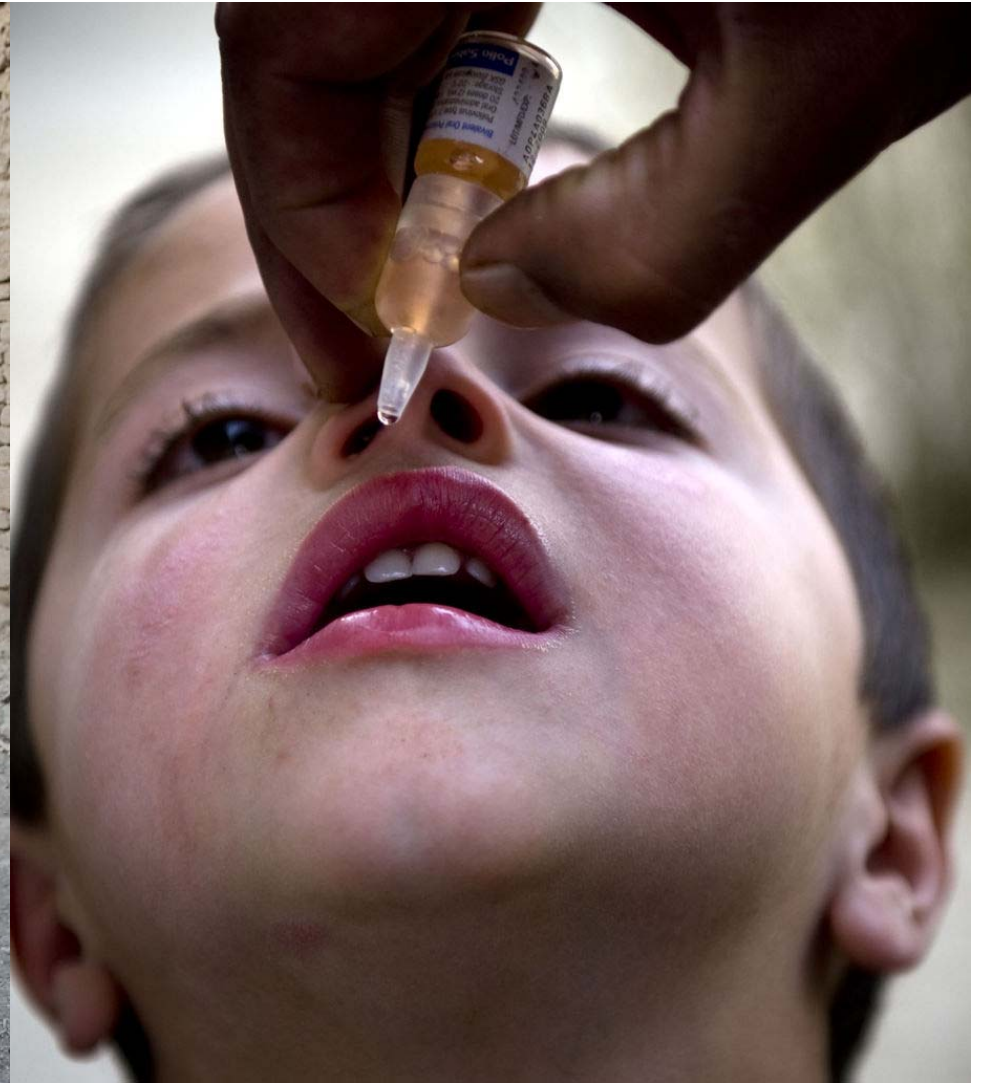


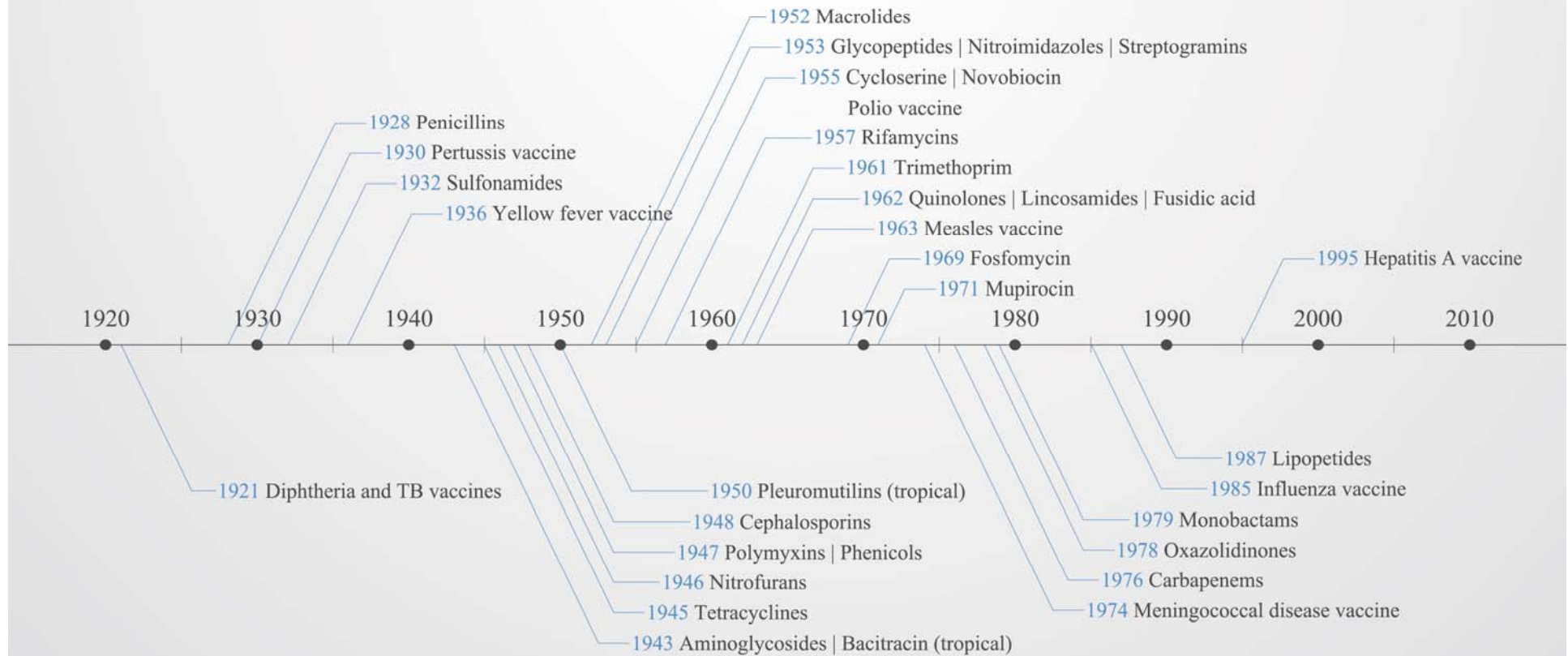
# GHITの活動から新薬開発へのファンディングを考える

BT Slingsby, CEO, GHIT Fund





# Anti-Infectives Over 100 Years



# Development of antibacterial agents in Japan

Period	1911-1955	1956-1975	1976-1995	1996-2015	Total
Penicillins	11	16	10	1	38
Cephems	0	6	40	2	48
Carbapenems and other $\beta$ -lactams* <sup>1</sup>	0	0	8	5	13
Aminoglycosides	7	8	8	0	23
Macrolides and lincosamides	5	15	8	2	30
Tetracyclines	5	9	0	1	15
Peptides* <sup>2</sup> and other antibiotics* <sup>3</sup>	9	8	4	4	25
Sulfonamides	19	11	2	0	32
Pyridone carboxylates	0	2	12	6	20
Miscellaneous antibacterials* <sup>4</sup>	10	4	0	2	16
Anti-TB* <sup>5</sup> and anti-HD* <sup>6</sup> drugs	11	14	0	3	28
Total	77	93	92	26	288

\*<sup>1</sup> monobactams,  $\beta$ -lactamase inhibitors

\*<sup>2</sup> including glycopeptides and lipopeptides

\*<sup>3</sup> chloramphenicol, fosfomycin, novobiocin, fusidic acid, mupirocin, streptogramins

