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Handbook on statistics for economies based on natural resources

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ULAANBAATAR CITY GROUP
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STATISTICS FOR ECONOMIES BASED ON NATURAL RESOURCE

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CHAPTER 1. INTRODUCTION

1.1. Foreword

In many countries, the mining industry is rapidly developing, generating substantial revenue and resulting in significant growth in those economies based on natural resources. The mining industry's impact on the environment is expected to increase over time. This new wave of development of the mining industry is posing new challenges to the national statistical institutions of both developed and developing countries with significant natural resources. Furthermore, there are deficiencies in the availability of mining statistics that are comparable across countries.

The Ulaanbaatar City Group (UBCG) on statistics for economies based on natural resources was established to address methodological issues related to statistics on natural resources and contribute to improving international standards and methods for producing such statistics, by pooling expertise from various countries.

The group would deal with statistics on direct and indirect activities related to mining. Mining, henceforth understood to include quarrying, is defined as the extraction of minerals occurring naturally as solids, liquids and gases. Direct activities and impacts are those associated with the extraction process itself, including specialised support services. Indirect activities and impacts include those associated with downstream processing, as well as mining-related components of other activities that are closely associated with mining, such as construction, transportation and the provision of technical services. The economic, environmental and social impact will also be considered by the group.

Since the turn of the century the world's appetite for natural resources has grown exponentially. Since 2000 China's GDP growth has been on average greater than 7%, India's has been greater than 5%. This growth has been predominantly in infrastructure but also in dwelling investment as well. There has been significant expansion in many countries' manufacturing sectors, all of which drives the increase in demand for natural resources. This demand for natural resources impacts those economies that are based on natural resources. Many of the countries are small and changes in commodity prices can impact their income streams.

In order to understand how this increase in demand for natural resources is impacting on economies, it is necessary to develop a suite of statistics that will assist decision making. Countries whose economies are dependent on natural resources would benefit from the material in this handbook.

These economies are dependent on natural resource as their main source of foreign income. This foreign income is important to living standards as it enables them to buy imports that they may not produce. However, unlike many products, natural resources have volatile prices. This then impacts on their ability to have a steady income stream. This income stream is important for government revenues, which are used to improve the living standards in the country.

Appropriate and timely statistics are essential to inform governments, businesses and communities about the decisions that must make to ensure that they make the best use of their natural resources. Against this background the Ulaanbaatar City Group (UBCG) was formed. The UBCG was formed to provide leadership in defining international best practices in statistical measurement for economies based on natural resources. The UBCG also serves as a forum for sharing expertise among statistical organisations, both national and international, as well as other stakeholders. The UBCG is also collaborating with the United Nations in developing and improving statistical methodologies and standards for natural resources.

The objectives for UBCG are to develop methodological and practical guidelines to accurately track mining activity. These guidelines will assist in measuring and assessing mining's contribution to the economy, its impact on society and the environment. This handbook is one of the main objectives of the group, and is focused on providing recommendations and best practice to ensure coverage, reliability, accuracy and relevance of statistical data.

The work of the UBCG aligns with other city groups. City groups are formed to address selected problems in statistical methods. The work of these groups could result in proposals to change international standards. City groups determine their own individual mechanism of work, their agendas and outputs. City groups are informal groups of experts primarily from national statistical agencies. Participation by representatives is voluntary as is the existence of the group itself.

1.2. Rationale for the handbook

The main reason for producing the handbooks is to enable National Statistical Offices (NSOs) to produce a suite of statistics that would be beneficial to decision makers. These statistics would cover mining and related activities. The set of statistics would provide information on the impact of mining on the economy, society and the environment. The handbook addresses a number of issues that were considered when establishing the UBCG.

The importance of understanding impact of the mining industry on a country's economy could be articulated and analysed. Mining enterprises carry out additional functions apart from their main activities. Mining enterprises also engage in the development of infrastructure, including roads, transportation and communications. Some of these activities are not currently classified under the mining sector. An assessment of the contribution made by the mining sector could include these indirect contributions.

The mining sector plays an important role in total production. As such, the prices of mining products are also important as these affect the contribution to the national economy. For instance, volatile mining products impact estimates of Gross Domestic Product (GDP). Therefore, a methodological assessment should be carried out on the impact of price volatility.

Considering that investment is one the components of GDP estimates, the issue of how to accurately estimate foreign investment should also be addressed. There is an urgent need to

define an efficient methodology for collecting data on the capital expenditure of mining industries and for information on foreign direct investment.

For many countries the informal mining sector plays a large role in their economies. Methodologies and recommendations for determining the size of the informal mining sector are needed. Due to the specific nature of the mining industry, workers engaged in the informal mining sector are likely to be constantly migrating, moving from site to site, which could hinder their involvement in household surveys. As mentioned, the price of mining products in the formal sector is high and thus impacts the informal mining sector. Therefore, the handbook will address the issue of how to calculate the economic contribution of the informal mining sector.

Some mining products are handled by a single company. This means many NSOs will have to deal with data confidentiality. This is linked with the issue of the classification and identification of activities of transnational companies. Dealing with transnational enterprises is also important for measuring GDP and associated income flows.

The handbook will also provide statistics that will assist users in examining the impact of mining on society. Measuring the benefits arising from and the income generated by the mining sector on the living standards is important. The spillover effects of the mining industry are identified in the handbook. **[DN Are we addressing this?]**

Despite the positive benefits that may flow to the economy from mining activity it is also important to measure its impact on the environment. The handbook will improve indicators to estimate the sustainable development of affected countries. Recommendations with regard to the development of economic accounting systems for the environment and on the development of relevant data sources will also be addressed. There is also an increasing demand for the development of methodologies and the identification of indicators for measuring desertification due to the inappropriate use of mining procedures that the handbook will discuss.

The rationale for producing the handbook is to address these issues. To do this the handbook will provide guidelines that will deliver consistency across countries. The handbook will also establish best practices in collection and dissemination for mining and related statistics.

As the target audience for the hand book is NSOs it is important the work of the UBCG reflects the *Fundamental Principles of Official Statistics* (UN 2014).

1.3. Fundamental Principles of Official Statistics

The UN Fundamental Principles of Official Statistics:

Principle 1. Official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honor citizens' entitlement to public information.

Principle 2. To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.

Principle 3. To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.

Principle 4. The statistical agencies are entitled to comment on erroneous interpretation and misuse of statistics.

Principle 5. Data for statistical purposes may be drawn from all types of sources, be they statistical surveys or administrative records. Statistical agencies are to choose the source with regard to quality, timeliness, costs and the burden on respondents.

Principle 6. Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.

Principle 7. The laws, regulations and measures under which the statistical systems operate are to be made public.

Principle 8. Coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system.

Principle 9. The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels.

Principle 10. Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries.

1.4. Scope and coverage of the handbook

The handbook's primary focus is on mining and its impact on the economy, environment and broader society. The handbook will not be examining other natural resources. The reason is that very few, if any, countries' economies are driven by non-mining natural resources. While natural resources, such as forests and water are important, they are not likely to drive an economy's output. This is an important distinction to make, as this is an area where the UBCG is interested in examining the impact of mining on the environment. The London city group, via SEEA, is examining broader natural resources.

As such recommendations will be limited to the highest priority statistics and methods to produce those statistics related to the mining industry and related activity.

1.5. Links with other City Groups

With the scope of UBCG focusing on mining, it is worth noting that it has links with other city groups. The two most directly linked are the Oslo Group (Energy statistics) and the London Group (Environmental statistics). Both of these groups have been active longer than the UBCG and have given many of the issues the UBCG face considerable analysis, which the UBCG can draw upon.

Oslo City Group

The Oslo group is a forum for countries to address challenges related to the collection and dissemination of complete, comparable and quality energy statistics. Some of the topics considered are:

- User needs for energy statistics
- Scope of official energy statistics
- Country best practices in the collection and dissemination of energy statistics
- Selected methodological and data quality challenges in energy statistics
- Needs for harmonization of important energy statistics systems
- Key content provider for the new UN manuals on energy statistics, International Recommendation on Energy Statistics (IRES) and Energy Statistics Compilers Manual (ESCM)
- Methods for improving consistency in different statistic systems and reducing response burden

London City Group

The London group plays a leadership role in defining international best practices in the theory and practice of environmental accounting within the framework of the System of Environmental-Economic Accounting (SEEA). Some of the topics considered are:

- Physical flow accounts (materials, water and energy);
- Asset accounts for natural resources and land;
- Environmental activity accounts and related flows;
- Ecosystem accounts;
- Applications and extensions of environmental accounts;
- Training and implementation material.

The London group is responsible for *System of Environmental-Economic Accounting 2012*. This is the Central Framework that was adopted at the forty-third session of the United Nations Statistical Commission as an international statistical standard. The UBCG as part of its handbook will incorporate these standards.

1.6. Structure of the handbook

The contents of the handbook are structured in accordance with its objectives. The handbook will be structured as follows.

Chapter 2 will examine the existing definitions and classification that the UBCG will use, covering industry and product classifications. Classifications such as the Central Product Classification and the International Standard Industrial Classification will be examined and potentially extended to provide further detail if necessary.

Chapter 3 will draw on international frameworks and principles to ensure that the handbook produces guidelines that are internationally comparable. These would primarily cover the System of National Accounts, the Balance of Payments Manual, the Government Finance Statistics Manual, the System of Environmental Economic Accounting and the International Labour Organisation's Prices and Labour manuals.

Chapter 4 will discuss data sources and general methodology requirements for producing Mining and related statistics. The chapter will cover the different types of enterprise surveys, household surveys and potential administrative data sources. Chapter 5 details the set of standard indicators and potential survey questions that NSOs should produce. The chapter discusses how the indicators are used to address various policy questions that government and users might face.

Chapters 6, 7 and 8, will develop the analytical and contextual frameworks for the indicators, by grouping them into impacts on the Economy, Society and the Environment. The chapters will also discuss dissemination strategies along with country experiences. These three chapters will also highlight particular measurements issues that NSOs are likely to face in collecting, compiling and producing statistics.

Chapter 9 will develop some of the rationale for NSOs to prioritise their mining statistics and Chapter 10 will examine areas for further research.

CHAPTER 2. DEFINITION AND CLASSIFICATION

2.1. Definitions of mineral resources

1. The System of National Accounts 2008 (SNA 2008) and the System of Environmental Economic Accounting 2012 (SEEA 2012) provides the general definition of natural resources with respect to their different roles in economy. To ensure the methodological uniformity with existing recommendations, this manual is broadly based on the conceptual framework of SNA 2008, the Central framework of SEEA 2012, International Recommendations for Industrial Statistics, 2008 (IRIS,2008) and other related publications.

2. Natural resources comprise the mineral and energy resources, biological resources, water resources and land and soil resources. The scope of this manual, however, is confined to the mineral resources, which refer to concentration [or occurrence] of material of economic interest in or on the Earth's crust in such form that there are reasonable and realistic prospects for eventual economic extraction. Such mineral resources form a subset of environmental assets defined in SEEA covering subsoil resources of coal, oil and natural gas, metallic or non-metallic minerals. Through economic activities these resources are brought as natural input in the production process. Extraction of mineral resources and its transfer to economic activity reduces the environmental assets which are reflected in the national balance sheet of natural resources.

3. From the perspective of the natural input to economy mineral resources are broadly classified into following groups:

i. Oil resources
ii. Natural gas resources
iii. Coal and peat resources
iv. Non-metallic mineral resources (excluding coal and peat resources)
v. Metallic mineral resources

Mineral resources enter to economy as natural input. The point they enter to economy is different by type of resources. As mentioned in ISIC, revision 4, the mining activities also includes exploration and geological observations which generally precede the extraction activities. Entering point to economy might be exploration for some resources but extraction for others. In any case, the main outcome of mining activities is the conversion of mineral resources to mineral products.

4. According to the SEEA 2012 "Natural resources include all natural biological resources (including timber and aquatic resources), mineral and energy resources, soil resources and water resources."

Mineral is a naturally occurring substance that is solid and stable at room temperature, representable by a chemical formula, usually a biogenic, and has an ordered atomic structure.

Ore is a type of rock that contains minerals with important elements including metals.

Natural resource inputs are physical inputs to the economy from natural resources. They derive from stocks of natural resources comprising mineral and energy resources, soil

resources, natural timber resources, natural aquatic resources, other natural biological resources and water resources, all of which are considered to be owned by residents of the country in which the resources are located. Natural resource inputs comprise physical inputs to the economy from natural resources. The majority of natural resource inputs that enter the economy (e.g., extracted minerals, removals of timber, water abstracted for distribution) become products. There are different international guidelines describing products extracted from natural resources.

Product name	International Recommendations on Energy Statistics (IRES)	Energy Statistics Manual
Hard coal	Coals with a gross calorific value (moist, ash-free basis) which is not less than 24 MJ/kg or which is less than 24 MJ/kg provided that the coal has a vitrinite mean random reflectance greater than or equal to 0.6 per cent. Hard coal comprises anthracite and bituminous coals.	Hard coal refers to coal of gross calorific value greater than 23 865 kJ/kg (5 700 kcal/kg) on an ash-free but moist basis and with a mean random reflectance of vitrinite of at least 0.6.
Brown coal	Coals with a gross calorific value (moist, ash- free basis) less than 24 MJ/ kg and a Vitrinite mean Random Reflectance less than 0.6 per cent.	Lignite/brown coal: Non-agglomerating coals with a gross calorific value less than 17 435 kJ/kg (4 165 kcal/kg) and greater than 31% volatile matter on a dry mineral matter-free basis
Peat	A solid formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification). It is available in two forms for use as a fuel, sod peat and milled peat.	Combustible soft, porous or compressed, fossil sedimentary deposit of vegetal origin with high water content (up to 90% in the raw state), easily cut, of light to dark brown colour.
Natural gas	A mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some noncombustible gases such as nitrogen and carbon dioxide.	It comprises gases, occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both “nonassociated” gas originating from fields producing hydrocarbons only in gaseous form, and “associated” gas produced in association with crude oil as well as methane recovered from coal mines (colliery gas).
Crude oil	A mineral oil of fossil origin extracted by conventional means from underground reservoirs, and comprises liquid or near-liquid hydrocarbons and associated impurities such as sulphur and metals.	Crude oil is a mineral oil of natural origin comprising a mixture of hydrocarbons and associated impurities, such as sulphur. It exists in the liquid phase under normal surface temperature and pressure and its physical characteristics (density, viscosity, etc.) are highly variable. This category includes field or lease condensate recovered from associated and non-associated gas where it is commingled with the commercial crude oil stream.

5. Mining activities make considerable impact on the development of a country as a whole. The economic impact is measured in terms of their contribution to GDP and other macroeconomic indicators. The social impact is reflected by employment opportunities and public services created by these activities. The mining sites are often located in a geographically isolated area with the considerable distance from other settlements. Operation of mining activities may require development of residential facilities with other basic social services such as health, education, water and sanitation and transportation and communication. Earning from mining activities contribute to household income and affect the living standards of families where the main breadwinner is a mining worker. The impact on environment is measured by indicators related to the use of natural resources and emissions of mining industry to air, water, and soil.

6. To fit these measures into a set of established accounts the standard concepts of flows and stocks are used in the manual. Mining and quarrying as an economic activity produces goods and services that have economic value. Flows, according to SNA 2008, consist of transaction and other flows, which reflect the creation, transformation, exchange, transfer or extinction of economic value. Generally, stocks arise from accumulation of prior transaction and other flows, however in case of environmental assets most of the increment occur naturally, while the amount of frequency of extraction which determines the volume of flow has direct impact on assets. SEEA defines different types of physical flows such as natural inputs, products and residuals. Mineral resources as physical inputs are moved from their location in the environment as a part of production processes or are directly used in production. Residuals refer to the part of extracted minerals that are not retained in economy, which is considered to have returned immediately to the environment.

7. Changes in the stocks of mineral resources are determined by the amount of deposit arising from new discoveries and extraction of resources physically moved from the deposit. Some changes between the opening and closing stock in monetary terms are more accounting-related in nature and comprise those due to improved measurement (reappraisals) and those involving the categorization of the asset (reclassifications).

8. Flows and stocks are entered in the accounts of the institutional units that own the goods and assets involved, in the accounts of units that deliver or take delivery of services, or in the accounts of units that provide labour and capital or use them in production. An institutional unit in its capacity as a producer of goods and services is known as an enterprise. For its role as a legal entity in the business the enterprise is normally registered with the government authority. A business register compiled from the administrative data lists all enterprises, which will eventually compose a statistical frame for data collection. Institutional units in the context of a statistical unit are described in following paragraphs.

2.2. Identification of statistical unit

9. Identification of a proper statistical unit is essential to collect and compile relevant statistical data. Definition of an institutional unit together with other types of statistical unit is given in SNA as well as in International Recommendations for Industrial Statistics, which among other covers mining and quarrying activities. An institutional unit is an economic entity capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities. An institutional unit in its capacity of a producer of goods and services is known as an enterprise.

10. The enterprise is the basic statistical unit at which all information relating to its production activities and transactions, including financial and balance-sheet accounts.

However, an enterprise may be engaged in one or more economic activities at one or more locations. Therefore, for collecting detail data on more homogeneous categories of economic activities the establishment is a recommended statistical unit. The establishment is particularly appropriate statistical unit for collection of data on production of goods and services, employment and remuneration, stock of non-financial capital used and changes in inventories and gross fixed capital formation.

11. An establishment is defined as an enterprise or part of an enterprise that is primarily engaged in one kind of activity with single physical location and the primary activity accounts for the most of the value added of establishment. Small businesses operate as a single-establishment enterprise and the difference between the enterprise and establishment is rarely relevant. In case of larger business, an enterprise may own two or more establishments. In such case production and employment data are collected at the establishment level. Establishments of the same enterprise may be grouped into different industries as defined by ISIC. Nevertheless, the enterprise is suitable for the compilation of financial statistics as the only enterprise has legal authority to own the assets and incur liabilities.

12. The business register is instrumental in creating a statistical frame for regular data collection operation. As mentioned in IRIS-2008, it is desirable to derive the frame for every list based enterprise from a single general-purpose activity business register maintained by the statistical office. Such register generally provides exhaustive and exclusive list of statistical units in order to ensure that there is no omission or duplication in any enterprise/establishment – based survey. The business register contains the information on name, address, main activity (ISIC code), location (area code) and other relevant information.

2.3. Mining activities

13. Mining activities are defined in ISIC revision 4 as extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved by different methods such as underground or surface mining, well operation, seabed mining etc. Enterprises engaged in mining activities during a reference period and territory form the target population for data collection. Description and codes of mining activities as per ISIC revision 4 is given Table 2.1.

Table 2.1: Activities related to mining and quarrying by ISIC revision 4

Division	Group	Class	Description
Division 05			**Mining of coal and lignite**
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06			**Extraction of crude petroleum and natural gas**
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 07			**Mining of metal ores**
	071	0710	Mining of iron ores
	072		Mining of non-ferrous metal ores
		0721	Mining of uranium and thorium ores
		0729	Mining of other non-ferrous metal ores

Division	Group	Class	Description
Division 08			**Other mining and quarrying**
	081	0810	Quarrying of stone, sand and clay
	089		Mining and quarrying n.e.c.
		0891	Mining of chemical and fertilizer minerals
		0892	Extraction of peat
		0893	Extraction of salt
		0899	Other mining and quarrying n.e.c.
Division 09			**Mining support service activities**
	091	0910	Support activities for petroleum and natural gas
	099	0990	Support activities for other mining and quarrying

14. While above-mentioned activities refer to extraction of mineral resources for economic use products of mining activities are further processed in manufacturing. A number of manufacturing activities almost entirely depend on mining for their intermediate input. Therefore, the analysis of the economic activities related to mineral resources could include selected manufacturing activities. The manufacturing activities based on mineral resources are listed below by ISIC. The list does not include manufacturing activities processing other natural resources such as timber and aquatic resources.

Table 2.2: Manufacturing activities based on processing of mining and quarrying products

Division			**Manufacture of coke and refined petroleum products**
	191	1910	Manufacture of coke oven products
	192	1920	Manufacture of refined petroleum products
Division			**Manufacture of other non-metallic mineral products**
	231	2310	Manufacture of glass and glass products
	239		Manufacture of non-metallic mineral products n.e.c.
		2391	Manufacture of refractory products
		2392	Manufacture of clay building materials
		2393	Manufacture of other porcelain and ceramic products
		2394	Manufacture of cement, lime and plaster
		2395	Manufacture of articles of concrete, cement and plaster
		2396	Cutting, shaping and finishing of stone
		2399	Manufacture of other non-metallic mineral products n.e.c.
Division			**Manufacture of basic metals**
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non-ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals

15. Mineral resources are sparsely located across the globe. In many countries the scope of mining activities is very much limited. Therefore, the country analysis of mineral resources and inter-linkages with manufacturing and other activities such as construction, domestic and external trade depends on the mining activities in operation in a specific country. The

economic analysis of inter-sector exchange of mineral products may benefit from input-output data.

2.4. Mineral products

16. Products, according to SNA, are goods and services that result from a process of production in the economy. Mineral products emerge from the extraction of the mineral resources from environment and their transfer to economy. Not all resources extracted subsequently become products. It should exclude the residuals of the production process such as losses or unused items which return to environment immediately. Also excluded are so called mining overburden, which refers to a quantity of soil, stone or materials that are removed from the original places during extraction. Mineral products thus refer to the actual amount of mineral resources transferred to economy.

17. Flows of products between economic units are generally recorded in the account of the enterprises for its own business purpose. When a mining establishment produces crude oil and supplies it to a refinery unit for producing petrol or other related products such transaction is recorded by both entities. The amount of mineral products is therefore obtained from production data of all institutional units engaged in mining activities. The amount of mineral products used as intermediate input is derived from the data of other economic activities such as manufacturing and construction.

18. The Central Product Classification (CPC) provides the detail list of mineral products. CPC version 2.0 has direct correspondence with ISIC revision 4.0. Therefore, CPC is quite helpful to determine the main activity of an enterprise based on its products. In the broad economic category (BEC), mineral products mostly fall under the primary industrial supplies. The list of mineral products by CPC is given in Table 2.3.

19. Standard international classifications exist for commodities, industries and trade. A very large number of countries have their own national classifications designed to meet their own particular needs and differing to some extend from the international standards. The various existing international classifications came into being because of the need for having a basis for international comparison of national statistics on separate industries.

BOX 2.1 : The classification of mining activities and products in Russia

The Russian statistics applies the Russia Classification of Minerals and Underground Waters (RCMUW), developed by the Ministry of Natural Resources and Ecology of the Russian Federation. RCMUW is accepted and put into operation in December 2002.

