Public-Private Partnerships for Health: Opportunities in Cabo Delgado, Mozambique

Title Page

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Abstract

The government of Mozambique faces tremendous challenges in improving population health outcomes – first due to a heavy burden of disease, and second due to insufficient resources for the health sector. The mining and natural gas firms operating in Cabo Delgado province face a challenge in maintaining a productive workforce – first because the burden of disease decreases labor productivity, and second because the current health care infrastructure is of low quality. The firms solve their problem by paying high prices for private health care contractors, but this SYPA argues that this funding could be spent more efficiently if aligned with the government health system through one of several possible public-private partnerships.

This paper describes four potential options. Two target *prevention* of disease, specifically malaria, one with primarily state implementation and another with primarily NGO-led implementation. These partnerships would be likely to reduce the prevalence of malaria, which should reduce absenteeism and improve labor productivity while improving population health outcomes. Two other options target *treatment* services, one with an up-front investment in improving a public hospital, and another that adds a long-term contract between the firms and government with quality monitoring. This last, most ambitious partnership is the most technically correct in its ability to improve services and demonstrate cost savings for the firm, but involves the most risk and most difficult implementation.

The analysis contained in this SYPA leads to three recommendations:

- Until trust is established between partners, a long-term curative partnership is unlikely. The more limited partnerships should be pursued first to prove the state's ability to implement higher quality services when their resource constraint is lifted.
- Because establishing trust is a key goal, NGO implementation should be ruled out unless a state-implemented program is unsuccessful.
- A preventative and curative partnership are not mutually exclusive, so the state should recruit a mining firm for the preventative partnership (their workforce is more likely to benefit from malaria reduction) while continuing to pursue a curative partnership with natural gas firms targeting stabilization services prior to medical evacuation.

Specific Role

This scholarly project was produced as a second-year policy analysis (SYPA) for the Masters in Public Administration in International Development (MPA/ID) at Harvard Kennedy School. I was the sole author and researcher. The project was initially conceived during my internship with the health financing organization ThinkWell in Maputo, Mozambique; during the conceptualization, I was mentored by Dr. Kebba Jobarteh as my supervisor at ThinkWell. I then developed the ideas, conducted interviews, and drafted all written components of the project. I received advising and editing support from Prof. Ryan Sheely and Prof. Michael Walton at HKS.

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Table of Contents

The story of Mozambique's natural resources is not a new one: a very poor country discovers tremendous resource wealth, but its ability to leverage this wealth for equitable development is uncertain. This policy analysis will focus on the concurrent challenges of extractive firms and the state health system in Cabo Delgado, Mozambique, describing one potential avenue for translating corporate success into community success via a public-private partnership (PPP) for health. The discovery of natural gas in Cabo Delgado is new and promising, but the province has gemstone and graphite deposits that are already under development. This analysis will focus on natural gas, but ultimately mining companies may make more attractive partners. It is worth acknowledging explicitly one assumption that is built into this analysis—improving profits, in this case by decreasing the costs of maintaining a healthy workforce, is the most powerful motivator for private corporations. Without this assumption, the policy analysis would describe different options for corporate social responsibility programs; what is proposed here is more limited in scope, but potentially more sustainable and impactful because it targets firm profitability.

The analysis is structured with five sections and a conclusion. After a brief description of the context in Cabo Delgado in section I, the nature of the problems faced by resource firms and the state are defined in section II. Section III explores the literature on PPPs including four case studies of successful programs in similar contexts. Section IV establishes the criteria for assessing PPP options, so that section V can describe and evaluate each of four options in turn. The conclusion in section VI will summarize the differences in the options and make policy recommendations regarding how to proceed towards a successful PPP in Cabo Delgado.

I. Context

There are complex historical antecedents to the current challenges faced by the health sector in Mozambique. The roots of poverty and low state capacity run deep, and legacies of the slave trade, colonialism, and civil war have left Cabo Delgado one of the least developed provinces in one of the world's poorest countries.

History of Mozambique and Cabo Delgado

Up through the 15th century, the area of Mozambique was settled by successive migrations of Bantu-speaking peoples, without a single unified state but with many

chieftainships and smaller polities throughout the territory, including several strong kingdoms in the 15th – 17th centuries.[1] The Portuguese established their first trading outpost in the region in 1505, and within a century, had some degree of territorial control over the Zambezi region.[2] The Portuguese *prazo* system granted tracts of land to European settlers who were then entitled to control over agricultural production and the labor of indigenous inhabitants.[3] Portuguese as well as Arab traders extracted raw materials and, most notably, large numbers of slaves from the coast and later further in the interior, with important long-term consequences for development.[4]

Portugal colonial rule is sometimes considered unique from other major European colonial powers – weaker, perhaps, but more brutal.[5,6] Because Portugal was ruled by a dictator through much of its late colonial period, domestic agitation to improve conditions in the colonies was ineffective to nonexistent relative to activism in Britain or France.[7] Without as much administrative or logistical capacity as British or French colonial authorities, Portugal utilized a charter system in Mozambique until 1942, and the charter's forced labor practices largely persisted until independence in 1971.[8] Outside the territory governed by the private charter, Mozambicans were also subject to taxes and annual labor levies that bonded them into working for commercial farms, usually owned by white colonists.[9]

The struggle for independence in Mozambique was longer and bloodier than in most other African nations. The resistance movement was organized and armed under FRELIMO (Frente de Libertação de Moçambique, or Mozambique Liberation Front), which remained dominated by a small, educated elite, even as it gained momentum and success in destabilizing colonial rule.[10] As Frelimo and colonial authorities battled over territorial control, both sides

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[1] Isaacman, Allen F. *Mozambique: the Africanization of a European institution: the Zambesi prazos, 1750-1902*. Madison : University of Wisconsin Press, 1972, pp4-6.
[2] Isaacman, *Mozambique*, 15.
[3] Isaacman, *Mozambique*, 17.
[4] Nunn, Nathan. "The long-term effects of Africa's slave trades." *The Quarterly Journal of Economics*, February 2008, 139-176.
[5] Isaacman, Allen F. *Cotton is the Mother of Poverty: Peasants, Work, and Rural Struggle in Colonial Mozambique, 1938-1961*. Portsmouth, NH: Heinemann, 1996. Page 9.
[6] Allina, Eric. *Slavery by Any Other Name: African Life under Company Rule in Colonial Mozambique.* Charlottesville: University of Virginia Press, 2012. Page 12.
[7] Ibid., 180
[8] Ibid., 179
[9] Ibid., 13
[10] Funada-Classen, Sayaka. *The Origins of War in Mozambique: A History of Unity and Division*. Oxford: African Books Collective, 2013. Page 376.

provided some services to win "hearts and minds," but relied primarily on violent coercion, resulting in displacement, hunger, and social disruption.[11] Ultimately, a 1974 military coup in Portugal removed Antonio Salazar from power and led to sudden independence for Mozambique in 1975.[12] Frelimo took over rapidly, basing its rule on an intellectual brand of revolutionary socialism.[13]

Tragically, independence was followed by a brutal civil war between Frelimo and RENAMO (Resistência Nacional Moçambicana, or Mozambican National Resistance), fueled by the South African apartheid government's efforts to destabilize their neighbor.[14,15] Until 1992, Renamo launched frequent attacks that destabilized the countryside, and the weak, cash-strapped Frelimo government could do little to improve well-being (and forced collectivization and cash crop production did little to help).[16] The parties signed a peace accord in 1992 that should have ushered in multiparty democracy, but Renamo's support eroded over the next 20 years and they never gained much influence in the national assembly. Because the government is highly centralized, there remains little political diversity: the national government chooses governors in the provinces, so even where Renamo wins a majority of the parliamentary seats (in the 2014 elections, this occurred in 3 provinces), they have little to no control over local governance.[17]

These historical events alone may not explain the minimal social development throughout the country, but they certainly contribute, and the limited capacity of the provincial government to provide social services must be understood in this historical context.

The modern state

Nicola Gennaioli and Ilia Rainer describe a mixed picture of Mozambique's state capacity.[18] They find Mozambique to have a history of more pre-colonial political centralization than the average African country, which in their data is a strong predictor of post-independence state capacity to deliver services. However, this prediction holds true in Mozambique's degree of

[11] Ibid., 378
[12] Ibid., 383
[13] Newitt, Malyn. *A History of Mozambique*. London: Hurst & Company, 1995. Page 541.
[14] Funada-Classen 385
[15] Newitt 563
[16] Ibid., 565
[17] Pearce, Justen. "Mozambique: Unexpected Truce Still Hangs in the Balance." *The Conversation, Africa*, 17 January 2017.
[18] Gennaioli, Nicola, and Ilia Rainer. "The modern impact of precolonial centralization in Africa." *The Journal of Economic Growth* (2007) 12:185-234.

road paving and infant immunization only; in terms of infant mortality, adult illiteracy, and school attainment, the Mozambican state underperforms Gennaoili and Rainer's predicted performance.

Other metrics of state capacity paint a similar picture. Mattias Ottervik borrows Schneider's measure of the shadow economy to estimate overall tax compliance and ranks Mozambique 109th out of 162 countries, placing it higher than all its neighbors except South Africa.[19] However, Mozambique performs poorly on the World Bank's governance indicators, and its performance has worsened over the past decade. It ranks at the 23rd percentile for government effectiveness, below the sub-Saharan African average at the 27th percentile. [20]

The level of economic development achieved in Mozambique remains extremely low. Its GNI per capita (PPP adjusted) was $1,170 in 2015,[21] but this obscures dramatic inequality and a sharp urban-rural divide. Almost seventy percent of Mozambicans lived below $1.90/day in 2008,[22] and Cabo Delgado is part of the very poor periphery; were Cabo Delgado a country, it would have the 2nd worst maternal mortality and 3rd worst child mortality in the world.[23]

Natural resources

Mozambique has a number of promising natural resources, however, and Cabo Delgado province is home to graphite mines, gemstone mines, and, discovered in the past decade, massive natural gas reserves off the coast. Exploratory drilling began in 2010, and led by Italian firm Eni and American firm Anadarko, Mozambique has had several of the largest gas discoveries in the world in recent years.[24,25] Indeed, if the field is developed to full capacity, Mozambique will be the third largest exporter of liquefied natural gas (LNG) in the world.[26]

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[19] Ottervik, Mattias. "Conceptualizing and measuring state capacity: testing the validity of tax compliance as a measure of state capacity." Gothenburg: University of Gothenburg, Department of Political Science, Quality of Government Institute (working paper, series 2013:20). December 2013.
[20] World Bank Group, "World Governance Indicators." http://info.worldbank.org/governance/wgi/index.aspx#reports.
[21] World Bank Group: World Bank Databank. Need website
[22] World Bank Databank
[23] Maternal mortality is 822 deaths per 100,000 live births (Vilankulos, Amancio Miguel. "Improving maternal health in Cabo Delgado." ReliefWeb, 14 April 2015). Child mortality is 116 deaths per 1,000 live births (WHO, Mozambique Neonatal and Child Health Profile). Country ranking per World Bank.
[24] Court, Alex and Diane McCarthy. "Massive gas discovery transforms Mozambique backwater into boomtown. CNN, 3 February 2015.
[25] Helman, Christopher. "The 10 biggest oil and gas discoveries of 2013." Forbes, 8 January 2014.
[26] Cunningham, Nick. "Mozambique's LNG dreams falling apart." OilPrice, 24 May 2016.

