



TONGA

STRATEGIC DEVELOPMENT FRAMEWORK (2015–2025)

A RAPID COST-BENEFIT ASSESSMENT



COPENHAGEN
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CENTER

A NEW APPROACH TO PRIORITIZING FOR TONGA

No nation, however rich, has enough resources to do everything. Hard choices must be made. Ultimately, the trade-off is the defining characteristic of politics: deciding where to spend extra resources first.

But some policies deliver large benefits for low costs, whereas others deliver little for high costs. Knowing which policies are most efficient can be incredibly helpful for more informed decision making.

Together with the Royal Oceania Institute the Copenhagen Consensus think tank has done a rapid cost-benefit assessment of a number of key policy considerations for Tonga. These have been chosen from The Tonga Strategic Development Framework: 2015–2025 (TSDF II), which sets out a high-level integrated vision of the direction for Tonga

This analysis informs by showing which interventions would deliver the most social and economic benefits for every Tongan pa'anga (T\$) spent. Although value-for-money is not the only relevant measure, it certainly is one important measure. The report shows the likely return on investment, the benefit-cost ratio (BCR), of each intervention based on international evidence. A BCR of 15 would mean that for every Tongan pa'anga spent, a given intervention will deliver 15 Tongan Pa'anga worth of social, economic, and environmental benefits.

It highlights **EXCELLENT** (BCR over 15) or **GOOD** (BCR = 5 to 15) interventions with dark and light green. **FAIR** interventions deliver moderate returns (BCR = 1 to 5), and **POOR** interventions (BCR below 1) will likely generate fewer benefits than the cost, meaning cost recovery will not be possible within the national development strategy.

This Rapid Assessment is not a conclusion but rather an aid to begin an even more informed conversation of future priorities for Tonga.

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TONGA STRATEGIC DEVELOPMENT FRAMEWORK (2015–2025)

A Rapid Cost-Benefit Assessment

KEY MESSAGES

On January 15, 2022, a significant volcanic eruption struck Tonga. The country's central island, Tongatapu, was only 41 miles away from the undersea Hunga Tonga-Hunga Ha'apai (HTHH) volcano, which erupted with the largest known eruption since 1883. Large-scale property destruction, infrastructure damage, and agricultural disasters brought on by the subsequent tsunami and ashfalls are predicted to have cost 36.4% of Tonga's GDP. The eruption and its after-effects are estimated to have directly affected 85% of the population, especially impacting poor households reliant on agriculture and tourism.

Mitigating and recovering from the impacts of the disasters (2018 TC Gita, 2020 TC Harold, 2022 HTHH volcano eruption) and the global transmission of COVID-19 and its implications have been the dominant policy challenges since February 2022. However, no nation can afford everything. In the wake of falling productivity, which affects government revenues, the Government of Tonga, with limited means, must make difficult choices. The Tonga Strategic Development Framework: 2015–2025 (TSDf II) set out a high-level integrated vision of the direction that Tonga has been pursuing between 2015–2025.

Our analysis helps by showing which interventions would deliver the most social and economic benefits for every Tongan pa'anga (T\$) spent. Although value-for-money is not the only relevant measure, it certainly is one important measure. Here, we report on the likely return on investment, the benefit-cost ratio (BCR), of each intervention based on international evidence. A BCR of 15 would mean that for every Tongan pa'anga spent, a given intervention will deliver 15 Tongan Pa'anga worth of social, economic, and environmental benefits.

We highlight **EXCELLENT** (BCR over 15) or **GOOD** (BCR = 5 to 15) interventions with dark and light green. **FAIR** interventions deliver moderate returns (BCR = 1 to 5), and **POOR** interventions (BCR below 1) will not generate the benefits anticipated, and cost recovery will not be possible within the national development strategy.

Below are listed some of the best interventions identified in the Strategic Development Framework: 2015–2025. These typically have a medium to long-term focus. These interventions will deliver large social benefits for each Tongan pa'anga spent and are best prioritized:

- **Reducing corruption through e-procurement across government services**
- **Early warning systems**
- **Sea wall to protect infrastructure from rising sea levels**
- **Healthy lifestyles and preventative measures (focus on certain non-communicable diseases)**
- **Extension of community clinics**
- **'Better health' information programs**
- **Product diversification activities such as trade facilitation, reducing middle-men, and reducing barriers and costs to export**
- **Program to reduce technical barriers for exporters**
- **Investment in the growing financial services sector**
- **Improved access to e-Government services**
- **Increasing digital literacy**
- **Strengthen building code**
- **Integrated financial management system setup**
- **More support for Early Childhood Education**

With slight modifications, further policies could be **EXCELLENT**:

- **Technology-assisted learning at the right level** – Using technology that adapts to children's learning levels has been shown to have remarkably high returns in developing countries, returning the equivalent of 50+ Tongan pa'anga for each Tongan pa'anga invested. This may help Tonga make up some of the educational ground lost in the wake of school closures during the pandemic.
- **Microfinance for women with interpersonal violence (IPV) training** – Given that domestic violence is a significant issue in Tonga, with more than 79% of Tongan women and girls having experienced physical or sexual violence in their lifetimes (Jansen et al., 2012), an intervention combining micro-credit loan facilities with a component of gender training and counseling could prove to be an extremely effective intervention.

An overview of the intervention ratings is provided in Annex A–1, with a more detailed analysis of each intervention proposed in the National Development Strategy Framework that follows in Annex A–2 of this document. An outline of the methodology behind the

analysis is presented in Annex B. Annex C presents three back-of-envelope estimates for interventions suggested by the Leadership group (comprising Lord Fakafanua Speaker of the House and Chair of Royal Oceania Institute; Fane Kite Director Royal Oceania Institute; Sam Vea Head of Chamber of Commerce; Sivoki Lavemaau CEO Budget Division Ministry of Finance; Peter Poulson M&E consultant; Dr Kaitu'u Funaki, Director of Research Royal Oceania Institute and also professor at Ritsumeikan Asia Pacific University (Japan).)

Specific costs and benefits relevant to Tonga for 3 interventions (Renewable energy, Skilled migration and 2nd marine cable) are analyzed to present a specific estimate of the BCR ratings (Annex C-1, C-2, C-3).

It is important to note that these ratings were made during a rapid cost-benefit assessment over a period of less than three months. Ratings were conducted at the intervention level and were based on a combination of academic evidence, economic theory, and previous cost-benefit literature. The aim of this exercise is to highlight and identify interventions that are likely to be highly cost-effective and are best prioritized by the Government of Tonga.

ANNEX A–1:

OVERVIEW OF INTERVENTION RATINGS

INTERVENTION	RATING
<i>Recommendations</i>	
Reducing corruption (through e-procurement)	EXCELLENT
Early warning system	EXCELLENT
Sea wall to protect infrastructure from rising sea levels	EXCELLENT
Healthy lifestyles and preventative measures (focus on certain non-communicable diseases)	EXCELLENT
Extension of community clinics	EXCELLENT
'Better health' information programs	EXCELLENT
Product diversification activities such as trade facilitation, reducing middle-men, and reducing barriers and costs to export	EXCELLENT
Program to reduce technical barriers for exporters	EXCELLENT
e-Learning programs with Teaching at the Right Level (TaRL)	EXCELLENT
Microfinance for women with IPV training	EXCELLENT
Investment in growing financial services sector	GOOD
Increasing digital literacy	GOOD
Strengthen building code	GOOD
Set up of e-health systems	GOOD
Integrated financial management system set up	GOOD
Improved access to e-government service	GOOD
More support for Early Childhood Education	GOOD

INTERVENTION	RATING
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GPA 1: BUILDING RESILIENCE

Strengthen building code	GOOD
Second marine cable	FAIR
Early warning system	EXCELLENT
Relocating the capital	UNKNOWN
Sea wall to protect infrastructure from rising sea levels	GOOD to EXCELLENT
Climate proofing of existing infrastructure	FAIR to GOOD

GPA 2: REDUCING RELATIVE POVERTY

Women's micro-credit scheme	FAIR or with modification: EXCELLENT
Project to support the development of the subsistence economy (TRIP)	FAIR to GOOD
Skills and employment projects (vocational training for youth)	FAIR
Introduction of affordable housing finance	FAIR
Subsidies for the high cost of utilities	FAIR

GPA 3: SUPPLY & USE OF ILLICIT DRUGS

Investment in law enforcement	FAIR
Reducing corruption	EXCELLENT
Reducing money laundering	GOOD to EXCELLENT
Treatment, Rehabilitation, and Reintegration	GOOD

GPA 4: IMPROVING EDUCATION FOR ALL

More support for Early Childhood Education	GOOD to EXCELLENT
e-Learning programs with Teaching at the Right Level (TaRL)	EXCELLENT
Scholarships for students to all schools (student loans)	FAIR
Tonga Accelerating Resilience Project (TARP)	GOOD
Increasing digital literacy	GOOD
Teacher training	EXCELLENT
Set up Tonga's first national university	GOOD
Student and teacher subsidies	FAIR

GPA 5: IMPROVING ACCESS TO QUALITY & AFFORDABLE HEALTHCARE

Set up of e-health systems	GOOD
Healthy lifestyles and preventative measures (focus on NCDs)	EXCELLENT
Extension of community clinics	EXCELLENT
Increase dialysis capability	UNKNOWN
'Better health' information programs	EXCELLENT
Set up a health insurance scheme	FAIR

GPA 6: INCLUSIVE ECONOMIC GROWTH

Improved access to e-Government services	GOOD
Access to renewable energy in the outer islands	FAIR
Tonga Renewable Energy Project (TREP)	FAIR
Integrated financial management system set up	GOOD
Asset insurance scheme set up	FAIR to GOOD
Solid waste management system	FAIR to GOOD

GPA 7: CREATING TRADE OPPORTUNITIES

Promote new investment on property development	EXCELLENT
Product diversification activities	EXCELLENT
Food security programs	FAIR to EXCELLENT
Program to reduce technical barriers for exporters	GOOD to EXCELLENT
Establish co-operative societies in village communities	FAIR
Focus on coconut products/vanilla/handicrafts	FAIR to GOOD
Set up credit union:	
• Credit to farmers	FAIR
• Graduation programs	FAIR
• Credit support to enterprises	GOOD
Tax exemption for agricultural materials, fishing gear	FAIR
Increase promotion of exports	GOOD
Program to identify new markets	GOOD
Investment in the growing financial services sector	GOOD
Tonga Circular Economy Project	FAIR
Import Substitution	
• Via FDI generating knowledge transfer via generalized credit support	FAIR
• Via generalized improvements in basic transport infrastructure	FAIR
• Via generalized improvements in energy availability	FAIR to EXCELLENT
• Via generalized improvements in management capability	GOOD
• Via generalized improvements in broadband infrastructure	GOOD
• Via FDI generating knowledge transfer	GOOD
Microfinance for women	FAIR
Develop aquaculture sector	FAIR
New fishing venture into squid	UNKNOWN
Business support programs, plus business incubation/acceleration programs	FAIR
Tax reforms	FAIR to GOOD

GPA 8: IMPROVING PUBLIC INFRASTRUCTURE

Ports upgrade	FAIR
More safe/secure transport system	FAIR
Shifting to renewables (Green Climate Fund)	FAIR

GPA 9: STRENGTHEN PARTNERSHIPS

Tax incentives to encourage more exports and stimulate investment	FAIR
Increase exports of root crops	FAIR
Programs to promote private sector development	GOOD to EXCELLENT
Introduce new credit instruments (e.g., government loan guarantees)	FAIR

TRAFFIC LIGHT ANALYSIS ON NATIONAL STRATEGIC DEVELOPMENT FRAMEWORK (2015–2025)

GPA 1: BUILDING RESILIENCE

Tonga is highly vulnerable to the impact of climate change, such as sea level rise, drought, and floods. Building resilience in Tonga is crucial for helping the country adapt to and mitigate the effects of climate change. There are several strategies that can be used to build resilience in Tonga, including strengthening infrastructure and coastal protection, increasing access to clean water, promoting sustainable agricultural practices, and investing in early warning systems. In addition, building capacity and increasing public awareness of climate change impacts can help Tongans become more resilient to the impact of climate change.