\*<sup>4</sup> arzenobenzoles, nitrofurans, thiamphenicol, linezolid

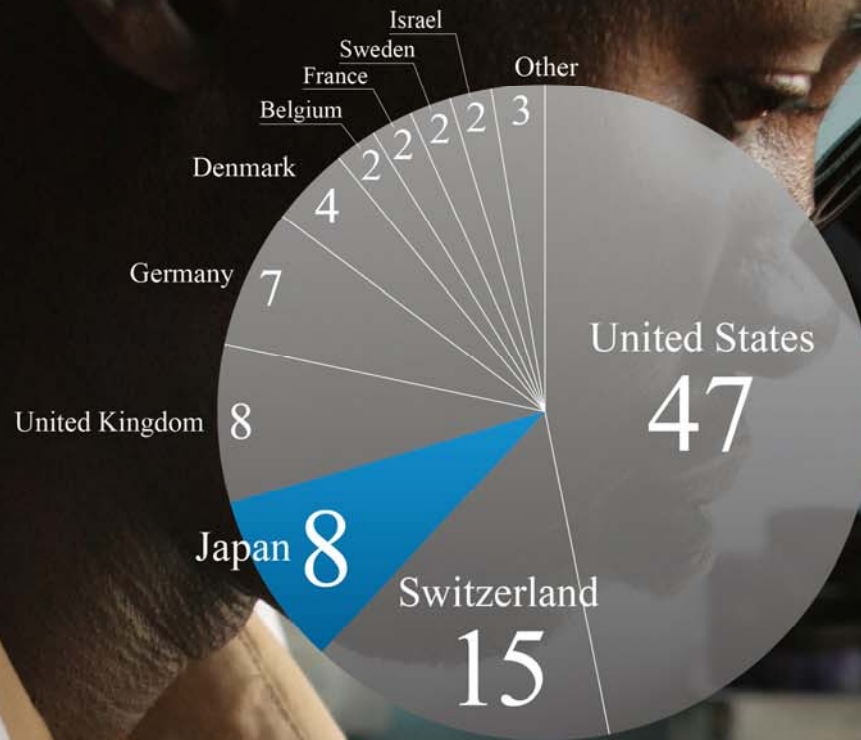
\*<sup>5</sup> anti-TB: anti-tuberculous

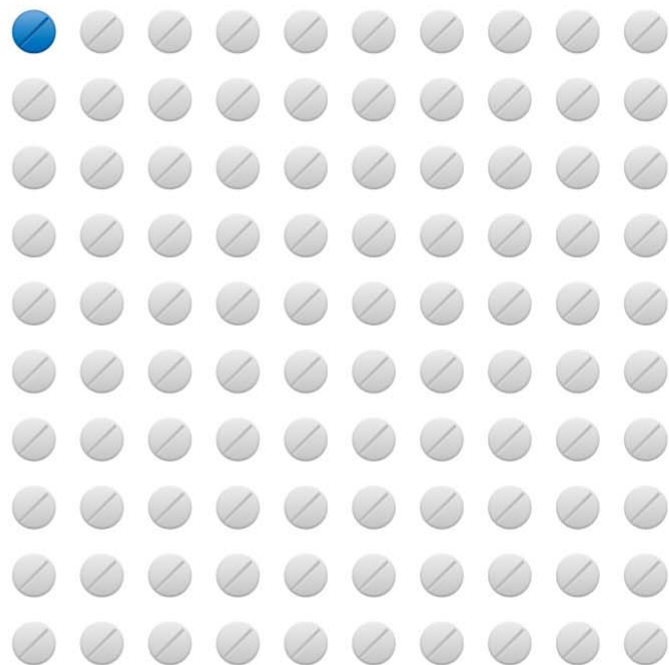
\*<sup>6</sup> anti-HD: anti-Hansen's disease

表 1. 世界標準となった“日本発”抗菌薬

- ・ コリスチン (1951 年)
- ・ セファゾリン (1971 年)
- ・ アミカシン (1977 年)
- ・ クラリスロマイシン (1991 年)
- ・ レボフロキサシン (1993 年)
- ・ メロペネム (1995 年)
- ・ ビベラシリン・タソバクタム (2001, 2008 年)

