructure rollout—where risk is low and scalability is proven.

In contrast, SE-aligned funders contribute smaller capital volumes but play an outsized role in early-stage and community-level interventions. These include philanthropic organizations, crowdfunding platforms, and CSR-linked investors, all of which prioritize social outcomes over profit. Social impact weightings for these actors range from 9% to 10% in the matrix, and return expectations are low or zero. For example, the Gates Foundation has committed over $1.2 billion to malaria programs globally since 2000, while crowdfunding platforms raised $1.3 billion in health donations in 2023 alone. These funders are critical to supporting innovation phases that lack market incentives, such as vaccine development, pilot programs, and delivery mechanisms in high-burden settings.

This Funding Matrix offers both a conceptual and practical contribution to this research. It clarifies which funders are best positioned to act at different stages of the innovation cycle and highlights the persistent mismatch between financial return expectations and public health priorities. In doing so, it

reinforces the central argument of this paper: that blended models integrating SE funding with traditional capital can bridge these gaps, accelerating healthcare innovation in low-return environments like Mozambique. This framework provides a valuable tool for policymakers, investors, and health innovators alike, enabling more coordinated and mission-aligned financial strategies.

6.1 Blended Capital Model Potential

As a result of the structural biases inherent in capital markets, healthcare projects that offer both social and financial returns possess unique syndication potential. This potential is most effectively realized through Blended Finance Models, which pool resources from funders with complementary mandates. When the financial and social return components are correctly allocated to the appropriate investor types—such as public donors for impact and private financiers for yield—the remaining value represents a leveraged opportunity. This not only expands the total funding pool but also enhances the efficiency and sustainability of financing frameworks. It reinforces the importance of tailored instruments that can bridge return expectations and operational timelines across funder categories.

This section builds on the observed limitation that high-risk, low-return health innovation environments—such as those in Developing Countries—often fail to attract traditional capital. In response, a central tenet of this research is that by blending finance sources, SE funders can provide a de-risking mechanism that attracts traditional funders. The matrix highlights blending potential across multiple funder types. Notably, some institutions serve as critical bridges between the traditional and SE ends of the spectrum, especially where the gap between mandates is too wide to close without structured support. These include DFIs, the IFC, CSR-backed investors, and impact funds.

These actors are particularly effective at bridging public and private finance by structuring blended finance vehicles that use tools such as first-loss guarantees, concessional lending, and public–private co-investment to de-risk innovation and catalyze private sector participation. These models have been applied across high-impact sectors, including healthcare, to mobilize capital that would otherwise remain idle in high-risk markets.

To visualize the strategic interplay between financial and social mandates, ***Figure 5*** below describes the complimenting nature of different funder categories. Where the blue (finance) line exceeds the orange (social mandate) line, the investor will willingly forfeit social opportunity, for financial return and *vice versa*. This allows both Traditional and SE funders to support the same project whilst both achieve their desired targets. Where these lines converge, there is little opportunity to trade financial for social returns but, these investors can be used as neutral funders to scale up the capital pool. The time horizon will ideally be matched.