Whether this potential economic boom will translate into opportunities for the average Mozambican, however, remains to be seen. Success stories of resource development that led to equitable economic growth, such as oil in Norway and diamonds in Botswana, are promising, but history abounds with cautionary tales – including that of oil fields in Angola, a country with a very similar history to Mozambique. Cockx and Franken show that natural resource development usually has a *negative* impact on social spending[27] – a discouraging prospect for Cabo Delgado, where publicly provided social services are already weak. The remainder of this study will describe an opportunity for Cabo Delgado to leverage natural resource developments for the benefit of its people.

II. Defining the problem

The firms' problem

The investment opportunity for Eni and Anadarko is tremendous, but they face a unique human resource challenge: extraction of liquefied natural gas requires careful work by highly trained, highly skilled staff. In the first place, very few highly skilled Mozambicans are available to work in Cabo Delgado, and in the second, it is expensive to relocate highly sought after employees to a rural province with minimal infrastructure and services, whether they are Mozambican or expatriate. Aside from the consumer comforts unavailable in Cabo Delgado, firms face a health care challenge: it is impossible to maintain satisfied, safe, and productive employees to the degree extractive firms require without offering improved health services.

First, knowledgeable employees will reject the placement without a guarantee of their physical wellbeing. Multiple informants from different companies reiterated that offering access to medical evacuations is a pre-requisite in any expatriate's work contract, given their low opinion of health services available in Mozambique.[28] Local staff may require care unavailable in Cabo Delgado, and though firms' willingness to pay for evacuations of national staff varies, nearly all accept responsibility for their care when an injury occurs at the worksite.

Second, due to the high burden of infectious disease in the area, labor productivity is decreased by absenteeism due to illness. Informants varied in their assessment of the risk posed

[27] Cockx, Lara and Nathalie Francken. "Extending the concept of the resource curse; natural resources and public spending on health." *Ecological Economics* 108 (2014): 136-149.
[28] Interviews with informants 10 (Dr. Eugenio Malfatti, Eni health director), 04 (gas industry senior staff), and informant 01 (expatriate with experience in the oil sector), January – March 2017.

by malaria. On one hand, Eni's medical director reported that expatriates contracting malaria is extremely rare, and he believes the risk is low even for national staff, because their high incomes relative to their surrounding communities allow them to protect their families with screens, mosquito repellent, and access to intermittent preventative therapy.[29] However, several other informants reported significant malaria risk. One Tanzanian national managed residential facilities for natural gas firms in Mozambique for four years as a sub-contractor, and she recalled four medical evacuations, including her own – three of them were due to cerebral malaria.[30] She also recalled two deaths of sub-contractors due to malaria for which they did not seek prompt treatment. The ruby mine in Cabo Delgado recently told one informant that malaria is their biggest health concern.[31] Finally, an informant familiar with the local International SOS clinic reported that malaria is one of the leading diagnoses for the (primarily expatriate) workers who receive care at the clinic.[32] The discrepancy between the views of Eni's medical director and these other informants may be due to several reasons: mine workers and Eni sub-contractors may be more at risk of malaria than more senior natural gas employees because of their lower socioeconomic status; Eni may not have seen high malaria rates yet because their project has not yet been fully staffed, or because their operation will be predominantly off-shore, in contrast to Anadarko and nearby mines; and the national staff that contract malaria may be self-treating or seeking care elsewhere such that their illness does not rise to the attention of the medical director. In any case, that Eni's medical director does not view malaria as a major threat is significant for the potential political viability of an anti-malaria campaign, but does not necessarily mean that reducing malaria incidence would not benefit staff of Eni or other firms.

The industry has found effective but expensive solutions to this challenge. First and foremost, according to Eni's medical director, they enforce strict fitness-to-work requirements, and any expatriate offered a posting abroad or any national offered a position on a drilling rig is subject to an extensive medical examination that could result in disqualification if they are found to have even minor health conditions. This may contribute to costs if it limits the pool of potential labor, though the director did not think this was currently a concern.

[29] Interview with informant 10, Dr. Eugenio Malfatti, 8 March 2017.
[30] Interview with informant 05, Rita Nkaurasa, 2 March 2017.
[31] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.
[32] Interview with informant 08 (familiar with I-SOS), 4 March 2017.

For medical care, aside from the direct care provided by firm-employed clinicians on offshore rigs, there are separate strategies for expatriates and national staff. For expatriates and a handful of senior Mozambican executives, International SOS, a private health care contractor, provides curative services at an extremely well equipped clinic in Pemba and at two other satellite clinics near the production sites. An annual "membership" at the clinic includes unlimited consultations and laboratory tests and costs $1,800 per person, though firms may receive discounts, but membership does not include interventions, medications, or evacuations, which renders the model effectively fee-for-service.[33] A consultation for non-members starts at $250. I-SOS also facilitates evacuation for staff that need more advanced care, including anyone needing surgical services or hospitalization, most often to private hospitals in Johannesburg. These evacuations cost no less than $20,000, and some firms provide secondary insurance for evacuations (Eni, for example, uses Europe Assistance). National employees typically receive private insurance that entitles them to local care, but not at the I-SOS clinic.[34] There are two other private clinics in Pemba where a patient could receive a consultation or medical hospitalization, but neither offer surgical care; for surgery, hospitalization, or specialty care, patients are transferred to Maputo, either via medical evacuation in the case of emergency, or commercial air travel for less urgent needs.

Many firms also spend privately on preventative health interventions such as malaria control. One informant, who previously worked as medical director for a mine in Mozambique, described the challenge with trying to reduce malaria among employees – while providing bed nets and mosquito repellant was effective initially, within six months, malaria rates rose again.[35] Endemic malaria often resurges in this manner, which makes it a uniquely appropriate target for some of the community-wide interventions proposed later in this analysis. Another informant, who had been evacuated for a case of cerebral malaria, reported that following her evacuation, the camp increased fumigation and drainage efforts around the camp, but there were further incidents of cerebral malaria in the following years despite these investments.[36]

Though the industry clearly spends more on its expatriate staff than its national staff, in both cases, they spend far in excess of what a company operating in a country with a robust

[33] Interview with informant 08 (familiar with I-SOS operations), 4 March 2017.
[34] Interview with informant 04 (gas industry senior staff), 13 February 2017.
[35] Interview with informant 03 (Dr. Egidio Langa), 10 February 2017.
[36] Interview with informant 06 (Rita Nkaurasa), 2 February 2017.

public health system would spend. Of note, Eni's medical director does not perceive health care costs to be of concern to the corporation; this is in contrast to the information obtained from informants connected to the mining industry. Whether this is because of fundamental differences in the two industries' workforce, or because Eni has not yet encountered the cost issues that it will when its operations in Mozambique are more mature, is not yet clear.

The health system's problem

Healthcare in Cabo Delgado is dominated by the public system administered by the provincial health directorate. The provincial hospital in the capital, Pemba, offers the widest variety of services in its outpatient department, inpatient wards, surgical theaters, and labor and delivery facilities. The province has 5 other district hospitals and 105 health centers; though its ratio of hospital beds to inhabitants is about average for Mozambique, Cabo Delgado's population is so dispersed that it has the second largest catchment area per health facility of all Mozambican provinces.[37] The facilities vary significantly in size and quality. The Palma health center, for example, closest to Eni's operations base, received a surgical theatre, laboratory, and maternal waiting house from Eni's corporate social responsibility program, all of which it was lacking previously.[38] The district hospital recently received a oxygen compressor system which allowed it to save almost $30,000 per year on transporting oxygen from Nampula province, but an informant familiar with the operations of the hospital reported that they are in major need of a water purification system because their current water source causes problems in their laboratory and laundry.[39]

Mozambique's health system faces compounding challenges: first, a heavy burden of disease, particularly infectious disease due to HIV and malaria, creates significant need; and second, the resources available to combat that need are insufficient.

Mozambique suffers from several major endemic diseases that contribute to high health care need and low life expectancy. An informant with detailed understanding of the provincial health directorate, who spoke under condition of anonymity, described the key unmet priorities for the health system as (1) access to sanitation, (2) human resources for health, (3) reducing maternal and child mortality, and (4) control of infectious diseases including malaria,

[37] República de Moçambique, Ministério da Saúde, Direcção de Planificação e Cooperação. "Anuário Estatístico de Saúde 2015." Maputo: May 2016.
[38] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.
[39] Interview with informant 07 (familiar with provincial hospital), 3 March 2017.

tuberculosis, and HIV.[40] The data support his qualitative assertions. Malaria is the leading cause of death in children, while HIV/AIDS is the leading cause overall, unsurprising given the 10.5% prevalence among adults, ranking Mozambique 8th in the world.[41] The burden of malaria in Cabo Delgado is even higher than the national average – 43.7% of children tested positive for malaria parasites in 2011, and 20-30% of hospitalizations are attributed to malaria alone.[42] HIV, tuberculosis, and malaria grouped together cause the greatest loss of productivity (measured by "disability-adjusted life years," or DALYs). All three of these diseases are treatable and preventable at relatively low cost, but addressing them effectively requires coordinated action across the health system.

Under-5 mortality is a useful proxy for an area's burden of infectious disease because malaria and diarrheal illness, both preventable with environmental improvement and access to clean water (and treatable with robust primary health care services), are usually the leading causes of death in children. This data point also allows for useful comparisons between settings, because comparing prevalence of one disease alone obscures how very different epidemiologic patterns can cause very similar burdens on health systems. Mozambique overall has an under-5 mortality rate of 78.5 per 1,000 live births, 23rd in the world;[43] as noted earlier, Cabo Delgado's 2011 rate of 116 per 1,000 would have made it second among countries. The Mozambican health system, and Cabo Delgado in particular, face a daunting task.

