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System of Environment-Economic Accounting 2012 Central Framework

Caraga Asset Account for Mineral Resources: 2015 - 2018

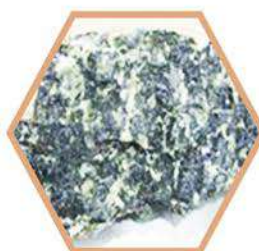
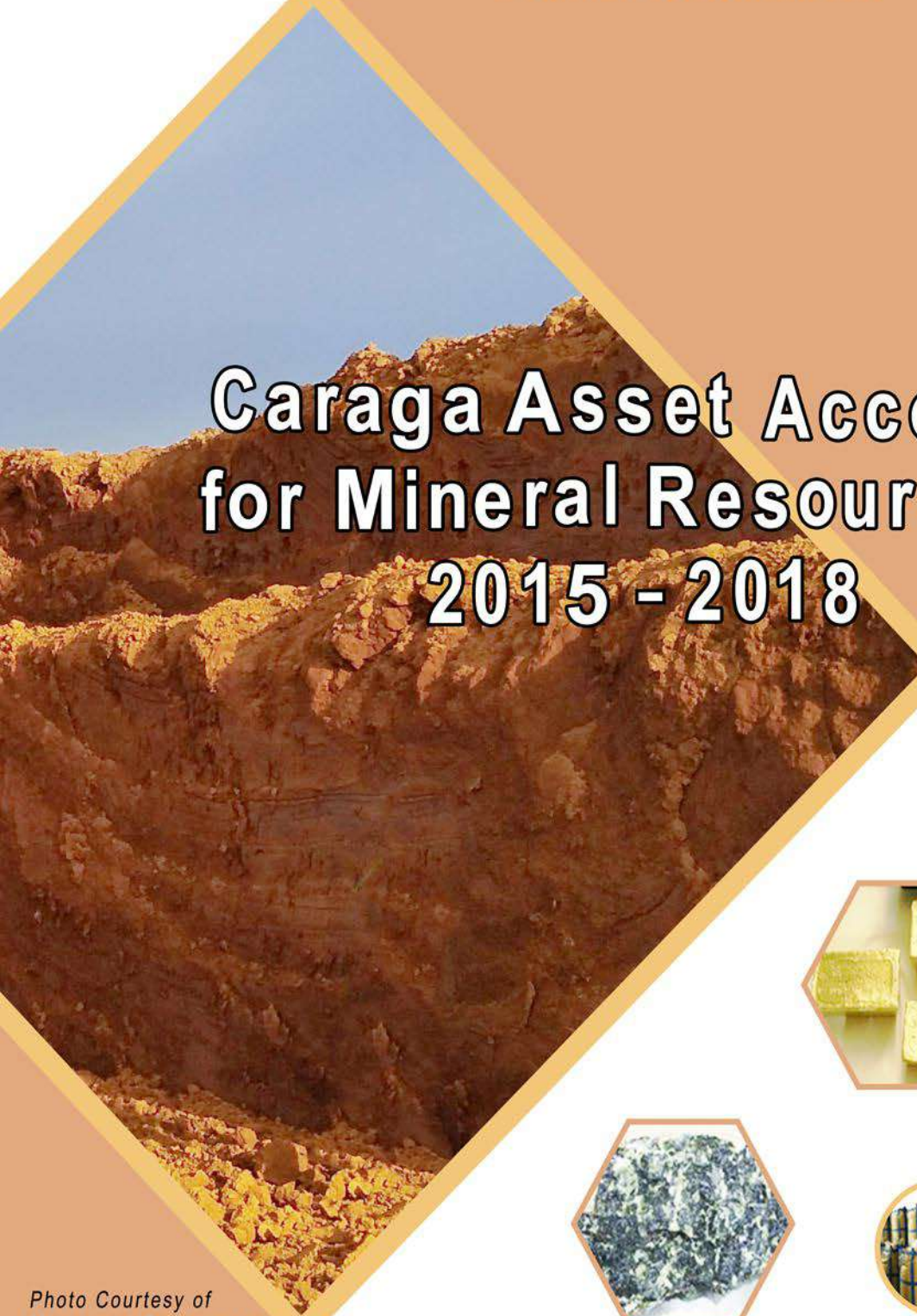


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Bureau Caraga



REPUBLIC OF THE PHILIPPINES
PHILIPPINE STATISTICS AUTHORITY
REGIONAL STATISTICAL SERVICES OFFICE XIII (CARAGA)



Caraga Asset Account for Mineral Resources: 2015-2018



Republic of the Philippines
PHILIPPINE STATISTICS AUTHORITY
Regional Statistical Services Office XIII (Caraga)

The Caraga Asset Account for Mineral Resources: 2015-2018

is a publication periodically prepared by the
PHILIPPINE STATISTICS AUTHORITY (PSA)
Regional Statistical Services Offices XIII (Caraga)

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The **Caraga Asset Account for Mineral Resources: 2015-2018** is available in printed and electronic formats (Word/PDF in CD Rom).
For details, please contact us at (085) 815 2878
Or email us at psacaraga_rso13@yahoo.com.ph

FOREWORD

Caraga is considered as one of the regions in the country with rich source of minerals. Mineral resources contribute to the region's wealth and are an asset in the economic growth of the area. The accounting of this asset is considered vital for the formulation of comprehensive planning, policy, and decision making in the region.

The Philippine Statistics Authority – Regional Statistical Services Office XIII (PSA-RSSO XIII) continues its endeavor for Environment and Natural Resources Accounting (ENRA) activities by focusing, this time, on the accounting of mineral asset in the region. The compilation and estimation for mineral resources covered the accounting period of 2015 to 2018. This compilation was based on the United Nations System of Environmental-Economic Accounting (SEEA) 2012 – Central Framework.

The publication of the Caraga asset account for mineral resources is a product of the collaborative efforts of the Steering Committee and Technical Working Group (TWG) composed of the data producers, data users, and compilers in the region. The result of this accounting will serve as a baseline information on the degradation and depletion of Caraga's mineral resources and its implication on the environmental assets of the region over the accounting period. Further, this will provide awareness and necessary information to the concerned agencies, institutions, local government units, and private individuals on the path of sustainable development.

Finally, we would like to thank the Regional Statistics Committee (RSC), and the Regional Development Council (RDC) of Caraga for their invaluable support which are both instrumental in defining some policy implications for successful utilization of the Mineral Asset Account in support for better planning and decisions.



DENNIS S. MAPA, Ph.D.

Undersecretary

National Statistician and Civil Registrar

General Philippine Statistics Authority

MESSAGE FROM MINES AND GEOSCIENCES BUREAU XIII

The Mines and Geosciences Bureau (MGB) Regional Office No. XIII commends the Philippine Statistics Authority for its remarkable initiative and synergy with partner agencies to develop the Caraga Asset Account for Mineral Resources. The Asset Account for Mineral Resources is timely and relevant since Caraga Region has been dubbed as the new mining capital of the Philippines due to its vast mineral resources and reserves and a host of the majority of the operating metallic and non-metallic mines, and mineral processing plants producing gold/silver bullions, and nickel & cobalt mixed sulfides and scandium oxalate. With this, mining has become one of the vital drivers of economic growth and social development. The significant contributions of the minerals industry to regional progress are truly indisputable with 10.4% share, at current prices, to the Gross Regional Domestic Product for CY 2019.

Accordingly, the continuous mining operations has environmental impacts. Thus, the creation of the Asset Account would greatly aid the MGB in showcasing the economic and environmental contributions of mining at regional level as it changes over time, and the evaluation and assessment of the impacts of mining activities towards the sustainability of responsible mining.

It is our cherished hope that this endeavor will continue to yield positive results. Rest assured of the full support and commitment of MGB Regional Office No. XIII in the transparency of providing significant and relevant data as it is one with you in the constant improvement of the Caraga Asset Account for Mineral Resources.

Salamat karajaw!


ENGR. GLENN MARCELO C. NOBLE
Regional Director
Mines and Geosciences Bureau Regional Office No. XIII

ACKNOWLEDGMENT

The Statistical Operations and Coordination Division (SOCD) of the Philippine Statistics Authority-Regional Statistical Services Office XIII (PSA – RSSO XIII) spearheaded the compilation of Caraga Asset Account for Mineral Resources as its third (3rd) project in support for Caraga’s Economic-Environmental and Natural Resources Accounting (EENRA). The accounting of this asset followed the UN System of Environmental-Economic Accounting (SEEA) 2012 Central Framework. In employing the framework, physical and monetary accounts were established to present statistical information on the depletion and degradation of the mineral resources within the accounting period 2015 to 2018.

Sincere recognition is given to the members of the Caraga EENRA Steering Committee and Technical Working Group from different agencies: Mines and Geo-sciences Bureau (MGB), Department of Environment and Natural Resources (DENR), and National Economic and Development Authority (NEDA) for their active involvement and for imparting their knowledge and expertise throughout this endeavor. We would also like to extend our heartfelt gratitude to the Local Government Units (LGUs) and the Provincial Mining Regulatory Board (PMRB) of each province in the region who gave their full support during the data gathering/compilation.

Our utmost appreciation to the data producers, data users, and compilers for their commitment and unwavering support to ensure the success of the Asset Account for Mineral Resources publication as well as for the active participation, suggestions, and recommendations imparted during the activities conducted by PSA.

This endeavor would not be possible without the financial support from the Macroeconomic Accounts Service (MAS) through the Philippine Economic-Environmental and Natural Resources Accounting (PEENRA) Project and the technical support of the Environment and Natural Resources Accounts Division (ENRAD) throughout this venture, especially on the data gaps.

Kudos to everyone who contributed in the preparation and compilation of the Caraga Asset Account for Mineral Resources: 2015-2018.



ROSALINDA C. APURA, D.M.
Vice-chairperson
Caraga EENRA Steering Committee
PSA-Caraga Regional Director

REGIONAL DEVELOPMENT COUNCIL RESOLUTION



REPUBLIC OF THE PHILIPPINES
REGIONAL DEVELOPMENT COUNCIL
CARAGA REGION

Resolution No. 58-B, Series of 2020

**“ENDORISING TO THE PHILIPPINE STATISTICS AUTHORITY (PSA)
THE CARAGA ASSET ACCOUNT FOR MINERAL RESOURCES 2015-2018:
METALLIC MINERAL ASSET ACCOUNT AND ITS POLICY IMPLICATIONS
AND SUPPORTING THE CONDUCT OF THE NON-METALLIC MINERAL
ASSET ACCOUNTING IN 2021”**

WHEREAS, the Philippine Statistics Authority (PSA) is responsible for all national censuses and surveys, sectoral statistics, consolidation of selected administrative recording systems, and compilation of national accounts pursuant to Republic Act (RA) No. 10625, otherwise known as the *“Philippine Statistical Act of 2013;”*

WHEREAS, PSA Regional Statistical Services Office (RSSO) XIII, in collaboration with relevant agencies, formulated the Caraga Environment and Natural Resources Accounting (ENRA), a compilation of the Mineral Asset Account of the Caraga Region;

WHEREAS, the Caraga Asset Account for Mineral Resources 2015-2018 has two (2) components, to wit: (1) Metallic Mineral Asset Account and (2) Non-Metallic Mineral Asset Account;

WHEREAS, in support to the conduct of the ENRA, the Caraga Regional Statistics Committee (RSC) passed Resolution No. 08, Series of 2019, *“Enjoining Concerned Regional Line Agencies (RLAs) and the Local Government Units (LGUs) to Support PSA Mineral Accounting Endeavour;”*

WHEREAS, the said mineral asset accounting was conducted to assess the available mineral assets over time and determine the asset life of the mineral reserves as an input to the development plan for the sustainability of economic activities, as well as determine the contribution of mining industry to the economy of the Region;

WHEREAS, the results of the Metallic Mineral Asset Accounting were presented during the 2nd Quarter 2020 Caraga RSC Meeting on 08 July 2020, and the same was also presented to and reviewed by the National Statistician (NS) Claire Dennis S. Mapa on 09 November 2020;

WHEREAS, there were six (6) policy implications identified by the Steering Committee and Technical Working Group (TWG) based on the results of the mineral asset accounting, to wit:

1. Enforcement and regulation of environmental and mining policies under RA Nos. 7076 and 7942;
2. Output from small-scale mine should be put through the open market;
3. Strict monitoring and enforcement of environmental impact mitigation capitalizing on progressive rehabilitation, social safety, and health concerns both in large and small-scale mining industries;
4. Mining revenues and legally-mandated funding allocations for the locality must be invested in most rewarding and socially beneficial projects;
5. The mining contribution to economic growth must not conceal the impact to the metallic minerals as a non-renewable resource, therefore, safety measures and regulations must be in place to ensure enforcement of responsible management of resources; and
6. Promotion of value-adding activities such as processing of raw materials to improve manufacturing industry and generate employment, which will in turn boost economic growth and social capital;

WHEREAS, NS Mapa noted that the identified policy implications from the ENRA Project are not part of the statistical data or general-purpose statistics and recommended that the same be incorporated in the final publication through passage of Caraga RSC and Regional Development Council (RDC) resolutions;

WHEREAS, the PSA RSSO XIII will embark on its 4th project in 2021 which is the compilation of non-metallic minerals;

WHEREAS, during the 4th Quarter 2020 Caraga RSC Meeting on 18 November 2020, the Committee passed Resolution No. 06, Series of 2020, *“Endorsing to the Caraga Regional Development Council (RDC) the Caraga Metallic Mineral Asset Account with Its Policy Implications and the Non-Metallic Compilation in 2021 for Support and Intervention;”*

NOW THEREFORE, BE IT RESOLVED, AS IT IS HEREBY RESOLVED, on motion of Department of Environment and Natural Resources Caraga Regional Executive Director Hadja Didaw D. Piang-Brahim and duly seconded by Caraga RDC-Infrastructure Development Committee Chairperson and Agusan del Sur Provincial Governor Santiago B. Cane Jr., to endorse to the PSA the Caraga Asset Account for Mineral Resources 2015-2018: Metallic Mineral Asset Account and its policy implications and supporting the conduct of the Non-Metallic Mineral Asset Accounting in 2021.

