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Mauritania

Counting on Natural Wealth for a Sustainable Future

Gianluca Mele

Abstract

A data set of key macro-sustainability indicators, constructed after several fact-finding missions, and World Bank methodologies on estimating wealth accounting are used to study Mauritania's wealth, which is estimated to be between USD50 and USD60 billion. The country's produced wealth represents roughly 12 percent of total wealth, much less than in lower-middle-income countries; by contrast, natural wealth represents approximately 45 percent of the total figure. Renewable resources account for slightly less than two-thirds of natural wealth, with fisheries alone equaling about one-fourth of natural wealth. This is good news for Mauritania, as sound management of these resources may ensure a constant flow of resources in the future and therefore—with adequate policies—the achievement of the same or higher levels of welfare for future generations.

On the negative side, however, the ratio of net adjusted savings over gross national income is estimated to have been negative since 2006, meaning that the wealth of the country is being depleted. Mauritania has recently joined the ranks of lower-middle-income countries, largely thanks to its considerable natural resources endowment. Over time the mining sector's contribution to gross domestic product has grown significantly and important discoveries continue to be made. The overarching objective of this wealth accounting exercise is thus to support Mauritania to measure its assets better and achieve a more complete picture of the prospects for future income, with a view to better orienting public policies toward sustainable growth and shared prosperity. The paper concludes with several indicative policy recommendations.

Mauritania:

Counting on Natural Wealth for a Sustainable Future

Gianluca Mele

ABBREVIATION AND ACRONYMS

ANNI	Adjusted National Net Income
ANS	Adjusted Net Savings
BTU	British thermal unit
CAPEX	Capital Expenditure
CECAF	UN Food and Agricultural Organization's Fisheries Committee for the Eastern Central Atlantic
CO2D	percentage of carbon dioxide
DEC	World Bank's Development Economics Vice Presidency
ED	Energy Depletion
EE	Education Expenditure
EIA	Energy Information Administration of the US Dept. of Energy
EITI	Extractive Industries Transparency Initiative
EU	European Union
EUR	Euro currency
FAO	Food and Agriculture Organization of the UN
FDI	Foreign Direct Investment
FNP	National Federation of Fishery of Mauritania (Fédération Nationale de Pêche)
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNI	Gross National Income
GNS	Gross National Savings
IBRD	International Bank for Reconstruction and Development
IMF	International Monetary Fund
IMROP	Mauritanian Institute for Oceanographic Research and Fishery of Mauritania (Institut Mauritanien de Recherches Océanographiques et des Pêches)
ITC	International Trade Centre
LCU	Local Currency Unit
MAED	Ministry of Economic Affairs and Development of Mauritania (Ministère des Affaires Economiques et du développement)
MCM	Mauritanian Copper Mines
MD	Mineral Depletion
MIFERMA	Société Anonyme des Mines de Fer de Mauritanie
MIGA	Multilateral Investment Guarantee Association
MRO	Mauritania Ouguiya currency
NFA	Net Foreign Assets
NFD	Net Forest Depletion
NK	Natural Capital

NPV	Net Present Value
OMRG	Mauritanian Agency for Geological Research (Office Mauritanien des Recherches Géologiques)
OMVS	Senegal River Basin Development Authority (Organisation pour la Mise en Valeur du Fleuve Sénégal)
ONS	National Statistics Agency of Mauritania (Office National de la Statistique)
PK	Produced Capital
PMD	Particulate Matter Damages
RR	Resource Rent
SDR	Social Discount Rate
SEEA	System of Economic-Environmental Accounting
SMCP	Mauritanian Company for Fish Exports (Société Mauritanienne de Commercialisation de Poissons)
SMH	Hydrocarbon Agency of Mauritania (Société Mauritanienne des Hydrocarbures)
SNIM	Mauritanian Mining and Industrial National Agency (Société Nationale Industrielle et Minière de Mauritanie)
SSA	Sub-Saharan Region
Tcf	Trillion cubic feet
TW	Total Wealth
UK	United Kingdom
UN	United Nations
USD	United States dollar
WAVES	Wealth Accounting and Valuation of Ecosystem Services
WBG	World Bank Group
WDI	World Development Indicators
WITS	World Integrated Trade Solutions

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Acknowledgements

It is hoped this analysis will contribute to increasing awareness among policymakers and other stakeholders regarding the importance of responsibly managing national wealth and utilizing renewable and non-renewable resources to establish the basis for long-term growth and shared prosperity.

The Role of the Extractive Industries in the Mauritanian Economy

MACROECONOMIC CONTEXT

In recent years Mauritania's economy has enjoyed strong and sustained growth. Grounded by an improving policy framework, GDP expanded by an average of over 6 percent annually over the last decade (2003-2013). GDP per capita[1] was USD1,106 in 2012. This solid overall growth rate was achieved in spite of the ongoing effects of the global financial and euro-zone crises, as well as a severe drought that struck the country in 2011. High iron ore prices and new gold and copper mines have led this growth, supported by fishing and construction, while a recovery in agriculture and the implementation of large infrastructure projects is expected to sustain the economy's momentum through 2013.

Mauritania's fastest-growing economic sectors are fisheries, which expanded by 15 percent in 2012, and public investment, which grew by 23 percent as the government used rising mining revenues to finance infrastructure projects. More than 50 percent of public investment currently focuses on energy and transportation, and recent net total private investment has also been robust, rising from an average of roughly 2 percent of GDP in 1999-2000 to an estimated 23 percent in 2012-2013[2]. Also gross fixed capital formation has increased remarkably in the same period, moving from roughly 15 percent of GDP to 40 percent of GDP. Iron ore prices have remained high by historical standards, and iron-ore production alone represents about 18 percent of GDP[3], and other mining (non-iron) output represents approximately 7 percent of GDP. Early predictions for the oil sector proved excessively optimistic, and oil currently represents roughly 3 percent of GDP. The medium-term growth outlook is very strong, being driven by substantial increases in iron-ore production and the development of the natural-gas sector. Agricultural production has rebounded following the 2011 drought thanks to abundant rainfall in 2012 and 2013. Mauritanian agriculture has been overwhelmingly rain-fed, making the sector highly vulnerable to climatic shocks. However, significant irrigation potential exists. The fisheries sector corresponds to approximately 7 percent of GDP and is an important reservoir of jobs, with roughly 40,000 people employed[4] in the sector, though many of them are foreigners.

Over the last two years the government's available fiscal space has increased to near-record levels thanks to prudent macroeconomic policies, stronger tax administration and high world prices for iron ore and

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[1] Current USD, source: WDI, World Bank
[2] Source: WDI, World Bank
[3] Source: Government, data refers to the year 2013
[4] Source, Etude des aspects macro-economique pour des pecheries durables en Mauritanie, WB, 2008

crude oil. International aid has also contributed to the government's expanding fiscal envelope; significant transfers were made in 2012 in response to the food crisis that followed the drought, and some exceptional grants were made by countries in the Middle East and North Africa. Mauritania also received the first payment on a new EU fisheries agreement. Together these factors generated a rare fiscal surplus in 2012. However, a fiscal deficit equal to roughly 1 percent GDP is estimated for 2013, as grants returned to normal levels while capital expenditures have risen. Public spending is expected to remain high in 2014 in anticipation of future revenues from new iron and gold mining projects, though some of these are not expected to become fully operational until 2017; however, in the medium term the country is expected to maintain a fiscal balance close to zero or slightly positive. While rising resource revenues present a valuable opportunity to address deficiencies in infrastructure and social spending, a growing dependence on the resource sector will make the country more sensitive to volatile global iron and gold prices over the medium term.

Mauritania's vulnerability to commodity-price shocks was made apparent in 2012-13. A moderate drop in export prices coupled with soaring imports due to massive infrastructure and energy projects prompted some deterioration in the trade balance in 2012, which experienced a deficit equal to 13 percent of GDP. In 2013 the situation has improved, and trade balance shifted back toward zero, due to lower-than-expected imports. However, it should be noted that these imports have largely been financed through FDI, which is also influenced by commodity markets, albeit over the longer term; therefore in the event of a protracted slump in export prices negative effects on the trade balance would likely be moderated by a decline in FDI-financed imports.

Export concentration remains very high, both in terms of trade partners and export goods, though there are signs of modest improvement. The mining sector (iron, gold and copper) accounts for roughly 70 percent of total exports, and more than 50 percent of all these exports go to China. Net FDI doubled between 2011 and 2012 to reach US$1.4 billion, and FDI is expected to remain over US$1 billion in 2013. As a result, international reserves are projected to reach a historic high of 7.4 months of imports in 2013.

Public debt levels are high, but the debt trajectory will remain manageable if current bilateral negotiations are concluded successfully. The resolution of significant arrears with Kuwait, which represent roughly one-third of total public external debt, is still pending, resulting in a debt-to-GDP ratio over 90 percent. It is therefore important for Mauritanian authorities to minimize the use of non-concessional financing until the Kuwaiti debt is rescheduled or annulled – totally or partly.

THE ROLE OF THE EXTRACTIVE INDUSTRIES IN THE MAURITANIAN ECONOMY

Annual real GDP growth averaged just 4 percent during the mid-2000s; in 2006, however, growth shot up to over 11 percent on the strength of rising resource exports, and GDP growth rates have remained solid through 2013. The rapid expansion in 2006 was driven by the start of oil production, as Mauritania's first offshore oil wells came on line, although extraction rates fell drastically within a few months due to serious technical difficulties[5]. Mauritania's overall macroeconomic indicators have continued to improve, thanks to the opening of the first gold and copper mines, and record iron ore prices. Every month the Cabinet authorizes

Figure 1: Iron, Gold and Petroleum Prices, 1990-2012
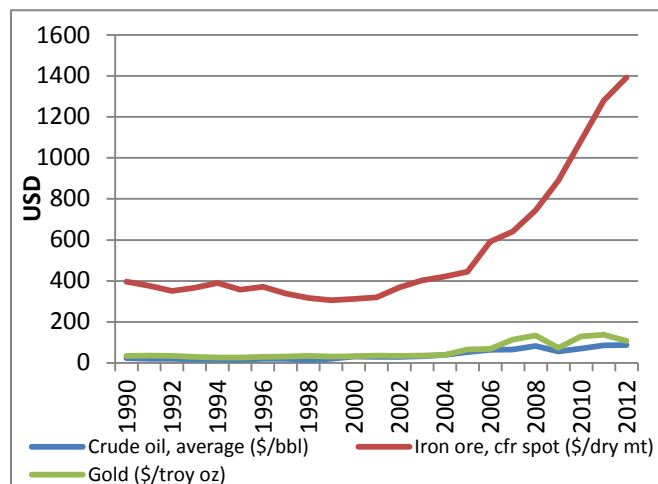
Sources: World Bank, prices in constant 2005 US$

new permits for mining exploration to foreign and national companies. The threats related to security in the interior parts of the country have not discouraged international mining companies and the total number of permits (to foreign companies) is – to date – approximately 200.