RCMUW is obligatory for application by federal enforcement authorities at creation of the state information systems and resources. State balances of mineral stocks which reflect the condition of mineral and raw-material resource base of the country were used for creation of RCMUW. Objects of RCMUW classification are minerals (natural accumulation of minerals, rocks, oil, gases) and underground waters in the ground.

RCMUW is intended for: normalization of geological and economic information on minerals and underground waters;

maintenance of classification and coding of minerals and underground waters;

development of reporting about condition and use of mineral and raw-material resources of the

Russian Federation; maintenance of federal and regional balances of mineral stocks; supply of information on minerals and underground waters to the users who are carrying out industrial and commercial activity in the field of investigation of deposits of minerals and underground waters.

In RCMUW each position is identified by codes from four up to twelve digits. Feature of coding of minerals is that on first four categories the integrated groupings of minerals which sequence corresponds to sequence of groupings of kinds of economic activities on extracted minerals according to the Russia Classification of Economic Activities (RCEA) are coded.

Kinds of economic activities on specified RCEA groupings correspond in RCMUW the minerals extracted in result of this activity. For example, to economic activity groupings in RCEA correspond integrated groupings of minerals in RCMUW:

RCEA		RCMUW	
10.10	Extraction, cleaning and agglomeration of coal	1010	Coal
11.10	Extraction of crude oil and natural gas	1110	Crude oil and natural gas

RCEA was constructed by harmonization with the official version of the Statistical Classification of Economic Activities in the European Community (NACE Rev. 1.1) by using in RCEA from NACE 4-digit codes. The detailed features of Russian economic activities are reflected in 5 - 6 digits.

The Russian Classification of Products by Economic Activity (RCPEA) was

constructed by harmonization with the Statistical Classification of Products by Activity in the European Economic Community (CPA 2002) by using in RCPEA from CPA 2002 codes (up to six digits). The detailed features of Russian economy are reflected in 7 - 9 digits.

The transit codes from RCPEA groupings to the Harmonized system (HS) were also developed.

2.5. Data items

20. It is highly recommended that a list of data items is prepared in priority to the questionnaire design for the survey that includes mining activities in its scope. A complete list of data item is given in IRIS-2008. A large and small version of the model questionnaire based on data items recommended by IRIS-2008 is presented in a UNIDO publication *Industrial Statistics: Guidelines and Methodology*. However, implementation of these recommendations depends on the purpose of the survey, available resources and other circumstances. One important aspect to be considered is that the main source of data for any industrial survey is the records maintained by businesses for their own accounting purpose. Therefore selection of data items should be made in clear understanding of the accounting rules and principles existing in the country of reference.

Table 2.3: Mineral products by CPC, version 2.0

Division	Class	Subclass	Description
Division 11			**Coal and lignite; peat**
	1101	11010	Coal, not agglomerated
	1102	11020	Briquettes and similar solid fuels manufactured from coal
	1103	11030	Lignite, not agglomerated
	1104	11040	Lignite, agglomerated
	1105	11050	Peat
Division 12			**Crude petroleum and natural gas**
	1201	12010	Petroleum oils and oils obtained from bituminous minerals, crude
	1202	12020	Natural gas, liquefied or in the gaseous state
	1203	12030	Bituminous or oil shale and tar sands
Division 13			**Uranium and thorium ores and concentrates**
	1300	13000	Uranium and thorium ores and concentrates
Division 14			**Metal ores**
	1410	14100	Iron ores and concentrates, other than roasted iron pyrites
	1421	14210	Copper, ores and concentrates
	1422	14220	Nickel ores and concentrates
	1423	14230	Aluminum ores and concentrates
	1424	14240	Precious metal ores and concentrates
	1429	14290	Other non-ferrous metal ores and concentrates (other than uranium or thorium ores and concentrates)
Division 15			**Stone, sand and clay**
	1511	15110	Slate
	1512	15120	Marble and other calcareous monumental or building stone
	1513	15130	Granite, sandstone and other monumental or building stone
	1520	15200	Gypsum; anhydrite; limestone flux; limestone and other calcareous stone, of a kind used for the manufacture of lime or cement
	1531	1531	Natural sands
	1532	1532	Pebbles, gravel, broken or crushed stone, macadam; granules, chippings and powder of stone
	1533	15330	Bitumen and asphalt, natural; asphaltites and asphaltic rock
	1540	15400	Clays
Division 16			**Other minerals**
	1611	16110	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk
	1612	16120	Unroasted iron pyrites
	1619	16190	Other chemical minerals
	1620	16200	Salt and pure sodium chloride; sea water
	1631	16310	Precious stones (including diamonds, but not industrial diamonds) and semi-precious stones, unworked or simply sawn or roughly shaped
	1632	16320	Industrial diamonds, unworked or simply sawn, cleaved or bruted; pumice stone; emery; natural corundum, natural garnet and other natural abrasives
	1633	16330	Chalk and dolomite
	1639	16390	Other minerals n.e.c.

21. Data collected from the survey are to be used to compile the set of indicators discussed in Chapter 5 and 6. Therefore, the information requirement for selected indicators pre-defines the list of data items from the survey. Nevertheless there can be a minimal set of data items that could be considered for most of the surveys. A full list of data items is given in IRIS-2008 which among others includes following major data items.

A. Characteristics of the statistical unit:
   Principle activity, location, type of unit (single establishment enterprise or the part of multi-establishment enterprise)
B. Number of persons employed:
   By sex; number of employees by categories such as production workers and other workers; number of employees engaged in mineral exploration and evaluation,
C. Compensation of employees
   Wages and salaries by sex and by categories such as production workers and other workers
D. Purchase of goods and services
   Disaggregated by goods and services
E. Value of shipments, receipts for services and other revenues
   Disaggregated by goods and services
F. Quantity of mineral resources extracted by type
G. Quantity of mineral products by CPC
H. Quantity of total energy consumed (terajoules), water consumed (cubic meters)
I. Inventories
J. Gross fixed capital formation, by type of assets
   Including capital expenditure on mineral exploration and evaluation

Above data items are listed for the purpose of questionnaire design, which may also include the indicators to be derived, for example wage rate, total output or intermediate inputs for the purpose of checking consistency of reported data.

2.6. International comparability

22. International comparability is one of the important dimensions of data quality produced by national and international statistical offices. It allows users to perform the cross country analysis of social and economic performance of countries in given sectors. The part of the national data is compiled for international reporting which is particularly subject to scrutiny in terms of the compliance of reported data with international recommendations and standards.

23. International comparability of data depends on uniformity of basic statistical methods applied and classification structure and codes used for data compilation across the countries. A certain degree of deviation is unavoidable due to the national conditions and practices. But countries are encouraged to comply with internationally accepted methods and standards as it improves the data quality in general and ensures the international comparability in particular. With respect to mining statistics the basic standards to be complied with are ISIC revision 4 (some regional classification code such as NACE and NAICS are compatible to ISIC), SNA 2008, SEEA and IRIS 2008.

24. The practice of different units of measurement is another challenge to international comparability. It involves physical unit, valuation method (basic prices or producer's prices) and currency unit. A standard unit of measurement by commodities is available in UN

Comtrade database. The questions related to basic prices, producer's process and other methods of valuation are discussed in SNA 2008. It is generally recommended to make the valuation of mineral exploration at market prices. There is a whole range of questions related to valuation of the different asset items under the gross fixed capital formation. Even after the proper valuation is made, the data are still available in national currency. For the purpose of cross country analysis, the UNIDO database converts the figures in national currency in to US dollars.

25. A number of data items are subject to international reporting on annual basis. Currently, UNIDO collects the data for following variables of mining and utility sectors on annual basis.

i. Number of establishments/enterprises
ii. Number of persons employed/employees
iii. Wages and salaries of employees
iv. Gross output
v. Value added

However, above set of variables has been inadequate to meet the demand of data users for policy relevant analysis. In the context of increased relevance of environment related data, it is recommended to add following variables for international reporting.

i. Quantity of mineral resources extracted
ii. Quantity of mineral products produced
iii. Gross fixed capital formation
iv. Quantity of energy consumed

CHAPTER 3. FRAMEWORKS AND PRINCIPLES

3.1. Introduction

This chapter is mainly based on the International Recommendations for Water Statistics (UNSD, 2012), as it is considered appropriate to use the schemes that the UN is promoting in relation to the international recommendations of this type.

The statistics of mineral resources use and integrate concepts, definitions, classifications and frameworks of the mining industry and statistics and environmental, economic, demographic and social accounts. This chapter provides a brief overview of the main concepts related to mining and its relationship with the environment, economy and society. It also presents SEEA Central Framework, particularly relating to mineral resources, which provides the overall framework for integrated environmental statistics and economics section.

The aim of this chapter is, in addition to providing an overview of the main accounting frameworks, to make some comments on the conceptual and technical resources necessary to develop economic, social and environmental indicators related to mining activities.

3.2. Principle frameworks

In order to characterize the main elements involved in the process of developing indicators for mining, some documents that introduce concepts and definitions that define the field of research are briefly described.

In this sense, the advantage of having International Statistical Standards1, is to facilitate, among other things, the integration of information from different sources and thus to promote consistency of statistical systems, and contribute to the formulation of internationally comparable statistics.

In this section, we highlight two main international statistical standards that have been used as a framework for some activities of UBCG: the System of National Accounts 2008 (SNA) and the System of Environmental-Economic Accounting Framework 2012 (SEEA). Both documents provide statistical frameworks that integrate financial information (SNA) and environmental-economic information (SEEA). In fact, the current trend is that the documents related to the economy and the environment will increasingly align to these two international statistical standards.

[1]To complement the idea, it should be mentioned that a *Statistical Standard* is "an agreed rule or guideline on how one or more parts of the statistical business process should be carried out, conforming with requirements for professionalism. Components of a standard are: (1) definitions; (2) statistical units; (3) classifications; (4) coding processes; (5) questionnaires, and; (6) output categories (SDMX 2009). An *International Statistical Standard*, is a "the comprehensive body of international statistical guidelines and recommendations that have been developed by international organisations working with national agencies" (SDMX 2009).

A. System of National Accounts 2008

General context of SNA 2008

The System of National Accounts 2008 (SNA 2008) is a statistical framework that provides a complete, consistent and flexible set of macroeconomic accounts for policy analysis and research purposes. It was adopted asan international statistical standard for national accounts during the 40th session of the Statistical Commission of the United Nations (2009).

The SNA is the internationally standardized set of recommendations for the development of measures of economic activity according to strict accounting conventions, based on accepted economic principles. The recommendations are expressed by a set of concepts, definitions, classifications and accounting rules which include the internationally accepted standards for measuring items such as gross domestic product (GDP), the economic indicator most commonly used.

The accounts themselves present in a condensed form, a large volume of detailed information, organized according to certain principles and perceptions about the workings of the economy. These constitute a complete and detailed record of the complex economic activities taking place within an economy and of the interaction between the different agents or groups of operators, which takes place on markets or elsewhere.

Also, the SNA detailed information not only on the economic activities that take place in a period, but also on the levels of assets and liabilities of an economy, and thus on the wealth of its inhabitants at certain points in time. In addition, the SNA includes an account with the exterior showing the relationship between an economy and the rest of the world.

To understand the nature of the economy, it is essential to be able to observe and analyse the economic interactions taking place between its various sectors. The application of SNA is possible at different levels of aggregation: for individual operators (or institutional units, as they are called in the SNA), for groups of these units (or sectors) or for the total economy.

The conceptual elements of SCN 2008

The SNA measures what happens in the economy, between what agents and for what purposes. To capture the flows of the economy, the SNA recognizes the relevant activities by identifying institutional units that compose it and the specification of the structure of the accounts reflecting transactions for the various stages of production and, finally, consumer goods and services.

1. Activities and transactions

The SNA is designed so that analytically provides useful information about the behaviour of institutional units and their activities, such as production, consumption and asset accumulation. To do so, the exchange of goods, services and assets that take place between institutional units are recorded as transactions. While some transactions represent the

payment of the exchange, which may be a good, service or asset of similar value, usually some kind of economic law, including notes and coins is involved.

Data on transactions constitute the basic material to calculate or deduct the value of the various elements in the accounts. The use of such data provides great advantages. The first is that the prices at which goods and services are exchanged in transactions between buyers and sellers in the markets provide the information necessary to assess, directly or indirectly, all off-balance. Secondly, a transaction between two institutional units must be registered by the two parties involved and therefore generally appear twice in a set of macroeconomic accounts. This establishes important linkages in the SNA. For example, production is obtained by adding the amounts sold, exchanged or transferred to other units plus the amounts of the entries less withdrawals from stocks. Thus, the production value is obtained by registering its single applications from data on transactions.

2. The institutional sectors of the economy

SNA distinguishes between two main categories of institutional units (or subjects of transactions): households and legal units. The latter are entities created to produce, mainly companies or non-profit institutions on one hand, or entities established by political processes, such as specific government units, on the other. The defining characteristic of an institutional unit is the ability to own property and assets, to incur liabilities and to carry out economic activities and transactions with other units in its own name.

For the purposes of SNA, the institutional units within the economy are grouped into five mutually exclusive sectors composed of the following types of units:

a. Non-financial corporations;

b. Financial corporations;

c. Government units, including social security funds;

d. Non-profit institutions serving households;

e. Households.

These five sectors account for the total economy. Each sector can be further divided into sub-sectors; for example, the sectors of non-financial and financial corporations are subdivided in order to distinguish between the companies under the control of government or foreign units and the rest of society.

SNA comprises a complete set of account flows and balances which can be prepared for each sector, at subsector level, if necessary as well as for the economy as a whole. The total number of accounts that can be compiled is therefore potentially very large, depending on the required and feasible level of disaggregation. Disaggregating into sectors and subsectors allows observing the interactions between different parts of the economy that must be measured and analysed for the purposes of policy formulation.

The institutional units residing abroad form the rest of the world. SNA does not require the preparation of accounts for economic activities that take place in the world, but must register all transactions between residents and non-residents in order to get a full accounting of the economic behaviour of resident units. Transactions between residents and non-residents are grouped into a single account, called "the rest of the world".

SNA 2008 and the mineral/energy resources

As already mentioned, the 2008 SNA emphasizes the way to record the economic activities in general, and thus, does not go into detail about the issue of mining activities. However, some parts from the manual which can be considered relevant to the construction of indicators as those discussed in this manual.

Although discussed in more detail in the SEEA-CF, here is considered the structure of the assets side of the balance, which is fundamental to access the information on availability of mineral resource, on the flows that occur during the year, and are emphasized items related to resource depletion, like new discoveries, losses from disasters (fires, spills, landslides, etc.), appearance and disappearance of assets, changes in classification, changes in the quality of assets, revaluation, among others.

For example, the SNA 2008 manual addresses the issue of mineral exploration, which consists of the value of expenditures on exploration for petroleum, natural gas and non-petroleum deposits and subsequent evaluation of the discoveries made.

These expenses include the costs of obtaining the prior licenses, license costs and acquisition costs of feasibility studies, the costs of actual test drilling and boring, as well as the costs of aerial or other type of survey, transportation costs, etc. incurred for making possible the development of the exploration. After commercial exploitation of the reserve, revaluations take place and the cost of these reassessments is also included in gross fixed capital formation. (10,106)

This serves as a conceptual basis for the development of the indicator Mineral exploration and evaluation (economy).

Another issue considered is the intellectual property, and several examples of it are the results of research and development, mineral exploration and evaluation, computer software and databases and original entertainment, literary or artistic. These examples are characterized by the fact that most of their value is attributed to intellectual effort. In general terms, they can be described as follows: products of intellectual property are the result of research, development or innovation leading to knowledge that researchers can sell on the market or use for their own benefit in the production, because the use of knowledge is restricted by legal or other protections. The knowledge can be incorporated into a single independent product or into another product. In the latter case, the product with the knowledge achieves a higher price than the price of a similar product without the added knowledge. Knowledge continues to be an asset as long as its use can create some form of monopoly profits for its owner. When there is no protection, it becomes obsolete and no longer is an asset. (10.98)

B. Central framework of the System of Environmental-Economic Accounting (SEEA Central Framework) 2012

General context of the SEEA Central Framework 2012

The central framework of the System of Environmental and Economic Accounting 2012 (SEEA) is a statistical framework consisting of a comprehensive set of tables and accounts that guide the compilation of statistics and provides a comparable and consistent policy for indicators, analysis and research.

At its 43rd session (2012), the Statistical Commission adopted the central framework of SEEA as the first international statistical standard for environmental and economic accounting, to implement it in a flexible and modular way. We urge all countries to compile their environmental and economic accounts based on SEEA central framework, to provide statistics derived from it and continue working together to address the remaining challenges, to provide a more comprehensive set environmental and economic accounts.

SEEA-MC provides a statistical framework which permits quantifying in physical and monetary terms the interactions between the economy and environment, particularly through the description of stocks and flows of natural capital in a period of time.

It also allows the development of aggregates and indicators on a wide range of environmental and economic issues. Particular examples include the measurement of trends in the use and availability of natural resources, the level of emissions and discharges to the environment as a result of economic activity.

In Figure XX is shown a simplified representation of the interaction between the economy and the environment. In general, flows from the environment to the economy are recorded as entries (e.g. flows minerals, wood, fish and water). Flows within the economy are recorded as product flows (including additions to the stock of fixed assets) and cash flows from the economy to the environment are recorded as waste (e.g. solid waste, air emissions and water return flows).

CHAPTER 4. DATA SOURCES AND GENERAL METHODOLOGICAL NOTES

4.1. Introduction

The statistics of the mining industry are based on numerous sources of information and apply different methods of data collection and compilation. Overall, the data are divided into two distinct categories: data on the physical environment (i.e., flows, stocks, emissions) and monetary data on mining and economic indicators (production value, wages and salaries, etc.). Information sources and collection methods depend on the practices used by each country, and that includes both institutional arrangements and the level of human and financial resources.

To develop the necessary data, a statistical office collects and transforms basic data of institutional units (firms, government agencies, households and institutions) in their role as producers, consumers and investors, employees, and so on. There are two basic aspects of the collection of economic data: it guarantees access to data already collected for administrative purposes and that the statistical office conducts a direct survey.

Note that this chapter takes as its main references the following sources developed by United Nations Statistics Division, through an international consultative process involving experts from national and international institutions:

- **The International Recommendations for Water Statistics (IRWS)** which were developed to help strengthen national information systems for water in support of design and evaluation of **Integrated Water Resources Management (IWRM)** policies

- **The International Recommendations for Industrial Statistics**, designed to provide a comprehensive methodological framework for the collection and reporting of industrial statistics in all countries, irrespective of the level of development of their statistical systems. It is intended primarily for the producers of industrial statistics, particularly the staff of national statistical offices involved in the collection and compilation of industrial statistics, but may be also useful to researchers and other users of industrial statistics.

4.2. Data sources

4.2.1. Overview of the data sources

The main data sources that can be used to produce the data topics in these recommendations could include the following:

- Establishment and household surveys

- Administrative Records
- Economic and population census
- National accounts and environmental accounts

Surveys and administrative records are mainly used to produce data on economic units, while the information about environmental impacts can be derived mainly from environmental accounts. Traditionally, the National Statistical Offices are the institutions responsible for collecting data through surveys and administrative records, but this can vary from country to country. In many countries Ministry of Industry or a similar institution is responsible for collection of statistical data on industry.

The survey data are collected directly from the economic units selected for the study. The data are gathered from all units of the population (census) or only from some representative data units selected through sampling (sample survey). The Information about the "physical" aspects of mining may be obtained by some other statistical tools such Energy Balances or institutions or publications of companies that perform the extraction of resources, like oil or gas.

The official administrative processes are established to monitor and enforce laws and regulations, which sometimes includes keeping a record of economic units. These records may consist of household or establishment units and may contain various information items about them. Usually the administrative data for statistical purposes are received from government agencies. However, administrative data can also come from non-governmental organizations, as for example the industry associations.

It is also possible to obtain data from collected for some research at the universities, research institutes or non-governmental organizations, which can have different projects and research programs related to mining and social or environmental studies.

Table 4.1 provides an overview of the data items that can be obtained from the different data sources. In general, statistical surveys and administrative records provide data on economic and social variables of mining, and some specialized exercises provide information on the physical conditions of the deposits and mines.

Table 4.1: Example of different data sources for construction of the mining indicators

	Economic impact	Social impact	Environmental impact
Surveys		X	X
Administrative registers	X	X	
Economic census	X	X	X
Population census		X	
National accounts	X	X	
Environmental accounts			X

It has been observed that the most common sources for compilation of statistical data on mining are the national accounts and the economic census providing a specific section with data for some variables of interest. However, depending on the population of interest, the available resources and the particular conditions in a country, performing a specific census can be a viable option for collecting the most complete and detailed mining statistics. A complete census of the units in the mining industry may be appropriate when, for example, a country does not maintain an updated business register (directory of companies).

Sample surveys are tools for gathering information from a part of the total population (a sample) to infer about the whole population. They are almost always less expensive than censuses. There are different types of surveys that can be used in mining statistics depending on the sampling units: (i) business surveys, (ii) household surveys and (iii) mixed household-enterprise surveys. In general, it is recommended that countries make efforts to establish a program of sample surveys to meet the needs of mining statistics in an integrated manner, as part of a comprehensive national program of sample surveys to businesses and households, to avoid duplication of work and minimizing the burden on respondents[2].

4.2.2. National accounts

The National Accounts are an organizational scheme for statistical information on macroeconomic aspects of the country: production, consumption, savings, investment by sector of economic activity and the primary and secondary distribution of income; as well as financial transactions and economic relations with foreign countries, by institutional sector.

BOX 4.1 : The System of National Accounts of Mexico (SNCM)[3]

SNCM is the summary of the activities of the national economy that took place in Mexican society for a certain period. The derivation of this information from censuses, surveys and administrative records, is a part of the statistics, the economy and the private and public accounting, applied to the national and global economy.

The following list presents the topics covered by SNCM:

Base 2008

- Gross Domestic Product (GDP)
  - Quarterly
  - Annual, by economic activity
  - Annual, by state
  - Annual, for public and private sector
  - Annual for state and local governments
  - Value added of total manufacturing exports

[2] International Recommendations for Energy Statistics (IRES), 2011, page. 115.
[3] http://www.inegi.org.mx/est/contenidos/proyectos/cn/

- Measuring the informal economy
- Short term
  - By industrial activity
  - Total Economic Activities
  - Gross Fixed Investment
  - Quarterly supply and use
  - Monthly indicator for electricity by state
  - Monthly Indicator for manufacturing by state
  - Industrial activity by state
  - Quarterly Indicator of economic activity by state
  - Quarterly indicators of tourism
  - Private consumption in the domestic market
- Supply and Use Tables
- Input-Output
  - Input-Output 2012 - Update
  - Input-Output 2008
- Tables Origin-Destination of the gross fixed capital formation
- Total Factor Productivity
- Institutional Sectors
- Satellite accounts

Base 2003

- Satellite accounts

4.2.3. Environmental accounts

BOX 4.2 : The Economic and Ecological Accounts of Mexico

The Economic and Ecological Accounts of Mexico (commonly known as SCEEM) provide information on the impact on the environment and natural resources as a result of anthropogenic activities, linking the main macroeconomic variables of the country and obtaining the Environmentally Adjusted Net Domestic Product (PINE). This is done by determining the amount of the costs for the depletion of natural resources and environmental degradation. This indicator also presents the spending by the public sector in favour of the environment for the prevention, control, reduction or elimination of pollution generated by the activities of production, distribution and consumption. The above is compiled in the framework of satellite accounts using their links with the central framework of National Accounts.

