ASSESSMENT OF THE IMPACT OF 2022/23 GOVERNMENT INVESTMENTS ON NATURAL CAPITAL IN UGANDA

using a Rapid Environment Economic Assessment Model

With support from

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1. Introduction

According to a 2018 World Bank report, The Changing Wealth of Nations, close to one-third of wealth in low-income countries such as Uganda comes from natural capital. The depletion of natural resources therefore represents a significant constraint to sustainable growth and poverty reduction. This has motivated the Government of Uganda to build a system for quantifying the value of its natural resources and to integrate this information in national planning processes.

Using the United Nation's global standard for the methodology for Natural Capital Accounting (NCA), the Government aims to identify the natural assets and ecosystem benefits that contribute to the national economy, and examine how the different sectors of the economy affect the country's natural asset base. It is also committed to going beyond conventional macroeconomic indicators like GDP to look at natural and human capital investments.

Uganda's Vision 2040 and the third National Development Plan (NDP III) both emphasise increased agriculture production, agro-industrialisation, improved health care and infrastructure development. This is reflected in annual sector budgeting. But there is a need to ensure that spending within these priority areas takes environmental considerations into account. Considering the impacts on natural capital of all development plans, investment projects and budgets is part of mainstreaming NCA in major government planning decisions.

The Government's NCA work is being led by the Ministry of Finance Planning and Economic Development (MoFPED) and the Uganda Bureau of Statistics. One of the analytical tools used by the MoFPED's Department of Macroeconomic Policy is the Rapid Environment Economic Assessment (REEA) model. This model can be used to analyse government investment plans to quantify the positive and negative impacts on natural capital, to help inform more environment-friendly planning and budgeting.

In this assessment, REEA was used to model the impact of the 2022/23 national development budget on selected economic indicators and categories of natural capital. The results are intended to inform the preparation of future budgets and the mid-term review of NDP III. Useful references are in Annex I and a short Glossary is in Annex II.

This work received technical and financial support from the Global Program on Sustainability of the World Bank. This support is gratefully acknowledged.

2. Methodology

The REEA model used in this assessment applies Leontief multiplier analysis to assess the impact of changes in Final Demand on Total Output across nine sectors[1] using the formula:

$$x = L.f$$

where: x = Total Output, in monetary units per year.
L = inverse of (I-A)
I = identity matrix
A= direct input coefficient matrix
f = Final Demand (or Final Use), in monetary units per year.

The calculated change in Total Output then impacts on the following five environment variables that were included in the model:

1. Electricity use
2. Forestry use
3. Water use
4. Wastewater generation and
5. Greenhouse gas (GHG) emissions.

An employment vector was also included.

The Leontief matrix is derived from an Input-Output Table (IOT). For our baseline we used the MoFPED's balanced Supply and Use Tables for fiscal year (FY) 2016/2017 with 162 products (rows) and 161 economic activities (columns). Since the supply table is a diagonal matrix, the IOT is simply the use table at basic prices. The IOT was aggregated into a 9 x 9 matrix, for the nine sectors being considered. We used this approach because of the change in budgeting which allocates funds to programmes, as opposed to granular sectors (as it was previously).

We calculated Output and Natural Capital impacts under two scenarios:

- **Scenario 1:** The 2022/23 development budget is implemented at 100 percent (%).
- **Scenario 2:** The 2022/23 development budget is implemented at 50%, which has been the recent experience for most capital development projects.

[1] The nine sectors assessed were: growing of cash crops, other agricultural activities, mining, manufacturing, construction, electricity, water supply, other services and accommodation & food services.

3. Results

Scenario 1 (100% development budget spend)

Table 1 and Figure 1 below summarise the changes in production output in the nine economic sectors with full development budget financing between the base year (2016/17) and FY 2022/23 ('before shock' and 'after shock').

Under this scenario, a GDP growth rate of 8.5% was realised. The difference in growth rates observed between the sectors depends on the multiplier (the number of times the output of a given sector changes as a result of a unit increase in a demand of its commodity).

The highest percentage growth rates are seen in mining, construction and electricity production, as a result of major capital spending on road construction and investment in agro-industrialization, among others. This reflects the prioritisation of agro-industrialization and competitiveness in NDP III and the 2022/23 budget.

A particularly high percentage growth in electricity utilization is recorded, reflecting the importance of energy in the development of the country, and calls for a stable energy blend that incorporates clean energy sources.