1. STRENGTHEN BUILDING CODE

GOOD: Tonga is one of the countries within the Pacific Islands that is exposed to high risks from natural disasters. The cost of natural disasters to the Government of Tonga is 4.4% of GDP lost per annum. To save lives and properties as well as avoid the expenses of evacuation and relocation from natural disasters, the Government is promulgating an efficient building code. Strengthening building codes in Tonga could have a significant effect on building resilience. Building codes are a set of regulations that dictate how construction projects must be completed to ensure safety and stability.

By increasing building codes to align with international standards, Tonga can ensure that buildings are constructed in a more resilient manner. This could include increasing the requirements for the use of earthquake-resistant materials, reinforcing masonry walls, and requiring all buildings to be constructed on strong foundations. Not only will this help to protect Tonga's existing structures, but it will also allow for new, more resilient

construction projects to be developed. A study carried out by the National Institute of Building Sciences in the USA revealed a BCR of 11 for investing in an international building code that is hazard-resistant (NIBS, 2019).

2. INSTALLING A SECOND MARINE CABLE

FAIR: As of 2020, 4.75% of the people of Tonga use broadband to access the Internet, 6.65% landlines, and 58% mobile phones (World Data, 2020b). As a result, the Government of Tonga (2015) is focused on improving telecommunication services in the country by expanding its telecommunication infrastructure. In 2013, the Government of Tonga carried out the Tonga–Fiji Submarine Cable Project by installing an 827-kilometer (km) submarine cable link and a landing station to enable the people of Tonga to have access to the international communications network. As a result of the growing demand for telecommunication services, the Government of Tonga (2015) intends to install a second marine cable. While details of this second project are yet to be revealed, the benefit-cost ratio (BCR) of the Tonga–Fiji Submarine Cable Project showed a BCR of 1.8 (Asian Development Bank [ADB], 2020b).

A second marine cable is a considerable capital investment; the cost of the first cable, \$30.8 million, is more than \$1,600 for each of Tonga's 18,800 households. The benefit-cost rating is poor when comparing estimates of potential costs and benefits of a second marine cable. The operations and maintenance (O&M) cost is estimated to be 30% of the total cost, based on the data from the first marine cable (ADB, 2021). This cost might be lower for the second cable due to synergies with the operations of the existing cable. However, it does not change the BCR rating; even a 90% reduction in O&M costs would increase the BCR of the moderate scenario to 0.9 and the BCR of the optimistic scenario to 1.9 (see Annex C—Second Marine cable CBA).

Backup connectivity via satellite could be an alternative. Starlink offers broadband bandwidth via satellite that could potentially be shared among a group of households. In New Zealand, the rate is NZ\$ 159 (around \$99) per month (RNZ News, 2022). At that rate, one satellite dish and router for every ten households in Tonga would cost \$2.2 million per year (\$23.8 million over 25 years at an 8% discount rate), yielding a benefit-cost ratio of 1.2 in the moderate scenario with a fair benefit-cost rating.

3. EARLY WARNING SYSTEMS

EXCELLENT: According to Lasse Melgaard, World Bank Resident Representative for the South Pacific, within the past five years, natural disasters, such as Tropical Cyclones Gita and Harold, as well as the recent Hunga Tonga-Hunga Ha'apai eruption, have caused an estimated \$457¹ million in damages and loss in Tonga. The Government of Tonga (2015) is focused on strengthening and deploying early warning systems to minimize the impact of natural disasters. An early warning system (EWS) is key in helping to mitigate the number of injuries or deaths as well as economic losses from a disaster. Investment in monitoring and predicting systems, as well as communication systems for information dissemination, has substantive benefits (Glantz, 2003). A study in Nepal revealed that investment in an EWS has a BCR ranging between 24 and 73 depending on the scenario employed (Rai et al., 2020). Similarly, a study by the Copenhagen Consensus Center in Malawi on improving the EWS revealed a BCR of 15.8 (National Planning Commission [NPC], 2021a).

4. RELOCATING THE CAPITAL

UNKNOWN: There are multiple reasons countries would like to relocate their capital cities. For example, Indonesia is relocating its capital city from Jakarta to Nusantara with the aim of shifting from the Dutch colonial government-built environment to a capital city that has been built specifically and has a very comfortable urban area for its residents. A similar example is the Federal Republic of Germany moving its capital from Bonn to Berlin following the integration of East and West Germany. The cost-benefit ratio of relocating a capital city would compare all costs and benefits. Costs such as the relocation of the government institutions, the loss of economic revenue in the former capital area, the short- and long-term disruption to government institutions, etc. Benefits could be a relatively disaster-free environment, relatively improved communications, economic activity gained in the new capital city, etc. In addition the potential impact on the local communities. The BCR is unknown.

5. BUILDING A SEAWALL TO PROTECT FROM RISING SEA LEVELS

GOOD to EXCELLENT: Since 1993, Tonga has recorded a sea-level rise of 6.0 mm as compared to the global average of 2.8–3.6 mm per year. The increase in sea level is contributing to beach erosion as well as flooding on coastal roads. The construction of seawalls is one of the measures adopted by the Government of Tonga (2015) to protect

¹ All references to dollars (\$) reflect United States dollars unless otherwise specified.

the coastal area from inundation. The project is a measure of controlling and mitigating the effects of sea rise on communities by increasing their safety (Van Zelst et al., 2021). While the construction costs of sea walls are high and vary depending on the structure and scope of the project, the maintenance cost is expected to be low.

In a study by Chow et al. (2017) in Hong Kong, they found the BCR of investing in a “sloping rock armor seawall with reclamation” to have a BCR of 31.9 while that of a “vertical blockwork sea wall” was 41.7. The project life is 50 years. For a 25-year life period for the same projects, the study revealed a BCR of 13.3 and 17.3, respectively. Kunreuther and Michel-Kerjan (2012) analyzed the costs and benefits of constructing a one-meter-high wall to protect homes in 34 of the most flood-prone countries globally. They estimate reductions in damage to infrastructure and property and avoided fatalities yield a benefit-cost ratio of 60 for building a one-meter wall and 14.5 for elevating homes.

6. CLIMATE PROOFING OF EXISTING INFRASTRUCTURE

FAIR to GOOD: Tonga is vulnerable to adverse climate change and extreme weather events. Climate-resilient infrastructure has the potential to improve the reliability of service provision, increase asset life, and protect asset returns. Climate-proofing policies and their guidelines are widely developed on the pillars of mitigation and adaptation measures for the construction of infrastructure projects. The objective is to ensure these projects increase their degree of resilience and can stand a longer project life due to future climate shocks. Disaster risk reduction (DRR) has long been recognized in the literature for its role in mitigating the negative environmental, social, and economic impacts of natural hazards. Hallegatte et al. (2019) suggest that strengthening new infrastructure assets is a robust solution with high economic returns. Out of the 3000 scenarios they analyzed, 96% had a benefit–cost ratio larger than one, 77% had a benefit–cost ratio larger than 2, 55% had a benefit–cost ratio larger than 4, and 25% had a benefit–cost ratio higher than 6. As part of its Climate Resilience Sector Project, the Government of Tonga (2015) is investing in climate-proofing evacuation roads. The project will upgrade around 6.8 km of roads to provide evacuation and post-disaster access roads to selected villages (ADB, 2017). A benefit-cost analysis of climate-proofing investment projects (roads) in the Pacific region indicates that by considering climate change and adapting to it, the BCRs for the road projects are within 1 and 2. The project’s life is assumed to be 30 years and 50 years (ADB, 2015).

Cost-benefit analyses of five projects on climate-proofing road improvement and development projects in the Pacific were conducted, and the BCR was estimated. The

three projects in the Solomon Islands yielded the following BCRs: Northwest Guadalcanal Road Project (29 km) BCR 2.73; Makira Island Coastal Road Project (72.5 km) BCR 2.94; North Malaita Road Project (31.5 km) BCR 2.94. Then in Timor-Leste, the Ermera–Maliana Road Project (61.2 km) had a BCR of 2.16, and the Dili–Mota Ain Road Project (78.8 km) had a BCR of 2.68 (ADB, 2011).

GPA 2: REDUCING RELATIVE POVERTY

Poverty is a significant issue in Tonga. According to data from the World Bank, approximately 15% of the population lives below the national poverty line. The majority of those living in poverty are found in rural areas, where access to basic services such as education and healthcare are limited. The poverty rate is also higher among women and children.

The Tongan Government has implemented several policies and programs aimed at reducing poverty and increasing economic opportunities, such as the Tonga Development Bank's microfinance program and the Ministry of Labor, Commerce, and Industries' training and employment program. However, the impact of these programs has been limited, and poverty remains a persistent problem in Tonga. Factors contributing to poverty include high unemployment, limited access to education and training, and a lack of economic opportunities.

1. MICRO-CREDIT SCHEMES FOR WOMEN *

FAIR: Recent evidence suggests only modest social and economic impacts of microfinance, with favorable cost-benefit ratios depending on low costs (Cull et al., 2018). Prior work by Copenhagen Consensus on the economic evaluation of microfinance for women in Haiti and Bangladesh yielded BCRs < 5.

EXCELLENT: However, combining a microfinance intervention with gender training for the prevention of intimate partner violence has been shown to be very cost-effective, as seen in South Africa. Given that domestic violence is a significant issue in Tonga, with more than 79% of Tongan women and girls having experienced physical or sexual violence in their lifetimes (Jansen et al., 2012), an intervention combining micro-credit loan facilities with a component of gender training and counseling could prove to be an effective intervention. In India, self-help groups against domestic violence yielded an EXCELLENT BCR of 16.

2. TONGA RURAL INNOVATION PROJECT (TRIP)

FAIR to GOOD: Tonga faces several economic challenges due to its small size and geographic remoteness. About 85% of Tonga's population resides in rural areas, depending on agriculture and fisheries as their main livelihoods, even as climate change and poor nutrition continue to threaten their well-being. Meanwhile, the rural population is declining due to migration and a lack of incentives for youth to remain in rural areas. The Tonga Rural Innovation Project (TRIP) – Phase II aims to improve livelihoods and help communities be more resilient to the effects of climate change and extreme weather by assisting them in identifying where infrastructure is needed and supervising its construction according to technical standards. It will also provide agricultural training and technical support, with the goal of improving the quantity, quality, and variety of agricultural production. In addition, it will promote the development of homestead gardens in which a range of fruits and vegetables will be grown to improve people's access to a variety of nutrients. The project is expected to reach 6,349 poor rural households in 122 rural communities across Tonga's five main island groups. Building resilience through the improvement of infrastructure typically yields BCRs that are GOOD. However, agricultural interventions such as training, extension services, irrigation training, and crop diversification attract BCRs below 5 and are, therefore, in the FAIR range.

3. VOCATIONAL TRAINING (SKILLING & EMPLOYMENT PROJECTS)

FAIR: Skills training, by itself, typically has low returns. It is costly, suffers from high attrition, and does not often provide marketable skills (Blattman and Ralston, 2015). Poverty alleviation reduction interventions – whether direct cash transfers, livelihood interventions, or integrated skills-capital-counseling – typically have BCRs between 1 and 3 (Sulaiman et al., 2016).

