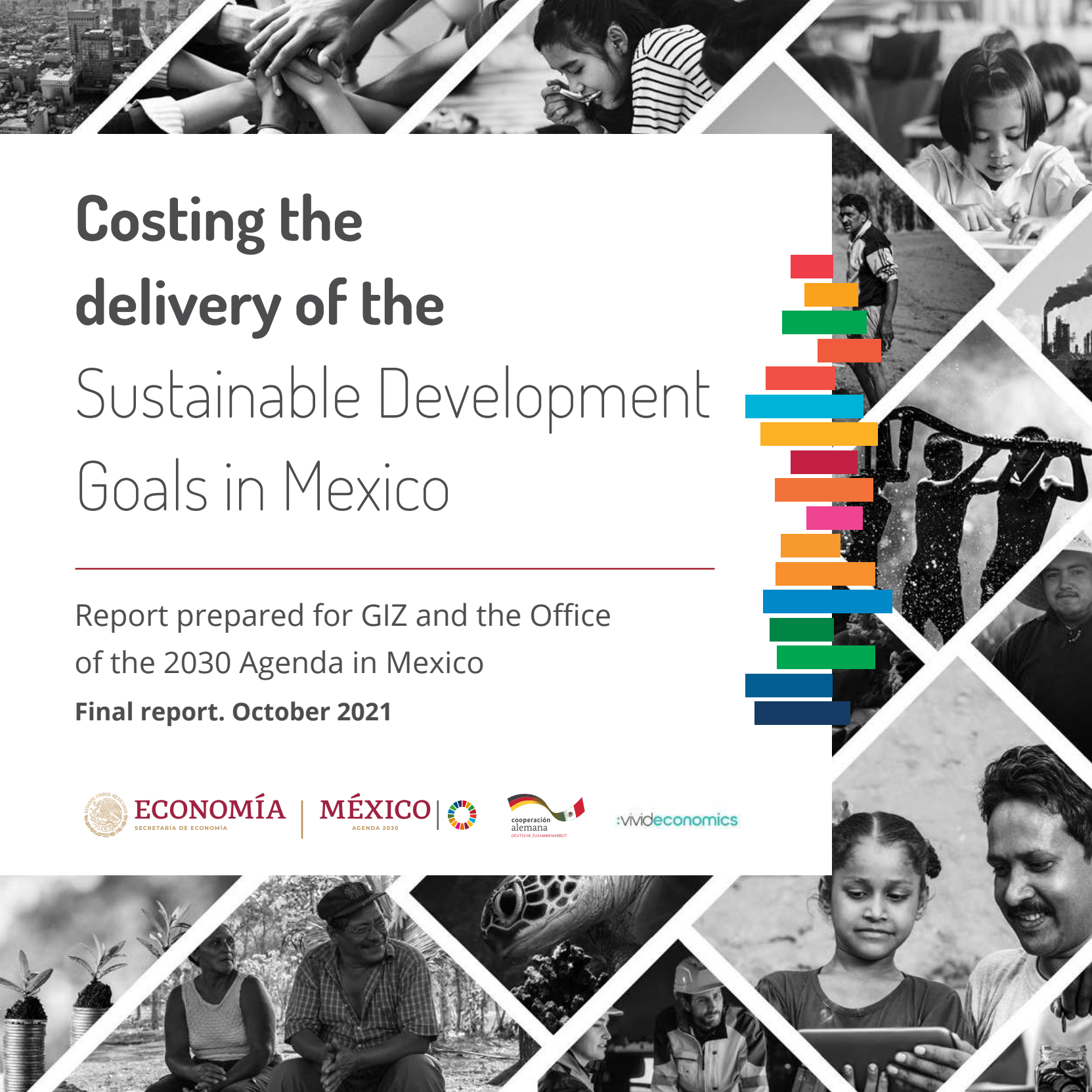

Costing the delivery of the Sustainable Development Goals in Mexico

Report prepared for GIZ and the Office of the 2030 Agenda in Mexico

Final report. October 2021

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Editorial

The contents presented were developed within the framework of the "2030 Agenda Initiative" program of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, in coordination with the Executive Secretariat of the National Council of the 2030 Agenda for Sustainable Development in Mexico and Vivid Economics. Multiple sources of information were used for the preparation of the content, multiple sources of information were used including data and analysis from Vivid Economics, as well as the review of experts on topics from the federal public administration, civil society, academia and GIZ. The analysis and conclusions expressed in this document do not necessarily reflect the institutional positions of GIZ or other partners. Partial or total reproduction is authorized, as long as it is non-profit and the reference source is cited.

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Acronyms

ATM	Automatic Teller Machine
BANSEFI	Banco del Bienestar (formerly known as the Bank for Savings and Financial Services)
CGE	Computable General Equilibrium (Model)
CONANP	National Natural Protected Areas Commission
CONEVAL	Consejo Nacional de Evaluacion de la Politica de Desarrollo Social
FDI	Foreign Direct Investment
FLW	Food Loss and Waste
GDP	Gross Domestic Product
GFLI	Global Food Loss Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTAP	Global Trade Analysis Project
GVA	Gross Value Added
GViEW	Global Vivid Economy Wide
IFT	Federal Telecommunications Institute
I-O	Input-Output
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems Services
ITU	International Telecommunications Union
IUCN	International Union for the Conservation of Nature
MPI	Multidimensional Poverty Index
OECD	Organization for Economic Cooperation and Development
OPEX	Operating and maintenance expense
SE	Secretaría de Economía
PES	Payment for Ecosystem Services
PNH	Programa Nacional Hídrico
REDD+	Reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries
RLI	Red List Index
SDG	Sustainable Development Goal
SNA	Sistema Nacional Anticorrupción
UFA2020	Universal Finance Access by 2020
UN	United Nations
UNDP	UN Development Program
UNEP	UN Environment Program
UNESCO	UN Education, Science and Culture Organization
UNGC	UN Global Compact
UNICEF	United Nations International Children's Fund
WASH	Water, Sanitation and Hygiene

Executive summary

This report seeks to quantify the financing necessary for Mexico to achieve 7 selected targets included in the United Nations (UN) Sustainable Development Goals (SDGs).

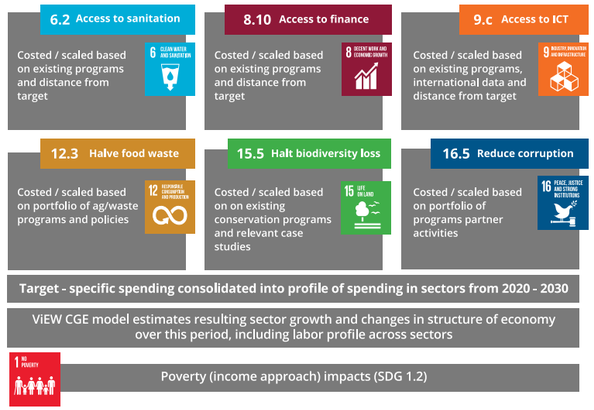
In 2015, UN member countries adopted an ambitious series of 17 interconnected SDGs aimed at achieving a better and more sustainable future for all. These goals address a broad scope of challenges the world faces, including poverty, climate change, and corruption. The goals are defined by 165 targets, some of which allow for national interpretation of achievement while others are absolute. Significant financing is necessary to meet these ambitious development targets. To mobilize this financing, a national-level quantification of financing needs is first required. This report performs this quantification for a subsection of SDG targets in Mexico.

The report was developed for the 2030 Agenda Office of Mexico in collaboration with the German Cooperation for International Development (GIZ) in Mexico. GIZ supports the Mexican government to plan for and deliver the 2030 agenda.

Overview of costing methodology

Targets selected for the analysis were chosen for their relevance to Mexico and to provide a set of transferable approaches that can be used to develop a more expansive costing. Multi-criteria analysis was used to identify the most relevant targets. Target selection criteria included 1) alignment with national SDG target priorities, 2) the co-benefit potential of targets, 3) balance across themes of the 2030 Agenda, 4) data availability and 5) the applicability of a target's costing methodology to other targets (i.e., utility). Seven targets were ultimately selected, covering social, economic, environmental and governance themes. These targets are the shown in Figure 1.

Figure 1 Selected SDGs for costing and overview of cost estimation approach



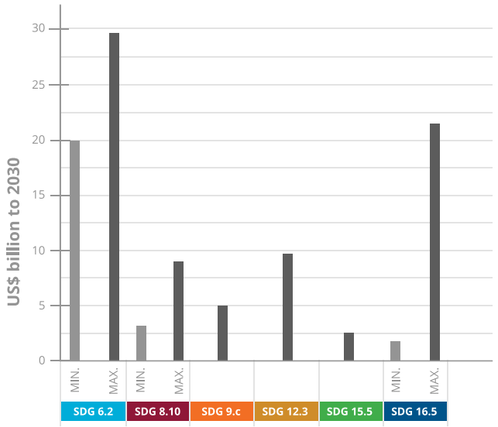
Source: Vivid Economics

The methodology for estimating the cost of achieving targets includes measurement of the direct costs of relevant interventions as well as positive indirect (cross-cutting) impacts. Six sector-specific targets call for a bottom-up costing approach using data from planned and previous interventions, national or international, to quantify direct costs. Positive indirect impacts are measured as the positive economic activity that results from the interventions. One economywide target (SDG 1.2) is measured using the added productive output expected from direct investment in other SDG targets as an input to the costing method. For this target, a computable general equilibrium (CGE) model was run to calculate macroeconomic impacts over time. Throughout the analysis, linear distribution of costs and constant costs are assumed, with costs reflecting federal spending estimates only.

Cost estimates for delivery of selected SDG targets in Mexico

Estimates suggest that delivering sectoral SDG targets[1] may require between USD 40 billion and USD 75 billion in total funding between 2021 and 2030. The financing needs will depend on the type of investment path used to reach the SDG targets as well as on Mexico's ambitions regarding intervention quality (e.g., lower ambition provision of basic sanitation or higher ambition provision of safely managed sanitation). The required annual investment is expected to range between USD 4 billion and USD 7.5 billion between 2021 and 2030.

Figure 2 Summary of costs and sources estimated for sectoral SDGs



Source: Vivid Economics

[1] This includes SDGs 6.2, 8.10, 9.c, 12.3, 15.5 and 16.5

By target these costs are estimated at:

SDG 6.2 – Ensure access to sanitation: ensuring universal access to sanitation and hygiene in Mexico by 2030 will require between USD 20 billion (for delivering basic sanitation) and USD 29 billion (for delivering safely managed sanitation) between 2021 and 2030.

SDG 8.10 – Ensure access to finance: ensuring 100% of adults have a bank account by 2030 will require between USD 2 billion and USD 8 billion by 2030.

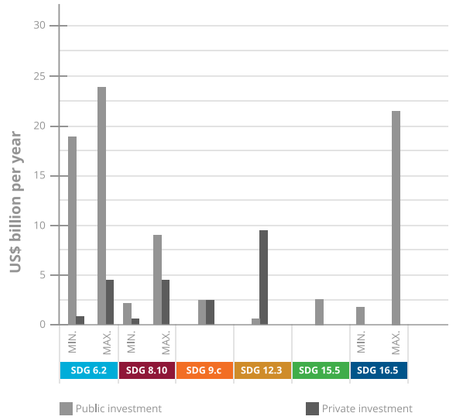
SDG 9.c – Ensure access to information and communications technology: providing Internet to 96% of the population by 2030 will require USD 4.7 billion between 2021 and 2030.

SDG 12.3 – Halve food loss and waste: halving food loss and waste by 2030 will require USD 8.9 billion between 2021 and 2030.

SDG 15.5 – Protect natural habitats: increasing Mexico's terrestrial protected areas to 30% will require USD 2 billion between 2021 and 2030.

SDG 16.5 – Reduce corruption and bribery: reducing the corruption prevalence rate observed during personal administrative processes substantial (by 23%, with a 2019 baseline) by 2030 will require USD 1.8 billion.

Figure 2 Summary of costs and sources estimated for sectoral SDGs

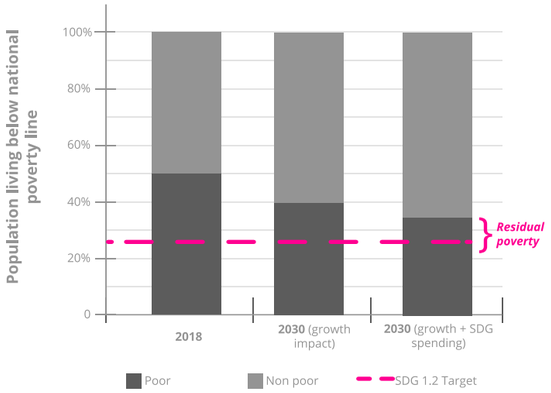


Source: Vivid Economics

The split between public and private sector spending depends on the approach taken by the government to reach each target. Between 2021 and 2030, the quantity of public spending is estimated to be between USD 28 billion and USD 59 billion while the quantity of private sector spending is estimated to be between USD 11 billion and USD 19 billion. In multiple cases, the annual public funding required to achieve SDG targets far exceeds the annual budget of specific public entities that could be expected to contribute.

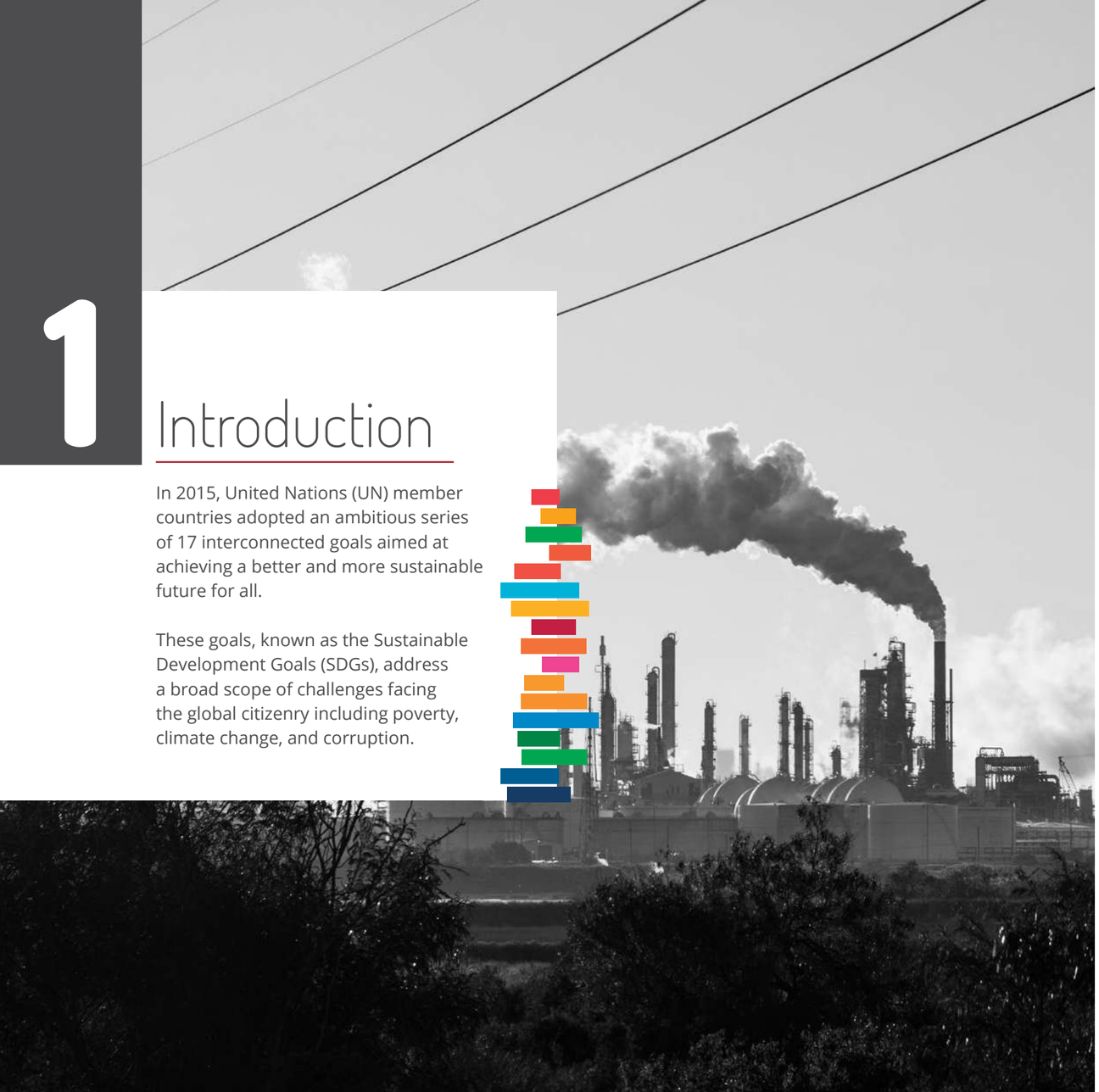
An additional reduction in poverty of 14% of the population, or 18 million people in 2030, is required to deliver SDG 1.2, costing approximates USD 10 billion in 2030. GDP growth and stimulus impact from SDG spending on the 6 sectoral targets are expected to reduce the share of population living in poverty by 11 percentage points. Assuming a cost of MEX$ 11,500 to lift one person out of poverty through direct cash transfer (as outlined in Annex 9), this residual poverty reduction would cost over MEX$ 200 billion (USD 10 bn) in 2030. This is a significant figure in the context of assessed costs for sector-specific SDG targets (estimated at USD 40-75 billion over a ten year period). Compared to current spending on cash transfer programs (over MEX$ 1 trillion in 2019), this figure appears less significant.

Figure 3 Expected GDP growth and stimulus impact from SDG spending could reduce the share of population living in poverty by 11 percentage points



Source: Vivid Economics

1 Introduction



In 2015, United Nations (UN) member countries adopted an ambitious series of 17 interconnected goals aimed at achieving a better and more sustainable future for all.

These goals, known as the Sustainable Development Goals (SDGs), address a broad scope of challenges facing the global citizenry including poverty, climate change, and corruption.

The SDGs are more ambitious than the predecessor Millennium Development Goals, and require a significant increase in financing these development targets. This increased requirement, estimated to grow from billions to trillions across the globe[2], necessitates a consideration of how governments and the international community can mobilize finance from many sources to deliver the SDGs. In order to begin this process, a quantification of financing needs is required at a national level, which this report seeks to address.

The SDG framework aims to achieve 165 targets across the 17 goals by the end of the decade. Targets range in their specific requirements, with some allowing for national interpretation of achievement while others are absolute. For example, SDG 1.2 states: "By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions." National definitions of poverty vary substantially, and thus quantification of SDG target 1.2 is specific to each country, as explored in section 4.3 of this report.

This report considers how governments and partners can approach costing the delivery of the SDG targets, with a focus on a set of 7 targets identified for the Mexican government. While the selected targets represent a fraction of the overall agenda, they were selected to provide a set of transferable approaches that can be used to develop a more expansive costing. Selected targets include both sector-specific targets, which can be fully costed based on a discrete set of interventions, as well as a consideration of impacts sector-specific spending on macroeconomic indicators such as poverty and equality.
This methodology was developed for the 2030 Agenda Office of Mexico in collaboration with the German Cooperation for International Development (GIZ) in Mexico, which supports the Mexican government to plan for and deliver the 2030 agenda.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has been extensively involved with providing technical assistance to governments all over the world in achieving SDG targets.

The main goal of this report is to provide a costing estimate for the implementation of SDG targets in Mexico. Key features of the approach taken include:

- *selection of targets that have a potential to indirectly spill over to other targets;*
- *quantification of Mexico's progress towards the SDGs;*
- *assumptions-driven estimate of delivery costs for each selec ted target; and,*
- *a formal approach for quantifying the spill-overs from in vestments aimed at specific targets.*

The remainder of this report is structured as follows:

- **Section 2:** provides a broad overview of the target selection and costing methodology;
- **Section 3:** presents an estimation of sector-specific costs of delivering selected targets;
- **Section 4:** presents an estimate of the cross-cutting impacts of investments associated with sector-specific target delivery; and
- **Annexes:** set out methodological detail for both the target-level cost estimation and the macroeconomic spill-over effect estimation.

2. [UNCTAD 2014]

2 Overview of costing methdology

This section provides detail on how a specific set of SDG targets was selected for costing.

This report focuses on a subset of targets, allowing for the piloting of costing method on priority targets. This approach was taken to maximize the expected benefit based on policy relevance, broader applicability, and potential for spill-overs to other targets. First, it allows for a greater focus on targets that are directly related to national development priorities and are therefore more likely to be immediately policy relevant. Second, a 'deep dive' into a subset of the targets allows for the development of a broadly applicable costing methodology that can be applied to other targets. Finally, it highlights how the government can make progress towards a broader range of SDG targets with investments in a smaller set of SDG targets due to cross-cutting impacts.

2.1 Target selection criteria

Multi-criteria analysis was used to identify the most relevant targets for the Mexican context. While the full SDG agenda is relevant for all countries, a select set of targets were included in this analysis to develop a methodology which can be expanded to other targets. The criteria to select targets for costing is summarized in Box 1.