Table 1. Output changes by sector under Scenario 1 (UGX billion)

Sector	Output		Percentage growth in Output
	Before shock	After shock	
Electricity	1,424	3,027	112.6%
Construction	15,715	19,279	22.7%
Mining	2,612	2,903	11.1%
Water	2,853	3,104	8.8%
Services	69,970	75,106	7.3%
Other agricultural activities	25,634	27,136	5.9%
Manufacturing	29,202	30,413	4.1%
Accommodation & food	5,093	5,158	1.3%
Cash crops	2,950	2,979	1.0%

Figure 1. Original and modelled output under Scenario 1 (UGX billion)

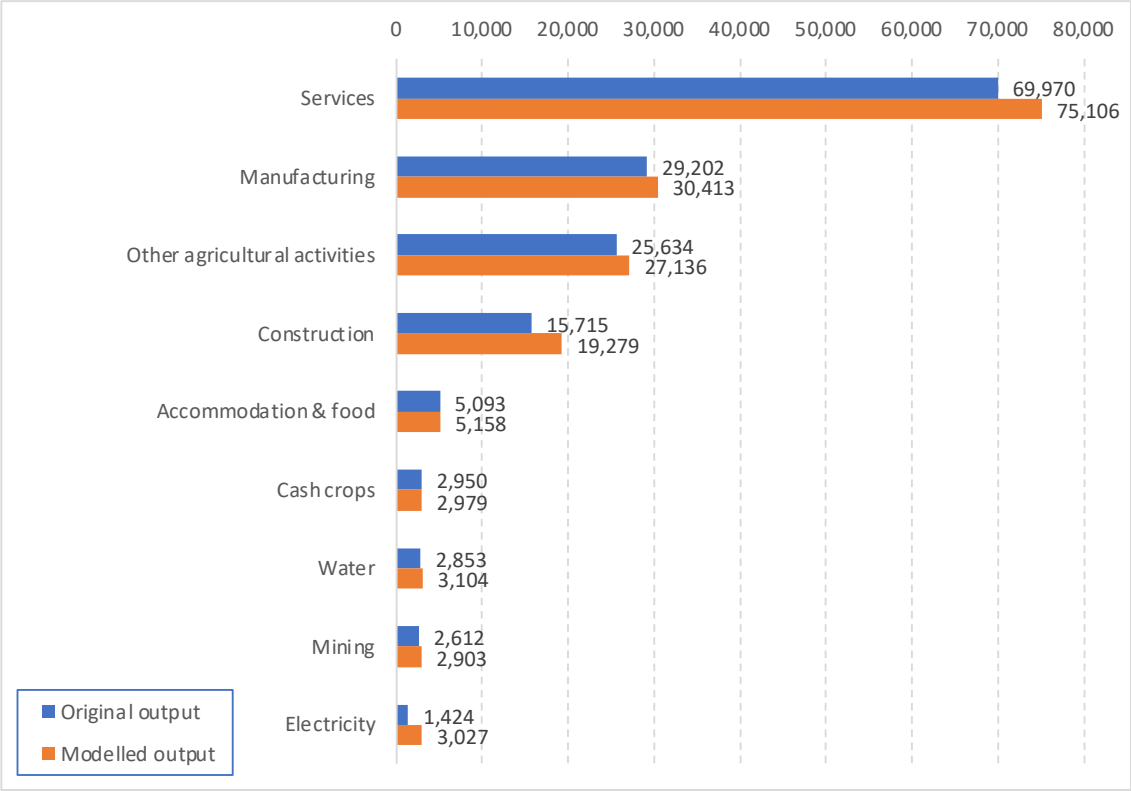


Table 2 and Figure 2 below show the change in use of different forms of natural capital under Scenario 1.