Unfortunately, the resources available to respond to this challenge are insufficient. Total health expenditure in Mozambique is $42 per capita annually,[44] well below the World Health Organization's baseline recommendation of $60.[45] The mix of funding sources in Mozambique is complex, with donor funds being partly channeled through the government and largely through private, "vertical" (disease-specific) NGO programs. Government spending is just over half of all health expenditure, but much of that comes from donor funds. In any case, the Abuja

[40] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.
[41] World Bank Databank.
[42] Ministério da Saúde (MISAU) & Instituto Nacional de Estatística (INE). "Inquérito de Indicadores de Imunização, Malária e HIV/SIDA em Moçambique (IMASIDA): Relatório de Indicadores Básicos, 2015." Maputo: June 2016.
[43] World Bank Databank.
[44] Global Health Observatory.
[45] Health Policy Project (USAID), "Health Financing Profile: Mozambique," page 1.

Declaration, a global commitment to which Mozambique agreed, set a target of 15% of total government expenditure to be channeled towards health; Mozambique spends only 8.8%.[46]

Just as child mortality is a useful proxy for disease burden, maternal mortality is a useful proxy for the strength of the curative health system. Giving birth is an inherently risky activity, but nearly all maternal deaths can be prevented with adequate surgical care and functioning referral networks that allow for prompt, effective intervention on common conditions such as obstructed labor or post-partum hemorrhage. Mozambique's maternal mortality of 489 per 100,000 live births places it 22nd in the world,[47] and as mentioned previously, Cabo Delgado's 2014 rate of 822 would make it third among all countries. Other metrics give a similarly bleak picture of the Mozambican health system's ability to respond to the populations' needs. Approximately 42% of people living with HIV are receiving treatment; 58% of one-year-olds in Cabo Delgado have received all recommended vaccinations.[48] Of children presenting to public clinics with a fever, only approximately two-thirds received the indicated malaria test.[49] These are all indications of health system quality, which may be affected negatively by poor infrastructure, insufficient equipment, stock-outs, absenteeism, low health worker morale, or other issues of mismanagement. One informant described the challenge of user fees at public facilities, which may very well amount to bribes, as it is unclear to patients whether some fees are official or not.[50] Unfortunately, systematic assessments of these issues and other issues of health system quality are rare in Mozambique, but by nearly all available metrics, the public health system is failing to meet the formidable challenge it faces.

There exist many potential remedies to these problems. An "ideal" health system is in the eye of the beholder; different countries successfully provide access to quality healthcare using a wide variety of public, private, and non-profit solutions. One "first-best" ideal of a health system would include a guaranteed package of essential health services made affordable and accessible for all residents of a nation, funded by national tax revenue in order to pool risk across the population. Leaving aside the question of whether this is truly ideal, it is not possible at this juncture in Mozambique: total tax revenue and the political environment lead to insufficient

[46] Ibid., 1.
[47] World Bank Databank.
[48] Global Health Observatory.
[49] MISAU & INE, 38.
[50] Interview with informant 06 (Rita Nkaurasa), 2 March 2017.

allocations for health spending, and the status quo of patchwork donor programs and an anemic Ministry of Health is a direct result of the political, economic, and administrative forces beyond the control of a health policymaker. This SYPA will explore one of many "second-best" solutions to the problem of ensuring quality health care in Mozambique.

The joint problem: the dynamics leading to inefficiency

In stark terms, two problems are present at the same moment: some consumers (firms) are spending too much, while some suppliers (the public system) are earning too little to provide services of sufficient quality to earn the "business" of the firms' employees. The beneficiaries or rent-seekers in this situation are private health care providers and the providers located outside of Cabo Delgado that receive medical evacuations. This policy analysis argues that the problem could be rectified, with efficiency gains from two primary sources – better utilization of inputs that require fixed costs, and internalization of the externalities inherent to infectious disease.

The factors of production in health care are, as in most industries, not infinitely divisible. Both physical capital (such as clinic structures, diagnostic equipment, and operating theaters) and human capital (high-skill labor that must be physically proximal to consumers) represent significant fixed costs. As a result, firms seeking to provide all the services that their employees might need will face issues of scale. Even if accidents on a drilling rig that require surgical care occur monthly, the operating theatre and surgeon required for effective treatment will sit idle for an inefficient length of time. Firms are clearly sensitive to these scale effects; one informant had worked for the same extractive firm in two different countries where operations were at very different scales, and the site with a large number of employees established its own on-site hospital while the small-scale operation provided him with health insurance that he could use in-country or in South Africa.[51] This represents room for enhanced efficiency: if both the public *and* firm employees could access these fixed cost investments, they would be more efficiently utilized.

Infectious diseases are classic cases of negative externalities: individuals under-invest in disease prevention because they do not privately realize the social gains of reduced infectious burden. Public health interventions that would reduce the burden of malaria or diarrheal disease, then, are appropriate activities for the state, which can aggregate the costs and benefits of disease prevention. However, a variety of frictions lead to underinvestment by the governments of

[51] Interview with informant 01 (experience in oil industry), 3 February 2017.

Mozambique and Cabo Delgado. Low labor productivity means few resources available, and a wide variety of institutional issues in the structure of the government result in insufficient expenditure. Given the high productivity of their labor force, extractive firms are particularly well positioned to overcome some of these challenges – they would derive great benefit from reduced infections, and they may in fact be willing to pay enough for these benefits to cover the costs of disease prevention in the surrounding community. In another framing, they *must* pay for prevention activities in the community in order to realize benefits; any intervention isolated to their own labor force is likely to fail, given that mosquitos fly over walls, rotavirus contaminates communal water sources, tuberculosis spreads throughout housing settlements, and so on. Addressing infectious diseases effectively must involve community-wide or even regionally coordinated efforts, so firms must take public health seriously to address the health of their labor force.

The rest of this policy analysis will operate under the theoretical assumptions above. With an understanding of these tenants, it is clear that the interests of the public and the private sector in improving health outcomes are often aligned, and public-private partnerships present an opportunity for pooled resources to solve shared problems.

III. Reviewing the literature

Public-Private Partnerships

Over the past several decades, governments around the world have explored new ways of partnering with the private sector to deliver services to their constituents. The relationship of the state to the private sector may be as straightforward as procurement or short-term contracting, but other, more complex arrangements qualify as "public-private partnerships" (PPPs). While there is no single definition of a PPP, they are commonly held to be formal relationships between the public sector and a private entity, designed to deliver a service to the public, in which some degree of responsibility, risk, and reward are shared between all partners. Full privatization of utilities, for example, would not qualify; a true PPP might instead include a 30-year service contract in which a private company builds infrastructure, provides a service (like electricity or waste management), and is compensated by the government according to specific performance metrics. These sorts of PPPs have been used to provide a variety of public utilities, as well as for the operation of toll roads or telecommunications.

The reference guides compiled by the World Bank and HK Yong specify that an arrangement between the public and private sector should only be classified as a "partnership" when the private partner assumes a certain degree of risk.[52,53] However, while these PPP guides are comprehensive in describing arrangements of *state funding* for *private service provision* to the public, they do not describe PPPs in which resources flow in the other direction. Marc Mitchell, focusing on the health sector, offers a broader definition of PPPs, and describes drug donation programs or vaccine development initiatives in which the private sector makes contributions to public welfare.[54] Taking into account the wide variety of spending done under an umbrella of "corporate social responsibility," instances of private contributions to public goods abound.

The notion of PPPs used in this analysis combines elements from both the World Bank and Mitchell. It is principally concerned with instances where the private sector leverages its strengths (including funding) for public benefit – but, more along the lines of the World Bank's definition, it focuses on instances when firms do this *with a profit motive*. While CSR has doubtlessly transformed communities around the world, this report hypothesizes that PPPs can create more sustainable change by tying the interests of powerful extractive industry firms to the interests of the local community. The case studies described here all, to a varying degree, exhibit this trait: private firms identified private benefit from improving public health services.

Case studies: a rationale

Despite the frequency with which firms invest in some aspect of the health system, comprehensive documentation of these programs remains scarce. These cases were found using publicly available information, initially through internet searches and recommendations from global health experts. Only cases in which there was overlap between employee health services and publicly available services were studied, leaving out most CSR projects. After narrowing to programs with this central characteristic, the examples below were chosen based on several criteria: they are relatively well documented, involve substantial financial commitments from firms, achieved some degree of success, and, most importantly, they demonstrate broad themes

[52] World Bank, *Public-Private Partnerships Reference Guide*. Washington: International Bank for Reconstruction and Development / World Bank, 2014.
[53] HK Yong, *Public-Private Partnerships Policy and Practice: A Reference Guide*. London: Commonwealth Secretariat, 2010.
[54] Marc Mitchell, *An Overview of Public Private Partnerships in Health.* Boston: Harvard School of Public Health. (No year given.)

of health PPPs and can be used to construct a typology that will be described at the conclusion of this section. Initial analysis was performed using a modification of the Mining Health Initiative's analytic framework (Appendix 3), though the details of this interrogation have been dropped in favor of a more narrative presentation. Each case offers important lessons about the origins, strengths, and challenges of health PPPs that channel private resources for public benefit. This collection was not intended to be comprehensive, but rather illustrative and instructive.

Case study #1: Marathon Oil's malaria program in Equatorial Guinea

In 2001-2002, Marathon Oil began investing in a drilling operation off of Bioko Island, Equatorial Guinea.[55] They quickly identified malaria as a prominent threat to their core business.[56] The disease posed a potential cause of death for its expatriate employees and a cause of absenteeism for their local employees, whether due to their own illness or the illness of their dependents.[57]

Executives were also inspired by meetings held by the Roll Back Malaria global campaign, which spurred their idea to partner with the public sector to combat the disease.[58] After reaching out to the Ministry of Health to establish basic terms of a potential relationship, Marathon founded the Bioko Island Malaria Control Project (BIMCP) and contracted an NGO partner, Medical Care Development Initiative (MCDI), to begin implementation of a comprehensive anti-malaria campaign. The campaign centered on controlling the mosquito vector, emphasizing indoor residual spraying (IRS) throughout the island, bed net distribution, and the installation of screens in houses.[59] The program also paid for free malaria tests and treatment at all public clinics on the island, first for high-risk groups and then eventually for all patients.[60] Both partners contributed significant resources – the $50 million in funding over 10 years was split 2:1 between Marathon and the government, with the government's portion

[55] Kraus, Joseph R. *The "Business" Of State-Building: The Impact Of Corporate Social Responsibility On State Development In Equatorial Guinea.* Dissertation. University of Florida, 2010. Page 192.
[56] *Bioko Island Malaria Control Project: Ten Year Anniversary Commemorative Book.* Published by Marathon Oil. Page 4.
[57] In malaria-endemic areas, adults rarely die of malaria because of acquired immunity; contracting malaria leads to several days to a week of flu-like symptoms and missed work, but the threat of death is not as severe as for individuals infected for the first time, including children and visitors from non-endemic areas.
[58] Interview with MCDI project manager, 6 March 2017.
[59] BIMCP., 10.
[60] Ibid., 12.