The change of base year in all publications SCNM preserves the methodological and conceptual improvements in environmental accounting and incorporates the latest available

in the country information[4].

Since the environmental accounting uses the same accounting conventions, it is in general consistent with the system of national accounts. Here we will refer the SEEA Central framework with its specific analytical focus on the environment and its linkages with the economy, as well as with its focus on the measurement of stocks and flows in physical and monetary terms.

The above mentioned international standard for environmental accounting includes:

1. Asset accounts:
    - Stocks and changes in stocks (flows) of natural resources such as land, forest, water, fish, soil and mineral and energy resources in land, forest, water, fish, soil and mineral and energy resources in physical and monetary terms.
    - Wealth accounts and calculation of depletion.
2. Combining the accounts:
    - Combine modules of SEEA to form a full sequence of accounts and integrate physical and monetary accounts
    - Aggregates such as Green GDP (e.g. PINE in Mexico), or Net Saving and productivity/efficiency indicators

4.2.4. Economic census

Economic Census (EC) is used to determine the characteristics of establishments producing goods, companies merchandising the goods and service providers, nationally, with a high level of geographical and sectorial breakdown. They are composed of several procedures, corresponding to the various sectors of economic activity. Economic censuses are held for example every five years, in years ending in 4 and 9, to meet the country's economic structure. Different questionnaires are used.

BOX 4.3 : The Economic census in Mexico

The most recent economic census in Mexico (EC 2014) was the eighteenth census event in the country and its purpose was to obtain basic statistical information relating to the year 2013 on all goods-producing establishments, retailers and service providers and to generate economic indicators for Mexico to a high level of geographical, sectoral and thematic detail.

These censuses capture the basic economic information virtually for all economic activities that take place in the country, except for agriculture, livestock and forestry, since the latter are covered by the Agricultural Census.

[4] http://www.inegi.org.mx/est/contenidos/proyectos/cn/ee/default.aspx

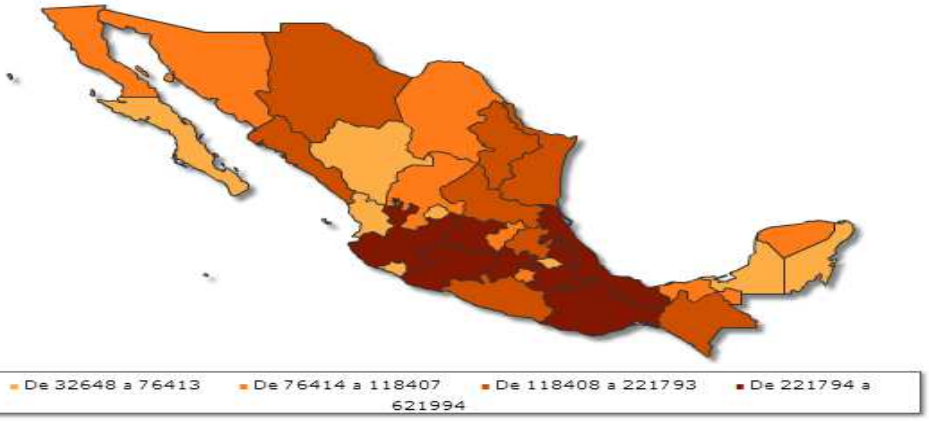
Also, in the recent census new items were incorporated: environment, global value chains and supply services, with the aim of measuring the current economic events. In total more than 1.4 million blocks throughout Mexico were traversed to capture information from a population of 5.6 million establishments.

Universo total con datos de 2014

	Establecimientos	Personal ocupado
Establecimientos	5,664,515	29,893,584
Iniciaron actividades antes de 2014	5,256,884	29,196,686
Iniciaron actividades en 2014	407,631	696,898

Variable: Establecimientos Corte: Inició antes del 2014

Mapa de Establecimientos con corte en Inició antes del 2014



Variación de crecimiento con respecto a los censos de 2004 y 2009 (Porcentaje)

Variación de crecimiento con respecto a los censos 2004, 2009, 2014	Establecimientos	Personal ocupado
2004-2014	32.0	28.9
2009-2014	10.1	7.8

4.2.5. Population census[5]

BOX 4.4 : The Population census in Mexico

Statistical methods are used to determine the characteristics of the inhabitants of Mexico and their accommodation at national, state and municipal level, by location, by groups of neighbourhoods. The census is conducted every ten years, those ending in zero; also every ten years (but those ending in five) is carried out counting.

Produced datasets:

- Total population
- Population, 3 years and over

[5] http://www.inegi.org.mx/est/contenidos/proyectos/ccpv/cpv2010/Default.aspx

- Population, 12 years and over
- Female population, 12 years and over
- Population by households and housing
- Household census
- Housing

4.2.6. Establishment surveys

This type of surveys include statistical units and are used to efficiently capture comprehensive statistical information from enterprises of all sizes operating in the country and to determine the characteristics and conditions of the establishments of the various sectors, as well as their perception of changes on economic development.

They are carried out more often than censuses and provide information also at sub-national level. The target population (respondents) and the frequency depend on the nature of each survey and intended information to be collected. They might take place monthly, quarterly, annually, biennially, at five years span, or, on special occasions up to the request of the government or other agencies.

An important tool is a directory (or inventory) of economic units which provides information related to the financial institutions, to support decision-making in both the public and in private. The sampling frame should contain all the units that are in the target population of the survey, without duplication or omissions. A statistical business register can provide a comprehensive list of all enterprises and other units, together with their characteristics, that are active in a national economy. Apart from being a tool for conducting statistical surveys, a business register is a source for statistics in its own right. The establishment and maintenance of a statistical business register in most cases is based on legal provisions, since its scope and coverage are determined by country specific factors. For countries that do not maintain an up-to-date business register of companies, it is recommended to build one based on the last economic census and amend it as needed, based on the relevant information obtained from other statistical sources[6].

4.2.7. Household surveys

Although household surveys are not designed specifically for collecting data in the mining industry, they may contain data related to the social impact, such as the number of domestic workers, or the level of wages.

The frequency of these surveys is a key to obtaining information on a regular basis. These studies should reflect not only nationally, but also in rural and urban areas and regions, in order to achieve an adequate analysis of the data[7].

[6] International Recommendations for Energy Statistics (IRES), 2011, pág. 117.
[7] *Íbid*, págs. 118 y 119.

BOX 4.5 : Description of the data of the household survey of Mexico used for defining the indicators

National occupational and employment survey[8]

The National Survey of Occupation and Employment (ENOE) in Mexico aims to obtain statistical information on the occupational characteristics of the population nationwide, as well as other demographic and economic variables to deepen the analysis of the labour aspects.

In compliance with the international recommendations and given the amendment made in 2014 to the Constitution of the United Mexican States, which raised the minimum legal working age from 14 to 15 years, ENOE covers the universe of the inhabitants 15 years and older.

The information is adjusted to demographic projections by the National Population Council (CONAPO) updated on April 16, 2013 and based on the results of the Census of Population and Housing 2010.

The ENOE results are presented on a quarterly basis, at national level, for the 32 states, 32 self-representing cities and towns in five ranges of number of inhabitants (less than 2 500, 2500-14999, 15000-99999 and more than 100000).

Indicadores estratégicos de ocupación y empleo

Cuadro 2.1
1a. parte

Indicador	Nacional					
	Total[1]	Áreas más urbanizadas[2]	Áreas menos urbanizadas[3]			
			Total	Urbano medio[4]	Urbano bajo[5]	Rural[6]
1. Población total	**108 292 131**	**54 367 888**	**53 924 243**	**15 584 194**	**14 736 400**	**23 603 649**
2. Población de 14 años y más	**79 669 989**	**41 773 707**	**37 896 282**	**11 311 458**	**10 453 107**	**16 131 717**
Población económicamente activa (PEA)	47 137 757	25 315 245	21 822 512	6 809 200	6 109 592	8 903 720
Ocupada	44 651 832	23 689 099	20 962 733	6 471 984	5 860 376	8 630 373
Desocupada	2 485 925	1 626 146	859 779	337 216	249 216	273 347
Población no económicamente activa (PNEA)	32 532 232	16 458 462	16 073 770	4 502 258	4 343 515	7 227 997
Disponible	5 597 546	2 493 392	3 104 154	793 409	760 352	1 550 393
No disponible	26 934 686	13 965 070	12 969 616	3 708 849	3 583 163	5 677 604
3. Población ocupada por:	**44 651 832**	**23 689 099**	**20 962 733**	**6 471 984**	**5 860 376**	**8 630 373**
3.1 Posición en la ocupación	**44 651 832**	**23 689 099**	**20 962 733**	**6 471 984**	**5 860 376**	**8 630 373**
Trabajadores subordinados y remunerados	29 280 772	17 170 538	12 110 234	4 372 153	3 601 825	4 136 256
Asalariados	27 227 323	15 922 476	11 304 847	4 081 762	3 351 224	3 871 861
Con percepciones no salariales[7]	2 053 449	1 248 062	805 387	290 391	250 601	264 395
Empleadores	2 117 984	1 184 418	933 566	324 956	302 081	306 529
Trabajadores por cuenta propia	10 262 054	4 465 502	5 796 552	1 426 070	1 452 463	2 918 019
Trabajadores no remunerados	2 991 022	868 641	2 122 381	348 805	504 007	1 269 569
No especificado	0	0	0	0	0	0
3.2 Sector de actividad económica	**44 651 832**	**23 689 099**	**20 962 733**	**6 471 984**	**5 860 376**	**8 630 373**
Primario	5 899 290	176 762	5 722 528	344 665	1 161 116	4 216 747
Agricultura, ganadería, silvicultura, caza y pesca	5 899 290	176 762	5 722 528	344 665	1 161 116	4 216 747
Secundario	10 594 481	5 671 204	4 923 277	1 752 088	1 516 790	1 654 399
Industria extractiva y de la electricidad	362 893	181 317	181 576	66 621	58 365	56 590
Industria manufacturera	6 735 752	3 802 642	2 933 110	1 082 519	931 795	918 796
Construcción	3 495 836	1 687 245	1 808 591	602 948	526 630	679 013
Terciario	27 860 436	17 629 117	10 231 319	4 349 107	3 156 104	2 726 108
Comercio	8 980 970	5 368 811	3 612 159	1 426 909	1 151 793	1 033 457
Restaurantes y servicios de alojamiento	2 977 420	1 810 825	1 166 595	494 695	381 732	290 168
Transportes, comunicaciones, correo y almacenamiento	2 214 244	1 489 281	724 963	321 618	222 006	181 339
Servicios profesionales, financieros y corporativos	2 890 844	2 252 470	638 374	333 119	185 459	119 796
Servicios sociales	3 765 695	2 458 687	1 307 008	623 986	409 883	273 139
Servicios diversos	4 777 146	2 807 968	1 969 178	797 415	560 644	611 119
Gobierno y organismos internacionales	2 254 117	1 441 075	813 042	351 365	244 587	217 090
No especificado	297 625	212 016	85 609	26 124	26 366	33 119
3.3 Nivel de ingresos	**44 651 832**	**23 689 099**	**20 962 733**	**6 471 984**	**5 860 376**	**8 630 373**
Hasta un salario mínimo	5 996 024	2 045 606	3 950 418	818 521	1 034 654	2 097 243
Más de 1 hasta 2 salarios mínimos	10 352 980	5 004 255	5 348 725	1 686 748	1 615 576	2 046 401
Más de 2 hasta 3 salarios mínimos	9 327 734	5 547 960	3 779 774	1 419 265	1 086 525	1 273 984
Más de 3 hasta 5 salarios mínimos	7 539 198	4 742 531	2 796 667	1 197 331	848 756	750 580
Más de 5 salarios mínimos	3 915 085	2 839 939	1 075 146	546 632	339 636	188 878
No recibe ingresos[8]	3 757 337	872 712	2 884 625	364 324	601 353	1 918 948
No especificado	3 763 474	2 636 096	1 127 378	439 163	333 876	354 339
3.4 Duración de la jornada de trabajo	**44 651 832**	**23 689 099**	**20 962 733**	**6 471 984**	**5 860 376**	**8 630 373**
Ausentes temporales con vínculo laboral	1 275 075	722 136	552 939	185 174	153 206	214 559
Menos de 15 horas	3 150 521	1 350 303	1 800 218	417 733	478 921	903 564
De 15 a 34 horas	8 559 431	4 008 201	4 551 230	1 275 714	1 257 915	2 017 601
De 35 a 48 horas	18 994 507	10 770 320	8 224 187	2 592 866	2 242 132	3 389 189
Más de 48 horas	12 422 262	6 635 014	5 787 248	1 980 618	1 717 083	2 089 547
No especificado	250 036	202 125	46 011	10 870	11 110	15 013

[8] Para mayor detalle se sugiere consultar:
http://www.inegi.org.mx/est/contenidos/proyectos/encuestas/hogares/regulares/enoe/default.aspx

4.2.8. Administrative registers

Administrative records are established in accordance with the laws and regulations. Each regulation (or related group of regulations) results in a register of institutional units – companies, people, etc. - and is subject to those regulations, together with the data resulting from application of this regulation.

The statistical offices refer collectively to registration and data as an administrative source. The administrative authorities keep records of the units in accordance with legislated administrative requirements or simply for internal purposes in order to assist the units in managing their operations. Statistical offices can use the data from an administrative source[9].

Description of the data of the administrative records used for defining the indicators

Different administrative registers are established to serve different roles in response to legislation and /or regulations. Some of these services are: (i) to monitor activities related to production of goods and services, including mining and utilities; (ii) to enable regulatory activities and audit actions; and (iii) assess outcomes of government policies, programmes and initiatives. These data is collected by diverse governmental agencies, mainly for the purpose of carrying out various non-statistical programs. A wider definition would include also organizations operating in private sector. These data are organized in registers (which can be from simple lists to sophisticated database systems) and these registers and the related data are referred to collectively as administrative data. The data originating from administrative sources can be effectively used to compliment the compilation of statistics on mining activities. Examples for such administrative registers are tax register, social security database, and register of companies (industrial register), register of Economic Chamber.

The main benefits of administrative data are:

- Cost reduction, since Surveys and censuses are expensive while administrative data can be cheap, often “free”;
- Reduced burden on data suppliers; Statistics can be compiled more frequently with no extra burden;
- A full coverage of target population;
- No survey errors and lower non-response;
- Better small-area data;
- Timeliness can be improved for some types of data but not for all.

Next to these benefits of administrative data, their disadvantages, limitations and issues have to be considered:

<to be described>

[9] Recomendaciones internacionales para las estadísticas del agua 2010, pág. 117.

CHAPTER 5. STANDARD INDICATORS

5.1. Introduction

Background: This chapter consists basic metadata on the agreed list of standard indicators for measuring the impacts of mining on the economy, social sector and environment. During the developing of this handbook, a proposal for a set of indicators is being developed.

The indicators determined to inform policy makers and the community on issues faced by policy-makers in economies with significant mining activity, including assisting international comparability.

The list of standard indicators, developed based on the following criteria leaded the selection of indicators:

- Should be consistent with goal of the Ulaanbaatar city group and potential to measure economic, society, and environmental impacts of mining.
- Should be based on internationally accepted methodologies and uncomplicated to interpret.
- Should be able to use the identical methodology with a scientific basis and consistent with international recommendation and standards.
- Should be generally measurable (statistically feasible) over time.

The chapter is developed to provide the economies based on natural resources countries and national and international stakeholders with guidance on the definitions, methodological concepts and data sources for the indicators that are being used to measure the impacts of mining.

The list is composed total 95 indicators for contribution to the economy, 29 indicators for impact on the society, and 18 indicators for impact on the environment of mining activities.

The list of indicators is not fixed; countries can be select and complement a national list that suits their needs. Country data should be used for compiling the indicators where such data are available and of reasonable quality.

Scope: The scope of the indicators are covered to measure the mining contribution to the economy, and to measure mining impacts on the human well-being (human health, education, income), social equity and environmental sustainability.

There are 142 recommended indicators to determine impacts of mining activities. The big number of indicators are not easy to deal. Therefore, indicators were prioritized by consensus approach as following.

- **High priority**: Indicators must to have for demonstrate the impact on official statistics, which countries' economies are depend on natural resources (mining production).
- **Medium priority**: Indicators good to have for demonstrate the impact on official statistics.
- **Low priority**: Indicators like to have for demonstrate the impact on official statistics.

5.2. The indicators to measure impacts of mining activities on the three pillars as economy, society and environment

This session provides the measurement issues to define impacts of mining and mining-related activity from an economic, social, and environmental perspective.

First meeting of Steering Committee of the group was approved the terms of references, and discussed the work streams of the group. The second work stream was namely "assess the impact of mining industry on economies and develop methodological and practical recommendations on how to demonstrate the impact on official statistics". According to the work stream developed measurement issues to determine impacts on three pillars to demonstrate the impact on official statistics. This work stream will require consultation with users and policy makers to ensure that the data will be of relevance to them.

5.2.1. Measurement issues on contribution of mining to the economy

UBCG has identified following 22 measurement issues for contribution of mining to the economy.

i. Measurement of mining production in terms of quantity and value
ii. Measurement of prices of mineral commodities and the impact of mineral prices on the terms of trade, as well as mining-induced terms of trade impacts on the rest of the economy
iii. Measurement of intermediate consumption in the mining industry, including energy inputs
iv. Measurement of mining gross operating surplus
v. Measurement of mining inventories
vi. Measurement of mining fixed capital investment (eg current and expected expenditure, capital stock, capital services, consumption of fixed capital expenditure)
vii. Measurement of financial investment (including foreign investment, both direct and portfolio) and associated incomes, including retained earnings
viii. Measurement of impact of mining on trade statistics, including coherency with production statistics
ix. Measurement of mineral exploration, discoveries and sub-soil reserves
x. Measurement of the impact of mining on government finances, including measuring of taxes on mining
xi. Measurement of productivity in the mining industry

xii. Measurement of construction activity associated with the mining industry
xiii. Measurement of impact of mining on transportation
xiv. Measurement of other economic activity to support the mining industry, including role of input-output analysis
xv. Measurement of 'down-stream' economic impacts of mining, including the manufacturing of mineral products
xvi. Measurement of infrastructure to support mining activity
xvii. Measurement of mining impact on national income, including balance of payments incomes associated with mining and measures of real gross domestic income and real net national disposable income
xviii. Measurement of national wealth
xix. Measurement of impact of mining on regional economies (including regional prices and regional housing markets)
xx. General measurement issues, including dealing with multinational enterprises, dealing with confidentiality issues, correction of 'off year' reporting, ensuring coherence of information from different sources and consistency thereof, by developing a coordinated approach to large mining projects, measuring informal mining activity)
xxi. Measuring procurement of nationally produced goods and services
xxii. Standardization of units of measure

5.2.2. Measurement issues for impacts of mining on the social sector

The measurement issues for impacts of mining on the social sector are arranged into 5 sets as below:

1. Labour force
    i. Measurement of employment in the mining industry
    ii. Measuring the demographic characteristics of the mining labour
    iii. Measurement of employment in mining-related activities
    iv. Measurement of impact of mining demand for labour on supply of labour to other parts of the economy
2. Income
    i. Measurement of mining wages and salaries, total and averages
    ii. Measurement of distribution of mining incomes, including gender distributions
3. Health and productivity
    i. Measurement of workers' conditions and industrial relations in the mining industry
    ii. Measurement of mining skills and capabilities, including job vacancies skill shortages
    iii. Measurement of the impact of mining on workers' health and the health of the community generally
4. Measurement of the impact of mining on social issues

i. Measurement of fly-in/fly-out and drive-in/drive-out workers, including impacts on demands for social services

ii. Measurement of internal and international migration flows associated with mining (including remittances)

iii. Measuring the impact of mining on poverty

iv. Measuring social impacts of population dislocation associated with mining activity

v. Measurement of the impact of mining on education and training

5.2.3. Measurement issues for impacts of mining on the environment

The following five measurement issues defined to develop indicators determined the impacts of mining on the environment:

i. Measurement of the direct and indirect demand from the mining industry for environmental inputs, both market and non-market, incorporating measurement in terms of value;

ii. Measurement of emissions and waste products from the mining industry;

iii. Measurement of damage to land;

iv. Measurement of the environmental impact of economic activity 'downstream' from the mining industry; and

v. Measurement of the impact of mining on green growth and the green economy.

5.3. The indicators to determine impacts of mining and mining activities

5.3.1. Introduction

The next three sub-sessions cover methodological sheets of indicators (142) to determine impacts of mining and mining activities on three pillars as example, including this session.

Determined the all list of the economic, social and environmental indicators to assess impacts of mining sector attached in annex 1 with priority, definition, measurement issue, and estimation method, which can be inform policy makers and the broader community on these issues. However, detailed practical recommendations for measuring the impact of the mining industry on the economy, social sector and environment will be provided in chapter 6 to 8 of this handbook. Through the following sub-sessions of the chapter used following terms:

Data source: a specific data set, metadata set, database or metadata repository from which data or metadata may be obtained.

Estimates: values inferred from incomplete data sets by applying rules or methods. Incomplete data sets include sample survey data.