4. AFFORDABLE HOUSING FINANCE

FAIR: Poverty and unemployment are major contributing factors to homelessness in Tonga. Nearly 20% of Tonga's population lives below the poverty line due to sparse gainful employment opportunities on the islands. Much of the country's economy is dependent on the export of a few agricultural and livestock products, making it difficult for many others employed in other sectors to earn living wages. Production of such exports can also be unstable due to fluctuating worldwide demand and regional conditions, which in turn, makes jobs even in those sectors unstable. Without stable employment, many impoverished residents have difficulty maintaining stable housing and must face the prospect of homelessness in Tonga. Considering the susceptibility of human settlements

and built infrastructure, housing policies are crucial in promoting community resilience, especially given small island nations like Tonga's multipronged disaster-risk scenarios.

The welfare outcomes of housing have also been documented in the literature following the works of Dunn (2002) and Dunn and Hayes (2006). These studies have particularly focused on the health benefits of social housing for the poor and concluded that housing is a valuable health capital. However, equitable shelter provision and sustainable spatial development are often more difficult in small island developing states (SIDS) because of their unique developmental and geographical constraints—such as small size, remoteness, and greater exposure to economic and environmental shocks (Das, 2018). The key to a sustainable housing policy is successful land reform. Addressing the problems of inadequate housing includes recognizing that squatter settlements are a permanent feature and require basic services to sustain. Along with the identification of suitable land for housing for poor and low-income households, weak land administration has been one of the main constraints of the land reform issue. It is essential that an effective legal framework be established when dealing with land-related matters where customary landowners and developers can directly communicate with mediation from the state (Juswanto, 2019).

Cost-benefit literature points to the evidence that low-income housing projects tend to have BCRs between 1 and 2 (Ghana and India). Prior research by Copenhagen Consensus in Ghana on social housing units (Adjasi, 2019) yielded an estimated BCR of just over 1. Randolph et al. (2019) assessed the economic impact of providing better housing outcomes in Australia and estimated a BCR of between 2.25 and 4.80.

5. SUBSIDIES FOR HIGH COST OF UTILITIES

FAIR: Petroleum dependency makes Tonga highly vulnerable to oil price changes and shocks, which in turn, affect the affordability of food, goods, electricity, and transport. More than 91% of its overall grid-connected electricity demand is supplied by generators fueled by imported diesel. This reliance on fossil fuels has exposed the economy to high electricity tariffs due to volatility in oil prices, its remote location, and the high cost of transport. Utility subsidies to consumers of water and electricity services are often justified as a mechanism for making services affordable for the poor. However, critics object that such subsidies can work against improving the quality of service to existing consumers and extending access to unconnected households. Subsidies for utilities can put pressure on government budgets, especially if they are not well-targeted or are not designed to be sustainable over the long term. Financially strapped utilities are often

inefficient, provide low-quality services, and lag in expanding networks. In addition, by making energy more affordable, subsidies can lead to increased consumption, which can have negative environmental impacts. A study by the World Bank found that household subsidies for electricity in developing countries can have a BCR of up to 3 (Komives et al., 2005).

GPA 3: SUPPLY AND USE OF ILLICIT DRUGS — REDUCE HARM

Tonga, like many other countries, has a problem with illicit drug use and supply. According to the United Nations Office on Drugs and Crime (UNODC), cannabis is the most used illicit drug in Tonga, followed by methamphetamine. The use of illicit drugs in Tonga is associated with a range of social, health, and economic problems, including crime, poverty, and poor health outcomes. The supply of illicit drugs in Tonga is believed to come from both domestic and international sources (being smuggled into the country from other Pacific Island countries and from countries in Asia).

The Government of Tonga (2015) has taken several steps to address the problem of illicit drug use and supply, including law enforcement efforts to disrupt drug trafficking and the cultivation of illicit drugs, as well as efforts to provide treatment and support for individuals who are struggling with drug addiction. However, the impact of these efforts has been limited, and the problem remains a significant challenge. Addressing this issue requires a comprehensive approach that includes both demand and supply reduction efforts, as well as addressing underlying social and economic factors that contribute to drug use. This can include prevention and education programs, alternative livelihoods, healthcare and social services, and economic development.

1. INVESTMENT IN LAW ENFORCEMENT

FAIR: Investment in law enforcement is important in reducing the crime rate. Such investments into security programs or criminal justice systems could, among others, be channeled through improving the police service and/or improving the courts for effective and timely delivery of their services as well as improving the correction system. A review of case studies by Dossetor (2011) on crime prevention and criminal justice programs revealed BCRs ranging from 1 to 2.

2. REDUCING CORRUPTION

EXCELLENT: Corruption is considered a cancer to development (Gong and Yang, 2019). According to the Global Corruption Barometer Pacific (2021), two-thirds of respondents (66%) in Tonga perceive that the levels of corruption in both the public and private sectors have increased. Common among government agencies and the public sector is bureaucratic corruption associated with poor administrative management.

One of the strategies for curbing corruption in Tonga is the establishment of an e-procurement system. e-Procurement systems have extraordinarily high BCRs, above 100. The broad logic underpinning this rating is that it typically costs around \$10 million to implement a fully functioning e-procurement system, from design to pilot to roll-out. However, up to 13% of a country's GDP is spent on procuring goods, services, and works. Should this hold for Tonga, this value is approximately \$61 million. Evidence from several countries indicates that e-procurement may reduce prices of procured items by 6%, on average, freeing up resources for other development priorities. In this case, it would generate a saving of \$3.7 million annually.

3. REDUCE MONEY LAUNDERING

GOOD to EXCELLENT: Most countries, including Tonga, have an anti-money laundering (AML) framework in place based on the 40 recommendations of the Financial Action Task Force (FATF). Despite this, Tonga still faces a range of money laundering threats and risks (APG, 2021). Money laundering is an activity that is shielded from the public eye, which obstructs direct measurement. In light of this, a CBA of anti-money laundering policy is rare (Ferwerda, 2018). The components of a CBA of AML are detailed in Ferwerda (2018). However, compared with the monetary and non-monetary costs of money laundering prevention for society and the economy, the benefits are small (Geiger and Wensch, 2007). A relatively low-cost intervention with EXCELLENT yield (BCR 49) is to reduce to zero the legal persons and arrangements for which beneficial ownership info is not publicly available. (Cobham, 2017), another intervention with likely GOOD BCR is to reduce to zero the cross-border trade and investment relationships between jurisdictions for which there is no bilateral automatic exchange of tax information (Cobham, 2017).

4. TREATMENT, REHABILITATION & REINTEGRATION

GOOD: Illicit drug use places a significant burden on a country's economy. The use of illicit drugs is associated with increased costs to the criminal justice system (courts, prisons), victims of crime, and the healthcare system (hospital visits and treatment); reduced

individual productivity (loss of income and employment); and broader consequences for families and communities (child maltreatment, domestic violence, and road traffic accidents) (Longo et al., 2020). Voce and Sullivan (2022) synthesized data from 67 benefit-cost analyses of prevention, law enforcement, and treatment programs. Eighty percent of the 70 separate benefit-cost ratios exceeded 1.0, indicating that savings outweighed the costs for most programs reviewed. On average, demand reduction programs produced a return on investment of \$5.40 for every dollar spent.

GPA 4: IMPROVING EDUCATION FOR ALL

Tonga's education sector is based on a system of primary, secondary, and tertiary education. Primary education is compulsory and free for children aged 6–14. Secondary education is not compulsory, but it is free for students who have completed primary education. Tertiary education is provided by the Tonga Institute of Higher Education and the University of the South Pacific's Tonga Campus. The Government of Tonga provides funding for the education sector, but there are also private schools and colleges. The literacy rate in Tonga is high, with around 98% of the population able to read and write. However, the education system has been criticized for not providing enough opportunities for students to continue their studies after completing their secondary education.

1. EARLY CHILDHOOD EDUCATION

GOOD to **EXCELLENT**: Recent studies in Tonga show poor reading outcomes in the first three grades of primary education and little understanding from communities of the importance of the first years of a child's life on development, learning, and later successes. The results from the Tongan Early Human Capability Index (TeHCI) (Brinkman and Vu, 2016) also show that over half of all children in Tonga attend school for the first time without exposure to any early education program, including some form of preschool, kindergarten, early education center, or playgroup. International literature suggests these children will find it harder to transition into the school environment and are at a higher risk of dropping out of school early and failing in school. In prior work done by Copenhagen Consensus, preschool education in sub-Saharan Africa yielded an excellent BCR of 36 (*African Best Buys*, 2021), with other interventions such as psychosocial stimulation and early childhood stimulation for stunting typically yielding BCRs of over 15 (all in the EXCELLENT range).

2. E-LEARNING PROGRAMS WITH TEACHING AT THE RIGHT LEVEL (TaRL)

EXCELLENT: Innovations in information and communication technology (ICT) and their integration into the education sector have massively impacted the education process, particularly in higher education. eLearning describes the use of ‘tools’ such as computers, the Internet, and in general, information and communication technology (ICT) to provide learning or education in one or more subject areas (Pittinsky, 2003). For the learning experience to be ‘optimized,’ a blended approach involving both traditional and eLearning-based methods is required (Pais, 2007). Providing technology and other inputs alone often show no effectiveness whatsoever, including the famous one-laptop per-child intervention (Angrist et al., 2023).

Technology-assisted learning at the right level has been shown to be one of the most cost-effective ways to improve learning (NPC, 2021b; Angrist et al., 2023; Rodriguez Segura, 2020). This intervention involves students working individually with educational software in a dedicated classroom at their own pace. It can address different learning levels in classes, large class sizes, and variable teacher quality. BCRs for this intervention are typically in the EXCELLENT range (Angrist et al., 2023; NPC, 2021b).

3. STUDENT LOANS

FAIR: Primary school education is compulsory in Tonga from the ages of 6–14, with attendance free of charge. Currently, 97% of children are registered. However, these figures drop dramatically at the secondary level, with only 75% of students going on to higher education. A major issue is the cost of attendance, with most secondary schools requiring fees estimated at T\$ 900–T\$ 1100 (\$ 400–500) per year, plus uniform and textbook requirements. With an average annual wage of T\$ 10,000 (\$ 4,000), many families cannot afford to keep their children in school. Western missionaries set up the first modern schools in the late 1800s, and private church groups are still heavily involved in the country’s education system. There are about 41 high schools, of which only a quarter are administered by the government, and 118 primary schools (107 government and 11 church schools). Some 72% of secondary students study at non-government, private schools.

Both loan and grant need-based assistance can be effective tools to improve the academic and labor market outcomes of students from low-income households. A few related studies have arrived at a similar conclusion in the developing country context. For instance, Card and Solis (2020) showed that a loan program in Chile increased the likelihood of college completion, and similar positive effects have also been found for

comparable loan programs in Colombia, Mexico, and South Africa (Canton and Blom 2010; Gurgand et al., 2011; Londoño-Vélez et al., 2020; Melguizo et al., 2016).

Second, need-based grant funding may yield a large positive long-term return for the government. While a longer time horizon is needed to evaluate the long-term benefits of each program, a cost-benefit analysis suggests that the program paid for itself through higher tax contributions within a decade, providing a benefit of \$1.96 in discounted tax revenue for every dollar of grant funding awarded. As such, this program may be a cost-effective approach to improving the outcomes of low-income families in developing countries (Wright, 2021).

Last, imposing strict repayment conditions on student loan borrowers may significantly penalize them as new college graduates entering the labor market. For example, the results indicate that one unintended consequence of imposing a short moratorium on loan repayment is that it induces students to accept lower-paying jobs when they leave college. As such, while loan funding improves students' outcomes during college, these students enter the labor market at a disadvantage.

4. TONGA ACCELERATING RESILIENCE PROJECT

GOOD: The Tonga Accelerated Resilience Program (TARP) will deliver flexible and distance learning guides for students, parents, and carers and pre-prepared audio and video lessons. See e-learning and improving digital literacy.

5. INCREASING DIGITAL LITERACY

GOOD: Digital literacy refers to the individual's ability to use digital platforms and resources to find, evaluate, and obtain information (Meyers, 2013). Digital literacy interventions such as mobile phones, mobile health tools, media exposure, access to the Internet, internet-based educational strategies, and social media exposure are effective pathways to access health services and information and enhance access to educational resources, financial services, and e-government initiatives. The benefits would include increased productivity and access to new information and resources, while the costs would include training expenses, equipment costs, etc.