Box 1. Selection criteria for SDG targets

Alignment with national SDG target priorities: The menu of options for the 2030 Agenda is large and many nations have selected specific targets as priorities. For example, in Mexico, the National Strategy for the Implementation of the 2030 Agenda in Mexico sets out clear priorities which include ending corruption (SDG 16.5) as a highlighted goal.

Co-benefit potential of targets: Investment in delivery of specific SDG targets is expected to create stimulus across the economy. Direct spending from delivery of a specific target requires inputs from multiple sectors across the relevant supply chains. For example, investment in increasing access to sanitation may also reduce poverty by improving health outcomes, which leads to less medical spending and more time for economic activity. SDG targets are in part selected to maximize total co-benefits, which results in the greatest net benefits per dollar of investment. In the analysis presented in this report, co-benefits related to reduced poverty are considered.

Balance across themes of the 2030 Agenda: The UN has identified three 'pillars' of sustainable development – goals focus on 'people', 'planet' and 'prosperity' (SDGs 16 and 17 are considered cross-cutting in their own categories of ('peace' and 'partnership', respectively). For overall national development, it is important to have at least one target from each of the core pillars of the 2030 agenda.

Data Availability: reliable quantification of SDG targets is contingent upon existing data. While targets may perform well on other criteria, where data is not available, it may not be possible to assess costing needs in a timely and cost-effective manner.

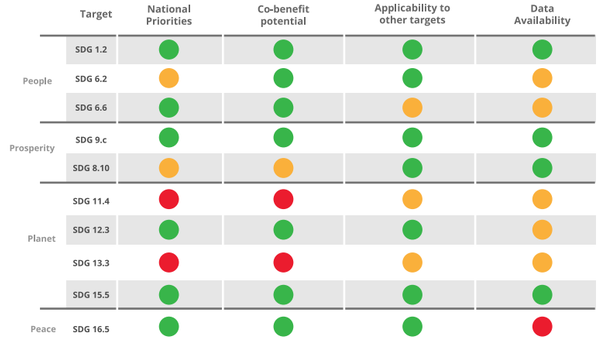
Applicability of costing methodology to other targets (utility): shortlisted SDG targets should require costing methodology that can be adopted and applied to a wide range of targets. Targets that can be applied to similar targets (e.g. infrastructure delivery or increased access to a service) have higher utility in this sense than targets with a methodology that is limited to that target.

Table 1. Overview of selected SDG targets

Teme	Target	**Priority** alignment to development priorities	**Utility** representation of broader policy needs
People/ Social	**SDG 1.2:** Reduce by at least half national poverty.	A national commitment to halve the number of people in poverty (national strategy for the implementation of the 2030 Agenda).	Poverty is an overarching focus of SDGs and Mexico's 2030 strategy, macroeconomic approach can be replicated for other targets (SDG 8, 10, 17).
	SDG 6.2: Achieve access to adequate and equitable sanitation and hygiene for all.	Supports national commitment to gender equality via impacts on female safety and health.	Linked to SDGs 5 and 3 directly and SDG 8/1 indirectly.
Prosperity/ Economic	**SDG 9.c:** Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet.	National Digital Strategy introduced in 2014.	Strong links to other SDG targets such as poverty alleviation (SDG 1), quality education (SDG 4), decent work and education (SDG 8) and reduced inequalities (SDG 10).
	SDG 8.10: Access to banking/ financial services for all.	National strategy includes expansion of access to financial services (including microfinance).	Key driver of SDG 1 targets around poverty alleviation and SDG 10 equality aims.
Planet/ Environmental	**SDG 12.3:** Halve per capita global food waste/loss.	National strategy aims to reduce food loss, increase nutrition and ag productivity.	Linked to SDG 2 (reduce hunger, increase agriculture productivity), SDG 3 (improve health outcomes) and SDG 13 (reduce emissions).
	SDG 15.5: Halt the loss of biodiversity, prevent extinction of threatened species and conserve ecosystems.	National Strategy and Action Plan for Biodiversity (2016-2030) introduced in 2016.	Conservation policies relevant across SDG 14 and 15, methodology must consider how costs could change over time and progress.
Peace/ Gobernance	**SDG 16.5:** Substantially reduce corruption and bribery.	National strategy aims to 'eradicate corruption, waste and frivolity'; National Anti-Corruption System key focus of Administration.	Success in anti-corruption programmes links to cost of doing business, attracting FDI, promoting trade and industrialisation.

Since 2015, the Mexican government has identified which SDG targets were aligned with the national development plan. In 2017, a national council for the 2030 agenda was formed, and in coordination with all major stakeholders, a draft of the 2030 National Strategy was released.

Figure 4. Multi Criteria Analysis for Target Selection



Source: *Vivid Economics*

The selection criteria can be applied to a long list of potential targets to identify a core set for further development of a costing methodology. Applying these criteria should allow for the development of a short list of targets which can be expected to provide the most benefit across a wide range of the economy, given costs. Figure 4 demonstrates how the selection criteria was applied a list of potential SDG targets.

Seven targets were selected for costing in Mexico based on the multicriteria analysis. The selected targets have been shortlisted from the long list of targets in Figure 4 by applying the selection criteria to each potential target. These targets included in the shortlist are summarized in Table 1.

2.2 Overview of Costing Methodology

The methodology for estimating the net economic cost of achieving targets can be delivered in two stages: the direct costs of interventions to drive targets and positive indirect (cross-cutting) impacts. Six of the shortlisted targets are related to a specific sector and call for a bottom-up costing approach. There are several options for costing each direct target, including the use of planned policy estimates as well as previous national interventions and costs. If no planned policy or previous intervention is available, data from international examples can be drawn on. The direct costing methodology applied for these selected targets is described in detail in Section 3. The positive indirect impacts are measured as the positive economic activity that results from the interventions. This positive economic activity helps deliver against SDG 1.2.

Progress towards economywide goals such as SDG 1.2 can be measured from the added productive output expected from direct investment in other SDG targets. In the case of SDG 1.2, poverty alleviation is measured by the extent to which spending towards direct targets generates activity in productive sectors, driving up incomes across the labor force. To estimate the magnitude of these spill-overs, a computable general equilibrium (CGE) model has been run to calculate macroeconomic impacts over time. The model captures complex interactions between households, firms, and the governments. A specific approach for this type of modeling is described in detail in Annex 2.

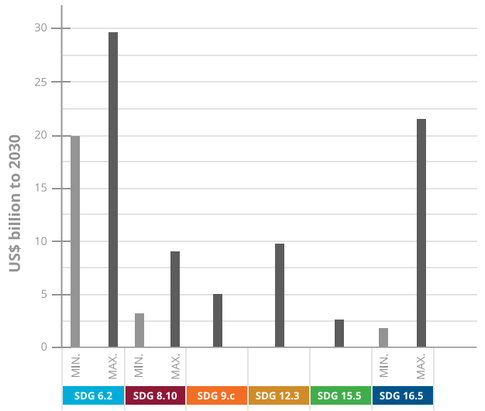
3 Cost estimates for delivery of selected SDG targets in Mexico

This section summarises at a high level the approach taken to estimate the direct costs of delivering SDG targets in Mexico[3].

3.1 Results overview for sectoral targets

Estimates suggest that delivering SDG targets 6.2, 8.10, 9.c, 12.3, 15.5 and 16.5 may require between USD 40 billion and USD 75 billion in total funding between 2021 and 2030. The financing needs will depend on the type of investment path used to reach the SDG targets. For example, estimates suggest that ensuring universal access to sanitation and hygiene by 2030 will require between USD 20 billion and USD 29 billion between 2021 and 2030. The lower bound estimate includes the cost of delivering basic sanitation provision. The higher bound estimate includes the cost of delivering safely managed sanitation provision.

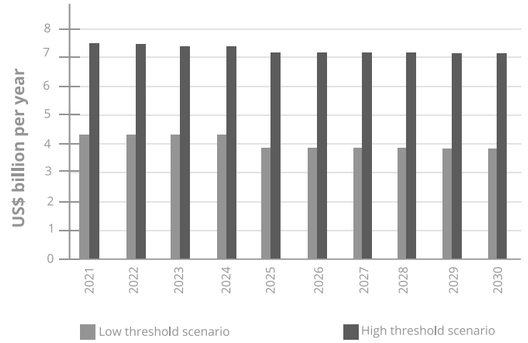
Figure 5. Providing safe and adequate sanitation for all can account up to 50% of the total investment needs



Source: *Vivid Economics*

The required annual investment is expected to range between USD 4 billion and USD 7.5 billion. Costing the delivery of SDGs in Mexico assumes a linear distribution of costs between 2021 and 2030. Under both scenarios, the annual financing requirements decrease slightly to reflect the change of investment for SDG 9.c needed to connect the remaining 4% of the target population between 2025 and 2030.

Figure 6. Annual investments are assumed to be linearly distributed, and frontloaded to 2024



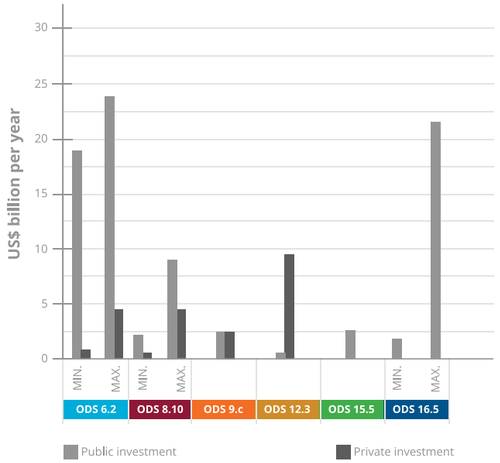
Source: *Vivid Economics*

The share of public spending is estimated to be between USD 28 billion and USD 59 billion between 2021 and 2030. As mentioned, the financing needs for the public sector depend on the approach taken by the government to reach each target. Under most scenarios, reaching SDG 6.2 represents between 41% and 69% of the public sector's over-

all SDG spending needs. Under a high-cost scenario public spending required to reduce corruption may reach similar proportions.

The share of private sector spending is estimated to be between USD 11 billion and USD 19 billion between 2021 and 2030. As mentioned above, the financing needs for the private sector depend on the approach taken by the government to reach each SDG. Contributing to the reduction of food loss and waste, through cold chain management and centralised composting improvements, accounts for 43% to 72% of the private sector's investment.

Figure 7. SDG target costs are most significant for sanitation and anti-corruption efforts



Source: *Vivid Economics*

The methodology, assumptions and data underpinning the costing of each SDG target is described below.

3.2 Data overview

Table 2. Cost estimates use Mexican datasets where available

SDG	Dataset	Source	Internacional reference
6.2: Sanitation for all	WASH infrastructure costs	Stakeholder interview	
	WASH population data	WHO/UNICEF	
	Current WASH spending	WHO	
	Current and future population	OECD	
8.10: Access to finance	Financial inclusion statistics	INEGI	
	Costs of opening bank account	Monedero Smart	
	Financial Inclusion Programme	World Bank	
	Current Financial Inclusion spending	PNIF	
	Current and future population	OECD	
9.c: Information and communication	Population using internet	INEGI	
	Share of rural population	SEMARNAT	
	Cost to deploy mobile broadband	Copenhagen Consensus	
	Cost to deploy last mile broadband	Espinoza and Reed	Unit costs from Peru applied to Mexico
	Internet Para Todos spending	Forbes	
	Current and future population	OECD	
12.3: Reduce food loss and waste	Food loss and waste statistics	WRAP México[4]	
	Costs of campaigns to reduce household food loss and waste	Love Food Hate Waste UK[5]	UK costs scaled to Mexico
	Costs of improving cold chain management	ReFED	US costing methodology applied to Mexican estimates
	Current and future population	OECD	

SDG	Dataset	Source	Internacional reference
15.5: Reduce degradation of natural habitats and loss of biodiversity	Surface of protected land	CONANP	
	CONANP's current budget	Pronatura Noroeste	
	CONANP's ideal current budget	Pronatura Noroeste	
16.5: Reduce corruption	CCost of corruption	INEGI	
	Requested budget to fight against corruption	Mexican Government	
	UK ODA spending for Procura Mexico	Stakeholder interview	
	Current and future population	OECD	

Note: International reference indicate where international benchmarks were used.

Source: *Vivid Economics*

3.3 SDG 6.2: Sanitation for all

Target 6.2 aims to achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations, by 2030.

The objective is to ensure that 100% of the population has access to safely managed sanitation services, including a handwashing facility with soap and water by 2030.

There are two approaches to providing adequate and suitable sanitation and hygiene: providing basic infrastructure only or providing safely managed infrastructure. While both approaches include the availability of a handwashing facility on premises with soap and water, sanitation services 'levels' are based on the quality of defecation processing. Basic infrastructure provision refers to improved facilities which are not shared with other households. Safely managed infrastructure refers to the use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site.[6,7] The WHO/UNICEF Joint Monitoring Program defines SDG 6.2 as delivering safely managed sanitation services.[8]

Mexico has made good progress expanding access to basic sanitation services nationally, but a significant proportion of the population still remains without safely managed sanitation services. According to WHO and UNICEF, in 2017, 50% of the population had access to safely managed sanitation services. The number increased to 57% in 2020. Additionally, a much larger share of the population, 91%, had access to at least basic sanitation services in 2017, a share that rose to 92% in 2020.[9]

Estimates derived from the current study suggest that ensuring universal access to sanitation and hygiene by 2030 will require between USD 20 billion and USD 29 billion between 2021 and 2030. The lower bound estimate includes the cost of delivering basic sanitation provision. The higher bound estimate includes the cost of delivering safely managed sanitation provision. The estimated annual costs range between 85% and 123% of Mexico's 2015 national WASH expenditure (which includes spending on drinking water infrastructure).[10]

These estimates are in line with alternative costing exercises undertaken in Mexico. A costing exercise featured in Mexico's Sixth National Communication to the UNFCCC estimated a cost of MXN 1.4 billion (USD 72 m) to develop green infrastructure (including artificial wetlands) to treat over 330 m3 of water per year by 2030.[11] Assuming global average water needs, this investment could cover 2.5 m households, or 10% of the estimated need to deliver the SDG target.[12] This exercise suggests additional water treatment may be available for urban households for USD 30 – 90/household/year. Given higher per household fixed costs, rural treatment solutions are expected to be higher.

The public sector is expected to finance the provision of sanitation and hygiene infrastructure to rural areas. Rural sanitation facilities require high upfront costs but are not likely to be recoverable through user fees. As such, the public sector is expected to finance these interventions, which account for between 84% and 97%, USD 19 - 24 billion, of the total investment needs. The private sector is expected to finance a large share of interventions in urban areas, where it can recover costs more easily. It is expected to contribute between 3% and 15%, between USD 0.6 - 4 billion, of the investment needs.

Method and assumptions

The objective is to estimate how much it would cost to provide basic infrastructure or safely managed infrastructure for the 2030 rural and urban population. For this SDG target, costing uses 2017 data as a baseline. [14]

The first step is to estimate the future population without access to adequate and equitable sanitation in 2030. The WASH data from the WHO/UNICEF Joint Monitoring Program provides useful information on shares of urban and rural households having access to adequate sanitation and hygiene infrastructure. Using the OECD's population projection for Mexico, it is possible to infer the share of households requiring intervention by 2030,[15] where households are made up of, on average, 3.7 people. [16]

The second step is to multiply the number of households living in rural and urban communities needing intervention in 2030 by the cost of their respective interventions.

Estimates are based on two approaches to providing adequate and suitable sanitation and hygiene: providing basic infrastructure and providing safely managed infrastructure. Based on the WHO/UNICEF Joint Monitoring Programme data, basic infrastructure provision refers to improved facilities which are not shared with other households. Safely managed infrastructure refers to the use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site. [17,18]

The main intervention for rural households consists in building individual biodigesters or dry sanitation infrastructure. Both types of intervention cost approximately USD 341 per household per year.[19]

Interventions for urban and peri-urban areas households consist in repairing or build treatment plants. The feasibility of each intervention depends on geography. For that matter, it is estimated that half of the households that require intervention live in urban and peri-urban areas, where artificial wetlands are feasible. In this case, the cost of a treatment plant in artificial wetlands amounts to USD 0.50 per month per household. The remaining half of households requiring intervention live in urban areas requiring full treatment plants. In this case, the cost of a treatment plant in urban areas is assumed to cost USD 5 per month per household.[20]

Delivering infrastructure to rural areas may require significant additional investment from the public sector. Utility scale sanitation requires large scale facilities that have high upfront costs and can only be recovered in very densely populated areas. As such, the private sector is expected to finance the sanitation intervention in urban areas. The public sector is expected to finance the provision of sanitation and hygiene infrastructure to the remaining rural areas.

The goal is to ensure that 100% of the population has access to sanitation services.

3.4 SDG 8.10: Access to finance

Target 8.10 aims at strengthening the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.

The objective is to ensure 100% of adults have a bank account by 2030. A bank account is defined as payroll, savings, pension, checking, fixed-term or investment fund account, or an account which can receive governmental transfers.[21] According to this definition, 47% of adults in Mexico held a bank account in 2018.[22]

Estimates derived from the current study suggest that meeting SDG 8.10 by 2030 will cost between USD 2 billion and USD 8 billion by 2030. The lower bound refers to estimates scaling up the benefit-to-cost ratio of the World Bank-supported Mexico Financial Inclusion Program.[23] The higher bound refers to estimates computed using existing costs of opening a bank account in Mexico, adding the additional assumption that maintaining an account open costs 50% of the opening fee per year.[24] The dedicated spending is equivalent to 13% and 52% of Mexico's annual spending on financial inclusion' in 2019.[25]

The public sector is expected to finance more than half of these costs, between USD 1 billion and USD 7 billion by 2030, reflecting the government's commitment to expanding financial inclusion. The private sector is expected to pay between 10% and 50%, USD 207 million and USD 4 billion, of the investment needs between 2021 and 2030. The public sector is expected to fund the remaining 50% - 90%, USD 1 - 7 billion, of the investment needs between 2021 and 2030. The total sum of investment is likely to depend on the scenarios described below.

3.4.2 Method and assumptions

The objective is to estimate how much it would cost to open and maintain a bank account for the 2030 adult population.

The first step is to estimate the future population of adults that will need a bank account by 2030. The 2018 Encuesta Nacional de Inclusión Financiera provides useful information on the share of adults having a bank account in 2018.[26] Using the OECD's population projection for Mexico,[27] it is possible to infer the share of adults requiring a bank account by 2030.

The second step is to multiply the number of adults needing to open a bank account by 2030 by the cost of opening and maintaining bank account. There are two cost scenarios for providing and maintaining a bank account in Mexico. The first scenario applies current market costs to open a bank account in Mexico[28] assuming that the annual cost of maintaining a bank account is equivalent to 50% of the cost of opening the account. The second method scales the unit cost from a World Bank-supported Mexico Financial Inclusion Program[29] to the number of bank accounts required by 2030. The two methods yield different cost estimates.

It is estimated that the private sector participation ranges between 10%, which is the proportion contributed from the financial sector to the World Bank Financial Inclusion programme,[30] and 50%.

3.5 ODS 9.c: Information and communications technology

Target 9.c aims at significantly increasing access to information and communications technology (ICT) and strive to provide universal and affordable access to internet in Least Developed Countries by 2030.

The objective is to provide internet to 96% of the population by 2030. Though Mexico is not a Least Developed Country, internet access is an important government priority, and access to internet is guaranteed by the state in the Mexican constitution.[31] World Bank data shows that Mexico's internet coverage has increased significantly since 2000, when only 5% of the population had access to internet; over the past 10 years, internet access has increased by approximately 40 percentage points.[32] According to the 2020 Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares, 72% of the population, 84 million people, had access to internet in 2020.[33] This represents an increase of 6 percentage points in comparison to 2018.[34] The expected maximum internet coverage that can be attained in Mexico by 2030 is 96%. This is equivalent to global 'best practice', represented by South Korea's current internet coverage.[35]

Providing internet access to 96% of the population by 2030 could be carried out in two phases. Between 2021 and 2024, broadband coverage is expected to increase by more than 20 percentage points. Due to increasing costs to reach the most remote areas, connecting the remaining 4% of the population to achieve the 2030 target could take place over the remaining 6 years.

Estimates derived from the current study suggest that meeting SDG 9.c by 2030 will cost USD 4.7 billion between 2021 and 2030, with 40% of the financing delivering broadband to most of the unconnected population. Taking internet penetration from 72% to 92% between 2021-2024 could require a total investment of USD 2.8 billion by focusing on rural (but not remote) populations.

Reaching the last mile to meet global goals may require significant additional investment. Connecting the remaining 8 million people in 'remote' areas to reach broadband coverage of 96% may require a total investment of USD 2 billion between 2025 and 2030.

On average, annual spending to meet SDG 9.c is 5 times the Internet Para Todos 2021 budget.[36] The annual public sector spending (reflecting remote access costs) is expected to represent three times the Internet Para Todos 2021 budget.