# JAPAN: Drug Development World Ranking: No.3

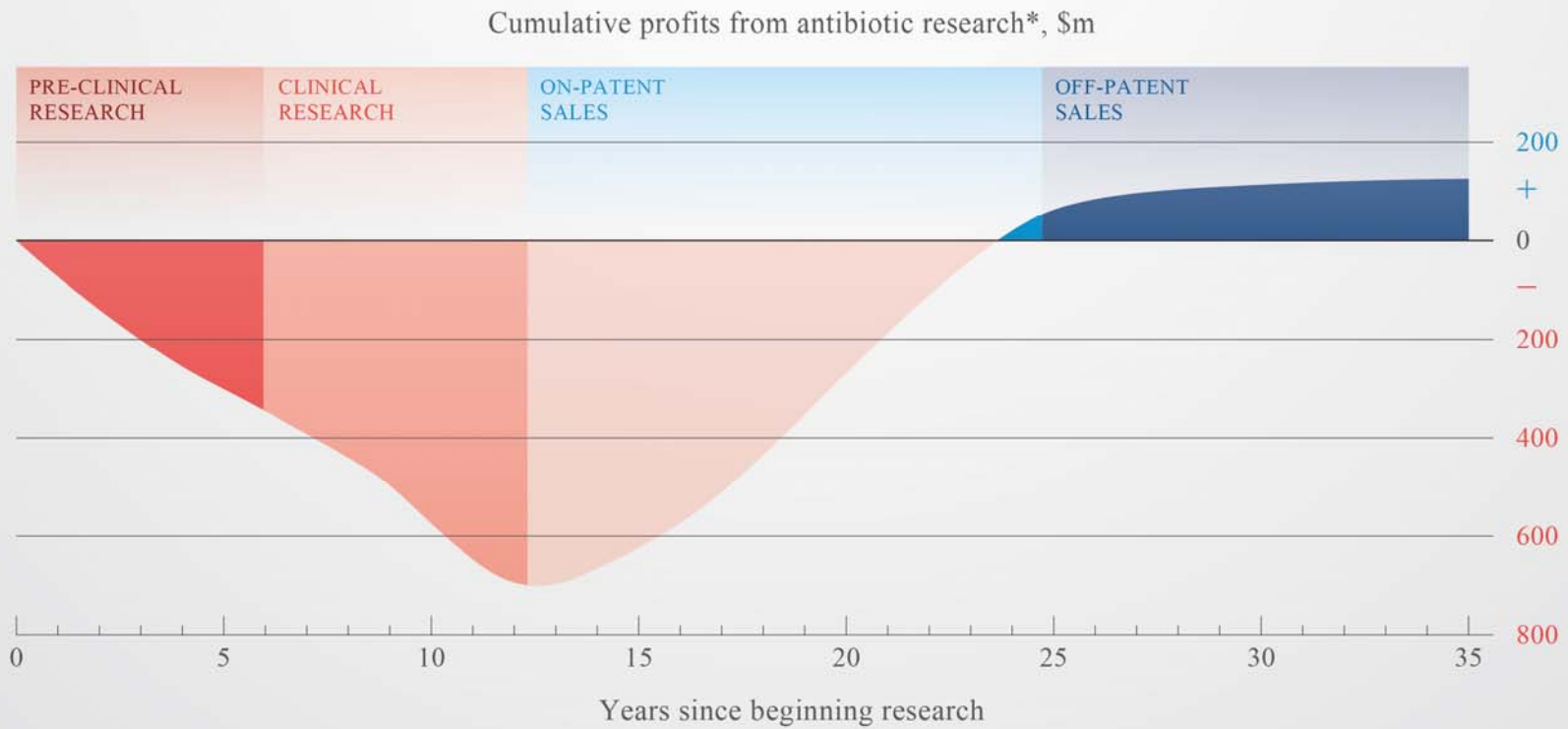




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—  
100

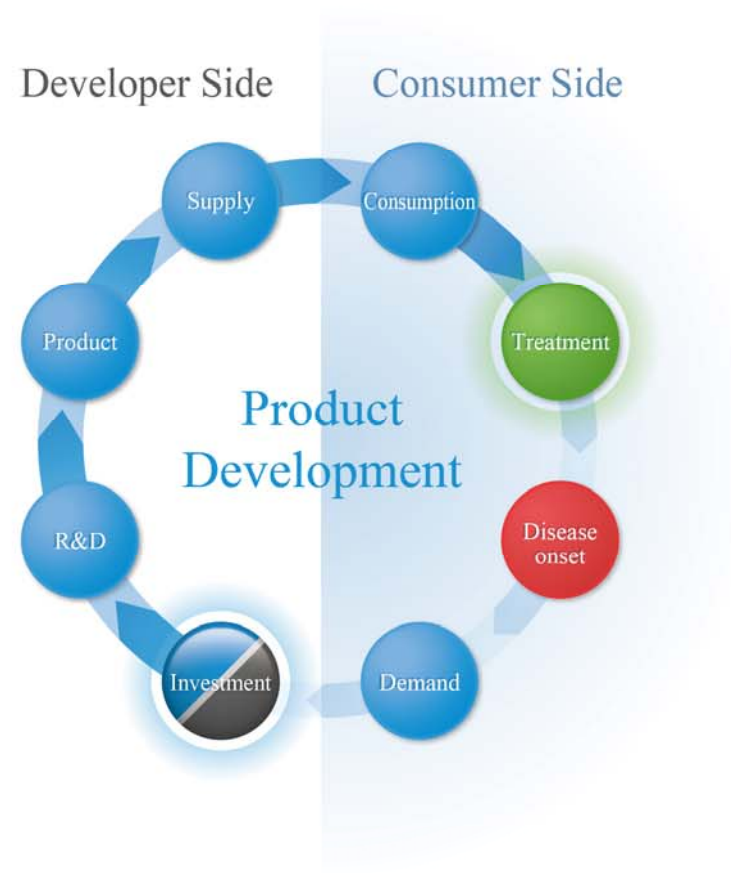
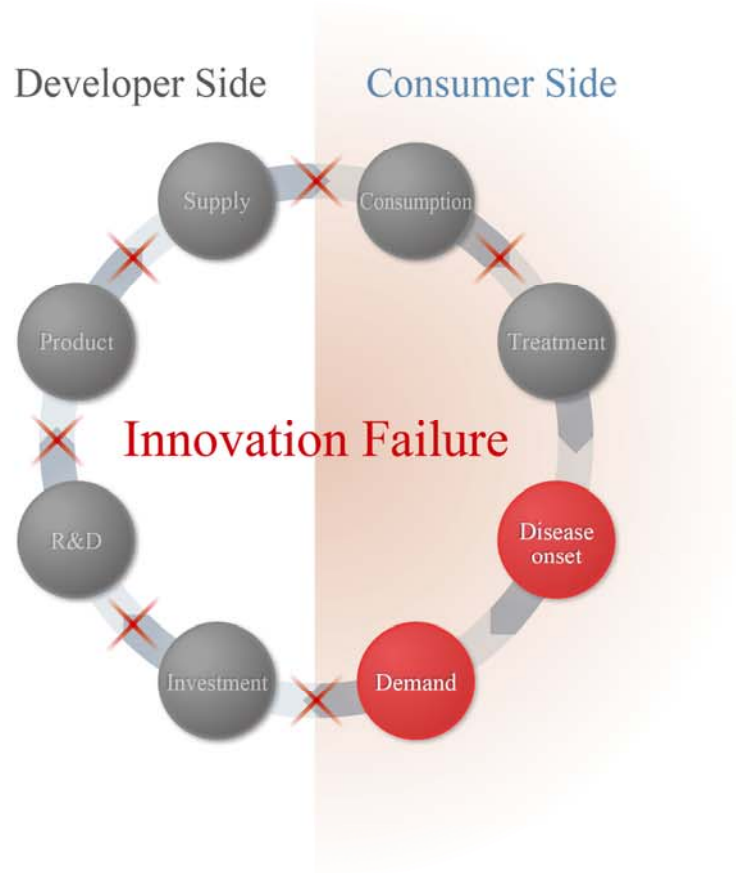
Of the 336 brand-new drugs (new chemical entities, or NCEs) approved for all diseases in 2000-2011, only four, or 1%, were for neglected diseases

# Breaking Even with Antibiotics



Source: Review on Antimicrobial Resistance

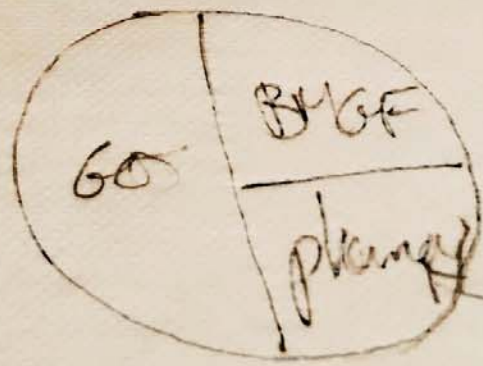
\*Based on average of representative sample of R&D processes





Global  
health  
BSPD.

COM



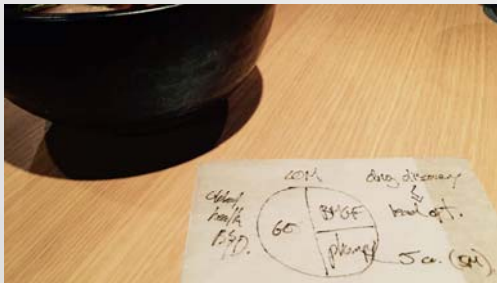
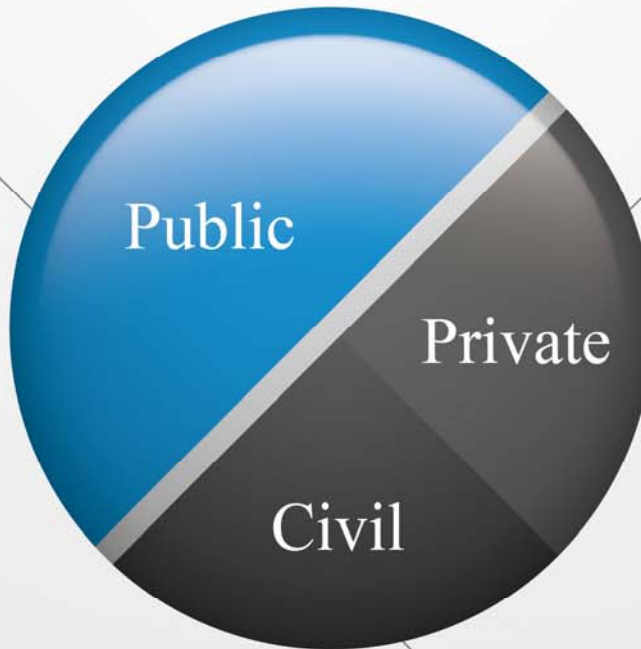
drug discovery  
↙  
lead opt.

5 ce. (SM)