The European Commission (2010) found that the benefits of digital literacy training, such as increased employability and productivity, outweighed the costs of the training by a ratio of 3:1. In Tonga, 45% of the total population are mobile-broadband users,

while 31% are Internet users (UNESCAP, 2016). We estimate a GOOD rating for improving digital literacy in those already using digital technology and a POOR rating for those living in rural and underserved areas, given the poor access and, therefore, challenges faced in using ICT. While this rating might seem at odds with the GOOD ratings for digitalization and broadband expansion, it should be noted that the benefits of these interventions mostly arise from sectors of the society that are already digitally literate and where economic activity is high, for example, government, businesses, and those living in urban centers, all of which are beneficiary groups distinct from digital training for rural communities.

6. TEACHER TRAINING

EXCELLENT: Interventions targeted towards teachers' professional development can involve either pre-service training (which refers to training delivered to teachers before they have begun teaching) or in-service training (which refers to training active teachers receive while teaching). Types of professional development interventions vary widely in terms of content and delivery methods; however, here, the analysis will be limited to in-service training focused on specific subject areas (literacy, mathematics, gender-based teaching methods, etc.) as qualified teacher recruitment has been separated into its own intervention category. When teachers are better qualified, they have the potential to positively impact students' test scores and overall life outcomes (Popova et al., 2018). Prior work by Copenhagen Consensus in Malawi estimates a BCR of 22.5 (NPC, 2021b).

7. SET UP FIRST NATIONAL UNIVERSITY

GOOD: The University Bill has been drafted and approved by the Legislative Assembly for setting up Tonga's first National University. There is a proposed budget (\$1.9 million) for an interim body with key positions plus other expenses. The University is expected to unite various institutions, including the Tonga Institute of Education, Tonga Institute of Higher Education, Tonga Institute of Science and Technology, Tonga Maritime Polytechnic Institute, Queen Salote Institute of Nursing and Allied Health, as well as the Tonga Police College. The University will offer academic, technical, and vocational programs and qualifications from certificate to post-doctorate level. Universities can have a positive impact on economic development and social welfare.

Higher education institutions, particularly research universities, play a significant role in the economic development of a region by creating new knowledge, training a skilled workforce, and attracting high-tech industries, thus providing vital contributions to

regional innovation and economic development processes (Sánchez-Barrioluengo, 2014). Universities can also raise the quality of regional innovation strategy processes and create collective innovation assets that have the potential to yield EXCELLENT BCRs. However, the BCR may be different depending on the specific circumstances and can depend on the quality of the university, the level of government support, and the country's overall economic and political environment.

8. STUDENT & TEACHER SUBSIDIES

FAIR: Of the South Pacific's 14 countries, Tonga is one of the smallest, with a population of just 109,000 people, and one of the more impoverished nations. While many improvements have been made to the quality of education in Tonga, the cost of annual fees at secondary and tertiary levels excludes many families from the school system. Primary school education is compulsory from the ages 6–14. Attendance is free of charge, and 97% of children are registered. These figures drop dramatically at the secondary level, however, with only 75% of students continuing their education.

At issue is the cost of attendance, with most secondary schools requiring fees. Students complete three years of junior secondary, from the ages of 12–15, and three years of senior secondary, from ages 15–18. Fees are estimated at T\$ 900–T\$ 1100 (US\$ 400–500) per year, plus uniform and textbook requirements. With an average annual wage of T\$ 10,500 (\$ 4,426) (World Bank, 2021), many families cannot afford to keep their children in school.

In the education services sector, the literature points to student-centered interventions, rather than structural ones, having higher returns (e.g., teaching at the right level, integrating technology, and early childhood education) with a BCR of over 30. Cash transfers, school feeding, and subsidies for uniforms and textbooks have markedly lower BCRs of < 10. School uniforms represent a large share of education expenditure in developing countries and are considered a serious impediment to school enrollment. According to Kremer and Holla (2009), for instance, the provision of free school uniforms leads to 10%–15% reductions in dropout rates. Prior work by Echevin, (2017) in Haiti estimated BCRs for this intervention range from 1.4 to 4.4 when calculated for a single cohort and from 1.6 to 3.5 when considering multiple cohorts. The research also estimates a BCR of 2.9 for private school subsidies, which could be in the form of vouchers or tuition subsidies.

GPA 5: IMPROVING ACCESS TO QUALITY AND AFFORDABLE HEALTHCARE

1. SET UP E-HEALTH SYSTEMS

GOOD: Public service delivery in developing countries is still characterized by inefficient, rigid, and manual systems (Singh and Travica, 2018). ICT, when appropriated as e-government for citizens, can improve poor people's access to education, health, financial services, and public safety enhancement. Nwinyokpugi and Bestman (2020) point out that rolling out e-services in Africa would enhance economic growth and impact poverty reduction, with e-services not only being economically viable but also equitable. They show that e-services serve as a mechanism to improve effective public service delivery, improve transparency, and combat corruption.

In Tonga, the digital health and e-governance project leverages the increased bandwidth from the fiber optic cable by fostering an e-governance environment together with more direct investments in digital health for improved health system response and efficiencies. Ensuring that quality primary healthcare services can be maintained in remote areas is a major challenge for Tonga. The range and scope of secondary and tertiary services also need to be expanded to treat and limit complications due to noncommunicable diseases (NCDs). We estimate a BCR rating of GOOD. Copenhagen Consensus has conducted some 20 benefit-cost analyses in e-services that consistently fall in the GOOD range. For example, expanding public services through e-delivery, such as the expansion of payments through Universal ID in India, has a BCR of 8.5 (Srivastava and Mukherjee, 2018), and the provision of services at Union digital centers a BCR of 8.4 (Bakshi and Rahman, 2016).

2. HEALTHY LIFESTYLES & PREVENTIVE MEASURES (FOCUS ON CERTAIN NON-COMMUNICABLE DISEASES)

EXCELLENT: NCDs inflict considerable economic costs in Tonga. According to the World Bank, NCDs currently cost the country 8.3% of GDP, an economic burden that is expected to rise to 12.3% in 2040. By 2040, the percentage of lost effective labor force due to NCDs (in particular, cardiovascular disease, diabetes, chronic respiratory disease, and cancer) in Tonga will be 18.5% (World Bank, 2016). It is estimated that 70–77% of deaths in Tonga can be attributed to neoplasms, diabetes, and cardiovascular disease (Carter et al., 2012). Although data on cause-of-death data are patchy, cardiovascular disease (CVD) is considered the major cause of death in Tonga. A cardiovascular disease risk of 30% or

higher or existing CVD is high; higher percentages of men are at risk than women, with CVD risks of 16.6% and 7%, respectively. As is the case elsewhere, CVD risk increases with age, as would be expected, with a significant increase from 0.8% to 11.3% from 40–54 years to 55–69 years (WHO, 2017).

Some 34.4% of the population between 25–64 years has diabetes, including 29.7% of men and 38.6% of women. The country is now ranked among the top ten globally in the prevalence of diabetes. Cancer is responsible for about 9% of deaths in Tonga. Chronic respiratory disease is also widely prevalent and responsible for 7% of deaths in Tonga. As a result of this growing NCD disease burden, life expectancy in Tonga has started to decline, from 69 to 65 in men and from 72 to 69 in women (Lin et al., 2016). Nutrition and health counseling would therefore prove to be an important and cost-effective intervention. A recent study by India Consensus for Andhra Pradesh and Rajasthan shows that a six-year intervention (2016–2021), which includes counseling for breastfeeding, complementary feeding, and hand washing, gives a BCR of 61 and 43 respectively (Joe et al., 2018). The provision of calcium and multiple micronutrients for pregnant women also yields BCRs with an EXCELLENT rating. Many interventions for the prevention and promotion of NCDs are also highly cost-effective. These include tobacco and alcohol control policies such as taxation, voluntary and legislative actions to reduce sodium intake, and mass media campaigns for reducing physical activity (Bertram et al., 2021). Prior work by Copenhagen Consensus estimates BCRs of between 20 and 35 for cutting salt intake and salt reduction campaigns. Tobacco taxation yields a BCR of 40 while increasing tobacco prices by 125% yields a BCR of 22.

3. EXTENSION OF COMMUNITY CLINICS

EXCELLENT: The Tongan Government currently provides the majority of the country's primary healthcare through the network of reproductive and child health clinics, health centers, and hospitals. The network consists of 34 maternal and child health clinics, 14 health centers, three district hospitals, and the tertiary referral hospital, Vaiola Hospital, located in the capital city, Nuku'alofa. However, patients, particularly in rural and remote areas, often bypass the lower-level health services and go directly to a hospital, which can result in late presentation and the reduced technical efficiency of the health system. Prior work by Copenhagen Consensus in Ghana, which analyzed the strengthening of the health system by promoting the delivery of quality primary healthcare services, yielded a BCR of 38.

Kelly et al. (2023) studied the impact of reducing the unmet need for modern contraception and expanding access to quality maternal health services as priorities for improving women's health and economic empowerment in five Pacific (Kiribati, Samoa, Solomon Islands, Tonga, and Vanuatu) and four Caribbean (Barbados, Guyana, Jamaica, and Saint Lucia) countries. The coverage-targets-achieved scenario required an additional \$12.6 million (\$10.8 M– \$15.9 M) over 2020–2030 for the five Pacific countries. This additional investment was estimated to potentially avert 126 000 (40%) unintended pregnancies, 2200 (28%) stillbirths, and 121 (29%) maternal deaths, leading to a 15-fold economic benefit of \$190.6 M (\$67.0 M– \$304.5 M) by 2050.

4. INCREASE DIALYSIS CAPABILITY

UNKNOWN: Chronic kidney disease (CKD) is a global public health problem; however, there is increasing evidence that indigenous people suffer disproportionately from CKD (Nugent et al., 2011). In Tonga, 4.9% of deaths (32 deaths) were attributed to CKD (GBD, 2019). The costs of setting up dialysis facilities would include the purchase of equipment, such as dialysis machines, water treatment systems, and medical supplies, as well as the cost of building and maintaining the facility. In addition, ongoing costs such as staff salaries, electricity, and medical supplies must be taken into consideration. The estimation is that the BCR would tend to be poor because of the high costs of benefiting very few people.

5. “BETTER HEALTH” INFORMATION PROGRAMS

EXCELLENT: Malnutrition in Tonga, lack of education, and poor diet and lifestyle choices have led to a startling rise in noncommunicable diseases in the country. The emergence of lifestyle diseases, particularly diabetes and cardiovascular disease, poses a huge challenge to the health system and the overall health of the nation, with an alarming 99.9% of the adult population estimated to be at moderate to high risk of developing a noncommunicable disease (Rodny et al., 2015).

The rise in Tongans consuming imported foods high in fat and low in nutritional value has correlated with a dramatic increase in poor health outcomes, including heart disease and adult-onset diabetes. While the World Health Organization (WHO) estimates that roughly 25% of the population has diabetes, the Tongan Health Ministry (THM) reports that the prevalence of diabetes among its people is actually closer to 34–40%. Furthermore, as of 2016, Tonga ranked among the most obese countries in the world, with an obesity rate of more than 40%, and many others considered overweight. The importance of

nutritious eating practices, physical exercise, and overall healthier living for the Tongans is therefore crucial. Counseling for nutrition, as well as complementary feeding promotion, typically return BCRs in the EXCELLENT range, as seen in prior work by Copenhagen Consensus: BCRs for education for complementary feeding and hand-washing in India = 52, complementary feeding promotion in Ghana = 36, breastfeeding promotion in Ghana = 24, counseling patients for TB regimen adherence in Ghana = 190.