The private sector is assumed to provide finance for rural coverage between 2021 and 2024, while the public sector is expected to finance remote area coverage from 2025 onwards. The private sector finances both capital and operation expenses related to mobile broadband deployment, except for remote area coverage.[37] The public sector finances remote area coverage and ICT capacity building. As such, the private sector is expected to pay 49% of the investment needs, USD 2.3 billion, between 2021 and 2030. The public sector is expected to pay 51% of the investment needs, USD 2.4 billion between 2021 and 2024.

3.5.2 Method and assumptions

The objective is to estimate how much it would cost to deploy mobile broadband to the projected adult population in 2030. Between 2021 and 2024, broadband coverage is expected to increase by more than 20 percentual points. However, due to increasing marginal costs and difficulty to reach the most remote areas, connecting the remaining 4% of the population to achieve the 2030 Target will take place over 6 years.

The first step is to estimate the 2030 adult population requiring broadband connectivity. The 2020 Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares provides information on the share of adults having access to internet.[38] Using the OECD's population projection for Mexico,[39] it is possible to infer the share of adults requiring broadband connectivity by 2030.

The costs of providing mobile broadband service are used as a proxy for estimating broadband connectivity. Providing a mobile broadband service can be more cost effective than expanding access through fixed line connections, since it can cost only a third as much.[40] Experimental models such as satellite/mesh networks are assumed to be no more cost effective than mobile broadband network expansion.

The second step is to estimate the cost of deploying mobile broadband to 92.2% by 2024. Cost proxies are computed using Copenhagen Consensus' annual cost per person to reach 60% mobile broadband cover between 2015 and 2030.[41]

The third step is to estimate the costs of deploying mobile broadband to connect the remaining unconnected Mexican remote areas between 2024 and 2030.[42]

The goal is to provide internet to 96% of the population by 2030.

3.6 SDG 12.3: Reduce food loss and waste

Target 12.3 aims to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses by 2030.

The objective is to halve food loss and waste in Mexico. Farm gate to retail and households are the two main components of food loss and waste. 20 million tons of food was lost or wasted between the farm gate and retail shelf in 2019. Household food loss and waste represented another 11 million tons in 2019. In total, food loss and waste in Mexico in 2019 is equivalent to more than 54 MtCO2e or the carbon dioxide emissions of 24 million cars. It also accounted for 60 billion liters of water, that is the amount of water used in households over 3.6 years.[43]

Estimates derived from the current study suggest that meeting SDG 12.3 by 2030 will cost USD 8.9 billion between 2021 and 2030. This represents 3.6% of the food loss and waste annual costs to the Mexican economy.[44]

The private sector is expected to finance 93%, or USD 8.3 billion, of the investment needed to halve food loss and waste. The private sector is expected to finance the totality of investment required to halve food loss and waste at the farm gate to retail level, primarily the costs of improving cold chain storage in the food product supply chain to prevent spoilage.[45]

The public sector is expected to finance some of the household level food loss and waste reduction by implementing a USD 600 million public awareness campaign. The public sector is expected to contribute to the totality of the campaigning costs.

Method and assumptions

The objective is to estimate how much it would cost to halve the projected 2030 food loss and waste. This requires estimating cost of interventions at the farm gate to retail and household level.

The first step is to estimate the level of food loss and waste in 2030 in Mexico. By combining recent estimates of food loss and waste in Mexico with the OECD's population database, it is possible to infer the quantity of food loss and waste in 2030 for the projected population, assuming a constant per-capita level of waste.[46,47]

The second step is to estimate costs of reducing food loss and waste at the farm gate to retail level. In Mexico, the main food loss and waste farm gate to retail challenge is the lack of cold chain infrastructure to lengthen food's shelf life.[48]

Assuming that cold chain management infrastructure costs are proportionately similar in both the US and Mexico, it is possible to use the benefit-to-cost ratio established in a US study to estimate how much investment is needed to halve farm gate to retail food loss and waste.[49]

The third step is to estimate costs of reducing food loss and waste at the household level. Assuming that campaigning costs in Mexico are similar to those reported for a national campaign in the UK, it is possible to use the benefit-to-cost ratio of the UK Love Food Hate Waste campaign to Mexico. The UK campaign was effective at reducing household level food waste by 21% and the same impact is assumed for Mexico. The remaining 29% food loss and waste needed to reach the objective are estimated by applying unit costs for centralized composting infrastructure reported in the US ReFED study.

The goal is to halve food loss and waste in Mexico.

3.7 SDG 15.5: Reduce degradation of natural habitats and loss of biodiversity

Target 15.5 aims to protect and prevent the extinction of threatened species by 2030.

The objective is to limit the share of protected areas that increase/maintain their vegetation surface/canopy or prevent losses to less than 5% per year by 2030. By 2030 100% of Mexico's protected areas will maintain their vegetation cover or prevent losses to less than 5% per year.[50]

Given Mexico's recent commitment to contribute to protect 30% of the planet, terrestrial protected areas in Mexico are expected to increase up to 30% by 2030.[51] This is in line with one of the expected United Nations Convention on Biological Diversity 2030 goals.[52]

Estimates derived from the current study suggest that meeting SDG 15.5 will cost USD 2 billion between 2021 and 2030. On average, annual spending to meet SDG 15.5 is 6 times CONANP's 2021 budget.[53]

The public sector is expected to contribute to 100% of the investment needs between 2021 and 2030. The public sector is expected to contribute to the totality of the investment needs between 2021 and 2030 (likely in partnership with conservation organizations and other national governments e.g., under Article 6 of the Paris Agreement).

Method and assumptions

The objective is to estimate how much it would cost to preserve the 2030 share of protected areas.

The first step is to estimate the surface of protected areas in 2030. Given Mexico's recent commitment to contribute to protect 30% of the planet, terrestrial protected areas in Mexico are expected to increase up to 30% by 2030.[54] As such, by 2030 100% of Mexico's protected areas will maintain their vegetation cover or prevent losses to less than 5% per year.

The second step is to multiply the surface of protected areas in 2030 by the per-hectare cost to maintain protected areas intact. CONANP's budget per hectare of protected land is estimated by the recent Pronatura Noroeste's report Presupuesto para el ambiente 2021: Análisis y propuestas, which reflects an 'ideal' budget to enable CONANP to protect Mexico's protected areas.[55] The ideal budget put forward by Pronatura Noroeste is USD 6.22 per hectare, which is more than three times the current per hectare budget allocated to CONANP.

3.8 SDG 16.5: Reduce corruption

The objective is to substantially reduce corruption prevalence rate observed during personal administrative processes by 23%, based on 2019 data.[56]

Corruption is measured using INEGI's Encuesta Nacional de Calidad e Impacto Gubernamental 2019 measure of corruption prevalence during personal administrative processes. In 2019, the rate of people who had contact with a public official and experienced at least one act of corruption was 15,732 per 100,000 inhabitants nationwide.[57] In other words, 15.7% of the population reported experiencing corruption during administrative processes in 2019.[58] Although other forms of corruption may exist, only corruption during administrative processes is included here given the scope of the federal government.[59]

Estimates derived from the current study suggest that meeting SDG 16.5 by 2030 will require a total investment of USD 1.8 billion from the federal government between 2021 and 2030. This is based on an assumed expansion of current spending on anti-corruption initiatives including application of public procurement processes across the federal government. This represents an annual requirement 14% higher that Mexico's 2021 anti-corruption federal budget.

Under a high-cost scenario, the total investment needed to reach SDG 16.5 could reach USD 21 billion between 2021 and 2030. The high-cost scenario is based on the assumption that reducing corruption is equivalent to 50% of the costs of corruption.

The public sector, represented by the federal government, is expected to contribute to the totality of the investment needs between 2021 and 2030. Both scenarios assume that the government is responsible for the financing of the anti-corruption initiatives.

Method and assumptions

The objective is to estimate how much it would cost to reduce corruption by 23% given 2030 levels of corruption.

The first step is to estimate the level of corruption in Mexico by 2030. By combining recent estimates of corruption from the 2019 Encuesta Nacional de Calidad e Impacto Gubernamental, with the OECD population projection database, it is possible to infer the amount of people affected by corruption in 2030.[60,61]

The cost of reaching SDG 16.5 is based on two scenarios. The lower cost scenario is based on current spending linked to anti-corruption initiatives. The higher cost scenario poses that the cost of reducing corruption is equal to 50% of the cost of that corruption.

The second step is to estimate the cost of reducing corruption based on current spending linked to anti-corruption initiatives. The objective of this exercise is to scale current spending to the 2030 population. Current spending includes the 2021 suggested anti-corruption federal budget, International donor activity in Mexico including UK FCDO's Global Anti-Corruption Program delivering transparent federal procurement portal and cost estimates of personnel to maintain and update Mexico's future public procurement system.[62,63]

The analysis adds to this estimate the labor cost to maintain and update Mexico's future public procurement system. It is estimated that 20 full-time 'data stewards' will be required to implement and maintain public procurement systems for each of the 16 Dependencias del Gobierno Federal. The estimate of 20 is based on the number of data stewards in place in the Mexico City government under a public procurement program supported by the UK embassy.

The third step is to estimate the cost of reducing corruption based on the assumption that it represents 50% of the actual cost of corruption. In this high-cost scenario reducing corruption by 23% between 2021 and 2030 costs 50% of the proportional cost of corruption, where the cost of corruption in Mexico for the 2019 baseline is measured using INEGI's corruption cost estimate.

The objective is to estimate how much it would cost to reduce corruption by 23% given 2030 levels of corruption.

3.9 Overarching assumptions

The costs to deliver selected SDG targets are also based on a set of overarching assumptions, including:

- **Linear distribution of costs.** This means that, unless specified otherwise, costs are assumed to be evenly spread over the period from 2021-2030.
- **Constant costs.** The estimates do not account for change in costs over the decade and similarly the costs are presented as current prices and do not account for inflation.
- **Costs reflect federal spending estimates only.** Additional spending, for example at state and city level is not considered for some targets, such as SDG 16.5.

References chapter 3

Costing the delivery of the Sustainable Development Goals in Mexico

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4 Estimating the co-benefits of direct SDG spending

4.1 Overview

Direct investments in specific sectors from SDG-relevant interventions are expected to contribute to economic growth and wider impacts across the overall economy, which are not fully captured through a direct costing approach. The sector level costing methodologies set out in Section 3 represent a 'partial equilibrium' based approach and are likely to exclude the full extent of the benefits from SDG spending across the wider economy. Given the likely significant investment associated with delivering SDG targets in specific sectors, modeling the impacts of such investments across national supply chains can provide a picture of wider impacts relevant for the SDG Agenda.

While the policy scaling approach is useful for estimating direct benefits, it is likely to underrepresent the full profile of investment benefits and hence overestimate the net economic cost. For example, sector level analysis may find an investment in solar power generation is required to achieve SDG 7.2 in a country. This investment will (in the long run) lower the price of energy, which in turn leads to consumers or firms having more money to spend in other areas. This theoretical increase in wealth contributes to achieving SDG 1.2 (if additional income is distributed in a way that households in poverty benefit from lower energy costs). Similarly, investment in achieving SDG 6.2 is likely to improve people's health and reduce the amount of time people spend on sanitation and hygiene activities. This can increase the amount of time people have for income generation, which may contribute to achieving SDG 1.2. Study has also shown that achieving SDG 15.5 would improve hydrological ecosystems services.[64] With health natural ecosystems and water quality improvements, the cost of sanitation may be reduced, which ultimately benefits the achievement of SDG 6.2. These wider benefits are also referred to as 'cross-cutting impacts' in this methodology document.

Table 3: SDG-relevant cross-cutting impacts (illustrative)

Cross-cutting impacts	Relevant SDGs
Poverty	**1.1:** By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than USD1.25 a day. **1.2:** By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
Sectoral Growth	**8.1:** Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries. **8.2:** Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labor-intensive sectors. **10.1:** By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average. **10.2:** By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.
Gender Equality	**5.5:** Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life. **6.2:** Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020.
Trade	**17:** Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020.

Source: *Vivid Economics*

4.2 Methods for estimation

There are three primary ways to estimate cross-cutting impacts:

Input-Output (I-O) models link production inputs to outputs. I-O models typically do not include growth over time and are not well suited for estimating cumulative sectoral and economy wide impacts of specific policies.

Partial equilibrium analysis models a single market at a snapshot in time. This approach is very useful when considering a limited scope of impacted sectors as they provide a very detailed view of small portion of an economy. These models inherently assume many connections in the economy are fixed – for simplicity – which is a clear limitation if the goal is to estimate aggregate cross-cutting impacts.

Computable general equilibrium (CGE) models are models of economic fundamentals across the whole economy that project how different actors in the economy will respond to policy interventions over time (such as SDG spending).

CGE models address both the shortcomings of I-O models and partial equilibrium analysis and are recommended as the most appropriate method to estimate cross-cutting impacts. Before proceeding to an in-depth discussion of applying CGE models, it is worth noting their disadvantages:

- Due to the fundamental behavioral assumptions the models attempt to depict, they are very compli cated. Often, they are referred to as "black boxes" (Böhringer et al., 2003).
- Calibrating a CGE model to a particular economy is data intensive. This is often a limiting feature for CGE analysis.
- The model requires strong simplifying assumptions about consumption and production behavior, such as the way inputs are combined for production.

Despite the limitations of CGE models, they offer clear advantages for estimating cross-cutting impacts over other methods. CGE models, while complicated, have at their core a set of interlinked mathematical equations describing assumptions about economic systems. If the modeler is clear about the linkages the CGE model captures and the assumptions made, this system of equations can demonstrate subtle links in economy that I-O and partial equilibrium models cannot. Assumptions about individual consumption and firm production can be easily linked to historical data for careful analysis of policy scenarios and projections. Given these advantages, a CGE model is the recommended approach to estimating the cross-cutting impacts of SDG spending.

The remainder of Section 4 is structured as follows:

- Section 4.2.1 provides an overview of CGE models;
- The Annexes of this report present the steps to apply CGE modeling for estimating cross-cutting impacts; detailing the application of a CGE model to estimate the cross-cutting impacts of SDG implementation in the case of Mexico specifically;
- Section 4.3 details an approach to estimating the impacts of delivering SDG 1.2; and
- Section 4.4 estimates the impacts of SDG target-level spending on poverty by 2030.

CGE Model Overview

CGE models are flexible models of full economies that aim to capture the relationships across inputs, outputs and sectors in an economy over time. These models use economic theory and estimated behavioral parameters to calculate how individuals and firms will react to policies – which can be modeled as a change in prices or a specific investment in a sector (or sectors). In a CGE model, households receive income as wages for providing labor to productive sectors and via capital rents to reflect their ownership of firms. Households utilize their income for either consumption or savings. When a household saves, this represents investments, which increases national capital stock. Firms combine various inputs – land, labor, capital, and goods and services from its supply chain – to produce goods. The model is characterized by a set of equations and estimated behavioral parameters that describe individual consumption choices and production in various sectors and regions. The CGE model applies these equations to distribute inputs across productive sectors and produce goods and services for consumption within the country and export to other countries, and in turn provide wages for labor and returns to capital.

There is a wide selection of CGE models in use and the Global Trade Analysis Project (GTAP)[65] hosted at Purdue University is one of the leading sources of data for these models. This section discusses a stylized example for the Global Vivid Economy Wide model (GViEW), developed by Vivid Economics, to explore how a CGE model can be applied to assess cross-cutting impacts from SDG related investments. The model includes structural assumptions for firms in various sectors which combine workers of different occupations with capital, land, and energy to produce an output (good or service), which is then consumed by households and/or traded on international markets. Sector specific production parameters create differential effects of policies across sectors. For example, auto manufacturing is relatively capital intensive while tourism is relatively labor intensive. A policy focused on increasing returns to capital will likely have a relatively more significant impact on auto manufacturing than tourism, assuming similar size of sector.

The next section details how the model's output can be used to cost SDG 1.2. The annex contains a significant amount of information regarding the details behind the CGE analysis.

4.3 SDG 1: Eradicating Poverty

SDG 1, 'End poverty in all its forms everywhere', aims to eradicate poverty through increased access to economic services and significant mobilization of resources.

The targets covered by this goal include reducing the number of people living in extreme poverty (e.g. on less than USD1.90 a day) globally, reducing poverty according to national definitions, increasing access to basic services, reducing vulnerability to extreme climate events and promoting gender sensitive estimates of poverty alleviation.

Table 7: Summary information for SDG 1.2

Target	Indicators (Internacional)	Indicators (Mexico)
By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.	**1.2.1** proportion of population living below the national poverty line, by sex and age.	Percentage of the population in poverty.
	1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.	

Note: Poverty line defined by CONEVAL in May 2021 as 3,717.71 pesos/month in urban areas and 2,622.13 pesos/month in rural areas.[66]

Source: *Vivid Economics*

INTRODUCTION

Specifically, SDG 1.2 calls for efforts to 'reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions' through increased access to economic resources. Globally, poverty is measured by the number of people living on less than USD1.90 a day (UNDP, 2019). National poverty levels differ from the international definition of extreme poverty (usually higher income level) and reflect the cost of living/normative position on the minimum quality of living in a given country. Some countries calculate this at a specific income level, others tie it to a basket of goods, which can vary from year to year. While SDG 1 has an overall goal of completely eliminating poverty, SDG 1.2 aims to halve the population in each country living under the nationally-defined poverty line.

A 2018 report by the World Bank estimated that 735 million people were living under the global poverty line, with significant variation across regions. A related measure, the multi-dimensional poverty index (MPI) – developed jointly by the UNDP and Oxford Health and Development Initiative – provides a more holistic definition of poverty that underscores three key dimensions of poverty: health, education, and standard of living (UNDP, 2019). The MPI definition of poverty encapsulates many other SDGs – such as SDG 3 (good health and wellbeing) and SDG 4 (quality education). According to the MPI, 1.3 billion people are multi-dimensionally poor (Alkire et al., 2019).

Access to decent work and income is a key ingredient for reducing poverty. A labor market is the backbone of all economies as it is linked to household income. Supporting the development of growing sectors inevitably leads to reduc-

ing poverty in all dimensions as average wages rise. Educational access and sound healthcare simultaneously are synergistic with a growing labor market; as wages rise, educational access and healthcare systems generally improve and vice versa. In terms of SDG targets, reducing poverty (SDG 1.2) results from SDGs 2 (access to nutrition), 3 (good health and well being), 4 (quality education) and 8 (decent work and economic growth). Poverty reduction is also influenced by SDGs 10 (reduced inequalities) and 16 (peace, justice and strong institutions), which are related to wages and the labor market.

The national definition of poverty in Mexico is substantially stricter than global indicators. CONEVAL measures poverty across a range of indicators that include a 'wellbeing line' defined in May 2021 as below Mex$3,717.71 per person per month in urban areas and Mex$2,622.13 per person per month in rural areas. The global 'extreme poverty' equivalent is the 'minimum wellbeing line' of Mex$1,778.98 per person per month in urban areas and Mex$1,360.83 per person per month in rural areas.[67] Income poverty in Mexico is measured along two dimensions: a "food basket" and a "non-food basket", which includes public transit, education, etc. The poverty line is tied to being able to afford goods in both baskets, while extreme poverty is having sufficient income to afford the food basket only. The "food basket" was updated from 23 goods to 40 goods in 2019 [68] while goods in the "non-food basket" were determined in 2009.[69] Values of goods in the baskets are updated regularly using the National Consumer Price Index, which is calculated by INEGI.

According to CONEVAL, 41.9% of the population was living in poverty in 2018, though a higher share (48.8%) lived below the national poverty line.[70] Similar to the MPI, CONEVAL has adopted a multi-dimensional approach for measuring poverty that takes into account social wellbeing, health and education. This approach incorporates a threshold for the income needed to afford basic foods and services (known as the "wellbeing threshold") and six key "social indicators":

- educational lag;
- lack of access to health services;
- lack of access to social security;
- housing with inadequate quality or insufficient space;
- lack of access to basic housing services;
- lack of access to food.

The multidimensional poor in Mexico are defined as individuals who are deprived in one or more social dimension and whose income fall below the wellbeing threshold. Extreme poverty is defined as being below the minimum income threshold and falling into three or more social indicators. Summary statistics for the number and percent of people falling into various poverty indicators are presented in Table 4.

Table 4: Poverty indicators in Mexico (2018)

Indicator	Percentage	Millions of Individuals	Average deprivations
Poverty			
Population living in poverty (total)	41.9	52.4	2.2
Population living in moderate poverty	34.5	43.1	1.9
Population living in extreme poverty	7.4	9.3	3.6
Population vulnerable due to social deprivations	29.3	36.7	1.7
Population vulnerable due to income	6.9	8.6	0.0
Population not living in poverty and not vulnerable	21.9	27.4	0.0
Social Deprivation			
Population with at least one social deprivation	71.2	89.1	2.0
Population with at least three social deprivations	18.8	23.5	3.4
Social Deprivation Indicators			
Educational gap	16.9	21.1	2.7
Lack of access to health services	16.2	20.2	2.7
Lack of access to social security	57.3	71.7	2.1
Lack of housing quality and space	11.1	13.8	3.2
Lack of access to basic housing services	19.8	24.7	2.9
Lack of access to food	20.4	25.5	2.6
Wellbeing			
Population whose income is less than the minimum wellbeing line	16.8	21.0	2.4
Population whose income is less than the wellbeing line	48.8	61.1	1.9

Note: The column "Average Deprivations" refers to the average number of social deprivations an individual faces total. For example, individuals with "lack of access to social security", on average face 2.1 social deprivations.