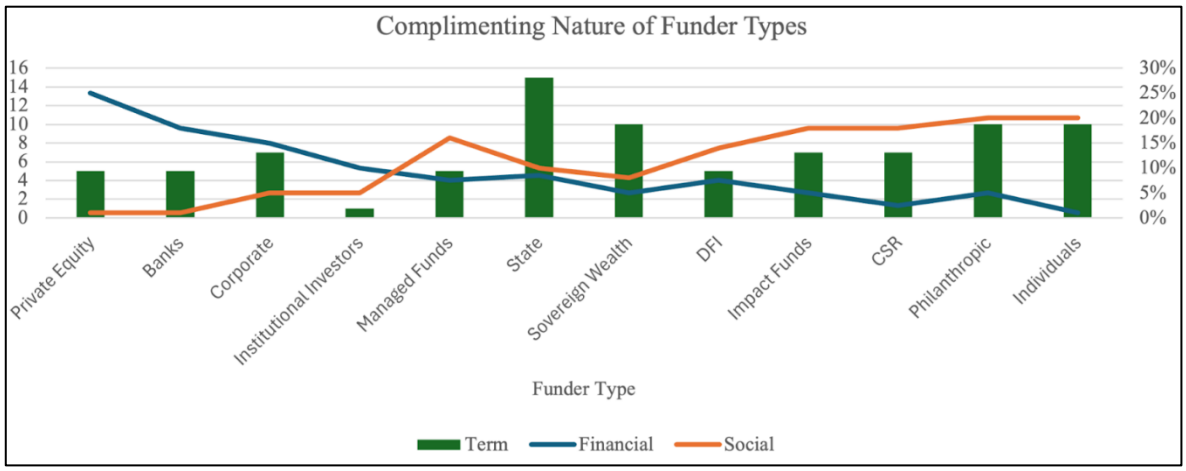

Figure 5. **Potential Funder Salient Investment Criteria**

Together, these insights affirm that strategically structured collaboration, not compromise, is the foundation of effective blended finance. SE funding can serve as a catalytic force, while traditional actors—when aligned with mission-oriented outcomes—can offer the scale and sustainability required to transform national health landscapes. In Mozambique, this model shows promise in accelerating access to malaria treatment. More broadly, it provides a replicable policy pathway for other resource-constrained settings grappling with endemic diseases.

This chapter has illustrated that strategic alignment—not merely funding volume—is the critical variable in achieving healthcare impact. The following chapter builds on this argument, examining how blended capital models can be institutionalized to support long-term system transformation in malaria-endemic regions and beyond.

Some observations are:

- DFIs remain critical enablers in this architecture. They use policy instruments and credit enhancements to attract private co-funding, and often set early funding precedents that shape the direction of broader investment. Their flexibility and catalytic function make them essential actors in unlocking pipeline continuity—particularly in low-income health systems, where early innovation must transition into sustainable delivery without being stranded by risk-averse capital.

- The viability of blended finance strategies must be assessed within the constraints of local capital markets. Without access to low-cost capital, most health innovation projects cannot achieve financial viability. This highlights the critical role of institutions such as the IFC and the EIB, which offer concessional loans with flexible maturity periods based upon the Impact of the investment. Such terms provide the affordability and long-term flexibility to attract complementing risk-averse Traditional Investors into blended financing arrangements.

- Corporate investment, into company relevant R&D, is particularly relevant in this context for pharmaceutical companies. Global companies such as *Pfizer*, *AstraZeneca*, and *Johnson & Johnson* invest heavily into R&D and compensate for the time horizon that innovation requires and risk of non-success with high internal investment yields. They are however demonstrating a growing commitment to CSR goals. These firms' participation in concessional partnerships, donation programs, and global public–private health initiatives.

- One of the most successful applications of this financing logic is the IFFIm. It raises funds by issuing Vaccine Bonds, backed by legally binding donor pledges, to generate rapid and large-scale upfront capital for Gavi's immunisation programmes [179]. Between 2006 and 2023, IFFIm raised nearly $4.6 billion, enabling the deployment of vaccines in over 70 countries [180]. Institutional investors participated at scale—receiving full market-rate returns—while global health actors secured the ability to rapidly procure and distribute life-saving vaccines to underserved populations. This structure illustrates the core strength of blended finance: it does not split returns. Rather, it aligns them structurally, allowing each actor to secure the return that matches their core mandate. It is not a compromise, but a coordination strategy, demonstrating the real-world value of the logic represented in the matrix.

In summary, this demonstrates that effective innovation financing in low-income, high-burden settings is not about volume alone, but about strategic alignment. By coordinating funders according to their mandates, risk profiles, and return expectations, it becomes possible to unlock significant value otherwise lost in fragmentation. The matrix presented herein affirms that SE-aligned funding, when deployed as a catalytic layer within blended structures, can activate broader flows of capital across the innovation pipeline. This finding—rooted in both empirical modelling and structural analysis—now forms the foundation for the **Strategic Discussion**.

7 STRATEGIC DISCUSSION

The analysis presented in the preceding chapters demonstrates that the structure, timing, and coordination of financing mechanisms play a critical role in the development and deployment of healthcare innovation in low-income, high-burden settings such as Mozambique. This chapter synthesizes the key findings and positions them within current global health financing literature to assess both the strengths and limitations of SE funding—particularly within a Blended Finance Model—as a strategy to bridge the persistent Healthcare Finance Gap.

The Mozambique case study reveals a recurring pattern of underinvestment and misaligned capital flows that hindered the timely delivery of high-impact interventions. Predictive modelling in **Chapter 5** confirmed that delays in deploying innovations like the R21/Matrix-M vaccine are not merely operational inefficiencies—they result in quantifiable increases in mortality. Conversely, interventions supported by blended and SE-aligned funding—such as the *Goodbye Malaria* initiative—show measurable improvements in health outcomes, offering empirical support for the central premise of this research: that healthcare innovation is only as effective as the financial architecture that enables its translation to population-level access.

