APOPO:

A Case Study in Social Enterprise Development

Using the Four Lenses Approach

A Supplement to the Four Lenses Strategic Framework

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1   Methodology

This case represents the second installment of a case study series developed to test and enhance the "Four Lenses Strategic Framework" as a tool for analyzing organizational behavior and performance in aspiring and established social enterprises. It is organized around four key performance criteria: Depth of Impact, Blended Value, Efficiency, and Adaptability. These criteria are further examined through four intrinsically linked strategic lenses: Stakeholder Engagement, Resource Mobilization, Knowledge Development, and Culture Management. The Four Lenses Strategic Framework is an integrated approach to social enterprise that postulates that high performance is linked to an organization's activities across the Four Lenses. Building on this premise, the APOPO[1] case study describes activities across strategic focus areas and illuminates the synergies and tensions that arise when taking an entrepreneurial approach to addressing a social problem like appropriate technology in Eastern Africa. The case study highlights the organization's many notable strengths, and illustrates potential implications of APOPO's shift towards a social enterprise model, the challenges that lie ahead, and the lessons this case holds for similar organizations.
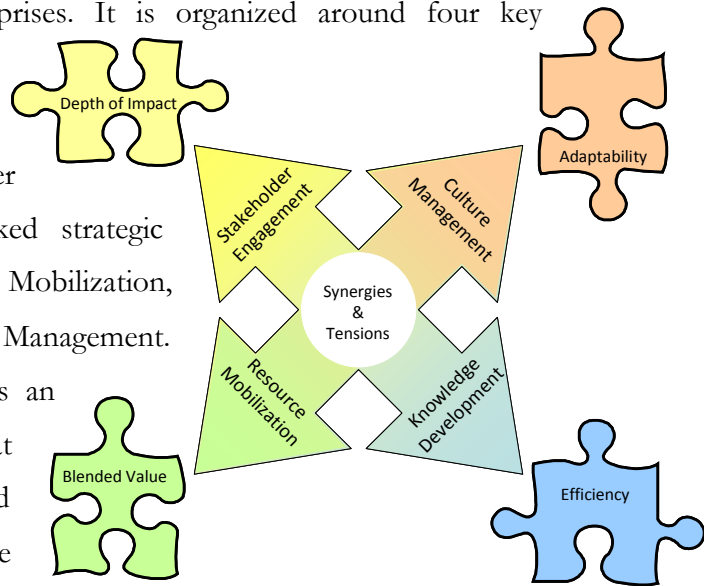
Performance Criteria	Primary lens through which performance is delivered…	Secondary lenses further enhancing or hindering performance…
Depth of Impact	How successful are we at engaging all stakeholders deeply and durably?	How do our culture, resources and knowledge support (or hinder) a deeper stakeholder engagement?
Blended Value	How successful are we at mobilizing resources in an integrated, viable and renewable manner?	How do our knowledge, stakeholders and culture support (or hinder) viable resource mobilization?
Efficiency	How successful are we at developing knowledge that leads to more appropriate processes?	How do our resources, culture and stakeholders support (or hinder) the development of appropriate processes?
Adaptability	How successful are we at creating a culture that supports initiative and reduces resistance to change?	How do our stakeholders, knowledge and resources support (or hinder) a culture of change and initiative?

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[1] Anti-Persoonsmijnen Ontmijnende Productontwikkeling

This case was developed through an extensive documentation review, electronic correspondence, and a series of phone and in-person interviews with APOPO's founder, Bart Weetjens, and CEO, Christophe Cox. Site visits were made to the APOPO headquarters and training fields in Morogoro, Tanzania, and to partnering health clinics in Dar es Salaam. Members of APOPO's top management team and governance board also provided input. Information for the case was also gathered through a Virtue Ventures consultancy with APOPO, funded by the Philippson Foundation, to support strategic and business planning, change management, and the integration of social enterprise methodology into APOPO's approach. Capacity building support from the Philippson Foundation has helped APOPO move closer to sustainable social impact, and was the impetus for the organizational changes described in this case study.

2   Acknowledgments

The authors would like to thank APOPO's founder, Bart Weetjens, and CEO, Christophe Cox, for generously opening the doors of their organization for this analysis. It is our hope that both APOPO and other technology-based social enterprises might gain insight into organizational performance through this case and the application of the Four Lenses Framework. Thanks also to the APOPO staff for their generous accommodation throughout the research process for this case. Much gratitude is owed to Anne Henricot at the Philippson Foundation for first sponsoring APOPO's capacity-building efforts, and second, for the financial contribution to documenting this case. Finally, many thanks go to the Skoll Foundation for supporting the development of the Four Lenses Strategic Framework, this and other cases, and the tools and resources that accompany the Framework. The field of social enterprise will continue to strengthen and evolve as a result of the Skoll Foundation's commitment to capacity-building initiatives like the Four Lenses.

3   Introduction

The residual presence of unexploded landmines poses a significant threat to community safety and ongoing development in post-conflict countries. While reliable tracking of the number, status, and location of mines is impossible given unregulated use, projections suggest that 100 million uncleared landmines remain globally.[2] Given current funding levels to address landmine contamination,[3] it will

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[2] GICHD. *Guide to Mine Action and Explosive Remnants of War* (2007), p 17.

[3] $475 million USD in government aid funds were allocated toward mine action in 2006 according to the UN.

take over 500 years to clear the globe completely. Civilian casualties due to unmarked landmines occur regularly, with 1,367 deaths and 4,296 mine-related injuries recorded across 68 countries in 2006 alone.[4]

At the same time, two million people each year die from tuberculosis (TB) – more than any other curable infectious disease.[5] Almost nine million new active TB cases are diagnosed each year, 90% in the developing world and 80% in 22 World Health Organization (WHO)-designated 'high-burden countries' (HBCs). The persistence of the TB epidemic particularly in Africa, the expanding global population and the increased co-incidence of TB with HIV infection suggest an urgent public health issue that has drawn renewed attention.

While seemingly unrelated, these problems point to a larger void in appropriate detection technologies in developing countries. Quick, reliable, affordable detection presents operational and economic bottlenecks for both landmine and TB eradication. The Belgian NGO APOPO seeks to address this detection problem by training African rats to support life-saving activities using olfactory detection methods, alleviating African countries from their traditional reliance on Western experts to address domestic development issues by providing an appropriate technology alternative. To date, APOPO has proven its "HeroRAT" technology for the effective detection of both landmines and TB, demonstrating potential advantages in speed, cost, and accuracy in both applications when compared with traditional detection methods.

APOPO's head office and research center are located at the Sokoine Agricultural University in Morogoro, Tanzania, where it conducts breeding activities, pre-training of animals, coordination of operations and R&D efforts. In total, APOPO employs 126 staff (80 in Tanzania and 46 in Mozambique), with annual operating expenses just over €1 million in 2007. Operational landmine clearance is currently underway in Mozambique, where APOPO has 25 accredited HeroRATS working to clear over 3.7 million m^2 in the south-western region of the country over the next five years. APOPO's TB detection technology is in validation stages, pending additional scientific research to prove the technology's accuracy. Further detection rat applications in the areas of search and rescue and cargo inspection are in R&D phases.

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[4] ICBL. *Landmine Monitor Report* (2007), p 39.

[5] Cunningham, Jane. *Diagnostics for Tuberculosis: Global Demand and Market Potential*, Special Programme for Research & Training in Tropical Diseases (TDR) sponsored by UNICEF/UNDP/World Bank/WHO, 2006.

APOPO's unique story has attracted significant media attention over the years, and the organization's "mine-sniffing rats" are known across Europe and the United States. Print and television coverage by *Newsweek*, *The Economist*, *New York Times*, *BBC*, *Animal Planet,* and *National Geographic,* among others, provides access to a hitherto untapped audience of potential donors, but also places additional reputational pressure on the organization. APOPO's founder, Bart Weetjens, has received accolades for his personal vision and leadership to date and has been awarded twice by the Development Marketplace and named a Fellow by both the Schwab Foundation for Social Entrepreneurship and Ashoka. Most recently, APOPO won the Skoll Award for Social Entrepreneurship in the amount of $1 million USD over three years.

Driven by promising research results for the TB application, a desire to scale the organization, and capacity-building support from the Philippson Foundation, APOPO has renewed its focus on strategic planning and systems development to support its future growth. Recognizing the organization's competitive advantage in the research and development aspects of detection technology, its Board has adopted a new mission:

> *"To become the Centre of Excellence in detection rat technology*
> *to enhance the impact of life saving actions.[6]"*

At the same time, APOPO's leaders have placed an emphasis on the continued development of earned income financing strategies, hoping to incorporate social enterprise methodology to enhance the organization's financial sustainability and free it from earmarked, grant cycle-support.

APOPO's media success and resulting acclaim, its potential to scale, and its shift from a traditional, research-driven NGO to a social enterprise make it an exciting case study for our purposes. How will APOPO's organizational culture support or hinder its shift towards social enterprise practice? How will its communication and management systems adapt to support ongoing growth and success? How can APOPO leverage its demonstrated strength in media engagement to decrease its dependence on government grants and generate its own, flexible funding? Employing the Four Lenses Strategic Framework, we hope to gain an in-depth understanding of APOPO's model and to shed light on some of these unknowns.

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[6] APOPO Strategic Plan, October 2008.

4   Company Overview

4.1   History

Bart Weetjens, a Belgian native with an affinity for rodents, founded APOPO in 1997. Particularly struck by the devastation caused by landmines in Sub-Saharan Africa and the subsequent dependence on foreign aid and expertise for humanitarian mine removal, Weetjens proposed a new demining technology that promised to be as effective as conventional practice—mine detection dogs (MDDs)—and potentially cheaper. The key component to this new technology was the use of Giant African Pouched Rats.