# GHIT Founding Partners

June, 2013

USD 100M, 8 Partners



# GHIT Funding Partners

January, 2018

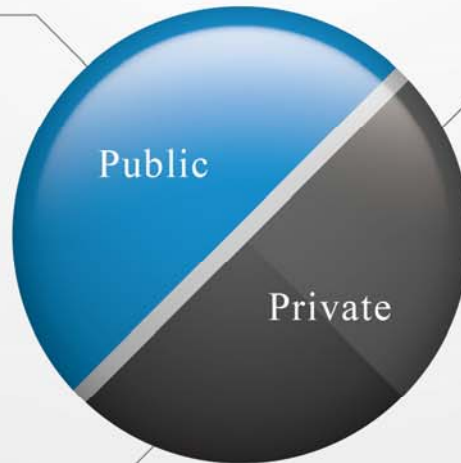
## Full Partners



## Full Partners



## Sponsors



## Full Partners



## Associate Partners



## Affiliate Partners





HIV/AIDS

1.0 M  
deaths in 2016



Malaria

445,000  
deaths in 2016



Tuberculosis

1.4 M  
deaths in 2016  
(0.4 M among people with HIV)

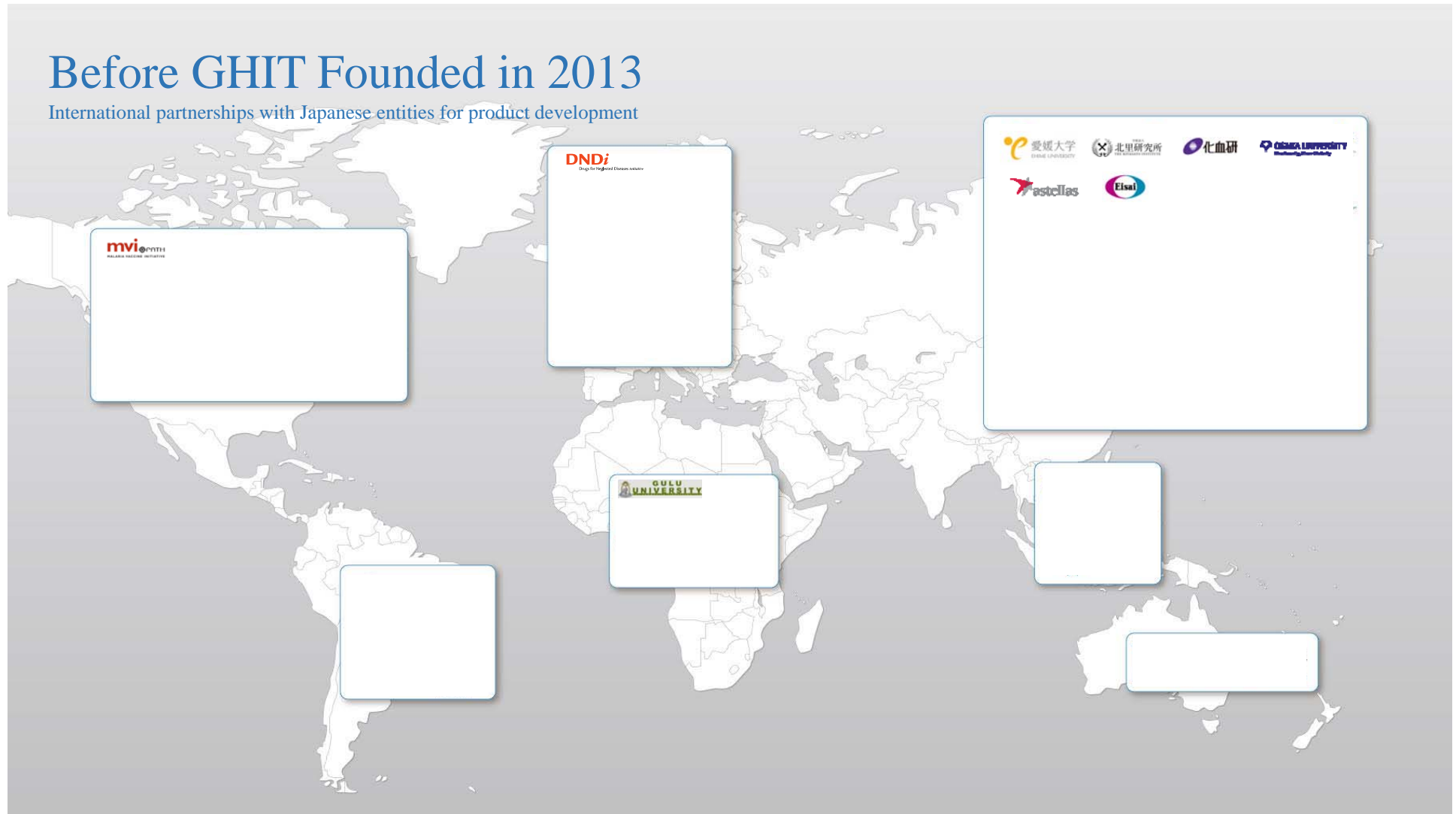


NTDs

1.0 B  
affected

# Before GHIT Founded in 2013

International partnerships with Japanese entities for product development

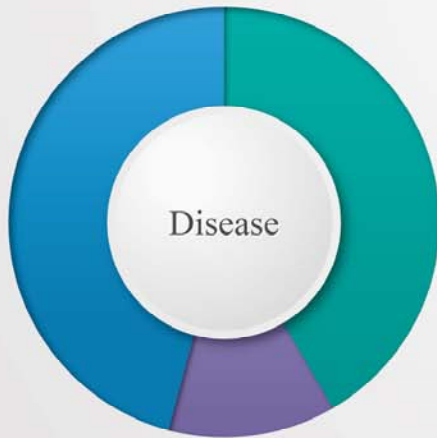


# GHIT Product Development Partners

Since 2013

41 Japanese Organizations    53 Non-Japanese Organizations

## Investments to Date US\$ 115.3million



Malaria 41.9%



Tuberculosis 12.5%



NTDs 45.6%



Drugs 70.8%



Vaccines 24.3%



Diagnostics 4.9%



Discovery 16.9%

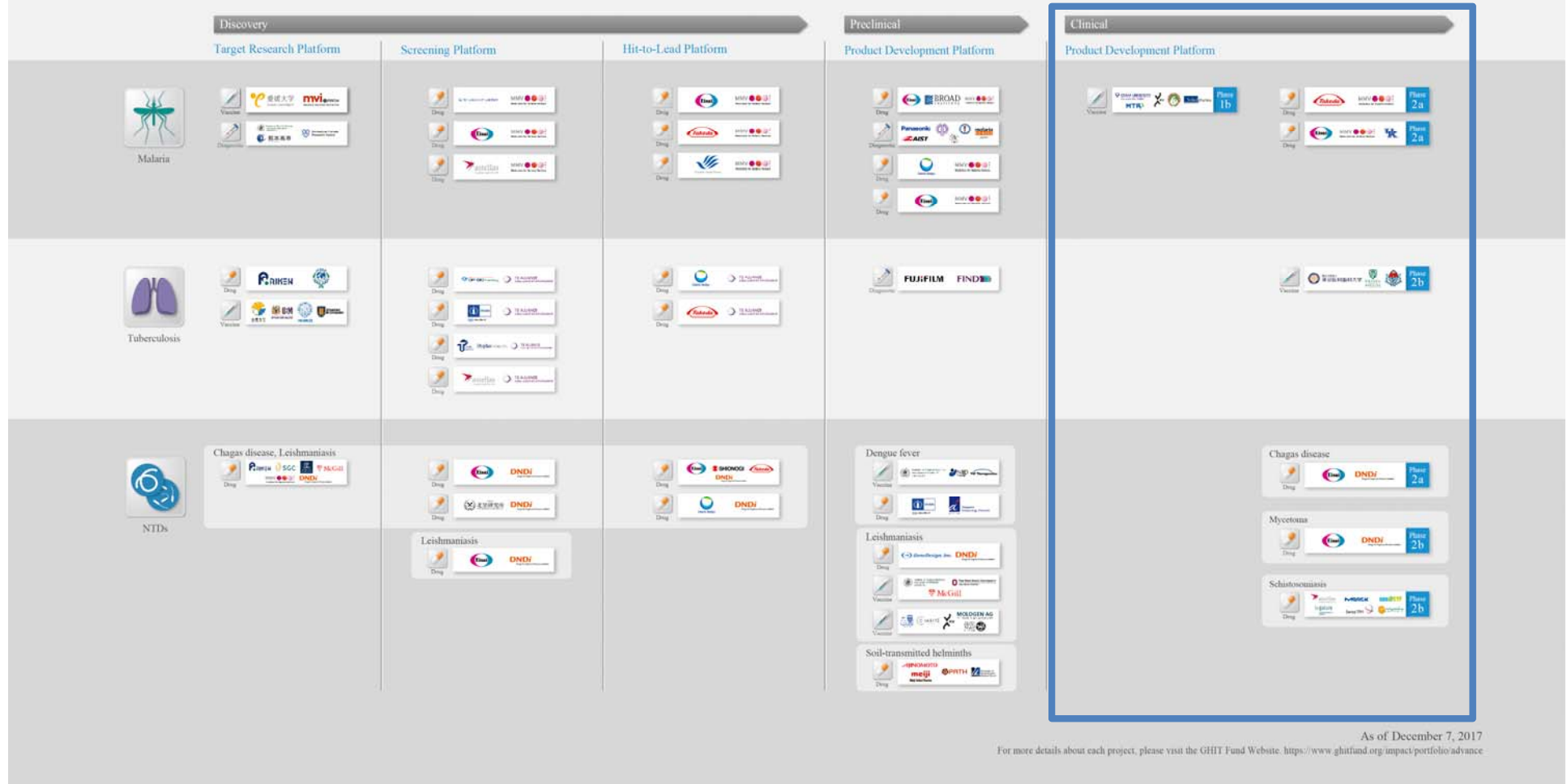


Preclinical 38.4%



Clinical 44.7%

# GHIT R&D Pipeline





# GHIT Invested Clinical Trials



**DSM265**

Disease: Malaria  
Intervention: Drug  
Development Stage: Phase IIa  
Country: Peru