6. SET UP HEALTH INSURANCE SCHEMES

FAIR: In the context of under-resourced public sector provision of healthcare in the slums and the growing health burden and inequalities in these settings, social health enterprises may be able to provide innovative solutions because they tend to be more responsive to community needs in ways that the public sector entities are not providing quality healthcare at an affordable cost. The logic of health insurance schemes is one in which one group (the government or healthier individuals) subsidizes another group's health services. Economically, this describes a transfer where resources are shifted from one group to another. While there will, of course, be other benefits in terms of improved health seeking, typically, the transfer dominates the benefit-cost calculus. With the benefits being equal to the costs, the BCR tends toward 1 or a FAIR rating. Donfouet et al. (2020) assessed the economic valuation of setting up a social health enterprise in an urban poor-resource setting in Kenya. The BCR obtained for the scheme was 1.11.

GPA 6: INCLUSIVE ECONOMIC GROWTH, ACCESS TO GOVERNMENT SERVICES, BROADBAND, AFFORDABLE ENERGY, AND CLEAN ENVIRONMENT

Tonga faces many of the challenges typical in small island economies, including geographic isolation, limited human and financial resources, and high costs for doing business and providing basic services. The economy has a narrow base, dependent on inflows of remittances and external assistance, and is vulnerable to external shocks. Tonga's economy had a 2.4% average growth rate during fiscal years 2015–2019, ending in June. The gross domestic product contracted by 0.8% in fiscal year 2020 and 5.3% in fiscal year 2021, mostly due to the impacts of the disasters and the coronavirus (COVID-19) pandemic (ADB, 2022).

Public institutional reforms are considered “high quality institutions [that] enable a better economic and investment climate, foster better governance and accountability, encourage

trust, reinforce property rights, and avoid the exclusion of sections of the population.” In other words, such reforms are synchronized with public administration systems with the aim of improving efficiency (Baimyrzaeva, 2012). What this means is that institutional reforms are expected to cover almost all key government agencies and hence, are broad in nature. The specific institutions that are of concern to the people of Tonga are, therefore, unknown. “This requires careful discussion and debate on what aspects of the institutional reforms are most suited to our needs. It requires careful choice and consideration between the various possible forms of democracy and associated institutional arrangements. It may even require us to further develop democratic and administrative institutions that are particular to our conditions” (Government of Tonga, 2015).

1. IMPROVED ACCESS TO E-GOVERNMENT SERVICES

GOOD: Improved access to e-government services has been embraced by governments around the world. e-Government services are a range of services that include e-procurement and digitization of public records, among other sectors. The objective is to improve the efficiency of public service delivery, at the same time assuring the public of accountability. The BCRs vary depending on the intervention, its scope, and the degree of digitization that already exists in the country. For instance, e-government procurement has BCRs averaging 100 because the cost of the technology is a small percentage of the annual benefits from government consumption. Another example of where the benefits of digitization dwarf the costs is the electronic registration of births in Haiti, with a BCR of 11. With most of the population unregistered, the size of the beneficiary market is large compared to the minimal costs of technology. Alternatively, a study in Malawi on e-filing and tax nudges for improved tax compliance had a BCR of 7, while e-permits for construction approval in the same country recorded a BCR of 3.2 (NPL, 2021d). Interventions that require internet access and training for the public attract lower BCRs because of the costs involved.

2. ACCESS TO RENEWABLE ENERGY IN THE OUTER ISLANDS

FAIR: Currently, Tonga’s energy supply is 87.5% fossil and 12.5% renewable. Renewable energy is clean and generates lower carbon emissions as compared to fossil fuels (coal, oil, and gas). The increasing demand for energy consumption coupled with the fight against climate change has intensified the need for renewable energy. Solar, wind, and hydro energies are a few of the renewable energy sources that have been gaining increased attention in recent years. A cost-benefit analysis (CBA) of solar micro-grid for remote communities in Ghana showed a BCR of 1.7 (Kemausuor et. al., 2020). In Haiti,

the results of a CBA on renewable energies (wind, solar PV, concentrated solar power, and hydro) showed BCR ranging from 0.47 to 1.52 (Kashi et al., 2017). A CBA of a solar project in Nauru, a one-island Pacific country, revealed a BCR of 1.5 (ADB, 2019). Similarly, a cost-benefit analysis of a Hybrid Solar PV-Diesel-ESS System for Kumundhoo, Maldives, indicates a BCR of 1.24 (Tae et al., 2017).

3. TONGA RENEWABLE ENERGY PROJECT (TREP)

FAIR: Tonga is accelerating its efforts to achieve a 70% clean energy target by 2030, with solar power as the key driver. The results of studies on CBA of renewable energies show BCRs of less than 2 (see above).

4. INTEGRATED FINANCIAL MANAGEMENT SETUP

GOOD: The establishment of an integrated financial management system (IFMS) in Tonga is a step in the right direction, and it has been promoted as a core component of public financial reforms. Such a public financial reform is expected to improve efficiency in budgetary, financial, and accounting operations and promote better public financial management (PFM). The establishment of IFMS also requires an information technology (IT) infrastructure supporting financial transparency in the country. The benefits associated with IFMS are enormous. According to OECD-DAC (2011), it helps manage macroeconomic issues better, provides real-time information on public finance, and increases transparency at the country level as well facilitates better governance of the budget. There is no evidence of the BCR in this study; however, the BCR is likely GOOD (5–15).

5. ASSET INSURANCE SCHEME SET UP

FAIR to GOOD: The establishment of an asset insurance scheme in Tonga is a step towards risk management of the country's assets because of natural disasters on public sector assets. According to the World Bank (2015), Tonga is expected to incur an average of \$15.8 million per year because of earthquakes and tropical cyclone losses. A policy intervention for financial disaster in Tonga is the establishment of an asset insurance scheme. The benefits and cost of risk insurance in selected countries in Asia (India, Malaysia, and the Philippines) showed BCRs ranging from 2 to 10. The change in BCR is also a function of the frequency of the disasters (Sivapuram et al., 2018).

6. SOLID WASTE MANAGEMENT SYSTEM

FAIR to **GOOD**: Waste generation within the Pacific Island is estimated to be an average of 0.45 kg per person per day. Tongatapu, the island with the highest population in Tonga, is faced with significant waste disposal challenges. The collection, treatment, and disposal of solid waste are of much concern to the Government of Tonga (2015). As a result, the Tonga Waste Management Act (2005) was enacted, paving the way for the implementation of the Tongan Solid Waste Management Project (TOSWMP) (ADB, 2014). Recycling, landfill management, composting, and disposal are a few of the components of solid waste management (SWM). Economic evaluations on SWM factor benefits rise from improved public health impacts, preserved aesthetics, and direct economic benefits, while the costs include operating and maintenance costs and the opportunity costs of land used for landfill sites. Studies in Saint Lucia reveal a benefit-cost ratio ranging from 9.57 to 10.90 (where the preserved aesthetic value accounted for more than 92% of the total benefits). However, in the case of Trinidad and Tobago, the benefit-cost ratio ranged from 0.97 to 1.24 because avoided public health impacts comprised the larger share of total benefits (90%) and ranged from \$ 22.7 million to \$ 29.2 million per year over the five-year period. Solid waste management contributed larger social benefits to Trinidad and Tobago in terms of public health but relatively less in terms of preserving aesthetic values. (Phillips and Thorne, 2013).

GPA 7: CREATION OF TRADE OPPORTUNITIES

Tonga has a small economy that is primarily based on agriculture and fishing. However, there are opportunities for trade in other areas, such as tourism, handicrafts, and seafood. For example, the tourism industry in Tonga has been growing in recent years, with the number of visitors to the country increasing by 6.3% in 2019 (World Data, 2020a). This presents opportunities for businesses to provide services such as accommodation, transportation, and tour guides to tourists. Handicrafts are another area where there is potential for trade, as Tonga has a rich cultural heritage, and traditional crafts such as tapa making and weaving are an important part of this culture.

Another opportunity for trade in Tonga is seafood. The country has a rich fishing ground, and seafood exports accounted for 3.2% of the country's total exports in 2019 (Tonga Bureau of Statistics, 2020). There is potential for businesses to export seafood such as tuna, Mahi Mahi, and shellfish to international markets. In addition, the Government of Tonga (2015) is actively seeking to attract foreign investment and develop the country's infrastructure. This could create opportunities for trade and business in areas such as transportation and logistics, as well as renewable energy.

1. PROMOTE NEW INVESTMENT

EXCELLENT: According to the OECD (2017), fiscal and policy instruments that should be avoided include single-use zoning and restriction of competition between enterprises, particularly new entrants. Government can play a vital role in stimulating property development by designing tax instruments and value-capture tools to steer land use and reduce the cost of compliance to land use regulations. Interventions previously studied by the Copenhagen Consensus included the reform and digitization of government services, which has good returns: land records' BCR = 39 in India, and e-procurement and land titling reform have excellent BCRs.

The automation of citizen/enterprise payment functions and management support interventions also have BCRs between 5 and 10. These include business registration, tax filing, VAT automation, and the establishment of a credit reference bureau. Interventions with slightly lower BCRs in the FAIR range include R&D spending in developing countries, local content procurement in Haiti, reduced electricity tariffs for the industry in Ghana, start-up incubator support in India, and Pand prototype building plans to lower the cost of construction compliance.

Public Private Partnership (PPP) has been deleted from this headline, because it pertains to the financing of a reform or intervention. Who ultimately provides the funds does not change the social, economic, or environmental benefits or costs of an intervention or reform.

2. PRODUCT DIVERSIFICATION ACTIVITIES

EXCELLENT: "Coerced" diversification has only FAIR results. Interventions at the farm level, like irrigation support, crop insurance, extension services, and subsidies for fertilizer and seeds, are typically rated FAIR, between 1 and 5, as are interventions targeting harvesting activities like warehousing, packaging and conservation facilities, and refrigerated trucks. Agricultural interventions that have higher BCRs are associated with the market, e.g., trade facilitation, reducing middle-men, and reducing barriers and costs to export, which are EXCELLENT. The conclusion is that the identification of the market opportunity will incite changes in farmer planting decisions, as farmers are revenue maximizers.

3. FOOD SECURITY PROGRAMS

FAIR to EXCELLENT: To the extent that food insecurity is addressed by minimizing post-harvest losses, investment in roads, electricity, and cold chain storage is FAIR. Investments in Research and Development in partnership with CGIAR have EXCELLENT returns.

4. REDUCING TECHNICAL BARRIERS FOR EXPORTERS

GOOD to EXCELLENT: Interventions that remove middle-men and other speculators and make prices more transparent tend to have a high BCR, like the commodity exchange reform in Malawi (BCR = 16). Facilitating certification for exports also has good returns, particularly high-value commodities, like seafood certification for export in India (BCR = 8), as opposed to that for organic products with a BCR of 1.5. Benefits largely rely on the extent to which export revenues cover the certification expenses.

5. ESTABLISH CO-OPERATIVE SOCIETIES IN VILLAGES

FAIR: Co-operatives to leverage the high upfront costs of agriculture can increase farmer uptake, as is the case for irrigation and energy infrastructure. They are also in a better position to negotiate farm gate prices on behalf of their members. Studies of farmer co-operatives in China (Zou and Wang, 2022) found that members have significantly higher household income than non-members; the idea is that co-operatives reduce the transaction costs of farmers, similar to Ethiopia (Ahmed and Mesfin, 2017).

A systematic review of 21 studies looking into the performance of African farmer co-operatives by social impact (Khambule, 2015) shows that co-operative membership leads to a moderately strong and positive impact on farmers' production and yields, a small but positive impact on farmer income, and inconclusive impacts on market access, acreage, and poverty. A comparative analysis of the environmental and economic performance of agricultural co-operatives and smallholder grape farmers in China calculates a BCR of 1.6 for co-operatives (Deng et al., 2021); a similar intervention to formalize mining co-operatives in Ghana yielded a BCR of 1.2.