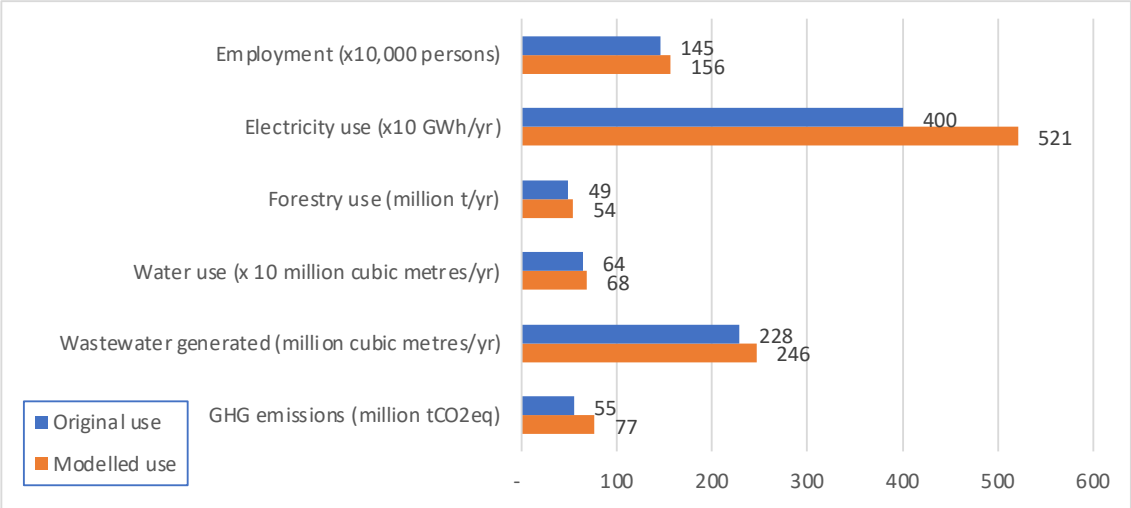
An increase in employment of 7.7% is coupled with an increase in the utilisation of all forms of natural capital. A significant increase in electricity use is recorded, but when this is compared to electricity being generated as an output, there is a positive energy balance. Which emphasises the fact that going forward the country needs a stable blend of clean energy to spur economic growth.

With the recorded increase in electricity utilisation and employment, an increase in waste generation was also seen, especially for wastewater and GHG emissions. If not well mitigated, these waste streams could reduce the gains arising from the investments. Proper care should therefore be taken to dispose of wastewater safely and to reduce emissions by using new technology and cleaner energy.

Table 2. Use of natural capital under Scenario 1

Natural Capital	Original	Modelled	Increase (%)
Employment (persons)	1,451,930	1,563,503	7.7%
Electricity use (GWh/year)	4,000	5,210	30.3%
Forestry use (million t/year)	49	54	9.6%
Water use (million m^3/year)	637	683	7.3%
Wastewater generated (million m^3/year)	228	246	7.9%
GHG emissions (million tCO2eq)	55	77	40.4%

Figure 2. Changes in the use of natural capital under Scenario 1



Scenario 2 (50% development budget spend)

Table 3 and Figure 3 summarise the changes in output for the nine economic sectors under 50% development budget financing. Under this scenario, lower GDP growth of 5% was realised. As with the first scenario, the largest percentage increases in output were seen in electricity production, construction and water.

Table 3. Output changes by sector under Scenario 2 (UGX billion)

Sector	Output		Percentage growth in Output
	Before shock	After shock	
Electricity	1,424	2,228	56.5%
Construction	15,715	17,497	11.3%
Water	2,853	3,098	8.6%
Mining	2,612	2,777	6.3%
Other agricultural activities	25,634	26,911	5.0%
Services	69,970	72,594	3.8%
Manufacturing	29,202	29,989	2.7%
Accommodation & food	5,093	5,133	0.8%
Cash crops	2,950	2,971	0.7%

Figure 3. Original and modelled output under Scenario 2 (UGX billion)