coming directly from oil revenues. The original oil extraction agreement provided for this type of arrangement – the government of Equatorial Guinea ceded control over the oil revenue, allowing Marathon to manage how the resources would be spent in support of Equatoguinean people.[61] This unique revenue arrangement likely played a major role in the conditions necessary for a program as robust as BIMCP. Marathon took the lead in managerial support for the project, and the public sector contributed by utilizing public clinics for the provision of tests and treatment.[62] Rather than rely on the public sector supply chain, however, MCDI procures and delivers these commodities to public clinics, ensuring better stock reliability.[63] Of note, Marathon invested more than just financial resources in the program; for much of the project, staff from Houston and Bioko Island, from both their CSR office and their operations team, joined weekly conference calls with BIMCP to ensure progress.[64]

The role of the NGO partner is also significant for the project model's generalizability. Neither Marathon nor the government had experience in IRS, making MCDI a key player in this aspect of the program.[65]

As the BIMCP program progressed, the big gains in malaria reduction that were realized in the first five years became more difficult to achieve. The second five-year phase included drainage of standing water to eliminate mosquito breeding sites and an expanded IRS campaign to account for an almost doubling of housing structures on the island since the previous census.[66] It also provided for the training of community health workers to conduct outreach and community-based education.[67] They were employed in localized "test and treat" campaigns for which they were paid, and community health workers continue to support testing and treatment activities at local clinics, though they are not paid salary but instead compensated through "in-kind" donations such as meals and t-shirts.[68]

Key to the success of BIMCP was its robust data collection. Initially in collaboration with MCDI, the program trained and employed several epidemiologists who were eventually made full-time staff in the public sector to lead the collection of data from all over the island regarding

[61] Interview with MCDI project manager, 6 March 2017.
[62] Ibid., 6.
[63] Interview with MCDI project manager, 6 March 2017.
[64] Kraus 193.
[65] Ibid., 193.
[66] BIMCP 20.
[67] Marathon Oil Corp, "Hope for Bioko." Online video clip. YouTube, 19 August 2014.
[68] Interview with MCDI project manager, 6 March 2017.

malaria prevalence in humans and in mosquitos.[69] This system enabled targeting IRS and other activities to malaria "hotspots." By improving data collection at public clinics, BIMCP was able to show dramatic improvement in health outcomes as well as malaria incidence – most notably a 65% reduction in overall child deaths[70] and a reduction in population-wide parasite prevalence from 45% to 11%.[71] The system also allowed for an economic welfare analysis, which Marathon leadership says revealed a four-fold return on investment for the community at large.[72] In addition to training epidemiologists, MCDI has hosted Ministry of Health employees as full-time secondees within their organization, with the understanding that when the project is completed, these staff will return to the Ministry with greater skills.[73]

A full cost-effectiveness analysis of the project is not available, but even using the maximum possible estimate (using all costs of the program and only accounting for the reduction in child deaths), the program is extremely cost-effective at $2,000-$3,300 per death averted. This figure does not take into account the increased productivity of adults who no longer suffer malaria and no longer stay home to care for ill children.[74] The island may serve as a site for a malaria vaccine trial in coming years, and BIMCP continues with Marathon's support to seek complete eradication of malaria on the island. Long-term sustainability of the program will be a challenge, as Marathon's presence will draw to a close in the next decade as oil fields are depleted. The push towards vaccination and eradication is fueled by this short timeline; BIMCP hopes to leave a lasting impact on the island even after the oil and oil revenues have finished.[75]

Case study #2: BHP Billiton's malaria program in southern Mozambique

Unsurprisingly, malaria is a popular disease of focus for PPPs, given its infection patterns and the difficulty in protecting any one group of inhabitants without addressing an entire endemic area. In southern Mozambique, British corporation BHP Billiton constructed an

[69] BIMCP 18.
[70] BIMCP 4.
[71] Interview with MCDI project manager, 6 March 2017.
[72] *Combating malaria: How an oil company is helping to tackle the problem* (2009). . Fountainebleau: INSEAD.
[73] Interview with MCDI project manager, 6 March 2017.
[74] Note: BIMCP (BIMCP 16) reports 4,500 to 7,500 under-5 lives saved in 2008 alone, divided by $15 million project expenses in 2004-2008, gives estimate of $2,000-$3,300 per life saved / death averted. Note that this is an absolute maximum estimate, used with the assumption that all expenses 2004-2008 only achieved a saved life in 2008, and that the lives saved ended in 2008.
[75] Interview with MCDI project manager, 6 March 2017.

aluminum smelter that, during the 2-year construction phase alone, suffered losses of 13 workers' lives and $2.7 million due to malaria.[76] The South African Medical Research Council (SAMRC) recruited BHP Billiton and several other private-sector partners into a malaria-focused partnership called the Lubombo Spatial Development Initiative (LSDI). LSDI was initiated by SAMRC with a founding contribution from BHP Billiton, and was designed primarily to coordinate IRS campaigns in the region spanning southern Mozambique, northeastern South Africa, and Swaziland, which share a common epidemiologic burden. In addition to IRS (conducted by an NGO), tests and treatment were distributed to public-sector health facilities.

The catchment area of LSDI was much larger than Bioko Island, and the coordination of three ministries of health and numerous non-state partners was much more complex. Perhaps as a result, the goals of the organization were somewhat less ambitious, and the ability to collect robust, coordinated data was more limited. Overall health improvements were evident, however. A decline in malaria prevalence in children was observed and, important for the business case of such partnerships, BHP Billiton saw major improvements in health indicators among smelter employees: malaria case reports dropped by 70% and medical evacuations dropped by 77%.[77] BHP Billiton was less involved in LSDI's day-to-day operations than Marathon Oil was in Equatorial Guinea, but they did offer support for LSDI's financial management systems.

Perhaps the most important difference between the two programs were their fates: LSDI's activities (spraying and test/treatment distribution) were ultimately absorbed into the Ministry of Health in Mozambique and the public sectors in Swaziland and South Africa.

Marathon Oil and BHP Billiton engaged in robust, effective partnerships, but their projects only targeted malaria, and were designed as purely disease-specific or "vertical" programs. This may have made it easier to show efficacy, and the choice was made given the most significant disease burden in their areas of operation, but other health priorities were unlikely to be affected. The examples described below are more comprehensive health system interventions that primarily target *curative*, rather than preventative, health services.

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[76] World Economic Forum. "Global Health Initiative Public-Private Partnership Case Example: Creating a public-private partnership to build local malaria intervention capability in Mozambique, Swaziland, and South Africa." Geneva, 2006.

[77] Van der Bergh, Andre. "BHP Billiton Case Study: Malaria." BHP Billiton corporate presentation, 2004. Page 13, 16.

Case study #3: Freeport-McMoRan's curative health services in Papua, Indonesia

Many accounts of Freeport-McMoRan's activities in Indonesia describe displacement, environmental degradation, and community conflict, but its support for local health services stands apart. Since the 1960s, Freeport has had extensive mineral extraction interests in Papua, one of the poorest and most remote provinces of Indonesia. As of the 1990s, government health services in the area were essentially nonexistent: "Freeport and the missions provided the only medical care for the highlands."[78] Freeport funded the construction and operation of several hospitals and clinics, all available to the local population at no charge. In a "company town" in the highlands,[79] International SOS runs both a hospital designed primarily for employees (Tembagapura Hospital) and a hospital open to the public (Banti Hospital, RSWB), in addition to several clinics available to the public and employees.[80,81] There is a third hospital in the lowlands, Mitra Misyarakat (RSMM), supported by Freeport and managed by Caritas, an NGO.[82] In 2008, this 78-bed hospital was the first hospital in the entire province of Papua to receive Ministry of Health accreditation.[83] Its budget is a remarkable $6.6 million (88 billion rupiah) for 2017.[84] The unique aspect of Freeport's support for these hospitals is that Papuan patients, including community members not employed by the mine, can seek care directly or be referred to the hospitals from Freeport's clinics and receive free treatment.[85]

Using the term "partnership" to describe these health services is inaccurate, however. Freeport supports health services available to the public, but the government has minimal participation in any of the facilities.

Case study #4: First Quantum Minerals' curative health services in Zambia

In Zambia's copper belt, First Quantum Mining also participates in a malaria prevention partnership with the public sector,[86] but their major innovation and investment is in curative

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[78] Leith, Denise. *The Politics of Power: Freeport in Suharto's Indonesia.* Honolulu: University of Hawaii Press, 2003. Page 124.
[79] US State Department, diplomatic cable, 7 November 2007, Jakarta. Available via WikiLeaks.
[80] Email from Govert Waramori, 8 February 2017.
[81] PT Freeport. "Hospitals and Clinics." Webpage, http://ptfi.co.id/en/csr/health-program/hospitals-clinics (accessed 22 January 2017).
[82] Ibid.
[83] Makur, Markus. "Timika hospital receives first accreditation in Papua." Jakarta Post, 30 October 2008.
[84] Email from Ramlon Marbun, 9 February 2017.
[85] Leith 124
[86] Mining Health Initiative (MHI). "A Mining Health Initiative case study: First Quantum Mining Limited, Zambia: Lessons in Government Engagement." January 2013.

health services. Rather than targeting a single disease, this partnership supports a public hospital that serves both local communities and mine employees.

FQM self-insures its 9,500 employees and their 60,000 dependents. The mine established a comprehensive medical clinic on site, which is managed by a non-profit health provider under a fee-for-service model, with payments from FQM directly to the non-profit.[87] As described by FQM's health director Anna Pascall, choosing which services to offer at the clinic was a balance between conserving scarce resources and ensuring capacity to deal with major accidents. The 30-bed facility has significant diagnostic capacity, including x-ray and CT; for approximately 1% of patients who are very ill or badly injured, the hospital is able to stabilize before transfer to a higher-level facility. Offering surgical services on site was not seen as an efficient investment, given the rare need. Up to now, employees in need of surgical care are medically evacuated to Lusaka (for Zambian employees) or South Africa (for expatriate employees). This presents significant costs, felt more acutely because FQM self-insures, and can present an inconvenience to employees and their families.[88]

To address these problems, FQM established a relationship with the district health management team and proposed a partnership at Solwezi General Hospital, the public referral hospital that serves the area surrounding the mine.[89] Beginning in 2011, FQM has provided approximately $2.2 million for the renovation of the hospital including the surgical theater, emergency department, and, in particular, the "high-cost" ward.[90] The high-cost ward allows patients (or their insurance companies or the mine) to pay higher prices for more comfortable care. Though the arrangement is still being negotiated, Pascall hopes that a private health care provider will take over management of the ward, operating it as an innovative partnership resembling a concession. She envisions a fee structure whereby the private provider would pay a flat annual fee plus a portion of profits to the district health office. The fees from the high cost ward would subsidize the rest of the hospital, where uninsured Zambians receive care for free.