6. FOCUS ON COCONUT PRODUCTS, VANILLA & HANDICRAFTS

FAIR to GOOD: Re-orienting farmers towards certain commodities can happen in any number of ways. Subsidizing fertilizer and other farm inputs is rated as FAIR. The BCR was 4 in both Ghana and Haiti for subsidies on maize and rice, respectively. Agricultural

extension, including mobile advisories and soil testing, also falls into the FAIR range. Investments in irrigation yielded BCRs in the GOOD range but only for high-value crops that could cover the cost and maintenance of irrigation infrastructure; otherwise, investment in irrigation is FAIR.

7. SET UP CREDIT UNION

FAIR to **GOOD**: Generally, publicly managed credit and insurance programs in the agriculture sector have BCRs in the FAIR range: a credit guarantee scheme for agro-processors in Malawi had a BCR = 1; crop insurance in Haiti, BCR = 1.3; crop insurance in India, BCR = 1.4; farmer loan waivers in India, BCR < 1; matching grants for irrigation in Malawi, BCR < 1. However, interventions that lower the cost of financial institutions by reducing the risk of default yield higher benefits: a credit reference bureau in Ghana showed a BCR of 12. Another area that has BCRs in the GOOD range is capacity-building interventions for exporting and/or manufacturing enterprises: capital grants, management consulting, and guaranteed credit to MSMEs have BCRs in the GOOD range.

8. TAX EXEMPTION FOR AGRICULTURAL MATERIALS, FISHING GEAR

FAIR: The success of an intervention that lowers the cost of agricultural inputs or fishing gear, whether by tax exemption or subsidy, depends on the price elasticity of demand of the targeted consumers. By how much will consumption increase due to the decrease in price? In such interventions, society bears the cost, whereas the direct benefits are private, accruing to the farmer or fisherman. Take, for example, the case of fishing in Spain (Merayo et al., 2017), where, at baseline, resource rents and producer surplus amount to € 7.7 million.

A scenario in which subsidies are doubled increases resource rents to € 161.9 million but costs €12.5 million in public funds and almost 7000 artisanal workers. In general, small-scale or artisanal industries tend to support higher levels of employment, however inefficient, and these industries also tend to be more responsive to changes in their cost structure. Additional funds would have to be assigned to displaced workers either in the fish processing sector or alternative occupations, effectively lowering the BCR in the short run. A benefit-cost analysis would also have to include the environmental costs of intensified fishing and the use of non-biodegradable materials like fuel.

9. INCREASE PROMOTION OF EXPORTS

GOOD: Based on a systematic review undertaken by the UK Department of International Trade (2021), export promotion services helped firms overcome barriers to trade, particularly when they address information failures and cultural barriers. Providing reliable information to decrease exporter uncertainty is beneficial, especially for SMEs, which face the highest costs and information asymmetries. In general, studies estimate that a 10% increase in the export promotion budget would increase export value by 2.5% to 16.9%. The evidence suggests that export promotion is most effective at helping small firms with no previous experience in exporting. More specifically, export promotion leads to a 10.7% increase in the propensity to export for small firms, compared with a 3.5% increase in the propensity for large firms. The nature of export promotion programs should focus on the creation of duty drawback schemes to eliminate duty pre-payments and credit requirements, making available long-term credit and targeted information on commodities and markets (Belloc and Di Maio, 2011). Previous Copenhagen Consensus analyses on trade include trade facilitation and liberalization in Bangladesh, BCR = 2–10; capital grants to Ghanaian SMEs, BCR = 7; trade facilitation in the African Free Trade Area, BCR = 20; and export certification for seafood in India, BCR = 8.

10. PROGRAM TO IDENTIFY NEW MARKETS

GOOD: See above – Increase promotion of exports.

11. INVESTMENT IN THE GROWING FINANCIAL SECTOR

GOOD: Governments have a particularly important role in promoting universal access to basic financial services and financial inclusion through subsidies and a variety of direct measures (UNCTAD, 2021). Especially effective are policies to expand account penetration, such as requiring banks to offer basic or low-fee accounts, granting exemptions from onerous documentation requirements, allowing correspondent banking, and using electronic payments into bank accounts for government payments. Measures can also include a focus on the traditionally underserved to promote an accessible financial system that supports broad-based and inclusive growth. This may include customized bank opening rules to favor the growth of rural banks, lowered minimum deposit rates, assisted access to banking services for people with disabilities, and facilitated loans for people in areas affected by natural disasters and farmers. Policies could also aim at generating demand for better financial services. These could include the use of financial services by governments, for instance, through payments by electronic transfer to bank accounts. This can cover the payment of direct benefit transfers, such as pensions,

through electronic transfer. Improved financial literacy and capabilities and consumer empowerment could also increase demand for financial services.

The United Nations *Guidelines for Consumer Protection 18* provide concrete supply and demand policy guidelines to protect vulnerable and disadvantaged consumers of financial services. UNCTAD (2021) estimates that 75% of remittance transfers are used for essentials such as food, education, health, and housing, and a 10% rise in remittances may contribute to a 3.5% reduction in the share of people living in poverty. Therefore, financial inclusion is important to facilitate access to speedy, safe, and affordable remittance transfer services. Because developing countries are net importers of financial services, greater accessibility should be focused on reducing transaction costs. In developing countries, one-third of adults, on average, have no financial or digital money account. Since remittance recipients are more likely to join the financial sector, reducing the costs associated with these transfers would place more disposable income in the hands of households and SMEs; this is also an explicit SDG target. The least expensive means to fund and receive a transaction was mobile money, with 4.5%. Regulation should promote interoperability of platforms or even shared infrastructure to reduce operational costs, increase networks and financial access, facilitate competition, and achieve economies of scale. Mobile money could be linked to a bank account to provide access to other financial services such as savings, credit, and insurance.

12. TONGA CIRCULAR ECONOMY PROJECT

FAIR: Previous Copenhagen Consensus analysis reveals that interventions to improve energy access to unserved or under-served populations have a BCR of less than 5 because they typically target remote or difficult-to-access areas, and electricity becomes more expensive the farther it is from the generation site. Electricity generated from renewables like wind and solar via microgrids in Haiti, India, and Ghana all had BCRs of less than 2. Notably higher was renewable energy produced for large markets: regional solar energy parks in sub-Saharan Africa have a potential BCR of 3, and projects that use waste in order to generate electricity have added health benefits, as proposed in Ghana, where the BCR was 5.

Wattanasilp et al. (2021), studying biogas to energy profitability in the cassava sector in Thailand, indicated that the BCR would also fall into the FAIR range, with profits, on average, around \$ 50 per ton and investment, operational, and maintenance costs, which vary by technology, averaging around \$ 35 per ton. There are similar results in an analysis undertaken by the ADB (n.d.) for Vietnam.

13. IMPORT SUBSTITUTION

FAIR to EXCELLENT: Supporting industries in a general sense can generate FAIR to EXCELLENT returns depending on the constraints of the country and the type of intervention. In Copenhagen Consensus' previous work, it was noted that returns to broadband and management capability generate good returns (Auriol and Fanfalone, 2014; Quartey et al., 2019). Improvements to energy availability generate the widest range depending on the type of technology and the constraints of the country; however, in general, gas, coal, and hydro tend to be less costly and more reliable than solar and wind. Improvements to basic transport infrastructure typically yield BCRs in the FAIR range. See, for example, the upgrading of road infrastructure around tourism sites in Malawi (National Planning Commission, 2021g).

As a rule, it is more effective for the government to target generalized support to business agnostic to a given sector (i.e., avoid picking 'winners'). A strategy focusing on selected industries risks directing resources away from a potentially strong sector that is currently unknown to the government but has a competitive cost structure that simply needs reinforcement.

- Via FDI generating knowledge transfer via generalized credit support: FAIR
- Via generalized improvements in basic transport infrastructure: FAIR
- Via generalized improvements in energy availability: FAIR to EXCELLENT
- Via generalized improvements in management capability: GOOD
- Via generalized improvements in broadband infrastructure: GOOD
- Via FDI generating knowledge transfer: GOOD.

14. MICROFINANCE FOR WOMEN

FAIR: Microfinance programs typically have BCRs around 1. When paired with graduation programs, the BCR increases to between 2 and 3.

15. DEVELOP AQUACULTURE SECTOR

FAIR: The costs of a fish breeding program include investments for husbandry and testing facilities, rearing of selection candidates, trait recording, and genetic analysis. Benefits follow from the increase in genetic levels of traits, the economic values of these traits, and the production output of the company, market, or industry. Genetic improvement increases farm profit, either via cost reduction per unit product, increased production output, or a combination of both. Over ten years, the BCR of such a project in Europe was between 2 and 3 (Janssen et al., 2018).

A simpler aquaculture project in Kenya included the cost of pond construction, farmer training, and supplies. The benefits projected were an additional source of income, improved food security, and new employment opportunities from aquaculture enterprises, hatchery production, and trade of fish as well as value-added activities along the value chain. The BCR = 1 (Wambua, 2018). This corresponds to a Copenhagen Consensus study in Ghana, where the BCR was 1.2.

16. NEW FISHING VENTURE INTO SQUID

UNKNOWN: The return on investment in the squid sub-sector depends on market dynamics regionally and globally, as well as local capacity.

17. BUSINESS SUPPORT PROGRAMS, BUSINESS INCUBATION & ACCELERATION PROGRAMS

FAIR: Incubator support for startups in India has a BCR of 1.8. The BCR for vocational training ranges from 1–10 in Ghana, Haiti, and India. More consistent were the BCRs for on-the-job management training and subsidized apprenticeships, which were between 5 and 6.

18. TAX REFORMS

FAIR to GOOD: In general, the more costly it is to comply, the less compliance there is in practice, which has repercussions on the amount of revenue that the government can collect. Interventions that lower compliance costs for citizens and investors have BCRs between 1 and 5. They include the use of prototype plans to substantially reduce the cost of the architectural plans approval stage of the construction permit process (BCR = 3.3) in Malawi; tax e-filing and tax nudges have a BCR of 6.9; free business registration/bank information seminars have a BCR of 1.7, which is also true in Malawi; digitization of property and business fees has a BCR of 9 in Ghana.

GPA 8: IMPROVING QUALITY AND ACCESS TO PUBLIC INFRASTRUCTURE, INCREASED RESILIENCE, AND INCLUSIVE GROWTH

1. PORTS UPGRADE

FAIR: More than 98% of Tonga's imports arrive by sea. Upgrading their main port is aimed at promoting and sustaining trade as well as making the port more resilient against future disasters. A cost-benefit analysis of Oslo Port revealed a BCR ranging from 1 and 5 (Hovi, 1998). In Tonga, a cost-benefit analysis of rehabilitation and development of the Queen Salote International Wharf (QSIW) and other port infrastructure in Nuku'alofa Port revealed a BCR of 1.7 (ADB, 2020a).

2. SAFE & SECURE TRANSPORT SYSTEM

FAIR: Tonga faces many challenges to sustain and develop the transport sector, which is considered critical to its economic development. The country's main transport sector for safer and more reliable travel is by road, sea, and air (World Bank, 2021c). According to the World Bank, Tonga lost 5.9% of its GDP in 2016 because of road crash fatalities and injuries (GRSF, n.d.). To minimize the potential damages and costs of road fatalities, the Government of Tonga intends to invest in improving road infrastructure by installing a speed management system. The BCR of this investment is 2 (GRSF, n.d.).

A Copenhagen Consensus Center's analysis of upgrading and paving the road network in Malawi showed a BCR of 2.8. Another way of traveling in Tonga is by sea using the ferry. A cost-benefit analysis of investing in ferry ports and upgrading ferries in Ghana showed a BCR of 1.2 (Kashi et. al., 2020).