Large-scale iron mining began in the mid-1960s, when the World Bank, the Mauritanian Government, the French Government and the international iron-mining consortium MIFERMA[6] financed the country's first commercial iron mines. Today SNIM is the majority owner of Mauritania's iron mines and the sole extractor, with an annual production volume of roughly 11 million tons.[7] Current expansion plans are projected to boost extraction capacity to 25 million tons by 2018 and to 40 million tons by 2025. SNIM will remain the only iron ore company until 2020. SNIM has an important social dimension and has contributed to the achievement of several public goals by co-financing port and railways extensions, telecommunication projects and by creating some 10,000 jobs, both permanent and seasonal. It has even set up its own Foundation, and contributes significantly to several nationally relevant projects. Its participation to national budget has doubled from roughly US$140 million (on average, over the recent years) to US$300 million starting from 2014. Mauritanian iron ore tends to be high-grade, and the country's proved and probable iron reserves are vast at an estimated 3 billion tons. Prospective partnership agreements between SNIM and international mining firms and

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[5] It quickly declined below 20,000 bl/day after mid-2007 and is now around 9,000 bl/day. Hydrocarbon reserves are considered modest: proven and probable crude oil reserves at 310 mln barrels in 2008 compared with 2.1 bln for Chad.
[6] The *Société Anonyme des Mines de Fer de Mauritanie* was a joint venture by French, British, Italian and German steel firms established prior to Mauritania's independence from France in 1960.
[7] Source: International Trade Centre (ITC), Trademap database.

proposed infrastructure projects, including a seawater pipeline from the coast to the ore-processing center at Zouérat, could further expand the country's iron-ore export capacity. Mauritania is currently the continent's second-largest iron exporter after South Africa, and its estimated iron reserves are so large that even as extraction rates continue to increase its stock of ore is expected to support large-scale exports for many decades to come The Swiss extractive company Xstrata has also entered the Mauritanian iron ore industry recently, in an agreement with SNIM.

Mauritania also exports gold and copper, at 200,000 ounces and roughly 45,000 tons, respectively, in 2012.[8] Gold is exclusively in the hands of foreign companies and the main extractor is KINROSS Gold, a Canadian mining firm[9] that launched operations in Mauritania in 2007 and employs roughly 1,500 local workers. Initial production was approximately 11,000 ounces per year, but increased to over 200,000 ounces in 2010 and is expected to more than double after 2016, depending on gold prices.[10] KINROSS Tasiast undertakes a careful corporate social responsibility policy, with a goal of spending US$10 million a year on several projects designed to benefit the local population, including establishing training technical centers and healthcare facilities and expanding access to drinking water, among other efforts. Unlike Mauritanian iron ore, locally mined gold ore has a generally low gold content (approximately 1 gram of gold per ton), which translates into higher production costs. Looking at copper, the main company engaged in actual mining is MCM (Mauritanian Copper Mines), which operates in the Akjoujt region. Copper mining started in 2006, and by end-2009 the extraction reached roughly 4 million tonnes at a strip ratio of 3:1 (waste to ore). The plant employs roughly 1,500 individuals and produces approximately 4,000 tonnes of concentrate copper per month[11].

As noted above, oil production in Mauritania began in 2006. Mauritania's proven and probable crude oil reserves are estimated at around 600 million barrels,[12] a significant stock but far less than was initially estimated and well below the level of other oil-producing countries, including regional oil exporters such as Chad. The first field to be discovered was the Chinguetti oil field, in 2001, followed by Banda in 2002, Pelican and Tiof in 2003, Tevet in 2004, Faucon in 2005, and several more recent discoveries. Mauritania's three major oil-reserve regions are the coastal basin, the Taoudeni basin, which spans an area between Mauritania and Mali that is roughly the size of Spain, and the offshore fields. Initial estimates of Mauritania's total oil reserves and production capacity, however, have failed to pan out, and the currently extracts a relatively modest 8,000 barrels a day. Nevertheless, high oil prices and increasingly efficient extraction technologies have made this sector an important contributor to the Mauritanian economy (tax revenues, salaries, exports), and oil currently represents roughly 3 percent of

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[8] Source: ITC, Trademap: www.trademap.org
[9] Kinross Gold Corporation has active mines in Canada, the United States, Brazil, Chile, Ecuador, Russia, Ghana and Mauritania. In Mauritania it operates through the affiliate KINROSS Tasiast Ltd.
[10] For more details on the methodological assumptions, please see Annex 2.
[11] Source: www.first-quantum.com , Guelb-Moghrein plant.
[12] For more details, see the official EITI website: www.eiti.org.

GDP, or roughly US$160 million. An oil fund was established at the beginning of activities (2006) and it has slowly grown in spite of the subdued oil production, due to rising oil prices. Currently (early 2014) it is estimated to be equivalent to US$ 100 million.

The start of oil production came at an important juncture in the country's political history. A few months earlier, in August 2005, a coup d'état ended the 21-year rule of President (and former Prime Minister) Maaouya Ould Sid'Ahmed Taya; this was the beginning of what local observers described as a "transition" period. The initial regulations, exploitation agreements and general management of the oil sector occurred in a climate of severe political instability and very weak governance, which was characterized by rapid changes in leadership. As a result there are serious limitations in the availability, reliability and accuracy of oil-sector data. In recent years many large companies have operated in the country, such as Agip, Mobil, Shell, an Exxon, and a number of major international firms are still operating in the Mauritanian oil sector, including TOTAL, TullowOil, Repsol, and China National Petroleum Corporation. Annual reports describing the government's revenue collection from oil and mining operators are regularly prepared and published on a government website.[13]

Significant natural-gas reserves have recently been discovered. Natural-gas deposits are estimated to be particularly large in the southern part of the country and offshore. Both public and private interests in the sector have increased rapidly, and plans are well advanced for a gas-to-power project in Banda, which could more than double Mauritania's power-generation capacity. This project includes energy exports to Senegal and Mali, while domestically it is expected to substantially reduce electricity costs and improve electricity connectivity for more than 50 percent of the urban population living in informal settlements. The project will be developed through a public-private partnership with the support of IBRD and MIGA; it is expected to be completed by end-2015[14]. The considerable potential of the natural-gas sector highlights the significant role and growing importance of extractive industries in the Mauritanian economy. However, the extent to which natural capital can be used to address the country's substantial development and poverty reduction challenges will depend on how the sector is governed and how the fiscal resources it generates are managed and invested.

The government has registered some progress in improving the extractive industry governance and transparency, and Mauritania is fully compliant with the Extractive Industries Transparency Initiative (EITI) standard and its specific program for resource-rich developing countries known as EITI++.

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[13] See: www.cnitie.mr.
[14] Cf. The World Bank Group's Country Partnership Strategy (CPS) 2014-2016 for the Islamic Republic of Mauritania, World Bank, 2013.

The Role of Renewable Resources in the Mauritanian Economy

Mauritania's 754 kilometer Atlantic coast encompasses some of the richest fishing waters in the world. Industrial fishing exports average roughly 800,000 tons of fish per year, while artisanal fishing catches average about 80,000 tons. The fisheries sector is estimated to generate more than 40,000 direct jobs, though many of these are filled by workers from neighboring countries (especially Senegal) and employment estimates do not differentiate between permanent and seasonal workers. Nearly all domestic fishing boats operate out of the ports of Nouakchott and Nouadhibou, which together account for roughly 90 percent of total catches. Mauritania's main export partners in this sector are Europe and China. All exports are managed by the Mauritanian Commercial Fish Company (*Société Mauritanienne pour la Commercialisation de Poisson* – SMCP), formerly a public enterprise, now a private firm working with the support of the public sector. Based in Nouadhibou, SMCP was created in 1984, and for the past three decades it has maintained a *de facto* monopoly on frozen fish products landed in Mauritania and bound for export. The degree of processing in Mauritania is limited to a handful of enterprises active in the production of fishmeal, where value-addition remains quite limited. The fisheries sector is not only an important contributor to employment, income and vital nutrition for vulnerable households; international fishing-rights agreements also represent a major source of non-tax revenue. However, the sector suffers from ineffective policies, mismanagement, and organizational dysfunction. Also, the measures needed to avoid overfishing are generally neglected.

Agriculture is also a major industry in Mauritania. The agricultural sector has significant development potential, particularly irrigated agriculture along the northern bank of the Senegal River.[15] The irrigation potential of the country is equivalent to 140,000 ha, out of which merely 30 percent is exploited (mainly for rice production) while the remaining part is occupied by vegetation. The Senegal River Basin Development Authority (*Organisation pour la Mise en Valeur du Fleuve Sénégal* – OMVS)[16] is a regional organization that aims to improve the income and food security of local populations while preserving local natural ecosystems, which was established in 1972. The region has recently attracted several investors (regional and international) for various projects including riverine transportation and hydroelectric power.

Pastureland currently covers roughly 40 percent of Mauritania's total land area, while arable land is far more limited. Agriculture in Mauritania is typically conducted on a semi-subsistence household production model, and dates, sorghum, tubers and millet are among the country's most important crops, while livestock production includes cattle, sheep, camels and poultry. Herding represents the livelihood of a significant share of the population and is especially critical for traditional communities. However, total agricultural and livestock

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[15] The World Bank has been supporting the government with a large irrigation program along the Senegal River, which is aimed at rehabilitating more than 11,000 hectares and diversifying production.
[16] Member countries are Guinea, Mali, Mauritania and Senegal.

productivity falls far short of meeting national food needs, and approximately 70 percent of Mauritania's demand for cereal is met by imports. More specifically, while livestock provides a surplus for exports, crops are generally insufficient to cover national demand and are highly dependent on external shocks (such as prices and climate). Total arable land in Mauritania accounts for roughly 500,000 ha. Within this figure, rain-fed land accounts for a large portion, although highly volatile depending on the yearly rainfall (it can shift between 5'000 ha to over 200,000 ha). Mauritania is also among the countries most hit and concerned by desertification; according to FAO more than 70 percent of the territory is menaced by this phenomenon. Agriculture and livestock together employ roughly two thirds of the Mauritanian labor force[17], but due to low productivity and structural inefficiencies the sector represents barely 16 percent of GDP.[18] As a Sahelian and largely desert country, Mauritania is vulnerable to climate shocks, which heighten the risk of food insecurity and put upward pressure on food prices. The government has given a high priority to agriculture as reflected in its Poverty Reduction Strategy Papers and in the focus of much bilateral and multilateral support, including that provided by the World Bank Group. Mauritania's ability to manage its renewable resources, to sustainably increase the productivity of the primary sector and adopt policies that ensure broad-based participation in the growth of agriculture, livestock and fisheries will be critical to realizing its economic and social development objectives.

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[17] Source: Labor Survey, ONS, 2013: approximately 57% of employed workforce is concentrated in the rural sector.
[18] World Bank staff estimate, in nominal terms, 2013.

Wealth Accounting Analysis

BEYOND GDP GROWTH: WEALTH ACCOUNTING AND NATIONAL SAVINGS

Macroeconomic analysis often focuses on GDP growth as the primary measure of economic development; however, GDP does not tell the whole story, and a number of other indicators - although harder to quantify - can be equally crucial in explaining socioeconomic gains or losses. This is especially true for countries with a large endowment of extractive resources. GDP and similar measures describe the value of national production or, from a different perspective, national income, but they do not account for the basis of that production—the contribution of different types of capital assets or changes in the composition of those assets over time, including the depletion of renewable and nonrenewable resources or damage to the local ecosystem as well as the accumulation of reproducible physical and human capital. In resource-rich countries these dynamics have crucial implications for long-term growth, and national-income indicators are not capable of evaluating them.[19]

In this context wealth accounting can be used to quantify the different types of capital—produced, intangible and natural—that drive economic growth. The following analysis attempts to identify patterns in capital formation and depletion in Mauritania and reveal their implications for the country's long-term development. The methodology, known as wealth accounting, is designed to determine the value of renewable natural resources (agricultural land, forests, fisheries, etc.), nonrenewable resources (minerals, hydrocarbons, etc.), produced capital (public infrastructure, private capital stocks, etc.), and human capital (education, training, workforce skills, etc.), as well as intangible capital that is not easily valuated in monetary terms (public institutions, the administrative and governance systems, private and civil-society organizations, etc.), but which nevertheless has a major impact on long-term growth potential.