One of the strengths of this research lies in its introduction of the **Funding Matrix (Chapter 6)**, which offers a novel framework for mapping how different funder types align with various stages of the innovation lifecycle. This analytical tool clarifies that traditional capital—such as private equity or institutional investment—is most compatible with late-stage scale-up and commercialization, where financial return is more predictable. In contrast, SE-aligned capital—including philanthropic funding, crowdfunding, and CSR-linked investment—exhibits greater flexibility, risk tolerance, and mission alignment, making it more suitable for early-stage innovation and delivery in resource-constrained environments.

The Funding Matrix finds support in the literature. *Eichler and Glassman* (2008) [181] emphasize that performance-based and results-aligned finance are most effective when situated within systemic architectures that manage both capital flows and stakeholder incentives [181]. This principle is echoed in *Kumar et al.* (2020), who note that structured finance platforms—such as those incorporating layered returns and risk distribution—can unlock private investment for public goods [182]. The real-world example of IFFIm's Vaccine Bonds further illustrates this. This model affirms that financial and social returns need not be mutually exclusive when capital structures are well-aligned.

At the same time, the Mozambique case highlights several constraints that temper the model's scalability. A key limitation is the fragmented nature of SE engagement, often uncoordinated with public health systems. Without deliberate integration into national health strategies or formal innovation pipelines, SE initiatives risk duplicating efforts or misaligning with policy priorities. Additionally, the availability of reliable, disaggregated financial data remains a challenge, as noted in **Chapter 10.** This constrains the ability to isolate SE-specific contributions and to rigorously evaluate cost-effectiveness—a gap also acknowledged in broader global health financing literature (Schäferhoff et al., 2015) [182] [183].

Moreover, the operational environment in Mozambique further validates the need for concessional, impact-first capital. With prime lending rates exceeding 18%, traditional credit is inaccessible for most health-focused enterprises. This financial context underscores the unique role of SEs, not simply in terms of risk tolerance, but in their ability to mobilize capital early, flexibly, and in alignment with public health objectives rather than purely commercial criteria.

A significant operational strength of SEs is their capacity to function across sectors. Unlike traditional investors who are bound by fiduciary constraints, SEs can deploy capital in hybrid roles—as funders, implementers, and system enablers—bridging gaps between public mandates and private capabilities.

In fragile health systems, this institutional agility is not just a comparative advantage; it is a structural necessity.

Importantly, while the findings of this study are promising, they are context-dependent. Mozambique's position as a high-burden malaria country with active donor involvement may amplify the effectiveness of blended SE models. Generalising this success requires caution. As the next chapter argues, successful replication elsewhere will depend on factors such as local regulatory frameworks, health system maturity, and the presence of intermediary funders capable of structuring and coordinating blended finance models.

In conclusion, the strategic insight emerging from this research is that bridging the Healthcare Finance Gap requires more than increased funding—it requires a reconfiguration of financing models that reflect the realities of health innovation cycles and local delivery contexts. When aligned with the right partners, SE-linked blended finance has the potential to accelerate innovation, expand access, and build more resilient health ecosystems in developing regions. Mozambique offers a compelling proof of concept; the task ahead lies in scaling this approach while accounting for its limitations and ensuring alignment with long-term system goals.

8 KEY LESSONS AND STRATEGIC RECOMMENDATIONS

While this research paper focuses on the case of malaria in Mozambique, the broader aim is to assess whether SE funding within blended models can be applied to other contexts. This chapter explores how the frameworks and findings of this research may be translated to support innovation and treatment access for neglected diseases endemic to other Developing Countries.

8.1 Key Lessons

The following lessons capture the critical enablers and constraints identified in the Mozambique case, offering guidance for applying similar financing strategies in other contexts.

- **Innovation Alone Is Insufficient Without Timely Financing:** The modelled outcomes in **Chapter 5** confirmed that even highly effective interventions, such as the R21/Matrix-M vaccine, cannot achieve their potential impact without well-timed, adequate financing; population pressure further plays a significant role. Delays in rollout—caused by misaligned or unavailable funding—translate directly into preventable mortality. The case of *Goodbye Malaria* illustrates that early-stage innovative support can dramatically improve intervention timelines

- **Funding Mandates Must Align with Innovation Stages:** *The Funding Matrix* ***(Figure 4)*** demonstrates that different types of capital are best suited to different stages of the Healthcare Innovation Lifecycle. Early-stage interventions require risk-tolerant, impact-first capital from SEs or philanthropic donors, while scale-up phases benefit from traditional capital with higher return expectations. Failure to match capital to the stage of innovation risks inefficiency, duplication, or stagnation.