Source: *https://www.coneval.org.mx/Medicion/MP/Paginas/Pobreza-2018.aspx.*

Indicators of poverty in Mexico illustrate the usefulness of CGE modeling for measuring poverty reduction from an income perspective. Poverty reductions in CGE models are most directly estimated through wage effects. As Table 4 shows, 49% of Mexico's population in 2018 had a wage below the income line. This represents an improvement from 2014, when the share living below the wellbeing line was 53%.[71] GViEW best captures wage effects of targeted spending, and can estimate how direct SDG spending will impact the number of people above or below the 'wellbeing line', including households that are brought above this line as a result of an intervention (or set of interventions). To construct a projected poverty line, inflation is assumed to be constant – though this can be specific to each country.

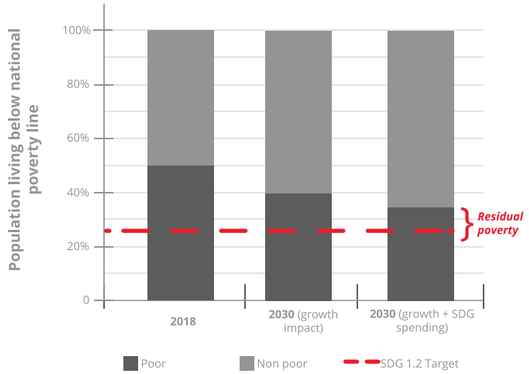
Additional considerations

CGE models can be used to deliver insight on how SDG spending will generate cross-cutting impacts for Mexico's social deprivation indicators. This analysis measures SDG 1.2 narrowly as percent of population below national poverty line (e.g. indicator 1.2.1 in table above). This paragraph discusses how additional analysis can examine multi-dimensional poverty. This is relevant for other countries (and CONEVAL) but since Mexico has explicitly identified a target for SDG 1.2 'percent living in poverty', explicit analysis of multi-dimensional poverty is left for future work. 72% of Mexico's population had at least one social deprivation and 22% had at least three. The main driver of social deprivations is "lack of access to social security" by a large margin. According to CONEVAL, lack of social security access is primarily driven by a large informal sector in which workers do not have access to tax benefits that formal sector workers do (CONEVAL, 2011). GViEW explicitly includes formal/informal sector share changes that can be used to understand the evolution of this social deprivation indicator. Taken together, GViEW is not only a sound approach for cross-cutting impact measurement of SDG spending, but is also particularly well suited for Mexico as it incorporates key features that are aligned with Mexico's multidimensional national poverty definitions.

4.4 Macroeconomic impacts of SDG-related spending

Additional economic activity driven by spending and investment related to the delivery of SDG targets discussed above is expected to have an indirect impact on reducing poverty in Mexico. Figure 8 demonstrates how this effect, combined with expected per capita economic growth, could help to deliver the SDG 1.2 target to halve poverty by 2030.

Figure 8: Expected GDP growth and stimulus impact from SDG spending could reduce the share of population living in poverty by 11 percentage points



Source: *Vivid Economics*

An initial impact on poverty has been modelled in line with expected economic growth over the next decade. For 2020 and 2021 recent estimates of total GDP growth from the Ministry of Finance (published in April 2020) anticipate a 3.9% contraction in 2020 and a return to growth of 1.5% in 2021[72] returning to 2.5% to 2.7% over the next five years.[73] From 2026-2030 growth estimates are held constant at levels projected for 2024 and 2025. These macroeconomic assumptions are matched to population projections from the OECD for Mexico.

Estimating spill-over impacts on poverty from SDG target delivery

To model the indirect spill-over impact of SDG-related spending on poverty, the share of identified costs from outside the Mexican economy must be estimated. This calculation reflects an assumption that government spending redirected from other programs or increased tax payments does not inherently have a growth effect, but foreign private investment and aid flows could drive additional growth by increasing the capital stock of the economy. Table 5 sets out target-level assumptions of external spending in line with approaches set out in section 3.

Table 6: External spending assumptions for SDG targets

SDG Target	Share external	Notes
6.2	11%	Assumes share from private investment (15%) reflects foreign investment proportional to national import profile for environmental technologies and water.[74]
8.10	18%	Assumes share from private investment (36%) reflects foreign investment in line with foreign bank market share in Mexico's financial services industry.
9.c	46%	Assumes share from private investment (46%) fully funded from foreign investment.
12.3	9%	Assumes share from private investment (93%) reflects minor foreign investment.
15.5	50%	Assumes increased spending on forests supported significantly by foreign governments for example through Article 6 climate finance mechanisms.
16.5	5%	Assumes marginal spending from development partners continues but is largely driven through Mexican government capacity and investment.

Source: *Vivid Economics*

By applying these external share assumptions to the sector-level spending estimates discussed in section 3, the additional income effects can be estimated. CGE modeling estimates that these programs could raise an additional 2% of the population out of poverty by 2030.

Addressing residual poverty to achieve SDG 1.2 in 2030

An additional reduction of 14%, or 18 million people in 2030, is required to deliver SDG 1.2. Assuming a cost of MEX$ 11,500 to lift one person out of poverty through direct cash transfer (as outlined in Annex 9), this residual poverty reduction would cost over MEX$ 200 billion (USD 10 bn) in 2030.
This is a significant figure in the context of assessed costs for sector-specific SDG targets (estimated at USD 40-75 billion over a ten year period). Compared to current spending on cash transfer programs (over MEX$ 1 trillion in 2019), this figure appears less significant.

Additional key assumptions in this analysis include:

- A static national poverty level equal to the level defined in 2018
- Real GDP growth in line with Mexican Government projections
- Proportional impacts of wage increases in which incomes below the poverty line are increased at the same rate as all incomes.

4.5 Direct target estimation

There are several approaches for costing SDG targets, each of which will be more appropriate under different circumstances and for different targets and settings.

These approaches can be summarized in three standard options which will be explored in depth for each specific target:

- **Option 1:** scale costs of past interventions within the country of interest to meet SDG goals;
- **Option 2:** apply cost estimates from interventions delivered internationally and adjust for target country context; and,
- **Option 3:** apply existing cost estimates from national policy documents and strategies.

A key consideration in choosing which option to apply is the availability of data required to cost the relevant target. Option 3 is appropriate where analysis has previously been conducted and incorporated in an existing national strategy for the relevant target. In the absence of existing analysis, option 1 (scaling in-country costs) offers the most accurate estimate where relevant data is available as it uses direct evidence from previous experience in the country to inform the analysis. Option 1 has the most stringent data requirements, including a history of interventions for a given target in the country of interest as well as data regarding the intervention.

Implementing Option 1 will require an assumption about how existing intervention costs can credibly scale within the target country to meet the SDG target. A straightforward approach is to assume policy implementation costs scale linearly. For example, suppose an internet access project costs USD1 m and reaches 1% of the population without access, then a linear assumption would suggest that to reach 100% of the population, it will cost USD100 m. A more complex assumption is that intervention costs are increasing in scale – e.g reaching the last 10% (leaving no one behind) of the population costs more than the first 10%. Engagement with subject matter experts and review of similar interventions in other countries can provide some context for making an assumption around how interventions might scale for a particular target.

Option 2 (applying cost estimates from internationally project evidence) may be appropriate where in-country data is not available and relevant project data can be identified in an international context. This option requires identification of interventions relevant to SDG targets globally, and relevant metrics to quantify the impacts of these interventions. Given the universal nature of the 2030 agenda, this option may be easier to obtain data to implement. If country specific data is not available, option 2 should be utilized.

Using cost estimates from other countries requires assumptions about how these costs transfer to the country of interest and how these costs scale. Estimation of costs to deliver targets may vary significantly across countries for multiple reasons – such as differences in population, income, infrastructure, quality of institutions (e.g. government corruption), or even geography. For example, mountainous countries with a dispersed population (such as Lesotho) will likely require greater per capita investments for delivery of internet access for all (SDG 9.c) due to the increased construction costs the terrain demands.[75] Accurate cost estimation within a country using estimates from an international context requires consideration of these differences across countries.

Transferring costs from other countries is often a second-best alternative but may be appropriate where more detailed studies are not feasible. For interventions requiring infrastructure and construction costs, detailed cost studies are likely to produce the most robust cost estimates, but can be costly and require more time than is available to make a policy decision. Given the consideration of SDG implementation at the national level, detailed projects may not be scoped out to the level required for such a specific cost estimate. Transferring values from similar projects delivered elsewhere provides an alternative approach to identify relative cost levels for policy planning.

Some key considerations for applying values from an intervention in another country include the extent to which values can be adjusted for the national context. OECD guidance on applying a value transfer approach identifies three levels of robustness in this approach (Atkinson et al., 2018):

Direct value transfer – assumes values (e.g. costs) from one country can be directly applied to another country. This approach may be appropriate where a discrete product is provided, such as a diagnostic study, database or training workshop.

Income-adjusted value transfer – adjusts values by a per capita income calculation and applies to country of study. This may be relevant where labor costs are likely to differ but little else. For example a straightforward investment project such as energy efficient buildings interventions may differ at the national portfolio level by a number of factors, but labor costs are likely to be the most significant driver of cost differences between countries.

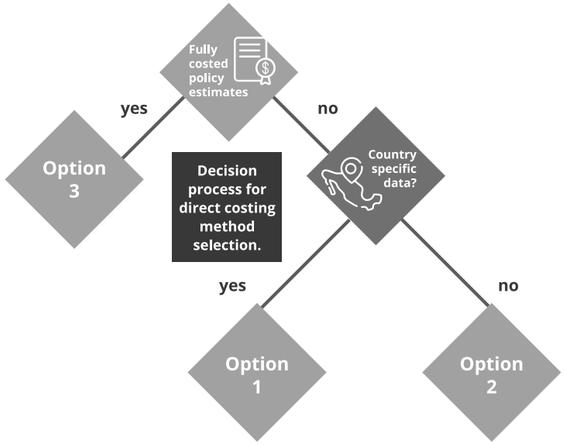
Value function transfer – adjusts costs from an example project by a number of relevant factors, which could include some of the following examples: labor costs, geography/climate, logistics system performance, project overhead cost. In general, the more variables considered between the project example and the target country, the more robust cost estimates will be, but this is limited to variables that are likely to be relevant for the specific intervention.

Unless the project used as international evidence has met the SDG target completely, option 2 will require a similar assumption to option 1 regarding cost scaling. Overall, value transfer estimates (option 2) are easier to obtain from a data perspective but may be slightly less relevant than policy scaled estimates (option 1). This is due to the extra assumptions required to impute costs.

Option 3 (using existing estimates from policy documents) is the most straightforward approach where these estimates are readily available. This option consists of gathering information on cost estimates for the delivery of SDG targets that have been previously developed by governments or other organizations. The data restrictions of this option can be assumed to be minimal, where estimates are provided by government or other stakeholders. The main consideration when using other organization's estimates is to have a deep understanding of the assumptions and data used to arrive at the estimates. Since no estimates are actually computed in this option, it is crucial to understand the credibility of the cited target costs. Relevant factors to consider include government incentives, previous history, experience of organization. In many cases, option 3 will not be feasible given a lack of specified studies.

The process to select one of the options for costing direct targets is summarized in Figure 9.

Figure 9: Decision process for direct costing method selection.



Source: *Vivid Economics*

Note: Options refer to the options described in detail above.

The rest of this section explores specific methodologies for short-listed targets including SDGs 6.2, 8.10, 9.c, 12.3, 15.5 and 16.5.

4.5.1 SDG 6.2: Access to sanitation for all

SDG 6 aims to 'ensure availability and sustainable management of water and sanitation for all.'

6 CLEAN WATER AND SANITATION

The targets covered by this goal include achieving universal access to clean drinking water, increasing equity in access to clean sanitation and hygiene (with particular attention to women and girls in vulnerable situations) and increasing water quality by reducing pollution.

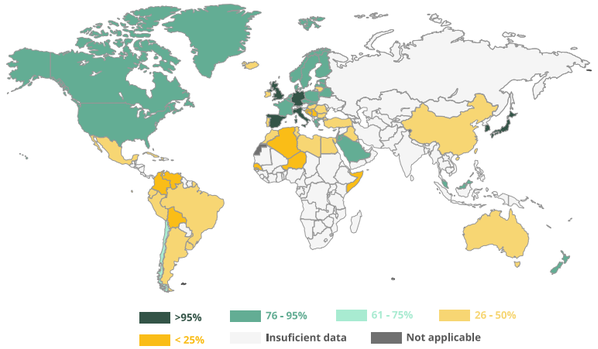
Table 7: Summary information for SDG 6.2

Target	Indicator (International)	Indicators (Mexico)
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.	**6.2.1a** Proportion of population using safely managed sanitation services (WHO/UNICEF).	None specified
	6.2.1b Proportion of population using a handwashing facility with soap and water available (WHO/UNICEF).	

Source: *Vivid Economics*

Specifically, SDG 6.2 aims to `achieve access to sanitation and hygiene services for all, and end open defecation.' This target is measured primarily by the proportion of the population using safely managed sanitation services, including a hand washing facility with soap and water. The proportion of the global population using basic sanitation services increased from 55% to 71% between 2000 and 2015.[76] This leaves 2.3 billion people without access to basic sanitation – 70% of which are in rural areas.

Figure 10: Proportion of population using safely managed sanitation services across countries in 2015



Source: *UN's 2018 synthesis on clean water and sanitation*

In a 2019 report, the United Nations International Children's Fund (UNICEF) underscores that access to sanitation is largely a rural problem (UNICEF, 2015). Rural areas are home to 72% of all people lacking basic sanitation. Diseases stemming from poor water sanitation have consequently hit the rural poor the hardest, with women and girls disproportionately affected. According to the same report, it is estimated that universal access to sanitation will not be met until 2043 at current funding levels. To meet the universal water, sanitation and hygiene (WASH) targets by 2030, it is estimated that USD28.4 billion will need to be invested annually. Three key roadblocks to progress on SDG 6 have been identified:

Political priorities and financing: many governments have struggled to make rural sanitation a national priority;[77]

Lack of results at scale: despite many existing interventions, many have struggled to generate equitable results at a national level; and,

Unproven approaches: UNICEF documents a 'shift from construction-driven approaches towards social mobilization and behavioral change approaches.' These approaches have had mixed results – a systematic review showed that most sanitation interventions have only increased latrine usage and coverage by 14 and 13 percent, respectively.

Focusing on gender equality in increased access to sanitation is a key element for meeting other SDG targets. In many developing countries, women spend much of their time gathering clean water for household use.[78] Gender inequity is further exacerbated by menstrual health issues that women and girls face as a result of poor water hygiene. Previous studies have documented that urban slums have particularly bad reproductive health issues caused in part by lack of access to basic sanitation (Rop, 2010; United Nations Women, 2018). By targeting gender-water equity, this will free up time for women and children to spend on various other activities in addition to improving health. Delivering SDG 6.2 can directly support SDG 5 (gender equality), SDG 3 (health) and SDG 1 (no poverty).

Much work has been done to define various metrics for understanding progress towards SDG 6. The key distinctions across sanitation services 'levels' are based on the quality of defecation processing. This ranges from private facilities used by a single household that hygienically dispose of waste (safely managed) to an absence of any facilities (open defecation). These definitions have been developed by the World Health Organization and UNICEF and are detailed in Box 2.

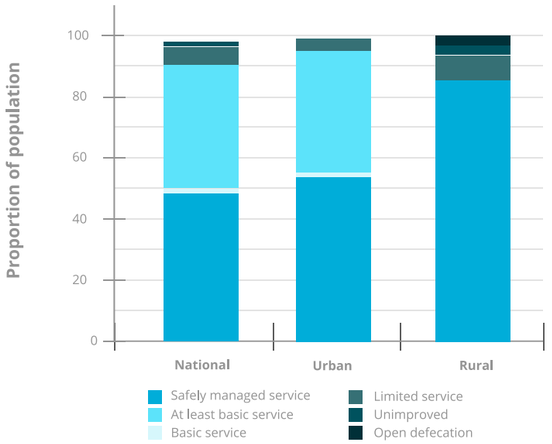
Box 2: Levels of sanitation service

- **Safely managed:** Private improved facility where fecal wastes are safely disposed on site or transported and treated off-site. This is the level of service required for all households by SDG 6.2, as measured through indicator 6.2.1.A.
- **Basic services:** Private improved facility which separates excreta from human contact.
- **Limited services:** facilities designed to hygienically separate excreta from human contact shared by two or more households.
- **Unimproved:** lack of facilities that separate excreta from human contact.
- **Open defecation:** lack of any facilities for defecating.

Mexico has made good progress expanding access to basic sanitation services nationally, but a significant proportion of the population still remains without safely managed sanitation services (SDG 6.2). In 2000, 18% of the population in Mexico had access to safely managed sanitation services. In 2017, this was up to 50% of the population. A much larger

share of the population (91%) have at least basic sanitation services. This indicates that to achieve SDG 6.2, roughly 62 million people need an improved level of WASH service. From 2017 to 2020, the population with safely managed sanitation services has increased from 50% to 57%. In 2020, 92% of the total population has access to basic sanitation services, with rural areas making the most significant contribution from 81% to 86%.

Figure 11: Mexico's progress towards indicator 6.2.1



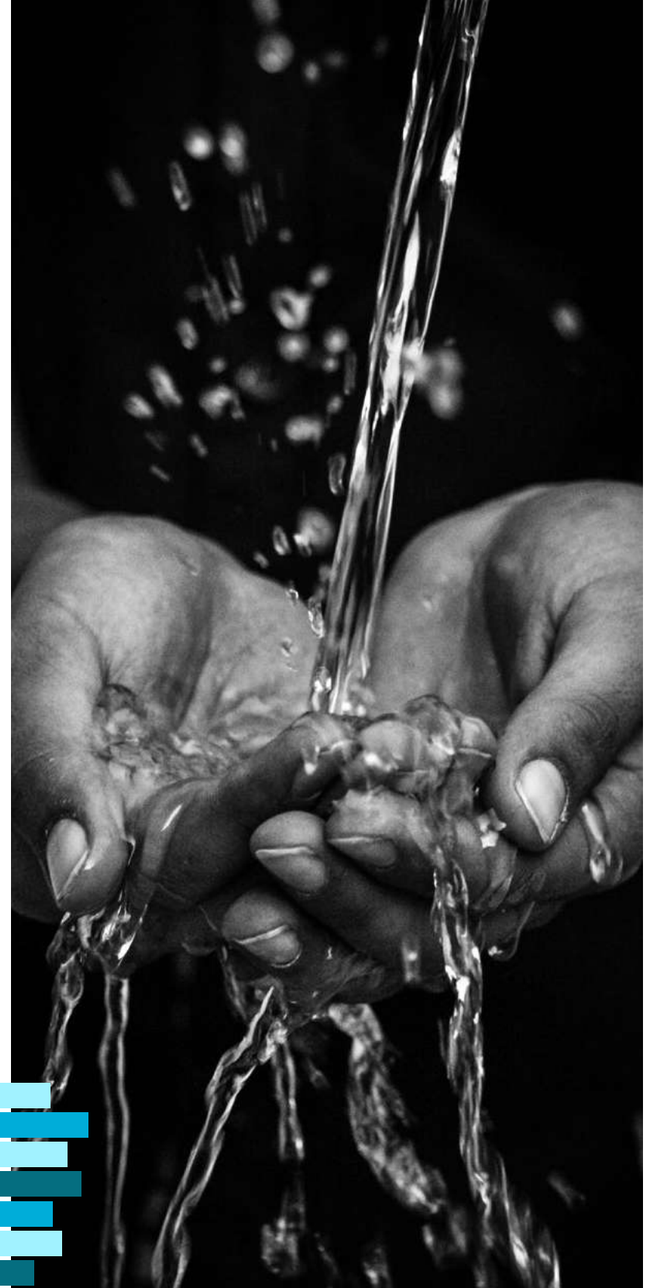
Source: *UN Water data accessed at: https://www.sdg6data.org/country-or-area/Mexico*

Water and sanitation policy in Mexico is conducted at both the federal level and state levels. The federal agency CONAGUA plays a large role in setting national standards and providing financing for sanitation projects. The 2007-2012 landmark `National Water Program' (Programa Nacional Hídrico (PNH)) was aimed at improving water utilization on many fronts, including sanitation. The latest version of this plan, drafted for delivery over 2019-2024, does include sanitation in its objectives, but only at the 'basic' level (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) & Comisión Nacional del Agua (CONAGUA), 2020). According to article 115 of the Constitution, municipalities are ultimately responsible for provision of drinking water, drainage, sewerage systems and treatment and disposal of sewage.[79]

Estimating costs for implementation in Mexico

Option 1 is to apply existing cost estimates to meet SDG 6.2 from a previous international study focussed on WASH interventions. Direct estimates of capital expenditures per person by country needed to meet SDG 6.2 are available in a study from 2016 (Hutton & Varughese, 2016). A straightforward application would be to take the direct capital investments needed per person for 'safely managed' services and scale this by the projected total population without access to these services from the present to 2030.[80] This analysis includes data specific to SDG 6.2 and Mexico (Hutton & Varughese, 2016).