Many questioned the credibility of his idea, but Weetjens found an ally in a university friend, Christophe Cox. Following a two-year feasibility study, Weetjens and Cox established a research laboratory in partnership with the Sokoine University for Agriculture in Tanzania, supported by a research grant through the Belgian Government. Using operant conditioning methods, it quickly became apparent that the rats not only had an exceptionally good sense of smell, but offered significant cost advantages over alternative technologies. Rats could be trained in about 12 months to reliably detect any specific odor, including the scent of explosive residue (Figure 1). The rats were less expensive to breed, feed, house, and transport than dogs; were inherently immune to Sub-Saharan diseases; and were too light to set off the mines. Unlike dogs, the rats could work with multiple handlers because they didn't bond as strongly with their trainers.

FIGURE 1: A HeroRAT at work

After nearly seven years of R&D and verification studies funded by several government organizations and a handful of donor institutions, APOPO's "HeroRATS" achieved demining accreditation from the Geneva International Centre for Humanitarian Demining (GICHD) and the National Demining Institute of Mozambique (IND) in 2004, allowing for official demining activities to take place in Mozambique.

With increased grant funding from the Belgian and Flemish Governments and healthy interest from the media, HeroRATS started to gain momentum. In 2005, APOPO launched www.heroRAT.org, a website featuring interactive cartoon games, and introduced the "Adopt a HeroRAT" program, aiming to increase funds from independent donors. With a growing number of HeroRATS accredited in Mozambique, APOPO won several modest government and humanitarian contracts, generating some earned income for the organization.

By the end of 2008, APOPO's operating budget had expanded to nearly €1.25 million, supporting the laboratory and training center in Morogoro, an integrated mine clearance operation and logistics office in Mozambique, over 100 employees, 57 accredited HeroRATS, and more than 200 rats in training. APOPO's headquarters at the Sokoine University of Agriculture include administrative offices, training rooms, a chemical lab for sample testing and development, storage facilities, a garage, and 24 hectares of testing fields, containing more then 1,500 landmines of 14 different types. APOPO's operations have expanded to include a TB laboratory with TB training cages, sample-processing capabilities, and data input facilities.

4.2 Business Model

APOPO has historically functioned as a traditional nonprofit research center, relying on government grants, other private funding and institutional donations to support its R&D efforts. The organization has only recently undertaken operational activities, with the implementation of full-scale demining efforts in Mozambique in 2008. While implementation is the logical next step for a successful technology R&D organization, it presents specific operational and capacity related challenges that APOPO will continue to encounter as additional applications reach implementation stages.

A Board of Directors (BOD) made up of five Belgian advisors steers the organization and supervises APOPO's top management team. APOPO's management and Board structure have recently undergone significant changes as the organization shifts to becoming more strategic and market-driven. Specifically, where Weetjens and Cox historically managed the organization as co-directors, Cox now sits as APOPO's Chief Executive Officer (CEO) while Weetjens heads up media relations, development, and new business opportunities. At the same time, significant changes have occurred within the organization's BOD, with three new Board members joining and one leaving the Board in the last six months.

APOPO operates within a linear supervisory model, with two training supervisors and one general supervisor overseeing the organization's staff of rat trainers, handlers, and support personnel. Outside consultants have been brought in to advise on animal behavior, training, and strategic planning. An American volunteer (first supported by Ashoka and later by an LGT Venture Philanthropy Fellowship) has assisted with web-marketing and fundraising efforts for the past year. APOPO's trainers and handlers are Tanzanian and Mozambican. Of the upper management team, temporary consultants, and volunteers, all but one employee originate from Western countries.

4.3   Demining Application

Mine clearance is often the most tedious and costly element of the mine action process. Operators employ a toolkit approach to mine clearance, combining manual deminers, mine detection animals (dogs and/or rats) and mechanical demining equipment to best fit the unique characteristics of each mine clearance project.[7]

APOPO's proven Mine Detection Rat (MDR) technology works much like conventional Mine Detection Dogs (MDDs), with detection rats scanning suspected land for explosive scents. Before MDRs can access a minefield, the land must be cleared of vegetation using an armored bush cutter, and "safe lanes" for trainers and handlers to walk through must be cleared manually. MDRs wear small harnesses that are either tethered to a line strung between two handlers, or attached to the end of a pole and directed across the land in measured paths. When a rat detects a suspected landmine, it indicates by scratching the ground with its paws. Suspected mines are marked geographically, and manual deminers are then called in to uncover and disarm the mines. Minefields are surveyed by multiple rats to ensure accuracy throughout the process.

It takes just under one year to train a fully accredited MDR. Rats begin training at five weeks old on socialization, and become acquainted with new smells, various walking surfaces, different cages, handlers, and the transport lorry. From the age of six weeks, the rats begin "clicker" training, learning to associate the sound of a training clicker with a food reward. Next, the rats proceed through a series of training levels, consecutively increasing in difficulty and ranging from simply approaching the scent holes in a training cage to correctly identifying a positive scent sample among negative samples. The training process varies based on whether rats are needed for landmine

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[7] GICHD. *Guide to Mine Action and Explosive Remnants of War* (2007), p 6.

detection, TB detection, or new applications. Rats are trained to identify only one type of scent, though there may be multiple variations of one scent. For example, mine detection HeroRATS learn to identify over 14 types of landmines, ensuring that they will be able to detect the broad range of explosive devices present in a minefield.

Mine Detection Rats have several notable advantages over dogs. They are less expensive to breed, house, feed, and train, resulting in predictably lower costs to develop accredited rats. While these cost savings have yet to be fully realized as the technology has only recently become operational, the cost competitiveness of MDRs is expected to increase dramatically as breeding and training techniques improve.

In Mozambique, APOPO operates a magnet facility for operational demining based on government contracts to perform landmine detection and manual demining services in the Gaza Province. There, Project Manager Andrew Sully, originally from the UK, manages a small demining operation including 25 accredited HeroRATS, handlers and trainers from both Mozambique and Tanzania, and other support staff.

Since 2004, APOPO demining teams have successfully reopened over 500,000 square meters of suspected minefields in Mozambique. APOPO recently received endorsement from the International Conference for the Great Lakes Region (ICGLR), which proposed APOPO's HeroRATS provide mine detection services in 11 countries across the region, including Angola, Burundi, Uganda, Zambia, and Sudan.. While funding has yet to be secured for the project, a contract of this magnitude would increase the organization's operating budget considerably.

4.4 TB Application

In 2004, The World Health Organization (WHO) put out an urgent call prioritizing TB detection technology to address global increases in infection. Since the discovery of tuberculosis in 1882, microscopic examination of stained sputum has been the primary means of diagnosis worldwide, with 87 million tests requested annually. Yet this outdated technology presents significant limitations to accurate and timely diagnosis of active TB. For microscopy, specificity, which measures the percentage of non-diseased patients who are so indicated by a given test, is very high (around 98%),

making it an appropriate technology for second line screening. [8] However, sensitivity, which measures the percentage of diseased patients so indicated by a test, is quite low, with average sensitivity levels between 20-60% in peripheral settings.[9] Patients typically wait about five days to receive results from microscopy, and up to 10 weeks for culture results, widely considered the "gold standard" for TB detection (in terms of accuracy only, with sensitivity rates of around 90% and specificity of 98%—the long wait period and higher costs limit the practicality of this diagnostic technology in the field). Alarmingly, 50% of TB-related deaths are never actually diagnosed. Recognizing TB detection as a potential application for HeroRAT technology, APOPO began developing TB HeroRATS in 2005.

TB HeroRATS undergo a similar training process to Mine Detection Rats, with sensitivity and socialization training beginning early in the rat's life. Once identified as TB HeroRATS, the animals begin training with known-positive TB samples and are introduced to APOPO's unique "line cage," which contains ten small "sniffer holes" along the bottom of the cage. HeroRATS start at one end of the cage and systematically scan each hole in succession, stopping to indicate positive samples by scratching or biting at the sample hole (Figure 2). If the rat indicates on a "known" positive sample, it is rewarded with mashed banana or peanuts before returning to work. This

FIGURE 2: A TB HERORAT IN THE LINE CAGE

process is similar to that of demining HeroRATS; however, when screening for TB, the rats remain in a controlled laboratory environment and are sheltered from outside distractions and smells. In this type of arrangement, often referred to as "remote scent tracing," the smell is brought to the rat rather than the other way around.

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[8] Steingart, Ramsay & Pai. "Optimizing sputum smear microscopy for the diagnosis of pulmonary tuberculosis". *Expert Review of Anti-infective Therapy*. June 2007, Vol. 5, No. 3, Pages 327-331.

[9] Steingart, Karen R MD, MPH. "Improving the Diagnosis of Pulmonary Tuberculosis in Low-Income Countries: *a systematic review of fluorescence microscopy"*. Division of Pulmonary and Critical Care Medicine, San Francisco General Hospital, University of California, San Francisco and Francis J. Curry National Tuberculosis Center.

While the exact organic compound that HeroRATS detect in patient sputum remains unclear, APOPO has demonstrated in preliminary studies that HeroRATS can detect TB with levels of accuracy equivalent to conventional microscopy. In addition, HeroRATS are roughly 70 times faster than human screeners. A microscopy technician can clear about 40 patients in one day using conventional techniques; one HeroRAT can clear 40 patients in just *seven minutes*. With a unique combination of speed, accuracy, and affordability, the use of HeroRATS could drastically shift medical approaches to diagnosing TB in the future. Before that can happen, however, the technology must be irrefutably proven in scientific studies.

APOPO is currently undertaking several studies to prove the TB HeroRAT technology. It has partnered with four World Health Organization (WHO) certified DOTS (Direct Observation and Treatment Strategy) Centers in Dar es Salaam, and collects sputum samples weekly for use in training and research. In 2008, APOPO's TB HeroRATS screened samples from roughly 8,000 patients and correctly identified 344 positive TB patients who had been incorrectly diagnosed by microscopy, improving screening accuracy by over 4% while still in research stages.