- **Blended Finance Unlocks Complementary Strength:** The integration of SE capital with Traditional Finance, through de-risking instruments or co-investment platforms, offers a powerful model for aligning diverse stakeholder interests. Strategic alignment, not compromise, defines success in these models.

- **SEs Provide Critical Flexibility and Local Responsiveness:** Unlike traditional funders, SEs are structurally suited to navigate the institutional pluralism of fragile health systems. They can adapt to local constraints, deploy funds with fewer bureaucratic delays, and build trust through community-level engagement. This makes them essential actors not only in innovation development but also in delivery and adoption.

- **Economic Conditions Shape Financing Feasibility:** High lending rates, weak infrastructure, and limited public spending capacity—conditions seen in Mozambique—require alternative financing approaches. Commercial debt and venture equity are often unsuitable in these contexts. Concessional loans, CSR-linked contributions, and SE grants emerge as essential enablers, particularly when coordinated through structured platforms.

8.2 Strategic Recommendations

- **Institutionalize Blended Finance Platforms:** Governments and global health bodies should work with SEs and DFIs to create standardized blended finance vehicles for health innovation. These should include risk-sharing instruments (e.g., first-loss guarantees), concessional tranches, and clear impact evaluation frameworks to attract both philanthropic and commercial capital.

- **Map Capital to the Healthcare Innovation Lifecycle:** Public health agencies and SEs should adopt tools such as the *Funding Matrix* to strategically match funders to specific innovation phases.

This will optimize capital deployment, prevent stage-based funding gaps, and ensure that promising innovations do not stall before reaching scale.

- **Prioritize SE Capacity Building in High-Burden Countries:** To enhance their long-term impact, SEs in developing economies need support in governance, financial modelling, digital infrastructure, and policy navigation. Donors and multilateral actors should invest in SE ecosystem strengthening, enabling them to scale and sustain operations beyond short-term interventions.

- **Create National SE Funds for Health Innovation:** Inspired by Mozambique's *Fundo da Malária*, countries should consider establishing dedicated SE-driven Healthcare Innovation funds. These vehicles can pool donor and CSR capital, support rapid response, and align innovation rollout with national health priorities. Legal and regulatory frameworks must be adapted to enable these structures.

- **Promote Policy Alignment and Regulatory Reform:** National governments should integrate SE participation into health strategies and ensure procurement, licensing, and funding policies accommodate blended models. International donors and DFIs can support this by providing technical assistance and facilitating South-South knowledge transfer on SE best practices.

These recommendations are intended to move beyond project-level interventions and toward systems-level reform. By reconfiguring how capital is mobilized, allocated, and governed, stakeholders can build innovation ecosystems that are not only more inclusive and effective, but also more resilient. While this study focused on malaria in Mozambique, the strategic principles outlined here hold value for addressing other endemic diseases across similarly constrained Developing Countries. The concluding chapter now reflects on research limitations and proposes key directions for future study—both to test the generalizability of findings and to strengthen the operational relevance of SE funding in global health contexts.

9 CRITICAL EVALUATION AND DIRECTIONS FOR FUTURE RESEARCH

Building on the insights of this case study, this chapter offers a critical appraisal of its methodological constraints and outlines priority areas for future research. While the study contributes meaningfully to the literature on SE funding and healthcare innovation in low-income contexts, particularly for malaria treatment in Mozambique, several limitations constrain its broader application.

One major limitation of this research lies in its exclusive reliance on secondary data sources. Although national and international datasets provided sufficient macro-level indicators, the absence of primary data collection limited the study's ability to capture qualitative insights from on-the-ground stakeholders. Direct interviews with SE operators, local health authorities, or representatives from donor agencies might have revealed more nuanced understandings of practical barriers, governance dynamics, and context-specific implementation challenges. Additionally, while the predictive model used in **Chapter 5** offers a valuable lens for visualizing potential outcomes of different funding strategies, it does not establish causality between specific funding interventions and health outcomes. Rather, the projections are based on historical trend extrapolation and are therefore best viewed as indicative rather than definitive.