Metadata: a set of data that describes and gives information about other data. In other word, the metadata summarizes basic information about data, which can make finding and working with particular instances of data easier. The metadata of the indicators provides, a simple

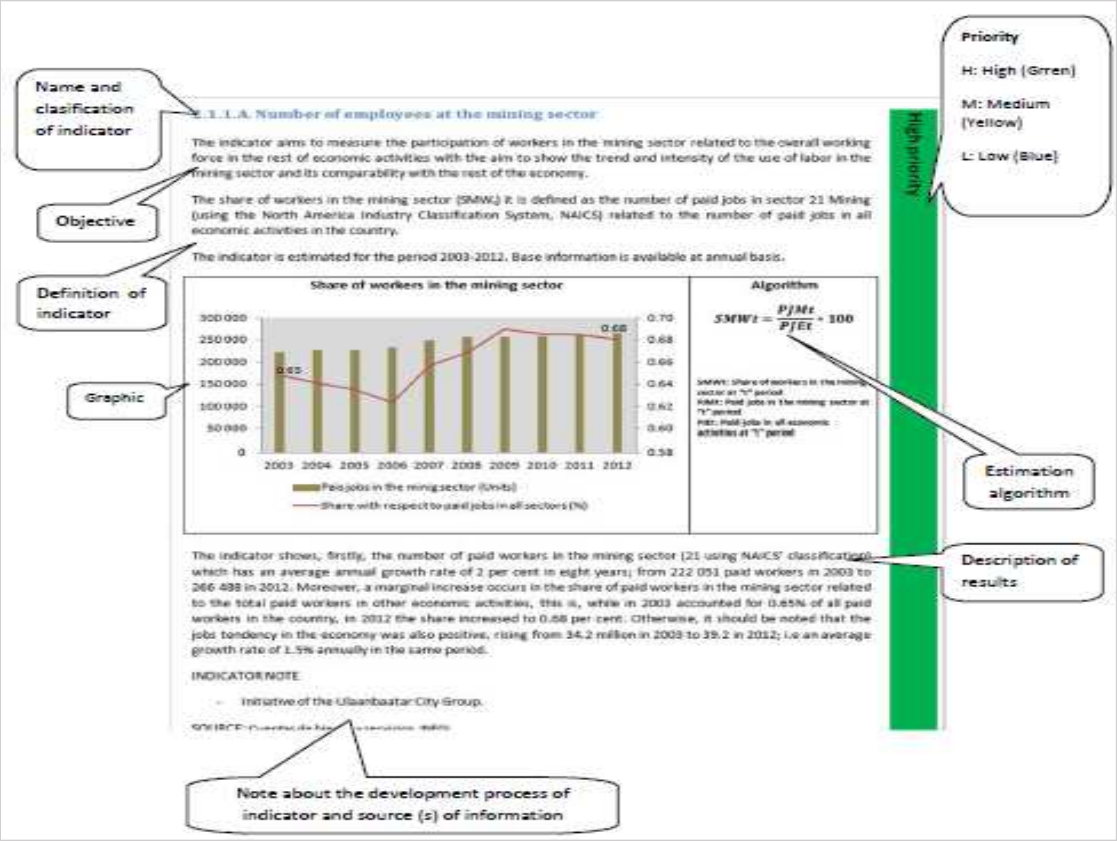
definition, purpose of the indicators, the calculation methods, and some additional description.

5.3.2. Methodological sheet of indicators

This session presents a methodological sheets (Figure 5.4) that that contains elements as the definition and purpose of the indicator; calculation algorithm, which shows how the indicator is constructed; a graph showing the trend of the indicator and; one possible interpretation of the result.

The methodological sheet can be indicated priority of indicators that high-priority indicators have a green label, the medium priority, yellow, and finally the low priority identified with a blue colour. Following figure shows the guide that way to reading of each methodological sheet.

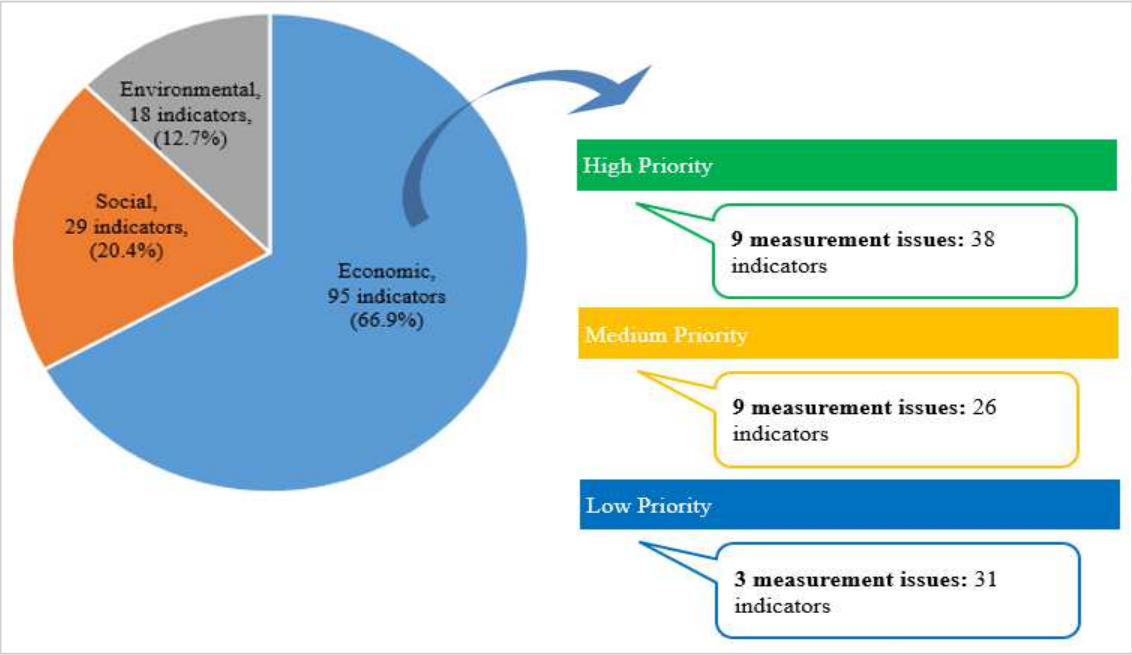
Figure 5.1. Contain of methodological sheets



5.3.3. The indicators to determine contribution of mining activities to the economy

The UBCG developed and proposed more than 90 indicators for measuring contribution of mining to the economy, which was constructed through the outcomes of several workshop, meeting, and video conferences conducted to expert group and steering committee of the group.

Figure 5.2. Indicators for measuring contribution of mining to the economy



These indicators have been categorized as production, stock and investment statistical indicators, expenditure statistical indicators, trade and price statistical indicators and analytical statistics and transformations:

- Production & Stock & Investment statistics
  - Total production of mining products, by value
  - Total production of mining products, by quantity
  - Inventories, fixed capital and investment
- Expenditure statistics
  - Expenditure, by raw materials, spare parts, and packing materials used for production processes
  - Expenditure of electricity, fuel and water
  - Expenditure of the transport vehicles and other transport running
  - Expenditure of waste and air emissions management
  - Cash cost
  - Other service cost
- Trade & Price
  - External trade
  - Domestic trade
  - Consumer and housing price
- Analytical statistics and transformations
  - GDP & GNI
  - IOT & SUT
  - Productivity
  - Taxes & Royalty & Export duties

As seen from the Figure 5.3 the data sources to derive these indicators include:

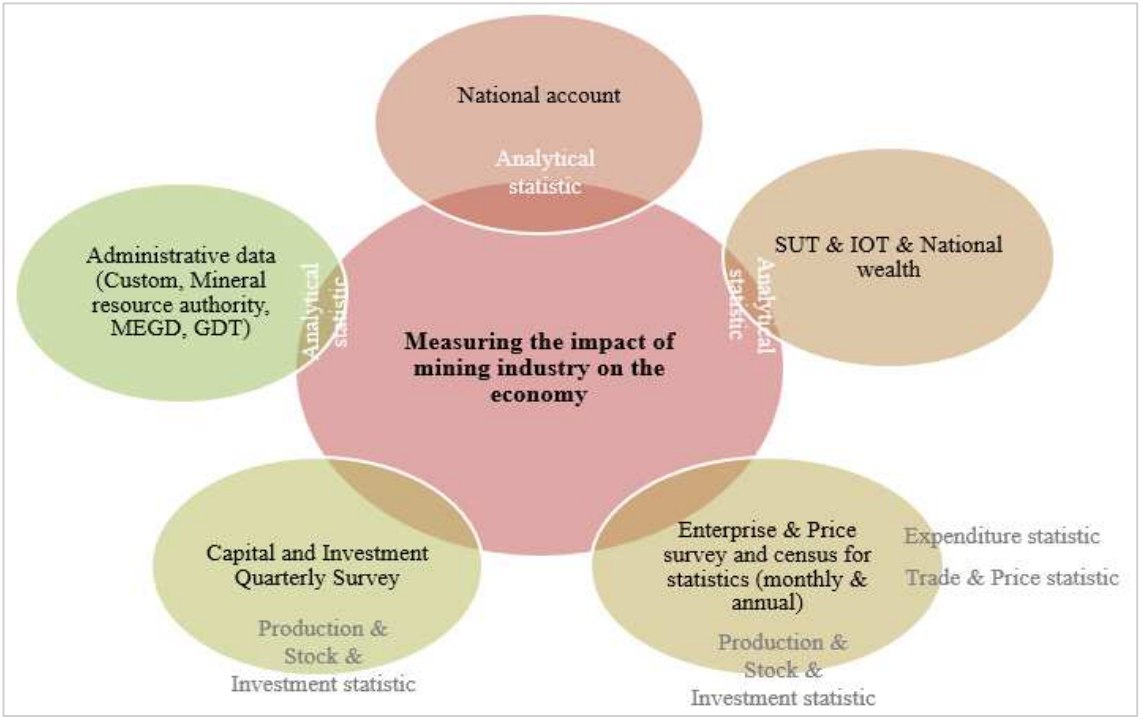
Official statistics:

- National accounts
- SUT, IOT and national wealth
- Capital and investment quarterly survey
- Enterprise and price survey
- Other surveys such as mining sites' survey and artisanal and small scale mining survey.

Administrative data:

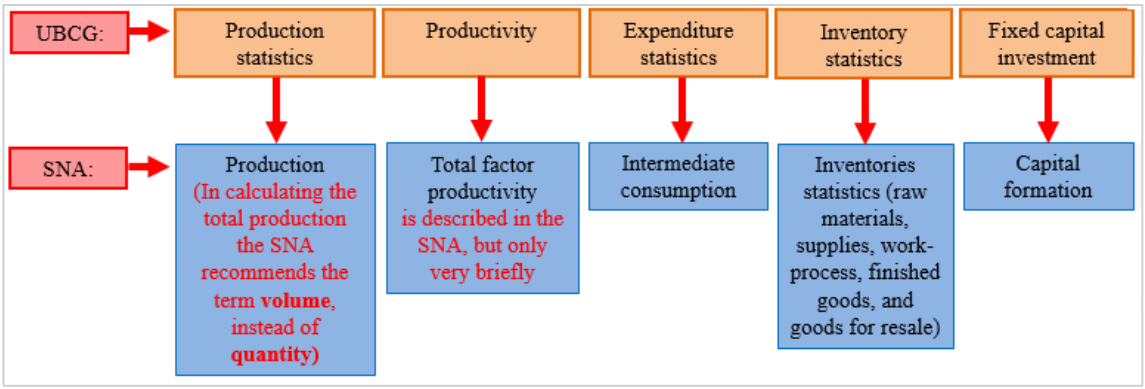
Administrative data from ministries and agencies such as Customs authority, Mineral resource authority, Ministry of Environment and Green Development and General Department of Taxation.

Figure 5.3. Data sources of economic indicators



The Figure 5.4 shows the consistency of UBCG indicators to measure economic impacts of mining with SNA. For example, the production statistics indicators identified by UBCG matches the production indicator of SNA. The difference is that UBCG considers quantity in estimating the total production whereas SNA recommends using volume. UBCG proposes to derive productivity indicator, which is linked to the indicator total factor productivity in SNA. In a case of expenditure consumption indicator of UBCG it is related to the SNA indictor of intermediate consumption. Inventory statistics of UBCG is coherent with inventories statistics of SNA that covers raw materials, supplies, work in process, finished goods, and goods for resale. The fixed capital investment is related to the capital formation of SNA statistics.

Figure 5.4. Data sources of economic indicators



5.3.4. The indicators to define impacts of mining activities on society

The UBCG has identified and suggested 29 indicators for measuring impacts of mining on society. Of the 29 indicators, 15 indicators classified as high priority, 11 indicators as medium, and 3 indicators as low priority.

These indicators have been categorized as labour statistics, health statistics, income statistics and other statistics. The figures 5.6 below show the indicators under each statistics and data sources. As seen, the social indicators can be derived from various sources such as household socio-economic survey (HSES), labour force survey (LFS), wage and salary survey and other special surveys. Other official statistics includes gender statistics, population and vital statistics reports. The administrative data used for measuring impacts on social sectors include data from the Ministry of Health and Ministry of Education and Science etc.

Figure 5.6. Measuring the impact of mining industry on social sector

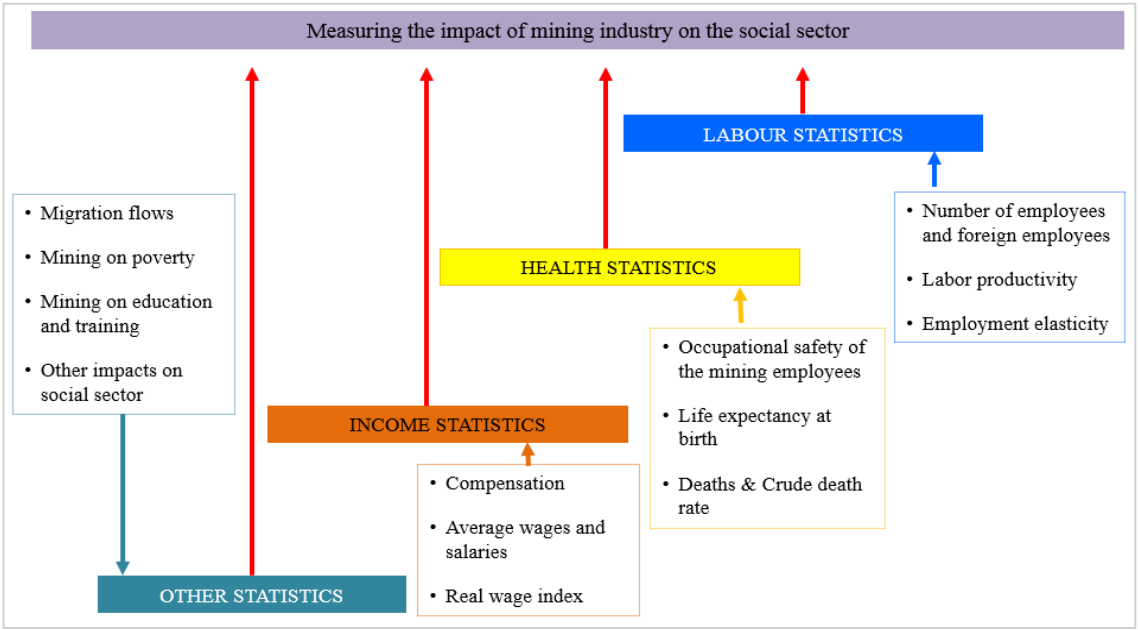


Figure 5.7. An example of the methodological sheet for a society indicator

BOX 5.2 : Impacts of mining sector on number of employees

Name of the indicator: Number of employees of the mining sector

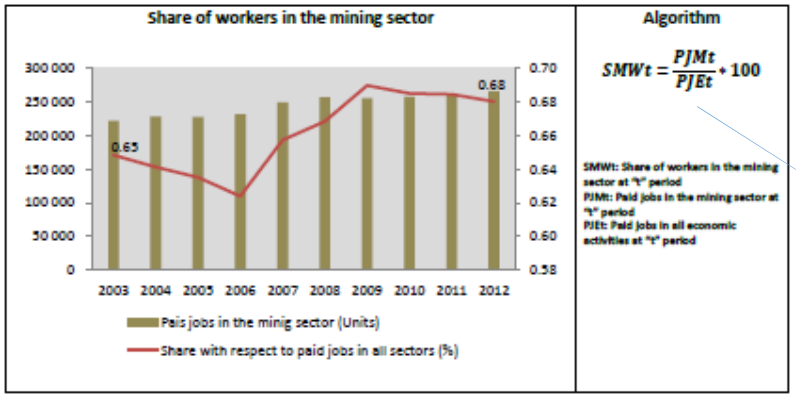
Priority
H: High (Green)
M: Medium (Yellow)
L: Low (Blue)

High priority

Objective of indicator: The indicator aims to measure the participation of workers in the mining sector related to the overall working force in the rest of economic activities with the aim to show the trend and intensity of the use of labor in the mining sector and its comparability with the rest of the economy.

Definition of indicator: The share of workers in the mining sector (SMWt) is defined as the number of paid jobs in sector 21 Mining (using the North America Industry Classification System, NAICS) related to the number of paid jobs in all economic activities in the country.

Graph: The indicator is estimated for the period 2003-2012. Base information is available at annual basis.



Estimation algorithm

Description: The indicator shows, firstly, the number of paid workers in the mining sector (21 using NAICS' classification) which has an average annual growth rate of 2 per cent in eight years; from 222 051 paid workers in 2003 to 266 488 in 2012. Moreover, a marginal increase occurs in the share of paid workers in the mining sector related to the total paid workers in other economic activities, this is, while in 2003 accounted for 0.65% of all paid workers in the country, in 2012 the share increased to 0.68 per cent. Otherwise, it should be noted that the jobs tendency in the economy was also positive, rising from 34.2 million in 2003 to 39.2 in 2012; i.e an average growth rate of 1.5% annually in the same period.

Indicator note: Initiative of the Ulaanbaatar City Group.

5.3.5. The indicators to determine impacts of mining activities on environment

There are 18 indicators for measuring impacts of mining on environment. Of these indicators, 17 indicators are high priority, and an indicator is low priority to define impacts of mining sector on environment.

The data to measure impacts of mining on environment are compiled for a wide range of administrative data sources. Administrative data collected and integrated by the related ministries and agencies of environment is an important source for deriving statistical indicators to measure mining impacts on environment such as, air and water emissions and waste products from the mining industry, and damage to land from mining activity.

Figure 5.8. An example of the methodological sheet for an environment indicator

BOX 5.3 : Impacts of mining sector on the environment

High priority

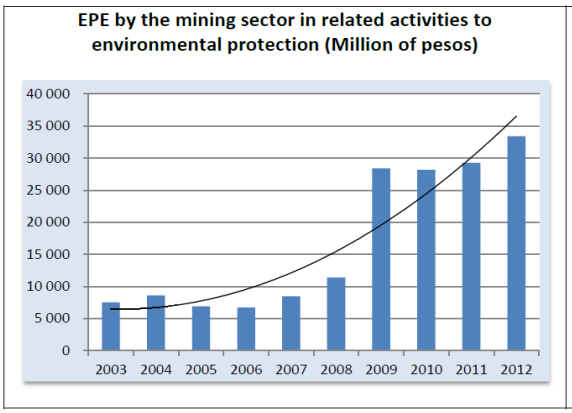
Name of the indicator: Cost of environmental protection

Objective of indicator: The Environmental Protection Expenditures (EPE) represents monetary expenditures for prevent, measure, control and remedy or abate pollution or any form or environmental degradation; as well as to protect, manage and promote the environment.

Definition of indicator: The indicator aims to measure the environmental expenditures incurred by the mining sector (expenditures related to public sector) in related activities to environmental protection.

The Environmental protection expenditures by the mining sector (EPEM) are defined as the sum of current and investment expenditures.

Graph: The indicator is estimated for the period 2003-2012. Base information is available at annual basis.



Algorithm

$$EPEMt = OEt + IEt$$

EPEMt: Environmental protection expenditures in the mining sector at period "t"
OEt: Current expenditures at period "t"
IEt: Capital expenditures at period "t"

Description: The indicator shows the amount spent for environmental protection activities on mining activities incurred by the public sector, such as the operation and maintenance of basic infrastructure in ecology and economic infrastructure projects of hydrocarbons, among other sectors, it has a tendency to increase in the period 2003 and 2012 as it passes 7 516 million pesos in 2003 to reach 33,396 million in 2012, that is an average annual increase of 18 percent. The most pronounced growth was in 2009, being able to maintain and even increase this kind of expenditures in subsequent years.

CHAPTER 6. MEASURING THE ECONOMIC IMPACT OF MINING

6.1. Executive Summary

In order to measure the impacts of the mining industry within a country's economy it is necessary to be aware of the main determinants of the mining economy, measurement framework, related concepts and methodology. Also, it requires good data sources necessary to analyse and estimate the results.

By its very nature, such a process is not easily captured by a single indicator, and a small set of measures will be needed. These indicators should be based on internationally comparable data.

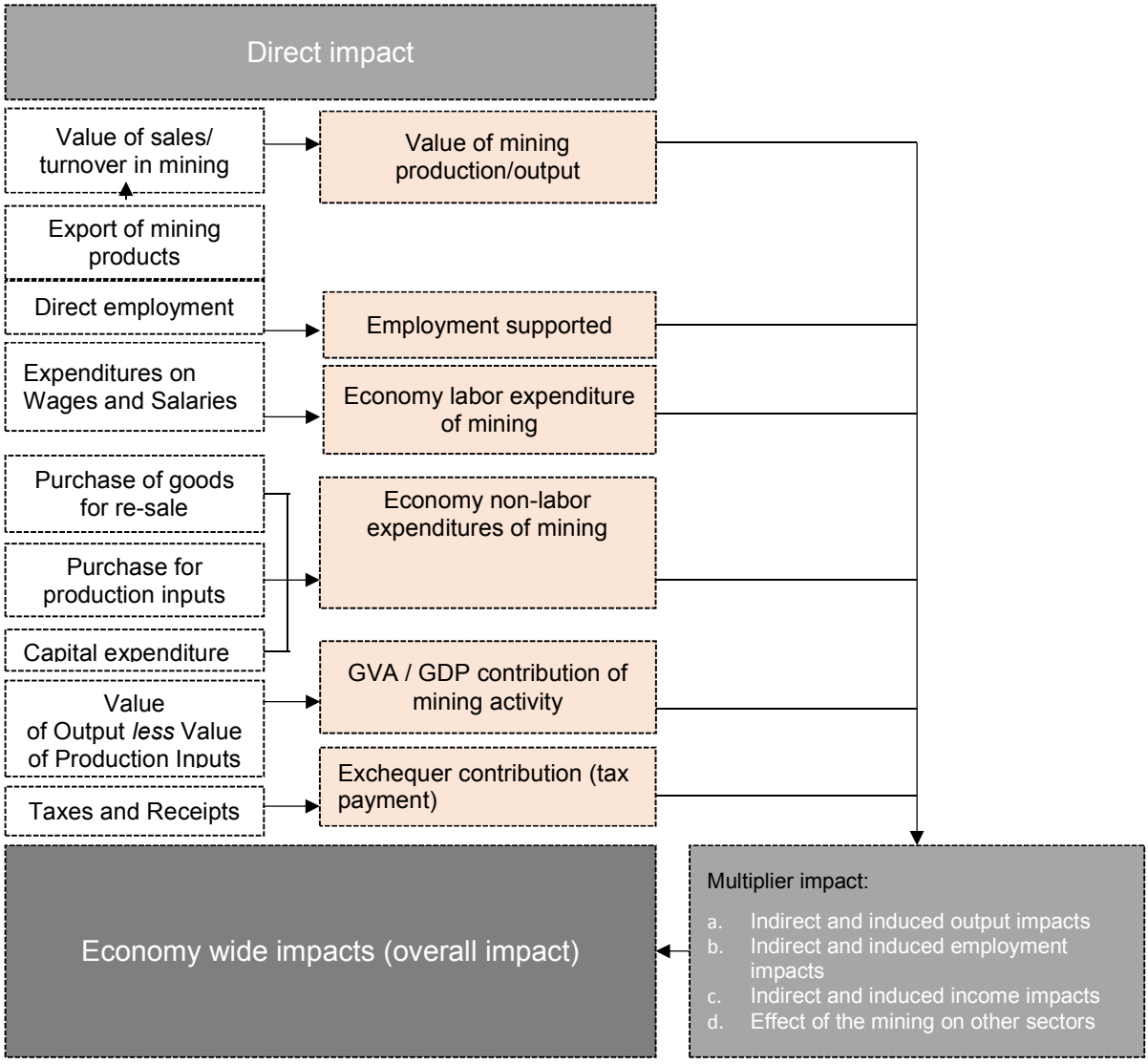
In this chapter we deal with an assessment of the impacts of the mining industry on economy and finance in terms of measurement of natural resource revenues and estimation of related statistics. We provide an overview of the scope of main statictics and estimation methods. Also, the estimation of related statistics is made based on available databases and its results are interpreted.