Establishing the partnership was complicated and took many years to negotiate, depending heavily on the leadership of health ministry officials as well as on Pascall's

[87] Interview with Anna Pascall, 9 February 2017.
[88] Email from Anna Pascall, 1 February 2017.
[89] MHI, 12.
[90] Mwizabi, Gethsemane. "FQM injects KR12 million in Solwezi General Hospital rehabilitation." Ndola: Times of Zambia, 20 May 2013.

persistence and commitment to the vision.[91] Of note, there had previously been a high cost ward, but the fee structure suffered from the same challenge of many similar "private wards" in public hospitals: the fees were set too low to even cover costs in the high-cost ward, and the end result was actually reverse subsidization, with public funds being used to keep the high-cost ward solvent.[92] In addition to the main employees of the mine, there are other privately employed Zambians in the district (primarily contractors servicing mine facilities, including cleaning and security staff) who have health insurance, but no private facilities in which they could utilize the insurance. Under district management, relationships between private insurers and the high-cost ward have been generally unsuccessful given the different approaches to health care provision between the private sector and the government. These differences are compounded by staff shortages at the hospital, with few clinicians or administrators having any extra bandwidth to negotiate and improve relations. Pascall hopes that management of the high-cost ward by an independent, private provider will reduce the burden on the hospital, increase hospital revenues, and further satisfy private insurers.

While it is quite young, and its successes remain to be seen, the partnership between FQM and Solwezi District Hospital is an innovative approach towards a PPP, and will serve as a model for a proposal described later in this analysis.

Case study typology

The main distinction between the case studies here, between *preventative* and *curative*, may initially seem like a surprising or even regressive framing. Public health has recently moved away from traditional dichotomies between disease prevention and treatment; improving health outcomes nearly always requires interventions of both types. However, the distinction is useful here because of the different effects each program has on the labor force. The two types of programs target different aspects of firm profitability: preventing disease should reduce absenteeism and increase labor productivity, while making curative services more efficient should reduce direct health care expenditures. Of note, both types of programs could certainly impact the other outcome; workers contracting malaria less often thanks to a preventative PPP will also need fewer clinic visits, which would reduce health care expenditures, and making local services more efficient in a curative PPP would reduce the lost labor productivity associated with

[91] Ibid., 19.
[92] MHI 16.

medical evacuations. The categories then are not mutually exclusive, but focusing on different priorities – hopefully as a result of firms identifying their particular needs – will guide partnerships towards different activities.

A number of other axes could be used for categorizing these types of PPPs. The degree of state implementation versus non-state implementation will be used below to distinguish two preventative PPPs. On one end of the spectrum, the state could implement all activities using clinicians or anti-mosquito sprayers employed directly by the government; on the other end, all the services could be performed by NGOs or private contractors; and many possible mixes lie in between. A third distinction involves the degree of risk assumed by the private partner. This concept is more familiar to traditional PPPs, but manifests quite differently in PPPs where resources flow from the private sector. In a no-risk scenario (hardly a partnership at all), private firms make a single contribution such as investment in infrastructure; on the other hand, as in Equatorial Guinea, the firm could establish lofty goals such as malaria eradication and could plan to finance whatever interventions are necessary to achieve these goals. The analytic framework established by the Mining Health Initiative offers a long list of useful questions to ask when assessing health PPPs (see Appendix 1), but the detail in these distinctions is beyond the scope of this policy analysis. For the purpose of the options proposed below, the distinctions will be between prevention and cure; between state and non-state implementation; and between one-time investment and long-term risk sharing and commitment.

IV. Analytical framework for policy options

The case studies above offer a broad spectrum of options that could help actors in Mozambique solve their concurrent problems. This section outlines how these options are to be evaluated, describing which aspects of the options should be interrogated and how, empirically, this study will do so. In general, this analysis has to navigate a dearth of hard data, either from the firms or health system. Two kinds of data in particular would be of great service – (1) a detailed account of health expenditure data from the firms, including diagnoses, outcomes, and costs associated with each illness event or absence due to illness; and (2) a comprehensive assessment of the public health services currently available in Cabo Delgado, such as USAID's Service Provision Assessment, detailing the capacity of the system to meet current and future

needs. In lieu of these two data sources, this analysis will utilize key informant interviews with individuals familiar with the firms or the government, plus publicly available data on the epidemiology and health outcomes of Cabo Delgado. Three aspects of each option will be assessed: *technical correctness, administrative feasibility*, and *political supportability.*

Technical correctness: what problems would a partnership solve?

Any successful public-private partnership in Mozambique must make a positive contribution towards solving the two key problems of the extractive firms and the health system.

The firm's current problem is high health care expenditures, but this is related to the underlying problem of maintaining labor productivity by providing quality services to employees in a context where sufficient quality of care does not usually exist. An ideal program would either improve labor productivity by reducing illness burden, decrease the cost of curative health services while maintaining quality, or both. With hard data from the firm(s), an analyst could estimate (a) which disease categories are driving low labor productivity and (b) which disease categories are driving up care expenditures. This would allow targeted recommendations for which disease categories or types of curative services a PPP should target.

In lieu of this data, the impressions and anecdotes from key informants will suffice. As noted, the degree to which malaria is a burden on extractive firms varies; while Eni's medical director dismissed it, most other informants provided examples of malaria's deleterious effects on both labor productivity and cost of care. The benefits of a malaria-focused PPP may be more enticing to a mine than to the natural gas firms, because mine employees tend to be lower-skill and of lower socioeconomic status, and consequently at greater risk of contracting malaria. A partnership focused on curative services should provide cost reductions for all types of extractive firms, though industries most at risk of workplace accidents may benefit most from surgical care. From key informants' perspectives, mines also seem more concerned with accidents than natural gas drillers.

The health system's problem is providing quality services to improve population health with insufficient resources. A successful program would improve service quality, likely through an increase of resources, targeted towards one of the binding constraints that prevent good health outcomes in Cabo Delgado. Without detailed data on quality of health services, priorities should be shaped by (a) the epidemiology of Cabo Delgado, (b) the proxies for health system quality described in section II, and (c) the impressions of key informants. Because malaria is (a) the

leading cause of hospitalizations and a leading cause of death, (b) is not currently addressed perfectly by the health system, as measured by the one-third of children with fever who do not receive a malaria test, and (c) is cited by several key informants as a major issue in Cabo Delgado, a technically correct preventative PPP should target malaria. In terms of curative services, assessing Cabo Delgado's needs is more difficult. One key informant offered a tangible suggestion for the provincial hospital's urgent need for a water purifier, but this is not an opportunity for a substantial partnership. Another informant offered several broader priorities, including reducing child and maternal deaths. Reducing child deaths requires improved primary care, while reducing maternal deaths requires access to surgical care and a functioning referral system so laboring mothers can be transferred quickly if they develop complications. In general, given the resource constraint, any partnership would be technically correct from the health system's perspective if it brought in resources sufficient or greater than what is required to execute the partnership activities. A PPP would provide further benefits to the health system if it established improved monitoring capacity and incentivized higher quality. In reality, there are many "binding constraints" on good health outcomes, and many potential targets.

Administrative feasibility: can the actors execute these programs?

There are many tasks required for a successful PPP, and each of them could be challenging for various partners. Broadly, these tasks include establishing a contract, financial management, delivering services, and monitoring and evaluation (particularly if the contract includes performance requirements).

Drafting a contract: these PPP types will be new to all of the partners, and they lack experience in drafting such contracts. The ability to successfully negotiate an agreement will require careful relationship building between firms, government, and other potential partners, and outside expertise may be required.

Financial management: Mozambique's government has recently suffered from high-stakes corruption scandals, notably $1 billion in secret loans taken by the government that were intended for a state-owned tuna fishing fleet but were largely wasted on military-grade gunboats.[93] Financial management of the project, then, may create administrative issues – either because the government lacks capacity to safely manage the finances, or because the firm

[93] Wirz, Matt and Julie Wernau. "Tuna and Gunships: How $850 Million in Bonds Went Bad in Mozambique." New York: *The Wall Street Journal*, 3 April 2016.

believes they do. Different PPP styles will have different degrees of financial management required, and whether the firm, the state, or an NGO partner manages the finances may have significant impact on a project's feasibility.

Delivering services: The status quo is problematic in large part because the state lacks the capability to provide quality health services, preventative or curative. Most informants ascribed this poor quality to a lack of resources, though it remains possible that there are other serious state capacity constraints, perhaps related to perverse incentive schemes for public-sector workers or the risk of graft. Some PPP options may require the state to provide new services or scale up currently provided ones, while others may task NGOs with service provision.

Monitoring and evaluation: Some of the PPP options proposed include service contracts that require careful monitoring and evaluation to ensure outputs and outcomes. This monitoring may require simple audits, such as spot-checks to ensure IRS has been completed, or much more complex evaluation of health care quality.

Political supportability: do powerful actors support or oppose?

A wide range of actors will be involved in or affected by a potential PPP, and some of them have the power to make a PPP successful or non-existent. The degree of support of key actors, and the power each actor has over the outcome, will be analyzed for each PPP option.

Provincial government: the provincial health authorities and other members of the provincial government have many competing priorities and minimal resources available. Interviews indicate that they will be tacitly supportive of any PPP that increases the resources available for health in Cabo Delgado. One informant described the previous relationships between the provincial health directorate and extractive firms as "excellent,"[94] and another suggested only that they do not contribute enough to health services, but when they do, their contributions are warmly welcomed.[95] They have more experience with contributions from firms to curative services: for example, Eni paid for major renovations to Palma's health center and purchased an oxygen compressor for the provincial hospital, Anadarko paid for a 6-bed isolation unit at the hospital, and a graphite mine regularly allows its ambulance to be used by the local health center when the mine is not using it. A PPP that addresses curative health services has more immediate relevance to officials' political standing in the district and nationally because

[94] Interview with informant 07 (familiar with provincial hospital), 3 March 2017.
[95] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.

preventative health services are rarely carefully assessed, either by an electorate or by national supervisors. That said, one informant did recognize that access to sanitation is the number one need in Cabo Delgado, and when the idea of a preventative partnership was proposed, he replied with enthusiasm that it "would be welcome," even if their experience to date has been that aid agencies are the only partners contributing to preventative health.[96]

Extractive firms – leadership: the firms hold most of the power in the proposed PPPs – their support will make or break the program (while the government could, in theory, be sidestepped if the firms dealt directly with NGOs providing services to the public). Their support for a program will be based primarily on technical correctness of the option and its ability to solve their problem of providing quality services affordably, but with the added dimension of risk. While firms may be wasting resources in the status quo, these are small line items in an enormous investment budget, and as the Eni medical director shared, health care is often not perceived as a problematic expense. The potential loss, if they committed to a failed program or, disastrously, restricted an employee's access to evacuation which resulted in harm or death, could be catastrophic. The mid-level leadership required to execute this PPP would suffer for their unnecessary innovation if the result were poor, and thus firms are quite risk averse, which affects their degree of support for various options.