The limitations of available data also presented challenges. Financial information specific to social enterprise activity in Mozambique was often embedded within broader development financing flows, making it difficult to isolate the direct impact of SE funding with precision. In many cases, contributions from SEs were entangled with NGO-led or bilateral efforts, complicating efforts to attribute innovation or access outcomes to a specific funding source. Furthermore, the scope of the research was restricted to malaria—a highly relevant but singular disease context. The modelling and funding analysis were not extended to other diseases, which may follow different innovation trajectories or face unique financing constraints. Finally, the deliberate focus on Mozambique raises questions of transferability, as findings may not apply uniformly to countries with different economic structures, policy environments, or healthcare governance systems.

To address these limitations and deepen the impact of this research stream, several avenues for future investigation are proposed:

- Comparative studies across multiple high-burden countries such as Nigeria, the Democratic Republic of Congo, or Uganda would help validate the generalisability of the findings. Applying the same framework in different political and economic contexts would illuminate regional variations in funding dynamics and innovation capacity.

- Future research should include primary data collection, particularly through interviews, surveys, or fieldwork with SEs, healthcare innovators, and public-sector actors. This would allow researchers to better understand how blended financing models are constructed, operationalised, and adapted in real time.

- Future work should aim for more specific impact evaluation. Collaborations with SEs and national ministries could facilitate access to detailed project-level data, enabling cost-effectiveness analyses and identification of which funding mechanisms most effectively support speed-to-impact.

- The conceptual framework developed here should be applied to a broader range of disease contexts—such as tuberculosis, schistosomiasis, HIV/AIDS, and maternal health—to assess its versatility and relevance across different health needs.

- Integrating health economics modelling, using tools such as Disability-Adjusted Life Years and Quality-Adjusted Life Years, would allow more robust prioritisation of interventions and direct

comparability with existing cost-benefit thresholds in global health policy.

- Scenario modelling under conditions of political and economic instability represents a crucial area for future exploration. Health systems in low-income countries are often subject to abrupt shocks—ranging from foreign aid withdrawal and currency crises to civil unrest and pandemics. Expanding future models to simulate these contingencies would help test the resilience of different financing strategies and offer insights into how SEs and blended models might respond under stress.

- Further research should explore whether blended financing models can be implemented within a single organisation. Working in collaboration with a social enterprise or mission-driven healthcare company could help determine whether internal capital layering, risk allocation, and return-tiering strategies are feasible at the organisational level.

- More research should also be directed toward the COVID-19 vaccine rollout as a real-world example of accelerated, large-scale innovation. The mobilisation of capital, cross-sector collaboration, and rapid implementation during the pandemic offer valuable lessons that could inform new frameworks for health innovation—particularly in emergency contexts or for underfunded diseases.

Together, these future research directions are essential not only for validating the findings of this study but also for advancing the operationalisation of SE funding models within the global health financing landscape. By deepening, broadening, and stress-testing this framework, future work can contribute to a more inclusive, scalable, and context-sensitive approach to funding healthcare innovation in resource-constrained settings.

10 CONCLUSION

This research set out to examine whether SE funding, when integrated into a Blended Finance Model, can narrow critical gaps in the innovation and delivery of malaria treatments in Mozambique—a country that remains heavily burdened by the disease despite decades of global efforts. The study combined a conceptual framework, country-specific modelling, and an original Funding Matrix to evaluate how different capital types interact with stages of the Healthcare Innovation Cycle.

The findings support the central hypothesis: SE funding, when aligned strategically with innovation timelines, plays a catalytic role in addressing the persistent Healthcare Finance Gap, in Developing Economies. Traditional financing models, governed by return-on-investment expectations and risk aversion, consistently fail to support early-stage or community-level health interventions in low-income settings. In contrast, SE-aligned capital—such as crowdfunding, philanthropic funding, and CSR-driven investment—fills this void, particularly when combined with concessional tools offered by Development Finance Institutions (DFIs) and sovereign partners.

The predictive model developed in this thesis shows that well-timed innovations like the Goodbye Malaria initiative (2013) and the anticipated R21/Matrix-M vaccine rollout (2026) can substantially reduce malaria-related mortality. Importantly, it demonstrates that timing and financing structure matter as much as the technology itself. Without early-stage, risk-tolerant funding—often led by SEs—many innovations would fail to reach the populations who need them most.

The Funding Matrix developed in this research further clarifies the functional role of each funder type and identifies high-potential intersections for blended finance. This framework is both descriptive and prescriptive: it reveals how existing funding misalignments can be restructured, and how future capital strategies should be designed to deliver both social and financial outcomes.