The referenced study uses a quantitative cost model to estimate unit costs for 140 low- and middle-income countries. The model generates cost estimates by the desired sanitation level, differentiated by rural and urban areas within a country. Rural areas generally have higher per capita costs of service – reflecting a less dense population. The model uses data from an extensive literature review and was verified by 40 independent experts in different countries. The data are based on existing project and infrastructure costs.



Option 2 consists of scaling programs from international experience. Mexico has rules and guidelines for clean water but has not implemented a program specifically targeting safely managed sanitation services. Many countries have so estimated from these countries can be applied to estimate costs in Mexico, with the relevant value transfer assumptions applied. For example, in 2014 the government of India launched the "Swachh Bharat Mission-Gramin" or Clean India Mission – Rural. This program committed USD20 billion to build over 100 million toilets in rural areas with a goal of making rural India open defecation free (UNICEF, 2020). Programs like this can be scaled to Mexico and adjusted for differences in construction costs and population.

Option 3 would apply planned costs. Given the 2019-2024 PNH represents the federal government's plans for the sector, this option may not be possible given the detail in current plans. This assumption was tested with relevant stakeholders.

Mapping costs to sectors

Direct costs for SDG 6.2 can be mapped as sector specific investments to estimate the cross-cutting impacts of delivering the target against SDG 1.2. Specifically, 6.2 will require large capital expenditures to build the necessary infrastructure for clean sanitation (especially in rural areas). This can be assumed to translate to a large investment in the construction industry to build water and pipelines. A smaller portion of the expenditures for 6.2 go to labor to maintain and operate and maintain the infrastructure. According to (Hutton & Varughese, 2016), in 2020 roughly 62.5% of total expenditure for delivery of 6.2 goes to capital and 37.5% goes to operating and maintenance (OPEX). This report forecasts that between 2020 – 2029, OPEX is expected to take a larger share of total cost delivery costs. These forecasts are useful for refining cost estimates of SDG 6.2 delivery.

4.5.2 SDG 8.10: Access to financial services for all

SDG 8, 'Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all', aims to deliver economic growth in a way that incorporates the social and economic aims of Agenda 2030.

The targets covered by this goal include positive economic growth (as measured by Gross Domestic Product (GDP)), increased employment (including compliance with international rules for decent work) and universal access to financial services.

Table 8: Summary information for SDG 8.10

Target	Indicators (International)	Indicators (Mexico)
8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.	**8.10.1** Number of commercial bank branches and automated teller machines (ATMs) per 100,000 adults.	Percentage of adults who have an account.
	8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider.	*(Alternative: access to financial services by small and medium enterprises (or productive units)).*

Source: *Vivid Economics*

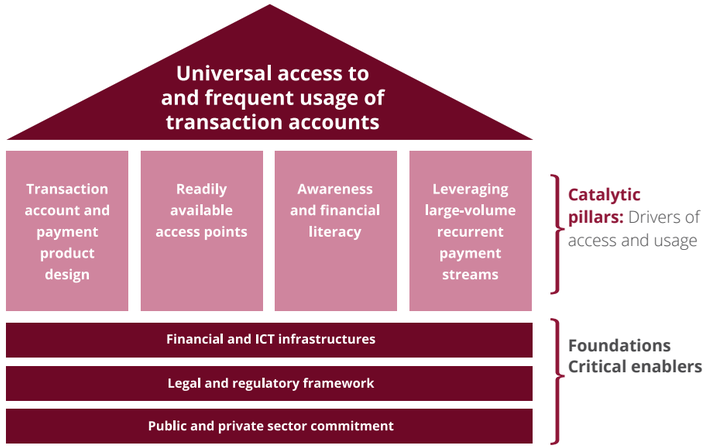
Specifically, SDG 8.10 calls for 'access to banking, insurance and financial services for all' through strengthened domestic financial institutions. This target is measured through the assessment of access by two channels: availability of financial institution access points (e.g. ATMs and bank branches) and penetration of bank accounts amongst the population. A 2019 global review conducted by the International Labor Organization found that 'extreme disparities in access to financial services' persist across the world (ILO, 2019). This global review finds that upper middle income countries (including Mexico) have an average of nearly 60% of adults with a bank account. A related measure, considering access to financial services for small and medium-sized firms is included under SDG 9, where indicator 9.3.2 measures the proportion of small-scale industries with a loan or line of credit.

Access to finance is a key ingredient for household level prosperity and economic mobility. Financial inclusion directly supports poverty alleviation and economic growth and in areas with low access to financial services, households face high interest rates and transaction costs for participating in the financial economy.[81] Access to financial services is an important enabling condition for other positive outcomes, including education, equality and innovation and has been identified as an enable for 7 of the SDGs.

The World Bank has launched a Universal Financial Access by 2020 (UFA2020) initiative that considers how mobile money technologies and other approaches can deliver against SDG 8.10.[82] This strategy includes three high level interventions to increase financial access in target countries:

- Draft and implement National Financial Inclusion Strategies (assumed to deliver financial services to 29.2 m adults in Mexico).
- Digitize government to person cash transfers (assumed to deliver financial services to 6.2 m adults in Mexico).
- Open the market and improve the legal/regulatory environment (assumed to deliver financial services to 35.6 m adults in Mexico).

Figure 12: Topics covered by the World Bank's UFA2020 strategy



Source: *World Bank Group (2018), accessed here: https://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020*

Digitalization and expanded internet access (SDG 9.c) can offer an effective and cost efficient way to increase financial access. In particular, the development of more robust digital systems for financial services can cover the cost of financial intermediation, reducing cost barriers for accessing and expanding banking and other services to populations currently without access (UN Digital Financing Task Force, 2020). To take advantage of these trends, governments and financial services providers must work hand in hand to apply new, low cost technologies to development objectives requiring expanding financial access. These reforms are likely to benefit from broader digitalization efforts, including digital identity development (which can lower barriers to creating a bank account).

Activity in Mexico related to target

Financial access in Mexico has significantly improved over the past decade but remains far from the global target. In Mexico, 47% of adults (46% of women and 48% of men) own a transaction account (up from 27% in 2011).[83] The proposed targets currently under consideration for delivery by 2030 are to increase this to 60% for all adults (59% of women and 62% of men),[84] though the global target is understood to require close to 100% access, so costing the delivery of the target will need to consider both.

Mexico's relevant national strategy considers a broader definition of financial access. The National Financial Inclusion Strategy aims that 77% of the Mexican population will hold at least one financial product[85] by 2024 (compared to 68% in 2018), and 46% of enterprises have held credit since they started operations (target of 63%) (Government of Mexico, 2020).

Recent progress on financial access in Mexico has included several projects and reports that can provide a template for estimating the cost of delivering further progress against the target. Specifically there are two sources that provide relevant data for cost estimation:

- The World Bank-funded Mexico Savings and Credit Consolidation and Financial Inclusion Project focussed on improving the performance of the country's credit and savings institutions and expanding financial services to underserved populations.[86] The project, delivered by the National Bank for Savings and Financial Services (BANSEFI, currently known as the Banco del Bienestar), mainstreamed 3.4 million people into the formal financial sector, expanded financial inclusion in rural areas to an additional 1.3 million people (59% women), enrolled 3.4 million people in deposit insurance (for a total of 9.5 m), offered financial education to 1.8 million people and created 3,800 additional points of access to financial services (2,400 of which represented new banking agents) covering 4.5 million people. The project ran from 2012 to 2017, cost around USD 200 m, half of which was provided as a World Bank (IBRD) loan and USD21 m from participating savings and credit entities (the balance from Mexican government). A signature program from this project, L@ Red de la Gente,[87] has continued past project close and is now available via a mobile app. BANSEFI has continued to implement efforts to deepen the financial services sector in Mexico, with 720 new banking agents incorporated through a new private network expanding financial services since 2017.

- The banking sector has also implemented measures to expand financial products. BBVA Bancomer has piloted alternative credit scoring methods and extending mobile banking to customers through the use of SMS messaging, via its open sandbox project. By connecting electronic banking to large retail chain, Banco Azteca added 8 million customers in 5 years (UN Digital Financing Task Force, 2020).

- The 2018 Financial Inclusion Report reports data on **1)** financial access points **2)** municipalities with access to financial services and **3)** population living in these municipalities. These are all supply-side measures and do directly map onto the targets of actual access, but are helpful in defining where gaps exist (Consejo Nacional de Inclusion Financiera, 2018).

Estimating costs for implementation in Mexico

There are several options to estimate costs for delivering SDG 8.10 in Mexico.

Option 1: scale up to target based on 2012 World Bank project. This option would require confirmation of project costs with project sponsor (BANSEFI) estimation of how specific activities could be extended to a larger share of the population.[88] This approach would apply a standard cost (e.g. USD 200/new account) to further expansion based on the costs of the 2012 project. In order to yield robust estimates, this costing would need to be verified against the specific details of the 2012 project to confirm 1) what share of project costs were directly applied to expanding the number of account holders, 2) how the current unbanked population in Mexico differs from the population affected by the 2012 intervention and 3) whether the policy and donor landscape going forward is likely to allow for a similar intervention or how interventions delivered through other modalities may affect costs. These details are best revealed through a combination of desktop research and stakeholder engagement.

Option 2: consider relevant interventions from international experience. The M-Pesa mobile money service in Kenya has been successful at expanding access to finance through the deployment of a mobile money platform delivered through a regional mobile phone operator. M-Pesa was able to reach a profitable operating margin of around 10% after 2 years of operation (Lyons, 2010). CGAP looked at whether this experience can be transferred to Latin America. In Mexico Oxxo serves a similar market, processing 85 million transactions per month across its network of 14,000 stores in 2015.[89]

Option 3: apply planned costs for delivery of financial of financial inclusion strategies such as those shared from BANSEFI, CNBV or other stakeholders. Based on planned costs identified through engagement with stakeholders, this option may require some combination of the other costing options to develop a complete set of delivery costs.

Mapping costs to sectors

Direct costs identified for SDG 8.10 can be mapped onto a sector specific investment to measure progress against cross-cutting impacts discussed in section 4. Specifically, interventions to deliver 8.10 are likely to result in spending within the financial services (banks) and public administration sectors. This spending can be modelled as a capital shock to the aggregated 'services' sector. Based on an assessment of likely funding sources, this capital will be sourced from a combination external public funds (e.g. World Bank grants and loans), domestic public resources (government spending) and external/domestic private sector investment (based on which banks, if any, may be involved in delivering identified interventions).

4.5.3 SDG 9.c: Increased access to internet and communications technology

SDG 9 aims to 'fund projects that provide basic infrastructure'.

The targets covered by this goal include achieving promoting sustainable infrastructure, enhancing scientific research, upgrading financial services, and substantially increasing access to internet services by 2020.

Table 9: Summary information for SDG 9.c

Target	Indicators (International)	Indicators (Mexico)
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.	**9.c.1** Proportion of population covered by a mobile network, by technology.	None specified

Source: *Vivid Economics*

Specifically, SDG 9.C seeks to `significantly increase access to information and communications technology.'[90] This target is measured through the proportion of the population covered by a mobile network. According to a 2019 report by the International Telecommunications Union (ITU) and the UN Education, Science and Culture Organization (UNESCO), 58% of households worldwide have access to the internet, up from only 19% in 2005 (ITU, 2019). Despite this significant increase in household internet access globally, many countries still face a low rate of connectivity. The experience of internet users also varies considerably across countries – in 2017 the average US internet user consumed 99 GB per month of data compared to Africa where users consumed only 7.2 GB per month on average.

Access to mobile internet devices, such as smartphones, is a key element for promoting universal internet access, particularly in developing countries. The same ITU report documents that 59% of users in developing countries that used the internet within the last three months were exclusively on mobile phones. Mobile phones represent a `leap frog' technology, that can connect users previously without internet access to information, markets, and any other benefits the internet can offer. A study of mobile phone access in the Nigerian wheat sector found that access to mobile phones increased profit by 29% (Aker & Mbiti, 2010). Broadband can serve as an alternative to mobile phone access.

The ITU and UNESCO have provided a list of specific goals for increased internet access that is in line with other SDGs. These goals have two major points relevant to SDG 9.c. First, entry level internet services should be affordable (less than 2% of monthly gross national income). Second, developing countries should strive for 65% internet penetration by 2025. These policies promote four 'pillars' of the impacts associated with greater internet access:

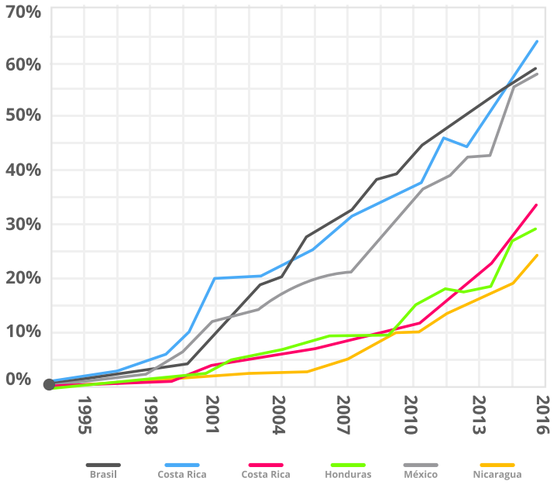
- **greater business connectivity (SDGs 8 and 1),**
- **education (SDG 4),**[91]
- **financial access (SDG 8),**
- **equality (SDG 10).**

The educational and inequality improvements associated with greater internet access are particularly relevant due to COVID19. Lockdowns around the world have drastically increased dependence on remote learning technologies, of which the poor have less access to.

Activity in Mexico related to target

Mexico has made substantial progress towards universal internet coverage relative to other Latin American countries. Internet connectivity has nearly doubled in Mexico from 2010 to 2016, increasing from 31% to 59%. Today, 72% of the population has access to the internet.[92] While the progress is promising, nearly 30% of the population remain unconnected from the internet equating to approximately 33 million people without the internet. Figure 13 provides the share of the population using the internet in various Latin American countries over time.

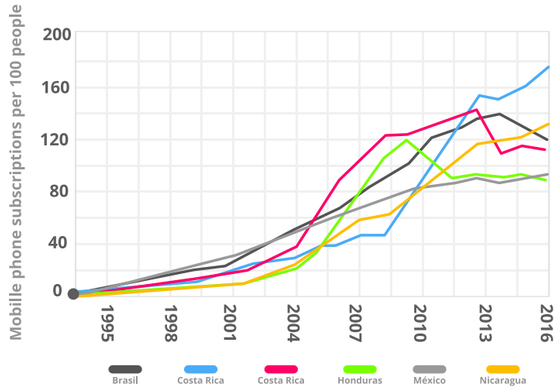
Figure 13: Central and South America Internet adoption



Source: *Vivid Economics based on World Bank data*

Progress on mobile phone access in Mexico has been slower than in other central and south American countries. Since Mexico has a very high rate of overall internet penetration, the lack of mobile cell phone subscriptions presents an opportunity to deliver against target 9.c cost effectively. As of 2017, Mexico ranked last out of six Latin American countries in terms of mobile cell phone subscriptions per 100 people. Initial progress in Mexico for mobile phone penetration was promising, but growth slowed significantly around 2010. Figure 14 illustrates mobile cell phone adoption in Latin American countries over time.

Figure 14: Mobile cell phone adoption in South and Central America



Source: *Vivid Economics based on World Bank data*

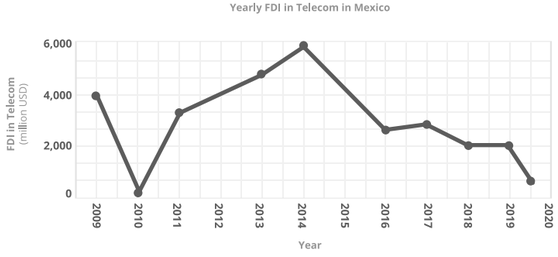
Mexico's unique market history may provide some insights for low mobile phone adoption rates relative to other Central American countries. Mexico's original telecommunications company `Telemex' was a state run monopoly. The organization was privatized in the 1990s but still owns a substantial proportion of the market. Telmex and `Telcel' are both owned by América Móvil. Through this arrangement, a single owner controls roughly 80% of the telephone lines in the country (Meyer, 2014).

In 2014, Mexico implemented major telecommunications reforms (the 'National Digital Strategy') aimed to restructure the industry, with consumers and lower prices as key features of the agenda (Baker, 2017). The strategy was included as part of Mexico's 2013 - 2018 National Development Plan and addresses digital challenges Mexico faces. The strategy outlines five focus areas that telecommunications policy will impact: 1) Government Transformation, 2) Digital Economy, 3) Quality Education, 4) Universal, Effective Health, and 5) Public Safety. The policy vehicles through which these five targets will be impacted can be summarized by three key features of the proposed legislation (Ruiz, 2013):

- **Foster competition** by labeling companies that control more than 50 percent of the telecommunications and broadcasting markets as "preponderant actors" and subjecting them to regulations and tariffs;
- **Establish access to telecommunications as a human right** (included as an amendment in Mexico's constitution); and,
- **Create the Federal Telecommunications Institute** (IFT in Spanish) to enforce and design regulation to promote competition and technology access.

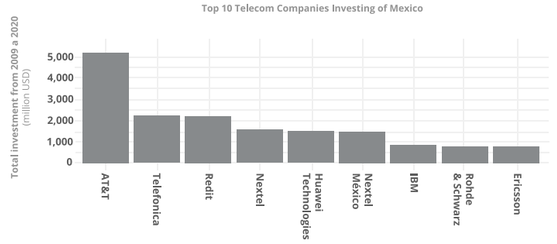
These market reforms have encouraged to a diversification of the telecoms market in Mexico. Figure 15 and Figure 16 demonstrate the significant levels of foreign investment in the sector following these reforms and the major international investors. According to a 2016 market research report by Global Systems for Mobile Communications, these reforms lead to `aggressive pricing strategies' by new market entrants such as AT&T (GSMA, 2016). As a result of the increased competition, telecommunication prices fell by 23.2%. This may lend an explanation for the large increase in the share of individuals using the internet in Mexico between 2010 and 2016 (Insituto Federal de Telecomunicaciones, 2016).

Figure 15: Foreign direct investment (FDI) in Mexican telecommunications sector (2010-2020)



Source: *Vivid Economics, based on fDiMarkets investment data*

Figure 16: Major investors in Mexico's telecom sector (2010- 2020)



Source: *Vivid Economics, based on investment data from fDiMarkets database*

These reforms are complemented by significant infrastructure investments to expand broadband access. Mexico is currently implementing a large-scale internet access program through its Red Compartida project,[93] which will allow private sector partners to invest USD 7 billion from 2017-2024 in an effort to provide access to 92.2% of the population. In addition to this, the government invested USD1 bn to install internet connections in schools, libraries and hospitals nationwide through its 'Mexico Conectado' program.[94] These investments aim to support the deployment of Mexico's 5G network.

COVID19 and Mexico's relatively low cell-phone penetration present a unique opportunity to deliver on multiple SDG targets. Preliminary studies have indicated that COVID19 is increasing educational inequality, as wealthier individuals have more access to resources conducive to remote learning (Aucejo et al., 2020). Cell phones, tablets, and computers are essential elements for remote learning, and Mexico's relatively low rates of technology adoption expose them to the risk of widening inequality. While SDG 9.c is linked to many other SDG targets, COVID19 has strengthened the connections between internet connectivity and SDG 4 (quality education), SDG 10 (reduced inequalities) and SDG 1 (no poverty).

Estimating costs for implementation in Mexico

Delivering SDG 9.c will likely require a large amount of investment, but not necessarily from the government. This SDG will largely be delivered through lower prices and greater FDI, meaning the costs (and revenues) will be borne by the service providers and, in turn, their customers. To reach the 'last mile' portion of the population, the government may need to subsidize infrastructure development that would be too costly for private firms to invest in. The 'Red Compartida' project provides a potential roadmap for partial delivery of the target (up to 92% access), leveraging partnership with private sector investors to extend access.

The primary option for estimating the cost of achieving SDG 9.c is measured by scaling private investments. Local stakeholders need to be engaged to gather data on investment costs in telecommunications infrastructure, which can in part be estimated by FDI flows in the sector. INEGI provides the National Survey on Availability and Use of Information and Technologies,[95] which contains detailed data on individual internet and mobile device use from 2015-2019. Combining this with public and private investment costs yields an average cost of delivery per person, which can then be scaled to estimate additional costs for expanding access.

The 'last mile' population should be carefully considered as internet access delivery is significantly more expensive. Key cost hurdles to reaching rural populations with internet connection include geographic access problems due to distance and terrain, lack of basic infrastructure (electricity and roads), and low population density that with low income (ITU, 2014). For example, in Africa GMSA estimates that delivery of internet services is 18% higher in rural locations and 35% higher in remote (sparsely populated) areas in Africa (ITU, 2019). These dynamics can be applied to the unit costs estimated from previous investments to calculate costs for accessing the residual population with internet services from the 'Red Compartida' program.