Extractive firms – employees: Firm employees may have their own position about the partnerships. They will likely be neutral to supportive of a preventative PPP – because a malaria infection is still a relatively rare event, the benefits are unlikely to have noticeable impact on each employee. A curative PPP might, in the long run, allow them to receive treatment without the inconvenience of travel to South Africa, but there would be initial opposition from expatriate employees in particular because they are very skeptical of the quality of local providers, according to informant interviews. Local employees, who will eventually comprise a large portion of the natural gas workforce but currently are common only in mining, may have greater support for a curative PPP because they are more likely to see evacuation as an inconvenience.

Private health care provider(s): some of the PPP options will have little to no affect on the private health care contractors that currently work with the firms, but others could dramatically change their revenue stream. International SOS would likely be opposed to any curative PPP that threatens to send patients to public hospitals rather than their private clinics or

[96] Interview with informant 08 (familiar with I-SOS), 6 March 2017.

costly medical evacuation services. However, their power over the outcome is only moderate; since they are established and trusted partners of the natural gas firm, they could stir opposition in the firm indirectly, but I-SOS would not have formal decision-making control over the PPP.

In other settings, the health insurance companies utilized by the firms might otherwise be potential partners, given that reducing health care costs for firm employees could increase their profit margins. However, because the firms are using multiple insurance companies for different purposes (and because the I-SOS model is effectively fee-for-service), it seems unlikely that any one of the insurers could reap sufficient benefit from improved public services to engage in these high-risk partnerships.

Of note, this analysis will not explore the perspective of some groups who could be affected by the PPP – namely, the community and beneficiaries, the national government, and other NGOs in Cabo Delgado. First, the opinion of these actors will not vary greatly between PPPs, and even if it does, they are unlikely to take an interest in the arrangement (in the case of the national government) or be able to affect the success of the program (in the case of the community and other NGOs), except in extreme circumstance.

V. Policy options

The following section will outline four options in total – two programs focused on prevention of illness, differing in their use of primarily state or primarily NGO implementation, and two programs focused on curative health services, one limited to infrastructure investment and one with additional commitments to quality metrics and ongoing support. The preventative options will focus on malaria, given the high prevalence in Cabo Delgado, but the basic structure could easily be adapted to tuberculosis, HIV, or diarrheal disease.

1. Preventative PPP – state implemented

Program description

In this first prevention-focused PPP, the public and private sector would pool resources to reduce malaria incidence in Cabo Delgado. The contributions of the firm would primarily be financial, though they may also provide input on management strategy if they so desired. The provincial health office would plan and implement the program using civil servants and existing and new state infrastructure. The program would utilize evidence-based approaches including

vector control (IRS, bed net distribution, drainage of mosquito breeding sites), increasing health system capacity to detect and treat malaria (training and equipping community health workers, improving supply chains for rapid tests and artemisinin-based therapies at public clinics), and education (particularly on use of bed nets and the importance of seeking care for children with malaria). An ideal program would emphasize monitoring and evaluation: collecting baseline data, rapid iteration and adaptation of various initiatives, detecting "hotspots" to target interventions, and tracking success over time. Firms should be encouraged to collect careful data on absenteeism and incidence among employees; demonstrating success will ensure continued support for the partnership, and documenting failure can guide future efforts.

Technically correct?

This program targets one source of the firm's challenge, the lost labor productivity as a result of endemic disease. If the program is successfully implemented, it should reduce prevalence of malaria in the labor force and thereby increase labor productivity. In terms of reducing firm costs, the program may offer long-term efficiency if successful; however, in the short term, it will likely represent increased costs.

This option offers an opportunity to dramatically improve public health if the program design is evidence-based. Indoor spraying, for example, is *effective*, but is not considered *cost-effective* when the analysis is based on very low per-person-per-year estimates of labor productivity or valuation of life. By lifting the resource constraint and valuing life and productivity differently – the firms are a good catalyst for doing both of those things, given that their employees achieve higher levels of productivity than the local average – spraying becomes very cost-effective, and would allow the government of Cabo Delgado to achieve greater reductions in malaria, a leading killer of children and impediment to labor productivity. However, it is sometimes difficult to trace the impact of prevention programs on outcomes; even if parasite prevalence is reduced, showing decreased deaths, improved health, and ultimately improved economic development is difficult. A robust program should plan for extensive data collection to demonstrate these impacts and maintain support.

Administratively feasible?

--Contracting: in theory, it should be relatively straightforward to establish a memorandum of understanding (MOU) between the firm and the government, outlining the firm's financial contribution and the proposed activities to be carried out. Given the potential

principal-agent problem in this program, the firm should be careful to ensure accountability in the contract; options to do so include spacing payments over time (and building in cancellation clauses if activities are not performed) and establishing dispute resolution systems in advance.

--Financial management: the financial management of this program would, on one hand, be simple, involving straightforward transfers of resources from the firm to the district health office. However, legal paths for this transfer may need to be established. In addition, the risk of graft and mismanagement exists to the same extent it exists in any government activity in Mozambique. In previous CSR activities, firms in Cabo Delgado have preferred to procure equipment and donate in-kind rather than transfer funds to the public sector; this system could be maintained for consumables such as insecticide spray and test kits, if the firm felt more confident in their auditing and financial management procedures.

--Implementation: the primary weakness of this PPP option lies in the state's limited ability to implement effective health campaigns. Of note, Cabo Delgado has executed successful IRS campaigns in two districts in the past few months, so it may be feasible to scale up these activities.[97] The spraying teams were comprised of community members trained and supervised by provincial health directorate employees; these same employees could be deployed to new communities to replicate these activities. Providing effective clinical care for malaria may be difficult, however; though tests and artemisinin combination therapies should be available at all public clinics, there have been issues with missing stock in other provinces and, as stated previously, only two-thirds of children with fever at pubic clinics received malaria tests, which may be partly due to test kit stock-outs. What may be more difficult still is establishing robust data collection, given that clinics and hospitals use only paper records and most sources acknowledge widespread issues with data quality.

--Monitoring & evaluation: this program would require relatively simple spot checks of various activities, such as verification that houses have been sprayed or unannounced supervisory visits to clinics to check for stock-outs. This activity may be best suited to a third party NGO selected by the firm.

Politically supportable?

--Government: this program might offer some political benefit to state officials as their constituents see increased activity in service of better health, particularly as prevention activities

[97] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.

tend to be frequently visible in communities. The impact may be less visible than the curative PPPs described below, though, as many patients place less value on health prevention activities than on curative services that more clearly "save lives." The more subtle political barriers are likely to be a reluctance to take on extra work, but this could be ameliorated by the extra resources available.

--Firm leadership: a program like this should be appealing to the firm because it enhances labor productivity. In addition, it offers the firm good press and public relations, as would any CSR program. Relative to other options, this bears a small to moderate amount of risk because of the potential wastage of resources and loss of decision-making power to the state. Depending on the degree of mistrust between the firm and the government, utilizing an NGO for implementation (see Option 2) may be more supportable.

--Firm employees: there should be no opposition from firm employees, as this program is should only impact their lives in a positive way as malaria burden is reduced.

--Private contractor: there would likely be no significant opposition from the private health care contractors, because community-wide prevention activities are not currently within their purview, so the program represents no threat to their operations. In theory, in a fee-for-service model, healthier patients require fewer services and thus reduce compensation, and malaria is one of the most common reasons for I-SOS consultation; however, their cost structure depends more on membership fees than clinic visits, so the actual compensation they receive for a case of malaria is likely to be quite low and thus this program would not pose a major threat to their business model.

2. Preventative PPP – NGO implemented

Program description

The largest obstacle in a state-implemented preventative PPP is the state's capacity limitations. To overcome this challenge, partners could contract or form an NGO to conduct prevention activities. This most closely resembles Marathon Oil's program in Equatorial Guinea described in Section III. The program would be structured with an NGO receiving financial contributions directly from the firm, and establishing a typical MOU with the government describing proposed activities.

Technically correct?

The program is just as technically correct as the previous option, as the same activities would be pursued. The major drawback to this option is that it misses an opportunity to develop state capacity: the government of Cabo Delgado loses a revenue stream that may support the development of good public health administration. The state's role would be reduced to authorization and preventing duplication, but it would not gain implementation experience.

Administratively feasible?

--Contracting: This sort of arrangement happens much more often than the previous option. It will also require up-front investment in designing the MOU and establishing expectations of firm's contributions, but firms are familiar with using NGO contractors. The government has not utilized NGO contractors for prevention activities in the past, but an informant acknowledged that other provinces do, and they are certainly accustomed to establishing memoranda of understanding with NGOs.[98]

--Financial management: the NGO would be responsible for financial management. This may reduce risk of mismanagement or graft, but NGOs are by no means immune from these risks, so this should not be considered a complete solution to financial risks.

--Implementation: the main purpose of this option is to improve program implementation by contracting an experienced NGO or forming one with experienced staff.

--Monitoring and evaluation: equivalent to the previous option.

Politically supportable?

--Government: the state would be less supportive of this option because of the reduced responsibility and oversight of the state – indeed, they could effectively be cut out of the arrangement, except for their ability to approve or deny an MOU. One informant who had worked as the medical director for a mine elsewhere in Mozambique had contracted NGOs for their corporate social responsibility programs in the past, and he said that the provincial health directorate there expressed disappointment that the activities did not flow through the government.[99] Whether their motivations are to improve state capacity or to extract resources for personal gain, this option would be less attractive.

[98] Interview with informant 09 (familiar with provincial health directorate), 6 March 2017.
[99] Interview with informant 03 (Dr. Egidio Langa), 10 February 2017.

--Firm leadership: in general, the firms have concerns regarding the quality of state health services, but all firm-associated informants acknowledged the importance of coordinating activities with the state. Firms may have a slight preference for this option, but they may also be responsive to state disapproval.

--Firm employees & private contractors will support this program as they did option 1.