RESOLVED FURTHER, that copies of this resolution be furnished to PSA RSSO XIII and all Caraga RDC members for their information and consideration.

APPROVED, during the 104th (4th Quarter 2020) Caraga RDC Full Council Teleconference Meeting on 25 November 2020.

Certified Correct:



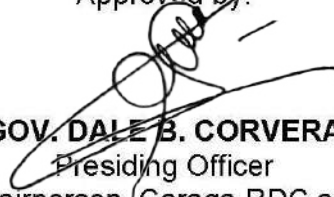
MICHELLE P. DELA CALZADA
Acting Secretary, Caraga RDC and
OIC-Assistant Regional Director, NEDA Caraga

Attested by:



PRISCILLA R. SONIDO
Vice Chairperson, Caraga RDC and
Regional Director, NEDA Caraga

Approved by:



GOV. DALE B. CORVERA
Presiding Officer
Chairperson, Caraga RDC and
Governor, Agusan del Norte

REGIONAL STATISTICS COMMITTEE RESOLUTION



REPUBLIC OF THE PHILIPPINES
REGIONAL STATISTICS COMMITTEE
Caraga

RESOLUTION NO. 6 (S. 2020)

“RESOLUTION ENDORSING TO THE REGIONAL DEVELOPMENT COUNCIL (RDC) THE CARAGA METALLIC MINERAL ASSET ACCOUNTS WITH ITS POLICY IMPLICATIONS AND THE NON-METALLIC COMPILATION IN 2021 FOR SUPPORT AND INTERVENTION”

WHEREAS, the Philippine Statistics Authority (PSA) is responsible for all national censuses and surveys, sectoral statistics, consolidation of selected administrative recording systems, and compilation of national accounts pursuant to Republic Act (RA) No. 10625, otherwise known as *“Philippine Statistical Act of 2013;”*

WHEREAS, the PSA Caraga, in collaboration with the relevant agencies, worked on the Caraga Environment and Natural Resources Accounting (ENRA), which is the compilation of the Mineral Asset Account of the Region;

WHEREAS, in support to the conduct of the ENRA, the Caraga Regional Statistics Committee (RSC) passed Resolution No. 8 series of 2019, *“Enjoining Concerned Regional Line Agencies (RLAs) and the Local Government Units (LGUs) to support PSA Mineral Accounting Endeavour;”*

WHEREAS, the endeavor aims to come up with publications that will serve as relevant sources of information in order to assess whether current forms of economic activity are depleting and degrading the available environmental assets;

WHEREAS, the results of the Caraga ENRA Project were presented during the 2nd RSC Meeting on 08 July 2020 and the same was also presented to and reviewed by the National Statistician (NS) Claire Dennis S. Mapa on 09 November 2020;

WHEREAS, there were six (6) policy implications identified by the Steering Committee and Technical Working Group (TWG) based on the results of the mineral asset accounting, to wit:

- 1) Enforcement and regulation of environmental and mining policies under RA Nos. 7076 and 7942;
- 2) Output from small-scale mine should be put through the open market;
- 3) Strict monitoring and enforcement of environmental impact mitigation capitalizing on progressive rehabilitation, social safety, and health concerns both in large and small-scale mining industries;

- 4) Mining revenues and law-mandated funding allocations for the locality must be invested in most rewarding and socially beneficial projects;
- 5) The mining contribution to economic growth must not conceal the impact to the metallic minerals as a non-renewable resource. Therefore, safety measures and regulation must be in place to ensure enforcement of responsible management of resources for the conservation and protection of the ecosystem; and
- 6) Promotion of value-adding activities such as processing the raw materials can improve the manufacturing industry and generate employment, which will in turn boost economic growth and social capital;

WHEREAS, NS Mapa noted that the identified policy implications from the ENRA Project are not part of the statistical data or general-purpose statistics and recommended that the same may be incorporated in the final report through passage of Caraga RSC and Regional Development Council (RDC) Resolutions;

WHEREAS, after the metallic compilation, PSA Regional Statistical Services Office (RSSO) XIII will embark on its 4th project in 2021 which is the compilation of non-metallic minerals;


NOW, THEREFORE, BE IT RESOLVED AS IT IS HEREBY RESOLVED, to endorse to the Caraga RDC the Caraga Metallic Mineral Asset Accounts with its policy implications and the non-metallic compilation in 2021 for support and intervention.

RESOLVED FURTHER, that copies of this resolution be provided to the Caraga RDC for information and appropriate action.

APPROVED, during the RSC Meeting on 18 November 2020 in Butuan City, Philippines.

Certified Correct:

Approved by:


ROSALINDA C. APURA, DM
RSC Vice-Chairperson and
Regional Director, PSA RSSO XIII



PRISCILLA R. SONIDO, CESO IV
RSC Chairperson and
Regional Director, NEDA Caraga

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ACRONYMS

BSP	Bangko Sentral ng Pilipinas
DENR	Department of Environment and Natural Resources
DMPF	Declaration of Mining Project Feasibility
DMT	Dry Metric Ton
EENRA	Economic-Environmental and Natural Resources Accounting
EIA	Environmental Impact Assessment
ENRAD	Environment and Natural Resources Accounts Division
FAME	Fishery, Agro-forestry, Mineral and Eco-tourism
FDES	Framework for Development of Environment Statistics
GVA	Gross Value Added
GO	Gross Output
GRDP	Gross Regional Domestic Product
LGU	Local Government Unit
LME	London Metal Exchange
MAS	Macroeconomic Accounts Service
MAQ	Mining and Quarrying
MGB	Mines and Geosciences Bureau
MPSA	Mineral Production Sharing Agreement
MSME	Micro, Small, and Medium Enterprise
NEDA	National Economic and Development Authority
NPV	Net Present Value

PEENRA	Philippine Economic-Environmental and Natural Resources Accounting
PMRB	Provincial Mining Regulatory Board
RDC	Regional Development Council
RDP	Regional Development Plan
RR	Resource Rent
RSC	Regional Statistics Committee
RSSO	Regional Statistical Services Office
SDG	Sustainable Development Goal
SEEA	System of Environmental – Economic Accounting
SNA	System of National Accounts
SOCDD	Statistical Operation and Coordination Division
TWG	Technical Working Group
UN FDES	United Nations Framework for the Development of Environment Statistics
UNFC	United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources
UNSC	United Nations Statistical Commission
WMT	Wet Metric Ton

DEFINITION OF TERMS

The definitions of the following terms are based on the Department of Environment and Natural Resources Administrative Order Nos. 2010-21¹ and 2015-03², and Britannica Dictionary:

Discount Rate (hurdle rate) is the minimum rate of return on the project or investment.

Financial or Technical Assistance Agreement (FTAA) means a contract involving financial or technical assistance for large-scale exploration, development and utilization of mineral resources.

Force Majeure means acts or circumstances beyond the reasonable control of Contractor/Permit Holder/Permittee/Lessee.

Gold (Au) is a dense, soft, highly malleable and ductile precious metal with a lustrous yellow color which often occurs in free elemental (native) form, as nuggets or grains, in rocks, in veins, and in alluvial deposits. It is widely used for jewelry, goldware or coinage, dental material, investment products and in the electric and electronics industry.

Metallic Minerals are minerals with brilliant appearance, quite opaque to light, giving a black or very dark streak, and from which a metallic element/component can be extracted/utilized for profit.

Metallurgical Chromite is a relatively hard, metallic, black oxide mineral of chromium and iron with a molecular formula of (FeCr₂O₄), that is the chief commercial source of chromium can be used as a refractory material and as alloying element for production of corrosion resistant super alloys, and stainless steel.

¹ Consolidated Department of Environment and Natural Resources Administrative Order for the Implementing Rules and Regulations of Republic Act (RA) No. 7942, otherwise known as "The Philippine Mining Act of 1995"

² Revised Implementing Rules and Regulations of RA No. 7076, otherwise known as the "People's Small-Scale Mining Act of 1991"

Minerals refer to all naturally occurring inorganic substances in solid, liquid, gas or any intermediate state excluding energy materials such as coal, petroleum, natural gas, radioactive materials and geothermal energy.

Mineral Agreement is a contract between the Government and a Contractor, involving Mineral Production Sharing Agreement, Co-Production Agreement or Joint Venture Agreement.

Mineral Processing means the milling, beneficiation, leaching, smelting, cyanidation, calcination or upgrading of ores, minerals, rocks, mill tailings, mine waste and/or other metallurgical by products or by similar means to convert the same into marketable products.

Mineral Products are materials derived from ores, minerals and/or rocks and prepared into a marketable state by mineral processing.

Mineral Reservations refer to areas established and proclaimed as such by the President upon the recommendation of the Director through the Secretary, including all submerged lands within the contiguous zone and Executive Economic Zone.

Mineral Resources are any concentration of ores, minerals and/or rocks with proven or potential economic value.

Mining is the activity, occupation, and industry concerned with the extraction of valuable minerals or other geological materials from the Earth.

Mining Operations mean mining activities involving exploration, feasibility study, development and utilization.

Moisture Content is the percentage moisture content equals the weight of moisture divided by the initial weight before drying multiplied by 100.

Nickel (Ni) is a silvery-white lustrous metal, and is markedly resistant to oxidation and corrosion and high electrical and thermal, which makes it extremely useful for the development of stainless and heat-resistant steels.

Nickel-Cobalt Mixed Sulfide is an intermediary product of nickel refining that is a mixture of nickel and cobalt sulfides extracted from low-grade laterite ore, which contains about 40%-60% of nickel by weight.

Ore means naturally occurring substance or material from which a mineral or an element can be mined and/or processed for profit.

Ore Reserve is the term usually restricted to one of which the grade and tonnage have been established with reasonable assurance by drilling and other means.³

Permittee means the holder of an exploration permit or Mineral Processing Permit issued under the Implementing Rules and Regulations of the Philippine Mining Act of 1995 (RA No. 7942), and People's Small-scale Mining Act of 1991 (RA No. 7076).

Permit Holder means a holder of any mining permit or Mineral Processing Permit issued under the Implementing Rules and Regulations of RA Nos. 7942, and 7076 except permits that authorize exploration activities only.

Quarry means an open pit, mine or excavation, where stone, sand, gravel, or mineral is obtained from open faces, with or without a waste rock overburden.

Quarrying means the surface exploitation of stone or mineral deposits from the earth's crust.

Resource Rent is the total revenue that can be generated from the extraction of the natural resources, less the cost of extracting the resources (including the normal return of investment).

Scandium (Sc) is a silvery white, moderately soft and classified as a rare earth metal. It has low density and high melting point which suggest applications as an alloying agent for lightweight metals for military and high-performance applications. The main application by volume is in aluminium scandium alloys for the aerospace industry and for sports equipment.

³ Dictionary of Mining Engineer

Scandium Oxalate Hydrate is a chemical compound with a molecular formula of $\text{Sc}_2(\text{C}_2\text{O}_2)_3 \cdot \text{H}_2\text{O}$ which appears as a white crystal powder, which can be refined to produce Scandium.

EXECUTIVE SUMMARY

Caraga is endowed with abundant natural resources, encompassing agriculture, fishery, forestry, minerals, and eco-tourism destinations. Hence, the Regional Development Council (RDC) has zeroed in on strategic programs and initiatives towards securing Caraga's position as the Fishery, Agro-forestry, Mineral and Eco-tourism (FAME) Center in the country.⁴ Thus, environmental accounting is also necessary to evaluate the present status of the environment and implement measures or reforms to boost the economic development of the region.