Where data is not available, the second option is to examine international projects and adjust them according to Mexico's current situation. According to a 2019 report by the Broadband Institute for Sustainable Development, USD 109 billion will be needed to achieve broadband access for all in Africa (Broadband Institute for Sustainable Development, 2019). This comprehensive report details the assumptions and data sources needed for the methodology behind this figure. The detail provided in the report serves as an excellent platform for scaling these estimates to the Mexican context. The full model is detailed in the report, but the key cost assumptions are:

- ***Capital expenditures*** are estimated for three main network segments: mobile and radio, network backhaul (e.g satellite) and satellite for remote areas;
- ***Operation expenditures*** include annual maintenance costs; and,
- ***Skill and content costs*** include the availability of local labor and training required to maintain networks.

The third option is to apply planned costs from existing policies. This option can be partially delivered from the 'Red Compartida' project costs, as well as any additional plans discovered through stakeholder engagement.

Mapping costs to sectors

Direct costs for SDG 9.c are mapped into a sector specific investment to measure progress against SDG 1.2 as a result of the cross-cutting impacts. Specifically, since 9.c will require large capital expenditures to build the necessary infrastructure for internet access (especially in rural areas). This translates to a large investment in the construction industry. A smaller portion of the expenditures for 9.c go to labor to maintain and operate the network, and thus some of the estimate will be directed to services. Stakeholders will be engaged to understand the breakdown of capital (construction) vs labor (services) cost. If in-country data is not available, assumptions can be applied from previous studies.[96]

4.5.4 SDG 12.3: Halve food waste

SDG 12, 'Ensure sustainable consumption and production patterns', aims to promote sustainable production and consumption through efficient resource utilization.

The targets covered by this goal include achieving efficient use of natural resources, halving global food waste, managing chemical waste in an environmentally sound manner, and promote sustainable production processes.

Table 10: Summary information for SDG 12.3

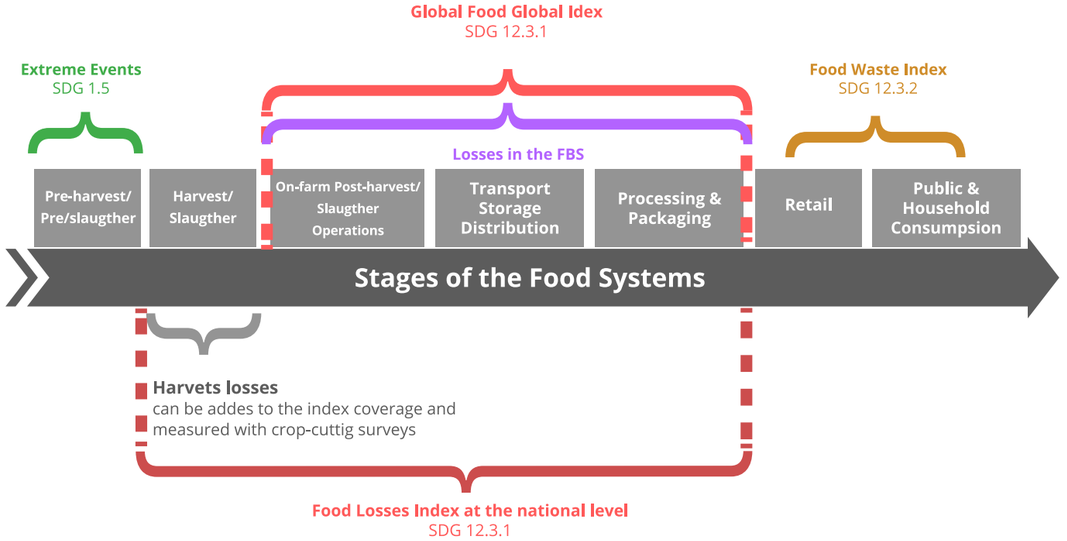
Target	Indicators (International)	Indicators (Mexico)
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.	**12.3.1** Global food loss index.	None proposed

Source: *Vivid Economics*

Target 12.3 under this goal aims to reduce food waste and loss through a two part target focussed on 1) reducing food waste in the sale and consumption of food and 2) developing a more efficient food production system that increases the share of agricultural products that make it to market. The focus on developing a more sustainable food system has strong linkages to other SDG targets related to human health, economic growth and environmental protection. According to the UN Development Program (UNDP), 1.3 billion tonnes (or 1/3) of food are wasted yearly while hunger and malnutrition continue to be significant problems around the world. The environmental consequences of food waste are significant; 22% of global carbon emissions come from the food sector and 8% of global emissions are associated with food waste alone (Poore & Nemecek, 2018). Wasted food also contributes to reduced agricultural productivity (SDG2), increased flows of waste (SDG12) and where matched with malnutrition indicates a failure in global and national markets.

Progress against the two aims of SDG 12.3 is measured through a pair of complementary indices: the Global Food Loss Index (GFLI), created by FAO, and the food waste index, developed by the UN Environment Programme. The GFLI 'measures the changes in percentage losses for a basket of 10 main commodities by country in comparison with a base period' (FAO, n.d.). As show in Figure 17, the food loss index considers lost volumes of food from harvest to retail, including 4 stages of marketing food products: harvest/slaughter, on-farm post-harvest/slaughter operations, transport storage and distribution and processing and packaging. The 'food waste index' accounts for wasted food from retail and consumption activities (UNEP, n.d.).

Figure 17: SDG 12.3 is measured through two indices considering the full supply chain for agricultural products

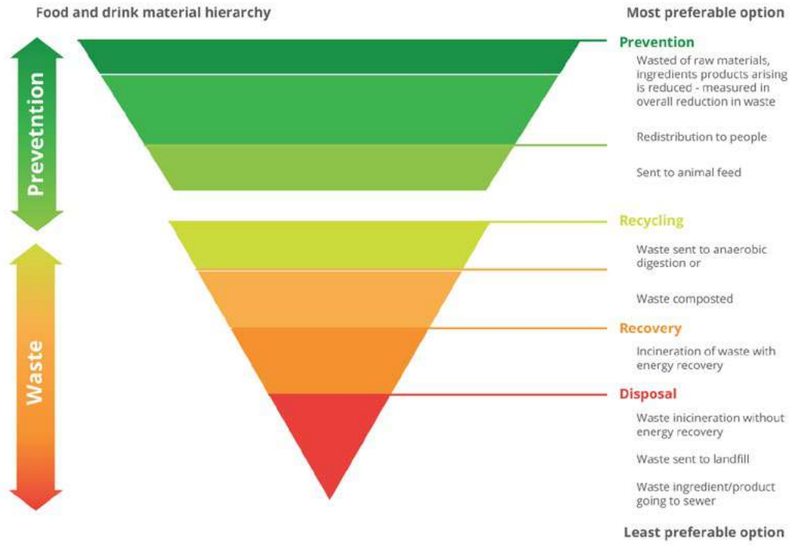


Soruce: *FAO, 2018.*

These indices are still in development and have not been calculated for all countries. However, the methodology for each index is transparent, allowing for a close estimation of both indices. Food losses can be measured through food balance data maintained by the FAO[97] while food waste can be proxied from municipal solid waste data aggregated by the World Bank. Where country-specific analysis has been undertaken, alternative measures may be available, as is the case for Mexico.

Addressing food loss and waste requires consideration of food supply chains. Key contributors to food loss include large scale barriers including climate change/drought, pests, and poor infrastructure to connect producers to market. Interventions that improve harvest techniques, educate processors on food quality and increase the resilience of seeds and harvest technology are all amongst the recommendations for reducing food loss (Delgado et al., 2017). Food waste can be mitigated through waste management and consumer awareness raising.

Figure 18: Hierarchy of intervention areas for reducing food loss and waste



Source: *WBG 2019 based on WRA*

Activity in Mexico related to target

At 35%, Mexico's estimated food loss and waste rate is slightly above the global average of 30% (World Bank, 2019). According to FAO data, food losses from 2015-2017 in Mexico averaged around 6% of all food produced in the country (5.8% amongst the top 10 commodities). These losses are highest amongst rice (29%), Maize (16%) and soybeans (32%). According to the What A Waste 2.0 report, Mexico's municipal solid waste has a high share of food organic matter (52%), especially when compared with other upper middle income countries, amongst which the average organic matter content of MSW is 43% (The World Bank Group, 2018). This amounts to nearly 28 million tonnes of food waste on an annual basis, compared to around 10 million tonnes of food losses before retail.[98] Together, food loss and waste can also have a significant economic impact. The World Bank estimated that food loss and waste cost Mexico USD25 billion, or 2.5% of the national GDP (World Bank, 2019).

There is not currently a national strategy for food loss and waste (FLW) in Mexico, though the preliminary analysis has been conducted, as summarized in Conceptual Framework for a national Strategy of Food Loss and Waste. This report calls for a 'farm to fork' approach to food loss and waste, including a national strategy including (i) preventing FLW; (ii) food recovery and donation, so that every piece of suitable food is destined for human consumption; (iii) channelling FLW to animal feed; (iv) food recycling and recovery; and (v) final disposal.

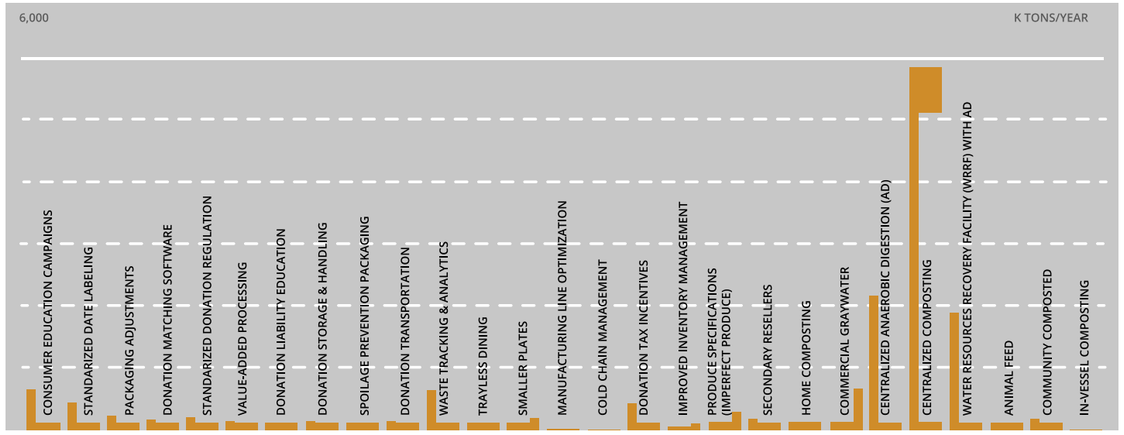
This is important in the context of the water and environmental footprint of Mexico's agricultural sector, which consumes more than 70% of the freshwater resources and remains the second largest emitter of GHGs – at 12% of the total in 2018 – after the energy sector. An analysis estimated that FLW arising from the production of 22 products required 40 billion cubic meters of water a year (World Bank, 2019).

Estimating costs for implementation in Mexico

Option 1 – *scale existing projects.* Interventions to address food waste must be consumer focussed rather than producer focussed. Composting projects, both on large scale as seen in Mexico City and at the household level can provide a model for costs to address high rates of food waste.

Option 2 - *Apply values from other studies/projects.* A study in the US (Refed) found centralised composting is amongst the most effective interventions at actually reducing FLW, though a range of awareness raising and education activities across the supply chain can deliver results at low costs (ReFED Collaborative., 2016). At USD500 m for 500 m tonnes/year diversion, composting costs can be calculated quite directly as well as the other 26 interventions.

Figure 19: Effectiveness of FLW interventions considered for the USA



Source: *Refed (www.refed.com/analysis?sort=diversion-potential).*

Option 3 – *assume national plans correct.* This is unlikely to be useful for FLW in Mexico until a relevant national strategy is developed, but engagement with relevant stakeholders may yield useful data from activities related to preparing this strategy.

Mapping costs to sectors

Direct costs for delivering SDG 12.3 could be mapped into a sector specific investment to measure progress against SDG 1.2 as a result of the cross-cutting impacts. Depending on the balance of interventions, the likely sectors affected will include agriculture (for upstream interventions targeting food loss), trade (for retail-oriented interventions) and services (for solid waste interventions and awareness raising campaigns). The sources of capital are likely to be domestic, unless a clear donor interest is identified.

4.5.5 SDG 15.5: Protect habitats to reverse the loss of biodiversity

SDG 15, 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss', aims to improve the land based natural world.

The targets covered by this goal include conserving ecosystems, combatting desertification, promoting biodiversity and protecting endangered species.

Table 11: Summary information for SDG 15.5

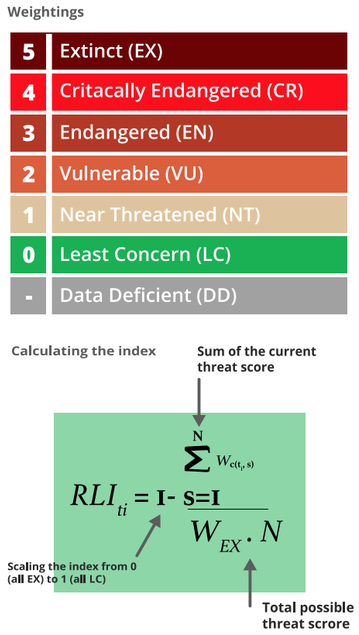
Target	Indicators (International)	Indicators (Mexico)
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	**15.5.1** Red List Index	Percentage of terrestrial protected natural areas that increase or maintain its surface with vegetation cover, or that present losses of less than 5%. Percentage of Payment for Environmental Services that correspond to territories of native peoples.

Source: *Vivid Economics*

Specifically, SDG 15.5 calls for urgent and significant action to preserve natural habitats and protect both biodiversity and endangered species. Globally, biodiversity has been declining for decades. In the year 2000 there were approximately 10,000 species in danger of extinction – in 2020 this number has tripled to over 30,000 (IUCN, 2019). This target is primarily measured via the Red List Index (RLI), developed by the International Union for Conservation of Nature (IUCN), which serves as a measure of biodiversity across a country's ecosystems.

The RLI is measured nationally for five taxonomic groups: mammals, birds, amphibians, reef-forming corals and cycads (plants). The RLI is a continuous index, ranging from zero to one. A RLI value of zero for a specific species indicates that a species has gone extinct while a RLI value of one means that the species is not expected to go extinct in the foreseeable future. RLI values closer to one indicate that on average, species are less in danger of extinction within a country, while a value closer to zero indicates more species are in danger of extinction. The index values and weights are described in Figure 20.

Figure 20: RLI values and index construction



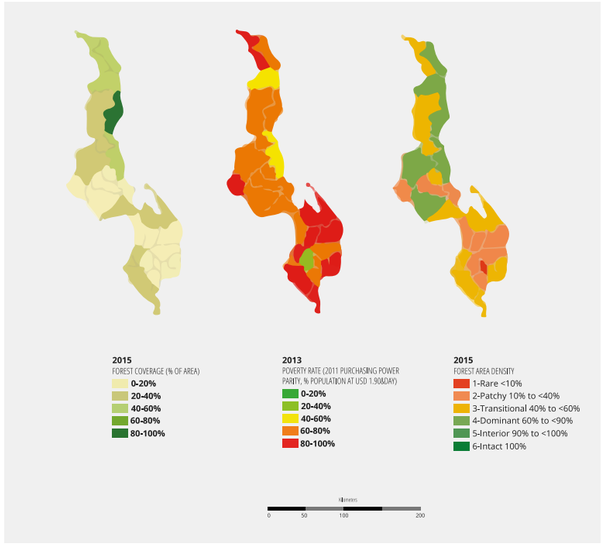
Note: *In the formula, W is the weight (from zero to five), and the numerator sums over all species (s, of which there are N). The denominator represents the maximum score possible if all species were extinct (the total number of species N multiplied by the index weight of being extinct (5 in this case)).*

Source: *ICUN, 2014.*

Preserving habitats (especially forested areas) is a key element for stopping biodiversity loss and promoting economic wellbeing in developing countries. According to a 2020 report by the United Nations Environment Program (UNEP) and FAO, forests provide homes to more than 80% of amphibian species, 75% of bird species, and 68% of mammal species (UNEP & FAO, 2020) Many developing countries depend heavily on forests and natural resources for basic economic needs such as food and income. Halting biodiversity loss (and thus protecting forests) is also essential for global food security, and thus it is in the interest of nations globally to conserve forest resources. Figure 21 underscores the relationship between forestry cover and poverty in Malawi. Areas with higher poverty levels are strongly correlated with lower forestry levels.

Recognizing misaligned economic incentives is critical for halting biodiversity loss and conserving wildlife habitats. Delivering SDG 15.5 will require global and national efforts to recognize what is commonly referred to as the 'tragedy of the commons' – a situation in which public goods (e.g. forests) are overconsumed because no one individual has the incentive to conserve. For example, farmers living in forested areas may choose to clear land to grow additional crops if they are not compensated for the public goods provided by the forest. Overconsumption of public goods is a common type of externality (or market failure) and economics presents an array of possible solutions for these types of problems, including through direct compensation of land users as is facilitated through Payment for Ecosystem Services (PES) programs.

Figure 21: Forestry Cover and Poverty in Malawi



Source: *UNEP*

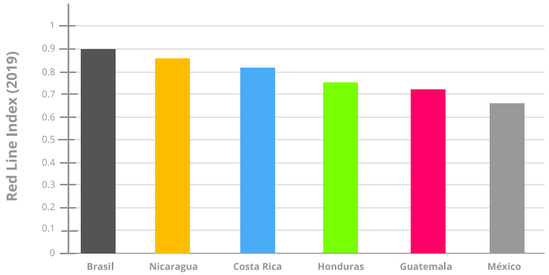
The solution space for preserving forests and promoting biodiversity is large, giving policymakers many options for making progress towards SDG 15.5. The policy pursued needs to be context dependent as many countries (such as Mexico) have unique land rights systems, so pursuing a 'blanket' strategy is ineffective. Broadly, there are three key areas for intervention:

- ***Development of national parks, forests, and other protected areas*** - to prevent further development and enforce policies protecting natural habitats;
- ***Development of new habitats*** – including reforestation and afforestation programs to develop new habitats; and,
- ***Incentive based policies*** - such as PES programs that compensate land users for the conservation of habitats.

Activity in Mexico related to target

Relative to other countries in Latin America, Mexico ranks relatively low in biodiversity (as measured by the Red List Index). This difference has been persistent across time, and Mexico has consistently scored below Central and Southern American RLI values over the past three decades.[99] Mexico's RLI has steadily declined from 0.73 in 1993 to 0.67 in 2019. Figure 22 gives RLI values for 2019 for major countries in Latin America.

Figure 22: RLI for Latin America in 2019



Source: *Vivid Economics, based on Our World in Data*

From 1990-2020 Mexico lost roughly 4.9 million ha of naturally regenerating forest – the equivalent of 6.9% of its total forest in 1990.[100] Achieving sustainable levels of deforestation is crucial for meeting other SDG targets and delivers upon multiple targets. Reducing deforestation is directly linked to SDG 8 (decent work and economic growth), SDG 9 (Industry, Innovation, and Infrastructure) and it supports SDG 6 (Clean Water and Sanitation) (GIZ, 2019).

Mexico's current deforestation policy is a mix of federal laws and local regulations and standards. Mexico's forests are home to roughly 10 million people, most of which inhabit political boundaries referred to as 'ejidoes' and 'communidades agragrias'. In these communities, forests are common property and managed by the locality. Up to 60% of the forests in Mexico are owned by these communities[101] – many of which are indigenous. While the indigenous populations have many land rights, they have less economic power to protect their natural capital (Klooster & Masera, 2000). Federal regulators establish logging standards and work in conjunction with local leaders and experts.

Forests are protected in Mexico under the National Natural Protected Areas Commission (CONANP), with support from the National Forestry Commission (CONAFOR). CONANP is a federal agency that oversees the protection and conservation of 182 wildlife areas (natural parks, biosphere reserves, etc.) totalling 908,310 km2 of protected land. In light of the economic crisis spurred by COVID19, CONANP's budget has come under threat, with 75% cuts likely, leading to a closure of all offices in the Yucatán peninsula, including the Mexican Caribbean biosphere reserve – the largest biosphere reserve in the country (Varillas, 2020). Aside from formally protected areas, CONAFOR contributes to the protection of forests by participating in the formulation of sustainable forestry development policy.[102]

To address deforestation, the Mexican government has additionally implemented a "payments for ecosystems" program through CONAFOR. These programs are voluntary and compensate local landowners and communities for conserving their land. Since PES programs are voluntary, there is some concern that landowners that join them would already conserve their land and the effect of the program would be minimal. Empirical evidence provides strong evidence that Mexico's PES design has overcome this issue (Alix-Garcia et al., 2019). Specifically, Mexico's program has adopted two unique measures:

- Targeted payments to particular areas of the country that prioritizes land based on deforestation risk; and,
- Differentiated payments based on risk level and ecosystem type.