3. Curative PPP – up-front investment

Program description

In this option, based loosely on First Quantum Mineral's partnership in Zambia with Solwezi General Hospital, firms would finance the upgrade of hospital infrastructure and services in Cabo Delgado. The firm and health ministry would agree on the particular services to be improved, such as surgical services, which would require construction or refurbishing of operating rooms, training and/or hiring of surgeons, surgical nurses, and technicians, and establishing or improving supply chains for surgical supplies. The provincial hospital has recently opened a "private" clinic and ward within its walls—patients can opt to pay a higher consultation fee (1000 meticais, approximately $15) to be seen more quickly and receive care with more comfortable amenities, though the staff is the same as the general hospital staff.[100] Depending on the current condition, this partnership may require refurbishment of the private ward. This kind of partnership could also target one specific service that is currently being performed by I-SOS: stabilization of patients before medical evacuation. Two informants familiar with the provincial health directorate mentioned that one extractive firm had already approached the hospital about this possibility, though negotiations were in very early stages.[101]

Technically correct?

This option is focused on solving the firm's problem of purchasing health care at expensive, private-contractor rates. If quality at a public facility was increased sufficiently, firm employees could use services locally, which would reduce the need for extremely expensive medical evacuations. It may also decrease the costs paid to private contractors if the public sector becomes a more efficient competitor. However, this PPP option presents higher risk to the firm,

[100] Interview with informant 07 (familiar with provincial hospital), 3 March 2017.
[101] Interviews with informants 07 (familiar with provincial hospital) and 09 (familiar with provincial health directorate), 3-6 March 2017.

because if quality were not sufficiently improved, then the firm would have invested resources into a facility they never use (see "Politically supportable?" below).

In terms of solving the health system's problem, any improvement in care quality would be an improvement for local communities. It is possible that the chosen service target, such as surgical services, does not necessarily represent the highest need in the community (where malaria and diarrhea are bigger killers). Ideally the contract could be designed such that multiple needs are met; for example, scaling up surgical services to treat on-site injuries would also improve the system's ability to respond to obstetric emergencies and reduce maternal mortality. If the partnership targeted pre-evacuation stabilization, it would have the least spillover for non-employees, because they would not be able to afford subsequent evacuation. However, if designed carefully, the infrastructure and training investments required to provide stabilization could create spillover benefit to local patients.

Administratively feasible?

--Contract: the contracting requirements of this option would be relatively straightforward, with the firm contributing a specified amount of money and the state constructing or renovating specified facilities or performing particular training or systems activities. The funding required would be primarily up-front investment costs, though the firm may prefer disbursing multiple tranches over the course of construction to ensure progress.

--Financial management: because this would be a one-time transaction (or a single program with multiple disbursements), there would be no more risk of mismanagement than in the public system generally.

--Implementation: if the contract is well planned, the health ministry should be able to complete the activities to which they commit. However, it is not clear that infrastructure alone will improve care quality at public facilities. There may remain issues of poor management, misaligned incentives for overworked public sector employees, broken supply chains, or others.

--Monitoring and evaluation: with most of the activities that would be included in this type of program, it would be very easy to verify whether the activity has been completed. Some of the priorities such as improving supply chain management may be less straightforward, so the initial contract should be drafted carefully to ensure targets are deliverable or that progress is made via iterative and adaptive improvements.

Politically supportable?

--Government: improving curative services would give the most political gain for local officials – it is a highly visible and popular move. Given that a private ward already exists within the provincial hospital, there is no political risk of proposing this system. However, there is risk that if new facilities were built but paying patients did materialize, the government would face maintenance costs in excess of revenues. One informant described such a situation in Lesotho. Construction firms building a large dam supported a new intensive care unit at a local hospital, with the intention of having their employees treated there, especially when they suffered from one of the frequent accidents at the construction site. Ultimately, though, the cost per patient of hospitalization in the ICU was in excess of the cost of evacuation to nearby South African facilities, and the firms continued to evacuate instead of utilizing the new ICU. The poor optics of an underutilized ICU in contrast to overburdened primary clinics became a political liability for local officials.[102] The next option described would include long-term commitments between the firm and the health ministry to avoid this risk.

--Firm leadership: as with the other options, the partnership may be a good public relations opportunity for the firm, but it also poses some risk. There is risk of failure and inefficient expenditure: if up-front investment is required, but quality is not delivered such that firm employees can utilize the facility, then the firm will save no money on future health care costs. The advantage of this option over the other curative option described below is that by only agreeing to up-front investment, the firm is not obligated to make future payments or send employees to a sub-standard facility.

--Firm employees: among national employees, an initial investment in a local health facility is unlikely to raise ire, and may even be popular if employees perceive that they have the option for local treatment when they prefer it. However, most informants indicated that expatriate employees have a strong aversion towards local health services. This plan would be concerning to expatriate employees, who currently comprise 90% of the gas industry workforce. They are a very small percentage of mining workforce, though, and the gas industry will reverse this proportion to reach 90% local staff over the next 10 years; as a result, this partnership would be much more politically feasible for a mining company or for a gas firm in the future.

[102] Interview with informant 02 (Dr. Jorge Cabral), 3 February 2017.

--Service provider: significant opposition may come from the private service provider, as this program could reduce demand for their services. If the firm sees the contractor as a trusted expert on health services, or if there are contractual commitments to seek care from the private providers, this opposition may weaken the firm's willingness to participate.

4. Curative PPP – up-front investment + long-term commitment

Program description

The core of this program would be the same as the previous option, but it would solve the challenge of public sector risk by committing the firm to long-term support for a public facility if quality metrics are met. This arrangement would align incentives between the firm and the provincial health office: both partners would be eager to see quality improved so that patients can receive local, less-expensive care than the status quo currently allows. The first key addition in this option is measuring care quality. Measurement should include both process metrics, such as adherence to checklists for surgical procedures or availability of stocks and supplies, and outcome metrics, such as post-operative infection rates. The second key addition is the firm's commitment to continue to support the facility if the quality metrics are met. This could be specified on a fee-for-service basis, so each firm employee treated at the facility is paid for at a certain rate (likely depending on diagnosis), or on a fixed annual fee basis, resembling a capitation model. The Queen 'Mamohato Memorial Hospital in Lesotho has utilized a similar system but with the partners reversed (the public sector pays a private consortium to provide care), and the metrics used in this setting may be useful in designing the partnership in Cabo Delgado.

Technically correct?

This option is arguably the most technically correct. From the firm's perspective, it offers the most potential to increase quality of curative services to a degree, specified in the contract, such that their employees could safely utilize local facilities. This could be done at pre-specified rates to ensure that the firm saves money versus its current expenditure levels. This analysis would also be crucial to avoid the scenario described above in Lesotho, in which the cost of admission to a newly constructed local ICU was higher than evacuations had been, so firms did not change their behavior and continued to evacuate, leaving a brand new ICU unused and unable to provide any revenue to the public system.

From the health system's perspective, the advantage of this program is the aligned incentives. If quality metrics are met, the public system receives increased resources, rewarding the system for high performance in a manner currently very rare in Mozambique's health system. Improved clinical services should translate to improved health outcomes for the community, though with the same caveat as in the previous option – it is possible that the services desired by the firm are not the most pressing needs for the community. There is also a risk that the compensation agreed upon would not be sufficient to cover the costs of meeting the proposed quality metrics. However, given the high rates currently paid to the private contractor, there likely exists a Pareto-improving fee structure that would decrease firm expenditure and exceed the costs borne by the public system in providing such quality. Given that individual consultations at I-SOS start at $250, while a consultation at the private ward in the provincial hospital costs $15, it would seem that the zone of potential agreement is quite large. Right now, the hospital's private ward and the I-SOS clinic are not competing in the same market because of their very different levels of quality, but it seems reasonable that greater quality could be delivered at the provincial hospital's private ward while still undercutting I-SOS.

Administratively feasible?

--Contract: the contract design for this option would be very difficult, more so than any other option presented. Outside experts would be required, given the complexity of establishing appropriate quality metrics and payment levels, with which neither the firm nor the public system currently has any experience and may have very conflicting views.

--Financial management: this option would entail a gradual, but hopefully predictable, funding stream rather than only a one-off investment. This would place greater demands on public financial management systems, but should be a solvable problem over time.

--Implementation: this option would be by far the most implementation-intensive and complex of all the presented options. The state has minimal experience delivering the high quality that the firm would demand. It may find that engaging an experienced NGO partner in managing the public facility, such as Médecins sans Frontières or Partners In Health who have experience in supporting public facilities in other countries, is the only way to quickly deliver.

--Monitoring and evaluation: this option also presents the most complicated M&E needs because of the complex quality metrics. A third-party evaluator would be essential to monitor system quality, and the cost of monitoring may be a significant component of the program.

Monitoring and Evaluation of Complex PPPs

Public-private partnerships of any nature include the possibility of informational asymmetry. Service providers have information about the amount or quality of the services they provide that the financing partner may not know with precision. This is especially true in the health sector – markets for health care everywhere suffer from several key features that can create frictions between payers, providers, and patients.

- **There is a great diversity of possible services that must be offered.** Neither patients nor providers can be expected to segregate based on initial symptoms (diarrhea can signal infection or cancer, for example), so health facilities must have the capacity to offer a wide range of tests and treatments with widely varying levels of required skill or supplies. Choosing compensation levels for every possible diagnosis or activity is in itself a burdensome task.
- **There are inherent informational asymmetries.** Even the most careful monitoring system cannot fully evaluate a provider's behavior – whether a provider hears crackles when listening to a patient's lungs cannot be verified after the fact, for example, but would significantly change diagnosis and thus required treatments.
- **Forecasting is difficult.** Patients are rarely able to predict their own health care needs, and health systems face further challenges in predicting populations' needs. Most health systems are therefore built with excess capacity, and compensating providers only for services provided may neglect the need for this excess capacity.

In the case of the PPPs proposed here, the provincial hospital will provide a service that is difficult and expensive to monitor perfectly, and the firm will be in the position of paying for a service about which they may not have full information. The firm would be interested in assessing service *quantity* and *quality*.

Measuring *quantity* must go far beyond measuing how many patients were treated. Even if two patients both require "surgery," a patient hospitalized for non-urgent removal of their gall bladder will require a very different amount of care than a patient requiring emergent trauma surgery for a workplace accident. Different systems use different units of analysis for payment; historically, the US health care system used strict fee-for-service or input-based payment, so providers were compensated for every consultation, every medication, and every piece of equipment used to treat a patient. This has gradually moved toward compensation based on diagnosis ("bundled payments"). Other systems are "capitated," so a provider is paid a set annual fee for all the care that an individual receives in a year. The tradeoff in these different systems is usually considered a trade between incentive and risk: providers will keep costs down if they can benefit from it, as in a capitated system, but they bear more risk if costs are unexpectedly high; in fee-for-service, providers assume no risk, but actually have an incentive to increase costs. Anna Pascall of First Quantum Minerals in Zambia actually noted that they *prefer* a system that motivates providers to provide more

care to their employees; unlike in the United States, Pascall sees under-utilization of services as a bigger threat than over-utilization, and thus uses fee-for-service to motivate FQM's private providers to provide more care. The other consideration in resource-poor contexts is the cost of administration. Accounting for every syringe and ibuprofen tablet may be unduly burdensome, while capitated payment presents a simpler option.