The United Nations Statistical Commission (UNSC) on its forty-third session, adopted the System on Environment-Economic Accounting (SEEA) Central Framework as the first international statistical standard for environmental-economic accounting. The environment and its relationship to the economy has been put to the core of official statistics and was based on agreed concepts, classifications, definitions, and accounting rules. Also, it enables the information to be organized into tables and accounts in a unified and in conceptually clear manner.⁵ SEEA reorganizes the relevant environment statistics according to stocks and flows within and between the environment and the economy based on the principles of the System of National Accounts (SNA). In this way, it creates links between environment statistics and SNA and facilitates the analysis of relationships between the economy and the environment.

Caraga, particularly Surigao del Norte, has been known as the mining capital in the country since out of 50 metallic mines operating in the Philippines, 25 operate in the region with one of two nickel processing plants and one of two gold processing plants are also in the region.⁶ Using the UN SEEA Central Framework-2012, environmental capital such as mineral resources was measured through asset accounts. Asset accounts record the opening and closing stocks of the mineral assets owing to the changes of

⁴ Caraga Regional Development Council. Caraga Today 2020

⁵ System of Environmental – Economic Accounting 2012- Central Framework

⁶ Philippine Information Agency (October 1, 2019)

stocks (additions and reductions to stocks) over an accounting period. It also assess whether current patterns of economic activities are depleting or degrading the available environmental assets. In addition, the framework is also for understanding the interactions between the economy and the environment.

Available data of Caraga's mineral assets were compiled covering the accounting to 2018. This report presents the physical and monetary accounts for nickel ore, gold ore, and metallurgical chromite. The mineral reserves were classified according to the criteria derived from the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC-2009) as Class A - Commercially Recoverable Resources; Class B - Potentially Commercially Recoverable Resources; and Class C - Non-commercial and other Known Deposits. However, due to the insufficient data from the previous years, backtracking was done to complete the accounting.

In monetary terms, the Net Present Value (NPV) approach was applied on the valuation of the mineral assets which only focused on Class A reserves. The values of the mineral reserves were estimated which were observed that these are dependent on the fluctuation of foreign exchange rates, and the evolution of market prices. Moreover, nickel ore mining was estimated to have the highest contribution to the economy as the resource rent.

Addressing the data gaps encountered in this study was a major challenge but needed to support the completion of the estimation of the mineral accounting in the region. Furthermore, the estimation of the resource value in the region can also be improved with available, sufficient and properly recorded data.

EXPLANATORY NOTES

Introduction

The growing population and the economic development of the region led to the extraction of the natural resources resulting to unbalance biological diversity of the environment. Mining activities typically cause impacts on the environments such as on land, air, water, flora, fauna and the people who basically depend on these resources. Today, environmental accounting is considered as one of the areas for extensive research. Thus, the environmental asset accounting is necessary to monitor the level of exploitation of resources through figures. With the Environmental Impact Assessment (EIA) and partaking in the National Greening Program (NGP), the Department of Environment and Natural Resources (DENR) required mining companies to secure ISO 14001 certification which sets out the criteria for an environmental management system, and abiding Executive Order No. 79 in ensuring environmental protection and responsible mining in the utilization of mineral resources.⁷ Especially, the region reportedly hold half of the Mindanao's mineral deposit.

Coordination between the government and communities as well as better access to financial resources can boost the mining industry. The booming industry can create better opportunities to contribute to the attainment of various Sustainable Development Goals (SDGs) through its significant effect on Gross Regional Domestic Product (GRDP), inducements effect on flourishing establishment, increase number of Micro, Small, and Medium Enterprise (MSME), and influxes of more investments and improve of the total revenue. This will lead to more savings or deposits, strengthen bank growth, and availability of loan portfolio. The industry also increases the capacity for more household spending and enhances human capital development. As a result, it increases volume of imported goods to the community and lift export earnings.

⁷ Executive Order No. 79, "Institutionalizing and Implementing Reforms in the Philippine Mining Sector Providing Policies and Guidelines to Ensure Environmental Protection and Responsible Mining in the Utilization of Mineral Resources"

Moreover, mining industry can significantly impact local, regional, and national socio-economic status by fostering economic development and social inclusion. Mining industry contributed to reduce poverty, promote gender equal opportunity, give decent work (offer training and apprenticeship program), and endorse industry innovation and infrastructure development.

Table 1. Contribution of Nickel Ore, Gold Ore, and Chromite Ore Mining to the Gross Value Added (GVA) of Mining and Quarrying (MAQ) Industry in the Philippines at 2018 Constant Prices, in Million Pesos: 2015-2018

	Level				Percentage Share to the GVA of MAQ			
	2015	2016	2017	2018	2015	2016	2017	2018
Total MAQ	148,589	156,807	160,065	163,322				
Mining of nickel ore	25,542	20,574	18,518	17,740	17.2	13.1	11.6	10.9
Mining of gold and other precious metal ore*	23,401	25,292	25,871	25,071	15.7	16.1	16.2	15.4
Mining of chromite ore**	155	151	222	443	0.1	0.1	0.1	0.3

Note: *Included other precious metal ores (e.g. mining of silver ores) but majority of the sub-industry came from mining of gold ore.

**Unpublished figure and only available in the worksheet level. Mining of chromite ore is included in the Stone quarrying and other mining and quarrying.

Source: Philippine Statistics Authority

The total value of MAQ in the country increased from 148,589 million pesos in 2015 to 163,322 million pesos in 2018. Mining of nickel ore in 2015 contributed 17.2 percent to the total Gross Value Added (GVA) of MAQ industry. From 2015 to 2018, it recorded an annual decrease from 17.2 percent to 10.9 percent share, respectively. On the other hand, the contribution of mining of gold and other precious metal ores shows a fluctuating trend with the highest contribution to MAQ of 16.2 percent amounted to 25,871 million pesos in 2017. Mining of chromite ore in the country also contributed 0.1 percent from 2015 to 2017 and increased to 0.3 percent in 2018 which translated to 443 million pesos. (Table 1)

Table 2. Percent Contribution of Mining and Quarrying to Gross Regional Domestic Product (GRDP) at Constant 2000 Prices and to Total Employment in Caraga: 2015-2018

Mining and Quarring Industry	2015	2016	2017	2018
Contribution to GRDP	22.5	20.5	18.2	16.8
Share to Total Employment	5.3	3.5	3.3	2.6

Source: Philippine Statistics Authority

In 2015, mining and quarrying industry in the region contributed 22.5 percent to the total GRDP at constant 2000 prices. From 2015 to 2018, a declining trend was observed with 20.5 percent in 2016, 18.2 percent in 2017, and 16.8 percent in 2018. Moreover, in 2015, mining and quarrying industry generated 5.3 percent to the total employment of Caraga, 3.5 percent in 2016, 3.3 percent in 2017, and 2.6 percent in 2018. (Table 2)

The region is producing and processing mineral commodities particularly but not limited to nickel ore, nickel-cobalt mixed sulfide, scandium oxalate, gold, silver, and metallurgical chromite. Nickel is a component of many industrial and consumer products, including stainless steel, batteries, magnetic and electrical equipment. As presented, mineral production for nickel ore decreased from 2015 to 2018 with 46.56 million Wet Metric Ton (WMT) to 30.81 million WMT. This was due to the suspension of the mining firms for not meeting up the environmental standard, fluctuating metal price in the world market, and force majeure circumstances (e.g. non operation due to security problem). (Table 3)

The estimated production of gold ore in 2015 was 1.05 million WMT and decreased its production in the succeeding years as shown in Table 3. Gold ore production in 2016 dropped to 0.86 million WMT and slightly decreased to 0.72 million WMT in 2017. Moreover, closure of some gold mine operation under Mineral Production Sharing Agreement (MPSA) operated in 2018 resulted to a lower gold ore production with 0.57 million WMT as reported by the MGB Caraga. (Table 3)

Table 3. Mineral Production by Commodity, Caraga: 2015-2018
(in Wet Metric Ton)

Commodity	2015	2016	2017	2018
Nickel Ore	46,556,119.05	36,428,484.23	32,901,676.76	30,808,109.08
Gold Ore	1,054,844.55	856,949.84	719,344.67	566,545.46
Metallurgical Chromite	3,296.56	2,847.67	-	-

Note: "-" No mineral production due to environmental compliance

Source: Mines and Geosciences Bureau-Caraga/Mines and Geosciences-Central Office/Philippines Statistics Authority

Over the years, there were only few metallurgical chromite mine that operated in the Philippines due to the struggle to sustain production in the face of marketing problems which has been the cause of major concern among chromite producers.⁸ The region produced metallurgical chromite with 46% Chromium (III) oxide (Cr₂O₃) which occur as residual deposits. Chromite is the most important ore of chromium.⁸ It has a wide range of usage in industries such as an additive endowing alloy to enhance hardness and resistance to corrosion and oxidation which made chromium indispensable in countless everyday applications. The production of metallurgical chromite in 2015 was 3,296.56 WMT and decreased to 2,847.67 WMT in 2016. (Table 3)

Table 4. Production of Mineral Products and By-Products
in Caraga: 2015-2018

Commodity	2015	2016	2017	2018
Gold bullion (kg)	4,877.00	4,625.00	3,187.00	2,894.18
Silver bullion (kg)	1,870.13	2,755.53	1,013.92	567.46
Nickel/Cobalt Mixed Sulfides (DMT)	50,924.00	54,053.28	59,225.65	45,864.60
Scandium Oxalate (dry-kg)	-	-	-	4,515.00

Note: "-" Denotes no mineral production

Source: Mines and Geosciences Bureau-Caraga/Mines and Geosciences-Central Office/Philippines Statistics Authority

Gold is usually associated with silver in nature and is recovered as a by-product of gold ore refining which is being done in the region. Gold is chiefly used for jewelry and is also ideal for electronic and electrical appliances being a good semi-conductor. Based on the available information,

⁸ Mines and Geosciences Bureau: Chromite Commodity Profile 2016. Page 1

216,289.64 WMT of gold ore would produce a kilogram of gold in 2015, 185,286.45 WMT in 2016, 225,712.17 WMT in 2017, and 195,753.36 WMT of ore per kilogram of gold were produced in 2018.⁹ The region produced 4,877.00 kg gold bullion with an average fineness of 670.5 in 2015. However, the production declined to 4,625.00 kg in 2016, 3,187.00 kg in 2017, and 2,849.18 kg in 2018. On the other hand, silver has long been valued as a precious metal and is used in many pre-modern monetary systems in bullion coins, sometimes alongside gold. Silver bullion produced during the accounting period has a fluctuating trend. However, silver bullion can be observed to have the highest production of 2,755.53 kg in 2016. Low production of gold and silver bullion in 2018 is also due to the low production of gold ore. (Table 4 and Table 15)

Nickel/cobalt mixed sulfide and scandium oxalate are mineral by-products of the processing of nickeliferous ore.¹⁰ Production of nickel/cobalt mixed sulfide fluctuates from 2015 to 2018. The highest production was observed in the year 2017 with 59,225.65 Dry Metric Ton (DMT) and has the lowest production of 45,864.60 DMT in 2018. (Table 4)

The production of scandium oxalate in 2018 is considered as a technical breakthrough in the history of Philippine mining since it was the first time to be recovered as a by-product of the process.¹⁰ Scandium is the lightest rare earth element which has critical utilization areas such as the aerospace industry, solid oxide fuel cells, electronics industry, and is also used in metallurgical applications. As reported by Mines and Geosciences Bureau, 4,515.00 dry-kg of scandium oxalate was produced in 2018. (Table 4)

⁹ See Appendix C Table 15

¹⁰ Retrieved from <http://www.mgb.gov.ph/attachments/article/742/Nickel%20leads%20in%20H1%202019.pdf>

Objectives

Metallic mineral resources, as one of the drivers of the economic development of the region, were accounted following the United Nations (UN) System of Environmental-Economic Accounting (SEEA) 2012. This compilation aims:

1. to assess the change over time whether the economic activity is depleting and degrading the available mineral assets,
2. to determine the asset life of the mineral reserves as an input for the developmental plan for the sustainability of the economic activity, and
3. to determine the contribution of mining industry to the economy of the region.

CONCEPTUAL FRAMEWORK

Environmental Assets

Environmental assets are the naturally occurring living and non-living components of the Earth and constitute the biophysical environment, which may provide benefits to humanity. As defined in Central Framework, environmental assets are viewed in terms of the individual components (timber, water, soil, land, minerals, and energy) that make up the environment, with no direct account taken of the interactions between these components as part of ecosystems. Thus, exploration will have an impact on the welfare and endowment of the future generation.