Among the most useful measures available for gauging a change in a country's underlying stock of productive capital is Adjusted Net Savings (ANS) calculated as a percentage of Gross National Income (GNI) per capita. ANS is derived from the standard national accounting measure of gross savings, but includes four key adjustments: (i) the depreciation of fixed capital is deducted in order to obtain net national savings; (ii) the depletion of natural resources is deducted to reflect changes in asset values associated with their exploitation

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[19] Hamilton, K. and E. Ley (2010) "Measuring National Income and Growth in Resource-Rich, Income-Poor Countries," *Economic Premise* n.28 Washington DC: The World Bank.

activities; (iii) pollution damages from carbon dioxide and particulate emissions[20] are deducted to account for the long-term cost of environmental degradation; and (iv) current expenditures on education are added as a proxy for the positive impact of human-capital formation on long-term growth. Intangible capital is not surprisingly the most difficult component to measure and is ultimately calculated as a residual after subtracting other forms of capital from an estimation of the total value of capital.[21] The advantage of this measure is that it enables an assessment of the extent to which current depletion of natural resources is balanced by the natural resource rents and changes in human and man-made capital. This has important implications for long-term consumption and intergenerational equity in the exploitation of natural resources. However, it is only a snapshot at one point in time and does not take into account the probability of new discoveries.

A large literature on ANS rates has revealed a troubling trend among resource-rich countries in Sub-Saharan Africa (SSA), where high GDP growth rates often obscure a decline in the underlying stock of natural capital. While some countries have been able to effectively transform their natural assets into produced and human capital, in many cases the exploitation of natural wealth has fueled an unsustainable increase in present expenditure on consumption or low-productivity investment, at the expense of long-term growth.[22] Moreover, the available data indicate a general correlation between negative adjusted savings rates and persistently low indicators of socioeconomic development, such as literacy rates, nutrition levels and public health outcomes.[23]

Given the major role that natural resources play in the growth of the Mauritanian economy, the following analysis focuses primarily on natural capital. Mauritania's stock of natural capital can be broken down into six categories, which together represent the majority of the country's renewable and nonrenewable resources. These are: iron ore, gold ore, natural gas, crude oil, fisheries and livestock pastureland. The analysis is designed to calculate the depletion of each of these forms of natural capital.

The first step is to calculate resource rents (RR) for each category of capital, which reflect the net current income derived from renewable and nonrenewable resources. For extractive resources RR can be defined as the total revenue from gross resource sales minus all costs incurred in the extraction process—including the opportunity cost of produced capital—adjusted for inflation. The value of RR is projected over a period of 25

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[20] In the impossibility of identifying/estimating updated figures on pollution costs, this analysis interpolated path values based on the estimates available for the period 1997-2010 and predicted an estimate for 2013 (historical estimates on particulates emissions are provided by WB's WDI).

[21] See Annex 2 for more details. Since the value of cropland could not be estimated separately, it is also included in this residual.

[22] See Collier, P., R. Van Der Ploeg, M. Spence and A. Venables (2010) "Managing Resource Revenues in Developing Economies," *IFM Staff Papers* 57:84-118 Washington DC: IMF

[23] See Hamilton, K. and E. Ley (2010), "Measuring National Income and Growth in Resource-Rich, Income-Poor Countries," *Economic Premise* n.28, Washington DC: The World Bank.

years, which is a proxy for one generation. During the 2013-2038 period inflation is estimated at an average rate of 3 percent. The return to fixed capital (or the opportunity cost of capital) is assumed to be 10 percent annually and is deducted from the RR for each category. Finally, RR is also adjusted for the social discount rate; which according to standard World Bank practices is set at 4 percent as per the Ramsey formula.[24]

The central challenge of macroeconomic management in resource-rich countries involves determining what share of RR should be consumed, and what share should be saved and invested to support future welfare improvements. This is an especially important question for a country like Mauritania, where the immediate needs of the population are large. One theoretical framework for addressing the tradeoff between spending and saving is derived from a variation on the permanent income hypothesis.[25] In the standard microeconomic formulation of this model the key determinant of an individual's consumption is not their present disposable income, the returns they are earning at any given moment, but rather their "permanent income," which is defined as the long-run return on their total assets. This includes both their human capital (educational attainment, professional skills and experience, etc.) and their physical and financial assets (real property, investment capital, etc.).[26] The macroeconomic parallel of the permanent income hypothesis applies these concepts to the level of the nation, encouraging governments to base their economic-policy decisions on the long-run returns to the national capital stock rather than exclusively the current flow of GDP. Despite a number of important caveats[27] this model provides a valuable long-term perspective on productivity and discounting.

Before proceeding with the analysis, several additional methodological issues should be noted. First, the results underestimate the total wealth stock, as several categories of natural capital—including agricultural land, forests and minor mineral resources, among others—are not included in the analysis due to the unavailability or unreliability of the data. Second, data limitations also impact the reliability of the analysis of the included categories. For instance, demersal fish species were not included in the calculations for the fisheries sector because the data were deficient, fragmented or otherwise unreliable. Third, the estimates are based on the best information currently available, but any number of intervening factors may alter basis for its estimates and projections, including technological innovations, new resource discoveries, climatic shifts, etc. Finally, long-term

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[24] The formula is: $r = \delta \, (\gamma \cdot c/g)$ where: r is the social discount rate; δ is the pure time-preference rate; γ is the elasticity of marginal utility of consumption, measuring the relative curvature of the utility function (i.e. how quickly utility drops as consumption increases); and c/g is the ratio of consumption over growth (GDP per capita) and provides a measure of whether and how much future incomes will be higher than today, and therefore if marginal consumption is worth more at present rather than in the future.

[25] Friedman, M. (1957) "A Theory of the Consumption Function" Princeton, NJ: Princeton University Press.

[26] Cf. Hall, R. E. (1978) "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence," *Journal of Political Economy* 86(6): 971-987

[27] The permanent income hypothesis rests on a number of assumptions that may not hold in all real-word situations. For example, it assumes efficient capital markets with perfect and symmetric information, as well as adequate liquidity. These conditions are especially unlikely to be met in developing countries such as Mauritania.

projections for inflation, the exchange rate, and commodity prices are based on several dependable sources,[28] but they still include an inevitable degree of uncertainty. More details on data sources and methodology are provided in Annexes 1 and 2.

RESEARCH QUESTIONS AND RESULTS

The wealth accounting analysis conducted for this report is designed to address three primary research questions. (i) What is the estimated existing stock of capital in the country, including produced, intangible, and both renewable and nonrenewable natural capital? (ii) What is the current rate of adjusted net national savings in Mauritania, and what are its implications for the sustainability of the country's stock of wealth? (iii) What would sustainable growth require in terms of the management of both renewable and nonrenewable resources?

The findings of the analysis indicate that the value of Mauritania's total stock of national wealth[29] is approximately US\$60 billion, or roughly US\$16,000 per capita. To put this in context, in low-income countries total wealth per capita averages approximately US\$8,000, while it averages about US\$30,000 in middle-income countries and about US\$400,000 in high income countries.[30] Mauritania's figures put it squarely between averages for low- and middle-income countries, roughly double the average of the former and about half the average of the latter. This would seem reasonable for a country which has just entered the ranks of lower-middle income countries. Breaking down Mauritania's total wealth into its components (natural capital, produced capital and intangible capital) presents a similar pattern to that found in most low-income countries (see Figure 2 and Figure 3, below).

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[28] These include World Bank commodity-price projections, IMF projections and JP Morgan reports on future mining prices, among other sources.

[29] For details on the methodology for calculating national wealth, see: World Bank (2011) "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium," Washington DC: The World Bank.

[30] The study refers to 120 countries. For more details, please see World Bank (2006) "Where is the Wealth of Nations? Measuring Capital for the 21st Century," Chapter 1, Washington DC: The World Bank

Figure 2: The Composition of National Wealth in Low-, Middle- and High-Income Countries

Low Income Countries
- 36%
- 50%
- 14%

• Natural capital is most important in low income countries—more than twice as large as produced capital

Middle Income Countries
- 21%
- 20%
- 59%

• In middle income countries natural capital and produced capital are roughly equal

High Income Countries
- 3%
- 17%
- 80%

• Intangible wealth dominates in all countries, especially in high income countries

■ Intangible Capital ■ Produced Capital ■ Natural Capital

Mauritania's stock of natural capital amounts to approximately US$30-35 billion, or roughly US$9,000 per capita.[31] More than half of the country's natural wealth is concentrated in renewable resources. Given effective sustainability-focused policies this component of wealth can support a continuous flow of income over the long term. However, this cannot be taken for granted; just because a resource is renewable does not mean that it will necessarily be renewed over time. Unsustainable management of renewable resources can lead to permanent depletion of capital stocks in much the same way as the extraction of nonrenewable resources.

Figure 3: The Estimated Composition of Natural Wealth in Mauritania

Produced Capital 12%

Intangible capital 44%

Natural capital 44%
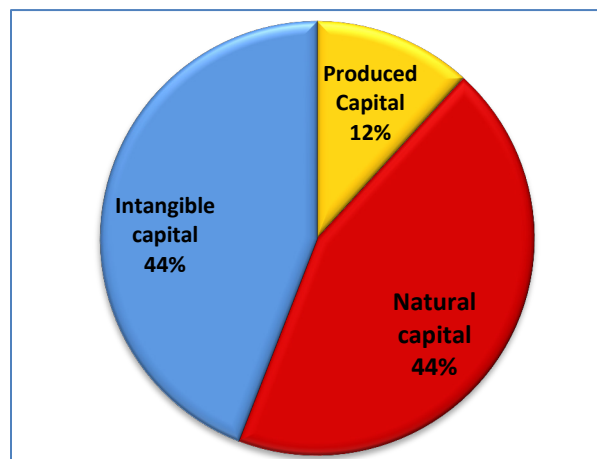
Although the size of Mauritania's national wealth stock broadly conforms to the pattern observed in lower-middle income economies,[32] its composition is more heavily weighted towards natural wealth. This reflects the fact that Mauritania is unusually well-endowed with mineral and fishery resources, and is not in itself

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[31] Please note that Figure 3 does not include estimates of net foreign assets, which are negative in Mauritania. Natural capital represents a bigger share of total wealth when net foreign assets are excluded.

[32] Mauritania's GNI per capita in 2012 equaled roughly US$ 1108 (PPP, Atlas method), exceeding the threshold of US$1,035 that separates low-income countries from lowe-middle-income countries. However, GNI per capita is just

a problem. On the contrary, it is a potential blessing. However, the presence of significant natural wealth does not always translate into shared prosperity, either for the current population or for generations to come. The failure to responsibly manage natural resources and adopt policies that expand the economic impact of resource exploitation can jeopardize broad-based growth and poverty reduction both now and in the future.