In summary, this thesis makes the case that strategic alignment—not simply greater capital volume—is the key to unlocking healthcare innovation in low-return environments. By reframing SE funding not as supplementary, but as foundational within blended finance ecosystems, this research offers a new model for sustainable, scalable healthcare transformation in Mozambique and other malaria-endemic settings.

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APPENDIX

Appendix A.

Table A.1. **Mozambique Malaria Mortality Trends and Projections (1980–2040): Impact of Interventions Across Population Growth**

Year	Population	Recorded Deaths Smoothed			Deaths as a % of Population
		Pre-Intervention	Current Intervention	Pending Intervention	
1980	11 413 587	28 118			0,25%
1981	11 640 015	28 621			0,25%
1982	11 901 827	29 137			0,24%
1983	12 163 328	29 688			0,24%
1984	12 426 223	30 272			0,24%
1985	12 680 065	30 787			0,24%
1986	12 909 797	31 186			0,24%
1987	12 964 793	31 628			0,24%
1988	12 956 772	32 046			0,25%
1989	13 087 604	32 371			0,25%
1990	13 303 459	32 410			0,24%
1991	13 561 175	32 245			0,24%
1992	13 816 881	32 068			0,23%
1993	14 206 254	31 517			0,22%
1994	14 912 873	31 632			0,21%
1995	15 594 830	31 819			0,20%
1996	16 079 553	32 278			0,20%
1997	16 521 724	32 661			0,20%
1998	16 923 195	31 761			0,19%
1999	17 337 893	30 860			0,18%
2000	17 768 505	29 960			0,17%
2001	18 220 716	29 060			0,16%
2002	18 694 946	28 160			0,15%
2003	19 186 754	27 410			0,14%
2004	19 694 411	26 660			0,14%
2005	20 211 114	25 909			0,13%
2006	20 735 982	25 159			0,12%
2007	21 280 513	24 409			0,11%
2008	21 845 571	23 659			0,11%
2009	22 436 660	23 849			0,11%
2010	23 073 723	23 455			0,10%
2011	23 760 421	23 302			0,10%
2012	24 487 611	23 764			0,10%
2013	25 251 731	23 197	23 197		0,09%
2014	26 038 704	23 106	21 866		0,08%

2015	26 843 246	23 015	20 963		0,08%
2016	27 696 493	22 924	19 817		0,07%
2017	28 569 441	22 834	18 980		0,07%
2018	29 423 878	22 764	18 096		0,06%
2019	30 285 595	22 694	18 041		0,06%
2020	31 178 239	22 624	17 986		0,06%
2021	32 077 072	22 555	17 930		0,06%
2022	32 969 518	22 486	17 875		0,05%
2023	33 897 354	22 417	17 820		0,05%
2024	34 858 402	22 348	17 766		0,05%
2025	35 834 558	22 280	17 711		0,05%
2026	36 838 050	22 211	17 657	16 845	0,05%
2027	37 869 643	22 143	17 603	16 020	0,04%
2028	38 930 124	22 075	17 549	15 237	0,04%
2029	40 020 302	22 007	17 495	14 491	0,04%
2030	41 141 009	21 940	17 441	13 782	0,03%
2031	42 293 100	21 873	17 388	13 740	0,03%
2032	43 477 453	21 806	17 334	13 698	0,03%
2033	44 694 973	21 739	17 281	13 656	0,03%
2034	45 946 587	21 672	17 228	13 614	0,03%
2035	47 233 250	21 606	17 175	13 572	0,03%
2036	48 555 945	21 539	17 123	13 531	0,03%
2037	49 915 680	21 473	17 070	13 489	0,03%
2038	51 313 492	21 407	17 018	13 448	0,03%
2039	52 750 447	21 342	16 965	13 407	0,03%
2040	54 227 642	21 276	16 913	13 365	0,02%

Appendix B.