Stock Accounts

The SEEA Central Framework developed by the UN is a multipurpose conceptual framework intended for understanding the interactions between the economy and the environment, and for describing the stocks and changes in stocks of environmental assets.¹¹ It puts statistics on the environment and its relationship to the economy and the environment at the core of official statistics. The environmental capital can be measured through the asset accounts. The asset accounts record the opening and closing stocks of the environmental assets and the different types of changes in the stocks over an accounting period. It also assesses the patterns of economic activity whether these are depleting and degrading the available environmental assets.

SEEA Central Framework applies the accounting concepts, structures, rules and principles of the System of National Accounts (SNA). In principle, when accounting for environmental assets in physical terms include all environmental assets whether or not they have a monetary value. In mineral resources, the scope is known deposits. Accounting for changes in the stocks of environmental assets presents various measurement challenges, thus, understanding the dynamics is important in making a reasonable assessment of certain environmental assets. In the Central Framework, consistent with the

¹¹ Ibid, footnote no. 5

SNA, the scope of valuation is limited to the benefits that accrue to economic owners. The use of natural inputs by the economy is linked to changes in the stock of environmental assets that generate those inputs.

Valuation (NPV)

Basically, governments have a level of ownership of influence over the extraction of environmental assets, valuation of these assets in monetary terms may provide useful information for assessing future streams of income for government. The prices at which assets are bought or sold are the basis of decisions by investors, producers, consumers and other economic agents. Ideally, observable market prices should be used to value all assets, and every item should be valued as if it were being acquired on the date to which the estimate of the stock relates. These enable the values of different types of assets and allow the formation of opening and closing values of stocks that can be used to assess national and institutional sector estimates of wealth in monetary terms.

The SEEA emphasized that the important consideration in application of general principles of valuation of environmental assets is to estimate the value of the asset in situ rather than after its removal. Using the discounted value of future return or commonly referred to as the Net Present Value (NPV) which uses projections of the future rate of extraction of the asset, together with projections of its price, to generate a time series of expected return, the value of the asset can be determined.

Framework for the Mineral Asset Accounts

The closing and opening stocks were measured following the estimation of the mineral asset of SEEA Central Framework as shown in Table 5. It started with the opening stock of the environmental asset and ended with the closing stock of environmental assets. In physical terms, the changes between the beginning and the end of the accounting period were recorded as either additions to the stock or reductions to the stock. In monetary terms, the same entries are made but an additional entry was included to record the revaluation of the stock of environmental assets. This entry accounts for the changes in the value of assets over an accounting period that is due to movements in the price of the assets or to changes to assumptions underlying the NPV approaches that are typically used to value mineral resources.

Table 5. Basic Structure for Mineral Asset Account

Opening stock of mineral resources	
Additions to stock	
Discoveries	Estimates of the quantity of new deposits found during an accounting period.
Upward reappraisals	An increase due to changes in the categorization of specific deposits between class A, B or C based on changes in geologic information, technology, resource price or a combination of these factors
Reclassifications	May occur if certain deposits are opened or closed to mining operations owing to government decisions concerning the access rights to a deposit
Total additions to stock	Aggregated estimates of discoveries, upward reappraisals and reclassifications
Reductions to stock	
Extractions	Quantity of the resource physically removed from the deposit
Catastrophic losses	Reflects losses due to catastrophic or exceptional events like flooding and collapsing of mines
Downward reappraisals	A decrease due to changes in the categorization of specific deposits between Classes A, B, or C based on changes in geologic information, technology, resource price, or a combination of these factors.
Reclassifications	May occur if certain deposits are opened or closed to mining operations owing to government decisions concerning the access rights to a deposit.
Total reductions to stock	
Revaluation of stock ^a	Relate to changes in the value of assets due to price changes and reflect nominal holding gains and losses on environmental assets.
Closing to stock	

Source: System of Environmental-Economic Accounting 2012-Central Framework, p.19

Note: ^a Only applicable for asset accounts in monetary terms

OPERATIONAL FRAMEWORK

Scope and Coverage

The compilation and estimation of the physical and monetary asset accounts focused on the metallic mineral asset of Caraga region particularly on the available data of the nickel ore, gold ore, and metallurgical chromite from the MGB Regional Office No. XIII in the accounting period of CYs 2015 to 2018.

Available data for mineral reserve were used for the estimation of the opening stock including those activities that affect the opening and the closing stocks particularly the discoveries, extractions, catastrophic losses, reappraisals, and reclassifications (Table 5). However, there was no data for catastrophic losses submitted by the mining companies to the source agency since these are rare in relation to mineral resources. Valuations of these resources were also accounted for the revaluation of the asset for the monetary accounts.

Sources of Data

The sources of key requirement data for the estimation of physical and monetary asset accounts are Mines and Geosciences Bureau and the Provincial/City Mining Regulatory Board. There was no data retrieved from small scale mining operating at LGUs. Due to the unavailability of some data for gold ore production, data from Medusa Mining Limited (ASX:MML)¹² annual reports from 2015 to 2018 were gathered and used as a reference to estimate the volume of gold ore to produce a kilogram of gold. In estimating monetary asset accounts, different data parameters were used. These parameters include data from 2012 Input-Output (I-O) Coefficients, 2012 Census of Philippine Business and Industry (CSPBI) from Philippine Statistics Authority, Treasury bill rates from Bangko Sentral ng Pilipinas (BSP), discount rates from National Economic and Development Authority (NEDA).

¹² Medusa Mining Limited (ASX:MML) is a publicly listed, Australian based gold producer, focused on growth in the Asia Pacific Region. One of its project is the Co-O Mine which operates in Agusan del Sur, Caraga.

Methodology

Physical Asset Account

Data for metallic minerals such as nickel ore, gold ore, and metallurgical chromite were compiled for the structure of the physical asset accounts. As recommended in the SEEA-Central Framework 2012, the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) was used to determine whether and to what extent, projects for the extraction and exploration of the resources have been confirmed, developed or planned.¹³ The underlying resources were classified based on the maturity of the project according to the UNFC-2009 criteria affecting their extraction:

1. Economic and Social Viability (*E*)
2. Field project status and feasibility (*F*)
3. Geological knowledge (*G*)

Known deposits were classified in three classes according to the criteria derived from the UNFC-2009:

Class A: Commercially recoverable resources (includes the commercial projects on production, approved for development, and justified for development);

Class B: Potentially commercially recoverable resources (potentially commercial projects that include development pending and development on hold); and

Class C: Non-commercial and other known deposits (development unclarified and not viable).

The compilation of physical asset accounts denotes the changes in the opening and closing stocks of mineral resources in the region. Stocks increased due to discoveries, reclassifications and reappraisals accounted. Moreover, the decrease in stocks of resources is attributed to the extractions and downward reappraisals being accounted for.

¹³ See Appendix E Table 20 for Categorization of Mineral Resources

Estimation and Calculation Procedure

1. The reported unit of measure for mineral production from the data source was either in WMT or DMT. MGB Caraga suggested to use WMT as the unit of measure for the compilation since the data for reserve was reported in WMT and the region also exports the raw mineral (nickeliferous ore) which was also reported in WMT. The compilation of the mineral resources in WMT was agreed by the TWG for the consistency of the report. The production data in DMT was converted to WMT using the following formula:

$$\text{Volume in WMT} = \frac{DMT}{(1 - MC)}$$

Where:

WMT = Wet Metric Ton

DMT = Dry Metric Ton

MC = Moisture Content (Data for the moisture content from the shipment reports by mining tenements were applied in the conversion of the production.)

2. Gold production was reported as a by-product in bullion together with silver. The two can be produced together in processing the gold ore. However, in accounting the mineral asset, gold ore must be determined. Volume of gold ore to produce a kilogram of gold was estimated using the data from the annual reports of Medusa Mining Limited¹⁴ (mother company of one of the gold mining company in the region). To estimate the volume of gold ore production/ore mined, the following formula was used:

$$OM_{cy} = AuP_{cy} * VAuO_{cy}$$

Where:

OM_{cy} = Ore mined in WMT produced in current year

AuP_{cy} = Gold in WMT/kg produced in current year

*VAuO_{cy} = Volume of Gold Ore to Produce a kilogram of Gold
in current year*

Note: Estimation of gold ore production was only applied in the year 2015 to 2017 since the year 2018 has available data for gold ore production (see Appendix C Table 15 for the estimation of gold ore production.)

¹⁴ Medusa Mining Limited (ASX:MML) annual reports are available at <https://www.medusamining.com.au/>

3. Opening stock basically revolves around the volume of the ore reserve. Stock of the asset before the beginning of the accounting period or the closing stock of the previous year serves as the opening stock for the succeeding year. However, due to unavailability of some reserves from the previous years, backtracking and imputation were utilized to estimate the stock using the following formula:

$$VR_{py} = VR_{cy} + VE_{cy}$$

Where:

VR_{py} = Volume of Reserve in WMT for the previous year

VR_{cy} = Volume of Reserve in WMT in the current year

VE_{cy} = Volume of Extraction in WMT in the current year

4. Discovery is based on the establishment of geological knowledge of the company. However, data for discovery was not explicitly seen from the reports of the data source. Date of approval for the Declaration of Mining Project Feasibility (DMPF) was determined to record the reserve for the period in which projects have feasibility studies.
5. Reappraisal was estimated by comparing the data on current and previous reserves after deducting production data for the previous year. This was obtained through the following formula:

$$Reappraisal = NS - (OS - Extraction)$$

Where:

NS = New Stock

OS = Old Stock

Note: The obtained results were classified as upward reappraisal (if positive) or downward reappraisal (if negative). Either upward reappraisals (additions) or downward reappraisal (reduction) reflect changes due to the use of updated information that permits a reassessment of the physical size of the stock. The reassessments may also relate to changes in the assessed quality or grade of the natural resource, or changes in the economic viability of extraction (including those due to changes in extraction technology) that are not solely due to changes in the price of the natural resource. The use of updated information may require the revision of estimates for previous periods to ensure a continuity of time series.¹⁴

¹⁴ Ibid, footnote no. 5

5. Data for reclassification was not readily available, however, there are ways to record using derived indicators. Reserve reclassification was obtained through the criteria set under the UNFC-2009 classification system. It may occur if certain deposits are opened or closed to mining operations owing to government decisions concerning access rights to a deposit. Mineral reserves that were reclassified to other categories were recorded in the reclassification.

The reserve was classified to Class B, recorded as reclassification addition to stock due to the production activity on hold/or where justification as commercial development may be subject to significant delay for a year. On the other hand, if the production activity is on hold/or where justification as commercial development may be subject to significant delay exceeds one year, the reserve will be classified to Class C.

Monetary Asset Account

Monetary asset account was estimated using the NPV approach. NPV is the value of an asset determined by estimating the stream of income expected to be earned in the future, and discounting the future income back to the present accounting period as defined in the SEEA 2012- Central Framework. To compute the NPV, the Resource Rent (RR), asset life, and appropriate discount rate must be determined.

1. Estimation of Resource Rent

Resource rent is the surplus value taken to be returned to the asset life. To derive the resource rent, data parameters such as Net Operating Surplus (NOS) and return to produced assets must be determined. It was estimated using the following;

- 1.1. NOS was estimated through determining the Gross Output (GO) and Gross Operating Surplus (GOS).

1.1.a. GO is the gross value in PhP reported or by multiplying the price value to the volume of extraction. This is expressed through the following equation:

$$GO = price * extraction$$

Note: However, data for GO was also reported in the production report of MGB which corresponds to the volume of production.

1.1.b. To derive the GOS, operating cost is deducted from GO; i.e.,

$$GOS = GO - Operating Cost$$

Where:

GOS = Gross Operating Surplus (in PhP)

GO = Gross Output (in PhP)

1.1.c. NOS was determined by deducting the Consumption of Fixed Capital from the GOS.

$$NOS = GOS - CFC$$

Where:

NOS = Net Operating Surplus (in PhP)

GOS = Gross Operating Surplus (in PhP)

CFC = Consumption of Fixed Capital (in PhP)

1.2. To estimate the return to produce assets, different data parameters should be determined. These include the ratio of book value to revenue, value of produced assets, and T-bill rates.

1.2.a. Ratio of Book Value to Revenue was expressed through the following:

$$\text{Ratio of Book Value to Revenue} = \frac{\text{Book Value of Fixed Capital}}{\text{Revenue}}$$

Note: Book value of fixed capital and revenue was derived from the 2012 Census of Philippine Business and Industry (CSPBI) for mining and quarrying industry in the region as a base year.

1.2.b. After obtaining the ratio of book value to revenue, the value of produced assets was then estimated through the following formula:

$$\text{Value of produced assets} = \text{Ratio of Book Value to Revenue} * \text{Gross Output}$$

1.2.c. To estimate the return to produce assets, the following equation was expressed:

$$\text{Return to produced assets} = \text{Value of Produced Assets} * T - \text{bill Rate}$$

T-bill rate is the rate on short-term debt instruments issued by the National Government (NG) for the purpose of generating funds needed to finance outstanding obligations.¹⁵ The data for the T-bills were from the official data of the BSP website for the year 2015 to 2018 in all maturities.