MAURITANIA'S NATURAL RESOURCE WEALTH BY CATEGORY

Fisheries

Of the six categories of natural wealth included in this analysis, two are renewable resources (fisheries and pasturelands) and four are nonrenewable minerals and hydrocarbons (oil, natural gas, gold and iron). The two renewable resources together represent the bulk of natural wealth at about 58 percent, while the four nonrenewable resources account for the remaining 42 percent.

Figure 4: The Relative Shares of Different Resource Categories in Mauritania's Natural Wealth

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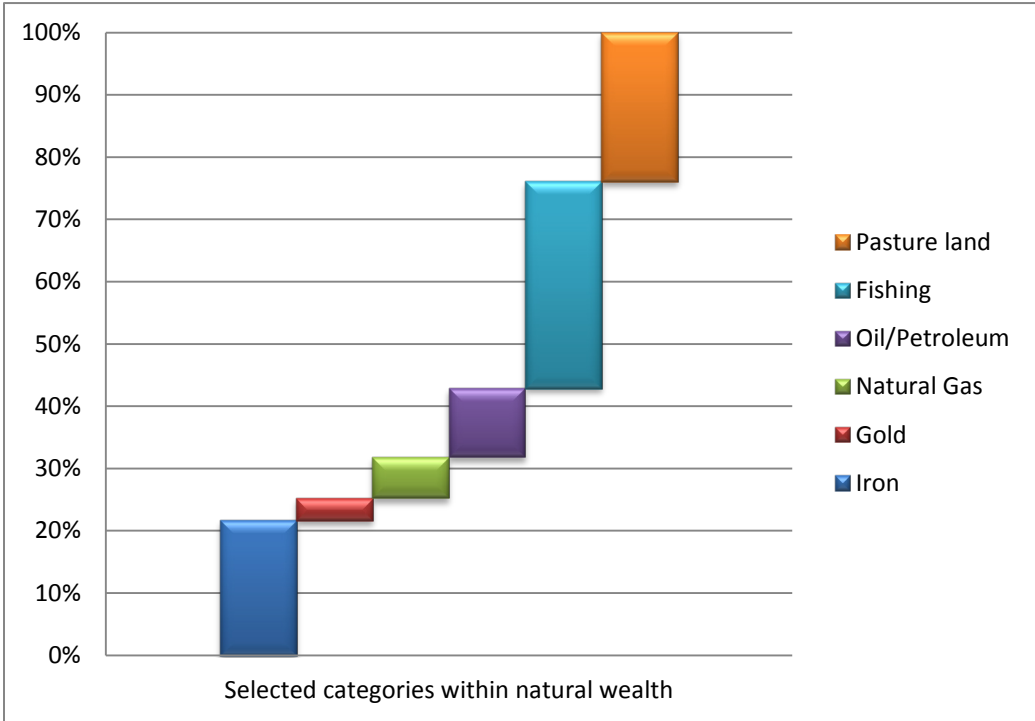
one measure of national income status, and Mauritania's rates of poverty and human development remain much more similar to the averages for low-income countries than for lower-middle-income ones.

The fisheries sector represents the largest share of natural wealth in Mauritania. With an estimated value of US$10 billion (or roughly US$2,800 per capita),[33] Mauritania's fisheries account for just over a quarter of the country's natural capital. Commercial fishing represents approximately 90 percent of the sector, with artisanal fishing accounting for the remaining 10 percent. Fishing contributes just 3 percent to annual GDP, but the sector registered double-digit growth rates in 2010 and 2011 and is expected to grow by 5 percent per year over the medium term. Meanwhile, the revenues generated by international fishing agreements have remained roughly constant as a share of total revenues for much of the past 7 years, typically accounting for around 20 percent of public-sector income. Due to the recent increase in mining revenues, however, the contribution of fishing agreements has declined in relative terms, accounting for 13 percent of total revenues in 2011 and 11 percent in 2012.

Although Mauritania is not a major global exporter of fish, with a world market share of slightly less than 1 percent, its waters are widely considered[34] to be among the richest on the planet. This has at least two important implications. First, the scale of fishery resources indicates that the sector has the potential to reinforce food security and support large-scale employment – especially by adopting policies oriented to move up the value chain. Second, the sector may continue to attract foreign investors and governments willing to pay significant amounts for fishing rights, which could continue to represent a substantial source of nontax revenue. However, both of these implications hinge on the ability of the government to sustainably manage its fishery resources. The long-term trajectory of the country's fish stocks will have important effects on employment, food security, public revenues and growth, as well as the preservation of biodiversity and the integrity of the larger marine ecosystem.

Sustainably managing the country's fisheries entails considerable challenges, and pressures on the sector are likely to increase over the medium term. Some of Mauritania's local fish species are already overexploited (see Table 1, below), and widespread global overfishing is expected to boost the value of remaining fishery resources. This underscores the importance of optimizing the rents from commercial fisheries and using a share of those resources to ensure that the sector is properly regulated.[35] Without effective monitoring and enforcement the overfishing of the highest-value species (e.g. octopus) may seriously jeopardize the regenerating mechanisms of the country's fisheries. Moreover, the incentives for overfishing are expected to intensify as global fish stocks dwindle. If left unchecked overexploitation could transform the fisheries sector into a so-called "finite resource",

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[33] As noted above these figures likely underestimate the total value of fish stocks as they exclude certain fish species for which the available data are inadequate.

[34] See, e.g., Forbes: http://www.forbes.com/places/mauritania/

[35] In July 2012 Mauritania signed a fishing agreement the European Union that touches on many key aspects of fishery regulation and fishing rights in Mauritanian waters, as well as environmental safeguards, labor regulations and financial compensation. The agreement was ratified by the European Parliament, October 2013, following long debates and negotiations.

which is a renewable resource that is rendered nonrenewable and thus may become biologically or commercially extinct over time. Actually, according to technical assessments conducted by IMROP (2006) and CECAF (2010),[36] several species are now under serious threat of being over-fished in Mauritania. Under the given assumptions, in 2013 the value of Mauritania's fisheries sector is estimated at roughly US$10 billion and it is being depleted at an estimated annual rate of US$390 million.

Table 1: Exploitation of Fishery Resources in Mauritania by Species[37]

Fishing product		Total Catch, 2005-2010	Diagnosis
Cephalopodes	Octopus	~ 30mln tons	overexploited
	Cuttlefish	~ 7mln tons	fully exploited
Non-cephalopodes	Black Hake (cod-like)	~ 12mln tons	moderately exploited
	Sardine (stock C)	~ 5mln tons	moderately exploited
	Sardine (round)	~ 1.5mln tons	overexploited
	Sardine (flat)	~ 1.3mln tons	under-exploited
	Jack mackerel (black + Atlantic)	~ 1mln tons	overexploited
	Mackerel	~ 0.6mln tons	fully exploited
	Thiof (white grouper)	~ 12mln tons	overexploited

Pastureland

Though smaller than fisheries, pastureland for livestock also represents a significant share of natural wealth, and is a more important source of livelihoods for poor Mauritanians. Mauritania's pastureland is valued at US$7 billion, or roughly US$2,000 per capita, and accounts for approximately one-fifth of the country's total natural capital. This sector is particularly important for job creation and food security, especially among the poor and members of vulnerable groups, and it is highly sensitive to rainfall fluctuations and the effects of climate change. Over half of the Mauritanian population derives its exclusive income from livestock[38]. It should be noted that the contribution of pastureland to the natural wealth stock is likely to be underestimated in this analysis, as the methodology sums the value of individual livestock products (milk, meat, leather, etc.), but is unable to capture the totality of production. Meanwhile, the value of Mauritania's cropland could not be estimated due to the absence or unreliability of key data.

Iron Ore

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[36] CECAF is the UN Food and Agricultural Organization's Fisheries Committee for the Eastern Central Atlantic.
[37] Source: IMROP
[38] See "Amélioration des Interventions des projets du FIDA dans le secteur de l'élevage en Afrique Sahélienne', International Fund for Agricultural Development (IFAD), Rome, 2007

As noted above, Mauritania is currently Africa's second largest exporter of iron ore, and iron accounts for the largest share of wealth in the country's extractive-resource sector. Extractive resources as a whole represent roughly 45 percent of Mauritania's natural capital. The net present value of its iron deposits is estimated at approximately US$6.5 billion, or US$1,800 per capita, and iron accounts for approximately one fifth of all natural capital—the same share as the country's pastureland. This analysis projects that annual iron production (currently 11 million tons) will increase to 25 million tons by 2020 and reach at least 35 million tons by 2025 and will last for many years. Future prices and production costs are based on the World Bank Development Economics Department's projections and on estimates by JP Morgan.[39]

Gold Ore

Gold reserves represent between 3 and 4 percent of Mauritania's natural capital stock, or US$1.1 billion (US$300 per capita), and gold is the resource most vulnerable to price volatility. Estimates of the net present value of gold reserves are extremely sensitive to price projections, and the figures presented in this analysis should be viewed with appropriate caution. The analysis estimates that gold prices will remain at an average of US$1500 per ounce over the medium term and then decrease to US$1200 per ounce.[40] Should average world prices fall below US$1300 per ounce before 2020 the rent generated by this sector would be significantly diminished or also negative. The annual depletion of gold reserves is estimated at US$41 million in 2013.

Natural Gas

Natural gas has only recently been discovered in Mauritania, and the sector currently represents an estimated US$2 billion (US$550 per capita), or approximately 6 percent of total natural capital. The analysis is based on the assumption that production will start in 2016 and will last for 22 years. The annual depletion of wealth in the natural gas sector is estimated at US$75 million. Once more it is useful to highlight that these figures depend on current assumptions: considering that natural gas is a very recent discovery in Mauritania, this paper adopted a conservative approach, and the resulting estimates are to be regarded as provisional.

Crude Oil

Finally, petroleum reserves are estimated at just over US$3.3 billion (US$930 per capita) and represent more than 10 percent of Mauritania's natural capital. Due to price volatility the analysis is based on an average fixed price of US$100 per barrel over the long term, adjusted for inflation. Data for production costs are

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[39] For more detail on the methodology used see Annex 2.
[40] Prices expressed in nominal 2013 terms.

based on estimates by the US Department of Energy.[41] The annual depletion of wealth in the crude-oil sector is estimated to roughly US$125 million.

Updated Figures for Adjusted Nets Savings in 2013

After formulating estimates for the different types of national wealth (natural, produced and intangible) and for annual wealth depletion in each natural-resource category, the Adjusted Net Savings (ANS) rate for 2013 can be calculated. The results of the analysis are presented in Figure 5, below.