PERU

BOLIVIA



**E1224**

Disease: Chagas disease  
Intervention: Drug  
Development Stage: Phase IIa  
Country: Bolivia



**(+)-SJ000557733**

Disease: Malaria  
Intervention: Drug  
Development Stage: Phase IIa  
Country: TBC

BURKINA FASO

IVORY COAST



**PZQ**

Disease: Schistosomiasis  
Intervention: Pediatric Drug  
Development Stage: Phase IIb  
Country: Ivory Coast

SUDAN



**BK-SE36/CpG**

Disease: Malaria  
Intervention: Vaccine  
Development Stage: Phase IIb  
Country: Burkina Faso, Uganda



**E1224**

Disease: Mycetoma  
Intervention: Drug  
Development Stage: Phase IIb  
Country: Sudan

TANZANIA

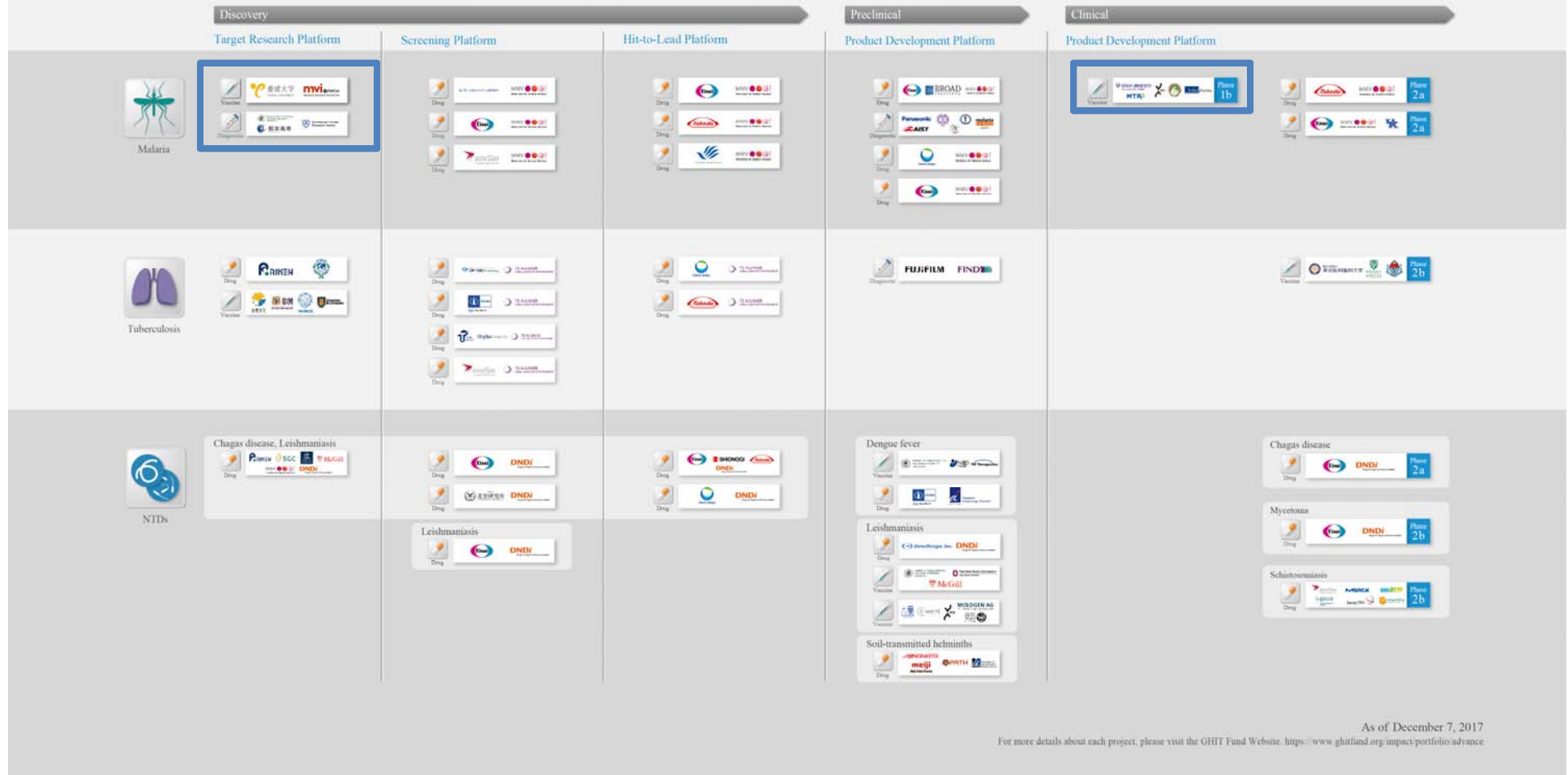


**DAR-901**

Disease: Tuberculosis  
Intervention: Vaccine  
Development Stage: Phase IIb  
Country: Tanzania

As of November 2017

# GHIT R&D Pipeline



# Malaria

445,000 people died in 2016

50% of the world's population at risk



A close-up photograph of a healthcare worker wearing white gloves administering a vaccine to a child's arm. The child is wearing a purple and green striped headband. The worker is holding a small blue and white vial. The background is slightly blurred, showing a yellow wall and a book.

## BK-SE36/CpG Malaria Vaccine

**Awarded Amount:** \$3,781,588

**Disease:** Malaria

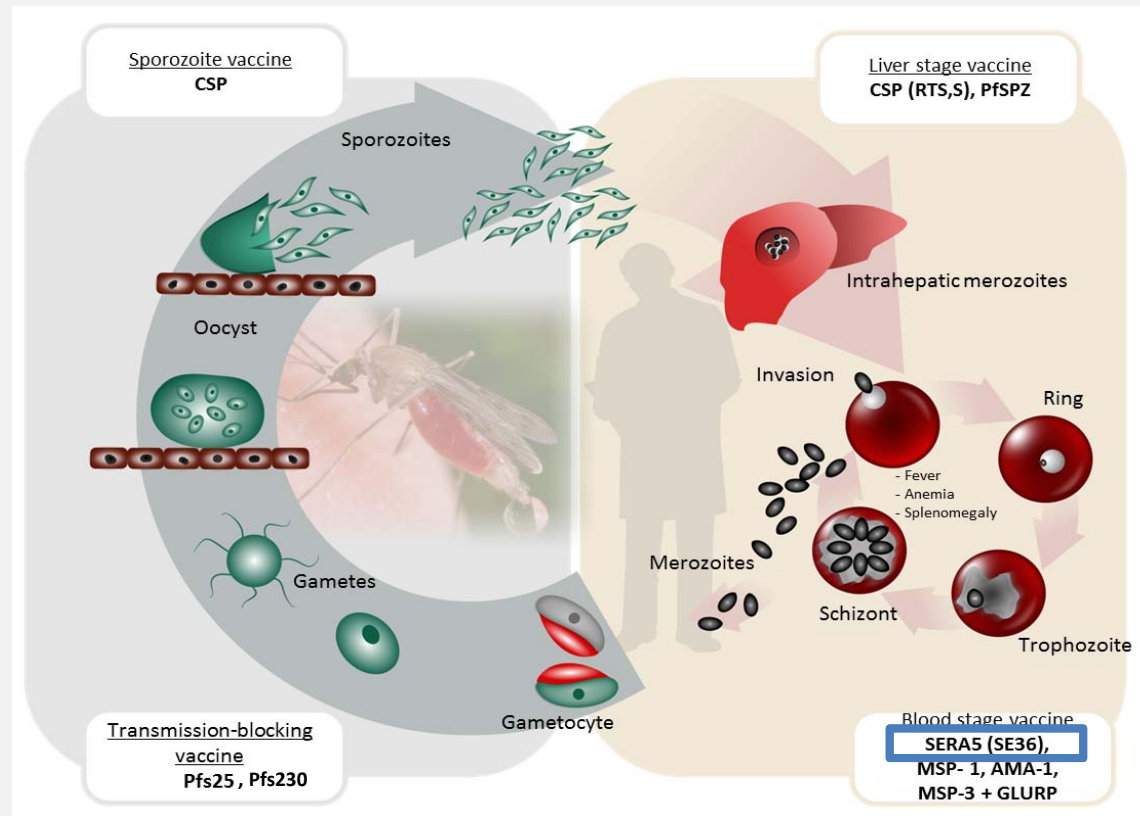
**Intervention:** Vaccine (BK-SE36/CpG)