1.1. Estimation of the resource rent (in PhP) was calculated through the following formula:

$$\text{Resource rent} = \text{NOS} - \text{Return to Produced Assets} - \text{IE}$$

Where:

NOS = Net Operating Surplus

IE = Interest Expense

2. Asset life for nickel ore, gold ore, and metallurgical chromite reserve were determined through dividing the closing stock of the given year by the actual extraction. The calculation is presented in the following formula:

$$\text{Asset life} = \frac{\text{Closing physical stock}}{\text{Extraction}}$$

¹⁵ Department of Economic Research/Department of Economic Statistics. FAQ Interest Rates, page 6. available at bsp.gov.ph/downloads/Publications/FAQs/intrates.pdf

3. Estimation of Resource Value using NPV

To come up at a resource value, the derived RR was discounted using the NPV and discount rate of 10 percent from the updated social discount rate of the Philippines and as per agreed with the TWG.

Resource Value (RV) was then computed using NPV through the following formula.¹⁶

$$= \sum_{T=1}^{N_t} \frac{RR_{+T}}{(1+r)^T}$$

Where:

V_t = value of the asset of time t

N = asset life

RR = resource rent

R = nominal discount rate

The computed resource value in a given period is the resulting value for the reserve at respective discount rates. The unit of resource value in every period was applied respectively by multiplying the unit of resource value to the changes to stocks. The unit of resource value was obtained through the following:

$$\text{Unit of Resource Value} = \frac{\text{Resource Value}}{\text{Closing Stock}_{(\text{Physical Account})}}$$

¹⁶ Formula was from UN SEEA Central Framework- 2012

Revaluation in every period was determined through the following formula:

$$\textit{Revaluation} = \textit{CS} - \textit{OS} - \textit{AS} + \textit{RS}$$

Where:

CS = Closing Stock

OS = Opening Stock

AS = Addition to Stock

RS = Reduction to Stock

The value of the closing stock for the monetary asset account can also be determined and counterchecked through the following:

Closing Stock for Monetary Account

*= Closing Stock of Physical Account * Unit of Resource Value*

RESULTS AND DISCUSSIONS

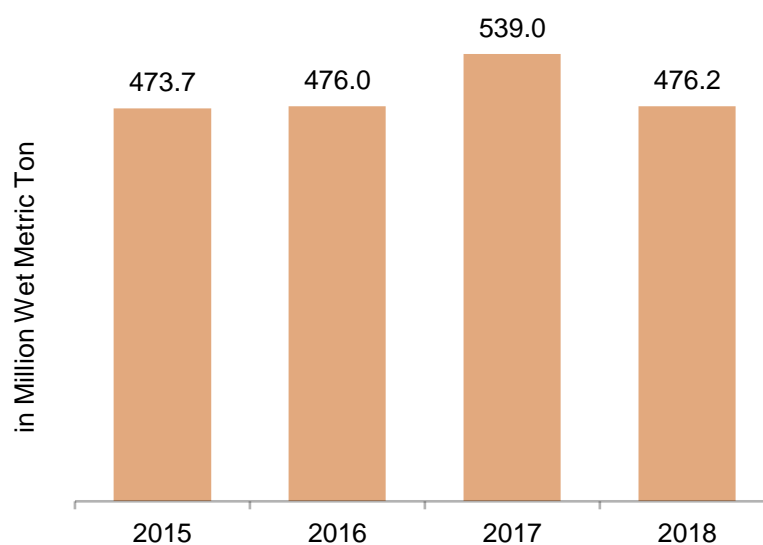
Physical Asset Accounts

The mineral reserves of Caraga for nickel ore, gold ore, and metallurgical chromite were estimated from CYs 2015 to 2018 based on the information available at the time of estimation. Backtracking and imputation were utilized to estimate the stocks due to unavailability of some data for mineral reserves. These were classified as Class A, Class B, and Class C according to the criteria recommended by the 2012 SEEA Central Framework.

A. Nickel Ore

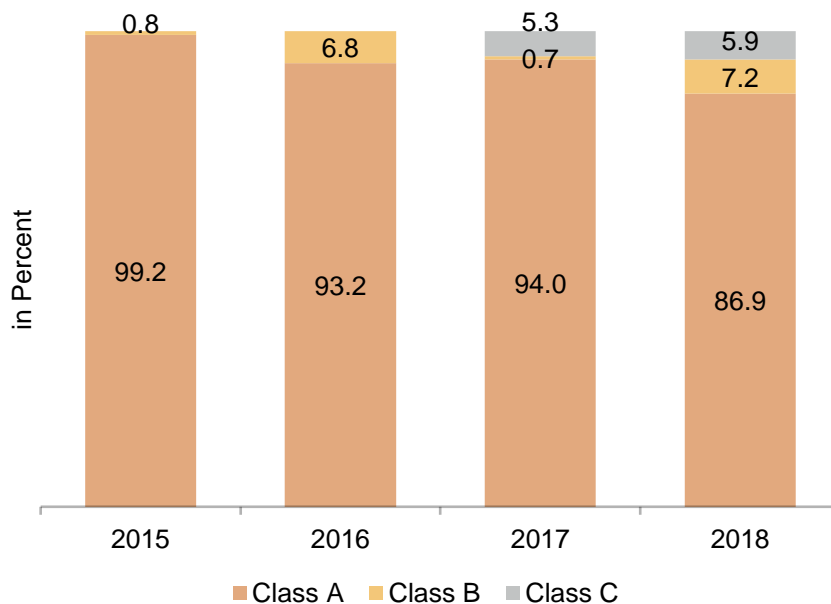
The stocks of nickel ore reserve from 2015 to 2018 exhibited a fluctuating trend as shown in Figure 1. In 2015, the opening stock of nickel ore reserve in the region was estimated at 509.37 million WMT. At the end of 2015, it posted a closing stock of 473.66 million WMT. The decrease of the reserve was due to the higher extraction of nickel ore compared to additions to stock.

Figure 1. Stock of Nickel Ore Reserve, Caraga: 2015-2018
(in Million Wet Metric Ton)



From 2015 to 2018, nickel ore reserve in 2015 was considered as the lowest estimated reserve. It slightly increased to 476.03 million WMT in 2016 due to the addition to stocks. Moreover, reserve in 2017 recorded the highest with 538.97 million WMT. The increase in the reserve was mainly attributed to upward reappraisals. In 2018, the estimated volume of nickel ore reserve in Caraga posted at 476.18 million WMT. (Figure 1)

Figure 2. Percent Distribution of Nickel Ore Reserve by Class (Class A, B, and C), Caraga: 2015-2018



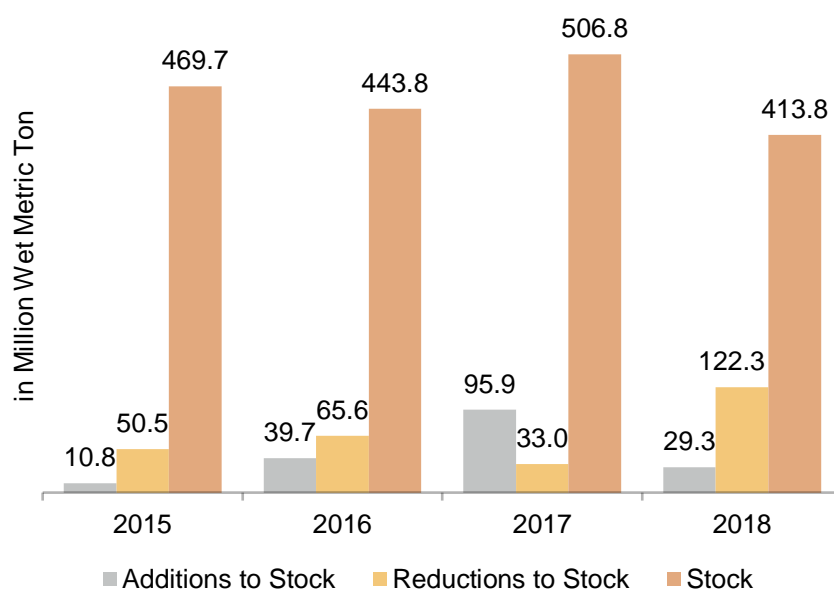
The estimated nickel ore reserve in the region as presented in Figure 1 was categorized accordingly. Estimated nickel ore reserves from different categories have an erratic trend as shown in Figure 2. Most reserves in 2015 became part of Class A with 99.17 percent of the total estimated reserve. In 2016, Class A reserve declined to 93.23 percent due to the number of mining operations suspended for not meeting up the environmental standards. Nickel ore reserve classified as Class B was 6.77 percent of the total estimated reserve and this corresponds to 32.21 million WMT.

In 2017, 94.02 percent of the total ore reserve was classified as Class A, 0.73 percent as Class B, and 5.25 percent as Class C. Moreover, nickel ore reserve belonging to Class C translates to 28.30 million WMT. These were ore reserve of mining companies under Class C, in which the mining

activities specifically mining production were on hold and/or where justification as commercial development may be subject to significant delay.

Class A nickel ore reserve dropped to 86.90 percent of the total reserve in 2018. Other categories were recorded at 7.16 percent as Class B or equivalent to 34.10 million WMT and 5.94 percent as Class C or 28.3 million WMT. (Tables 6b and 6c, and Figure 2)

Figure 3. Stock, Additions and Reductions to Stock of Class A Nickel Ore Reserve, Caraga: 2015-2018 (in Million Wet Metric Ton)



Stock of Class A nickel ore shows a fluctuating trend owing to the accounted changes of stocks (additions and reductions to stocks) from 2015 to 2018. Nickel ore reserve in 2015 was estimated at 469.75 million WMT and slightly declined to 443.82 million WMT in 2016. Moreover, 2017 recorded the highest reserve of 506.75 million WMT and fell off to 413.78 million WMT in 2018. This was the least estimated closing stock for the whole accounting period.

The mineral reserve increased due to the discoveries, upward reappraisals, and reclassifications. The discovery of 10.85 million WMT was recorded in 2015. Although no reported discoveries in succeeding years, reserves increased most likely because of the upward reappraisals and reclassifications. The estimated reappraisal in 2016 was 39.71 million WMT and spiked to 95.91 million WMT in 2017. In 2018, reappraisal was recorded at 25.37 million WMT. There were no reported reclassified reserves from

other category (Class B) in 2015, 2016, and 2017. However, a reclassified reserve of 3.91 million WMT in 2018 contributed to the growth of the Class A reserve which totaled to 29.3 million WMT in addition to stock. (Table 6, and Figure 3)

Table 6. Physical Asset Account for Nickel Ore Class A, Caraga: 2015-2018
(in Million Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	509.37	469.75	443.82	506.75
Additions to stock				
Discoveries	10.85	-	-	-
Upward reappraisals	-	39.71	95.91	25.37
Reclassifications	-	-	-	3.91
Total additions to stock	10.85	39.71	95.91	29.28
Reductions to stock				
Extractions	46.56	36.43	32.90	30.81
Catastrophic losses	-	-	-	-
Downward reappraisals	-	0.91	0.07	57.57
Reclassifications	3.91	28.30	-	33.87
Total reductions to stock	50.47	65.64	32.97	122.25
Closing stock	469.75	443.82	506.75	413.78

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

The decline of stocks was mainly because of the extractions of nickel ore reserve, downward reappraisals and reclassified reserves. The extraction of nickel ore had a decreasing trend from 46.56 million WMT in 2015, 36.43 million WMT in 2016, 32.90 million WMT in 2017, and 30.81 million WMT in 2018. However, not all extracted nickel ore were directly sold. Some of those were stockpiled due to cut off grade and low metal price. Furthermore, downward reappraisals also affect the decline of the reserve. In 2015, there was no recorded downward reappraisal. However, in 2016 it was estimated at 0.91 million WMT and declined to 0.07 million WMT in 2017. In 2018, an estimated downward reappraisal was recorded at 57.57 million WMT. Furthermore, nickel ore reserve from Class A reclassified to Class B also contributed to the decline of the closing stock annually. In 2015, 3.91 million WMT was reclassified to other category and 28.30 million WMT in 2016. There was no recorded reclassified reserve in 2017, however, 33.87 million WMT was reclassified in 2018. The total estimated reduction to stocks varies from the year 2015 to 2018. The year 2018 has the highest reduction to stock

with 122.25 million WMT. On the other hand, the lowest estimated reduction to stock was recorded in 2017 with 32.97 million WMT. (Table 6, and Figure 3)