6.2. Conceptual Framework

Mining activities include exploration activity, mine development, mineral production, and mine remediation exploration. Industrial products include coal, copper, molybdenum, gold, zinc, silver, lead, concentrates and industrial minerals.

Before we conduct an analysis of the impacts of the mining activity on the national economy, consideration must be given to the linkages and channels through which the **direct, indirect** and **induced** impacts take place and to the fact that how they are measured. The framework for measuring the contribution of these flows involves 3 types of group statistics: **production, expenditure and revenue.**

Figure 6.1: Component of the impact of the mining industry on economy and finance



As in the case of any assessment of economic impact at the industry level, it is important that caution is exercised in interpreting results. All economic activities will generate impacts. However, these activities give rise to associated opportunity costs of resource utilization. In the context of this paper, this means that if the mining industry did not exist, the reduction in economic activity would not equate with the impacts shown.

The schematic overleaf provides a description of the components of the direct and indirect impacts which are captured in this assessment. The key measurable outcomes of the direct and indirect impacts are as follows:

a. Mining sales turnover as a value of the mining production / output;

b. Persons employed in the mining as a measure of employment;

c. Mining Expenditures;

d. Gross value added of the mining output as a measure of the GVA contribution of mining; and

e. Tax payments as a measure of the exchequer contribution of the industry.

The first section on basic statistics to be used for an analysis examines core indicators of statistics for impact analysis.

The mining industry provides jobs, pays wage and generates value added in a country. Governments at national, provincial, and local levels collect taxes on these activities. The economic benefits resulting from the ***value added, income from goods and services, revenue, operational expenditure, employment, tax revenues*** of the mining industry are concerned in the section – an assessment of direct economic impact of the mining on the economy.

However the economic contribution of the mining is greater than these direct effects. The indirect contribution to the economy is wider than the direct impact. The mining operator purchases inputs from suppliers, and then re-sells the goods purchased from other companies to the supplier; this is the feedback effect. In order to create new supply and other goods employers are provided salary costs for domestic business. As the result, the impact through or from mining will occur in other economic industry. This is discussed in the assessment of indirect and induced impact of the mining on the economy.

The last section - Trend in the mining boom attemps to quantify some of its effect, using the Mongolian database.

6.3. Basic statistics to be used for an analysis

Basic statistics to be used for an analysis is provided in this chapter while a more detailed indicators, their description and estimation methods for measuring the economic impact can be found in annex 1.

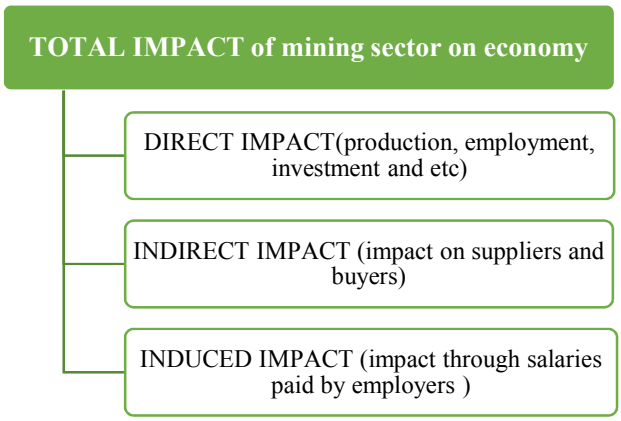
The economic analysis focuses on the direct, indirect and induced or wider economic impacts.

Direct impact – refers to the supply of primary mining products available in an economy.

Indirect impact – refers to the supply from the suppliers, providing the input to the manufacturers of the mining products, and that from the producers, using of the output, in an economy.

Induced impact – refers to the supply, secured by an increase in the income level of household enterprises, which is generated as a result of the direct and indirect impact.

Figure 6.2: Categories of impacts on the economy



Determining the impacts of the mining industry on the whole economy requires internationally comparable indicators. These must be compiled within a suitable conceptual framework and should follow certain criteria. Finally, these indicators must be able to provide important and clear signals to politicians and economic agents. The remainder of this statistics is structured as follows:

Table 6.1: Basic statistics for an direct impact analysis

Main indicator groups	Issue/indicator
Production/Output	**1. Measurement of impact of the mining industry on sales turnover** *1.1. Total sales turnover in the mining industry* *1.2. The share of output in the mining industry* *1.3. Export of the mining products* *1.4. Export as % of total sales revenues in the mining industry* *1.5. Export in the mining industry as % of total export sales revenues*
Employment	**2. Measuring direct employment in the mining industry** *2.1. Employed in the mining activities* *2.2. Employed in other support activities (estimated mining-related)* *2.3. The share of direct employment in the mining activities* **3. Measuring industry labour force in mining-related occupations** *3.1. Total number in labour force* *3.2. Number at work* *3.3. Number unemployed (incl. looking for a first job)* *3.4. Unemployment rate in the mining-related occupations*
Gross Value added/ GDP	**4. Measurement of the mining impact on national income, including balance of payments incomes associated with mining and measures of real gross domestic income and real net national disposable income** *4.1. Value of gross sales turnover in the mining industry* *4.2. Gross value added of the mining industry, at current and constant prices* *4.3. The share of value added of the mining industry to the GDP*

Main indicator groups	Issue/indicator
	4.4. GVA as % of turnover in the mining industry *4.5. GVA per employee in the mining industry* *4.6. Annual change of value added of the mining industry* *4.7. Gross national income per capita* *4.8. Annual change of GNI per capita* *4.9. Gross disposable income*
Expenditure	**5. Measuring direct expenditure in the mining industry** *5.1. Total direct expenditure on wages & salaries in the mining industry* *5.2. The share of expenditure on wages and salaries in the mining industry* **6. Measurement of non-labour input in the mining industry, including energy inputs** *6.1. Intermediate consumption of the mining industry* *6.2. The share of expenditure on non-labour input in the mining industry* **7. Measurement of direct capital expenditure associated with mining industry** *7.1. Total direct capital expenditure in the mining industry* *7.2. The share of capital expenditure / investment in the mining industry*
Government tax revenues	**8. Measurement total direct payment contributions of the mining industry** *8.1. Total tax payments* *8.2. Total social contributions* *8.3. Total direct payment contribution* *8.4. The share of total direct payment of the mining indistry to the general government revenue* **9. Measurement of state receipts from mining licence/lease holders** *9.1. Property income* *9.2. Dividends* *9.3. Rent and royalties* *9.4. Sales of goods and services* *9.5. Fines, penalties and forfeits* *9.6. Transfers non elsewhere classified* *9.7. Premiums, fees and claims related to nonlife insurance and standardized guarantee schemes* *9.8. Total receipts* *9.9. The share of state receipts of the mining industry to the general government revenue*

Table 6.2: Basic statistics for indirect and induced impact analysis

Main indicator groups	Issue/indicator
Output	**1. Measurement of indirect and induced output impact** *1.1. Industry output multiplier* *1.2. Indirect output impact* *1.3. Induced output impact* *1.4. Overall output impact* *1.5. The share of overall output in mining-related industry*
Employment	**2. Measurement of indirect and induced employment impact** *2.1. Industry employment multiplier* *2.2. Indirect employment impact* *2.3. Induced employment impact* *2.4. Overall employment impact* *2.5. The share of overall employment in mining-related industry*
Income	**3. Measurement of indirect and induced income impact** *3.1. Industry income multiplier* *3.2. Indirect income Impact* *3.3. Induced income Impact* *3.4. Overall income Impact* *3.5. The share of overall income in mining-related industry*
Trade industry	**4. Measurement of prices of mineral commodities and the impact of mineral prices on the terms of trade, as well as mining-induced terms of trade impacts on the rest of the economy** *4.1. Export and import unit price of the mining products* *4.2. Export and import price index of the mining products* *4.3. Export and import price index* *4.4. Terms of trade index (ratio of export price index to import price index)* **5. Measurement of impact of the mining on trade statistics, including coherency with production statistics** *5.1. Total sales of the domestic trade industry* *5.2. Total sales of the mining products at the domestic market, by types of minerals* *5.3. Total exports and imports* *5.4. Total exports and imports of the mining products*
Productivity	**6. Measurement of productivity in the mining industry** *6.1. Total productivity of the mining industry* *6.2. Total factor productivity of the mining industry* *6.3. Labor productivity of the mining industry* *6.4. Fixed capital productivity of the mining industry*

Main indicator groups	Issue/indicator
	6.5. Main raw material productivity of the mining industry 6.6. *Electricity productivity of the mining industry*
Construction	**7. Measurement of construction activity associated with the mining industry** 7.1. *Construction, capital repairs and maintenances associated with the mining industry*
Transportation	**8. Measurement of impact of the mining on transportation** *8.1. Freight turnover of the mining products, by mln ton km* *8.2. Carried freight of the mining products, by ton* *8.3. Passenger turnover of the mining employees, by pass km* *8.4. Passengers carried of the mining employees, by number of people* *8.5. Freight turnover of the mining products per 1 km railway length, by ton km* *8.6. Freight turnover of the mining products per 1 km improved auto road, by ton km* *8.7. Average intensity of traffic per day, by type of vehicle, by conversion to light car from heavy vehicle* *8.8. Tarmac and macadam road, power capacity of road construction, by value* *8.9. Power capacity of crossroad of railway, by value*
Regional impact	**9. Measurement of impact of the mining on regional economies (including regional prices and regional housing markets)** *9.1. Consumer price index, by regions* *9.2. Housing price index, by regions*

6.4. Assessment of direct economic impacts

This section assesses the direct economic impacts of the mining industry. The analysis includes the following components of the direct economic impact arising from mining activities:

- Production/Output in the mining industry and extent of export sales;
- Direct employment of the mining industry;
- Gross Value Added/GDP contribution of the mining industry;
- Expenditures, including on wages and salaries, and on non-labour inputs and capital spending/investment; and
- Exchequer impacts, including tax payments and payments to local authorities, and receipts from prospecting licence and mining facility holders through royalties, dead rent and licence fees.

Estimation of the overall contribution of the mining activities to the national economy value-added/GDP, and the contribution of the industry to the Exchequer in the form of tax payments. Direct economic impact includes the following statistics:

1. Production/Output in the mining industry and extent of export sales

The output of the mining industry can be measured by reference to the value of its sales revenues.

The share of output in the mining industry (SMO): The share of output in the mining industry is defined as total output in the mining industry related to total output in all economic activities in the country.

$$SMO_t = \frac{MO_t}{EO_t} * 100$$

SMO_t: *Share of sales turnover in the mining industry at t period*
MO_t: *Sales turnover in the mining industry at t period*
EO_t: *Sales turnover in all economic activities at t period*

BOX 6.1: The share of output in the mining industry in Mongolia, bln.tog

Indicators/statistics	2010	2011
Output in the mining industry	4 120.1	5 686.3
Output in the all economic activities	17 919.9	24 105.3
The share of output in the mining industry	***22.3***	***23.6***

Above table indicates the share of output in the mining industry during 2010 and 2011 in Mongolia. Share of output in the mining industry increased from 22.3 percent in 2010 to over 23.6 percent in 2011.

Export revenues as % of total revenues in the mining industry (SMExS): The majority of sales revenue earned in the mining industry is from export. The share of export revenues in the mining industry is defined as export revenues in the mining industry related to total sales in the mining industry in the country.

$$SMExS_t = \frac{MEx_t}{MO_t} * 100$$

$SMExS_t$: *Export revenue as % of total revenue in the mining industry at t period*
MEx_t: *Export revenue in the mining industry at t period*
MO_t: *Sales turnover in the mining industry at t period*

Export revenues in the mining industry as % of total export revenues (SMExE): The share of export revenues in the mining industry is defined as export revenues in the mining industry related to total export revenue in all economic activities in the country.

$$SMExE_t = \frac{MEx_t}{EEx_t} * 100$$

$SMExE_t$: $Export\ revenue\ as\ \%\ of\ total\ export\ revenue\ in\ all\ activities\ at\ t\ period$
MEx_t: $Export\ revenue\ in\ the\ mining\ industry\ at\ t\ period$
EEx_t: $Total\ export\ revenue\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.2: The share of export in the mining industry in Mongolia, bln.tog

Indicators/statistics	2010	2011
Export turnover in the mining industry	3 148.0	5 065.0
Export as % of total sales in the mining industry	***76.4***	***89.1***
Export turnover all economic activities	4 554.3	6 923.3
Export as % of total Export	***69.1***	***73.2***

The indicator shows, firstly, in 2011, a total of 5065.0 bln.tog, or 89.1% of sales revenue, was generated from export. Secondly, the share of export in the mining industry in the total export in the country accounted for 69.1 in 2010, increased to 73.2 percent in 2011 (see table above).

2. Employment

The employment, supported by mining, is an alternative measure of its economic contribution to gross value added. Employment is expressed by the number of additional jobs created as a result of the expenditures made by mining activities.

The share of main employment of the mining activities in the national employment is low, but the mining activities create mining-related employment. Other support activities include activities such as office employment and administration, technical and research activities.

The share of direct employment in the mining industry (SMEmp): The share of direct employment supporting the mining industry is defined as total persons engaged in the mining industry related to total employment in all economic activities in the country.

$$SMEmp_t = \frac{ME_{mpt}}{EEmp_t} * 100$$

$SMEmp_t$: $Share\ of\ direct\ employment\ in\ the\ mining\ industry\ at\ t\ period$
$MEmp_t$: $Total\ persons\ engaged\ in\ the\ mining\ industry\ at\ t\ period$
$EEmp_t$: $Total\ employment\ in\ all\ economic\ activities\ at\ t\ period$

Where: $Total\ persons\ engaged = Employed\ in\ the\ mining\ activities + Employed\ in\ other\ support\ activities$

BOX 6.3: Direct employment supported in mining in Mongolia, thous.persons

Indicators/statistics	2010	2011
Employed in the mining activities	-	-
Employed in other support activities	-	-
Total persons engaged	34.1	45.1
Total employment	1 033.7	1 037.7
Direct employment as % of total employment	***3.3***	***4.3***

The indicator shows, in 2010, the number of paid workers in the mining sector accounted for 3.3% of all employment in the country, the share increased to 4.3 percent in 2011.

Unemployment rate in the mining-related occupations (RMUnemp): The stronger activity arising from the mining boom results in lower unemployment. Unemployment rate in the mining-related occupations is the ratio of the number of unemployed people in the mining related occupations to the sum of the number of employed and unemployed people in the mining related occupations.

$$RMUnemp_t = \frac{MUnemp_t}{ELForce_t} * 100$$

$RMUnemp_t$: *Unemployment rate in the mining related occupations at t period*
$MUnemp_t$: *Number of unemployed in the mining related occupations at t period*
$ELForce_t$: *Total number in labour force in the mining related occupations at t period*

3. GDP/Direct gross value added

Gross value added (GVA) is defined as the value of production less the value of intermediate consumption. It is an equivalent measure to that of gross domestic product (GDP), which measures the extent of value added across the economy as a whole. GVA is therefore the best measure of the constribution of an industry/industry to economy-wide GDP. In the case of the mining activity in a country, the GVA contribution by reference to the value of sales turnover less expenditure on intermediate inputs (non-labour inputs such as purchases of raw materials and other services).

The share of value added of the mining industry to the GDP (SMVA): The share of gross value added in the mining industry is defined as gross value added in the mining industry related to the GDP.

$$SMVA_t = \frac{MVA_t}{EVA_t} * 100$$

$SMVA_t$: *Share of gross value added of mining industry to the GDP at t period*
MVA_t: *Gross value added in the mining industry at t period*

EVA_t: $GDP\ at\ t\ period$

GVA as % of turnover in the mining (SMVA_T): GVA as a share of turnover in the mining is gross value added of the mining industry divided by turnover in mining.

$$SMVA\_T_t = \frac{MVA_t}{MO_t} * 100$$

$SMVA_t$: $Share\ of\ gross\ value\ added\ of\ mining\ industry\ to\ the\ turnover\ in\ mining\ at\ t\ period$
MVA_t: $Gross\ value\ added\ in\ the\ mining\ industry\ at\ t\ period$
MO_t: $Sales\ turnover\ in\ the\ mining\ industry\ at\ t\ period$

GNI per capita (PMGNI_C): GNI per capita is gross national income divided by mid-year population.

$$PGNI\_C_t = \frac{GNI_t}{Pop_t}$$

$PGNI\_C_t$: $GNI\ per\ capita\ at\ t\ period$
GNI_t: $Gross\ national\ income\ at\ t\ period$
Pop_t: $Midyear\ population\ at\ t\ period$

GVA per employee (PMVA_Emp): GVA per employee in the mining is gross value added of the mining industry divided by employee in the mining.

$$PMVA\_Emp_t = \frac{MVA_t}{MEmp_t}$$

$PMVA\_Emp_t$: $Gross\ \ value\ added\ per\ employee\ in\ mining\ at\ t\ period$
MVA_t: $Gross\ value\ added\ in\ the\ mining\ industry\ at\ t\ period$
$MEmp_t$: $Total\ persons\ engaged\ in\ the\ mining\ industry\ at\ t\ period$

Annual change of gross value added of the mining industry (CMVA): Annual change of gross value added in the mining is gross value added of the mining industry at t period less gross value added in the mining at t-1 period.

$$CMVA_t = MVA_t - MVA_{t-1}$$

$CMVA_t$: $Annual\ change\ of\ gross\ value\ added\ at\ t\ period$
MVA_t: $Gross\ value\ added\ in\ the\ mining\ industry\ at\ t\ period$
MVA_{t-1}: $Gross\ value\ added\ in\ the\ mining\ industry\ at\ t-1\ period$

BOX 6.4: Gross value added of the mining to the country economy in Mongolia

Indicators/statistics	2010	2011
Value of gross sales turnover in mining, bln.tog	4 120.1	5 686.3
Gross value added in mining, at current prices, bln.tog	2 102.2	2 536.2
Gross value added in mining, at constant prices, bln.tog	736.9	791.0

GDP, at current prices, bln.tog	9 756.6	13 173.8
Employed in the mining activities, thous.persons	34.1	45.1
The share of value added of the mining industry in the GDP	***21.6***	***19.3***
GVA as % of turnover in mining	***51.0***	***44.6***
GNI per capita, thous.tog	***3266.1***	***3774.3***
GVA per employee, mln.tog	***64.6***	***56.2***
Annual change of gross value added of the mining industry , bln.tog	***-***	***434.0***

Presented in Table 6.4.4 above are Mongolia estimates of GVA of the mining industry, utilising data provided in SUT and IOT. We estimate that mining activity resulted in a significant GVA contribution of 19.3 percent during 2012.

4. Expenditure

The overall economic impact of the mining activities will be a function of the level of expenditures of the mining on goods and services inputs. This will include impacts through spending on wages and salaries of persons employedand expenditures on non-labour business inputs and capital investment. These components are described below.

The share of expenditure on wages and salaries in the mining industry (SMWExp): The derived statistics aims to measure the level of total compensations by wages and salaries in the mining industry. Wages and salaries are an important component of value added in an economy; it is one of the main triggers of consumption of goods and services.

The share of expenditure on wages and salaries in the mining industry is defined as expenditure on wages and salaries in the mining industry related to expenditure on wages and salaries in all economic activities in the country.

$$SMWExp_t = \frac{MWExp_t}{EWExp_t} * 100$$

$SMWExp_t$: *Share of expenditure on wages and salaries in the mining industry at t period*
$MWExp_t$: *Expenditure on wages and salaries in the mining industry at t period*
$EWExp_t$: *Expenditure on wages and salaries in all economic activities at t period*

BOX 6.5: Total direct expenditure on wages and salaries in mining in Mongolia, bln.tog

Indicators/statistics	2010	2011
Expenditure on wages and salaries in mining	260.1	591.3

Expenditure on wages and salaries in the all economic activities	2 199.2	3 150.1
The share of expenditure on wages and salaries in the mining industry	***11.8***	***18.8***

A total of 591.3 bln.tog was spent on wages and salaries by mining activities during 2011whereas 260.1 bln.tog was spent in 2010. In 2010, the share of expenditure on wages and salaries in the mining industry was 11.8 percent and almost 18.8 percent in 2011.

The share of expenditure on non-labour input in the mining industry (SMIExp): When considering the overall economic impact of the mining industry on the domestic economy a main component is that of expenditure on country produced goods ans services. Expenditures include spending that is required when a mine is in operation. These include production materials and supplies, treatment and refining charges, professional and technical services, including education and training, and the total cost of electricity purchased, including water services.

The share of expenditure on non-labour input in the mining industry is defined as expenditure on non-labour input in the mining industry related to expenditure on non-labour input in all economic activities in the country.

$$SMIExp_t = \frac{MIExp_t}{EIExp_t} * 100$$

$SMIExp_t$: $Share\ of\ expenditure\ on\ non-labour\ input\ in\ the\ mining\ industry\ at\ t\ period$
$MIExp_t$: $Expenditure\ on\ non-labour\ input\ in\ the\ mining\ industry\ at\ t\ period$
$EIExp_t$: $Expenditure\ on\ non-labour\ input\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.6: Total expenditure on non-labour input in mining, bln.tog

Indicators/statistics	2010	2011
Expenditure on non-labour input in mining	1 896.8	2 899.1
Expenditure on non-labour input in the all economic activities	8 775.0	11 880.6
The share of expenditure on non-labour input in the mining industry	***21.6***	***24.4***

In 2012 expenditures on non-labour inputs within the mining activities amounted to 2899.1 bln.tug, up slightly from 1896.8 bln.tog in 2010. The share of expenditure on non-labour inputs in the mining industry was 21.6 percent in 2010 and was 24.4 percent in 2011.