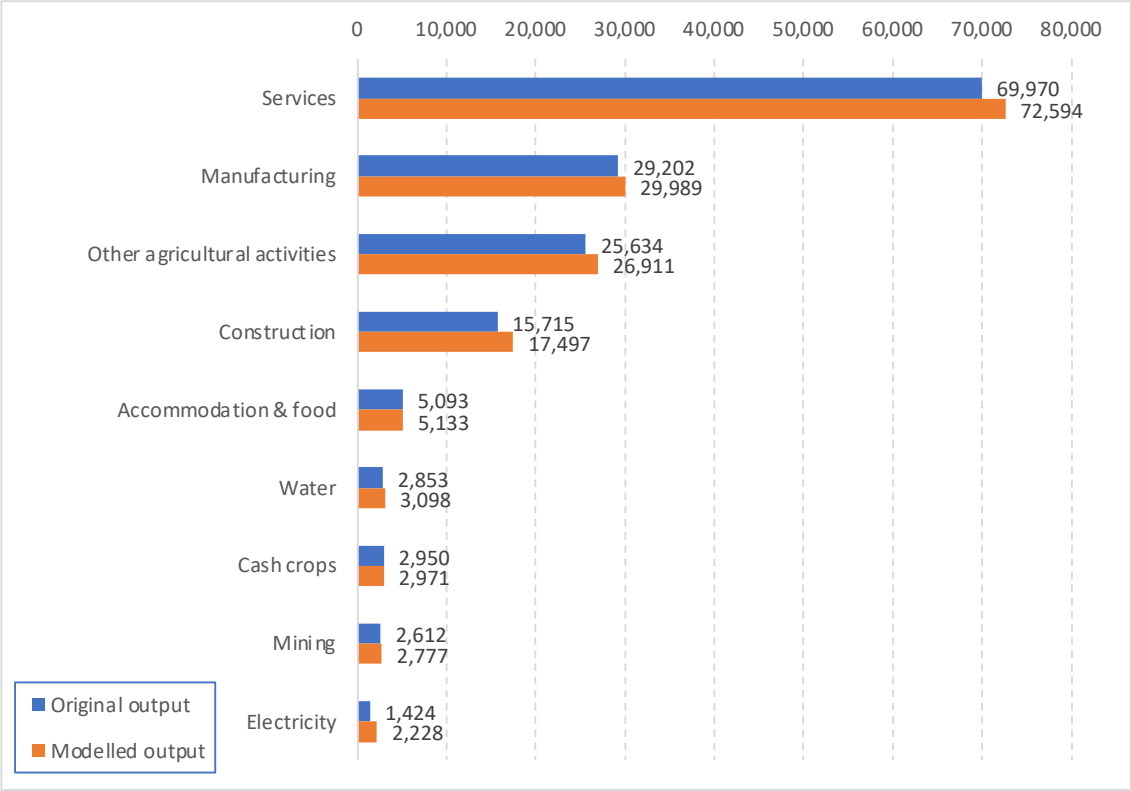
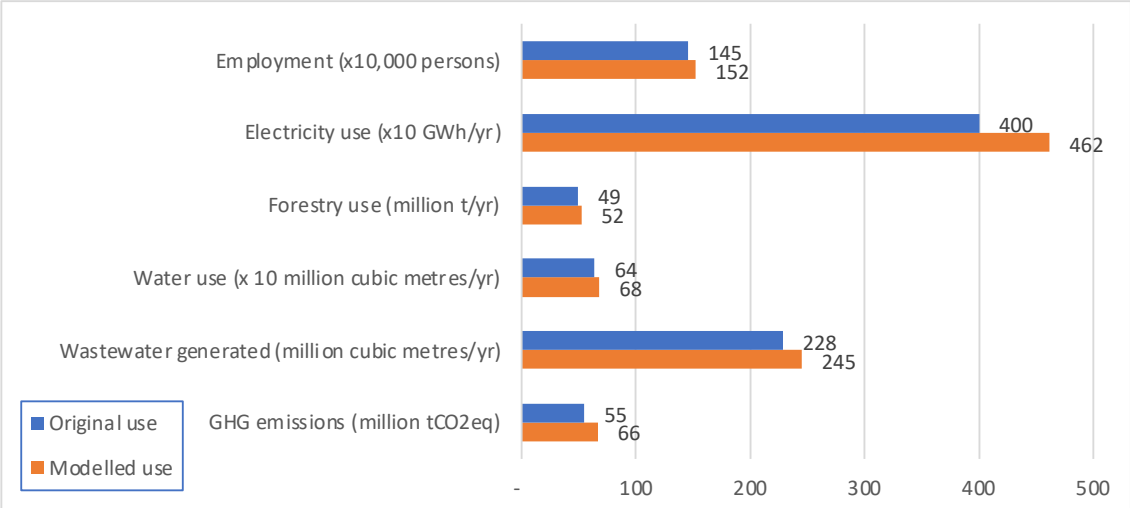


Table 4 and Figure 4 below show the changes in use of different forms of natural capital under Scenario 2. A lower increase in employment of 4.5% under this scenario is coupled with a lower increase in the utilisation of all forms of natural capital. But there is still a similar increase in wastewater production (7.3% compared with 7.9% under Scenario 1).