Table 7. Estimated Asset Life of Class A Nickel Ore Reserve, Caraga: 2015-2018

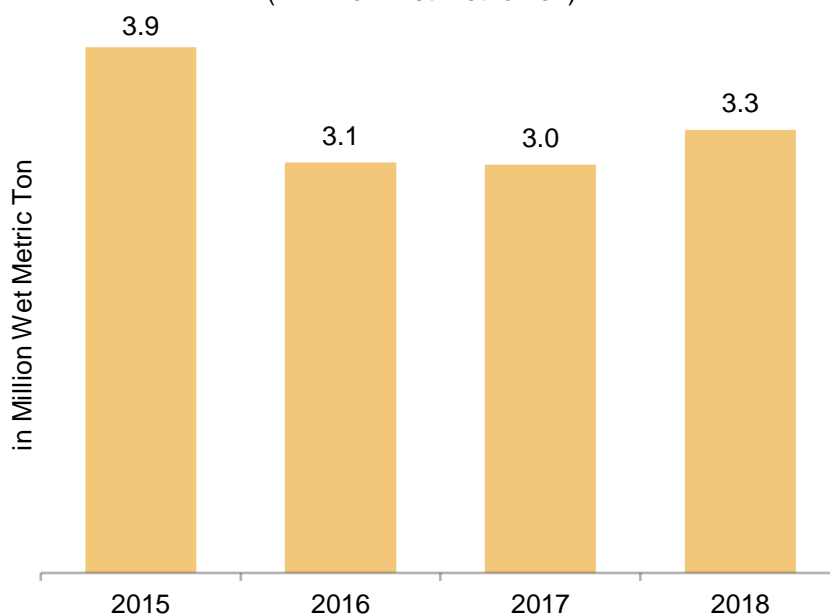
Year	Total Reserve (in million WMT)	Extraction (in million WMT)	Asset Life (in Years)
2015	469.75	46.56	10.09
2016	443.82	36.43	12.18
2017	506.75	32.90	15.40
2018	413.78	30.81	13.43

Source: Philippine Statistics Authority-Caraga

With the estimated volume of reserve and extraction in the respective years, the asset life of mineral reserve was determined. The asset life of nickel ore in 2015 was projected to last for 10.09 years as shown in Table 7. In 2017, the estimated mine life was 15.40 years which was considered as the longest asset life from 2015 to 2018. The increase of its mine life was attributed to a higher estimated volume of stock and a decline in extraction. In addition, the estimated average length of time before the nickel ore reserves will be exhausted was 12.78 years. (Table 7)

B. Gold Ore

Figure 4. Stock of Gold Ore Reserve, Caraga: 2015-2018
(in Million Wet Metric Ton)



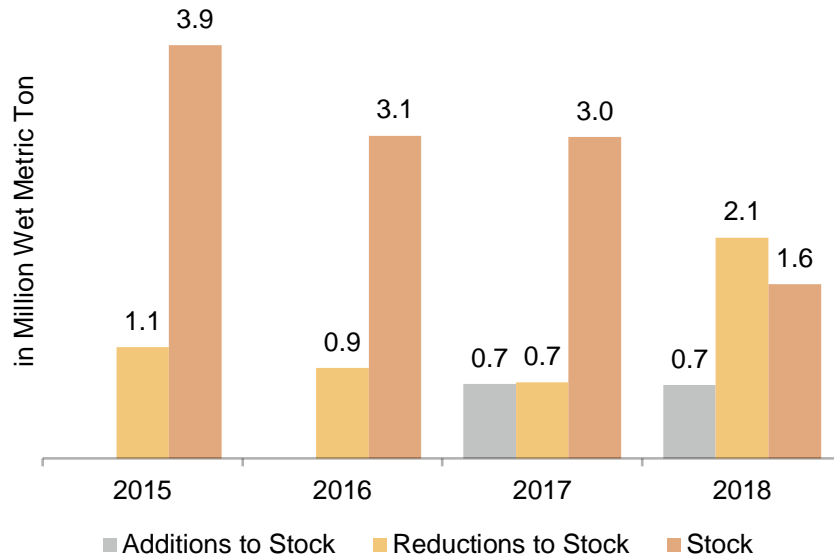
As shown in Figure 4, the volume of reserve posted a fluctuating trend from 2015 to 2018. In 2015, the reserve was estimated at 3.91 million WMT which recorded as the highest gold ore reserve. The extraction of the gold ore diminished the reserve which was also the reason of the decline of the estimated reserve in 2016 with 3.05 million WMT. In 2017, the region held an estimated gold ore reserve of 3.04 million WMT. As of 2018, the estimated gold ore reserve increased which posted 3.30 million WMT. The increase of the volume of the gold ore reserve was due to the decrease in estimated reductions to stock particularly extraction and increase addition to stock. (Figure 4)

Figure 5. Percent Distribution of Gold Ore Reserve by Class (Class A and Class B), Caraga: 2015-2018



Gold ore reserve contribution of Class A and Class B during the accounting period 2015 to 2018 is shown in Figure 5. Based on the available information, a hundred percent of gold ore reserve was categorized as Class A from 2015 to 2017. In 2018, half of the total reserve was under Class A and the other half was Class B. (Table 8b, and Figure 5)

Figure 6. Stock, Additions and Reductions to Stock of Class A Gold Ore Reserve, Caraga: 2015-2018 (in Million Wet Metric Ton)



The estimated opening stock of gold ore reserve in 2015 was 4.97 million WMT. There was no recorded addition to stocks in 2015 and 2016 which attributed to a decline of gold ore reserve in Class A. Moreover, addition to stocks in 2017 was observed with an estimated volume of 0.71 million WMT and 0.70 million WMT in 2018. Although stocks in 2017 and 2018 were recorded with additions to stocks, its closing stock remained low compared to previous years. This was due to the declining closing stocks from 2015 owing to a high volume of reductions to stock. Closing stock in the year 2018 diminished to 1.65 million WMT due to the escalation of reduction to stock with 2.09 million WMT. The spike in the reduction to stock was on account of 0.57 million WMT extracted reserve and 1.52 million WMT reclassified reserve to Class B. (Table 8)

Table 8. Physical Asset Account for Gold Ore Class A, Caraga: 2015-2018
(in Million Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	4.97	3.91	3.05	3.04
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	0.71	0.70
Reclassifications	-	-	-	-
Total additions to stock	-	-	0.71	0.70
Reductions to stock				
Extractions	1.05	0.86	0.72	0.57
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	1.52
Total reductions to stock	1.05	0.86	0.72	2.09
Closing stock	3.91	3.05	3.04	1.65

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 9 shows the projected asset life of gold ore reserve from 2015 to 2018. The estimated economically exploitable reserves are not very large and production has been declining. The gold reserve was sufficient until 4 years between the years 2015 to 2017. Moreover, asset life of 2.89 years for the 2018 reserve was estimated before it is depleted. On average, it was forecasted that the gold ore reserve would last for 3.60 years unless no new reserve converted economically which could extend the life of the reserves further. (Table 9)

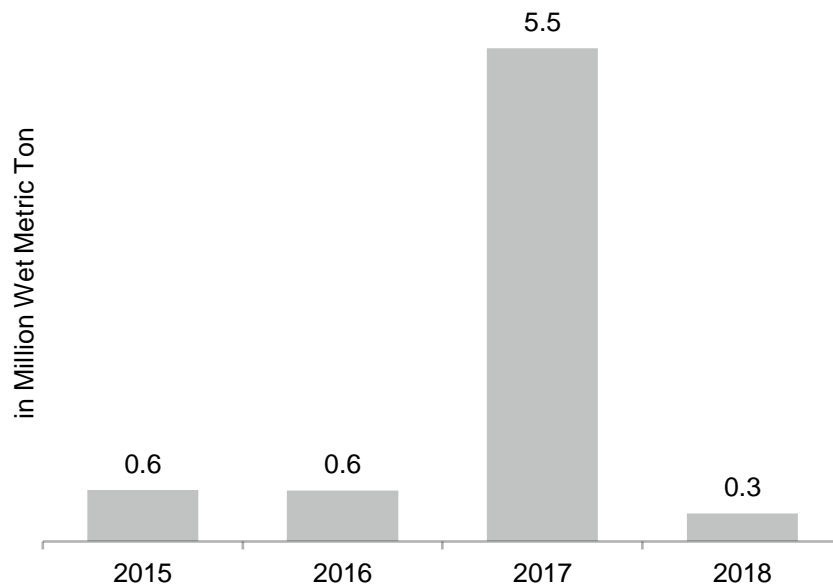
Table 9. Estimated Asset Life of Class A Gold Ore Reserve, Caraga: 2015-2018

Year	Total Reserve (in million WMT)	Extraction (in million WMT)	Asset Life (in Years)
2015	3.91	1.05	3.72
2016	3.05	0.86	3.55
2017	3.04	0.72	4.22
2018	1.65	0.57	2.89

Source: Philippine Statistics Authority-Caraga

C. Metallurgical Chromite

Figure 7. Stock of Metallurgical Chromite Reserve, Caraga: 2015-2018 (in Million Wet Metric Ton)



Metallurgical chromite reserve in the region was estimated at 0.57 million WMT in 2015 and 2016. In 2017, the reserve increased to 5.51 million WMT due to the increase upward reappraisal of the known reserve based on the geologic information. However, the recorded metallurgical chromite reserve in the region in 2018 drastically fell to 0.31 million although there was no extraction activity that could diminish the volume of economically mineable mineral. (Figure 7)

Figure 8. Percent Distribution of Metallurgical Chromite Reserve in Class A, B, and C, Caraga: 2015-2018



As shown in Figure 8, metallurgical chromite reserve was classified as Class A, B and C. Economically viable reserve with feasible extraction was classified as Class A. Thus, imparting the hundred percent reserves to Class A in 2015 and 2016. (Figure 8)

Table 10. Physical Asset Account for Metallurgical Chromite Class A, Caraga: 2015-2018 (in Thousand Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	574.14	570.85	568.00	-
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	-
Reclassifications	-	-	-	-
Total additions to stock	-	-	-	-
Reductions to stock				
Extractions	3.30	2.85	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	568.00	-
Total reductions to stock	3.30	2.85	568.00	-
Closing stock	570.85	568.00	-	-

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Closing stock of 568.00 thousand WMT in 2016 was reclassified to Class B on the grounds of project activity on hold by virtue of not meeting up the environmental standards imposed by the regime. Whereas, 4.94 million WMT estimated reserve in 2017 was recorded as upward reappraisal hence summing up the 2017 Class B reserve to 5.51 million WMT. In pursuant with the SEEA Central Framework, closing stock in 2017 was reclassified to Class C since the reserve is not commercially viable due to the activity on hold for more than a year. In addition, a reserve of 5.19 million WMT was estimated as a downward reappraisal in 2018 Class C based on the geological information. In 2018, the region recorded 0.31 million WMT Class C metallurgical chromite. (Tables 10, 10a, and 10b)

Figure 9. Stock and Reductions to Stock of Class A Metallurgical Chromite Reserve, Caraga: 2015-2018 (in Thousand Wet Metric Ton)

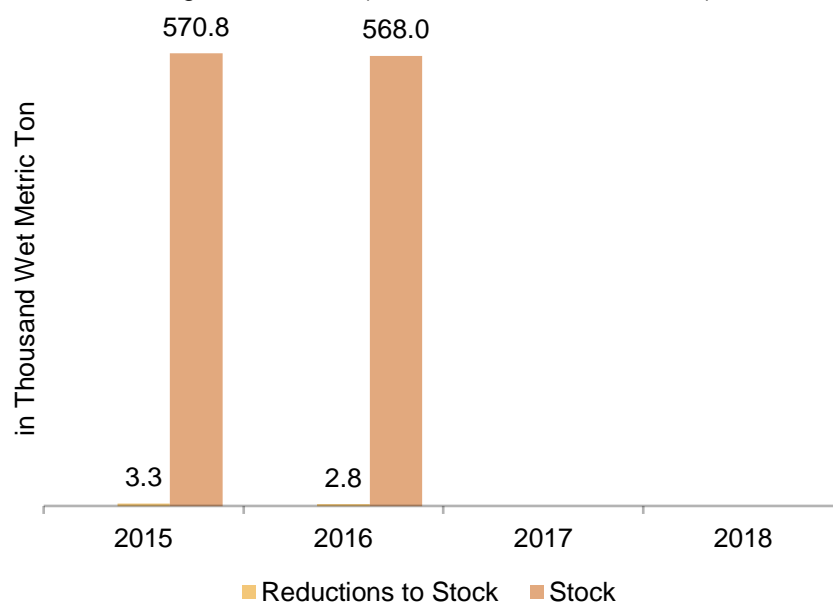


Figure 9 shows that the stock and reductions to stock of Class A metallurgical chromite reserve had a declining trend. There was no recorded additions to stock that would increase the volume of reserve in 2015 and 2016. Thus, closing stock decreases as reductions to stock increases. Opening stock for the accounting period was estimated at 574.14 thousand WMT and decreased to 570.8 thousand due to the reduction to stock with