The share of capital expenditure / investment in the mining industry (SMCExp): The direct impacts generated from the capital expenditures are likely not a reliable point of reference for examining trends in output, GDP or employment. During the construction phase of a mine, companies are highly labour intensive. However, once the mine is in operation, the total number of workers required reduces. Capital expenditures include the purchase of lands

and mining rights, expenditures on all buildings other construction, machinery, equipment and mine shafts and underground work.

The share of capital expenditure in the mining industry is defined as capital expenditure in the mining industry related to capital expenditure in all economic activities in the country.

$$SMCExp_t = \frac{MCExp_t}{ECExp_t} * 100$$

$SMCExp_t$: $Share\ of\ capital\ expenditure\ in\ the\ mining\ industry\ at\ t\ period$
$MCExp_t$: $Capital\ expenditure\ in\ the\ mining\ industry\ at\ t\ period$
$ECExp_t$: $Capital\ expenditure\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.7: Total capital expenditure in mining, bln.tog

Indicators/statistics	2010	2011
Capital expenditure in mining	895.4	899.4
Capital expenditure in the all economic activities	3 881.8	7 106.0
The share of capital expenditure in the mining industry	***23.1***	***12.7***

The total amount spent by the main operating mines in Mongolia on capital goods in 2010 and 2011 is shown in Table 6.4.7 above. It is estimated that a total of 899.7 bln.tog was invested in capital goods among the mines in during 2011.

The share of total expenditure in the mining industry (SMTExp): The share of total expenditure in the mining industry is defined as total expenditure in the mining industry related to total expenditure in all economic activities in the country.

$$SMTExp_t = \frac{MWExp_t + MIExp_t + MCExp_t}{EWExp_t + EIExp_t + ECExp_t} * 100$$

$SMTExp_t$: $Share\ of\ total\ expenditure\ in\ the\ mining\ industry\ at\ t\ period$
$MWExp_t$: $Expenditure\ on\ wages\ and\ salaries\ in\ the\ mining\ industry\ at\ t\ period$
$EWExp_t$: $Expenditure\ on\ wages\ and\ salaries\ in\ all\ economic\ activities\ at\ t\ period$
$MIExp_t$: $Expenditure\ on\ non - labour\ input\ in\ the\ mining\ industry\ at\ t\ period$
$EIExp_t$: $Expenditure\ on\ non - labour\ input\ in\ all\ economic\ activities\ at\ t\ period$
$MCExp_t$: $Capital\ expenditure\ in\ the\ mining\ industry\ at\ t\ period$
$ECExp_t$: $Capital\ expenditure\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.8: Total capital expenditure in mining, bln.tog

Indicators/statistics	2010	2011
Expenditure on wages and salaries in mining	260.1	591.3
Expenditure on non-labour input in mining	1 896.8	2 899.1

Capital expenditure in mining	895.4	899.4
Total expenditure in mining	3 052.3	4 389.8
Total expenditure in the all economic activities	14 856.0	22 136.7
The share of capital expenditure in the mining industry	***20.5***	***19.8***

Table 6.4.8 overleaf combines all the expenditure components profiled above for the mining industry, indicating a total for mining expenditure of 3052.3 bln.tog and 4389.8 bln.tog in 2010 and 2012, respectively.

5. Exchequer Contribution

Government revenues from natural resources are the revenue payments governments receive from natural resource enterprises.

In addition to its impact through expenditures, GVA and direct employment, the mining industry also contributes to the state in the form of various payments to the Exchequer.

The collection of data on government revenues from natural resources requires a template to gather these data in a systematic manner, present it in an analytically useful way, and ensure it is comparable across countries. The template that has been developed by the IMF is designed to capture all possible government revenues from natural resources; however, in practice, for many countries it is likely that data for only a subset of these revenues will be collected.

Tax revenue line items listed in the template cover the main taxes that would be payable by natural resource enterprises. These taxes are a subset of the main GFSM 2014 category Taxes (11). More specifically, taxes on income, profits and capital gains payable by corporations and other enterprises (1112), dividends (1412), and rent (1415) are the principal revenue categories associated with revenues from natural resources. A short description of each subcategory is provided in the **Annex 2** to this chapter while a more detailed description of the revenue categories can be found in chapter 5 of the GFSM 2014.

Table 6.3: Template—Government Revenues from Natural Resources

GFSM **Codes**	**Description***
11	**Taxes**
1112	Taxes on income, profits, and capital gains (payable by corporations and other enterprises) *Taxes on income payable by natural resource enterprises* *Taxes on extraordinary profits payable by natural resource enterprises*
112	Taxes on payroll and workforce
113	*Taxes on payroll and workforce payable by natural resource enterprises* Taxes on property *Taxes on property payable by natural resource enterprises*
114	Taxes on goods and services
1141	General taxes on goods and services (value added tax, sales tax, turnover tax)
	Value added taxes payable by natural resource enterprises *Unrequited value added taxes payable by natural resource enterprises*

GFSM Codes	Description*
1142	Excises *Excise taxes payable by natural resource enterprises*
1143	Profits of fiscal monopolies *Profits of natural resource fiscal monopolies*
1145	Taxes on use of goods and on permission to use goods or perform services
11452	Other taxes on use of goods and on permission to use goods or perform activities *Business and professional licenses payable by natural resource enterprises* *Pollution taxes payable by natural resource enterprises*
1146	Other taxes on goods and services
115	*Other taxes on goods and services payable by natural resource enterprises* Taxes on international trade and transactions
1151	Customs and other import duties (import taxes)
	Taxes on imports payable by natural resource enterprises
1152	Taxes on exports
	Taxes on exports of natural resources
1153	Profits of export or import monopolies
116	*Profits of natural resource export monopolies* Other taxes
1161	Other taxes payable solely by business
	Other taxes payable by natural resource enterprises
12	**Social contributions**
121	Social security contributions
1211	Social security employee contributions
	Employee contributions from natural resource enterprises
1212	Social security employer contributions
122	*Employer contributions from natural resource enterprises* Other social contributions
13	**Grants (not applicable)**
14	**Other revenue**
141	**Property income**
1412	Dividends *Dividends from government owned natural resource enterprises* *Dividends from government participation in natural resource enterprises (equity)*
1415	Rent *Royalties payable by natural resource enterprises* *Bonuses payable by natural resource enterprises*
142	*Production entitlements payable by natural resource enterprises* *Compulsory social infrastructure payable by natural resource enterprises* *Other rent* Sales of goods and services
1422	Administrative fees
143	*Administrative fees for government services supplied to natural resource enterprises* Fines, penalties, and forfeits
144	*Transfers not elsewhere classified*
145	*Voluntary social infrastructure payments payable by natural resource enterprises* Premiums, fees, and claims related to nonlife insurance and standardized guarantee schemes

* Terms in italics refer to categories exclusively associated with government revenues from natural resources. Source: *Government Finance Statistics Manual 2014*.

The share of total direct payment of the mining industry in the general government revenue (SMTax): The share of total direct payment in the mining industry is defined as total direct payment in the mining industry related to the general government revenue.

$$SMTax_t = \frac{MTax_t}{EGovR_t} * 100$$

$SMTax_t$: *Share of total direct payment of mining industry to the general government revenue at t period*
$MTax_t$: *Total direct payment in the mining industry at t period*
$EGovR_t$: *General government revenue t period*

BOX 6.9: Total direct exchequer contribution of mining, bln.tog

Indicators/statistics	2010	2011
Total tax payment	929.5	1 506.4
Social contribution	44.5	64.0
Total Direct Payment Contributions	974.0	1 570.4
General government revenue	3 122.5	4 468.2
The share of total direct payment in the mining industry	***31.2***	***35.1***

The total combined direct exchequer contribution of mining in the mining industry for 2010 and 2011 is shown in the table 6.4.10. It is estimated that the mining industry contributed a total of 1570.4 bln.tog or 35.1 percent to the general government revenue in tax and local authority payments during 2011.

The share of state receipts of the mining industry in the general government revenue (SMReceipts): The share of state receipts in the mining industry is defined as total receipts in the mining industry related to the general government revenue.

$$SMReceipts_t = \frac{MReceipts_t}{EGovR_t} * 100$$

$SMReceipts_t$: *Share of state receipts of mining industry to the general government revenue at t period*
$MReceipts_t$: *Total receipts in the mining industry at t period*
$EGovR_t$: *General government revenue t period*

BOX 6.10: State receipts from mining industry, bln.tog

Indicators/statistics	2010	2011
Property income	99.3	158.4
Dividends	41.0	80.1
Rent and royalties	58.3	78.4
Sales of goods and services	5.9	6.7
Fines, penalties, and forfeits	30.6	53.0
Transfers not elsewhere classified		
Premiums, fees, and claims related to nonlife insurance and standardized guarantee schemes	15.1	31.9
Total Mining Receipts	150.9	250.1
The share of total receipts in the mining industry	***4.8***	***5.6***

The table integrates the above elements to identify the overall level of receipts from

royalties, licence fees and other payments by mining and prospecting licence holders. A total of just under 250.1 bln.tog was paid to the state during 2011.

6.5. Assessment of indirect and induced economic impacts

This section examines the multiplier impacts of the direct activities measured in Section 6.4, through estimating the indirect and induced, and overall impacts of mining activities on the economy. These impacts reflectthe total economic impact of the mining activities. Wider output, employment and income impacts of the mining activities will be focused.

The approach applied in arriving at the economy-wide impacts is based on the input-output analysis, which forms the basis for derivation of the national accounts for the economy in line with internationally agreed principles. Specifically, this section utilises the supply and use and input-output tables for the economy. The analysis is conducted through the development of multipliers for interested indicators which are derived from these tables.

Where the impacts are to be estimated at the industry level, it is very important to explain the results. All economic activities create impacts.

First of all, let us remember the ***definition*** of 'Input-output economic modeling':

The main economic concept of the demand impact analysis to be made by input-output modeling is to determine if demand elements in balance are changed exogenously, what will be the consequence to the economy. When Leontyev reverse matrix is multiplied by the final demand vector, the total production vector is resulted, therefore, in practice; it is called the analysis of input-output multiplier. Demand multiplier is considered in total production in the standard input-output modeling. There are 3 main forms for common multiplier:

- Output multiplier
- Income multiplier
- Labor multiplier

Each method has own strengths and weaknesses, however; all directly depend on the quality of and access to the needed source data. Detailed approach will be shown in Annex 2.

Multiplier: Factor to be used in estimating the wider economic impacts of industry and economic activities. It considers the indirect and induced impacts of the industry. Indirect impacts relate to the additional economic activity supported in sub-supply of input to the industry. As these indirect impacts supported employment and associated incomes, the re-spending of these incomes elsewhere in the economy gives rise to induced impacts, thereby supporting additional activity and employment. Multipliers are calculated using detailed industry data of input-output analysis of the relationships between economic industries.

There are 2 methods of multipliers to assess the economic impact:

- Type I multiplier
- Type II multiplier

Type I multiplier calculates the economic-wide impact to be expressed by the **sum of direct and indirect impacts.** It is expressed by the activity changes, which can occur in other industry when the demand of direct impact industry increases.

Type II multiplier is the expanded form of type I multiplier. It includes **direct, indirect and induced impacts.** Induced impact is generated from the additional consumption, related to the additional employment income results from indirect impact. In other words, type II multiplier includes the households within additional industry, related to the input-output table.

Following multipliers will be applied to our analysis:

- **Output multipliers:** They are employed to measure the production of all industry, required for the demand of MNT 1 in an industry, and the intermediate expenses, to be provided by households.
- **Income multipliers:** They show how a change in the consumption costs impacts the income of the household enterprises and the labour supply. They describe how a change in the labour costs per the gross production of an industry impacts on the household income.
- **Employment multipliers:** They explain how a change in the gross production impacts on the volume of labour supply.

Output impacts: The economic impact from mining expenditure can be shown in the following modeling.

$$Indirect\ output\ impact\ (C)_t = (A_t * B_t) - A_t$$

$$Induced\ output\ impact\ (E)_t = (A_t * D_t) - C_t - A_t$$

A_t: $Total\ expenditures\ in\ mining\ at\ t\ period$
B_t: $Sector\ output\ multiplier - Type\ I$
D_t: $Sector\ output\ multiplier - Type\ II$

Overall output impact:

$$\boldsymbol{Overall\ output\ impact_t = Total\ expenditures\ in\ mining(A_t) + Indirect\ output\ impact\ (C)_t + Induced\ output\ impact\ (E)_t}$$

The share of overall output in the mining industry (SMOO): The share of overall output in the mining industry is defined as overall output in the mining activities related to total output in all economic activities in the country.

$$SMOO_t = \frac{MOO_t}{EO_t} * 100$$

$SMOO_t$: $Share\ of\ overall\ output\ in\ the\ miningactivities\ at\ t\ period$
MO_t: $Overall\ output\ in\ the\ mining\ \ activities\ at\ t\ period$
EO_t: $Sales\ turnover\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.11: Impacts of the mining Output in Mongolia (bln.tog), 2010

Statistics	Mining industry - TOTAL	Mining of coal and crude petroleum	Mining of metal ores	Other mining and quarrying	Mining support service activities
Direct Impact					
Total Mining Expenditure	3052.3	415.6	786.8	69.6	1780.3
Indirect Multiplier Impact					
Industry Output Multiplier - Type I		*1.27*	*1.25*	*1.33*	*1.77*
Indirect Output Impact	1702.7	112.2	196.7	23.0	1370.8
Induced Multiplier Impact					
Industry Output Multiplier - Type II		*1.52*	*1.64*	*2.06*	*2.19*
Induced Output Impact	1209.3	103.9	306.8	50.8	747.7
Overall Output Impact: Direct + Indirect + Induced Output Impact	**5964.3**	**631.8**	**1290.3**	**143.4**	**3898.8**
The share of overall output in the mining activities	***33.3***	***3.5***	***7.2***	***0.8***	***21.8***

We estimate that the expenditure of 1702.7 bln.tog causes the indirect impact. As the demand of the mining industry increases, the input of the supply of other relevant industries increases. This means that this measure impacts on the economy. The induced income impact, derived from the mining expenditure, is associated with the additional consumption, generated as a result of the indirect impact of the mining industry. It is estimated that the induced impact amounts to 1209.3 bln.tog. The total output impact on the economy from direct, indirect and induced impact results is 5964.3 billion tugrugs,which is 33.3 percent of the output in the national economy.

Employment impact: Employment impact on the economy from mining activities can be shown in the following modeling.

$$Indirect\ employment\ impact\ (C)_t = (A_t * B_t) - A_t$$

$$Induced\ employment\ impact\ (E)_t = (A_t * D_t) - C_t - A_t$$

A_t: $Number\ of\ persons\ employed\ in\ mining\ at\ t\ period$
B_t: $Sector\ employment\ multiplier - Type\ I$
D_t: $Sector\ employment\ multiplier - Type\ II$

Overall employment impact: $\boldsymbol{Overall\ employment\ impact_t = Employment\ in\ mining\ (A_t) + Indirect\ employment\ impact\ (C)_t + Induced\ employment\ impact\ (E)_t}$

The share of overall employment in the mining activitis (SMOEmp): The share of overall employment in the mining activities is defined as overall employment in the mining activities related to total employment in all economic activities in the country.

$$SMOEmp_t = \frac{MOE_{mpt}}{EEmp_t} * 100$$

$SMOEmp_t$: $Share\ of\ overall\ employment\ in\ the\ mining\ activities\ at\ t\ period$
$MOEmp_t$: $Overall\ employment\ in\ the\ mining\ activities\ at\ t\ period$
$EEmp_t$: $Total\ employment\ in\ all\ economic\ activities\ at\ t\ period$

BOX 6.12: Impacts of the mining employment in Mongolia (thous.person), 2010

Statistics	Mining industry - TOTAL	Mining of coal and crude petroleum	Mining of metal ores	Other mining and quarrying	Mining support service activities
Direct Impact					
Number of Persons Employed in the mining	34.1	9.5	10.4	8.8	5.4
Indirect Multiplier Impact					
Industry Employment Multiplier - Type I		*2.61*	*2.96*	*1.2*	*7.9*
Indirect Employment Impact	74.7	15.3	20.4	1.8	37.3
Induced Multiplier Impact					
Industry Employment Multiplier - Type II		*3.96*	*5.79*	*1.57*	*12.2*
Induced Employment Impact	68.7	12.8	29.4	3.3	23.2
Overall Employment Impact: Direct + Indirect + Induced Employment Impact	**177.5**	**37.6**	**60.2**	**13.8**	**65.9**
The share of overall employment in the mining activitis	***17.2***	***3.6***	***5.8***	***1.4***	***6.4***

The results from the economic impact analysis of the employment in the mining activities reveals that in 2010, there were 34.1 thousand direct employees and the indirect impact of the employment was 74.7 thousand in the industry relating to the mining activities. The induced impact of employment was 68.7 thousand employments. The overall impact of the employment in the mining industry on the economy was 177.5 thousand. The share of overall employment in the mining activitis in the total employment is 17.2 percent in 2010.

Income impact: The final component of our analysis of the economic multiplier impacts of the mining relates to the income multiplier impacts arising from the wages and salaries earned by the employed in the mining. Income impact on the economy from mining activities can be shown in the following modeling.

$$Indirect\ income\ impact\ (C)_t = (A_t * B_t) - A_t$$

$$Induced\ income\ impact\ (E)_t = (A_t * D_t) - C_t - A_t$$

A_t: $Expenditure\ on\ wages\ and\ salaries\ in\ mining\ at\ t\ period$
B_t: $Sector\ income\ multiplier - Type\ I$
D_t: $Sector\ income\ multiplier - Type\ II$

Overall income impact

$$\boldsymbol{Overall\ income\ impact_t} = \boldsymbol{Expentidure\ on\ wages\ and\ salaries\ in\ mining}\ (\boldsymbol{A_t}) + \boldsymbol{Indirect\ income\ impact}\ (\boldsymbol{C})_t + \boldsymbol{Induced\ income\ impact}\ (\boldsymbol{E})_t$$

The share of overall income of the mining industry (SMOWExp): The share of overall income in the mining activities is defined overall income in the mining activities related to expenditure on wages and salaries in all economic activities in the country.

$$SMOWExp_t = \frac{MOWExp_t}{EWExp_t} * 100$$

$SMOWExp_t$: *Share of overall income in the mining activities at t period*
$MOWExp_t$: *Overall income in the mining activities at t period*
$EWExp_t$: *Expenditure on wages and salaries in all economic activities at t period*

BOX 6.13: Impacts of the mining income in Mongolia (bln.tog), 2010

Statistics	Mining industry - TOTAL	Mining of coal and crude petroleum	Mining of metal ores	Other mining and quarrying	Mining support service activities
Direct Impact					
Expenditure on Wages & Salaries in the mining	260.1	49.4	142.8	18.3	49.6
Indirect Multiplier Impact					
Industry Income Multiplier - Type I		*1.8034*	*1.4272*	*1.234*	*3.22991*
Indirect Income Impact	215.7	39.7	61.0	4.3	110.7
Induced Multiplier Impact					
Industry Income Multiplier - Type II		*2.3758*	*1.8802*	*1.6257*	*4.2551*
Induced Income Impact	151.0	28.3	64.7	7.2	50.9
Overall Income Impact: Direct + Indirect + Induced income Impact	**626.8**	**117.4**	**268.5**	**29.7**	**211.2**
The share of overall income of the mining industry	**19.9**	**3.7**	**8.5**	**0.9**	**6.8**

According to our estimation, the wage revenue of MNT 626.8 billion was generated through the direct, indirect and induced impact of the mining industry in 2010.

6.6. Trends in the mining boom

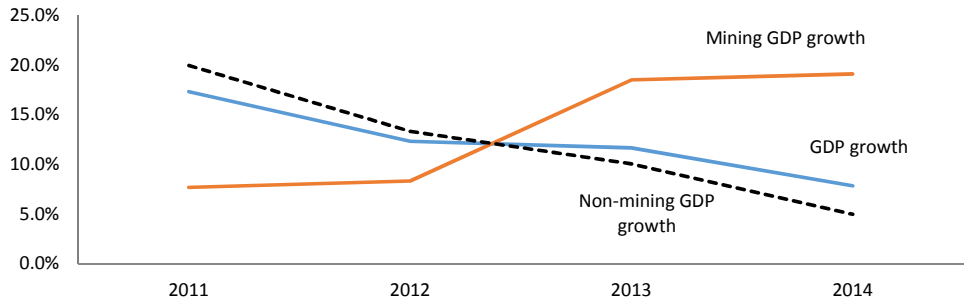
This section shows that the mining boom involves a comparision of two scenarios. These are how national economies develop with the mining boom and without mining boom. Differences between the economies with mining and without mining scenarios are interpreted as the effects of the mining boom.