3. SHIFTING TO RENEWABLES (THE GREEN CLIMATE FUND)

FAIR: The Green Climate Fund is a funding agency or unit established within the framework of the United Nations Framework Convention on Climate Change as an operating entity of the Financial Mechanism to assist developing countries. It promotes the paradigm shift towards low-emission and climate-resilient pathways in the context of sustainable development. The pathways include generating electricity from renewable sources such as wind, solar, geothermal, hydrogen, sustainable bioenergy, and wave energy; efficient and reliable energy transmission, distribution, and storage; investing in grid flexibility,

digitalization, and storage, which increase the capability of grids to operate efficiently and reliably with a higher proportion of renewable energy; and promoting access to modern renewable energy, such as modern renewable energy for cooking and, off-grid and mini-grid electricity from renewable sources (GCF, 2022). See GPA 6 of the Tonga Renewable Energy Project (TREP), which focuses on access to renewable energy in the outer islands.

GPA 9: STRENGTHEN BILATERAL, INTERNATIONAL PARTNERS TO INCREASE INCLUSIVE GROWTH

1. TAX INCENTIVES FOR INVESTMENT STIMULATION

FAIR: Tax incentives that typically characterize special economic zones have BCRs of less than 1. Tax incentives to stimulate research and innovation in the private sector have higher returns in the FAIR range. The foregone tax revenues must be balanced against the capacity to appropriate and commercialize new products or strategies. Creating a more conducive environment for investment has higher returns (see programs to reduce technical barriers for exporters, tax exemption, increased promotion of exports, microfinance for women, tax reforms, and business support programs).

2. INCREASE EXPORT OF ROOT CROPS

FAIR: The economy of Tonga is largely dependent on agriculture, which contributes 30% to GDP. The country's major commodities for export are root crops, fish, kava, and squash pumpkins (PSDS, 2013). According to the World Bank (2023), the total exports of goods and services accounted for 12.5% of GDP in 2021. The export demand for Tongan root crops is currently very high, hence the need to increase the current volume of between 4,000–5,000 tonnes. One of the policy interventions aimed at improving root crops is improving the quality of the management system. The cost-benefit analysis for this policy intervention in Malawi, with a focus on training for groundnut quality control, shows a BCR of 1.2 (NPC, 2021e).

3. PROMOTE PRIVATE SECTOR DEVELOPMENT

GOOD to **EXCELLENT:** Tonga's private sector is predominantly small, medium, and micro (SMMEs) that are faced with a number of constraints resulting in low growth (PSDS, 2013).

The Government of Tonga (2015) is focused on improving access to land for development to address some of these constraints with the aim of improving the sector by initiating land reform and reducing the costs of doing business. This involves upgrading the Business Online Registration System (BORS) to facilitate online payment (PSDS, 2013). A cost-benefit analysis of land reform programs in Malawi and Ghana attracted BCRs between 70 and 90 (NPC, 2021f and Adjasi and Adiaba, 2020). The result of a cost-benefit analysis of digitizing business fees showed a BCR of 9 (GIZ and Copenhagen Consensus Center, 2020).

4. NEW CREDIT INSTRUMENTS

FAIR: In general, it is difficult to justify government investment in private enterprise from a cost-benefit perspective; however, credit guarantee schemes (CGS) aimed at banks to increase loans to actors (e.g., agro-processing value) have BCRs between 1 and 5 because CGSs carry out collective negotiations with banks on interest rates and borrower screening that SMEs cannot negotiate individually. These measures contribute to minimizing the risk associated with lending, that is, a reduction in default rate and ultimately contributing to increasing the volume of credit. Reviews indicate that the returns to credit and microfinance for SMEs are generally positive but small, justifying BCRs in the FAIR range (Cravo and Piza 2016; Woodruff 2018). Several benefit-cost analyses reinforce this finding demonstrating BCRs for microfinance between 1 and 3 (King, 2008; Bairagi and Shadat, 2016; Adjasi, 2019; Crepon et al., 2020). Seven and Tumen (2020) show that doubling credit access across developing countries increases agricultural productivity by 4–5% (see Setting Up Credit Unions and Business Support Programs).

METHODOLOGY AND SCORING BACKGROUND

THE MODEL

We use a traffic light model, which was developed in conjunction with an Eminent Panel, including two Nobel Laureates, to assess the Open Working Group's sustainable development goals. Copenhagen Consensus also applied this framework for rapid assessments requested by NITI Aayog (the Government of India's think tank and planning body) and the African Academy of Sciences. The traffic light model categorizes all programs into one of five groups based on how much economic, social, and environmental benefit is obtained for each unit of cost, or the benefit-cost ratio (BCR). The categorization is as follows:

- **Excellent, $BCR \geq 15$**
- **Good, $5 \geq BCR > 15$**
- **Fair, $1 \geq BCR > 5$**
- **Poor $BCR < 1$.**
- **No data available.**

Categorizations were based on a number of sources: (a) a review of literature, particularly cost-benefit or cost-effectiveness studies, and (b) previous projects conducted for the Copenhagen Consensus. When these two sources did not provide a clear direction of likely benefit-cost categorization, internal discussions were then conducted. Due to the shortness of the timelines, external experts were not consulted at this time.

Modified projects considered are based on high-performing interventions identified through previous projects conducted for the Copenhagen Consensus.

HOW TO INTERPRET THE INFORMATION CONTAINED IN THIS REPORT

In cost-benefit analysis, benefits and costs are typically measured in currency, in this case, Tongan pa'anga. This allows comparison of programs, which may have very different objectives, for example, saving lives versus educating children versus avoiding deforestation. It is important to note that while benefits and costs are measured in currency, this does not merely represent money. There is a vast and considered literature that critically examines how to monetize various outcomes resulting from policies for the purposes of cost-benefit analysis. Therefore, benefits and costs, in principle, account for all social, economic, and environmental impacts. In practice, it is difficult to assess some of the impacts, especially on the benefit side, like dignity or shame, and so it is likely that almost all interventions will have some benefits that have not been quantified. Yet, where the omissions are not explicitly discussed, they are likely to be considered quite small, and hence the overall rankings remain approximately correct.

Importantly, the traffic light categorizations are not mostly an assessment of the competency or skill of those overseeing or implementing the programs. It is typically much more driven by the inherent social welfare efficiency of each program, as assessed in the CBA literature. Programs with poor objectives can be implemented well and will still only do little good, whereas programs that are inherently very effective can be implemented poorly and still yield phenomenal benefits 15x higher than costs (although, of course, poor implementation still degrades a program's yield).

The main takeaway of the report is simple: more money should be spent on EXCELLENT programs. This can be done by giving these a higher priority in the national development strategy and ensuring they remain protected from budget cuts throughout the year.

ANNEX C–1: SKILLED MIGRATION

Assessing Costs and Benefits of Skilled Migration to Tonga

The intervention proposed is a 100% increase in skilled immigration to Tonga. Skilled migration refers to persons aged between 15 and 64 who have completed tertiary studies and above. Three skilled groups were analyzed: technical experts in agriculture, forestry, and fishing; education professionals; and service (tourism) professionals. The main driver of benefits is the difference in salary gained by the immigrant, which affects productivity and welfare estimates. At a minimum salary differential of 10%, the benefit-cost ratio is 2.8.

Counterfactual

The number of returning residents to Tonga, arriving annually by air, is around 74, of which 32% are Chinese nationals. Over 90% of returning residents are between the ages of 20 and 44. The total domestically employed population is 33,422, and the number of formal jobs created annually is around 325. Thus, the increment would fill roughly a quarter of new jobs.

Costs

C1: Program administration. Since there are already migrants to Tonga, we assume the costs to increase the number of migrants would be negligible. Nonetheless, any administrative or monitoring costs would be shouldered by the government of Tonga.

C2: Migration costs. These are the explicit costs of migration, including firm search costs, application and visa fees, accreditation fees, etc. These are private costs borne by the immigrant/firm.

C3: Loss in productivity or efficiency. The source country will experience a welfare loss from losing skilled workers. In the short run, the remaining workers will have to take on the burden, although, in the long run, we expect their salaries to reflect the consequent shortfall of professionals.

C4: Brain drain. The emigration of workers has a demographic impact in the source country: there is an increase in the dependency ratio; that is, the remaining workers

must carry the burden of supporting the non-working population (e.g., elderly, children, handicapped). A slight reduction in GDP is anticipated in the short run (five years) in the source country until new people are trained (Marchiori et al., 2013).

Benefits

B1: *Salary differential*. The incentive to immigrate to Tonga is the higher salary that can be earned. This is a private benefit that accrues to the immigrant.

B2: *Welfare gains*. The productivity and/or efficiency gains associated with the immigrants can increase the productivity of the hiring firms and/or associated firms in the sector. This benefit accrues to the Tongan society.

B3: *Remittance investments*. These gains arise from the ability of remittance-receiving households to invest a portion of remittances in education, health, and entrepreneurship. This benefit accrues to the immigrant's household in the source country.

Assumptions and parameters

1. Baseline (current level of skilled immigration): 74.
2. The labor market in Tonga and the source country.²

Sector, profession	Occupation	Average hourly earnings, Tonga (2018) ³	(-10%), source country ⁴	(-30%)	(-50%)
Agriculture, forestry, and fishing (AFF)	Skilled/technical personnel	\$4.91	\$4.41	\$3.44	\$2.45
Education	Teachers	\$6.01	\$5.41	\$4.21	\$3.0
Services	Tourism	\$3.72	\$3.35	\$2.6	\$1.86

² Average hourly earnings from ILOSTAT, downloaded May 2023.

³ Average salary (2018) from UNDESA; consumer price inflation was 5% in 2018; 11% in 2022.

⁴ Salaries increase 2% annually.

The salary differential is considered the motivating factor for relocation to Tonga. The analysis was conducted first with a 10% salary differential to see if the benefit-cost ratio would be greater than unity.

3. Evidence shows that skilled workers tend to earn less initially in the destination country, even in cases where migrants share the same language/race as the destination country. This could be interpreted as the firm passing on the explicit costs of recruitment, training, and migration to the worker or as 'other' costs incurred where it relates to the social adaptation of the migrant to the new country (World Bank, 2018). This wage suppression, which is assumed to include the explicit costs of migration, is represented here as 80% of Tongan average salary in Year 1, converging to 100% in Year 5.
4. The average age of migration is 30, and skilled immigrants work in Tonga up to the age of 50.
5. Migrants in non-OECD countries remitted 15% of their gross incomes.⁵ This rate is applied to the wage differential. We project the proportion of remittances invested productively to be 25%, with a return on investment of 30% (Patrinos and Psacharopoulos, 2020).
6. New technology and learning are expected to spill over to the wider economy. The spillover rate resulting from South-South migrant flows is estimated to be around 4% (Maskus, 2014) of the value of the productivity of the migrant. For simplicity, the welfare loss experienced by the source country because of losing a professional is also estimated to be 4% but is applied to the source country's wage.
7. The higher dependency ratio is estimated by a 1% decline in per capita GDP, which was \$4879 for Tonga in 2019.

Analysis

Present value of all costs and all benefits over 20 years using 8% discount rate:

Salary differential	AFF	Education	Tourism
Benefits	\$966,000	\$1,160,000	\$715,000
Costs	\$341,000	\$415,000	\$263,000
BCR	2.8	2.8	2.7

⁵ Data from the World Bank, <https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS>.

Conclusion

The analysis shows that sourcing qualified immigrants is beneficial, even when the salary differential between the source country and Tonga is only 10%. For a 30% differential, the BCRs rise to 10, and 24 for a 50% differential. The Copenhagen Consensus has just recently completed an analysis on the free movement of labor within the African continent, with similar benefit-cost ratios: ranging from 3.7 for the broadest skill class like those analyzed here to 4.4 for STEM workers to 6.9 for physicians, considered the highest skill class.