Appendix B.1

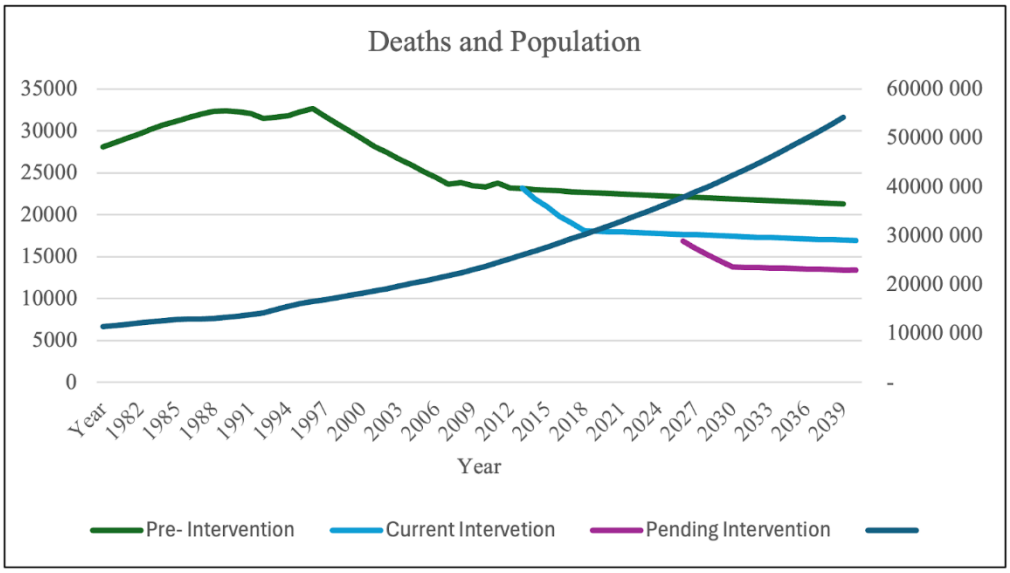

Figure B.1. **Projected Malaria Deaths and Population Growth under Three Intervention Scenarios in Mozambique (1980 - 2040)**

Appendix B.2

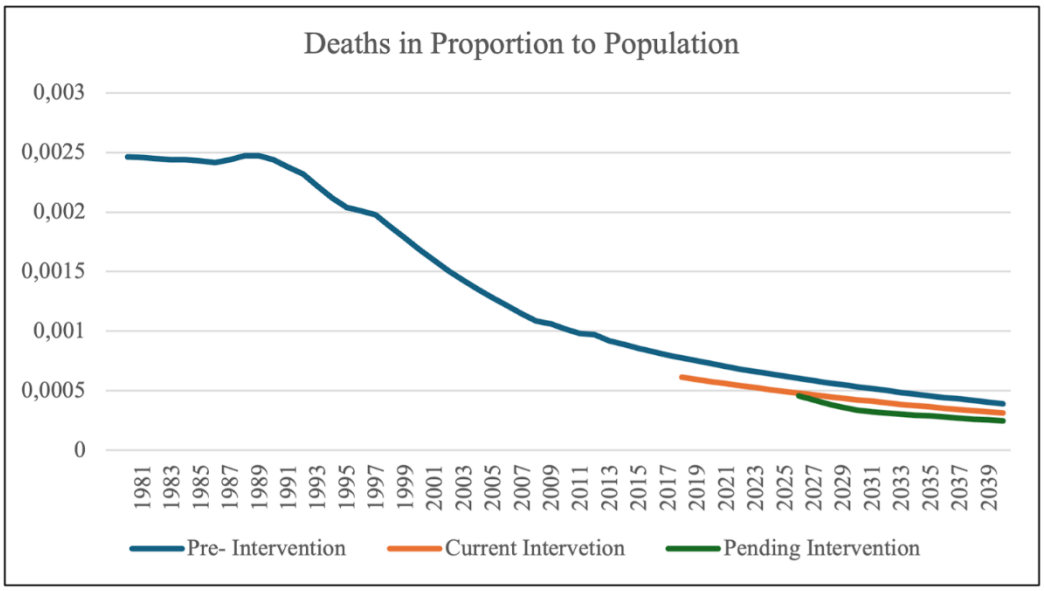

Figure B.2. **Malaria Deaths as a Proportion of Population Under Three Intervention Scenarios in Mozambique (1980 - 2040)**

AI DECLARATION FORM

Note: This form can be found on the following page.

Appendix: Declaration on the use of generative AI systems during BME projects

Title of the project:	Evaluating the Role of Social Enterprise Funding in Malaria Treatment Development in Mozambique: Lessons for Addressing Endemic Diseases in Developing Economies
Your full name:	Gallia Fenster
Student number:	s5076293

In the project I have used systems based on generative artificial intelligence (AI)[1, 2]
(please check one of the boxes with X).

☐ Yes ☐ No

If you have selected "Yes", complete the rest of the form. If you have selected "No", simply fill in the place, date and signature below.