Figure 5: Adjusted Net Savings and Gross National Savings as a Share of GNI, 1997-2013
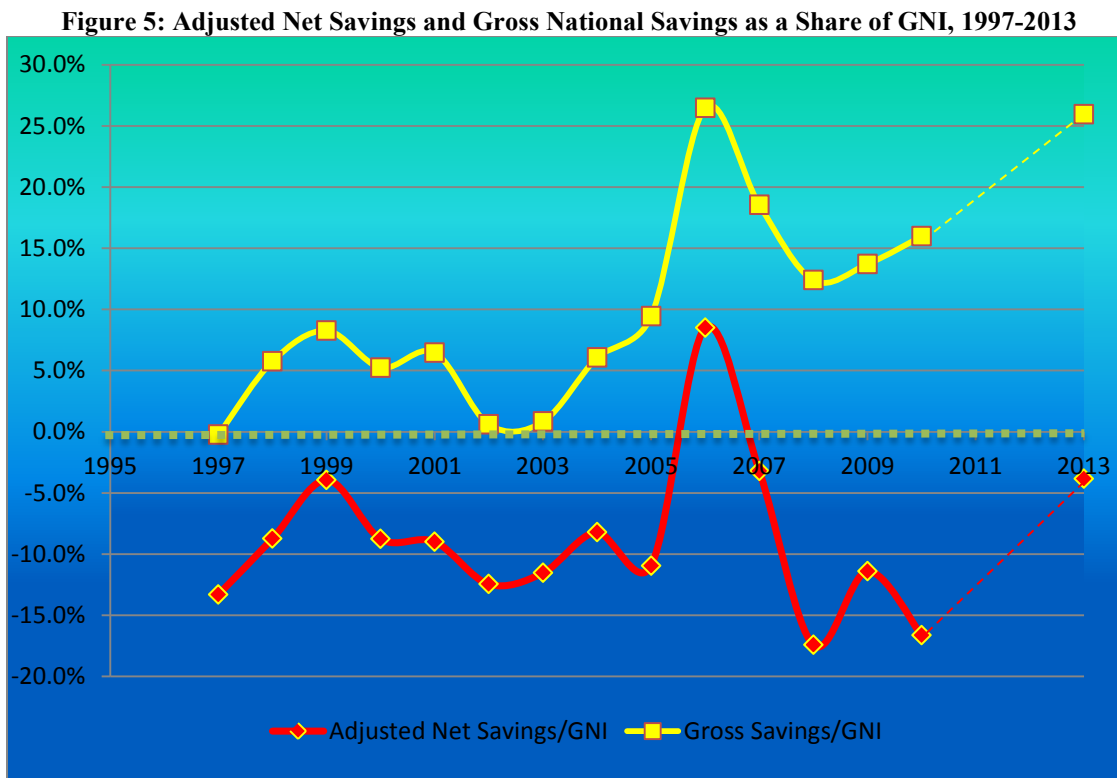
The analysis finds that while Mauritania's gross savings rate has been consistently positive, its national wealth stock is nevertheless in decline. Its 2013 ANS rate is slightly negative, and though currently above its recent average, this nevertheless indicates that the sustainability of Mauritania's national wealth is in jeopardy. Over the past 6 years the country's ANS rate has been consistently negative, with the exception of 2006, when domestic savings was boosted by a temporary boom in the oil sector.

The ANS methodology indicates that Mauritania's stock of national wealth fell by 3.9 percent in 2013. Countering this trend will require expanding the reinvestment of resource rents in produced and intangible

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[41] The Energy Information Administration, US Department of Energy; http://www.eia.gov/tools/faqs/faq.cfm?id=367&t=6

capital, especially public infrastructure and administrative capacity, while building human resources through greater education spending. Investing in produced and human capital will help to lay the foundation for enhanced competitiveness while promoting positive spillover effects from the high levels of FDI flowing into the country. However, if negative ANS rates persist, Mauritania's national wealth stocks will continue to be depleted, and its current growth may ultimately prove unsustainable over the long term.

Policy Implications

IN A CONTEXT OF NEGATIVE ANS OVER GNI, MAURITANIA NEEDS TO RECALIBRATE NATURAL-RESOURCE WEALTH MANAGEMENT TO BUILD THE FOUNDATION FOR LONG-TERM GROWTH

Sustainable growth is defined as "growth that meets the needs of the present without compromising the ability of future generations to meet their own needs"[42]. A country that grows rapidly on the strength of nonrenewable resources without rebuilding its stock of wealth by investing in other forms of capital will not be able to maintain its growth over the long term, and risks sacrificing the wealth of future generations to finance its current consumption. A sustainable growth strategy must account for the temporal and intergenerational dimensions of resource wealth by ensuring that current growth does not come at the expense of future growth. Clearly, the discovery of new forms of extractive resources can also play a positive role.

Looking at the macroeconomic and fiscal environment, the core question is whether the consumption/savings balance is adequate and if not what could be done about it. Adopting policies aimed at increasing savings and maximizing rents from natural resources, sustaining human capital investment, adopting transparent and consistent fiscal policies will be vital to building the government's policy credibility and expanding the available space for public investment or free-up resources to build fiscal reserves. Authorities are aware of the need to diversify the economy, boost competitiveness and private-sector confident, and promote progressive increases in domestic value addition to create jobs and make growth more than merely selling off raw commodities. These objectives have become more pressing in recent years, as a food crisis from 2011-2012 and by the sociopolitical instability of the Sahel region have underscored the importance of broad-based poverty reduction. The primary objectives of the government's latest Poverty Reduction Strategy Paper (*Cadre Stratégique de Lutte contre la Pauvreté*) for 2011-2015, as well as the World Bank's Country Partnership Strategy for 2013-2017 and complementary medium- and long-term development strategies focus on economic diversification, poverty reduction and job creation.

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[42] Quote from World Commission on Environment and Development's (Brundtland Commission) report "Our Common Future", Oxford: Oxford University Press, 1987

Reinvesting the revenues from natural resources into other forms of productive capital requires a strong policy framework grounded by clear policy commitments.[43] These should include (i) efforts to promote efficient resource extraction with a view to maximize resource rents; (ii) a fiscal regime for the resource sector that enables the government to recover an equitable share of resource rents; (iii) well-designed investment policies that use resource rents to generate sustainable returns over the long term; and (iv) an appropriate legal and institutional framework to promote efficient and sustainable land use, which is particularly important in countries such as Mauritania, where land tenure is often governed by traditional systems and informal arrangements.[44] In this respect, it should be highlight that, with the support of the World Bank, the Ministry of Economic Affairs and Development (MAED) of Mauritania has recently (2013-14) committed to adhere the Inclusive Green Growth model, with the objective of making economic growth more efficient, environmentally friendly, resilient, and equitable.

New resource discoveries or improvements in extractive technologies will positively impact current wealth estimates; this underscores the importance of promoting further exploration by mining and oil and gas companies. Thus it is also necessary to establish an appropriate trade-off between short-term rent extraction and long-term promotion of the sector. Using strategic planning to maximize the long-term value of natural resources will remain a central policy challenge in Mauritania. Given its high degree of external vulnerability and the persistence of high poverty rates despite strong recent growth, the responsible exploitation of natural-resource wealth coupled with appropriate re-investment policies should be among the government's top development priorities.

In this context the Hartwick rule can provide a set of useful parameters for understanding how natural-resource rents can be invested in other forms of capital in a way that maintains the total stock of national wealth intact. However, despite their usefulness as policy tools it is essential to avoid mechanistically applying indicators like the ANS or the Hartwick rule without considering the specifics of the country. Re-investment in physical and human capital *per se* is not always 'the' optimal use of resources. Important considerations which go beyond the scope of this paper include the absorption capacity, as well as the fact that new physical capital often requires significant ongoing expenditures to keep it functional, and increased education investment often

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[43] Cf. "World Bank (2013) "Priority Policy Linkages and Workplan: An Update on Progress" Wealth Accounting and Valuation of Ecosystem Services (WAVES) Partnership, Washington DC: The World Bank.

[44] <<If those who farm lack secure rights to land, they have less incentive to exert effort to use [land] productively and sustainably, or to carry out land-related investments. [...]Secure and unambiguous property rights also allow markets to transfer land to more productive uses and users. Cost-effective systems of land administration facilitate agricultural investment and lower the cost of credit by increasing the use of land as collateral, thus reducing risk for financial institutions.>> Extract from "The World Bank, World Development Report 2008: Agriculture for Development", Washington, DC: The World Bank, 2007
http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf , Chapter 6

implies a sustained increase in current spending. In a country such as Mauritania, which is highly exposed to external shocks, the long-term commitments imposed by investment may – for instance – end up limiting the fiscal space available for countercyclical stabilization or may force painful budgetary cuts in the event of a revenue downturn, etc. As is often said, but it is worth repeating, there is no such a thing as a 'one-size-fits-all' recipe.

In the past Mauritania's public policies have not always contributed to enhancing competitiveness and facilitating diversification. Government spending has focused on consumption (especially via food and fuel subsidies) rather than investment[45] (especially infrastructure development and education expenditures). Recent policy shifts suggest this may be starting to change, as public expenditures have been reoriented toward phasing-out subsides in favor of conditional cash transfers and increased public investment in critical areas such as energy and transportation infrastructure. This new fiscal policy stance may significantly contribute to improving the ANS rate and thereby protecting or increasing the stock of national wealth. Regular updates of the analysis presented here would help the government and its development partners to remain abreast of changes in the long-term trajectory of national savings.

RESOURCE RENTS MAXIMIZATION AND EFFICIENCY IN PUBLIC SPENDING: SHORT- AND LONG-TERM PERSPECTIVES

As described above, the central challenge of managing resource rents is striking the right balance between investment and consumption. A key element in this tradeoff is the marginal returns offered by different types of public investment. Mauritania suffers from a substantial dearth of essential infrastructure. For instance, presently just 30 percent of the national road network is paved, only 20 percent of the country's arable land is cultivated, and just 11 percent of irrigable land is irrigated, due to a lack of infrastructure..[46] This strongly suggests that increased investment in physical infrastructure will generate strong economic returns. However, if on one hand shortfalls of produced and human capital are certainly constraining development, on the other hand - and in the short to medium term especially – the absorptive capacity of Mauritania is likely to be low and an overemphasis on these forms of capital may result in unproductive investments. So, the time path for the use of revenues needs to be carefully thought out; one possibility could be to keep at least some part of the revenues in a sovereign wealth fund in the short term.

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[45] As an indicator of this, during the period 2003-2007 the average current expenditure equaled 24.1 percent of GDP, while the average for capital expenditure was equivalent to 8.3 percent of GDP. In the same period, the cumulated expenditure on wage bill, good and services, and subsidies was around three quarters of total expenditures and net lending.

[46] World Bank World Development Indicators, WDI, available online; and FAO website:
http://www.fao.org/isfp/country-information/mauritania/en/

Looking at public spending, the fundamental tradeoff is between current spending, which generates immediate but temporary benefits, and investment, which defers present benefits for the sake of future returns. The appropriate prioritization of public spending is a complex issue and extends well beyond the scope of this paper; however, a number of important considerations should inform the decision, such as: the estimated rate of return on public investments; the quality of investments and the efficiency of overall public spending; the execution capacity of public agencies; the long-term economic obligations arising from new investment projects; the strength of governance and public institutions; and the country's current fiscal-policy stance. This fundamental tradeoff may also have significant implications for fiscal sustainability; for example: countries experiencing natural resource boom in many cases increase current spending and – for instance – public sector wages; it should be borne in mind that while natural resource revenues are inherently volatile and uncertain, increases in current spending, like wage hikes, are typically impossible to reverse and may pose a threat to long-term fiscal sustainability if future revenues are unable to support current expenditure levels.