**Development Stage:** Phase Ib

**Country:** Burkina Faso

**Collaboration Partners:** Medical Center for Translational Research, Osaka University Hospital, Burkina Faso National Center for Research and Training on Malaria, Nobelpharma Co., Ltd., RIMD, Osaka University, European Vaccine Initiative (EVI)

# Malaria vaccine targets



# Uniqueness of BK-SE36, BK-SE/CPG

---

1. SERA5 gene (BK-SE36) is much less polymorphic than other candidates.
2. BK-SE36 is stable for at least 6 months at 30°C. (For 10 years at 5±3°C.)
3. Vaccine induced antibody is boosted after natural malaria infection.
4. BK-SE36 vaccine is highly immunogenic in young children and naïve adults.
5. Anti-SE36 antibody solely inhibit parasite growth *in vitro*



# BK-SE36/CpG clinical trial in Burkina Faso

---

## ■ Objective

The project will assess the **safety** and **reactogenicity** of 3 doses of the malaria vaccine candidate BK-SE36/CpG

## ■ Project design

- Double blind, single-dosage, randomized, controlled, age de-escalating phase Ib clinical trial
- 135 healthy subjects in 3 age cohorts (adults > 21-years-old; 5-10 years-old, and 12-24 month-old) will be participating in the trial to received either BK-SE36 or a control vaccine.



A photograph of two scientists in a laboratory. On the left, a Black man in a white lab coat is looking through a microscope. On the right, a white man in a white lab coat is looking towards the first scientist. The background shows various laboratory equipment, including a white machine with a red logo and a stack of yellow equipment.

## A Vaccine to Block Malaria Transmission Pfs230 Antigen Design and Display

Awarded Amount: \$595,650

Disease: Malaria

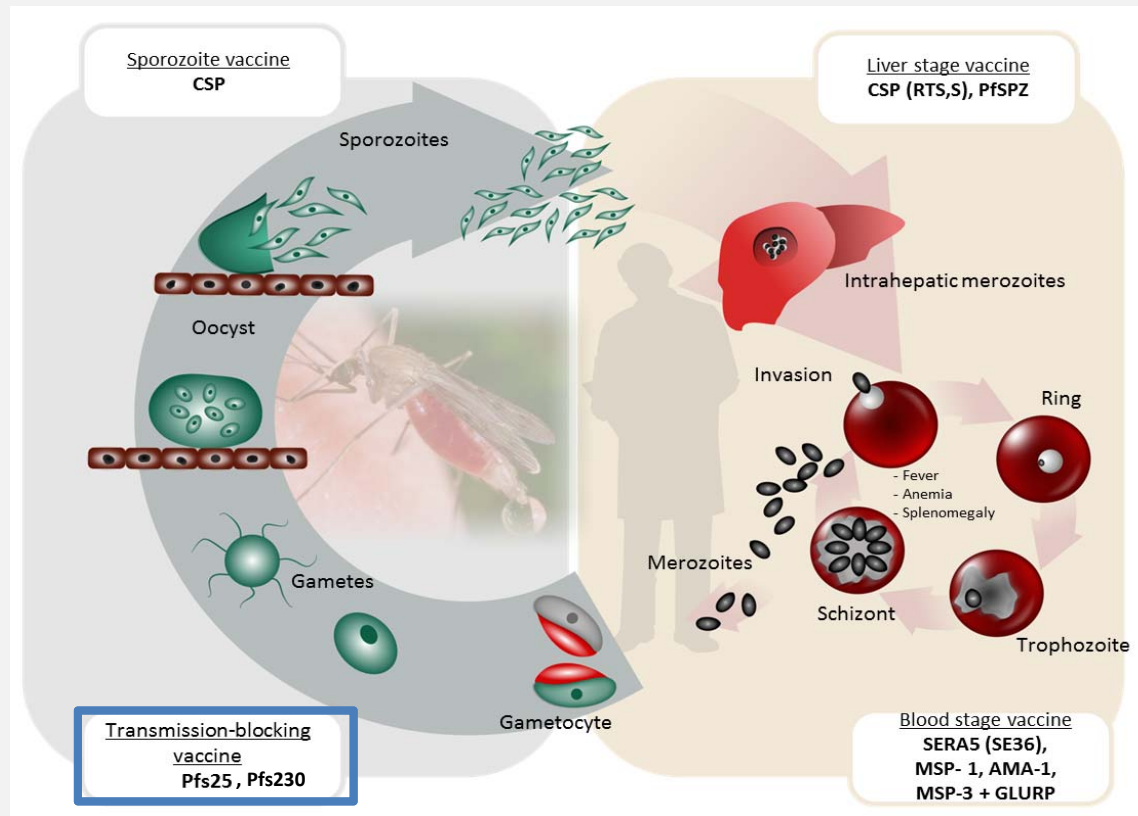
Intervention: Vaccine

Development Stage: Antigen Identification

Collaboration Partners: Ehime University, PATH Malaria Vaccine Initiative



# Malaria vaccine targets

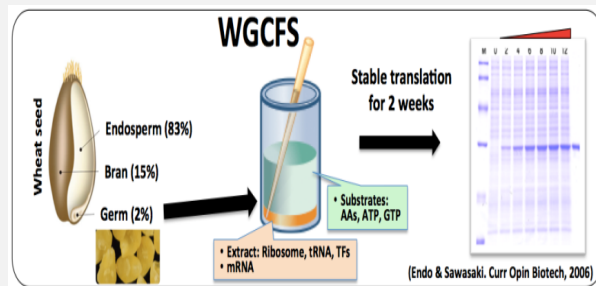


# Partnership between Ehime U & PATH MVI



## TBV basic research with WGCFS

- Candidate Discovery of TBV Antigens
- Wheat Germ Expression System (WGCFS) express quality malaria proteins
- Immunologic Evaluation



## TBV development

- Candidate Optimization & Production
  - Partnerships & capacities for optimization & production in scalable system
  - Adjuvant and formulation
- Candidate Evaluation
  - LMVR/NIH Ref Lab functional assays (SMFA)
- Translational Development
  - Human challenge models
  - Regulatory pathway