Mexico's PES programs have been shown to reduce deforestation by 30-40% in high risk areas (Alix-Garcia et al., 2019). Furthermore, this has led to behavioral changes. Using survey data, their study found that households devoted an extra 2.7 days per year to forest management after receiving the program which provides evidence in support of other SDG targets (8, for example).

Estimating costs for implementation in Mexico

The first option is to use something similar to option one of the overall costing methodology. This would involve scaling multiple policies. First, unit costs per conserved km2 can be recovered from previous programs. Land varies in value depending on where it is located and the natural resources it covers. Accounting for the opportunity cost of land when estimating the costs of conservation is a natural approach and previous studies have used this idea (Naidoo & Ricketts, 2006). Not only will land conservation costs vary spatially but revenues as well. Protected natural areas have the potential to generate tourism revenue (contributing to SDG 1 (no poverty) and SDG 8 (decent work and economic growth)). In the second quarter of 2018 tourism revenues for were estimated to be USD2.53 billion for the Yucatán Peninsula.

The second option is to combine land protection programs (such as PES) with afforestation. Since PES programs are voluntary (and thus not 100% successful at protecting land), combining this policy with afforestation can achieve SDG 15.5. Given Mexico's complex land rights system, PES programs will be particularly relevant as it has the potential to both protect land while safeguarding the economic rights of indigenous populations. The Mexican government pays anywhere from 16-80 USD per hectare per year in the current PES program, and deforestation risks have been shown to fall 30-40% for areas included in the PES (Alix-Garcia et al., 2019). Afforestation costs can be estimated from scaling international examples to Mexico and adjusting to reflect differences in land and labor costs.

The third option is to apply planned costs from relevant strategies. For example, Mexico has a National reducing emissions from deforestation and forest degradation (REDD+) strategy.

Mapping costs to sectors

Direct costs for SDG 15.5 can be mapped to a sector specific investment to measure progress against SDG 1.2 as a result of the cross-cutting impacts. The cost of implementing SDG 15.5 can be mapped into Agriculture and Service sector investments. Payments for Ecosystems programs transfer income to landowners that would otherwise be engaged in some agricultural good production with the land. Setting aside land for parks and national reserves requires labor to maintain and protect the land, which equates to an investment in services.

4.5.6 SDG 16.5: Reduce corruption and bribery

SDG 16, 'Promote just, peaceful and inclusive societies', aims to reduce violence and government corruption through strengthened institutions.

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

The targets covered by this goal include ending abuse towards children of all forms, promoting equal access to rule of law, reduce illicit financial and arms flows, and reduce corruption and bribery in all forms.

Table 12: Summary information for SDG 16.5

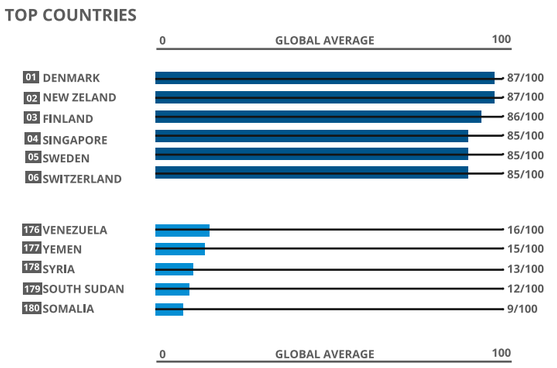
Target	Indicators (international)	Indicators (Mexico)
16.5 Substantially reduce corruption and bribery in all their forms.	**16.5.1** Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months.	Corruption prevalence rate when carrying out a personal procedure.
	16.5.2 Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months.	

Source: *Vivid Economics*

Specifically, SDG 16.5 calls for reduced corruption and bribery. This target is measured through the assessment of access by two channels: individual people that bribed public officials and businesses that bribed government officials. Global corruption varies significantly, and trust in public institutions is much lower in developing countries. The UNDP estimates that global corruption costs the world USD1.26 trillion per year– which alone is enough to meet SDG 1 (end poverty everywhere) for 6 years.[103] Accurate data on the true extent of a country's corruption is often hard to obtain due to the nature of how corruption is measured.

To complement direct (and sometimes incomplete) corruption measures, the public's perception of corruption is often used. Transparency International maintains a Corruption Perception Index "corruption perception index". The index is scored from 0 to 100, where a lower score indicates higher levels of perceived corruption. Globally, two thirds of countries received a poor corruption perception index score and sub-Saharan Africa had the lowest score of out of all regions. The least and most perceived corrupt countries are displayed in Figure 23.

Figure 23: Highest and lowest scoring corruption perception index countries



Source: *https://www.transparency.org/en/cpi/2019.*

Reducing corruption in public and private institutions is key for meeting many other SDG targets. Corruption in the public sector leads to inefficient uses of government revenues and suboptimal policies. According to the UN Global Compact (UNGC), the delivery of SDG 16 leads to positive impacts on SDG 5 (gender equality) and SDG 10 (reduced inequalities) through more inclusive institutions. Supporting SDG 16 also leads to progress on SDG 1 (no poverty) and SDG 8 (decent work and economic growth) through the creation of a stable and predictable business environment.

As set out in the UK Prosperity Fund's Anti-Corruption programme, there are three key interventions for reducing corruption and thus delivering SDG 16.5 (UK Government, 2018). These are summarized in Box 3

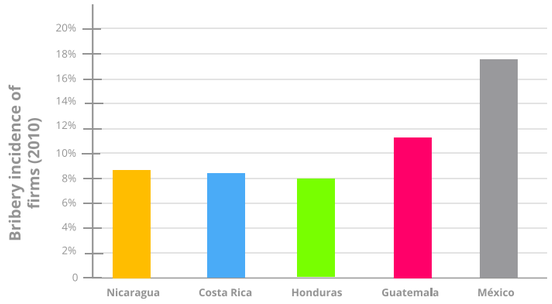
Box 3: Interventions for reducing corruption

Intervention 1 (transparency): Adoption of clearer, consistent, traceable processes and standards for identifying and investigating serious crime and corruption.

Activity to Date in Mexico

Corruption in Mexico has often been described as "endemic" in scale.[104] Mexico's perceived corruption index was 29 in 2019 – ranking them 130/180 of all countries measured. Public perception of institutions in Mexico has slowly fallen since 2011, with the largest increase in perceived corruption occurring between 2014 and 2016. Compared to other Latin American countries, Mexico has a significantly higher incidence of bribery (indicator 16.5.2). Figure 24 provides a visualization of indicator 16.5.2 for Mexico and other countries.

Figure 24: Indicator 16.5.2 across countries in South and Central America



Notes: *Bribery incidence is the percentage of firms experiencing at least one bribe payment request across 6 public transactions dealing with utilities access, permits, licenses, and taxes.*

Source: *Vivid Economics, based on World Bank data*

The estimated economic costs of corruption in Mexico are as much as 10% of GDP.[105] In 2015, there were 4.5 million registered acts of corruption, and it is estimated that 93.3% percent of all corruption victims did not file a complaint.[106] The Mexican Institute for Competitiveness estimates that corruption 'reduces investment by 5% and eliminates 480,000 jobs from small and medium sized businesses every year'.[107]

To combat the pervasive level of corruption, Mexico implemented a landmark anti-corruption program, the National Anti-Corruption System ('Sistema Nacional Anticorrupción', SNA). The key elements of this system are the creation of:

- *a 'coordinating committee'*, which is made up of representatives from seven independent Mexican institutions in charge of designing and implementing specific anti-corruption policies.
- *a 'citizen participation committee'*, which is composed of five civil service leaders (appointed by the federal senate).
- *an 'autonomous anti-corruption prosecutor'*, with a specialty in prosecuting cases of government corruption.

While this ambitious framework established good guidelines for reducing corruption in Mexico, progress has been slow. Many Mexican states have not formed the mandatory committees set forth by the law.[108] Additionally, it was not until 2019 that the first anti-corruption prosecutor was appointed.[109] Mexico already has a solid, but underutilized framework for combatting corruption. Fighting corruption will not only likely require additional monetary investments, but a government motivated to implement any added measures. An initial review suggests that the national corruption platform has been underutilized, despite having solid infrastructure established. For example, recent reports suggest that the prosecutor's office is severely understaffed;[110] scaling the labor costs of this program is a direct way to estimate the implementation of Intervention 2. Implementing interventions to improve transparency often involves creating clear and consistent public use data for government transactions.

Fiscal transparency, in line with Intervention 1, will play an important role in ensuring government accountability for spending on crisis response and recovery. Portals such as Fuerza Mexico[111] (set up by the Government's budget transparency initiative with the support of the US Agency for International Development) that tracked relief and reconstruction activities following 2017 earthquake in Mexico can serve as models and provide lessons. Updated sites have expanded transparency to day-to-day spending of Federal offices government contracts.

Estimating costs for implementation in Mexico

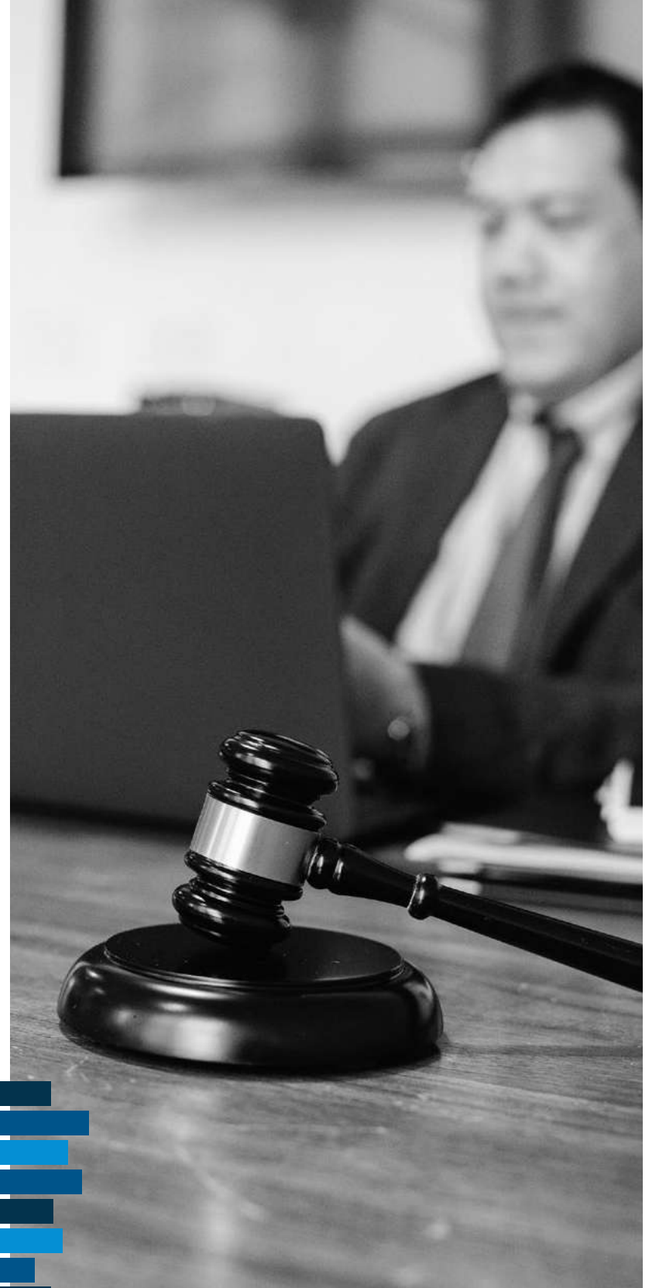
The first option is to scale existing interventions, including the work of the anti-corruption prosecutor in Mexico as well as partner programs focused on reducing corruption, such as the UK Prosperity Fund's Anti-Corruption program in Mexico. The inclusion of partner programs directly focused on building capacity for fight corruption reflects initiatives established by international cooperation and donor entities, such as USAID[112], GIZ[113], and PNUD[114], which work directly with the actors of the national anti-corruption policy and civil society. Engagement with relevant stakeholders provided a more detailed picture of what interventions have been delivered, for what cost and with what impacts. For example, the Fourth National Action Plan 2019-2021 has committed to implementing a pilot project in five social programs of the Federal Government that allows through citizen participation mechanisms, which includes identifying the traceability of public spending, detecting areas of risk for compliance of objectives and goals, as well as probable acts of corruption, and initiating complaint procedures in case of irregularities.[115] These exercises are being replicated at the local level and the results of the evaluation for state and local social programs are presented to the local citizen participation committees, in order to build a joint action strategy for corruption risk mitigation. The process to construct citizen participation mechanism at both local and national levels would require government expenditure to achieve.

Option 2 includes applying costs from international experience reducing corruption. This may include applying the costs for developing a transparency database that encompasses state as well as federal government, conducting anti-corruption training for civil servants, or other interventions.

Option 3 allows for the adoption of specific costs that have been assessed for delivery of the Anti-corruption strategies in place. These was explored through stakeholder engagement.

Mapping costs to sectors

Direct costs for SDG 16.5 can be mapped to sector specific investments to measure progress against SDG 1.2 as a result of the cross-cutting impacts. The entirety of this target is delivered through interventions that require increasing labor inputs (e.g. increased transparency, capacity, and criminal prosecution) in the Services sector, which includes a 'public administration' subsector.



4.6 National poverty policy in Mexico

Federal policies focussed on direct poverty alleviation level are outlined in the Plan Nacional de Desarrollo 2019-2024 (National Plan). The National Plan sets out the Government's main objectives and is structured around three themes: Politics and Governance, Social Policy and Economy.

The National Plan's Social Policy theme includes 'social programs' aimed at reducing poverty and increasing welfare. The plan includes 9 programs, which are set out in Table 1. Three of these are new programs: Pensión para el Bienestar de las Personas con Discapacidad, Jóvenes Construyendo el Futuro and Sembrando Vida.

Each program targets specific demographics, according to their age. This approach reflects the government's aim to support citizen welfare throughout all life stages.

Table 13: Nine social programs are set out in the National Plan of Development (2019-2024)

Program name	Objective
Programa para el Bienestar de las Personas Adultas Mayores	Financial universal support to women and men over 68 years of age throughout the country.
Programa Pensión para el Bienestar de las Personas con Discapacidad	Financial support to girls, boys and young people up to 29 years of age who have permanent disabilities, as well as people with disabilities from 0 to 64 years old who live in indigenous communities.
Programa Nacional de Becas para el Bienestar Benito Juárez	Financial support to girls, boys and young people under 18 years of age, whose homes are in a situation of extreme poverty and who study in a public school, from Initial and Basic Education, High School Education and Higher Education.
Jóvenes Construyendo el Futuro	Financial support to young people between 18 and 29 years of age who are not studying or working, so that they can train or intern for one year. The grants/scholarship include health insurance.
Jóvenes Escribiendo el Futuro	Financial support for people who are enrolled in a school-based higher education institution, are under 29 years old, do not receive another grant from the federal government, and live in a home in poverty. Priority is given to indigenous and Afro-descendant women, indigenous and Afro-descendant men, people who live in a priority care area, and people who live in contexts of violence.
Sembrando Vida	Financial support to farmers who live in rural localities and who have an income below the rural welfare line and who are owners or possessors of 2.5 hectares available to implement agroforestry. It can also include technical assistance or purchase of inputs for recipients. Covers specific states.
Programa Nacional de Reconstrucción	Financial support to people population affected by the earthquakes of September 2017 and February 2018. Priority is given to those who live in areas with a higher degree of marginalization, with a predominantly indigenous population or with high rates of violence Covers specific states.
Programa de Mejoramiento Urbano y Vivienda	Rehabilitation and / or improvement works of public spaces. Covers specific cities.
Programa de Microcréditos para el Bienestar	One million small businesses to have access to credits for the purchase of supplies and tools.

Source: *Plan Nacional de Desarrollo 2019–2024.*

Spending on Federal social policy

In 2020, the federal government allocated Mex$1,063,220 million for 149 social programs. The note on information for the budget allocation (Información Para El Proceso Presupuestario) includes information on the share of budget allocated to social budgets. CONEVAL provides a further breakdown of spending on social programs by area ("ramo").

However, CONEVAL highlights the fact that budget allocation does not always correspond to the performance achieved by social programs, and actual spending for each program is not yet available. Other departments such as HACIENDA may have a further disaggregated breakdown of the government's actual spending on these programs. CONEVAL is currently conducting an evaluation of social policy over the past two years, which is expected to be available in November 2020.

Impacts of Federal social policy

According to CONEVAL, social programs and policies achieved 66% of their targets in 2019. Targets refer to the indicators that social programs have in the beginning of the year. Indicators for most social program and policy are available in CONEVAL's repository of social programs and actions.

It is not yet possible to translate actual spending on social programs into performance or impact. CONEVAL has not yet published actual performance of the government in each of the social programs and policies. Table 14 lays out each program's main target and corresponding budget.

Data on spending and impacts for social programs in Mexico can be used to estimate the cost of delivering SDG 1.2 though redistribution of income. Specifically, programs including "Programa para el Bienestar de las Personas Adultas Mayores" and "Programa Pensión para el Bienestar de las Personas con Discapacidad" can be assumed to most directly target broad poverty alleviation. If the government spends the entire allocated budget to these programs and achieves the given targets for each program, a per capita cost can be estimated. Using these hypotheses, the cost of reducing poverty amounts to Mex$11,507 per person over one year. This is equivalent to a third of the annual minimum Federal wage and therefore is likely a lower bound of the cost of delivering SDG 1.2.

To deliver SDG 1.2 (reduce poverty by 50% by 2030), about Mex$350,000 million would be required each year, assuming that poverty reduction impacts are limited to 1 year. According to CONEVAL, 49% of the Mexican population (61 million people) lived under the poverty income line in 2018. Assuming the same amount of people living under the poverty line in 2020, and based on the cost to reduce poverty set out above, it would cost the government approximately Mex$350,000 million to reduce by half of those currently in poverty above the poverty line for one year. This is equivalent to about a third of the government's budget in social programs in 2020.

Table 14: Pensions and scholarships are the programs with most beneficiaries

Program name	Main target (2018)	Main target (2019)	Budget (2019)
Programa para el Bienestar de las Personas Adultas Mayores	8,481,255 beneficiaries		Mex$100,000 million
Programa Pensión para el Bienestar de las Personas con Discapacidad		817,007 beneficiaries	Mex$7,000 million
Programa Nacional de Becas para el Bienestar Benito Juárez		317,000 beneficiaries.	Mex$ 1,700 million
Jóvenes Construyendo el Futuro	931,000 beneficiaries	300,000 beneficiaries	Mex$ 44,300 million.
Jóvenes Escribiendo el Futuro			
Sembrando Vida	207,000 beneficiaries	400,000 beneficiaries	Mex$ 15,000 million
Programa Nacional de Reconstrucción	52,311 reconstruction initiatives		Mex$ 8,000 million
Programa de Mejoramiento Urbano y Vivienda			Mex$ 8,000 million
Programa de Microcréditos para el Bienestar		475,459 beneficiaries	Mex$ 3,000 million

Note: *Targets are for 2018. CONEVAL has not reported progress against targets for 2019 or 2020.*
Source: *CONEVAL; HACIENDA*

References chapter 4

Estimating the co-benefits of direct SDG spending

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84. Based on communication with the 2030 Directorate in the Office of the Mexican President

85. This measure refers to accounts, credits, insurance and retirement savings accounts. It may be calculated differently from the measure referred to in the Government's Agenda 2030 strategy. An alternative measure is provided in the National Financial Inclusion Strategy for 'percentage of adults with at least one account' which is estimated at 47% in 2018 and targeted to increase to 65% by 2024.

86. https://www.worldbank.org/en/results/2018/07/02/profundizar-la-inclusion-financiera-en-areas-rurales-de-mexico

87. A network of entities offering a range of financial services, such as international and national remittances, third-party payments, and micro-insurance, among others

88. 2030 population estimates calculated using UN DESA population projections: https://population.un.org/wpp/Download/Standard/Population/

89. https://www.cgap.org/blog/replication-limits-m-pesa-latin-america

90. The target is more ambitious for the poorest countries, striving to provide universal access to the internet for Least Developed Countries by 2020.para 2020.

91. Note that for increased internet access to have a positive impact on educational outcomes, it should be accompanied by interventions related to teacher training, curriculum review and digital skill development, among others.

92. https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2021/OtrTemEcon/ENDUTIH_2020.pdf

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95. http://en.www.inegi.org.mx/programas/enoe/15ymas/default.html#Microdata

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98. Other sources cite a smaller total of food loss and waste in Mexico (c. 20 million tonnes before retail and another 11 millions tonnes from retail and consumption) (World Bank, 2019)

99. See Our World in Data on Mexico's RLI value over time (along with other central American countries).

100. http://www.fao.org/documents/card/en/c/ca9825en

101. The estimated proportion varies by source, ranging from 45% to 60%. See Madrid et al. (http://www2.inecc.gob.mx/publicaciones2/gacetas/627/propiedad.pdf), Comunidades y Bosques (https://comunidadesybosques.ccmss.org.mx/cobertura_forestal_y_nucleos_agrarios.php) and CONAFOR (http://www.conafor.gob.mx:8080/documentos/docs/1/7825El%20Estado%20que%20guarda%20el%20Sector%20Forestal%20en%20M%C3%A9xico%202020.pdf).