INSTITUTIONALIZATION AND IMPROVEMENT OF SECTORAL INTELLIGENCE NEEDED FOR WEALTH ACCOUNTING

A final issue is the availability of information to estimate natural capital and total wealth. In Mauritania there are no comprehensive statistics on wealth accounting, and no attempt to expand, standardize, or regularly update these accounts to reflect the evolution of natural-capital stocks. It is highly recommended that the system of national accounts be updated to include changes in natural capital just as it does man-made capital. The United Nations has developed a System of Economic-Environmental Accounting (SEEA), which encompasses good-practice standards, concepts, definitions, classifications, and accounting rules for producing internationally comparable statistics on natural resources and their relationship with the economy.[47] The SEEA is, in other words, a statistical standard that provides methodology for measuring depletion and associated macro aggregates and indicators (such as ANS, or Adjusted National Net Income –ANNI-). Ideally, it would be updated periodically in line with strategic national development documents, such as for instance the poverty reduction strategy papers, or other planning documents. Adopting the SEEA system would be an important first step for the Mauritanian government in expanding its capacity to preserve, protect, and enhance the country's national wealth, building the foundation for prosperity both in the present and for generations to come.

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[47] For more on this, see: www.unstats.un.org.

Annex 1: Data Sources

Data appraisal and availability represent the very key issues for this type of analyses. This paper is the outcome of a heroic effort in identifying pieces of information and data coming from the public sector and the private sector, both at the macro and micro level, undertaken through empirical research (exchange of information and meetings) involving several stakeholders in Mauritania.

Data on final consumption, exchange rate (MRO/USD), population, GDP deflator, and Gross Fixed Capital Formation is sourced from the World Development Indicators (WDI) of the World Bank[48]. Data on the projections for iron and gold prices are based on the estimates of monthly world prices of commodities and indices by the Development Economics Department (DEC) of the World Bank[49].

Iron and Gold

Data on annual production, exports, profits, average price (EUR/ton), CAPEX and cost estimates for the iron sector are sourced directly from SNIM. Data on annual production, CAPEX and unit cost of production have been sourced from KINROSS Tasiast, during meetings in persons with World Bank staff in Nouakchott, as well as from company's documentation. In the case of gold, upfront capital costs have been estimated by World Bank staff basing on discussions with company representatives and local stakeholders. The team also met with the Office Mauritanien des Recherches Géologiques (OMRG) which provided precious background information and useful data on the overall mining sector.

Fishery

Data appraisal for the fishery sector was based on empirical research and direct surveying and meetings with: Société Mauritanienne de Commercialisation de Poissons (Mauritanian Company for Fish Exports, SMCP), Federation National des Pêches (National Federation of Fishery, FNP), the Institut Mauritanien de Recherches Océanographiques et des Pêches (Mauritanian Institute for Oceanographic Research and Fishery, IMROP), Direction de la Marine Marchande du Ministere des Peches (Directorate of Merchant Shipping at the Ministry of Fishery). In addition, World Bank staff visited the artisanal port of Nouakchott and the artisanal and commercial port of Nouadhibou, conducting direct interviews to local fishermen and insiders to obtain empirical data. This research utilized data on the number of boats, on the average catch (in tons) per year, on the average number of trips (per boat) per year, on the average number of sailors per boat, on labor costs (docking costs, crew costs, fuel costs and equipment costs), and on the price of various type of catches. The team provided assumptions for a

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[48] Online database available at: data.worldbank.org/data-catalog/world-development-indicators
[49] Data available at http://go.worldbank.org/QNYZRM5540

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number of remaining indicators for which direct data was not available, such as: the annual growth in ship fleets, the maximum size of the fleet over time, the costs of baits, crew provisions, cost of ice (or refrigerating systems), costs of maintenance and repair, depreciation costs (of the hull and engine – in the case of motorized boats –), other unspecified costs (such as permits). Future costs have been assumed constant but adjusted for inflation over time. It is important to highlight that the rents calculated for the fishery sector are based on the assumption that the stock behaves as a finite resource. This is not (yet) the case, although risks persist due to the overexploitation of several species (see page 17).

Natural Gas and Crude Petroleum

The World Bank team met with representatives from the Société Mauritanienne des Hydrocarbures (Hydrocarbon Agency of Mauritania, SMH) and with officials from the Ministry of Energy and Mines, who provided very useful cooperation and precious background information about the sector. With regard to natural gas, specific data on unit prices, costs of production, upfront capital costs, total annual production, and related estimates for the future were sourced from internal World Bank data based on a recent WBG project on the Banda gas field[50]. In the case of crude oil, historic data on production and prices were obtained by the SMH. Basing on that, future production is estimated at roughly 2,5 million barrels per year, and price is assumed to be equivalent to average USD 100 per barrel, adjusted for inflation over time. In the absence of better direct data availability, total unit costs of production have been assumed equivalent to the average for the African Total Upstream Costs, as per the estimates provided by the United States Energy Info Administration (EIA) of the US Department of Energy[51].

Pasture Land

Information on pasture land consisted in data on production and prices of milk, meat and a large set of animal derivatives produced in Mauritania. This data was retrieved with the very precious cooperation of the Ministry of Rural Development, which provided historic statistical figures. On the basis of such figures, staff proxied the estimates for future prices, productions and rents, basing on the average of the last available 5 years data.

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[50] For more information on this Project, please see :
http://documents.worldbank.org/curated/en/docsearch/projects/P145664
[51] http://www.eia.gov/tools/faqs/faq.cfm?id=367&t=6

Annex 2: Specific Methodological and Sectoral Issues

Common assumptions across all natural wealth estimates

For each sector, the analysis aimed at calculating the Resource Rents (RR), meaning the net income from resource extraction (renewable or non-renewable). RR can be defined as the total revenue from gross sales less all costs incurred in the extraction process, including opportunity costs of produced capital and adjustments for inflation. The rent is projected over the time of a generation (considered to be equivalent to 25 years, from 2013 to 2038). This study also considers an inflation rate of 3 percent along the considered period. This inflation rate is assumed on the basis of the latest IMF macroframework projections. The return to fixed capital (or opportunity cost of capital) is assumed to be equal to 10 percent and is deducted from the net operation rent of each sector, for each year; finally, the deriving adjusted rent is also adjusted for the social discount rate. The discount rate this paper utilizes is equivalent to 4 percent.

It should be highlighted that the present research could not undertake the analysis of the estimate wealth in the crop land and biological capacity of the land in Mauritania. This sector represents a very important resource for the country, but the unavailability and unreliability of data led to this conclusion (the methodology would require information on the sales of land, or on the annual flows of rents that the land generates. In the first case, the team was not able to identify any official source for such data, while in the second case the amount of information required underpins a massively extensive effort which was not possible to conduct during this search. This highlights how the results of the analysis underestimate the actual total wealth of the country).

The following paragraphs will provide a deeper description of the methodology for each sector. Once RR was calculated for each of these sectors, all RRs were summed to obtain the current Mauritania's stock of natural wealth. This estimate measure of the natural capital's (*NK*) stock represents one the components of total wealth (*TW*), according to the following basic equivalence:

$$TW = PK + NK + IK + NFAs$$

Where:

NK is the natural capital, and it corresponds to all lands, waters and their biodiversity. In this paper this is equivalent to the sum of Pasture Land, Crude oil, Natural Gas, Iron ore, Gold ore, and Fishery, as it is highlighted earlier.

PK is the Produced Capital, defined as the accumulation of investment series (i.e. gross fixed capital formation, GFCF[52]), accounting for depreciation of capital. In other words, produced capital can be regarded as the sum of physical capital and urban land[53].

NFAs are the Net Foreign Assets, calculated as total value of the assets that the country detains abroad minus the value of the domestic assets owned by foreigners. The figures that this paper used for NFAs are contained in the External Wealth of Nations Mark II database[54].

TW is the Total Wealth, to be regarded as the present value of future consumption which is sustainable, discounted at a rate of time preference, over the time of a generation. *TW* is calculated by converting final consumption expenditure from local currency units to US$ and subtracting the Adjusted Net Savings (ANS) figure – if that is negative – in order to obtain a sustainable consumption figure; then current prices are converted to constant using the USD GDP deflator, and finally the latest five year average of consumption (2008-2012, in constant prices) is taken into account as a basis for the calculation of the net present value of consumption over the 25 year period[55].

IK is the Intangible Capital, and it is calculated as a residual.

On the one hand this methodology allows us to estimate quantitatively the stock of wealth of a nation, and, more in detail, to provide a sectoral decomposition of this wealth. This outcome may be highly useful in contributing to the identification of priority sectors, and may support policy makers orienting longer term growth, investment, labor policies, among others. On the other hand, the methodology provides a proxy to estimate depletion for each sector[56]. As a consequence, the calculation of such depletion for each sector (e.g. energy, mineral) allow to compute an updated adjustment (for 2013) to the standard saving measure of Gross National Savings (GNS), which corresponds to the Adjusted Net Savings (ANS) or genuine savings.

ANS is a concise indicator of the sustainability of the country's investment and growth long term policies. The measures of savings traditionally utilized in the national accounts balance sheets do not reflect realistic changes in the broader evolution of resources' stocks. Quoting Joseph Stiglitz: "GDP tells you nothing about sustainability. [...] No one would look just at a firm's revenues to assess how well it was doing. Far more

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[52] GFCF typically comprises all domestic investment on land improvements, roads, plants, machinery, buildings, the technology in use and infrastructure. GFCF does not distinguish between different types of capital expenditure nor their different depreciation rates.
[53] According to the methodology in The Changing Wealth of Nations: Measuring Sustainable Development for the New Millennium (World Bank, 2011) this paper assumed an annual rate of capital depreciation equivalent to 5 percent, and a value for urban land at 24 percent of physical capital across all countries.
[54] Cf. Lane and Milesi-Ferretti, 2007; database online available at http://www.philiplane.org/EWN.html
[55] The discount rate assumed is equivalent to 1.5 percent
[56] For a detailed description of the methodology, please refer to: The Changing Wealth of Nations, The World Bank, 2010

relevant is the balance sheet, which shows assets and liability. That is also true for a country."[57] ANS is able to fill this gap and to provide an answer to this relevant question: has total wealth risen or fallen throughout the accounting period? In other words, ANS is a measure of a "truer" rate of savings in an economy, after taking into account investments in human capital, depletion of natural resources and damage caused by pollution.

$$ANS = (GNS - Depr) + EE - ED - MD - NFD - CO2D - PMD \text{ [58]}$$

After discounting consumption of fixed capital from GNS, current spending on education is added as a proxy and first approximation for human capital investments (EE also includes wages and salaries in the education sector and excludes capital investments in buildings and equipment); then rent from the depletion of natural resources is deducted, to account for mineral, energy and forest depletion; and finally damages from carbon dioxide emissions are deducted.

Going one extra mile, however, it was noted that the concept of ANS does not necessarily fully respond to the question of the sustainability of an economy if we do not introduce also the dimension of demographic patterns. When there is a growing population, for instance (which is the case of most developing countries), even a positive ANS may coexist with a declining wealth per capita. Where ANS is negative, of course, it is clear that both total and per capita wealth are shrinking. This paper, therefore, takes into account also the population dimension, assuming it as an exogenous variable. Defining total wealth as TW, population as P, and population growth rate g, then the change in wealth per capita can be represented through the following formula:

$$\Delta\left(\frac{TW}{P}\right) = \left(\frac{\Delta TW}{P}\right) - g * \frac{TW}{P} = \frac{TW}{P}\left(\frac{\Delta TW}{TW} - g\right)$$

where we deduct a population dilution term $(g * \frac{TW}{P})$ (the population growth rate times total wealth per capita) from the change in total wealth over population. In fact, we may interpret ΔTW as ANS. In other words, the equation argues a correlation between wealth and fertility rate, telling that total wealth per capita will rise or fall depending on whether the growth rate of total wealth (ΔTW/TW) is higher or lower than the population growth rate[59].