Effects of the mining boom on GDP: GDP growth is calculated by the ratio of value added at t period and value added at t-1 period in the mining industry.

$$GDP\ growth_t = \frac{MVA_t}{MVA_{t-1}} * 100$$

$GDP\ growth_t$: $GDP\ growth\ in\ the\ mining\ industry\ at\ t\ period$
MVA_t: $Value\ added\ in\ the\ mining\ industry\ at\ t\ period$
MVA_{t-1}: $Value\ added\ in\ the\ mining\ industry\ at\ t-1\ period$

BOX 6.14: Effects of the Mining boom on GDP growth (trend, through the year)

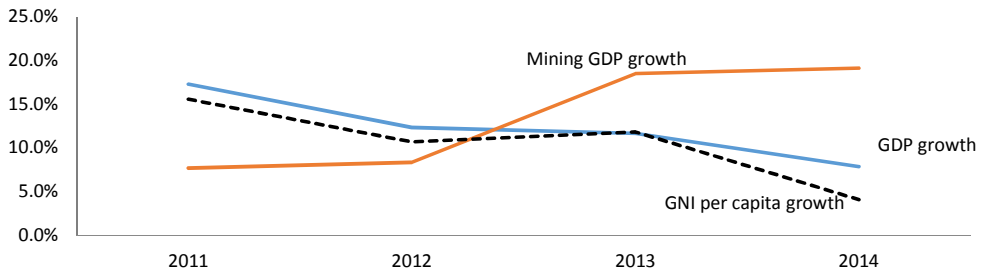


Effects of the mining boom on income: The effect of the mining boom on overall living standards can be gauged by the difference in real household gross national income per capita. GNI per capita growth is calculated by the ratio of GNI per capita at t period and GNI per capita at t-1 period in the economy.

$$GNI\ per\ capita\ growth_t = \frac{GNI_t}{GNI_{t-1}} * 100$$

$GNI\ per\ capita\ growth_t$: $GDP\ growth\ in\ the\ mining\ industry\ at\ t\ period$
GNI_t: $GNI\ in\ economy\ at\ t\ period$
GNI_{t-1}: $GNI\ in\ economy\ at\ t-1\ period$

BOX 6.15: Effects of the Mining boom on income (trend, through the year)



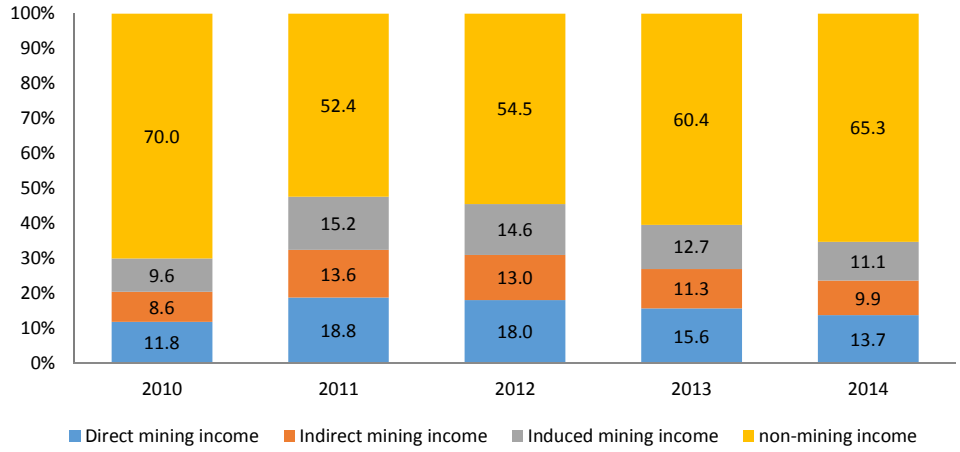
The share of j level income impact (SI) in the mining activities is defined as j income related to total income in all economic activities in the country.

$$SI_{jt} = \frac{I_{jt}}{EI_t} * 100$$

SI_{jt}: *Share of income in the j level at t period*
EI_t: *Income in the j level at t period*
EI_t: *Total income in all economic activities at t period*

Where: j-direct level, indirect level, induced level and non-mining level

BOX 6.16: Effects of the mining boom on income



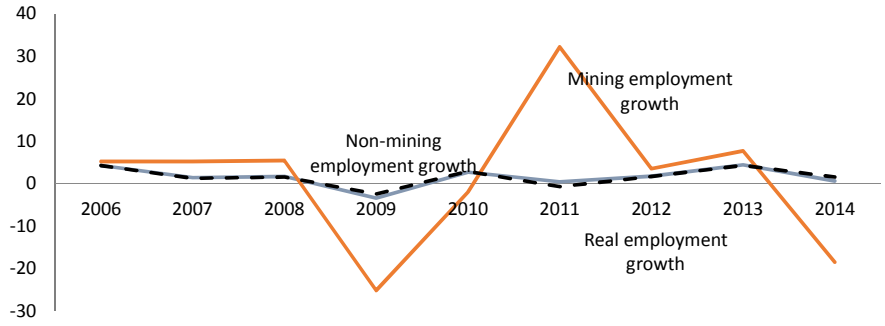
Effects of the mining boom on employment growth: The stronger activity arising from the mining boom results in higher employment.

Employment growth (Emp growth) is calculated by the ratio of employment at t period and employment at t-1 period in the mining industry.

$$Emp\ growth_t = \frac{MEmp_t}{MEmp_{t-1}} * 100$$

$Emp\ growth_t$: *Emp growth in the mining industry at t period*
$MEmp_t$: *Employment in the mining industry at t period*
$MEmp_{t-1}$: *Employment in the mining industry at t − 1 period*

BOX 6.17: Effects of the Mining boom on employment growth (trend, through the year)



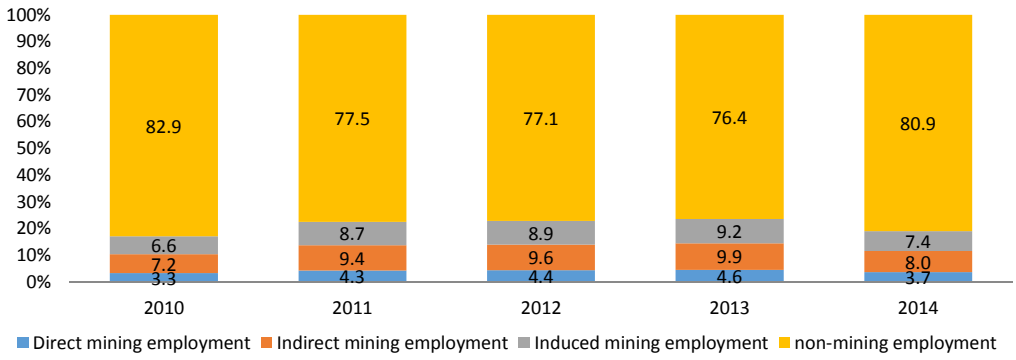
The share of j level employment impact (SEmp) in the mining activities is defined as j employment related to total employment in all economic activities in the country.

$$SEmp_{jt} = \frac{Emp_{jt}}{EEmp_t} * 100$$

$SEmp_{jt}$: *Share of employment in the j level at t period*
Emp_t: *Employment in the j level at t period*
$EEmp_t$: *Total employment in all economic activities at t period*

Where: j-direct level, indirect level, induced level and non-mining level

BOX 6.18: Effects of the mining boom on employment



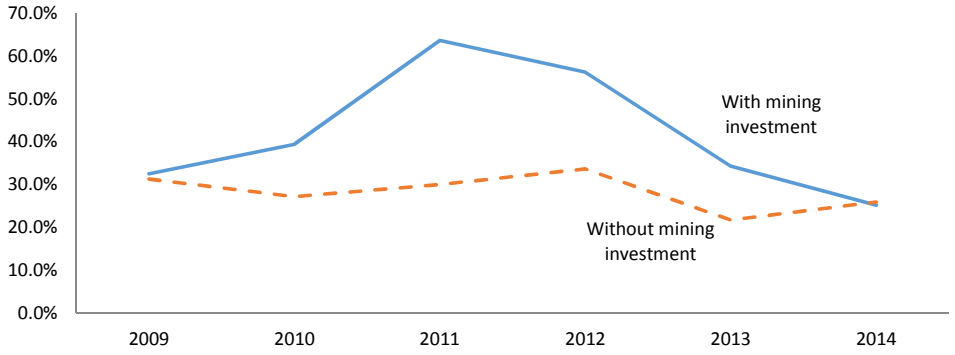
Effects of the mining boom on investment: Investment without the mining boom is lower than that with the mining boom.

The share of investment to the GDP (SMI) is calculated by the ratio of investment at t period and value added at t period in mining industry.

$$SMI_t = \frac{MI_t}{MVA_t} * 100$$

SMI_t: *Share of investment in the mining industry at t period*
MI_t: *Investment in the mining industry at t period*
MVA_t: *Value added in the mining industry at t period*

BOX 6.19: Effects of the Mining boom on investment, percent of trend GDP

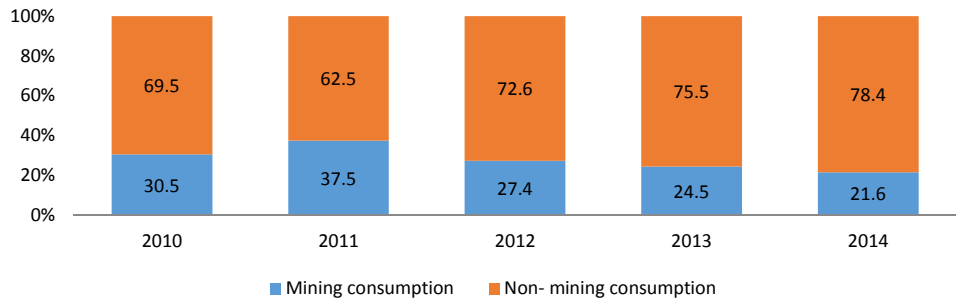


Effects of the mining boom on consumption: The share of consumption to total consumption (SMC) is calculated by the ratio of consumption in the mining at t period and consumption at t period in all economic activities in the country.

$$SMC_t = \frac{MC_t}{EC_t} * 100$$

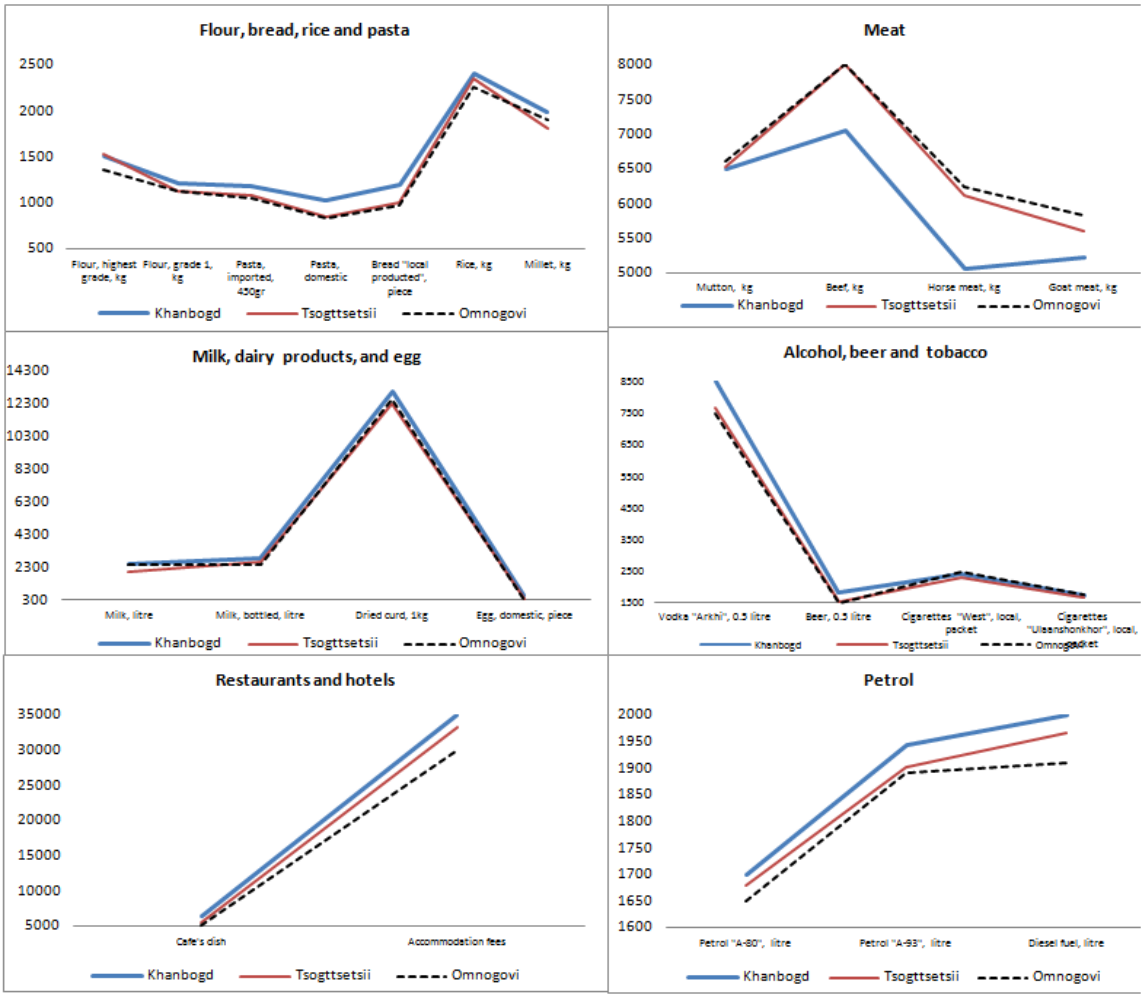
SMC_t: *Share of consumption in the mining industry at t period*
MC_t: *Consumption in the mining industry at t period*
EC_t: *Consumption in all economic activities at t period*

BOX 6.20: Effects of the mining boom on consumption



BOX 6.21: Impact of the mining boom on market costs

In the first 9 months of 2015, the average prices of some consumer goods and services



We compared and analysed the cost of commodity goods and services in Khanbogd soum with the nearby Tsogttsetsii soum and the province center. We used the average data as of first 8 months 2015 for the analysis. The figure below shows that the cost of the commodity goods except meat is higher than in Tsogttsetsii soum and province center.

Hotel price is higher by 16.2 percent than in Tsogttsetsii soum and by 30.0 percent higher than in province center, café's dish cost is higher by 5.0 percent than in Tsogtstetsii soum and by 16.7 percent higher than in province center. Cost for petrol A92 is higher by 2.2 percent than in Tsogttsetsii soum and by 2.9 percent than in province center. 24.5 percent of the respondents in survey buy their commodity goods from other soums and province.

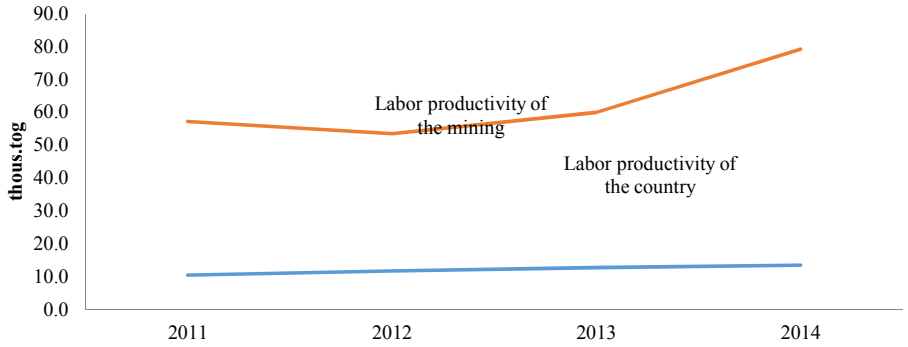
Source: Survey on impact of mining sector to economic, social and environmental status of Khanbogd soum, Omnogovi province in Mongolia, 2015

Effects of the mining boom on Labor productivity: The labor productivity is defined and calculated by the ratio of value added and annual average of employees in the mining industry.

$$LP_t = \frac{MVA_t}{ME_t} * 100$$

LP_t: *Lobor productivity in the mining industry at t period*
MVA_t: *Value added in the mining industry at t period*
ME_t: *Employment in in the mining industry at t period*

BOX 6.21: Labor productivity of mining industry (thous.tog/employees)

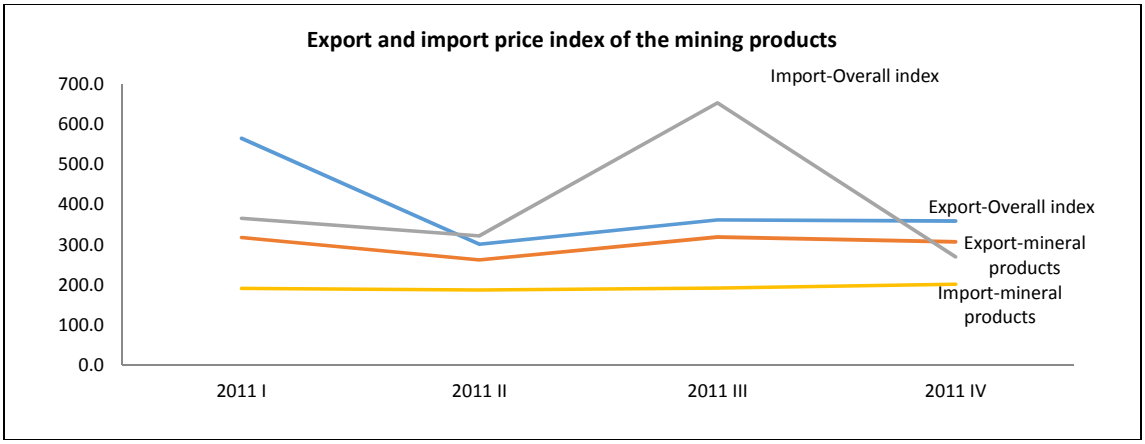


Trade industry: The share of export to total export (SMEx) is calculated by the ratio of export in the mining at t period and export at t period in all economic activities in the country.

$$SMEx_t = \frac{MEx_t}{EEx_t} * 100$$

$SMEx_t$: *Share of export in the mining industry at t period*
MEx_t: *Export in the mining industry at t period*
EE_t: *Export in all economic activities at t period*

BOX 6.22: Export growth with and without mining (%) and Export and import price index of the mining products


Export and import price index of the mining products
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
2011 I
2011 II
2011 III
2011 IV
Import-Overall index
Export-Overall index
Export-mineral products
Import-mineral products

CHAPTER 7. MEASURING SOCIETAL IMPACTS FROM MINING

7.1. Introduction

Mining as an activity has been there since the beginning of human society and minerals have contributed to the development of human civilization since the Stone Age. The human population is predicted to grow to about 9 billion by 2050; hence it would be necessary to expand production of minerals in order to support this growth. For most of its history, however, mining was dominated by mining benefits staying in the hands of too few people with little regard for environment, local community or development. Generally speaking, society, often mainly comprising indigenous, relatively backward communities in mining areas, has been affected by the impacts of mining. The situation has changed somewhat since the 1980s due to increasing concern worldwide regarding intensified environmental damage and failure to address the problems of poverty and marginalization of indigenous backward communities that have accompanied universal economic development in the post-World War II years.

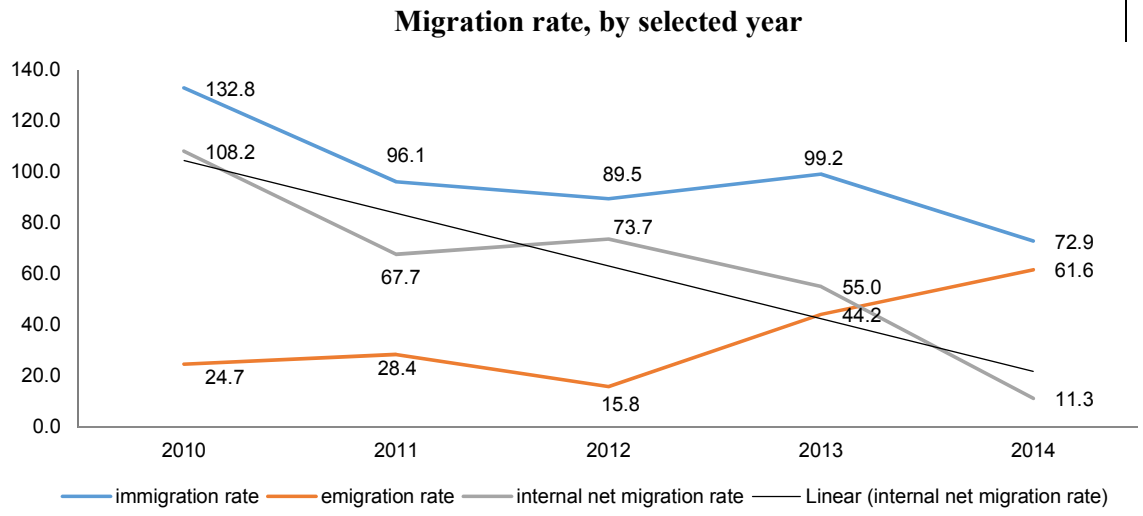
Mineral development involves use of large tracts of land and there are often problems and disagreements around issues such as resettlement, compensation and land rights of the indigenous people. Mining activities can bring benefits to the local communities through creation of jobs, encouragement to business and infrastructure development. Conversely, they may also generate social tensions and economic problems through loss of traditional livelihoods and culture, involuntary resettlement and inequitable distribution of benefits and costs within the communities, inadequate infrastructure development and health concerns due to exposure of populations to chemicals and particles and workers' safety.

Thus mining as an activity has both positive and negative impact on the society in general and the neighbourhood society in particular. These impacts could be during the start of a mining project, in the currency of it and after the inevitable closure of the project. The societal impacts of mining can be measured mainly through employment generation, the income generated by the employees, population dislocation due to mining activity, the effect on poverty, effect of mining on health and education of the population, migration in population etc.

BOX 7.1: Impact of the mining boom on migration
We calculated the important indicators, related to demography migration studies, as the immigration rate, emigration rate and internal net migration rate. These indicators are expressed by the number of migration participants per 1000 people. Immigration rate was 132.8 in 2010 but reduced to 72.9 in 2014. And the emigration rate was 24.7 in 2010 but increased to 61.6 in 2014. It shows the reduction of the internal net migration rate. We can conclude that although the mining sector creates mining-supported

workplaces, this tend to reduce after a while.

We asked the reason for immigrants and 70.3 of total respondents answered that they follow the mining activities.



Source: Survey on impact of mining sector to economic, social and environmental status of Khanbogd soum, Omnogovi province, 2015

1. **Labour:** Persons who, during the reference period, are engaged in any mining activity or who, despite their attachment to their mining activity, have temporarily abstained from work, for reasons of illness, injury or other physical disability, bad weather, festivals, social or religious functions or other contingencies necessitating temporary absence from work constitute workers. Labour Force in mineral sector indicates workers in the sector and is an important input for production minerals in the country. The reliable estimates of labour force are important for policy and planning purposes.

A. For measuring the employment in the mining industry the following indicators are proposed.

1.1 Number of employees at the mining sector: It can be measured as the average daily employed for all categories of workers directly working in the mines. It can be obtained through statutory returns/administrative records/surveys. For a mine it can be computed as follows:

Average daily employment=No. of man days worked ÷total number of days mine worked

Aggregate of all such mines data would be the Number of employees at the mining sector for the country.

1.2. Number of foreign employees at the mining sector, by nationality: Foreign employees are defined as the employees who are working in the mines in a country but are citizens of another country. Number of foreign employees at the mining sector, by nationality can be measured as the average daily foreign workers employed for all categories directly in

the mines. It can be obtained through statutory returns/administrative records/surveys. For a mine it can be computed as follows:

Average daily foreign workers employed=No. of man days worked by foreign employees ÷ total number of days mine worked

Aggregate of all such mines data would be the Number of foreign employees at the mining sector for the country. This information can be obtained nationality wise.