I have used the following generative AI based systems in the creation of this thesis: [1, 2]
(please list all systems used below)

1.	ChatGTP-4o (OpenAI)
2.	Mistal AI
3.	_____
Other:	_____

I further declare that I
(please check one of the boxes with X).)

☐ have actively informed myself about the capabilities and limitations of the above-mentioned AI systems to the extent that I can use them responsibly,
☐ have labelled the content taken from the AI systems listed above with my details in the table below,
☐ have verified that the content generated by the above-mentioned AI systems and adopted by me is factually correct,
☐ am aware that, as the author of this work, I am responsible for the information and statements made in it,
☐ am aware that the violation of the disclosure of the use of generative AI in my work is a deception and leads to an evaluation with an insufficient grade.

- Indicate in the table on the next page when the above-mentioned AI systems have been used during your project.
- When you have completed and signed the form, please add it to the beginning of your thesis/report, straight after the standard title page).

[1] This declaration does not apply to the use of basic widely used tools for checking spelling and grammar, translating texts and improving software quality for data analysis and software prototypes.
[2] If you are unsure whether an IT system used is a generative AI system and/or whether you need to declare it, declare it.

I have applied the above-mentioned AI systems as indicated below.

Areas of contribution	Number AI system(s) used	Description of the manner of use and compliance with good scientific practice, if necessary separately by chapter of the work
Development and conception of the research project	1; ChatGTP-4o (OpenAI)	Used to refine and narrow a broad research idea. My initial thoughts were vague and unclear; they lacked direction. AI assisted me in organizing my thoughts and provided me with specific directions to go in. Example of prompt used: "My thesis topic is currently too broad: I want to explore healthcare innovation in developing countries with a focus on investment. Please give me some possible subtopics of research within this. I am currently studying Biomedical Engineering, thus, please also provide me with topics relevant to Business which are necessary to form a background understanding; explain why you feel each topic could be relevant. Take the role of an educational facilitator."
Collection and evaluation of literature sources	1; ChatGTP-4o (OpenAI)	Suggested broad search terms and key topics to put into the search databases mentioned in the Approach section of this paper. Prompt: "What keywords should I use to search for academic sources on social enterprise funding in malaria treatment?"
Elaboration, collection and/or procurement of data	NA	
Processing of data	NA	
Selection of methodology	1; ChatGTP-4o (OpenAI)	Assisted in matching the overall research approaches to aim. Critically evaluated whether the research I did – Chapter 5: Predictive Model and Chapter 6: Funding Matrix – matched my overall research aim. Additionally, critically evaluated the reliability and effectiveness of my methodology.

Programming	NA	
Analysis/evaluation of the data/sources	NA	
Interpretation of the analysis /evaluation and derivation of conclusions	1; ChatGTP-4o (OpenAI)	Helped identify limitations and weaknesses in my analysis. Prompt: "Based on the findings, what are potential limitations in my model? Suggest how I might express them critically."
Writing of the manuscript: Creation of visualizations	NA	
Writing of the manuscript: Structuring the text	1; ChatGTP-4o (OpenAI)	Assisted me with the overall structure of the report, ensuring it flowed well, logically and was comprehensive.
Writing of the manuscript: Formulation of text	1; ChatGTP-4o (OpenAI)	Prompted for clarity, relevance, and phrasing. Prompt: "Does this paragraph contribute to my research aim? What are its strengths and weaknesses? How can I improve it? Give me the reasoning for your suggestions."

Writing of the manuscript: Revision of text	1; ChatGTP-4o (OpenAI) and 2; Mistral AI	Used to evaluate written sections against the marking criteria. Prompt: "Here is my conclusion. Based on these … academic criteria, is it strong? Suggest specific improvements. Give me the reasoning for these suggestions." Note: the critera were taken from the marking guidelines provided by the University of Groningen.

Further contributions / additional information:

Throughout the process, I made sure to cross-check and validate any AI-generated content. I regularly instructed the AI not to use or cite external sources unless explicitly stated, and I personally verified factual accuracy to avoid accidental plagiarism. The AI was used as a brainstorming and refinement tool; all the core ideas, structure, and source integration reflect my own academic work. Additionally, the direction and novelty are of my own passion and interest.

Initially, I explored the possibility of using AI to summarise sources when the abstracts of papers were unclear. However, this proved inefficient, and once I began my critical literature review, I personally read all the papers in full. This approach deepened my understanding of the topic and ensured that I developed a strong foundational knowledge, which in turn supported my ability to advance and move forward with the research.

Place	Date	Signature
Groningen	28/06/2025