4.5   The Decision to Become a Center of Excellence

Until now, APOPO has been primarily an R&D-focused organization, working with the support of research and government grants to develop its detection rat technology. It is only in the past three years that APOPO has had a marketable product in its accredited landmine detection technology. With its TB application nearing the final stages of verification testing and given the potentially monumental business opportunity were the technology to be proven, APOPO's Board and management team recognized the need to capture both social and financial value creation opportunities and maximize the organization's impact potential.

FIGURE 3: THE CENTER OF EXCELLENCE

The Board and management team have thus adopted a "Center of Excellence" strategy (Figure 3), which will position the organization to pursue rat detection technology research and development, while preparing APOPO to actively implement successful applications. When a promising technology emerges, such as in the case of TB detection, APOPO

will build the necessary capacity to "spin-off" or oversee implementation of the technology for a blended value profit.

With capacity-building support from the Philippson Foundation, APOPO has been working to develop the necessary Board expertise to shift toward this Center of Excellence model, which incorporates both R&D and social enterprise models. It has also enlisted the help of Virtue Ventures LLC, a consulting firm specializing in international social enterprise development, to help build the necessary systems to support its socially entrepreneurial goals.

5 Four Lenses Analysis

We can use the Four Lenses Strategic Framework to analyze APOPO's model in greater detail and determine strengths and weaknesses in the organization's implementation of social enterprise methodology by focusing on four key performance criteria: Depth of Impact, Blended Value, Efficiency, and Adaptability, as seen through each of the Four Lenses: Stakeholder Engagement, Resource Mobilization, Knowledge Development, and Culture Management. These performance criteria are critical factors in achieving truly sustainable social impact.

- **Depth of Impact:** How effective is APOPO at addressing the underlying causes of the social problem it seeks to address? In particular, how successful is it at engaging all stakeholders in a coherent and lasting way? Additionally, how does APOPO manage its culture, mobilize its resources, and develop its knowledge to achieve deeper impact?

- **Blended Value:** How effective is APOPO at making economic wealth creation and social value creation truly interdependent, so that eventually one cannot exist without the other? In particular, how successful is it at mobilizing resources in an integrated, viable and renewable manner? Additionally, how does APOPO develop its knowledge, engage its stakeholders, and manage its culture to create blended economic and social value?

- **Efficiency:** How effective is APOPO at systematically striving to "do more with less?" In particular, how successful is it at gathering and processing information and developing the knowledge it needs to make informed decisions to increase efficiency? Additionally, how does APOPO mobilize its resources, manage its culture, and engage its stakeholders to achieve greater efficiency?

- **Adaptability:** How effective is APOPO at adapting to changing conditions? In particular, how successful is it at creating a culture that supports initiative and reduces resistance to change? Additionally, how does APOPO engage its stakeholders, develop its knowledge, and mobilize its resources to achieve greater adaptability?

As we will see throughout this analysis, each of these performance criteria are inherently linked to organizational activities in each of the Four Strategic Lenses—if proper attention is not given to all four strategic lenses, high performance in all areas is difficult to realize. Even when an organization

demonstrates significant strengths in one performance area or strategic lens, without an integrated approach, organizational performance will stagnate.

5.1 Depth of Impact

The first criterion of the Four Lenses Strategic Framework for achieving sustainable social impact is the *ability to address the root causes of a social problem, rather than palliating the symptoms of the problem with short-term "quick fixes."*

With its new mission to become a Center of Excellence in detection rat technology, APOPO has effectively identified the social problems it seeks to address:

> 1. *A lack of scalable detection solutions:* Despite many advances in solving a wide range of ills in developing countries, the lack of scalable detection technologies on which these solutions depend remains one of the greatest operational and economic bottlenecks in addressing humanitarian problems requiring a detection component.

> 2. *An over-reliance of African countries on foreign expertise and aid:* Because detection solutions are not locally sourced, priorities are not commonly set and decisions are not commonly made where the social impact is actually needed but rather where the funding originates.

By developing a locally sourced technology and building local expertise in the detection field, APOPO seeks to reverse this dynamic from one of dependency to one of autonomy, providing African countries with the appropriate tools and guidance to tackle humanitarian detection challenges domestically.

The humanitarian mine action sector, for example, relies heavily on foreign aid. Funded through multilateral and bilateral channels and steered by international organizations and mechanisms, landmine clearance is very costly and ultimately heavily influenced by geopolitical considerations. It is typically driven by priorities established in Western power centers, involves input from highly paid foreign experts and requires the use of expensive foreign equipment, resulting in extremely high operational costs to governments and aid organizations. Local stakeholders are automatically excluded from the process because of the cost and nature of the technology used. As a result, geopolitical forces far removed from the needs of mine-afflicted communities hold the decision-making power when it comes to when and where humanitarian mine action efforts occur.

Similarly, high-burden countries experiencing high rates of TB infection have little say over prevention, detection, and treatment methods, which are typically dictated by foreign aid donor organizations. APOPO's TB detection technology stands to significantly reduce the cost of TB screening, potentially opening the door to a dramatic increase in screening coverage and eventual TB eradication. The increased speed and accuracy of TB screening using HeroRATS would mean earlier detection and better treatment for TB patients. If proven and adopted by national Ministries of Health, APOPO's TB detection technology could conceivably tip the power dynamic from large donor organizations back to local governments and communities.

5.1.1 Engaging Stakeholders to Achieve Deeper Impact

The Stakeholder Engagement Lens examines how effectively an organization identifies its key stakeholders and each stakeholder's role in solving (or contributing to) the social problem.

APOPO's model requires the development, testing, and implementation of appropriate detection technology, namely HeroRATS. To do this effectively, however, APOPO must engage a wide range of stakeholders at all levels. APOPO's stakeholders include its employees, its funders (including governments, donors, and investors), the international research community, institutional partners (such as the Sokoine Agricultural University), national policy makers (including the World Health Organization and the Tanzanian Ministry of Health), media partners, and the general public. As APOPO's model evolves, new stakeholders (such as commercial customers and vendors) must be incorporated into the organization's approach. Each stakeholder group has unique motivations, requirements, and interests as they relate to APOPO's model.

By engaging local employees in its operations, APOPO is addressing one of the most impactful social problems at hand—the reliance of African counties on foreign expertise. APOPO works to build local expertise and capacity by hiring from the communities where it works. With over 100 employees from Tanzania and Mozambique, APOPO strives to support the economic stability and growth, wellness, and education of committed employees. As such, APOPO's social impact is integrated throughout its operations; the two activities are connected and without one, the other cannot be achieved.

Engaging local partners is critical if APOPO is to achieve its targeted social impact. By engaging local institutions in the development of its technology, APOPO effectively builds local expertise and capacity. One of its most successful partnerships is with the Sokoine University of Agriculture

(SUA), a partnership that has evolved over the past decade. SUA supports APOPO not only by housing its physical headquarters, but also by providing a local face to the organization. Its partnership with SUA provides APOPO access to local human resource pools, legitimacy in the hiring process, and a local presence that forgoes the problematic perception of Western NGOs as being suspicious or untrustworthy.

Of course, APOPO's partnership with SUA brings challenges as well as benefits; its affiliation with the University imposes certain payroll and contractual restrictions, which require APOPO to adhere to government-established pay scales and hiring procedures. Additionally, nearly all of the organization's tangible assets are the property of the University, causing some difficulties with financial reporting and hindering the organization's ability to take on asset-backed debt. Despite these challenges, APOPO's partnership with SUA has been instrumental in its pursuit of building local capacity and expertise.

Engaging policy makers has been difficult given the institutional barriers to new technology among highly networked systems such as policy making in developing countries. APOPO has engaged various government agencies in its work to date. Cox and Weetjens have successfully navigated relations with Mozambique's national demining regulatory body, the National Demining Institute (IND), which has granted APOPO national demining accreditation and named it the sole demining operator in Gaza Province.

Not all government partnerships have been as successful; however, and APOPO continues to face challenges when involving the national Ministry of Health in its TB detection technology. Weetjens has successfully engaged several members of the Ministry of Health to attend monthly meetings to discuss APOPO's TB detection technology, but not without offering the standard "sitting fee" to all attendees. While this practice is in line with local customs and culture, the sitting fee clearly demonstrates an institutional barrier to forming productive partnerships with key Government agencies. Until local government agencies and institutions are reformed and empowered to make decisions about the most appropriate detection approach for local populations, APOPO will continue to encounter a "me first" mentality.

Given these structural and cultural barriers to local decision-making, the best way for APOPO to engage governments and policy makers is by proving its product. The organization does this effectively through its relationship with the DOTS Centers for TB research, reaching 500,000 people in Dar es Salaam, and detecting an average of 7 TB patients per week that are missed by microscopic

imaging in the public health centers. If APOPO can continue to show these kinds of results, saving lives even before the technology has been adopted, it will surely engage governments and policy makers over time, despite challenging cultural barriers.

5.1.2 Managing Culture to Achieve Deeper Impact

Culture management refers to the combination of the many belief systems and mindsets found among stakeholder groups listed above. This Strategic Lens examines the mindsets and values necessary to address the social problem at hand and looks at how an organization successfully builds a coherent cultural system of out of potentially conflicting stakeholder values.

Culture management presents a significant challenge to many social enterprises. For APOPO, it has been especially challenging to align the organization's mission with its stakeholder engagement strategy and organizational culture. APOPO's social impact hinges on building African expertise and technology to address humanitarian activities where detection services are involved. As such, the engagement of locals in the organization at all levels is necessary if APOPO is to build a cooperative, collaborative organizational culture leveraging the Western input from APOPO's founder, CEO, and Board with the skills and expertise of local Tanzanians.