Methodology and context for the gold and iron wealth estimates

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[57] Nobel Prize-winning economist Joseph Stiglitz on GDP and learning from business, Foreign Affairs, 2005
[58] Where: ANS = adjusted net saving; CO2D = CO2 damages; Depr = depreciation, ED = energy depletion; EE = education expenditure; GNS = gross national saving; MD = mineral depletion; NFD = net forest depletion; PMD = Particulate Matter damages.
[59] Cf. Where Is the Wealth of Nations?: Measuring Capital for the 21st Century, THE IMPORTANCE OF population dynamics changes in wealth per capita, The World Bank, 2006, Chapter 5.

The methodology followed by this paper is a Net Present Value (NPV) analysis. This paragraph will show the passages that led to estimate the mineral wealth of the gold and the iron ore clusters in Mauritania. Such methodology is based on the estimation of resource rents over the life of the mine. The resource rents (RR), in year t are calculated according to the following formula:

$$RR_t = \big((P_u - VC_u) * Q_t\big) - FC_t - A$$

Where:

VC_u is the unit variable cost associated with the extraction of one ton

P_u is the unit price of a ton

Q_t is the annual mineral production

FC_t corresponds to the annual fixed costs

A represents the amortized capital

The amortized capital is the opportunity cost of capital or "allowed profits":

$$A_t = I_t * \frac{pr * (1 + pr)^n}{(1 + pr)^n - 1}$$

Where

n = the life of the mine and

pr = the private sector discount rate.

The NPV of the rents are calculated by discounting the sum of annual rents using a social discount rate of 4 percent. Year t_0 is 2013 and the final year, year t_n corresponds to the end of the mining operations.

$$W = \sum_{t=n}^{t=0} R_t * \frac{1}{1 + r^t}$$

In order to obtain wealth per capita estimates, the figure W is then divided by population figures[60] for Mauritania.

The assumptions used to calculate wealth estimates for Mauritania's iron reserves are based on qualitative and quantitative fact-finding mission and empirical research conducted in Mauritania, during the months of

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[60] Data source: WDI, World Bank, population figure for 2010.

February-March 2013. Assumptions for the Iron and gold reserves come from a number of different sources[61]. With specific respect to the reserves of gold, there is a high degree of uncertainty; more than one feasibility study has been conducted to assess the potential expansion of the current mine (which produced roughly 200Koz both in 2010 and 2011). Basing on the fact-finding mission and on data obtained by discussing with the mining company and local stakeholders in Mauritania, this paper assumes that the expected expansions will take place bringing the production up to a range of 700Koz-800Koz per year (roughly equivalent to 23ton). Price of iron is assumed to stay constant over the life of the mine, while price of gold is assumed to decrease over the medium term (starting from 2020) to lower ranges.

A degree of uncertainty is however associated with several estimates and assumptions in the mineral cluster (among others, the high degree of mineral price volatility over recent years). As a consequence, these factors may considerably modify the outcomes of the analysis in some cases, and therefore the mineral wealth calculations ought to be interpreted with caution and are subject to change.

Table 2. Summaries of assumptions related to the iron and gold sectors

Assumption	Iron	Gold
Year	2013 (mines are already active)	2015 (estimated start of production)
Life of the mine	25 years	25 years
Upfront capital costs (US$)	-	USD 2bln
Unit cost of production (U$/ton)	USD 105/ton	USD 800/Oz
Unit price (US$/ton)	130	USD 1,500/Oz until 2020, then USD 1,300/Oz
Annual production	11-12mln ton	23 tons
CAPEX (US$)	280mln	400mln
Natural wealth per capita estimates ($)	**1'826**	**301**

Methodology and context for the Fishery wealth estimates

The methodology followed for the calculation of the wealth per capita estimates for fishing proved to be particularly complex, mainly due to scattered, weak, and in some cases unavailable pieces of information. The fishery sector was subdivided into three main lines of business: artisanal fishing with non-motorized boats, artisanal fishing with motorized boats, and commercial fishing. Within each of these categories, the analysis identified two classes of catches: pelagic and cephalopod. A third important class of catches – the demersal species – although not marginal represent a smaller amount of catches and were not included into this analysis mainly because data on this type of fishing was unreliable and – for most part – missing. The majority of catches

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[61] Please see Annex 1, at page 24, for more detail on this.

is represented by small pelagic fish (roughly 1 million ton a year) vis-à-vis the cephalopods (approximately 100,000 tons), which however are remarkably more valuable. A very significant portion of the catches is attributable to foreigners, which – in large part – do not even land in Mauritania.

The methodology consisted in calculating the Resource Rent for each of the six lines of fishery pre-identified (cephalopod artisanal non-motorized; cephalopod artisanal motorized; cephalopod commercial; pelagic artisanal non-motorized; pelagic artisanal motorized; and pelagic commercial). In each case – basing on the data and assumptions shown more in detail in the following paragraphs – the revenues were calculated, and subsequently the opportunity cost of capital (intended as the assumed profit margin) and the total operating costs (fixed costs, CAPEX and labor costs) were deducted. The rent, thus obtained, was discounted over the time of a generation (capped also in this case at 25 years) and by a 4 percent social discount rate. The calculations also utilized an assumption for the future average USD/MRO exchange rate (since data and assumptions have been made in LCU) which was estimated at 370. A 3 percent inflation rate has been taken into account, as well as for the other natural capital's sub-sectors. Finally, the NPV of rent has been divided by the population figure in order to obtain the wealth per capita.

Artisanal fishing - Cephalopods

The largest part of artisanal fishermen in Mauritania is engaged in octopus fishing (which represents the vast majority of cephalopod catches). Among the totality of boats used for cephalopods fishing, approximately three quarters are motorized, and correspond to the traditional small Senegalese vessels known as *pirogues*. The efficiency of these motorized boats at catching fish is 30 percent higher than the non-motorized ones, but – as to be expected – also variable and fixed costs are higher (more than threefold) compared to the non-motorized fishing. Basing on local interviews undertaken at the ports of Nouakchott and Nouadhibou, fishermen are paid, on average, approximately MRO1,000 per day (slightly more than USD 3) on either motorized or non-motorized *pirogues*, plus they receive some small food in kind as provision. Costs of a motorized artisanal boat are almost equally split between fuel and labor expenditures. A costly item for the motorized artisanal fishing is represented by the nets, corresponding to approximately 5 percent of total costs in a year.

Table 3. Main assumptions used for the wealth calculations of artisanal fishing of Cephalopods[62]

Assumption - CEPHALOPODS	Non-motorized vessel	Motorized vessel
Number of vessels in year 0	350*	1400
Annual vessel growth (y-o-y)	1 percent*	4 percent
Maximum fleet size (over the time of a generation)	600 units*	4000 units*
Average catch per day (tons)	0.02*	0.03
Annual number of trips	200*	260
Average price per ton (USD)	5,000	5,000
Average total costs per vessel (annual, in USD)	13,500	48,000
of which: Labor costs (USD)	4,000	8,600
Annual depreciation costs (USD)	100	550
Opportunity cost of capital	15 percent of total revenues*	15 percent of total revenues*
Natural wealth per capita estimates ($)	**15**	**80.7**

Artisanal fishing - Pelagic

When we look specifically at pelagic fish, it is important to highlight that the stocks of fish we are referring to belong to a sub-region that goes from Morocco to Senegal. This stock is estimated to equal approximately 10 million ton[63]. It is therefore hard to discuss the depletion of fish in one specific country, because of migratory species. As a matter of fact it would be very hard to isolate the portion of fish "belonging" exclusively to the Mauritanian waters, since most of the fish moves and migrates depending on seasons, temperature variations and a long potential list of environmental factors. This reduces further the level of confidence of the data under

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[62] Figures shown in this and in the following tables on fishery are based on data received from the Ministry of Fishery of Mauritania, the Institut Mauritanien de Recherches Océanographiques et des Pêches (IMROP) and on interviews conducted in Nouakchott and Nouadhibou during the month of February 2013. To note: the fleet sizes (of both the non-motorized and motorized vessels) have been capped to reflect the size at which diminishing returns may kick in due to overcrowding. At the same time this are all estimates and as such are subject to change, for example, depending on the evolution of the fishermen productivity. In this and the following similar tables:
(*)Asterisk indicates that the value is assumed. This is made in the cases when direct data was not available.
(**) According to the Ministry of Fishery, the number of these vessels is equivalent to roughly 350, while IMROP says 90. This paper opted for a rough average of 200 vessels, within this range.
(***) The average salary for a sailor employed on a commercial vessel catching cephalopods was assumed, proxied on the ratio calculated between commercial pelagic and non-motorized pelagic (given that the average salary of a fisherman catching cephalopods on non-motorized canoes is known).
(****) Depreciation costs of the hull were assumed based on the hypothesis that a commercial large vessel engaged in cephalopod fishing costs, on average, USD 50mln and that its lifespan is approximately 25-30 years.
(*) Asterisk indicates that the value is assumed. This is made in the cases when direct data was not available.
[63] Estimate sourced by interview with IMROP representatives in Nouadhibou, February 2013.

observance, since a regional approach to the estimate of wealth of the fishery sector would be, in light of the above, more fitting and methodologically reliable.

To date, artisanal pelagic fishing is undertaken by roughly 400 *pirogues*, three quarter of which are motorized. Also in this case, their efficiency is remarkably higher than the non-motorized ones, but, exponentially more than in the case of Cephalopods. Artisanal motorized canoes are 2.5 times more efficient in catching fish than the non-motorized canoes. This large spread is attributable to several factors, and especially: 1) the number of trips operated by motorized canoes is significantly higher (per year) vis-à-vis the non-motorized ones; 2) due principally to the higher quality of catches and to better conservation methods, the price of fish caught by motorized *pirogues* is almost twice as high compared to the non-motorized boat. Similarly, total costs are higher (more than fivefold) for the category of motorized artisanal fishing. Also the salaries show a difference, with fishermen working on motorized boats earning more than twice (MRO7000 per day, roughly USD23) than their peers working on non-motorized *pirogues* (MRO3000 per day, roughly USD10).

Artisanal fishing represents a tiny stakes of wealth, in terms of NPV, or in the case of the non-motorized fishing of pelagic the wealth figure becomes even slightly negative, signaling that the amount of inputs utilized to extract this resource are higher than the output. Despite the methodological caveats behind this finding, its relevance remains; at the same time, it should be noted that the segments of artisanal productions are extremely important since they provide labor and basic sustenance to a large portion of very poor households involved.

Looking more specifically at the labor costs, they represent roughly 50 percent of total costs for non-motorized boats catching pelagic, and 60 percent of total costs of motorized *pirogues* (due to higher salaries and to the higher number of people working aboard).