Table 4. Use of natural capital under Scenario 2

Natural Capital	**Original**	**Modelled**	**Increase (%)**
Employment (persons)	1,451,930	1,517,550	4.5%
Electricity use (GWh/year)	4,000	4,618	15.4%
Forestry use (million t/year)	49	52	6.0%
Water use (million m^3/year)	637	678	6.4%
Wastewater generated (million m^3/year)	228	245	7.3%
GHG emissions (million tCO2eq)	55	66	21.4%

Figure 4. Changes in the use of natural capital under Scenario 2



4. Conclusion and Recommendations

Under both scenarios modelled, there will be increased economic growth as a result of the 2022/2023 development budget allocations. The difference in growth rates (8.5% under Scenario 1 and 5% under Scenario 2) indicates that higher development budget performance results in greater economic growth.

The scenarios also show that a higher development budget will lead to increased employment and higher demand for energy. This will result in greater utilisation of natural resources. It is also clear that increased production through economic activities will result in more waste generation. While only wastewater and GHG emissions were modelled in this assessment, it is known that waste in other forms is also generated. The question of proper waste management therefore becomes critical as the country continues to invest in economic growth.

In conclusion, while effort is required to increase budget performance so as to increase economic growth, this should be done in a way that avoids natural capital depletion - and ideally delivers natural capital gains. Investment in clean energy should be promoted, since most economic activities require energy and the country might become energy deficient if this is not well planned for. GHG emissions also require better management, as there are increased GHG emissions under both scenarios considered.

Lastly, it is important to note that this is the first economic shock modelling to be conducted for Uganda using REEA. One of the limitations is that it only models a one-period shock assuming the same economic conditions as the base year (2016/17). Other dynamic economic models such as the UGAMOD, which uses more complex datasets, are being used to generate more detailed results that will complement the outputs from the REEA.

Annex I: Useful References

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2008). *System of National Accounts (SNA*). ISBN 978-92-1-161522-7. unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf

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Annex II: Glossary

(based on the SNA, 2008)

Concept	Definition
Asset	An asset is a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. It is a means of carrying forward value from one accounting period to another. All assets in the SNA are economic assets (SNA 3.5 and 10.8). All assets have a legal owner and an economic owner. (SNA 10.6)
Basic Price	Basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. (SNA 6.51a)
Consumption	Consumption of goods and services is the act of completely using up the goods and services in a process of production or for the direct satisfaction of human needs or wants. (SNA 9.39)
Expenditures	Expenditures on goods and services are defined as the values of the amounts that buyers pay, or agree to pay, to sellers in exchange for goods or services that sellers provide to them or to other institutional units designated by the buyers. (SNA 9.32)
Final Demand	Includes: final use by households, final use for non-profit institutions serving households, final use for government, gross capital formation (fixed capital and changes in inventories), and exports. Note that the SNA mentions 'final use' rather than 'final demand'.
Gross Domestic Product	1. Value added definition: GDP is the sum of gross value added of all resident producer units plus that part (possibly the total) of taxes on products, less subsidies on products, that is not included in the valuation of output. (SNA 2.138) 2. Final expenditure definition: GDP is also equal to the sum of the final uses of goods and services (all uses except intermediate consumption) measured at purchasers' prices, less the value of imports of goods and services. (SNA 2.139) 3. Income definition: GDP is also equal to the sum of primary incomes distributed by resident producer units. (SNA 2.140)
Intermediate Consumption	Consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. (SNA 6.213)

Concept	Definition
Natural Asset	Naturally occurring resources over which ownership rights have been established and are effectively enforced. (SNA 10.167). They should also be capable of bringing economic benefit to their owners, given the technology, scientific knowledge, economic infrastructure, available resources and set of relative price. (SNA 10.168)
Natural Resources	Natural resources consist of naturally occurring resources such as land, water resources, uncultivated forests and deposits of minerals that have an economic value (SNA 10.15). Natural resources are non-produced assets. The SNA treats natural resources as having an infinite life. (SNA 7.109)
Output	Output is defined as the goods and services produced by an establishment, excluding the value of any goods and services used in an activity for which the establishment does not assume the risk of using the products in production, and excluding the value of goods and services consumed by the same establishment except for goods and services used for capital formation (fixed capital or changes in inventories) or own final consumption. (SNA 6.89)
Production	Production is an activity, carried out under the responsibility, control and management of an institutional unit, that uses inputs of labour, capital, and goods and services. (SNA 6.2)
Total Output	The sum of intermediate consumption and final demand.
Use	Use of products by different groups of producing units, use of products by final consumers, use for exports and use for capital formation. (Adapted from SNA 14.84)
Value	The value (v) at the level of a single, homogeneous good or service is equal to the price per unit of quantity (p) multiplied by the number of quantity units (q), that is v = p * q. (SNA 15.10)