Though based in Tanzania from the outset, APOPO is no doubt a Western organization; its Board members and top management team are all from Belgium, and the organization's cultural and operational expectations are shaped by Western ideals. That said, APOPO has and continues to take significant steps to evolve into a more "home grown" organization by removing cultural barriers and addressing the local lack of capacity in a culturally sensitive way. Both Weetjens and Cox are fluent in the Tanzanian national language (Kiswahili), thus removing the most significant cultural barrier (language) to engage local partners and employees. Indeed, APOPO is up against the conventional model of international development in which foreign "experts" implement plans without considering the local context. Instead, Weetjens and Cox must define a new way of working that engages local resources and embraces local culture if they are to effectively address the root of the social problem and maximize APOPO's impact.

This means managing culture from both the Western point of view and the African point of view and finding common ground between the two perspectives. An example where APOPO management has successfully shaped the organizational culture to fit within the African context is by providing employees with loans and cash advances. Requesting a loan from an employer is a rare

occurrence in the developed world, where most employees have access to bank loans when necessary. However, few people in Tanzania have access to debt financing when times are tight, making Tanzanian culture much more communal when it comes to solving personal crises. If a family member falls ill or if parents can't afford to send a child to school, Tanzanians readily look to family, friends, and employers for assistance. Accommodating this cultural norm, Cox and Weetjens have established a revolving loan fund and generously provide repayable loans and cash advances to employees in need.

Illustrating a less harmonious integration of cultural norms, APOPO's Western managers have experienced ongoing issues with theft and have lost computer equipment and cash from their offices and personal residences. While many of APOPO's employees are connected in social circles outside of their work, they do not share incriminating information about their colleagues even when pressed by the police. Instead, the crime is left unsolved and in a few short weeks, a new computer is secured with an insurance payment. In this way, a toxic cultural norm is established; it is acceptable to steal from Western managers because new resources simply appear. Indeed, there is still work to be done to nurture an integrated organizational culture built on trust, partnership, and collaboration.

APOPO has taken steps to address the cultural divide within the organization. They introduced team uniforms—HeroRAT t-shirts, which were distributed to the entire staff and aimed to flatten cultural and organizational delineations between Tanzanian and Western staff. Other efforts have been made to show appreciation to the staff, including financial incentives, praise, motivational presentations, and other recognition of successful employees at regular staff meetings.

5.1.3 Mobilizing Resources to Achieve Deeper Impact

Resource mobilization describes the development, leverage, and strategic allocation of financial, human, physical (such as fixed assets) or other resources. It relates to how an organization raises money, leverages assets, or cultivates strategic relationships, and is key to high performance in social enterprise. Social impact is highly affected by resource mobilization strategies, and social enterprises that fail to align the two will find they are unable to achieve the depth of impact toward which they strive.

Here, we examine how APOPO has leveraged and deployed resources to effectively address the social problem at hand. Once again, APOPO faces the well-established development institutions in which foreign aid funnels from developed donor countries to underdeveloped recipient countries.

To date, nearly all of APOPO's funding has come from the Belgian and Flemish Governments and other international donors and foundations. In short, financial support for APOPO has been counterproductive to solving the social problem of dependence on foreign aid. Again, this is seemingly an immovable barrier, as governments in developing countries such as Tanzania simply do not have independent funds to invest in development projects, and so the organization is forced back into the conventional development model.

That said, APOPO has very effectively leveraged its relational resources on a local level, building strong partnerships with SUA, IND, Tanzania People's Defense Force (TPDF), and other national and regional bodies such as the International Conference on the Great Lakes Region (ICGLR). The ICGLR is an international body bringing together 11 countries from eastern and central Africa with the aim of restoring peace and security in the region.[10] While the group struggles to generate internal funding for its peacekeeping and rehabilitation projects, it has taken a leadership role in identifying the peacekeeping priorities and activities and setting strategic vision and mission for member countries moving forward. This group has endorsed APOPO's demining HeroRATS and has identified APOPO as the preferred landmine detection provider for all identified humanitarian demining activities in the region. If funding were secured for a project of this size, it would conceivably increase APOPO's annual operating budget by nearly threefold. Thus, while generating local funds to support humanitarian aid projects remains a considerable challenge, APOPO has nonetheless successfully gained the support of local strategy planners.

APOPO might consider allocating additional resources to several areas as they relate to stakeholder engagement and depth of social impact. First, APOPO has continually faced challenges with retaining employees with higher levels of education. History has proven that new hires with even high school education quickly leave to pursue further studies once they have saved enough money to do so. Other employees have left to pursue positions in government, perceiving employment by APOPO to be less secure given the risk associated with grant-funded projects. To date, APOPO has responded to this challenge by hiring only employees with low-level education, adequate to support the necessary cognitive and written requirements of the job, but no higher. While this approach has helped to reduce attrition levels, it conflicts with the organization's social mission to increase local capacity and expertise in the African context. To truly align resource mobilization strategies and

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[10] http://www.allafrica.com/

social impact, APOPO must arrive at a solution that builds local capacity while also encouraging long-term employee commitment.

APOPO successfully mobilizes one major local resource—the Giant African Pouched Rat (Cricetomys gambianus). These rats are unique to Sub-Saharan Africa and provide many advantages over other potential detection animals. First, they are inexpensive, relatively common, and can be captured in the wild. Because HeroRAT training must begin early in a rat's life, APOPO breeds its own stock. However, it often uses wild rats for breeding purposes, sometimes even soliciting for wild rats to be brought in by local villagers to support breeding efforts. Second, being indigenous to the area, Giant African Pouched Rats are resistant to local diseases and can withstand the demanding African environs. Finally, Giant African Rats demonstrate beneficial characteristics with regard to performing repetitive tasks; rats show no signs of "boredom" and are consistently motivated by food rewards and in fact seem to enjoy the repetitive nature of searching. Additionally, they appear to require less maintenance training and are difficult to "un-train" (for instance as a result of poor training technique or the accidental use of incorrectly labeled samples).

5.1.4 Developing Knowledge to Achieve Deeper Impact

Knowledge development refers to the combination of information (content, results from research, data) and processes (methodologies, systems, techniques, procedures) in a social enterprise model. Here, we consider knowledge development as it relates to stakeholder engagement and APOPO's depth of impact. In other words, how does APOPO gain knowledge and seek to understand *how* it can achieve deep and lasting impact?

The first social problem that APOPO seeks to address is the lack of scalable, affordable detection technologies in developing countries. Because APOPO specializes in *detection rat technology*, it is in fact a solution in search of appropriate problems, and this is where the organization's knowledge development strategies come into play. Tuberculosis detection, for example, was an unexpected addition to APOPO's research portfolio, which had previously focused only on demining applications. True to their mission, however, Weetjens and Cox recognized first the need for a more appropriate detection technology and second the potential fit for their HeroRATS. The two began initial research to better understand the field of TB detection, the major market players, and the limitations of traditional screening methods. They secured funding for preliminary experiments to determine if rats could indeed detect TB. With promising results, the organization has continued to

pursue TB research and found it could have a potentially disruptive affect on conventional detection methods.

APOPO also seeks to build local capacity and decrease local dependence on foreign aid—another area where knowledge development is critical to APOPO's understanding of how best to address this social problem. For instance, the issue of staff retention mentioned earlier is a perfect example of where increased knowledge development may be necessary if APOPO is to effectively address the issue at hand. This challenge is particularly difficult to navigate, because while the organization's mission and social purpose is to build local capacity, the organization itself cannot function if it is constantly experiencing high staff turnover. Thus, APOPO must first work to fully understand the problem of staff retention and then strike a balance between its social mission and achieving operational efficiency throughout its model.

Institutional voids are the issues, interests, institutions, and information that characterize a country environment. An in-depth knowledge of local institutional voids and non-market factors are critical to any organization's successful strategy design and implementation. Both the demining and TB detection landscapes are highly networked with complex histories that have created substantial barriers to entry for APOPO and other players. The countries that are most impacted by these issues are also those with low resources and poor infrastructure, the very countries that APOPO targets for its technology.

To illustrate, in the case of TB detection, Tanzania's incentive-based culture and the lack of qualified lab technicians (an institutional void) have stymied APOPO's progress thus far:

- *Incentive Based Culture:* Tanzania has historically received significant aid from international partners, due to its stable government and effectiveness with investments. But this process has also bred a culture that demands incentives for additional work, a consideration that affects human resource dynamics, future business model design, and stakeholder engagement strategies. Without a keen understanding of this non-market factor, APOPO's ability to achieve deep and lasting impact will be hindered.

- *Deficit of Trained Lab Technicians:* The biggest bottleneck in TB detection across Tanzania is surprisingly not a lack of facilities. In fact, it is a great source of pride for the Ministry of Health

that no Tanzanian lives further than 10 km from some form of health care facility.[11] While the physical infrastructure exists, tragically few of the facilities are staffed with adequate numbers of skilled health workers or necessary medical equipment.[12] This institutional void actually *supports* the work being done by APOPO, since trained lab technicians are not required to implement the HeroRAT screening system. With a clear understanding of institutional voids such as this one, APOPO can focus on the root causes of the social problem rather than palliating the issue.

5.2   Blended Value

The second criterion for achieving sustainable social impact is the *ability to rely less on economic wealth generated externally and develop the means of internal blended value creation.*

Specifically, APOPO delivers blended value in several areas. The organization's day-to-day functions create employment opportunities in countries with chronic levels of underemployment, and offer specialized training in animal behavior to individuals who may not have an opportunity otherwise. The income and other forms of support that APOPO provides to its employees have peripheral effects on the children, spouses, and other family members of APOPO team members. The direct impacts of APOPO's technology are also measurable; the demining application saves lives by eliminating the threat of landmines and unexploded ordinances (UXOs) and supports future economic development as contaminated land is reopened for settlement and use. APOPO's TB detection application saves lives through early detection of TB, promoting treatment and limiting exposure to others.