Towards rapid diagnosis of *Plasmodium vivax*  
malaria hypnozoite infection

Awarded Amount: \$728,830

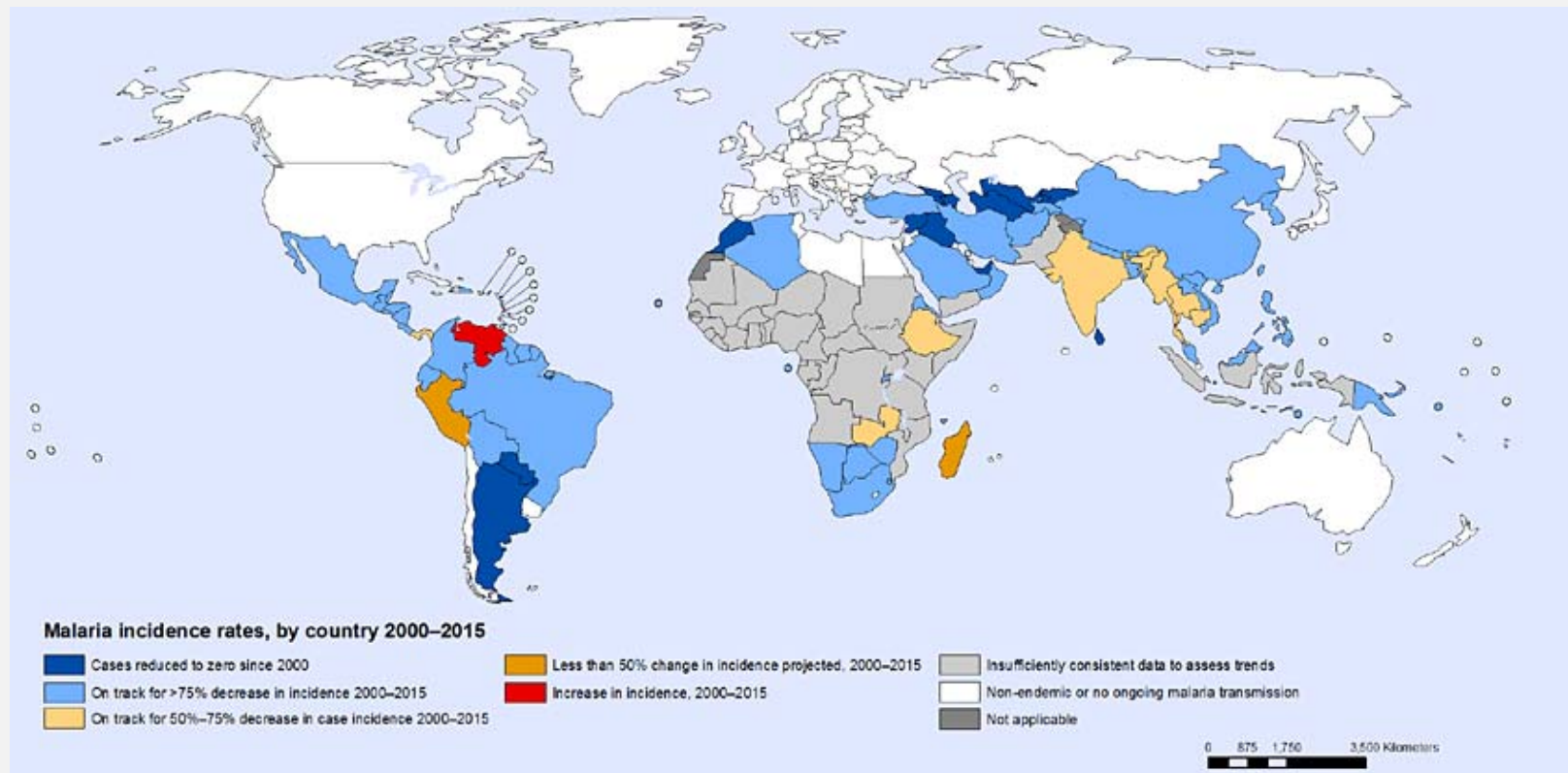
Disease: Malaria

Intervention: Diagnostics

Development Stage: Concept Development

Collaboration Partners: National Institute of Technology, Kumamoto College, Biomedical Primate Research Centre, Institute of Tropical Medicine (NEKKEN) Nagasaki University

# Projected changes in malaria incidence rates, by country, 2000-2015



A photograph showing a woman in a patterned blue and white dress holding a baby. The woman is looking down at the baby with a gentle expression. The baby is wearing a pink and white outfit. In the background, a large crowd of people is visible, many of whom are also holding babies. The scene appears to be outdoors, possibly at a community event or a market. The overall lighting is somewhat dim, and the image has a slightly grainy texture.

# GHIT Investment Mechanism

# Investment Mechanism



Survey



Define  
Target Product Profiles



Approve  
by the Board



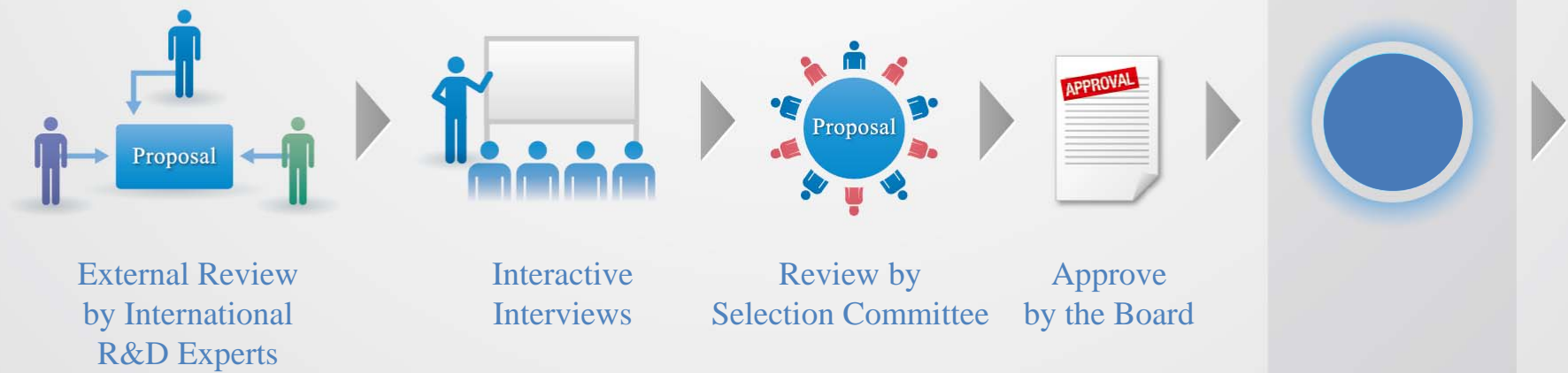
Request  
for proposals



## Define Target Product Profiles (TPPs)

	Drugs	Vaccines	Diagnostics
Malaria	<ul style="list-style-type: none"> <li>• Advance the eradication agenda with novel molecules:               <ul style="list-style-type: none"> <li>- single exposure radical cure &amp; prophylaxis and/or new drugs that could be used in combination that could address resistance issues</li> <li>- fast clearance long duration</li> <li>- targeting non-dividing stage</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Advance the eradication agenda:               <ul style="list-style-type: none"> <li>- transmission blocking vaccines</li> <li>- more effective prevention vaccines</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Accurate, sensitive POC RDTs(Point of Care Rapid Diagnostic Tests), specifically asymptomatic carrier.</li> <li>• RDT for Plasmodium falciparum and/or vivax with 2 logs better sensitivity and accuracy compared to current RDT product.</li> </ul>
Tuberculosis	<ul style="list-style-type: none"> <li>• Safer, faster-acting drug regimens with shorter treatment courses (<math>\leq 4</math> months)</li> </ul>	<ul style="list-style-type: none"> <li>• Preventative vaccines</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate, sensitive POC RDTs, specifically non-sputum TB diagnostics for carrier.</li> <li>• Universal point of care sample extraction and purification technologies.</li> </ul>
HIV	<ul style="list-style-type: none"> <li>• Long-acting injective 1st -line combination either for therapeutic/prophylactic</li> </ul>	<ul style="list-style-type: none"> <li>• Out of scope</li> </ul>	<ul style="list-style-type: none"> <li>• Whole blood viral load HIV POC RDTs (Finger stick)</li> <li>• Low cost HIV self-test RDT's using saliva</li> </ul>
Schistosomiasis	<ul style="list-style-type: none"> <li>• Safe and effective oral drugs and new pediatric formulations of existing drugs</li> </ul>	<ul style="list-style-type: none"> <li>• Preventative vaccines</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate, sensitive POC RDTs that can be used in hypoendemic geographies.</li> </ul>
Chagas disease	<ul style="list-style-type: none"> <li>• Safer and more effective drugs with shorter treatment courses (&lt; 30 days) and pediatric formulations</li> </ul>	<ul style="list-style-type: none"> <li>• Therapeutic and preventative vaccine</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate, sensitive POC RDTs</li> </ul>
Dengue	<ul style="list-style-type: none"> <li>• Safe and effective oral drugs</li> </ul>	<ul style="list-style-type: none"> <li>• Vaccines effective against all 4 serotypes</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate, sensitive POC RDTs</li> </ul>