3.30 thousand WMT in 2015. In 2016, the stock for Class A metallurgical chromite was extracted with 2.85 thousand WMT which denotes a decline of reserve to 568.00 thousand WMT. (Table 10, and Figure 9)

Table 11. Estimated Asset Life of Class A Metallurgical Chromite Reserve, Caraga: 2015-2018

Year	Total Reserve (in WMT)	Extraction (in WMT)	Asset Life (in Years)
2015	570.85	3.30	173.16
2016	568.00	2.85	199.46
2017	-	-	-
2018	-	-	-

Note: (-) denotes reclassified reserve
Source: Philippine Statistics Authority-Caraga

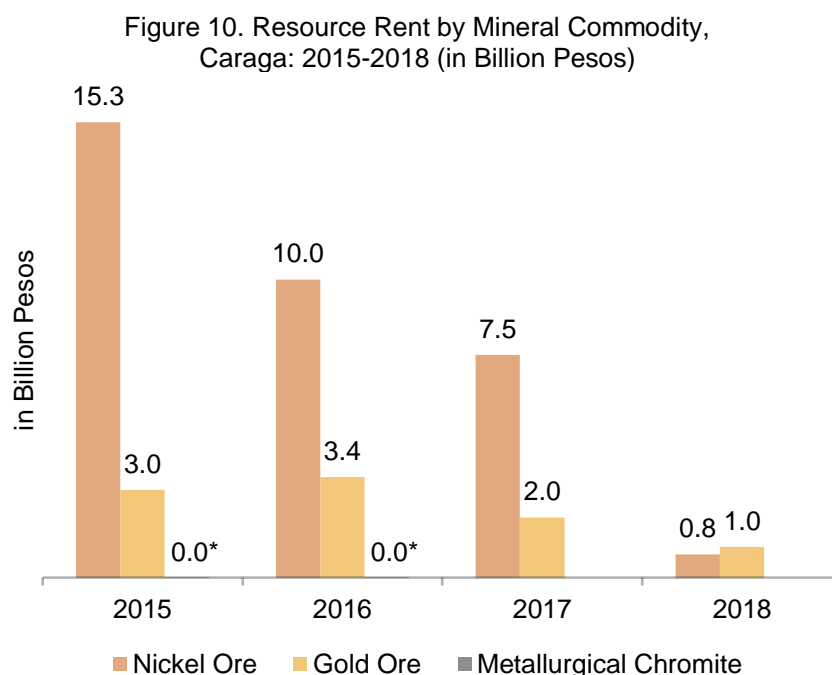
The estimated mine life of metallurgical chromite shows an increasing behavior as presented in the table above. Reserve for the year 2015 was projected to last 173.16 years. On the other hand, it would take 199.46 years before the reserve in 2016 will be depleted. However, asset life used in the estimation of the monetary asset account was 50 years in 2015 and 11 years in 2016. This was estimated using its ratio. This is also in accordance with the MPSA that shall have a term of 25 years from effective date. (Table 11)

Monetary Asset Accounts

The economic value of a mineral resource is measured by resource rent. This is the economic return above the return needed to be earned from the production of a mineral and the costs of extracting the mineral. Resource rent from mining industry can be also categorize into *differential rent*, *scarcity rent* and *entrepreneurial rent* depending on the situation of certain mining company. However, these three categories may exist at once or its combination. Differential rent refers to the excess profit that may arise owing to differences in the quality of the land.¹⁷

¹⁷ Hayes, Adam. (2019, August). Economic Rent. Retrieved from <https://www.investopedia.com/terms/e/economicrent.asp>

Resource rent has been estimated for minerals such as nickel ore, gold ore, and metallurgical chromite in the region from 2015 to 2018 in which available data from national accounts, Central Office-MGB, and regional MGB were the basis. The estimation of monetary asset accounts for mineral resources was only for reserves classified in Class A.



Note: (*) denotes in million pesos

As presented in Figure 10, resource rent by mineral commodity has distinct trends. Nickel ore has the highest rent to the environment notwithstanding the depletion of 15.33 billion PhP resource rent in 2015 to 0.79 billion PhP in 2018. The sharp fall in 2018 was due to the increase of T-bill rate as a result of policy rate hikes by the BSP and the US Federal Reserve as reported by the Department of Economic Research/Department of Economic Statistics,¹⁸ and to insure investment to finance the government projects as per definition of the T-bill¹⁹

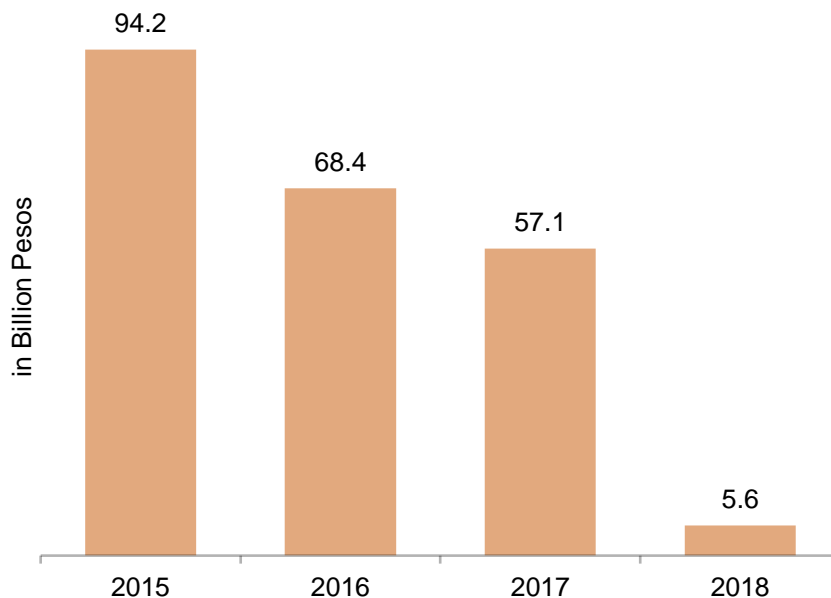
¹⁸ Department of Economic Research/Department of Economic Statistics. FAQ Interest Rates, page 9. available at bsp.gov.ph/downloads/Publications/FAQs/intrates.pdf

¹⁹ See T-bill rate definition with footnote no. 15

This can also indemnify which can be recovered by the government through appropriate taxes of the mining industry as a rent for mining the environment as discussed in RA 7942. (Table 19, and Figure 10)

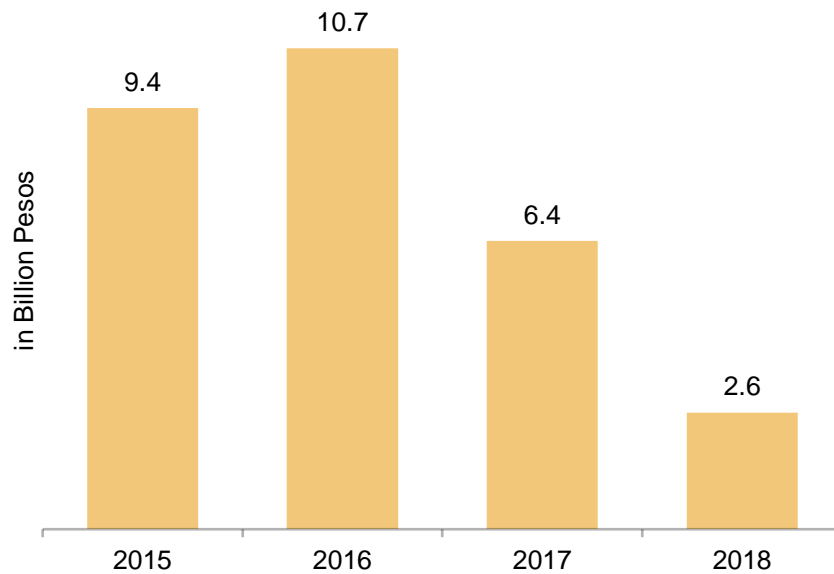
On the other hand, resource rent of gold ore was volatile which generated at 2.97 billion PhP in 2015. The rent climbed to 3.39 billion PhP in 2016 and decline to 2.03 billion PhP in 2017. It declined further to 1.04 billion PhP in 2018. In addition, metallurgical chromite has the lowest contribution to the economy in terms of rent to the environment. Its estimated resource rent escalated from 0.67 million PhP to 5.63 million PhP. (Figure 10)

Figure 11. Valuation of Nickel Ore Asset at 10 Percent Discount Rate, Caraga: 2015-2018 (in Billion Pesos)



The monetary behavior of nickel ore at respective discount rates shows a decreasing trend. At a 10 percent discount rate, a unit of resource value of 200.47 PhP per WMT was computed which amounted to 94.17 billion PhP of nickel ore reserve in 2015. The value of reserve in 2016 declined to 68.35 billion PhP which was quoted with 154.01 PhP of nickel ore per WMT. At a resource value of 112.61 PhP per WMT of nickel ore in 2017, it was estimated to generate 57.07 billion PhP. However, the price dropped to 13.59 PhP per WMT of nickel ore in 2018 at 10 percent discount rate which translated to 5.63 billion PhP. (Table 12, and Figure 11)

Figure 12. Valuation of Gold Ore Asset at 10 Percent Discount Rate, Caraga: 2015-2018 (in Billion Pesos)

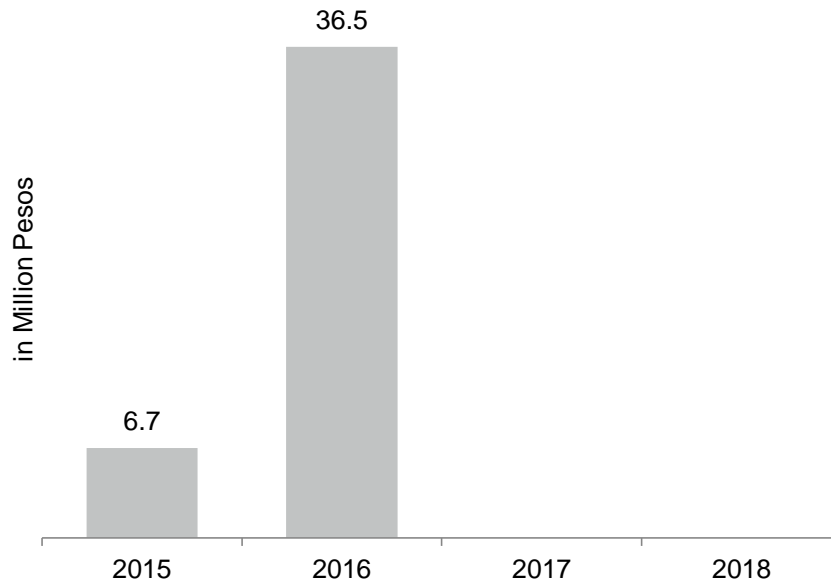


The estimated value of unexploited gold ore from the respected periods exhibited an erratic trend at different 10 percent discount rate. This discount rate was applied to project the rationalize income in valuing the future benefits and the present cost.

In 2015, gold ore was valued at 2,403.44 PhP per WMT which posted 9.40 billion PhP at a 10 percent discount rate. The highest approximated value of gold ore was 10.74 billion PhP which was quoted at 3,516.51 PhP per WMT in 2016. The value of gold ore decreased to 6.43 billion PhP in 2017 with a rate of 2,115.52 PhP per WMT. In 2018, the value declined to 2.60 billion PhP at 1,575.64 PhP per WMT of gold ore. (Table 13, and Figure 12)

Among the respected years at 10 percent discount rate, the year 2016 had the highest estimated price of gold ore per WMT which shows a positive recorded revaluation. This reflects a gain on the mineral asset as a result of an increased change in its price over an accounting period. However, the years 2015, 2017, and 2018 had a negative revaluation due to the decline in the estimated price of gold ore over an accounting period. (Table 13)

Figure 13. Valuation of Metallurgical Chromite Asset at 10 Percent Discount Rate, Caraga: 2015-2018 (in Million Pesos)



The spiking trend of the resource value of metallurgical chromite is presented in Figure 13 at 10 percent discount rate in year 2015 and 2016. The resource value was estimated at 6.69 million PhP at 11.72 pesos per WMT using the 10 percent discount rate. Moreover, the value of unexploited metallurgical chromite in 2016 significantly increased to 36.55 million PhP at 64.35 PhP per WMT.

The estimated value of the metallurgical chromite posted an increasing trend. It also showed a positive and accruing values which are recorded as revaluations which reflect a positive gain on the metallurgical asset.

(Table 14, and Figure 13)

WAYS FORWARD IN IMPROVING THE DATA SUPPORT AND ESTIMATION

- 1) Update the accounting of the mineral asset to measure and monitor the environmental economic asset of the region;
- 2) Enhance and organize systematic database from the data sources for a more complete and accurate data/information to obtain reliable statistics of the mineral asset accounting;
- 3) Encourage active participation of LGU and the mining establishments especially in the submission of data/information.