APOPO's new Center of Excellence strategy is well positioned to combine social impact and economic value creation. Detection services naturally lend themselves to a blended value model—detecting humanitarian challenges provides social benefit, while the detection services themselves command revenue-generating potential through niche commercial and development markets that provide demand and subsequent funding for the services.

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[11] McKinsey Report, Investing in Tanzanian Human Resources for Health, p.13.

[12]   Ibid, p.13.

5.2.1 Mobilizing Resources to Achieve Blended Value

APOPO's resource mobilization strategy serves as its core mechanism for creating blended value. How it leverages its financial and non-financial assets will ultimately impact its ability to create a whole greater than the sum of its parts.

APOPO's resource mobilization strategy deals in part with the way it raises funds to support its activities. To date, APOPO has functioned as a traditional research organization and a registered charity. While most of its funding came initially through the Belgian government, APOPO has taken steps recently to broaden its funder base and has reached out to several foundations supporting social entrepreneurship, including the Schwab Foundation, Ashoka, and the Skoll Foundation. While these funders offer critical support at this stage in APOPO's growth, its goal to become a Center of Excellence will shift the organization's fundraising approach from grant-based to earned income, increasing financial sustainability and maximizing the blended value potential of the venture. Whereas before APOPO focused almost exclusively on research funding, it will begin to seek funding to support implementation efforts for its detection services, either in the form of social investment seed funding, grants, or for-profit venture capital depending on the prospects of a given application. As APOPO moves to a cost-recovery implementation model, it will no doubt face challenges in complicated, networked, crowded markets such as landmine detection. Its model must, then, work within the established market dynamics, which emphasize the cost savings and social benefits that differentiate APOPO's products.

While the Center for Excellence strategy is still in its infancy, APOPO has already taken steps to decrease its dependency on large donors and short-term grant support. Hoping to achieve a more stable cash flow with increased flexibility (most large donors earmark their donations), APOPO introduced the "Adopt a HeroRAT" program in 2006, which includes a dedicated website where individual donors can pledge €5 per month to "adopt a rat," or give a one-time donation of €150 for naming rights and a picture of the donor's rat. Adopters receive regular email information and updates about their rat. The HeroRATS website attracted over 25,000 discrete visitors in 2008, and drew nearly 500 new "adopters" in the same year, thanks to outreach efforts by APOPO's fundraising volunteer, who works to develop and support the organization's independent fundraising efforts. While donations generated from the website remain a small portion of APOPO's funding, management is hopeful that rat adoptions will grow into a significant sustainability strategy moving forward.

APOPO has also successfully leveraged the organization's media appeal to attract funding from both institutional and individual donors. With public backing from Jane Goodall and media stories on BBC, PBS, Animal Planet, Newsweek, and National Geographic (among others), APOPO has gained international attention for its innovative approach to solving the detection needs of the developing world. As a result, individuals from around the world have been spurred to learn about these lifesaving rats and while this has not directly translated into overwhelming numbers of individual supporters, APOPO's public appeal could easily pay off in the future.

One area of blended value creation that APOPO has yet to explore is in the patenting and licensing realm. As far as Weetjens and Cox know, their project is the first in the world to pioneer the use of rats for detection purposes. They have designed and built several iterations of innovative training cages, and have perfected the sample preparation process. While further research in this area would be required, it's possible that APOPO could secure additional funding channels by patenting its technology or by licensing its technology to other organizations seeking to replicate APOPO's model in other parts of the world.

5.2.2 Developing Knowledge to Achieve Blended Value

Not surprisingly, APOPO's knowledge development activities to date have focused more on achieving blended value than on any other performance criteria—as a technology-driven organization, there is no point in focusing on depth of impact until you have a proven technology to stand on. From a technology perspective, Weetjens and Cox have accomplished much in a relatively short period of time, having successfully developed an indigenous technology solution for a local problem. Now they will begin to achieve social impact through strategic implementation.

Once their technology is proven and perfected, Weetjens and Cox will need to employ market research to fully understand market constraints and opportunities prior to launching a new application. As stated, many of the humanitarian detection markets APOPO will consider entering are convoluted, networked, and present high barriers to entry. This makes APOPO's market research even more important; its blended value model will need to take into account both the social impact of its technology as well as the market forces acting on its products and potential customers.

Competitive analysis will also play a key role in APOPO's ability to create blended value. As a provider of detection services, APOPO must first understand its competition in terms of other detection methods. For instance, competitors in the field of demining include manual deminers

using handheld metal detectors, machine detectors such as armored flails, and other animal detectors, namely Mine Detection Dogs. As APOPO pursues further detection applications, it will need to have a comprehensive understanding of the players in the field as well as its unique selling proposition if it is to support a blended value offering.

Part of achieving blended value obviously means developing a marketable product. APOPO has beaten the odds and achieved internationally recognized demining accreditation for its HeroRATS, but has faced greater difficulties in validating its TB technology. Importantly, there are significant differences between the mine action and tuberculosis communities when it comes to research and science; the mine action community has been historically rooted in military trials and operational proof of concept. In contrast, the international medical community adheres to rigorous standards when it comes to medical research and validation. As such, it is not surprising that Weetjens and Cox have encountered greater difficulties in proving their TB technology—the stakes are simply higher. Since neither Weetjens nor Cox has a background in the medical or research arena, they must forge relationships with highly regarded academics who can design and implement reputable validation studies for both the TB application as well as other applications in the future.

5.2.3 Engaging Stakeholders to Achieve Blended Value

APOPO's blended value model requires engaging its stakeholders in new and different ways. For example, where donor countries originally granted money directly to APOPO to run demining operations, in the blended value model (outlined above), donor countries will need to engage as "customers" purchasing detection services rather than funding entire mine action projects through APOPO. This is significant in that it allows APOPO to focus only on providing detection services, rather than providing full mine clearance capabilities (including manual mine clearance, heavy equipment rentals, and other accommodations that fall outside of APOPO's strategic focus).

Similarly, APOPO will need to begin engaging stakeholders on both the supply and demand sides: APOPO's demining application, for example, hinges on a precarious alignment between demand for landmine clearance and the willingness of governments and other social institutions to invest in humanitarian demining activities. Influencing nonprofit and government organizations to continue investing in mine clearing activities and demonstrating the superiority of MDR technology will be vital to the success of APOPO's demining application going forward (Figure 4).

It is also worth considering APOPO's relationship to the markets it serves. As a detection service provider, it is necessarily removed from the direct resolution of any social problem. Thus, it will be critical that APOPO engage its stakeholders in a new way of measuring "impact." Landmine clearance, for example, has historically been measured by the number of landmines removed from the ground. While this equation is widely accepted as a measurement of the efficacy of any mine clearance outfit, a far more effective method would be to
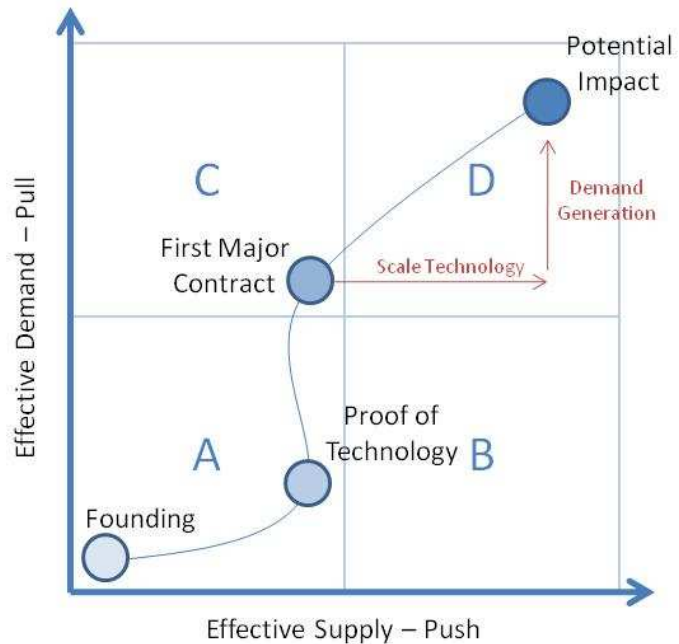

FIGURE 4: SOCIAL INNOVATION LIFECYCLE

measure the area of land "released" or deemed safe for a given project—a figure that more effectively measures the increase in quality of life and economic growth experienced by people who are able to return to their homes following armed conflict. Similarly, the efficacy of tuberculosis screening methods is widely measured by sensitivity and specificity rates, which measure a screening test's accuracy in gauging true positive and true negative samples. These are the benchmarks which APOPO's rat technology are up against, when, in reality, if the HeroRATS were judged on cost and speed alone, the sheer volumes of patients who would receive access to screening were this technology adopted would ultimately result in far more diagnoses if the rats can deliver accuracy equivalent to conventional screening methods. In other words, in many of these detection-related fields, conventional metrics can often be questionable. As APOPO introduces an innovative approach, it must simultaneously shift stakeholder perceptions of "success" if it is to maximize its blended value creation.

5.2.4 Managing Culture to Achieve Blended Value

Culture also plays an important role in attracting, strengthening, and maintaining resources to achieve blended value. For instance, organizational culture at APOPO will need to change in order to support a blended value social enterprise approach. While Weetjens and Cox have managed to avoid many of the common stereotypes attached to NGOs working in developing countries through

their strong ties with local universities and government groups, employees no doubt think of their work as "not for profit." In contrast, with the move toward a cost recovery, social enterprise approach, APOPO's staff will need to begin thinking of their actions and motivations within a "for profit" context. Without making some hard business decisions, APOPO will not be able to realize a sustainable blended value model.