The second metric of interest to payers is *quality*. In developed economies, health policy seeks to reward greater or lesser quantity in health care provision, but in a context like Mozambique, quality is more likely to be a binary metric – is the health care provided at an acceptable level of quality and safety, or not? Given the extreme risk presented by a poor health care outcome, firms will be especially concerned about quality. In general, individual quality metrics fall into either *process* or *outcome* categories. *Process* metrics include the presence of inputs like medicine stock or hand-washing stations and activities such as physical exam maneuvers during a consultation or following a checklist before a surgical procedure. *Outcome* measurements can range from proximal metrics like surgical infection rates to more distal metrics like mortality. Outcome metrics are more connected to the results that payers (and patients) care most about, but providers often object to having little control over them; process metrics, on the other hand, are easier for providers to achieve, but may not always result in better health.

Choosing a strategy for monitoring and evaluating a health PPP is a challenging task, even more so in resource-poor settings. This type of partnership would require extremely careful contract negotiations to choose the type of evaluation and compensation mechanisms. The final package would likely be a combination of all the types of metrics listed above. Negotiators may consider looking towards the Queen 'Mamohato Memorial Hospital in Lesotho as an example; the structure of the partnership as reversed (with a public sector payer and private health care provider) but the ways in which quality was measured and quantity was compensated could be instructive.

Politically supportable?

--Government: this program solves the risk of the other curative PPP because there is a guaranteed flow of resources if metrics are achieved, but it introduces an extremely heavy administrative burden. Only the most ambitious health officials would support this option.

--Firm leadership: when viewed proportionally to the previous option, this program offers lower risk to the firm, because quality metrics would be tied to future contributions, so they would only have to make on-going transfers to support the project if the system achieved sufficient quality to be used by their employees. However, there are significant risks if contract is not written very carefully, because unexpectedly poor quality could mean either (a) adverse outcomes for employees, or (b) a requirement to pay even if services aren't sufficiently good, posing a financial obligation with no benefit. This is likely to be politically unpalatable.

--Firm employees: this option may be unappealing to firm employees if they do not trust the quality of the local services, and quality metrics may not sufficiently address their worries,

particularly if they think they will no longer have access to the higher quality care offered by medical evacuations. Again, however, if employees see evacuation as burdensome, then this would be an appealing option, which may be truer of national staff than expatriates.

--Private contractors: this option would be at least as unsupported by the private firms, if not more so, than the previous option. It would represent an erosion of their responsibility and therefore revenue stream.

VI. Summary and recommendations

The four policy options presented above differ most in their degrees of administrative feasibility, particularly the implementation aspect (see Figure 1 for a summary of this variation). This is a major driver for the differences in political supportability, because of the high degree of risk each partner faces. Unfortunately, Option 4 is most technically correct – it offers the most clear path to driving down costs of care for firm employees – but it is the most administratively difficult and politically unsupportable. Therefore, at this time, **Options 1-3 are more appropriate for an initial partnership, which could establish trust and evidence of implementation success, making Option 4 more feasible in the future** (Recommendation 1).

		Option 1: Preventative, state mgmt	Option 2: Preventative, NGO mgmt	Option 3: Curative, one-time	Option 4: Curative, long-term
Technically correct	Firm	Correct	Correct	Correct	Most correct
	Health system	Correct	Less correct	Correct	Most correct
Administratively feasible	Contract	Feasible	Most feasible	Feasible	Least feasible
	Financial	Some risk	Least risk	Some risk	Most risk
	Implementation	Possibly feasible	Most feasible	Possibly feasible	Difficult
	M&E	Easiest	Easiest	Easiest	Difficult
Politically supportable	Government	Most	Supported	Most	Least
	Firm leadership	Supported	Most	Most	Least
	Firm employees	Supported	Supported	Of concern	Least
	Private contractors	Supported	Supported	Least	Least

Figure 1: Summary of variation among policy options

Given this additional goal of establishing trust among partners in order to make Option 4 more feasible in the future, **Option 2 should be disregarded at this time** (Recommendation 2). An NGO-led implementation strategy disallows two important possibilities – first, that the firms would develop trust in the state's performance, and second, that the state would develop increased implementation capacity when the resource constraint is lifted. Option 2 could be resurrected, however, if the initial partnership were to fail due to state failure; it still offers a viable option for the firm to improve labor productivity by reducing preventable disease, and may be appropriate if the state fails in an initial partnership.

Without sufficient data to distinguish between the appropriateness of Option 1 versus Option 3, the differences in various industries' health care needs may be most relevant significant. Mining companies seem much more concerned with malaria than natural gas firms, so they may be more likely partners for a preventative partnership. One natural gas firm, on the other hand, had already opened discussions of a partnership like Option 3, in which stabilization prior to medical evacuation would occur at the provincial hospital. The two partnerships are not mutually exclusive, and would be handled by different branches of the provincial health directorate. **The provincial health directorate should recruit potential mining partners for a preventative partnership (Option 1) and move forward in discussions of a curative partnership with natural gas firms (Option 3)** (Recommendation 3).

Finally, though not an official recommendation of the SYPA, I would implore all partners to carefully document the process by which this partnership is established. These kinds of projects are novel, but not as novel as the dearth of literature suggests; there are likely countless examples of successful PPPs that have not been published in academic literature or otherwise. As multinational corporations increase their engagement in developing countries, the potential for these partnerships to improve the lives of local people *and* improve the bottom lines of corporations will grow. Other potential partnerships will benefit from greater documentation of how previous partnerships were established, implemented, and evaluated. Private sector growth can and should transform health outcomes across the developing world, but increasing individual incomes is only one path by which this can occur – more can be done by aligning the needs and incentives of corporations and communities, as the PPP proposals in this SYPA do by linking the fates of public and private health services.

Appendices

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Appendix 2: Interviews

Mozambique interviews:

Informant 01: employee of extractive firm with experience in Angola and Mozambique (requested anonymity). Interview 3 February 2017.

Informant 02: Dr. Jorge Cabral, ThinkWell, many years working in Mozambique's public sector and as health financing consultant. Interview 8 February 2017.

Informant 03: Dr. Egidio Langa, former medical director of Vale (coal mining company in Tete province, Mozambique) and former employee of Cabo Delgado provincial health authority and provincial hospital. Interview 10 February 2017.

Informant 04: senior staff member of Eni (requested anonymity). Interview 13 February 2017.

Informant 05: Celio Panquene, former social program director for Syrah graphite mine, Cabo Delgado, Mozambique. Interview 28 February 2017.

Informant 06: Rita Nkaurasa, former camp director for natural gas firms in Cabo Delgado, Mozambique. Interview 2 March 2017.

Informant 07: person familiar with operations of provincial hospital (requested anonymity). Interview 3 March 2017.

Informant 08: person familiar with International SOS operations in Mozambique (requested anonymity). Interview 4 March 2017.

Informant 09: person familiar with provincial health directorate (requested anonymity). Interview 6 March 2017.

Informant 10: Dr. Eugenio Malfatti, Health Director, Eni East Africa. Interview 8 March 2017.

Case study interviews:

MCDI project manager, 6 March 2017.

Anna Pascall, health director, First Quantum Minerals, 9 February, 2017.

Personal email, Govert Waramori, PT Freeport, 8 February 2017.

Personal email, Ramlon Marbun, PT Freeport, 9 February 2017.

Personal email, Anna Pascall, FQM, 1 February 2017.

Appendix 3: Analytic Framework for PPPs

This framework was based heavily on that established by the Mining Health Initiative in their 2012 report, *Mining Health Partnerships: A Short Analytic Framework*, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/210167/MHI-Short-analytic-framework.pdf.

Foundational aspects

- What was the initial relationship between the firm and the community?
    - Does the firm face reputational risks or disruption to its activities because of the community's opinion?
    - How many people in the community rely on the firm for their livelihood?
    - How does the health of the community impact (or not) the productivity of the firm?
    - In what ways does the firm impact community health or local environment?
- What was the initial relationship between the firm and the government?
    - Do the firm's activities comprise a significant portion of the country's GDP?
    - Is there a culture of trust between the firm and the government?
    - Has the firm received favorable tax status or other concessions from the government?
- How does the firm usually approach sustainability, corporate social responsibility, or community development?
    - Has the firm engaged in similar projects elsewhere?
    - Does the firm incorporate community impact analysis into its investment process?
- How does the government usually approach PPPs or CSR?
- How was the program initiated?
    - Did the proposal initially come from the firm, the government, or another actor?
    - Were outside consultants involved in preparing the proposal, or was it developed within one of the partner institutions?

Technical aspects

- Is the program designed to strengthen the health system, or does it have potential to weaken it?
    - System-wide or disease-specific? If disease-specific, does it support or fragment the broader system?
    - Human resources – could program draw employees away from public system? Are new staff are trained according to national guidelines?
    - Are facilities integrated into public referral system?
- Does the program align with national and local priorities?
    - Aligned with public sectors' strategic plans?
    - Aligned with other donors/actors?
- Is the program designed for sustained impact?
    - Is the investment limited to infrastructure, or does it include ongoing services?
    - Does it address possible disruption in health services?
    - Is there a long-term investment or commitment?

- Is there an exit or handover strategy? Was it planned from the beginning or developed in response to emergent issues?

Partnership and governance aspects

- Are roles and responsibilities of all parties clearly defined?
- Are all partners transparent about their contribution, their goals, and the benefits of the program?
  - In particular, is the firm clear about how it will benefit? Aside from improved relationships with the government, are there benefits to the firm's core business?
- Are governance responsibilities defined and shared appropriately?
  - Does the state provide appropriate guidance and regulation for the project?
  - Are firms confident in protection of their interests and property rights?
  - Does project contribute to (or detract from) good governance?
  - To what extent does the firm participate in project management?
  - To what extent does the government participate in project management?

Program aspects

- Does the program promote (or detract from) equitable access to services, including for the poorest or most marginalized beneficiaries?
- Is the program evidence-based?
- Is the program adequately monitored/evaluated/measured?
  - Is data collection aligned with national systems?
  - Does the program measure inputs? Outputs? Outcomes?
- Does the program engage beneficiaries in decision-making?
- Does the program deliver value for money (cost-effectiveness)?