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Annex 1: Estimating sector-specific SDG target implementation costs

Implementation costs for sector-specific targets can be estimated using a bottom-up direct approach reflecting national plans and project experience. There are three distinct stages to direct target estimation:

- **Stage 1:** review progress to date against targets and analyze both the existing literature and data available for quantification. Identify any relevant gaps in the data.
- **Stage 2:** select the appropriate costing methodology (from a menu of options presented for each target). This depends on the outcome of stage one.
- **Stage 3:** conduct the analysis (cost the targets) and interpret the results.

This annex discusses the first two stages of this process.

Direct SDG targets are delivered through a combination of public or private investments in specific (sometimes multiple) sectors. Many SDG targets such as 6.2 (access to sanitation) can be delivered through large scale infrastructure projects and result in a profile of sector-specific capital expenditures that will deliver against relevant targets. Importantly, the capital expenditures can come from either private or public sources – further analysis can identify specifically the financing profile for the delivery of each target. Table 6 provides an overview of how SDG targets are linked to capital investment in specific sectors.

Table 15: Mapping between direct SDG targets and sector specific capital expenditures.

Direct SDG Targer	Relevant Sector
6.2 – Achieve access to adequate and equitable sanitation and hygiene for all.	Construction
9.c – Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet.	Construction, Services
8.10 – Access to banking/financial services for all.	Services
12.3 – Halve per capita global food waste/loss.	Agriculture, Trade, Services
SDG 15.5 – Halt the loss of biodiversity, prevent extinction of threatened species and conserve ecosystems.	Agriculture, Services
SDG 16.5 – Substantially reduce corruption and bribery.	Services

Note: *Sectors are based on the microdata available from Mexico's National Survey of Occupation and Employment, 'Trade' refers to retail and wholesale of goods within Mexico*

Source: *Vivid Economics*

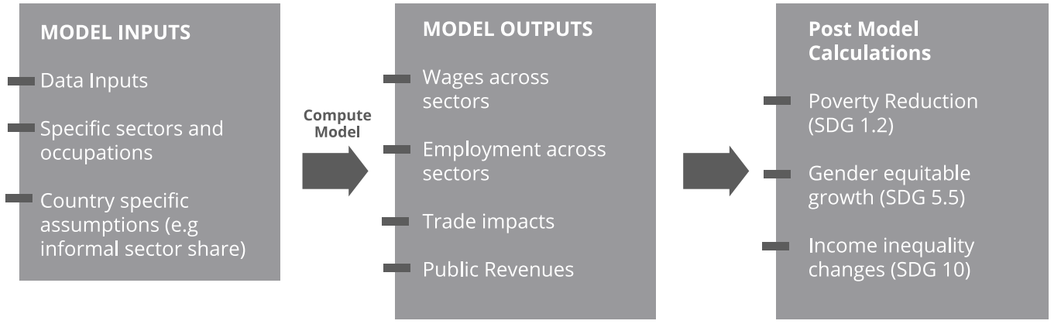
The remainder of this annex provides an in-depth analysis of each of the direct targets. Each subsection contains a review of each target, the progress and relevant policies to date in the context of Mexico and considerations for estimating costs to deliver the target by 2030. SDG 1.2 is discussed in separate annexes as progress towards this target is measured as a result of the cross-cutting impacts estimated from direct capital investments associated with the six targets considered in this annex.

Annex 2: CGE Analysis: Process

There are three distinct stages in the application of a CGE model to estimate cross-cutting impacts from SDG spending. These are shown in Figure 25 and include:

- **1.** model setup and key assumptions (such as data inputs, modeled sectors);
- **2.** computation of the inputs and estimation of a broad range of outputs; and,
- **3.** interpretation of model results and application of external statistics to understand results in the context of a specific policy.

Figure 25: CGE Model Process Overview

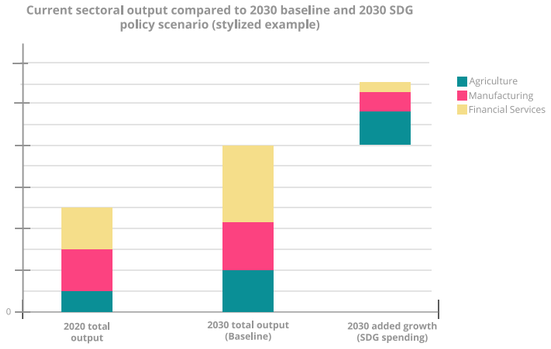


Note: *Exact data inputs will vary based on the specific CGE model used and policy scenario simulated. Common data inputs include GDP growth forecasts, employment and energy prices.*

Source: *Vivid Economics*

In this process, model computation requires the definition of baseline and policy scenarios. The first step is to compute the "baseline" scenario. In this case, the model projects a range of outputs (such as employment across sectors) to a given year (e.g calculate a projection of Mexico's employment profile in 2030 with no policy intervention). Economic growth is assumed to follow a business as usual pathway in the baseline scenario in order to provide a benchmark for the policy scenario. The second step is to compute the projected outputs in the "policy scenario", (e.g simulate the economy with SDG spending). This will produce a different set of outputs. The difference between the policy scenario and the baseline case provides a estimate of the policy. Figure 26 provides a visual representation of this process.

Figure 26: A stylized example of how to estimate policy impacts with CGE models



Note: *2030 total output (Baseline) represents projected growth in selected sectors in the absence of SDG spending. 2030 added growth (SDG spending) represents the additional growth in each sector (and thus total) from the profile of SDG spending.*

Source: *Vivid Economics*

There are three main takeaways from this example. First, the CGE model assumes a baseline level of economic growth in the absence of any intervention (in line with national plans). Second, additional economic growth can be delivered as a result of spending associated with the implementation of SDG targets. In a CGE model, economic growth is driven by changes in labor, capital (such as FDI), or productivity. Many of the targets (such as 9.c) are assumed to be delivered through additional capital and thus spur additional economic growth. Since sectors and households are linked, FDI in one sector can spill over into another through spending multipliers. Second, interventions can have unequal impacts on sectors. In the example illustrated above, estimated SDG spending added the most output to the agricultural sector, and the least to financial services. This feature of CGE models is key for understanding how investment in a particular sector impacts wider economywide targets such as SDG 1.2 (poverty reduction).

Annex 3: CGE inputs

CGE models generally have multiple key inputs needed in addition to the policy scenario inputs (e.g. profile of SDG spending). These inputs can be thought of as a calibration of the model to a specific economy. The majority of these data inputs come from the GTAP database or national statistical agencies. This section details the model inputs and relevant data sources for an illustrative example of Mexico.

There are ten sectors that were selected for GViEW's representation of the Mexican economy, aligned in this case to national labor statistics for Mexico. The GTAP database has a disaggregated set of 56 sectors, but using a high number of sectors will increase the complexity of the CGE model and reduce the robustness of results. In order to simplify the model, these sectors must be grouped into a format that matches national data.There are two important considerations when choosing sector groups in the model. First, sectors should be selected to capture the majority of employment in the country of interest. Second, the selection criteria should examine relevant sectors to costing specific SDG targets. For this application of GViEW, the sectors were chosen to jointly reflect the majority of employment in Mexico (ILO Services, 2008), and allow for observation of SDG targeted spending on specific sectors of the economy. These sectors are given in Table 7 and a specific mapping against GTAP disaggregated sectors is provided in the appendix to this report.

Table 16: GViEW model sectors for the Mexican Economy

Sector	
1. Agriculture	5. Services
2. Construction	6. Other
3. Manufacturing	7. Unspecified
4. Trade	

Note: *Sectors are aligned to labor statistics available from INEGI.*

Source: *Vivid Economics*

Within sectors, CGE models analyze labor inputs (and wages) across various occupations. GTAP data is disaggregated into 5 occupation types. In the case of Mexico, the set of occupations is again aligned to national labor statistics, which have a more disaggregated schedule of occupations that can be mapped to GTAP occupation types as shown in the appendix of this report. Table 8 provides the types of occupations considered in the model.

Table 17: GViEW model occupations

Type	Occupation
I	Managers (including officials)
II	Technicians
III	Agricultural workers and unskilled workers
IV	Service & shop workers, machine operators, assembly workers
V	Clerks

Source: *Vivid Economics*

Local stakeholder engagement can be useful to confirm the relevance of sectors and occupations selected for modeling. Sector and occupation groups may vary by national context (e.g. if the services sector is larger) and policy aims.

Annex 4: Model Assumptions and Processes

Input assumptions shape modeling approach and resulting outputs to measuring the net economic benefits of SDG spending. This section describes these assumptions and provides an overview of the modeling processes. Some of the assumptions are broad and apply to any application of the CGE model (such as the constant government deficit), while others are specific to the Mexican economy. The majority of assumptions are applied to model outputs off-model (or after the CGE model has been run) to interpret impacts on relevant SDG metrics. Key assumptions are detailed in Table 18.

Table 18: Key assumptions for measuring progress towards SDG 1.2 with CGE models

Assumption	Description	Justification
1.Wage Distribution	The wage distribution for a given sector-occupation pair (e.g. Services – Managers) shifts only in level and scale and not by shape (% of wages for managers in the services sector remains constant).	Allows for poverty and gender equality calculations.
2. Informal Sector Share	The share of the economy that is considered "informal" (does not pay income tax) changes with GDP growth. This elasticity is different for each country and can be measured using time series data for the relevant country.	Omitting the informal sector in developing countries will provide an unrealistic projection of future government revenues.
3. Sectoral Gender Growth	Gender shares in all sectors are in equilibrium – meaning that if a sector is 80% male and 20% female and 100 new jobs are added to the sector, 80 of the individuals will be male and 20 will be female.	Allows for economywide assessment of gender impacts across sectors.
4. Government Budget	Government has a constant deficit, in line with IMF projections (International Monetary Fund, 2019).	Government spending assumed not to change significantly as a response to policy intervention given sensitivity of debt levels to international financial markets.
5. Poverty Reductions	Wage increases over time are compared to national poverty level assumptions.	Allows estimation of impacts for poverty-specific targets (e.g. 1.2).
6. Labor market size	Assume labor market grows in line with population growth projections.	Allows for distributional and poverty assessment.
7. Labor Mobility	A base level of 'churn' is reflected in the background of the model and not explicitly modelled. Retirements/retrainings = new labor market entries.	In the absence of specific data, constant replacement is a reasonable assumption.
8. Source of capital	A sector-level assumption will be made for direct spending modelled in the policy scenario.	inance sources for SDG implementation will differ by target. E.g. private sector investment for infrastructure projects can be estimated from the World Bank's Private Participation in Infrastructure database and fDiMarkets transaction level data.
9. Inflation	Inflation is constant at 4.5%. This is based off the 20 year average annual inflation rates for Mexico (as calculated by INEGI).	This assumption is to calculate the projected poverty line in Mexico to understand how SDG 1.2 is impacted via sectoral spending.

Note: *Some assumptions, such as functional forms chosen for individual utility and production are omitted. These are some of the most "technical" assumptions (mathematically) and are common across CGE models. For a detailed discussion see (Böhringer et al., 2003).*

Source: *Vivid Economics*

The assumptions listed above summarize the inputs needed for the model. Once these inputs are obtained the modeler can compute a "baseline" scenario (no policy) and "policy scenario" and calculate the difference between these two projections to obtain the estimated effect of the policy. The actual computation of the model is mathematically and computationally intensive and requires an economic modeling expert familiar with the specific CGE model applied to compute.

Annex 5: Model Outputs

CGE models produce a broad set of outputs, including wages and returns to capital by sector. These outputs are useful for understanding the effects of a policy. In the case of costing SDG target implementation, the model can be used to understand the effect of SDG spending on poverty reduction and the gender employment gap. SDG 5 explicitly states gender equitable economic growth is a priority, and this can be assessed with a post model calculation. Table 10 provides a summary of CGE model outputs and the relevant SDG targets.

Table 19: Potential CGE Model Outputs

Output	Level	SDG Target
Employment	Sector-occupation	8.1, 8.2, 1.1
Wages	Sector-ccupation	8.1, 8.2, 1.1
Manufacturing as a share of total output	Sector	9.2
Government Revenue	National	All
Government Expenditures	National	All
Fuel prices	National	1.2
Imports (value)	National	1.2 (based on the potential impacts on imported household goods in closed economies)
Exports (value)	National	17.11
Carbon emissions	Sector	13.1

Note: *The outputs in this list are not exhaustive for all CGE models, rather it captures key elements that could be included as outputs of many CGE models (such as GViEW).*

Source: *Vivid Economics*

Annex 6: Post model calculations

CGE modeling provides various outputs that can be useful for understanding the effects of SDG spending on the wider economy. The model produces a value of output (Gross Value Added (GVA) or Gross Domestic Product) in each sector for both policy and baseline scenarios. The difference in each sector's output between the scenarios provides an estimate of the impacts on growth (SDG 8). Sectors will be differentially impacted based on the substitutability of inputs and capital expenditures.

Constructing a projected distribution of wages for every sector-occupation pair is a crucial step for aligning the model's output with SDG cross-cutting relevant to wages across groups (including SDGs 1, 5, 9). The CGE model will directly provide a share of output used to pay wages (GVA to labor). This aggregate flow can be applied to a distribution of labor in each sector-occupation pair to model impacts relevant to poverty and equality. To construct a projected distribution of wages for a given sector-occupation, there are four steps:

- Construct the 'empirical' distribution of wages for a given sector-occupation pair based on national labor statistics. For the case of Mexico, this comes from individual level labor force statistics provided by INEGI.
- Calculate the projected labor market size for 2030 at the sector-occupation pair level (apply population growth assumptions to 2020 empirical data and allow for distribution in line with CGE 'GVA to Labor' outputs).
- Use the projected average wage for the given sector-occupation (GVA to labor divided by employment in each sector-occupation pair). Shift the center of the 2020 empirical distribution to the projected average wage to construct the projected 2030 distribution.
- Use the projected number of workers for a given sector-occupation to scale the projected distribution. For example, if a sector-occupation pair starts with 1,000 workers in 2020, and grows to 2,000 workers by 2030, then the overall scale of the distribution needs to be doubled.

With the projected wage distribution in hand, the extent to which specific SDG targets are estimated to be delivered can be understood. There are various potential uses for this distribution – including the amount to which poverty is reduced (SDG 1.2). These are summarized in Box 4.

Box 4: Estimating poverty and gender impacts from SDG spending

Estimate poverty reductions (SDG 1.2) by combining the projected poverty line and wage distributions. There are three steps of this analysis:

1. Calculate a projected national poverty line based on national definition. In Mexico, this is done by combining a constant inflation rate and using the current consumer price index produced by INEGI.a

2. Use the projected wage distribution for each sector and combine this with the projected poverty line. Estimate the number of people below the 2030 poverty line in each sector-occupation pair by calculating the area under the curve up to the poverty line (in practice this is done via numeric integration).

3. Compare the total number of people in poverty from 2020 to the same in 2030 and interpret the results.

CGE model outputs can also be used to explore how income inequality evolves over time as a result of policy interventions. As discussed above, wages across sectors can be used to construct a projected profile of wages across sector-occupations. The impact of SDG spending specifically on wage inequality with CGE models can be estimated by comparing the spread (variance) of the full economy wage distribution (all sectors summed) under the policy scenario to the baseline scenario. If the spread is larger under the policy scenario then wage inequality has increased and if it is smaller, then wage inequality has decreased. More sophisticated options are available for estimating wage inequality (such as constructing a Gini Index) – however, this will yield qualitatively similar conclusions.

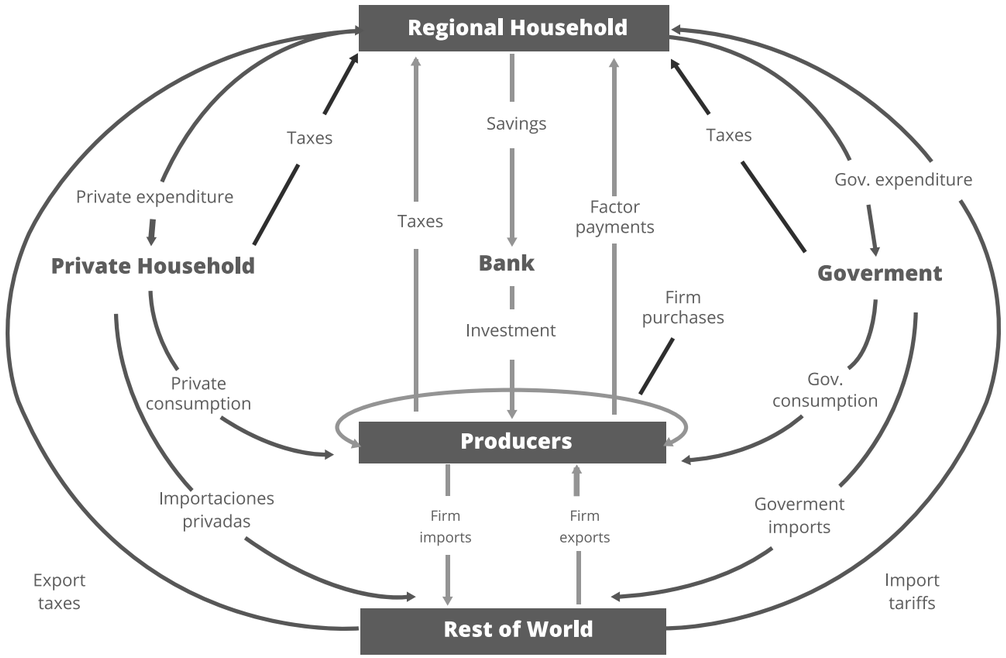
By applying informal employment assumptions, public revenues projected by the model can be tested for robustness. Research has shown that the informal share of a national economy is correlated with lower per capita income (and, when aggregated, lower GVA). The CGE model assumes all workers in the economy are 'formally employed.' This assumption results in overestimation of projected government revenues for countries with a large informal sector share of employment, since informal workers contribute to GVA but not tax revenues. To account for the informal economy in projecting government revenues, there are three options:

- Assume the informal share is fixed at current levels. Adjust projected revenues by the formal vs informal share. For example, if formal employment is 80% of total employment, adjust forecasted government revenues to be 20% lower.
- Assume the informal sector share is growing or shrinking at a country specific rate based on historical data. For example, if the informal sector share of employment shrinks by 0.5% per year, assume this will continue until 2030 and estimate the projected informal share. Then adjust government revenues based on the forecasted formal vs informal share
- Assume the informal employment share is zero and document that government revenues will be overestimated. This option should only be used where data on informal employment is not available or not reliable.

Annex 7: Schematic of example CGE model

Households consume a basket of goods that they pay for with wage earnings from firms and capital earnings from invested assets. Taken together, these modelled features capture important linkages that allow for direct investments to spill over into many facets of the economy. The interactions modelled in GViEW are represented diagrammatically in Figure 27:

Figure 27: Modeled economic interactions in GViEW



Note: *The representation of the above only shows the linkages between various economic actors in the model and not the strength of the linkages.*

Source: *Vivid Economics*

Annex 8: Mapping GTAP data to national statistics

Table 20: Mapping between official Mexican Sectors and GTAP sectors

Mexican sector	GTAP Sectors (Codes)
Agricultural	1–25
Manifacturing	26–45
Construction	46
Trade	47
Services	48–55
Other	56
Unspecified	Not applicable

Note: *A detailed description of the GTAP codes can be found at the GTAP https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector57.asp. Mexican sectors come from INEGI.*

Source: *Vivid Economics*

Table 21: Mapping between Mexican official occupations and GTAP occupations

Mexico occupation	GTAP occupation
Officials and managers	Officials and Managers
Professionals, technicians and art workers	Technicians
Office workers	Clerks
Merchants Personal service workers Education workers Workers in protection and surveillance	Service/shop workers
Agricultural Workers Artisan industrial workers and helpers Unspecified	Agricultural and unskilled workers

Note: *Mexican sectors sourced from INEGI*

Source: *Vivid Economics*

Annex 9: An overview of social policy programs in Mexico

Broadly speaking, there are three mechanisms by which poverty can be reduced by 2030:

- **1.** 'Grow' out of poverty – economywide GDP per capita growth lifts incomes across society, primary impacting those living closest to the poverty line. Central bank projections reflecting the COVID-19 pandemic provide a long-term picture for how this growth may be distributed over time.
- **2.** Spill-over effects from spending programs and infrastructure projects – spending associated with delivery of key programs and projects, as estimated for six sector-specific SDG targets in the analysis Vivid is undertaking for GIZ/SE. These spill-over effects are primarily tied to the introduction of new capital stocks (e.g. foreign investment) into the economy, which will be distributed across supply chains as modelled in Vivid's ViEW CGE model.
- **3.** Redistributive policies – Government programs to provide social protection and income support across vulnerable communities. The cost and impact of these policies are explored through consideration of national commitments and evaluations from accountable organizations including CONEVAL. Looking forward to 2030, this approach will be considered for the 'residual gap to target' after considering the impact of background growth and spill-over effects.

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Company profile

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