APPENDICES

APPENDIX A

Physical Asset Accounts

Table 6a. Physical Asset Account for Nickel Ore Class B, Caraga: 2015-2018
(in Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	-	3,910,498.00	32,212,799.41	3,910,498.00
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	225,471.52
Reclassifications	3,910,498.00	28,302,301.41	-	33,873,241.54
Total additions to stock	3,910,498.00	28,302,301.41	-	34,098,713.06
Reductions to stock	-	-	-	-
Extractions	-	-	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	28,302,301.41	3,910,498.00
Total reductions to stock	-	-	28,302,301.41	3,910,498.00
Closing stock	3,910,498.00	32,212,799.41	3,910,498.00	34,098,713.06

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 6b. Physical Asset Account for Nickel Ore Class C, Caraga: 2015-2018
(in Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	-	-	-	28,302,301.41
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	-
Reclassifications	-	-	28,302,301.41	-
Total additions to stock	-	-	28,302,301.41	-
Reductions to stock	-	-	-	-
Extractions	-	-	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	-
Total reductions to stock	-	-	-	-
Closing stock	-	-	28,302,301.41	28,302,301.41

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 8a. Physical Asset Account for Gold Ore Class B, Caraga: 2015-2018
(in Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	-	-	-	-
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	128,757.42
Reclassifications	-	-	-	1,520,000.00
Total additions to stock	-	-	-	1,648,757.42
Reductions to stock				
Extractions	-	-	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	-
Total reductions to stock	-	-	-	-
Closing stock	-	-	-	1,648,757.42

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 10a. Physical Asset Account for Metallurgical Chromite Class B,
Caraga: 2015-2018 (in Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	-	-	-	5,507,966.00
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	4,939,966.00	-
Reclassifications	-	-	568,000.00	-
Total additions to stock	-	-	5,507,966.00	-
Reductions to stock				
Extractions	-	-	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	5,507,966.00
Total reductions to stock	-	-	-	5,507,966.00
Closing stock	-	-	5,507,966.00	-

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 10b. Physical Asset Account for Metallurgical Chromite Class C,
Caraga: 2015-2018 (in Wet Metric Ton)

	2015	2016	2017	2018
Opening stock	-	-	-	-
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	-
Reclassifications	-	-	-	5,507,966.00
Total additions to stock	-	-	-	5,507,966.00
Reductions to stock				
Extractions	-	-	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	5,194,566.00
Reclassifications	-	-	-	-
Total reductions to stock	-	-	-	5,194,566.00
Closing stock	-	-	-	313,400.00

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

APPENDIX B
Monetary Asset Accounts

Table 12. Monetary Asset Account for Nickel Ore Class A at 10 Percent Discount Rate, Caraga: 2015-2018 (in Peso)

	2015	2016	2017	2018
Opening stock	129,243,969,729.29	94,169,823,245.11	68,353,008,767.80	57,067,542,685.75
Additions to stock				
Discoveries	2,174,747,011.25	-	-	-
Upward reappraisals	-	6,115,283,222.41	10,800,317,474.49	344,909,529.92
Reclassifications	-	-	-	53,161,164.46
Total additions to stock	2,174,747,011.25	6,115,283,222.41	10,800,317,474.49	398,070,694.38
Reductions to stock				
Extractions	9,333,020,293.88	5,610,424,788.60	3,705,194,256.86	418,820,046.24
Catastrophic losses	-	-	-	-
Downward reappraisals	-	140,026,759.06	7,545,004.95	782,646,836.48
Reclassifications	783,930,403.46	4,358,894,880.14	-	460,488,910.70
Total reductions to stock	10,116,950,697.34	10,109,346,427.80	3,712,739,261.81	1,661,955,793.42
Revaluation	-27,131,942,798.09	-21,822,751,271.92	-18,373,044,294.73	-50,178,503,760.16
Closing stock	94,169,823,245.11	68,353,008,767.80	57,067,542,685.75	5,625,153,826.54

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 13. Monetary Asset Account for Gold Ore Class A at 10 Percent Discount Rate, Caraga: 2015-2018 (in Peso)

	2015	2016	2017	2018
Opening stock	14,349,854,633.25	9,399,519,480.78	10,739,132,506.70	6,431,177,174.87
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	1,492,351,856.23	1,095,544,040.93
Reclassifications	-	-	-	-
Total additions to stock	-	-	1,492,351,856.23	1,095,544,040.93
Reductions to stock				
Extractions	2,535,253,677.17	3,013,476,420.93	1,521,787,184.91	892,669,253.17
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	2,394,966,265.94
Total reductions to stock	2,535,253,677.17	3,013,476,420.93	1,521,787,184.91	3,287,635,519.11
Revaluation	-2,415,081,475.30	4,353,089,446.85	-4,278,520,003.14	-1,641,244,642.99
Closing stock	9,399,519,480.78	10,739,132,506.70	6,431,177,174.87	2,597,841,053.70

Note: "-" Denotes no recorded data
Philippine Statistics Authority Caraga Estimation

Table 14. Monetary Asset Account for Metallurgical Chromite Class A at 10 Percent Discount Rate, Caraga: 2015-2018 (in Peso)

	2015	2016	2017	2018
Opening stock	6,570,056.24	6,691,212.85	-	-
Additions to stock				
Discoveries	-	-	-	-
Upward reappraisals	-	-	-	-
Reclassifications	-	-	-	-
Total additions to stock				
Reductions to stock				
Extractions	38,640.75	183,234.48	-	-
Catastrophic losses	-	-	-	-
Downward reappraisals	-	-	-	-
Reclassifications	-	-	-	-
Total reductions to stock	38,640.75	183,234.48	-	-
Revaluation	159,797.36	30,040,195.60	-	-
Closing stock	6,691,212.85	36,548,173.96	-	-

Note: "-" Denotes no recorded data
 Philippine Statistics Authority Caraga Estimation

APPENDIX C Mineral Production

Table 15. Estimation of Gold Ore Production, Caraga: 2015-2018

Commodity	2015	2016	2017	2018
Gold bullion (Kg)	4,877.00	4,625.00	3,187.00	2,894.18
WMT of Gold Ore/l kg of gold	216,289.64	185,286.45	225,712.17	195,753.36
Total Gold Ore (WMT)	1,054,844.55	856,949.84	719,344.67	566,545.46

Note: Available data for Medusa annual reports for 2015-2017 only were used as a reference for the estimation of gold ore to produce a kilo of gold available at <http://www.medusamining.com.au/>

Table 16a. Estimated Mineral Production by Commodity, Caraga: 2015-2018
(in Dry Metric Ton)

Commodity	2015	2016	2017	2018
Nickel Ore	31,104,081.57	23,846,556.49	21,699,775.10	20,238,572.00
Gold Ore	685,648.96	557,017.39	467,574.04	368,254.55
Metallurgical Chromite	560.05	2,620.00	-	-

Note: "-" Denotes no mineral production

Source: Mines and Geosciences Bureau-Caraga/Mines and Geosciences-Central Office/Philippines Statistics Authority

Table 16b. Gross Value of Production by Ore in Peso at Dry Metric Ton,
Caraga: 2015-2018

Commodity	2015	2016	2017	2018
Nickel Ore	32,077,607,396.97	18,897,211,940.39	19,784,540,918.84	22,766,268,459.00
Gold Ore	8,240,466,419.03	8,862,938,137.13	6,375,091,861.63	6,043,748,832.00
Metallurgical Chromite Ore	4,426,832.43	23,855,376.49	-	-

Note: "-" Denotes no gross value of production

Source: Mines and Geosciences Bureau-Caraga/Mines and Geosciences-Central Office

Table 17. Gross Value of by-Products Production, Caraga: 2015-2018

Commodity	2015	2016	2017	2018
Gold bullion	8,240,466,419.03	8,862,938,137.13	6,375,091,861.63	6,043,748,832.00
Silver bullion	44,276,243.63	68,528,165.36	26,606,703.22	14,674,822.00
Nickel/Cobalt Mixed Sulfides	13,846,252,560.58	11,237,393,034.33	15,762,856,833.49	14,993,978,791.00
Scandium Oxalate	-	-	-	137,632,563.00

Note: "-" Denotes no mineral production

Source: Mines and Geosciences Bureau-Caraga/Mines and Geosciences-Central Office

APPENDIX D Historical Prices

Table 18. Historical Metal Prices

Metal	Unit	2015	2016	2017	2018	Source
Nickel	US\$/lb	5.34	4.35	4.70	5.90	LME
Gold	US\$/oz	1,163.59	1,247.44	1,257.65	1,269.15	BSP
Silver	US\$/oz	15.72	17.08	17.05	15.69	BSP

Legend:

LME: London Metal Exchange

BSP: Bangko Sentral ng Pilipinas

Source: Mines and Geosciences Website

Table 19. Historical Treasury Bill Rates

Year	PhP per US Dollar Rate	T-Bill Rates*
2015	45.5028	1.894
2016	47.4925	1.595
2017	50.4037	2.449
2018	52.6614	4.389

Note: (*) Rate in percent

Source: Bangko Sentral ng Pilipinas retrieved from <http://www.bsp.gov.ph/statistics/sdds/tbillsdds.htm>

APPENDIX E
Categorization of Mineral Resources

Table 20. Categorization of Mineral Resources

SEEA Classes		Corresponding UNFC-2009 project categories		
		E	F	G
		Economic and social viability	Field project status and feasibility	Geologic knowledge
Known deposits	Class A: Commercially recoverable resources ^a	E1. Extraction and sale have been confirmed to be economically viable	F1. Feasibility of extraction by a defined development project or mining operation has been confirmed.	Quantities associated with a known deposit that can be estimated with a high (G1), moderate (G2) or low (G3) level of confidence
	Class B. Potentially commercially recoverable resources ^b	E2. Extraction and sale are expected to become economically viable in the foreseeable future ^c	F2.1. Project activities are ongoing to justify development in the foreseeable future Or F2.2. Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	
	Class C. Non-commercial and other known deposits ^d	E3. Extraction and sale are not expected to become economically viable in the foreseeable future or evaluation is at too early a stage to determine economic viability	F2.2 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F2.3. There are no current plans to develop or to acquire additional data at the time due to limited potential	

			Or F4. No development project or mining operation has been identified	
Potential deposits (not included in SEEA)	Exploration projects Additional quantities in place	E3. Extraction and sale are not expected to become economically viable in the foreseeable future or evaluation is at too early a stage to determine economic viability	F3. Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data Or F4. No development project or mining operation has been identified	Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)

Note

^a Including on-production projects, projects approved for development and projects justified for development.

^b Including economic and marginal development projects pending and development projects on hold.

^c Potential commercial projects may also satisfy the requirements for E1.

^d Including unclarified development projects, non-viable development projects, and additional quantities in place.

Source: System on Environmental-Economic Accounting (SEEA) 2012 – Central Framework, p. 163 table 5.6

APPENDIX F
Social Discount Rate Memorandum



INVESTMENT COORDINATION COMMITTEE

MEMORANDUM

For : Heads of Departments/Agencies of the National Government, Government-Owned and Controlled Corporations, Government Financial Institutions, Local Government Units and All Others Concerned

From : Secretary Carlos G. Dominguez
Department of Finance
Chair, ICC - Cabinet Committee

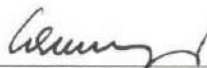
Secretary Ernesto M. Pernia
National Economic and Development Authority
Co-Chair, ICC – Cabinet Committee

Subject: REVISIONS ON ICC GUIDELINES AND PROCEDURES
(UPDATED SOCIAL DISCOUNT RATE FOR THE PHILIPPINES)

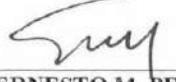
Date: 30 September 2016

1. The NEDA Board, during its 14 September 2016 meeting, confirmed the Investment Coordination Committee's (ICC) approval of the updating of the Social Discount Rate (SDR) **from the current rate of 15% to a lower rate of 10%.**
2. SDR reflects the hurdle rate which the economic internal rate of return (EIRR) of a proposed project must equal or exceed for it to become an economically viable investment. Since the late 1980s, the ICC has maintained a rate of 15% for project evaluation; however, several empirical studies conducted thereafter have recommended a lower rate, i.e., Asian Development Bank (1997) at 11.5% and Jenkins and Kuo (1998) and NEDA Manual (1999) at 10%. More recently, a study conducted by Prof. Ruperto Alonzo in 2014 yielded an SDR range estimate from 7.4% to 10%. Further, the updated SDR is consistent with the 10 to 12% rates currently being used by multilaterals banks and reflects the current circumstances in light of the positive developments in the economy over the past few years.
3. All project proposals submitted for ICC review shall henceforth adopt the updated SDR.

For information and guidance.


SEC. CARLOS G. DOMINGUEZ
Department of Finance *CD*




SEC. ERNESTO M. PERNIA
National Economic and Development Authority *EP*

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