# Investment Mechanism

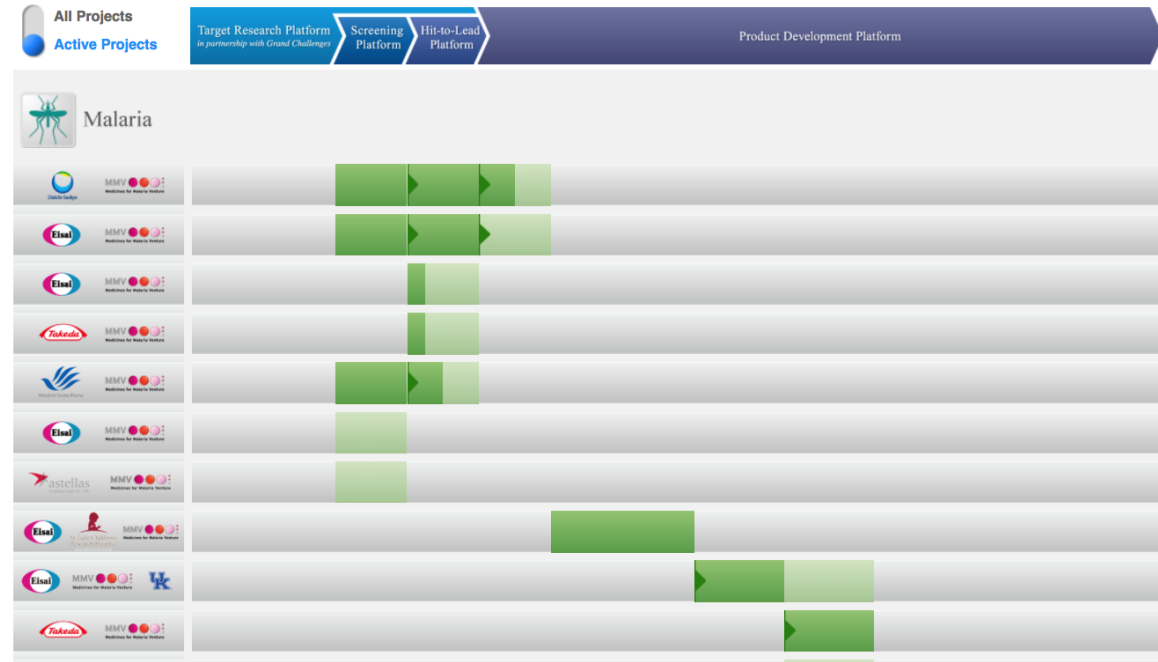




## GHIT Fund Advancing Portfolio

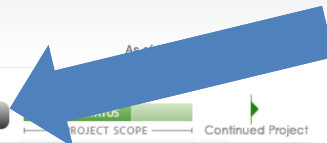
[Drug](#) [Vaccine](#) [Diagnostic](#) [Portfolio](#) [PDF Download](#) [PROJECT SCOPE](#) [Continued Project](#)

### DRUG DEVELOPMENT



\*Disclaimer: The awarded amount refers to the conditional investment figure agreed at the initiation of each project.  
As of 2017.12.07

Click



# Milestone-based Investment & Project Management

■ STAGE-GATE    ■ MILESTONE    ■ STAGE-ACTIVITY  
 Legend  
■ Successfully Completed    ■ Discontinued

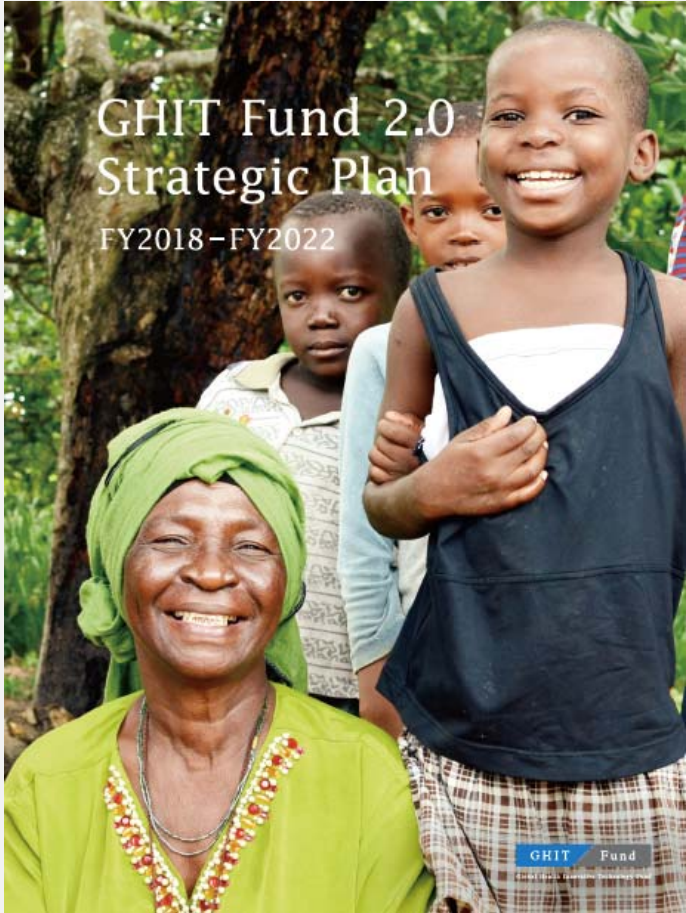
### Project Scope vs Current Reporting Period Status

For example, a successful investment in a Phase 2 clinical trial would add one stage gate and five milestone advancements. For the semi-annual program report, partners designate the current state of the project by specifying the project's current activity. For example, completing the study portion of the Phase 2 clinical trial by the second reporting period would credit the project with one stage gate and four milestone advancements. A green triangle represents a continued investment.

Phase	Phase 2		Phase 3		Phase 4		Phase 5	
	Start	End	Start	End	Start	End	Start	End
Phase 2	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Phase 3	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Phase 4	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Phase 5	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed

## DRUG DEVELOPMENT





R&D



Delivery

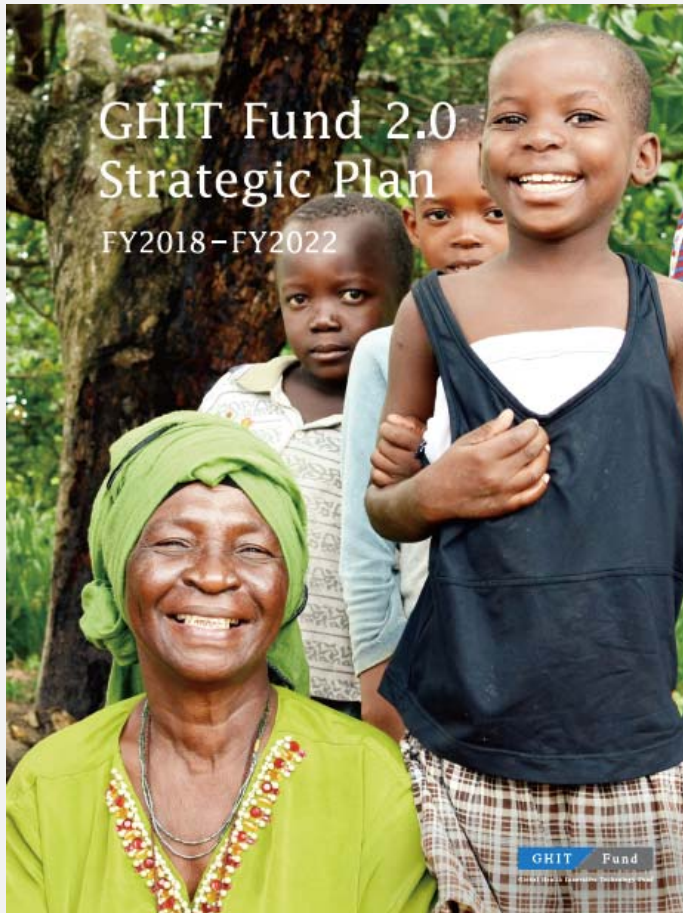


Governance



Finance





## R&D

- 2 Products approved
- 3 POC achieved
- 5 FIH conducted
- 8 Preclinical candidates identified
- 5 Hit-to-Lead programs identified
- 5 Innovative diagnostics identified

## Delivery



## Governance



## Finance



**GHIT** Fund

**Global Health Innovative Technology Fund**

*Innovation Changes Health. Change Innovation.*