Another cultural issue that may surface through the shift to social enterprise has to do with business ethics and social impact. Mine action, for example, is a human response to a man-made problem. The blended value model falls apart if and when an organization's profit plus social benefit are less than the social detriment that is making the problem in the first place. In other words, APOPO could continue detecting landmines, working to save lives and release contaminated land, and may even turn a profit in doing so; yet, if governments and military groups continue planting new landmines, the blended value proposition becomes a moot point. Regardless of detection capacity, if mines are still being planted there is no hope for eradication. In a situation like this, APOPO is no longer addressing the root cause of the problem and is instead "band-aiding" the issue. Thus, it becomes increasingly difficult to balance the economic and ethical requirements of a truly blended value model.

5.3 Efficiency

The third criterion for achieving sustainable social impact is the *ability to leverage the ongoing potential for increased productivity.*

5.3.1 Developing Knowledge to Achieve Greater Efficiency

As a technology-driven organization, knowledge development for efficiency is one of APOPO's many strengths. APOPO's research approach uses comprehensive knowledge management not only to inform design and to prove concept but also to track impact. As a result, APOPO is well versed in iterative trials and has the ability to rapidly shift its design approach based on research findings.

APOPO's iterative process has effectively informed the design of its training cages over the years. What began as a simple box with several holes in the bottom has evolved into a series of highly specialized cages; one training cage (known as the "square cage") spans the entire circumference of a laboratory room, and rats in training become accustomed to long periods of working by running this "track" while trainers quickly change out scent samples after the animal has past each sniffer hole.

Likewise, the cage used by internally accredited TB HeroRATS has been honed to maximize speed, accuracy, and ease of use. APOPO is now in the process of designing and testing a fully automated cage, which uses electronic sensors to detect a rat's prolonged indication over a positive sample and automatically delivers a food reward for correct indications. This effectively eliminates human error from the training process, and will improve the training process and decrease the time and cost to train animals. Interestingly, the automated cage will also decrease the need to employ local handlers and trainers, illustrating the inherent tensions that arise when balancing social benefit with the required efficiency to run a business.

As a result of tireless research efforts, APOPO has developed a highly efficient detection technology especially in certain applications; a rat analyzes 40 TB samples in seven minutes, more than 6,000% faster than a trained lab technician and with comparable accuracy![13] While this efficiency is extremely visible in the TB application, the comparative advantage of rats in other areas, such as demining, is less obvious. Thus, APOPO's success relies on further knowledge development to ensure accurate gauging of opportunities for HeroRAT technology as well as understanding when rat detectors simply might not be the most efficient option. Again, a clear understanding of the detection field (including competition, environment, and funding trends) will be essential as APOPO both grows its existing applications and pursues new applications for HeroRAT technology.

Breeding is another area where comprehensive knowledge management is instrumental to APOPO's efficiency; APOPO has already established the importance of beginning training at a very early age, and so has developed breeding facilities at their SUA headquarters in Morogoro. These facilities consist of a series of large outdoor cages that simulate the local environment and accommodate up to three breeding rats in each cage. Significant work, largely involving trial and error, has been done to optimize APOPO's breeding output (adjustments in the number of rats placed in the breeding facilities, the length of time in the cages, changes in diet, etc). However, despite these efforts, APOPO has faced mysterious challenges in creating a reliable breeding output, and further study must be done to improve the process.

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[13] A double blind test involving APOPO's TB HeroRATS screening 67 positive and 752 negative samples yielded a sensitivity of 86.5% and a specificity of 89.1%. Specificity of sputum smear microscopy is very high—roughly 98%, while sensitivity levels average much lower (20-60%) in peripheral settings.

Finally, APOPO's efficiency hinges heavily on the optimization of its training process—the faster APOPO is able to produce an accredited HeroRAT, the lower its costs. Many steps have been taken to improve and perfect the training process. APOPO has engaged an experienced animal behavior consultant to help codify the HeroRAT training process and eliminate "coaching" or unreliable reinforcement by the rat trainers. Additional knowledge management systems to monitor and control breeding, training, and accreditation progress will assist APOPO in further improvements in all of these areas, and the organization is currently in the process of selecting and implementing a management information system to support them in tracking and responding to collected data across all areas of the business.

Knowledge management is a distinct strength of APOPO, while the organization struggles more with activities related to culture management and stakeholder engagement. It is interesting, then, to consider how these efforts to further improve the knowledge management system will play out if the underlying lenses are not also addressed. As the integrated approach implies, it is difficult to make significant advancement in one lens without also bringing along the organization's staff and stakeholders through the other lenses. In a sense, systems will go only as far as the organizational culture will allow; only time will tell how the new MIS system improves APOPO's overall efficiency, but it is likely that additional attention to secondary lenses will be necessary before significant improvement is observed.

5.3.2 Mobilizing Resources to Achieve Greater Efficiency

As a secondary activity to achieving efficiency, how and where a social enterprise mobilizes resources can also have a significant impact. How well APOPO leverages its financial and non-financial resources to achieve greater efficiency will certainly impact its overall performance.

As a research organization, APOPO has relied heavily on grants to support its work. While this funding approach fits the activities of the organization to date, it also means a lack of institutional capacity to strategically plan company growth in the medium to long term. With its new Center of Excellence strategy, APOPO hopes to increase its own revenues from service delivery and operational projects to 75% of the annual budget through such contracted services, and has received assistance by the Philippson Foundation to guide this expansion.

By positioning itself as a social enterprise, APOPO has successfully won the support of alternative funders who acknowledge the importance of incorporating business strategies. A portion of the

Skoll Award for Social Entrepreneurship, for example, as been specifically allocated to support the salary of a newly hired Financial Manager who will oversee all financial reporting and monitoring. Similarly, Ashoka has, as part of Weetjens' fellowship stipend, provided him with a mobile-signal modem. While seemingly inconsequential, this form of support results in huge improvements in the organization's efficiency since the standard landline internet typically shorts out on a daily basis and is prohibitively slow.

APOPO has also worked to leverage human resources to achieve greater efficiency in many areas. First, it has taken steps to expand its Board of Directors in 2008 to include a Belgian executive of a large employment-based nonprofit, who brings significant expertise in running a social enterprise. This new addition to the Board will help to broaden the wealth of advice and support offered to Cox and Weetjens as the organization continues to grow and evolve. Moving ahead, APOPO should consider adding further diversity and expertise to its Board, tapping into local political and academic circles to appoint a Board member who could provide insight into the Tanzanian context. APOPO's Board could also benefit from the addition of members with extensive business, research, or legal acumen to increase APOPO's operational efficiency and potential impact.

APOPO has also recently hired a new project manager to oversee its operations in Mozambique. This individual has high-level project management skills, has taken quickly to his post, and is already making positive changes to process and protocols that are increasing APOPO's efficiency in Mozambique. Additionally, APOPO has engaged a leading researcher in the animal detection field who will help APOPO identify and implement a strong research plan going forward.

Moving ahead, APOPO will need to balance its resource mobilization efforts strategically between earned income, social enterprise funding, and traditional and nontraditional research funding. The Foundation for Innovative New Diagnostics (FIND), for example, is a public-private partnership organization that identifies and incubates promising diagnostic technology to address poverty-related illnesses in the developing world, and would make an ideal supporter of APOPO's TB technology. Using a multi-pronged approach to resource mobilization, APOPO will successfully leverage the benefits of an integrated model and capitalize on funding opportunities from multiple channels.

5.3.3 Managing Culture to Achieve Greater Efficiency

Culture management also greatly influences organizational efficiency. If an organization's culture doesn't promote results-oriented entrepreneurialism, optimal efficiency will be difficult to achieve.

Key to this issue is the incentive-based Tanzanian culture; while on one hand it would seem that employees are not motivated to go above and beyond to achieve higher efficiency, this also suggests a culture that is clearly motivated by financial incentives. APOPO has built on this fact by offering performance-based bonuses for animal trainers when one of their rats successfully passes a training stage. Even larger bonuses are granted when rats pass the internal accreditation test without making any mistakes. While this is a great example of leveraging cultural characteristics for the company's benefit, APOPO managers also have to be weary of "gaming" the system; some results suggest that a handful of trainers earn substantial bonuses by quickly moving their rats through the initial stages of training and then retiring them or handing them off to other trainers in exchange for new young rats. While APOPO's management has successfully leveraged incentive structures that play to cultural norms, these incentive systems must be rooted by an in-depth understanding of local value systems; a Western approach to performance cannot simply be installed, it must be embedded in the existing cultural system.

Managerial structure and culture also play a role in organizational efficiency, and as with any growing organization, several challenges have arisen as APOPO works to evolve its structures, systems, and culture. APOPO started off as a very small organization, with Cox and Weetjens learning about the detection, demining, and healthcare diagnostics fields as they went. Now, with APOPO an established research organization and shifting into an operational model, the small-scale organizational culture becomes less effective. Instead, the evolving organizational culture must focus more on codification, institutionalized systems, clear communication processes, distinct roles, and operational directives to function smoothly. Given APOPO's promising potential for growth and with its core technology already proven, the greatest focus now should be on creating a stable, efficient organizational culture that will grow and evolve with the company.

5.3.4 Engaging Stakeholders to Achieve Greater Efficiency

Stakeholder engagement is also a key to achieving operational efficiency; if the way in which stakeholders are engaged in a social enterprise model does not support or enhance organizational efficiency, the overall performance of the organization will suffer.

A great example of this relationship is illustrated by APOPO's partnership with DOTS centers in Dar es Salaam. To prove APOPO's TB technology, it first needed access to a steady supply of TB samples (both positive and negative) to train the TB HeroRATS and to verify their reliability with

research studies. Weetjens successfully arranged for the four "best" (largest and most reliable) DOTS centers to provide labeled and organized TB samples for APOPO's research in exchange for a monthly fee. Initially, the samples were labeled incorrectly and then later not at all, and so APOPO's driver now labels all of the samples at the centers as he collects them each week. APOPO continues to pay the monthly fee for access to the samples, though APOPO's staff does all of the work.