Table 4. Main assumptions used for the wealth calculations of artisanal fishing of Pelagic species

Assumption - PELAGIC	Non-motorized vessel	Motorized vessel
Number of vessels in year 0	100	300
Annual vessel growth	1 percent*	4 percent
Maximum fleet size (over the time of a generation)	200 units*	1500 units*
Average catch per day (tons)	0.08	2.1
Annual number of trips	140	200
Average price per ton (USD)	100	250
Average total costs per vessel (annual, in USD)	13,500	70,000
of which: Labor costs (USD)	6,500	45,000
Annual depreciation costs (USD)	100	550
Opportunity cost of capital	10 percent of total revenues*	10 percent of total revenues*
Natural wealth per capita estimates ($)	**-5**	**185.7**

Commercial fishing – Cephalopod and Pelagic

The paper takes into account two different categories of commercial fishing rent estimates: (i) pelagic fishing; and (ii) cephalopod fishing. This is where most of the wealth is concentrated, since these two clusters represent respectively a patrimony of USD 5 bln (pelagic) and USD 3.6 bln (cephalopod); or – in per capita terms – USD 1'475 (pelagic) and USD 1'040 (cephalopod).

A major consideration here is needed: is this wealth staying in Mauritania, or at least to some extent benefitting local population? Responding to this question is complex but an answer at first blush would lean on the "no" side. A large part of these catches do not make it to Mauritanian land, and are debarked in continental Europe or in the – geographically very close – Las Palmas islands. This phenomenon takes place beyond the specific case of Mauritania and is common to several developing countries rich in marine resources, who are able to get only tiny percentages (often under 10 percent) of the several billion value of fishery off their coasts. Foreign fishing fleets get the difference[64].

The importance of being able, for a fish-resourceful country, to estimate and track the wealth existing in its seas is even more acute in those countries, like Mauritania, where fishing communities are essentially made by subsistence and small-scale fishermen who tend to be characterized by endemic socioeconomic vulnerability, and for whom fish represents the biggest – or the only – source of protein. Clearly, the vulnerability of these populations is not exclusively attributable to the competition with industrial fishers, or to the access to global declining resources due to overexploitation; a number of other major issues are: inadequate health and educational services, ill-targeted social safety nets, distorting subsidies, and inadequate participation in decision making[65].

Our research and interviews found that at present the number of commercial fishing vessels operating in Mauritania stands between 400 and 500, almost equally divided into pelagic and cephalopod fishing. Interestingly, the number of vessels engaged in octopus fishing has shown a decreasing trend over the last few years, most likely attributable in part to the contraction in global demand attributable to the crisis of the previous years and due the effort of the Government in limiting the number of licenses.

The structure of catches by commercial vessels shows that catches of pelagic fish are significantly larger than the catches of octopus, in tonnage. At the same time, the price of 1ton of octopus is approximately 20 times higher than the price of pelagic fish. The costs associated with these large and sophisticated vessels are relevant, in terms of labor costs, refrigerating systems, and fuel – which alone represents between 15 percent and 20 percent of annual total costs. Upfront investments are also relevant, especially with respect to machinery and to the cost

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[64] Reuters article: "U.N. urges foreign fishing fleets to halt ocean grabbing", 20 October 2012, http://www.reuters.com/article/2012/10/30/us-fisheries-idUSBRE89T0PG20121030
[65] Fisheries and the right to food, FAO, 2009

of the hull and engines; consequently the annual depreciation costs associated with this type of fishing are high, as well. A large part of commercial boats is European. Following the introduction of the new protocol between EU and Mauritania on fishery, at least 60 percent of workers (excluding the officials and highly specialized personnel aboard) must be composed by Mauritanians.

Against this background, it needs to be highlighted that the depletion of fish wealth not figuring in the national accounts of Mauritania is a matter of concern to the eye of an economic analyst, and it should be even more so at the eye of the national policy makers. This is due to a combined effect of weak property rights schemes on fisheries (at the national and international level) and difficulties in obtaining precise and reliable data on market prices, production, costs, job creation related to the sector. The risk is evident, as a fish-rich country could register additional growth year-on-year in the national accounts, derived from a (supposedly) unsustainable overexploitation of the resource, without needing to subtract the corresponding reduction in fish stock capital. Especially in cases like the Mauritanian one, given the economic importance of the sector, omitting natural assets such as fish stocks from the national accounts may entail a substantial oversight in economic perception and surveillance[66].

Assumption - COMMERCIAL	Pelagic	Cephalopods
Number of vessels in year 0	200(**)	230
Annual vessel growth	5 percent(*)	- 2 percent
Maximum fleet size (over the time of a generation)	600 units(*)	500 units(*)
Average catch per day (tons)	60	3
Annual number of trips	180	220
Average price per ton (USD)	250	5,000
Average total costs per vessel (annual, in USD)	> USD 3mln	> USD 3mln
of which: Labor costs (USD)	~ USD 800K	~ USD 400K(***)
Annual depreciation costs (USD)(****)	~ USD 2 mln	~ USD 2 mln
Opportunity cost of capital	15 percent of revenues(*)	15 percent of revenues(*)
Natural wealth per capita estimates ($)	**1'475**	**1'040**

Methodology and context for natural gas and crude petroleum wealth estimates

Also in the case of natural gas and oil, the methodology of this paper is based on a Net Present Value (NPV) analysis. Resource rents are estimated over the life of the extraction (respectively of gas or oil) and subsequently a social discount rate of 4 percent is applied to the sum of all annual rents[67]. Year t_0 is 2013 and the final year, year t_n corresponds to the end of the mining operations.

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[66] The Sunken Billions: The Economic Justification for Fisheries Reform. Joint publication World Bank/FAO, 2008
[67] Mathematical detailed demonstration is provided in the paragraph on the mining sub-sector.

$$W = \sum_{t=n}^{t=0} R_t * \frac{1}{1 + r^t}$$

The final figure W is divided by population in order to obtain the wealth per capita.

With respect to the crude oil sector, the robustness of the estimation has been challenged by the intrinsic volatility and fragmentation of some essential pieces of information, such as the price and the costs. As it is known, the international price of crude oil has been characterized by highly unpredictable trends, highly sensitive to a large number of market factors, including psychological ones, and as such very hard to predict. For these reasons, this paper assumes a constant price (adjusted for inflation over time) equivalent to USD100 a barrel. As for the total costs of production, the difficulties in obtaining punctual information on the Mauritanian sites led to opt for regional averages for Africa, provided by the online database of the USA Energy Info Administration (45 $/Baril).

In the case of gas, this paper assumes a unit price of 8.5 $/mmBTU and fixed costs of production equivalent to USD 15 million a year[68]. A USD 600 million upfront investment is estimated initially, while the production is assumed to start from 2016 and to be equivalent to 15.3 million mmBTU, with exhaustion time of the resource estimated in 22 years[69]. Also in this case a 3 percent inflation rate is computed.

The recent discovery of gas in the Mauritanian subsoil is a decisive addition to further stimulate and intensify the economic development of the country, with a strong potential to effectively incentivize poverty eradication objectives. As a matter of fact, Mauritania suffers from serious shortages of power resources, current electricity production costs are high[70], and the country capacity will not be in a position to address this issue by using sustainable methods before a number of years. By 2017, aggregate demand of energy is expected to grow higher than 500MW, spurred by an increase in domestic demand but mainly driven by a skyrocketing demand from mining companies for the development of new projects (approx. 400MW).

Gas-exploration campaigns offshore allowed the identification of massive gas resources in the Banda field, currently operated by Tullow Oil, which are supposed to be larger than 1 Tcf[71], and thus sufficient to supply a gas power plant with a capacity of at least 350 years for roughly 20 years. The World Bank is currently supporting the Government with a Guarantee project (USD100 million) meant to facilitate the conclusion of an ambitious development program of the gas field.

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[68] Based on World Bank staff estimates, also used for the Banda field gas-to-power project.
[69] This is in line with the feasibility studies conducted on the amount of the gas deposit. In addition, a 22-year cap allows dealing with the exact same period of time, with 2038 as the final year.
[70] Due to the high price of energy commodities (hydrocarbons) and to considerable loss ratios.
[71] Tcf is a volume measurement of natural gas, corresponding to one trillion cubic feet (1,000,000,000,000 cubic feet).

	Oil	Gas
Inflation Rate	3 percent	3 percent
Time period	25 yrs	22 yrs
Unit Price ($/baril or $/mmBTU)	~100 (2013)	8.5 (2016)
Fixed Cost of production (total, $ million)	n.a.	15
Upfront Capital Costs ($ million)/Capex	n.a.	600
Production (annual, barils or mmBTU)	2.5 mln	15.3 mln
Revenue (M$)	~250 mln	~130mln
Unit Cost of Production ($/baril or $/mmBTU)	45	2.95
Natural Wealth Per Capital Estimate ($)	**930**	**550**

Methodology and context for pasture land wealth estimates

For pastureland this paper decided to opt for the calculation of the production of some key pasture products, such as milk (of various animal species), meat, grease, leather, and so on. On this basis, wealth in 2013 was calculated with the following equation:

$$W\,2013 = \sum_{t=2013}^{t=2038} \frac{\Sigma_i\,Q_{ti} * (P_{ti} * RR_{ti})}{(1 + 0.04)^t}$$

Where W is the wealth of the pasture land sector, P is its unit price, and RR is its total rent.[72]

Interviews were conducted in Nouakchott with experts and representatives from the Ministry of Rural Development, which also provided detailed data on meat, milk, and eggs annual production (tons). Lagged, six-year-average (2007-2012) values of these productions were used to estimate production numbers to project from 2013 over the 25 year generation span. The pasture goods that this paper utilized as a proxy for the whole production are: camel milk, cow milk, goat milk, ovine milk, eggs (number of eggs produced), chicken meat, goat meat, sheep meat, beef meat, and camel meat. Price was computed as the average price of the period 2000-2012[73].

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[72] Subscripts *t* and *i* represent time and pasture product type, respectively. Methodology and data according to The Changing Wealth of Nations, The World Bank, 2010.
[73] Source: Ministry of Rural Development of Mauritania.

Against this premises, wealth is calculated as the net present value of the return to land (rents from selling the above-listed livestock products) using a discount rate of 4 percent over a 25 year time horizon. Future rents are projected based on annual growth rates of 2 percent[74].

Rents are calculated as:

$$Rents = (total)\ Rent * Production * Unit\ Price$$

Where (total) Rent is represented by a constant of 45 percent of revenues, assumed to calculate returns to pastureland.

.	Average production (thous. tons, 2007-2012)	Average price (2001-2012, USD per ton)
Camel milk	~144	206
Cow milk	~61	462
Goat milk	~50	215
Ovine milk	~30	188
Eggs (number)	1,750,000	0.25 (price of each egg)
Chicken meat	~4	4,677
Sheep meat	~41	4,115
Goat meat	~23	4,177
Beef meat	~22	3,367
Camel meat	~25	3,733
Natural Wealth Per Capital Estimate ($) in 2013	**2'017**	

Methodological clarification with respect to externalities

The rent computations estimated by this paper are based on market prices, production data and other pieces of information or assumptions, but have not included any externalities resulting from mining activity; either the positive or the negative ones, such as CO_2 emissions, ecosystem's degradation, water contamination, etc. Moreover, several impacts on employment, capacity-building, development of local infrastructure, improved public service delivery, etc may be strictly correlated to resource rents. These are issues of great interest and relevance, at the same time, the methodology followed by this paper is not so sophisticate to factor also these (or other similar) externalities or impacts; in addition, even if that was possible, it would not be expected to have any (improving) bearing on the level of confidence of the whole analysis, since the overall frame remains anchored to high level aggregates and assumptions.

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[74] Average estimate assumed based on: Global Food Projections to 2020,Emerging Trends and Alternative Futures, Rosegrant, Paisner, Meijer and Witcover, International Food Policy Research Institute, August 2001

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