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ANNEX C–2: SECOND MARINE CABLE

Assessing Costs and Benefits of the Proposed 2nd Marine Fiber Optic Cable for Tonga

The first marine cable—the Tonga-Fiji Submarine Cable System (also known as Tonga Cable), is an 827 km fiber optic submarine cable system linking Nuku’alofa, Tonga, and Suva, Fiji, and connects to the Southern Cross Cable Network at the Suva Cable Landing Station in Fiji. On January 15, 2022, the Hunga Tonga–Hunga Ha’apai volcano, which is 65 km north of Tonga, erupted underwater and led to a cascading tsunami that hit the main island, affecting around 1,00,000 people, and severing the marine cable. As a result, Tonga lost almost all connections to the outside world, with repairs and restoration of the cable and connectivity to the island taking around five weeks.

The analysis estimates the benefit-cost ratio of a second marine cable to reduce the chances of potential breakdown of all communication due to natural disasters or accidental breakage of the first marine cable. All costs and benefits in this report are expressed in US dollars at 2021 value unless otherwise specified.

Assessment of Costs

The costs of the second cable are assumed to mimic the first cable.

C1: Capital Investment: The first cable cost \$30.8 million (ADB, 2020b); we assume the second cable mimics this cost structure, with the expected life of the cable around 25 years (ADB, 2020b)

C2: Operations and Maintenance

- The average annual operations and maintenance cost of the submarine cable system between 2014 and 2019 was T\$795,870, according to TCL in 2020 (ADB, 2020b).
- Future operations expenditure per year is considerably higher at \$1.4 million (ADB, 2020b). Total over 25 years at an 8% discount rate is \$14.6 million. This might include the costs of repairs in addition to TCL. A repair vessel alone costs \$90 million, and the annual running costs of a specialized team are \$12–\$14 million per year (Lightreading, 2022).

Assessment of Benefits

B1: *Avoided Productivity Loss*: The main driver of benefits is the avoided loss of productivity due to an internet outage during the repair of the cable. The productivity loss is only avoided when the first cable breaks. Two estimates of the likelihood of this happening are the historic data for the Tonga Cable and the frequency of repairs of undersea cables globally.

Assumptions and parameters

1. The Tonga Cable broke in 2019 from a ship's anchor (BBC, 2022) and again due to a volcanic eruption in 2022. Two breakages from 2014 to 2022 imply a yearly breakage risk based on historic data of $2/9 = 22\%$
2. There are 430+ cables globally and 200 repairs per year. Anchors and fishing nets cause 90% of all breakages globally (BBC, 2022). The implied yearly breakage risk based on global repairs is $200/430 = 47\%$.
3. The value of the avoided loss is extrapolated from an IMF study of productivity impacts (GDP) related to digitization through submarine cables in sub-Saharan Africa. The avoided loss is estimated by setting the GDP impact from digitization to zero during the internet outage period. One week's internet outage in Tonga would result in a \$2.4 million GDP loss using this approximation.
4. One percentage point increase in internet penetration generates a 0.37 percentage point increase in GDP per capita (Simione and Li, 2021).
5. GDP is \$469.2 million (World Bank, 2021a).
6. Internet usage is 72% (World Bank, 2021b).
7. Extrapolation 0% internet usage for one week ($1/52$ of a year) reduces GDP by \$12.0 million.

To estimate an order of magnitude valuation of the avoided loss, \$12 million is multiplied by the expected duration of the outage in weeks.

- After the volcanic eruption, the cable was broken in multiple places, and the parts were displaced. The repair took five weeks, including two weeks for the repair vessel to arrive from Port Moresby (EuroNews, 2022). Estimated productivity loss due to internet outage \$12.0 million.
- In 2019, the outage lasted two weeks before the breakage caused by a ship's anchor was identified and repaired (Phys Org, 2019). That time the repair vessel was on standby at a port in Apia, Samoa (Ocean News, 2019). The estimated productivity loss was \$4.8 million.

- The increased bandwidth from an additional cable might increase the pace of internet penetration, digitization, and resulting productivity increase, as observed in the IMF study from sub-Saharan Africa.
- The order of magnitude benefits for Tonga of such an increase using the relationship isolated by that study would be \$1.7 million per year, and the percentage point internet penetration brought forward. At an 8% discount rate, the present value of bringing forward the internet penetration from, say, 72% to 77% within five years would be \$29 million, and from 72% to 75% within two years would be \$9.3 million.

Benefit-cost analysis with Sensitivity checks

Comparing the present value of all the above costs and benefits yields a benefit-cost ratio ranging from 0.64 (poor) for the moderate scenario with the historically observed outages and a bump in productivity over two years from faster digitization to 1.3 (fair) for an optimistic five-year digitization boost to productivity from the second cable and outages in the first cable every second year. Varying the discount rate does not change the benefit-cost rating.

Moderate scenario

Million \$ over 25 years, present value at 8% discount rate

Costs	Capital investment	30,800
	Operations & maintenance	14,600
	Total	45,400
Benefits	Avoided productivity loss, historical outage risk	20,000
	Increased productivity from a jump in digitization brought forward two years	9,300
	Total	29,300
BCR		0.6

Optimistic scenario

Million \$ over 25 years, present value at 8% discount rate

Costs	Capital investment	30,800
	Operations & maintenance	14,600
	Total	45,400
Benefits	Avoided productivity loss, global repair frequency	31,000
	Increased productivity from a large jump in digitization brought forward four years	28,800
	Total	59,800
BCR		1.3

Sensitivity analysis of the Benefit-Cost Ratio for varying discount rates

	5%	8%	12%
Moderate scenario	0.7	0.6	0.6
Optimistic scenario	1.4	1.3	1.2

The operations and maintenance (O&M) cost is 30% of the total cost, based on the data from the first marine cable (ADB, 2021). This cost might be lower for the second cable due to synergies with the operations of the existing cable. However, it does not change the BCR rating; even a 90% reduction in O&M costs would increase the BCR of the moderate scenario to 0.9 and the BCR of the optimistic scenario to 1.9.

Conclusion

A second marine cable is a considerable capital investment; the cost of the first cable, \$30.8 million, is more than \$1,600 for each of Tonga's 18,800 households. The benefit-cost rating is poor when comparing estimates of potential costs and benefits of a second marine cable.

Backup connectivity via satellite could be an alternative. Starlink offers broadband bandwidth via satellite that could potentially be shared among a group of households. In New Zealand, the rate is NZ\$ 159 (around \$ 99) per month (RNZ News, 2022). At that rate, one satellite dish and router for every ten households in Tonga would cost \$ 2.2 million per year (\$ 23.8 million over 25 years at an 8% discount rate), yielding a benefit-cost ratio of 1.2 in the moderate scenario with a FAIR benefit-cost rating.

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ANNEX C–3: RENEWABLE ENERGY

Assessing Costs and Benefits of Replacing Diesel Generated Electricity with Solar Generated in Tonga

The Government of Tonga Energy Efficiency Master Plan (TEEMP) 2020–2030 that seeks to complement Tonga Energy Road Map 2010–2020 (TERM), emphasizes on the need to reduce Tonga’s dependency on fossil fuel. The objective is to reduce imported inflation as a result of importation of diesel that is used to generate electricity which contributes to increasing greenhouse gas (GHG) emissions. TEEMP identifies electricity generation as a key sector contributing to about 23% greenhouse gas (GHG) emissions.

TEEMP targets that by 2020, Tonga would increase its renewable energy capacity to at least 50% of electricity generation and 70% by 2030. To achieve the 50% target, the project involves installation of multiple units of battery energy storage system (BESS) with a total preliminary capacity of 10.1 MW and 19.9 MWh on Tongatapu. This study estimates the benefit-cost ratio of investing in renewable energy in Tonga. The cost and benefit analysis is to demonstrate the social, economic and environmental viability of the project.

A cost–benefit analysis for the project was carried out by comparing the cost and benefits of investing in renewable energy projects for a period of 25 years. We assume construction is for 3 periods starting from 2024. All costs and benefits in this report are expressed in US dollars at 2022 value. A discount rate of 8% was used while 6% and 12% were used for sensitivity analysis.

Assessment of Project Costs

- The total cost of the project is valued at USD 53.2 million as at 2017 (Asian Development Bank, 2018). With inflation, the project is valued at USD 63.2 million in 2022.
- The cost envelops capital expenditure, construction, supervision and capacity as well project management support.
- Other costs include land acquisition, taxes and duties, and contingencies (Asian Development Bank, 2018).

- Annual aggregated operation and maintenance (O&M) costs covering regular upkeep and periodic rehabilitation and repair works are estimated and included in the analysis.
- The study used an average of USD 0.02/kWh in 2020 as O&M costs (IRENA, 2021).
- The total annual generation capacity was estimated at 17,501,020 kWh/year.

Assessment of Benefits

The proposed increase in renewable energy will reduce the volume of diesel used for electricity generation, reduce carbon emissions and number of lives from air pollution. The Tonga Renewable Energy Project (TREP) under the Pacific Islands Renewable Energy Investment Program document stated the fuel (diesel) savings per year as 4,355,305 liters per year. The cost of diesel is valued at USD 4.35 per liter based on the average cost for last year (Matangi Tonga, 2023)]. Due to petroleum price volatility, no price adjustment was made. Thus the cost of fuel savings per year was estimated at USD 18.95 million per annum.

Total carbon emissions were estimated in tonnes. TREP estimated the total emission savings of the renewable energy expansion at 13,616 tonnes a year. The value of carbon emissions avoided is drawn from a recent review of the social cost of carbon literature (ToI, 2018). According to this review, the marginal value of a tonne of CO₂-eq avoided varies by discount rate. For a 3% discount rate the value is USD 25.30/tonne while for a 5% discount rate it is USD 7.60/tonne. Both figures are denominated in 2010 USD. For much higher discount rates like Tonga with a discount rate of 8%, the effective value of carbon emissions avoided is USD 0/tonne. To estimate the value of carbon emissions reduction also requires a growth factor in the social cost of carbon emissions, since the social cost grows over time as more CO₂-eq is released into the atmosphere. The growth factor is set at 2% as per year (ToI, 2018).

We estimate the health impact of investing in the project by using the disability-adjusted life years (DALYs) which is the sum of the life years lost due to disability (YLDs) and the years of life lost due to premature death (YLLs). However, for the purpose of this YLD was not included due to non-availability of data. To ascertain the value of YLL, we estimate the total number of deaths from air pollution (outdoor) that is associated with electricity generation. For Tonga, the total number of deaths from air pollution (outdoor) as of 2019 stood at 21 (OurWorldinData, 2019)].

The contribution of electricity generation from fuel to greenhouse gas (GHG) emissions stands at 23%. Using GHG share as a proxy for the share of unhealthy air pollution gives an estimated number of 5 yearly deaths from air pollution (outdoor) that is associated with electricity generation. Thus the number of life savings is 5. Considering the death from outdoor air pollution by age we find that the number is high from age 50 and higher from 70. We use 50 for this analysis to mean the age at which life was saved. This implies that the number of years saved is 27. (OurWorldinData, 2019). Finally, we obtained the GNI per capita for Tonga valued at USD 7,130 (World Bank, 2021). DALY was calculated as the number of deaths multiplied by the years of lives saved and by the GNI per capita. This was valued at USD 0.96 million per year.

Results of Benefit-Cost Analysis

As shown in the table below, the evaluation of the project costs and associated benefits based on a discount rate of 8% yields a BCR of 3.0. With a varied discount rate of 6% and 12% respectively the BCRs are 3.6 and 2.1.

Present value over 25 years from replacing diesel with solar	6% discount rate	8% discount rate	12% discount rate
Benefits (USD Million)	230	185	125
Costs (USD Million)	64	62	59
BCR	3.6	3.0	2.1

Conclusion

The analysis shows that investment in expanding renewable energy penetration is beneficial as it yields a return of USD 3.0 for every USD 1 invested. Such investment is FAIR.

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