While this arrangement results in operational inefficiency, it illustrates the precarious nature of stakeholder engagement. While APOPO supports its own staff to do the job it is paying the DOTS centers to do, it cannot afford to lose access to the invaluable supply of samples both for the validation and continued improvement of its technology. While APOPO's management has solved the problem temporarily by navigating around it, APOPO may need to renegotiate its current arrangement with the DOTS centers to improve operational efficiency. Both Weetjens and Cox are wary of "rocking the boat," and recognize the vital importance of maintaining an ongoing supply of samples. Again, this illustrates the tensions that arise when trying to balance activities like careful stakeholder engagement with organizational efficiency.

Staff engagement also plays an important role in achieving efficiency, and APOPO, like many startup and growing social enterprises, has experienced challenges with effectively capturing important information at the staff level and feeding it back to top management. For example, it has been difficult to successfully persuade ground staff to identify and report problems in the training process, resulting in significant implications for organizational efficiency. This challenge relates not only to local culture, but also to employee screening and recruitment practices. If this kind of staff feedback is not effectively captured, APOPO's process improvement may stagnate, and efficiency will decline. Moving ahead, Weetjens and Cox will need to engage staff in a collaborative bid for increased efficiency and design the organization's incentive structure around these goals.

APOPO's partnership with the Sokoine University of Agriculture (SUA), while it adds to many other performance areas, sometimes hinders APOPO's own organizational efficiency. For example, Cox faces significant barriers to hiring because of the organization's affiliation with the university, and has to concede more efficient contracting practices to stay in line with university hiring requirements. Additionally, APOPO is accountable to government-imposed pay restrictions that are subject to change at any time; Cox recently absorbed a substantial increase in payroll, reflecting a 25% pay raise plus payment in arrears for the previous eight months.

A final area in which stakeholder engagement plays heavily is in APOPO's interaction with the wider academic research community. To date, APOPO has spearheaded many of its research projects internally, and has had research published in one leading scientific journal. However, looking ahead, APOPO recognizes the need to engage widely accepted academic experts in the fields of detection and healthcare diagnostics to truly legitimize its technology. APOPO has already taken the first step in engaging the research community in its work by soliciting the support of a leading Dutch researcher in animal behavior.

5.4 Adaptability

Our fourth and final criterion for achieving sustainable social impact is the *ability to respond to ever-changing conditions.*

Adaptability and responding to shifting environments is difficult for many social enterprises, but incorporating calculated risk-taking, complementary (or even contradictory) approaches, and a willingness to embrace change is essential if a social enterprise is to withstand changing market conditions. APOPO has so far demonstrated impressive adaptability, as it successfully navigated market opportunities by pursuing HeroRAT technology in the TB detection field. Yet, at the same time, APOPO struggles with rapid organizational change, and adjustments to structures and systems are sometimes slow to come to fruition.

5.4.1 Managing Culture to Achieve Greater Adaptability

One of the greatest challenges facing social enterprises is organizational culture that leads to stagnation. In line with the infamous "NGO mentality," some organizations find it too difficult to operate in a culture of entrepreneurialism, performance-based evaluations, or other essential adaptations that are necessary for a traditional social sector organization moving into the social enterprise realm.

APOPO's leadership team is anchored by founder Bart Weetjens and CEO Christophe Cox. Typical of an entrepreneurial start-up, the dominant member of the APOPO family is Weetjens himself, whose initial vision and determination have been critical to APOPO's success. Weetjens' strengths, however, are in visioning, public relations, networking, and fundraising, while Cox excels at information management, logistics, and day-to-day running of the business. For the first eight years, APOPO functioned with Weetjens and Cox as co-directors, sharing responsibilities and each

with a hand in all aspects of the organization. As time went on and APOPO continued to grow, it became clear that the two leaders had different skill sets and strengths, and unclear distinctions between their roles sometimes caused tension. In 2008, APOPO's Board decided to redirect the organizational structure and divide the co-director roles, with Cox appointed as the CEO and Weetjens taking the lead on new business development, fundraising, and public relations. In the future, APOPO's leadership will face increasing challenges in setting strategic direction, scaling operations, and solidifying the organization's competitive position in humanitarian demining operations. A strong yet flexible leadership structure will ensure APOPO can grow and evolve in the right direction.

5.4.2 Engaging Stakeholders to Achieve Greater Adaptability

Adaptability as it relates to stakeholder engagement must be considered on multiple levels. On one hand, APOPO must cultivate partnerships with advisors and stakeholders who can inform the company's growth in response to market developments. At the same time, APOPO must both accommodate and work to shift stakeholder perceptions that disapprove of APOPO's technology; APOPO must adapt its approach, meet stakeholders where they are, and bring them around to the idea of using rat detectors for health and other humanitarian detection activities where they have not historically been accepted. Engaging the public regarding the stigmatization of rats is also important to APOPO's model. While public perception and aversion to rats as a species is difficult to overcome, APOPO has aptly leveraged its rats' appeal by playing up the human connection through caricatures and cartoons on its HeroRAT website (Appendix 8.2).

Through continued strategic networking in the demining and healthcare circles, Weetjens and Cox can make allies in the sectors who may ultimately shift APOPO's reputation in tough-to-enter markets. Cox has successfully navigated this dynamic in the demining industry, making a strong alliance with the head of operations of the Geneva International Centre for Humanitarian Demining (GICHD). The GICHD is charged with increasing the professionalism and efficacy of mine action efforts globally, has strong ties with the UN, and ultimately sets the Mine Action Standards that all accredited mine action operators must adhere to. A vote of confidence from the GICHD has surely given APOPO the credibility it needs to break into an otherwise impenetrable market (the mine action industry is known for being conservative and slow to accept new approaches). A partnership of this nature with someone at the World Health Organization could conceivably have the same impact on APOPO's TB application, helping it break into the mainstream.

While engaging strategic partnerships is important, so too is the ability to listen and respond to a wide range of stakeholders. To date, stakeholder input has not informed APOPO's strategic decision making, but could do so in the future. For instance, as a Center of Excellence, APOPO may decide to host stakeholder focus groups to better understand the technology needs of the general public in the area of detection to identify the most effective implementation models and potential new applications going forward.

Engaging the right stakeholders to inform strategic direction and adaptation is vitally important, and APOPO has begun to diversify its Board of Directors to leverage a wide range of experience and knowledge moving forward. Prior to the new additions to the Board, the group's expertise lay almost entirely in academia, appropriate for a research organization. But as APOPO moves toward a social enterprise model and begins looking at implementation of its technology, wider Board input will be needed to effectively inform the organization's strategic direction.

Involving new stakeholders in a model also becomes a cultural issue; as new members "join the team," the organization will at times be forced to redefine its relationships with existing stakeholders. For instance, the Board dynamics will surely shift with the addition of the new members, and will shift again if and when African representatives join. This becomes, once again, a careful balance between supporting longstanding relationships with existing stakeholders while also nurturing new relationships as they become available. An organization's culture ultimately dictates how such dynamics will play out.

5.4.3 Developing Knowledge to Achieve Greater Adaptability

Knowledge development also plays a huge role in informing organizational adaptation; a social enterprise must adapt based on sound information and a solid understanding of the market conditions impacting it. In 2002, when the WHO prioritized the TB pandemic as an urgent threat, APOPO diversified its main focus on landmine detection to include TB screening. Based on Weetjens' initial hunch that the HeroRATS would be able to detect TB, the organization began seeking support for initial research. Now, the organization's TB application promises to be its most significant contribution to the detection field to date.

APOPO's growth will also be heavily influenced by potential applications of its rat technology in commercial sectors. APOPO's leadership team and Board are already investigating potential fits with cargo inspection at the Port of Antwerp. Further research in these areas will contribute to the

organization's overall decision to pursue commercial opportunities or to remain in the humanitarian sector. If APOPO decides to go after commercial applications for its technology, implications for its social mission and strategic direction will need to be closely considered.

Market research to help APOPO understand the competitive landscapes in which it operates will also inform future decisions. There exist a plethora of emergent technologies in detection ranging from biological substitutes such as bacteria and bees (trained to swarm around mines), to electromagnetic, acoustic and seismic, bulk, and chemical detection methods,[14] all of which could conceivably crowd APOPO out of the industry if they took hold. APOPO must have a keen understanding of these competitive threats and potential complementary technologies to successfully navigate changing environments.

Finally, research and knowledge development in the area of legal and structural enterprise design will be critical moving ahead. As APOPO undertakes its Center of Excellence strategy and considers "spinning off" successful applications, the way in which it structures future arrangements will significantly impact the overall success of the business. Weetjens and Cox will need to balance social and financial payoffs given a wide range of potential implementation models to select the best design.

While APOPO excels in knowledge development to inform its organizational adaptation, it at times bypasses the other, more pressing lenses in this area. Culture management and stakeholder engagement are critical factors for successful adaptation, and without first addressing activities in these areas, further efforts in knowledge management alone may not be sufficient to spur adaptation.

5.4.4 Mobilizing Resources to Achieve Greater Adaptability

Mobilizing resources in a way that encourages adaptability rather than hindering organizational evolution is another way that social enterprises can achieve optimal performance. Recognizing the need to access flexible funds to support its growth, APOPO has made a conscious effort to decrease research-tied funding, increase funding for social enterprise, and begin looking at ways to generate earned income. The HeroRAT website, including the "Adopt-a-Rat" scheme mentioned above, is one way that APOPO has raised independent funds that are not earmarked or restricted.

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[14] www.rand.org/pubs/monograph_reports/MR1608/MR1608.ch2.pdf.

APOPO has also engaged in a private fundraising effort with a Belgian artist who designed and sold ceramic poppies to raise money for APOPO's mine action efforts. The artist passed away in 2008, yet friends and colleagues are committed to continuing her fundraising efforts, which have resulted in over €269,000 in donations since 2004.

APOPO has successfully engaged the social enterprise funding community, receiving awards and financial support from some of the most prominent social enterprise funders in the field, including the Skoll Foundation, the Schwab Foundation, and Ashoka. These funders, in theory, recognize the importance of capacity building and organizational growth to the success of social enterprise, and allow more flexibility in their awards than traditional government organizations and foundations. In addition, APOPO has added social enterprise support to its funding portfolio without sacrificing more traditional funds, resulting in a fairly diverse and stable funding base. Without a constant worry about raising new funds, APOPO's management team can instead focus on scaling the organization and adapting to changing forces.

There also exists a potential for raising an entirely different kind of funding in the future; if APOPO's implementation model succeeds and indeed results in the spin off of successful social ventures generating both economic and social value, there may be demand for venture capital investment in APOPO's applications. Only time will tell if APOPO's technology can withstand the pressures of a wider commercial market, but based on the potential demonstrated by APOPO's TB HeroRATS, the outlook is quite good.

Remembering that resources are also non-financial, APOPO's relationship with SUA should also be mentioned here. While the partnership has, as highlighted, been a huge asset to the establishment and growth of the organization to date, it is possible that at some point in the future this alliance may begin to hinder APOPO's ability to grow, shift, and adapt. If this does happen, it will be important that APOPO recognize it and be able to respond accordingly, making decisions to allow for growth without losing the value that SUA brings to the relationship.

6   Balancing Synergies and Tensions

Throughout this analysis, the balancing act that comes along with an integrated approach to social enterprise has surfaced again and again: balancing social impact with the rigors of scientific research, working to provide local employment opportunities in the face of cultural barriers and high attrition, balancing partnerships with local and national governments while trying to empower decision-making at the government level, etc. As the Four Lenses Framework illustrates, many of the synergies and tensions arising in social enterprise relate to the *secondary lenses* within each performance criterion. For instance, stakeholder engagement should be complementarily aligned with an organization's depth of impact, while there may exist tensions relating to impact across the other three lenses. The table on the following page provides a snapshot of the synergies and tensions in APOPO's   model   using   the   Four   Lenses   approach.

Performance Criteria	Strategic Lenses			
	Stakeholder Engagement	**Resource Mobilization**	**Knowledge Development**	**Culture Management**
Depth of Impact	APOPO seeks to increase the capacity and expertise of African countries in the field of humanitarian detection and, as such, inherently achieves impact by engaging its various stakeholder groups. By training and employing African nationals and engaging with local governments and research entities, APOPO decreases dependence on foreign aid.	**Synergies**: APOPO has successfully leveraged local non-financial resources, forming partnerships with key institutions like SUA and utilizing an untapped African resource—rats. **Tensions**: Traditional funding from donor governments supports APOPO's activities yet goes against building local capacity and independence.	**Synergies**: APOPO has done significant research to develop the most appropriate detection technology for the African landscape. **Tensions**: Further knowledge development may be required to solve problems of employee attrition and the best way to address institutional voids such as the incentive-based culture.	**Synergies**: APOPO's staff are aware of the organization's social mission and take pride in their work, building local expertise and empowerment. **Tensions**: APOPO's management team must balance African culture and Western culture, working to find the best of both worlds as the organization grows and evolves.

Performance Criteria	Strategic Lenses			
	Stakeholder Engagement	Resource Mobilization	Knowledge Development	Culture Management
Blended Value	**Synergies**: To achieve blended value, APOPO engages stakeholders on both the supply and demand sides, influencing donor patterns and priorities. **Tensions**: The blended value model requires that APOPO shift its engagement with certain stakeholders. Donor governments, for example, must shift from donors to customers.	APOPO's new Center of Excellence strategy combines the organization's research experience with a social enterprise model that has the potential to create integrated social and financial value, providing appropriate detection services at a fee while at the same time developing the capacity and internal expertise of African countries in the detection field.	**Synergies**: Research efforts to develop a marketable detection technology are critical to proving the product—key if APOPO is to create blended value. **Tensions**: Through further testing and knowledge development, APOPO may learn that the rats' competitive advantage may not be significant in some applications.	**Synergies**: The organization's scientific and business-like culture and local allies help it avoid Western NGO stereotypes. **Tensions**: APOPO must be wary of conflicting economic and social inputs in detection markets. When the blended value model is profitable at the expense of ethical standing, the model itself fails.

Performance Criteria	Strategic Lenses			
	Stakeholder Engagement	**Resource Mobilization**	**Knowledge Development**	**Culture Management**
Efficiency	**Synergies**: Existing partnerships with SUA and DOTS centers are critical to APOPO's efficiency and facilitate ongoing research, sample collection, and eventually the implementation of proven applications. **Tensions**: Cultural deterrents to efficiency hinder the organization's operations, making the *way in which* APOPO engages stakeholders increasing important.	**Synergies**: New funding opportunities with social enterprise donors and investors place greater importance on capacity building and organizational efficiency. **Tensions**: At the same time, grant-based funding continues to be the most logical means of supporting technical research. APOPO must strike a balance between its funding options to achieve greatest efficiency.	Rooted in research, APOPO excels at knowledge development for efficiency, constantly working to improve the technology design and implementation. Careful tracking of the training process, breeding progress, and cage performance has successfully led to an unlikely accredited detection technology that has the potential to disrupt the status quo in speed, accuracy, and cost.	**Synergies**: The national culture of incentive-based motivation can be leveraged for efficiency through performance-based bonus schemes, building on a culture that is motivated by financial incentives. **Tensions**: APOPO's management team must look out for undesired outcomes as a result of staff "gaming" the incentive systems.

Performance Criteria	Strategic Lenses			
	Stakeholder Engagement	**Resource Mobilization**	**Knowledge Development**	**Culture Management**
Adaptability	**Synergies**: APOPO faces potential challenges due to the public perception of rats, and has effectively adapted its model to meet stakeholders where they are and educate them about rat capabilities. **Tensions**: Stakeholder feedback could be more broadly incorporated into the organization's strategic planning process.	**Synergies**: APOPO has successfully identified and implemented independent fundraising programs, using the "Adopt-A-Rat" scheme and the Poppy campaign to raise flexible funding to support expansion efforts. **Tensions**: APOPO's partnership with SUA could hinder APOPO's adaptability if it does not evolve alongside the organization.	**Synergies**: Research across all areas (competitive landscape, existing technology, future outlook, etc.) plays a key role in APOPO's decision to pursue a new application of its technology. **Tensions**: While it excels at knowledge management, APOPO will not achieve maximum potential without addressing the other lenses in this area.	APOPO has demonstrated a keen ability to adapt to changing market conditions, evidenced by the organization's shift into the TB detection sector following success with landmine detection. Further research and the constant drive of APOPO's founders to find new detection applications will ensure the organization continues to leverage market opportunities.

7 Conclusion

The Four Lenses Strategic Framework gives us a new approach to evaluating the success of a social enterprise such as APOPO. Using this integrated, layered approach, we have analyzed organizational performance based on four primary indicators—Social Impact, Blended Value, Efficiency, and Adaptability. Throughout, we have explored the various synergies and tensions that arise across the Four Strategic Lenses (Stakeholder Engagement, Resource Mobilization, Knowledge Development, and Culture Management) and have noted successes by Cox, Weetjens, and their team across the Four Lenses, as well as some areas for future attention and improvement.

By taking an integrated approach to social enterprise, we can begin to understand the benefits of APOPO's model as it relates to all stakeholder groups involved:

- *APOPO's employees* benefit from employment and training opportunities and resulting wages, which go to support their families.

- *Partners* such as the Sokoine University of Agriculture benefit from the opportunity to lead in an entirely new area of detection technology and animal behavior research.

- *Funders* benefit from supporting an innovative organization with a high media profile.

- *Customers* who purchase APOPO's detection services benefit from the most appropriate and cost-effective detection technology in the African context.

- *Local governments* become empowered when they can choose a locally developed technology to solve their local problems.

- *Beneficiaries* of APOPO's services benefit from lifesaving detection activities and the eventual eradication of harmful threats, be they landmines, TB, or other future applications.

Likewise, APOPO's activities in resource mobilization have supported the organization's growth and success to date. It has effectively leveraged a broad range of financial support, spanning from government grants to social enterprise investment to public donations through its own fundraising programs. Moving ahead, APOPO faces potentially groundbreaking investment opportunities as it launches its detection technologies via spin-off social enterprises.

As a research organization, knowledge development is clearly APOPO's strongest lens, leading to the successful development of an unlikely detection technology and the surprising international accreditation of landmine detecting rodents. APOPO successfully employs knowledge development to address improvement in its technology design, training process, and management systems, and looks forward to legitimizing these practices with a new MIS system in the near future.

Finally, APOPO's organizational culture presents some challenges to the social enterprise structure, as challenges with governance, growth, and communication strategies have hindered the company's performance in the past. Ready for the challenge, however, APOPO's management team and Board of Directors have taken the necessary steps to address cultural issues and looks forward to an improved organizational structure.

Looking ahead, APOPO is faced with an exciting phase of growth, evolution, and potential large-scale success. As the organization scales, incorporates new stakeholders, and adapts its model in the face of an ever-changing global economy, it is encouraged to evaluate its activities across each of the Four Lenses, mindful of their impacts in all performance criteria. Given the organization's significant achievements across the Four Lenses thus far, if APOPO continues to employ an integrated approach to social enterprise as it scales, it will be well positioned to achieve truly sustainable social impact.

8   Appendices

8.1   Sample of APOPO's Printed Materials

8.2   www.Herorat.org