1.3. Number of engineering and technical staffs required newly in coming 3 years, by professions: This indicator intends to measure the no. of professionals required by the mining industry in the short term future. It is the number of professional engineers and other persons having skills in mining related activities likely to be employed in the mining industry in the coming 3 years. This data can be collected through administrative records/surveys

B. Measuring the demographic characteristics of the mining labour:

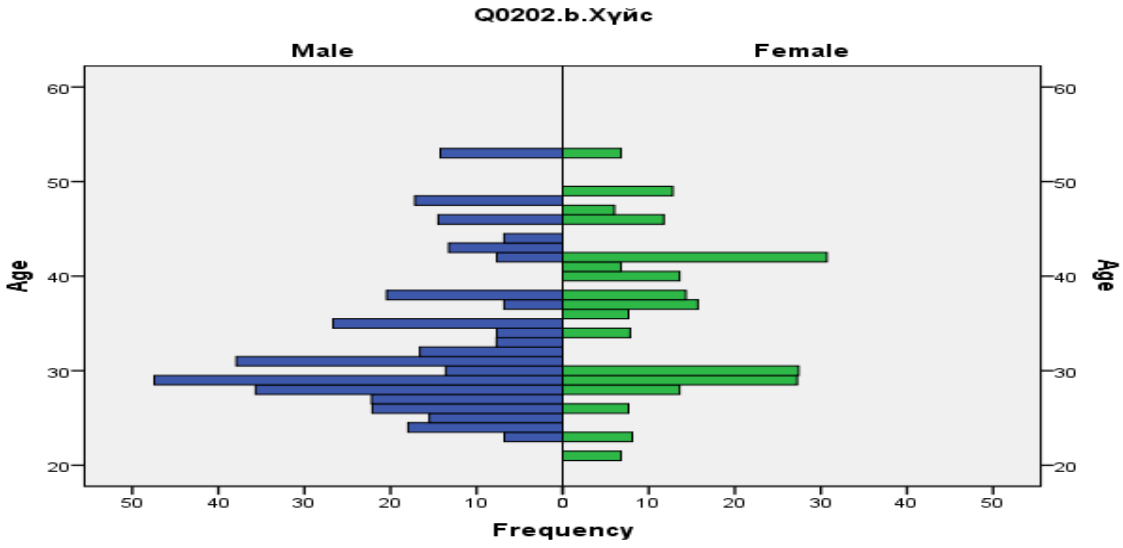
1.4 Number employed by age: It is the number of persons of specified age group employed in the mining sector. The age groups proposed are below 18, 18-30, 30-40, 40-50, 50-60 and 60 and above. The information can be obtained through surveys.

1.5 Number of employed by sex: It is the number of persons employed in the mining sector by sex. The classifications proposed are Male, Female and Transgender. The information can be obtained through surveys.

BOX 7.2: Impact of the mining boom on employment

We concerned the ages and gender groups of mining workers: 62.7 percent is male, 37.3 percent is female. And 93.4 percent of total workers are between 25-55 years old. And majority of the workers are male around 30 years old.

Employed in the mining activities, population pyramid, 2015



Source: Survey on impact of mining sector to economic, social and environmental status of

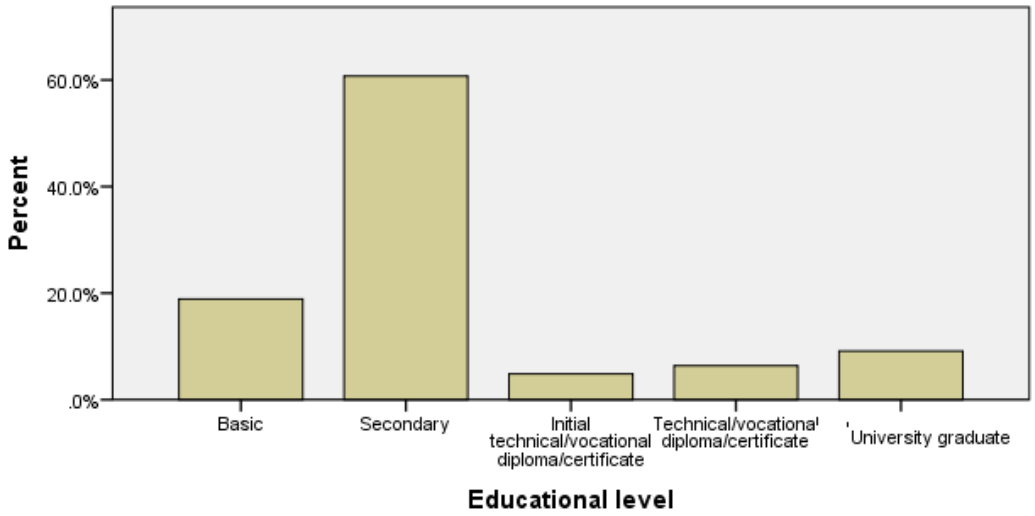
Khanbogd soum, Omnogovi province, 2015

1.6. Number of employed by education: It is the number of persons employed in the mining sector as per their level of education. The classifications proposed are illiterate, below class X, diploma holder, under graduate, graduate and post graduate and above. It is also proposed to obtain the information through surveys

BOX 7.3: Impact of the mining boom on employment, by level of education

By education level: 79.6 percent of the mining workers from Khanbogd soum have lower than secondary education, which shows that they mostly engaged in auxiliary activities.

Employed in the mining activities by educational level, share to total



Source: Survey on impact of mining sector to economic, social and environmental status of Khanbogd soum, Omnogovi province, 2015

1.7 Number of employed by occupation: It is the number of persons employed in the mining sector as per their occupation. The classifications proposed are Miners and Loaders, Foreman and Mining Mates, Geologists, Mining Engineers, Managers, Clerical and Administrative Staff and Others. It is proposed to obtain the information through statutory returns/ administrative records/ surveys.

1.8 Number of employed by marital status: It is the number of persons employed in the mining sector as per their current marital status. The classifications proposed Unmarried, Married, Widowed and Divorce/Separated. It is proposed to obtain the information through surveys.

C. Mining related activities: The mining related activities can include other sectors of the economy which are either supporting mining industry or using the mining products. Hence manufacturing, construction, transport, storage, services and electricity and gas can be considered as mining related activities. In these industries only those directly linked to

mining shall be considered as mining related activities. The indicators related to labour force in these activities are

1.9 Number of employees, by classification of economic activities: It is the number of persons employed in the mining related activities mentioned above. It can be obtained through surveys.

1.10 Number of employees at the mining sector, by classification of occupations: It is the number of persons employed in the mining related activities by occupation. This statistics can also be obtained through surveys. For occupational classification the NOC 2011 can be used. The broad occupational categories mentioned in NCO are:

0 Management occupations

1 Business, finance and administration occupations

2 Natural and applied sciences and related occupations

3 Health occupations Health occupations

4 Occupations in education, law and social, community and government services

5 Occupations in art, culture, recreation and sport

6 Sales and service occupations

7 Trades, transport and equipment operators and related occupations

8 Natural resources, agriculture and related production occupations

9 Occupations in manufacturing and utilities

D. Measuring of the impact of the supply of labour on other parts of the economy due to changes in the demand for labour from the mining industry.

This can be measured by analysing the employment survey data covering all sectors of the economy in areas where significant mining activities are carried out. The indicators suggested for measuring this impact are given below.

1.11 Number of employees, by classification of economic activities: It is the number of persons employed in the selected frame of area by various economic activities. The broad classification of economic activities can be as given below:

a. Agriculture, forestry and fishing
b. Mining and quarrying
c. Manufacturing
d. Services

It can be obtained through surveys.

2. Income: Income in this context means the wages and salaries received by employees in mining sector. Wage and salary consist of remuneration received in cash/cash equivalents for

the work performed during the reference period. It includes bonuses, allowances, overtimes and payments towards leave period. The following indicators are proposed to measure the income.

BOX 7.4: Impacts of the mining boom on household income

We concerned the sources of primary income of the households in Khanbogd soum: 30.2 percent of total households have mining activities, 24.8 percent livestock activities, 19.4 percent wages and salaries from the industries other than mining, 13.9 percent household businesses, 8.7 percent pension and allowances and 3.1 percent others. It shows that mining sector provides major percentage of household income.

Primary sources for household income, by baghs, 2015

Income source	Share to total number of households
Total households	**100.0**
Livestock	24.8
Household businesses	13.9
Mining industry	30.2
Wages and salaries (other than mining sector)	19.4
Pensions, allowances	8.7
Others	3.1

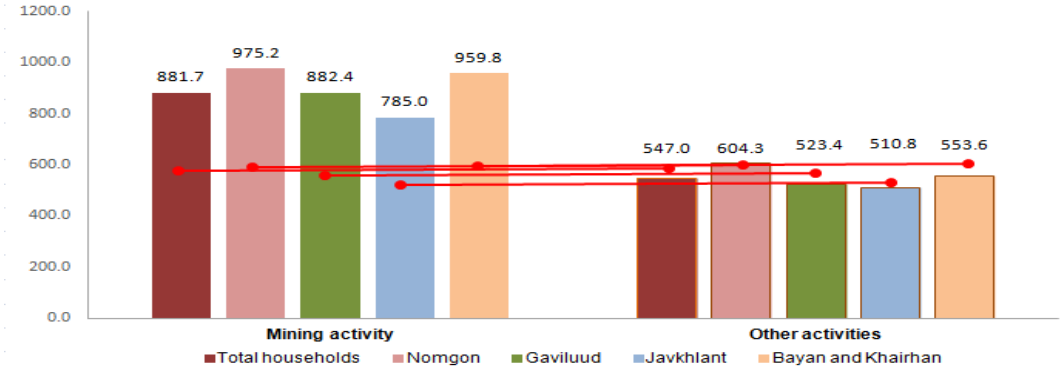
Source: Survey on impact of mining sector to economic, social and environmental status of Khanbogd soum, Omnogovi province, 2015

2.1 Total compensation of employees of the mining industry: It is the aggregate of salary/wages received by all the employees of the mining sector. It includes the wages and salary paid to both contract and direct employees. It can be obtained through statutory returns/administrative records/surveys.

2.1.1 Monthly average wages and salaries of employees of the mining industry, by domestic employees: It is the total compensation received by domestic employees during the month x total number of days mine worked in the month. Domestic employees mean those who are a citizen of the country of their work.

BOX 7.5: Impacts of the mining boom on household income

Monthly average wage and salaries of workers in mining industry



Average wages and salaries of the workers in Khanbogd soum: 881.7 thousand MNT in mining sector and 547.0 thousand MNT in sectors other than mining. The average wages and salaries of the workers in industries other than the mining is lower by 247-406 thousand MNT than in mining industry in all baghs.

Source: Survey on impact of mining sector to economic, social and environmental status of Khanbogd soum, Omnogovi province in Mongolia, 2015

2.1.2 Monthly average wages and salaries of employees of the mining industry, by foreign employees: It is the total compensation received by foreign employees during the month x total number of days mine worked in the month. Foreign employees are defined as the employees who are working in the mines in a country but are citizens of another country.

2.2. Real wage index of the employees of the mining industry: Real wage index is nominal wage index corrected for changes in purchasing power measured by the consumer price index. It is proportion of nominal wage index and consumer price index of corresponding year. A nominal wage index is proportion of nominal wage of current period and nominal wage of base period as expressed as a percentage. In other words it is the total current wages for the reference period x (total wages for the base period x consumer price index for the reference period). It can be obtained through statutory returns/administrative records/surveys.

2.3 Monthly average wages and salaries of employees of the mining industry, by sex: It it the total compensation received during the month by employees by sex x total number of employees by sex. The classifications proposed are male, female and transgender. The information can be obtained through administrative records/surveys.

2.4 Monthly average wages and salaries of employees of the mining industry, by occupations: It is the Total compensation received during the month by employees by occupation x Total number of employees by occupation. The classifications proposed are miners and loaders, foreman and mining mates, geologists, mining engineers, managers, clerical and administrative staff and others. It is proposed to obtain the information through statutory returns/ administrative records/surveys.

CHAPTER 8. MEASURING THE IMPACT OF THE MINING INDUSTRY ON THE ENVIRONMENT

8.1. Introduction

The extractive nature of mining operations creates a variety of impacts on the environment before, during and after mining operations. The extent and nature of the impacts can range from minimal to significant depending on a range of factors associated with each mine. These factors include: the characteristic of the ore body; the type of technology and extraction methods used in mining and the on-site processing of minerals; and the sensitivity of the local environment. The environmental impacts of mining, although significant, are generally confined to local areas. Apart from direct physical impacts of extractive activities, contamination of air, land and water may also result. However, mining in isolation may not be the main land use that upsets ecological systems, as environmental effects are cumulative in nature and other past activities or events may have contributed to these effects.

The impact of the mining industry on the environment has been a concern for many years. Governments and businesses have responded with a number of initiatives and regulations to protect and manage the environmental effects of mining activities. To do this effectively, governments need relevant statistics that measure the impact of mining on the environment.

There has been much literature on the impact of mining on the environment, but minimal work that systematically measures this impact and the changes over time. The System of Environment and Economic Accounts provides the basic framework to address this shortcoming. This handbook provides guidance and methodologies for National Statistical Offices (NSOs) to develop appropriate statistics and standards to address this.

This chapter discusses the main environmental impacts of mineral mining, such as wastes and the rate of resource use. The chapter also links these impacts to the statistics required for measurement.

Many NSOs currently produce a raft of environmental statistics including a suite of environmental accounts [DN reference]. However, they may not necessarily address the impact of mining. This handbook draws upon some of these indicators and provides practical guidelines for NSOs to establish appropriate data sets to measure this impact.

Much of this chapter draws upon the *System of Environmental-Economic Accounting 2012: Central Framework (SEEA2012)*. The SEEA2012 provides the underlying accounts framework to measure the impact of mining on the environment. Another source of material is the *Framework for the Development of Environment Statistics (FDES) 2013*. FDES is a useful guide to the indicators that might be used in measuring mining's impact.

8.2. Residuals

Some of the significant direct impacts of mining predominantly occur via the residuals 'produced' by the industry. The SEEA2012 defines residuals to be the "flows of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation" (SEEA 2012 p.49). Residuals can be grouped depending on analytical need, the physical nature or purpose of the flow. (SEEA 2012 p. 51). The most widely accepted groupings that relate directly to mining are solid waste, wastewater, emissions, and natural resource residuals. The SEEA 2012 has not defined a single classification of residuals as the various groups overlap.

8.3. Selected mining activities and their impact

8.3.1. Mineral exploration

The impact of mineral exploration will depend on the scale of exploration and what equipment is used in the exploration phase. Initial exploration may involve the use of satellites and aerial photography, with the latter impacting through noise and proximity to wildlife areas when conducted at a low altitude. Activities at ground level often require the use of bore holes, excavation pits and transect lines. The use of support equipment also leaves an impact on the environment. Exploration vehicles require access tracks, and even helipads, if left unrehabilitated, can have medium to long-term effects.

Main indicators

There are very few direct indicators that measure the impact of mineral exploration. Land and eco-system accounts are potential measurement tools to provide estimates of the impact of exploration. However, given the short term nature of this activity (compared to a mine in operation) any impact may be difficult to capture. While an accounts based process could be linked with rehabilitation expenditure and environmental management, the impact of exploration may not be significant compared with broader mining operations.

One alternative could be to use mineral and petroleum exploration expenditure, as a measure of overall activity. If this data were available by region then the impacts on the environment might be identifiable. It is worth noting that exploration expenditure is capitalised in the System of National Accounts and contributes to Gross Domestic Product.

8.3.2. Mining operation

Environmental impacts may also occur through mine establishment, ore extraction, mineral concentration and associated transport and infrastructure.

Inherent to mining and mineral processing operations is the generation of waste. These are mostly in the form of waste rocks, including surface waste rocks, rocks between ore bodies or layers and other unwanted material. This form of waste contains low or nil concentrations of the material desired and is often relatively toxic. Normally, waste rocks are stockpiled or

dumped adjacent to or near the excavation area, to be used later as backfill during reclamation.

Mineral processing produces wastes in grain sizes of fine sand, silt and clay fractions. Referred to as mine tailings, this type of waste contains significant concentrations of minerals that are not amenable to recovery at the time of initial mining. Tailings are usually disposed of in specially lined tailings dams, which are normally capped and revegetated to prevent the release of environmentally harmful materials. Other wastes from mining may be in the form of water and air pollution. The majority of air emissions associated with the mining industry includes dust, oxides of nitrogen, sulphur dioxide and carbon monoxide. Some of these come from mining vehicles and on-site plant machinery. Water quality may be affected by:

- *Acid mine drainage* - when large quantities of excavated rock containing sulphide minerals interact with water and oxygen to create sulphuric acid.
- *Heavy metal contamination and leaching* - heavy metals occur naturally in many ores, and are often released in the mineral extraction process. Metals (i.e. arsenic, cobalt, copper, cadmium, lead, silver and zinc) contained in an excavated or exposed rock may be leached out and carried downstream by flowing water.
- *Processing chemical pollution* - spilling, leaking or leaching of chemical agents (i.e. cyanide, sulphuric acid) from the minesite into nearby water bodies.
- *Erosion and sedimentation* - erosion of cleared land surface and dumped waste material resulting in sediment loadings into the adjacent water bodies, particularly during rainfall.

Environmental impacts resulting from mining are not limited to current mining operations. Mining residues and scars at old mining sites may also impact on local environments. The legacy of abandoned, unrehabilitated minesites has required comprehensive remediation efforts paid for with taxpayers' funds.

With the increasing extraction of unconventional gas resources, such as coal seam gas and shale gas there have been growing concerns over the environmental impact. The environmental impacts from these forms of extraction are not fully understood. Besides competing concerns of water and land usage, there are concerns over damage to both surface and underground water supplies. While indicators could be used, there needs to be accurate high quality data for decision makers. The accurate measurement of residuals is an important part of this process.

Main indicators

There are numerous indicators to consider for mine operations, with the measurement of residuals and the use of environmental inputs being the most significant. The indicators should cover all the groups of residuals, providing as much detail as possible.

Other indicators to consider are environmental ratios, such as air emissions per unit of value added. SEEA 2012 provides the following ratios:

- Productivity and intensity indicators

- Decoupling indicators
- Polluter pay indicators

Environment protection expenditure on rehabilitation and residuals should also be captured. Having this data will enable NSOs to produce both monetary and physical accounts in these areas. Coupling these with other accounts, such as water, land and eco-systems will provide rich detail for analysing the impact of mining on the environment. Building upon this, indicators on environment management activity by mining businesses can be developed capturing not only expenditure, but whether businesses have environment management plans, environmental protection income, or eco-efficiency savings.

8.3.3. Rate of mineral resource use

Minerals, oil and gas are finite and non-renewable. Their consumption today poses a threat of scarcity to future generations. For the mining industry to be sustainable it would need to maintain a rate of resource use which is reasonable, that is, its consumption of resources does not go beyond a level which can ensure the availability of resources for the future of the industry and the people. This rate of resource use depends on a variety of factors including the rate of use of existing known resources, the rate at which new resources are discovered, and the rate of recycling of existing materials. If discoveries or recycling do not keep pace with the rate of use, depletion will result.

Main indicators

The main indicator here is the rate of depletion. SEEA 2012 (p. 146) defines depletion "in physical terms,[as] the decrease in the quantity of the stock of a natural resource over an accounting period that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration." SEEA then states that for non-renewable resources "depletion is equal to the quantity of resource extracted." The reasoning behind this is that the regeneration of these resources is considerable in human time-scales.

The System of National Accounts (SNA) can provide a balance sheet approach to measuring changes in the stock of assets, however, it incorporates increases via discoveries that need to be separated out. Developing asset accounts for subsoil assets in conjunction with the SNA balance sheet approach will provide greater detail analysis. For more detail on these approaches see the 2008 SNA and SEEA 2012.

8.3.4. Use of energy and water by the mining industry

The mining industry is not a major user of energy compared to other industries, like manufacturing and electricity. The mining industry is not a high user of water, although most water consumed is sourced from the environment.

Main indicators

The main indicators to measure energy and water use here relate to intensity indicators such as the amount of energy per unit of value added. However, this may be difficult to measure as

many mining corporations will potentially produce their energy on own account or extract it free from the environment in the case of water usage.

In this case an economy-wide set of water and energy accounts will enable analysis of the supply and use of these products. By compiling these alongside the SNA supply and use tables an integrated estimate of intermediate usage is formed between the environment and the economy.

8.3.5. Environmental management

In order to mitigate the adverse impacts from mining activities mentioned above, the mining industry and government undertake environmental management measures. These measures are aimed at the prevention, reduction or elimination of pollution or any degradation of the environment. They include waste management and protection of biodiversity, landscape, air and climate. Protection mechanisms can be backed legislation from the government.

Environmental management involves the use of mechanisms in the development, operation and subsequent rehabilitation of mine sites. These mechanisms can be supported by regulation and legislation. In some countries the mining industry has introduced its own code for self-regulation.

Main indicators

The main indicators are the same as those above on environmental management activity and protection expenditure.

8.3.6. Rehabilitation

The amount of 'rehabilitation' to an area disturbed by mining can range from restoration, where an area is brought to as near as possible to pre-mining condition, to re-contouring and revegetating to a state that is non-polluting and compatible with environmental regeneration and community expectations (Hancock 1993). Re-contouring can involve construction of pit walls and waste dumps, covering of reactive materials, dismantling of buildings/plant, revegetation, and ongoing environmental quality monitoring.

Main indicators

The main indicator here is the amount of expenditure spent on rehabilitation. Another useful indicator is the proportion of businesses who undertake rehabilitation activity. However, the appropriate use of standards is required in reporting rehabilitation activity to be of any analytical benefit.

The development of eco-system accounts would be of great benefit, especially if they are timely. Then assessments pre- and post-mine operations of the impact of the mine and rehabilitation can occur.

8.3.7. Oil and gas disasters

The environmental impact from an oil or gas disaster is discussed separately due to the scale of the impact. While the disasters can potentially be captured from the measurement of residuals, it is also the immediacy of the occurrence rather than at a constant rate over time that needs consideration. Monetary measures such as disaster recovery expenditure and government fines are available as indicators over the short term. However, without developed eco-system account it may prove difficult to measure the longer term impact from the damage to the environment.

BOX 8.1 : Environmental Statistics in Kazakhstan

Kazakhstan produces a suite of statistics on the environment across a number of agencies, that measure:

- Hazardous waste,
- Environmental protection and sustainable development,
- Emissions of greenhouse gases by sector,
- Air pollution index (API) of 19 cities in Kazakhstan.
- Report on the costs of environmental protection, which includes the following indicators:
    - Costs by type of economic activity,
    - Fee for regulatory emissions (discharges) of pollutants by type of economic activity,
    - Fee for excess emissions (discharges) of pollutants by type of economic activity
    - Funds (lawsuits, fines) recovered for damages by type of economic activity,
    - Fee for the use of natural resources by type of economic activity,
    - Special payments of subsurface users by type of economic activity.

8.4. Environmental accounts and the mining industry

The SEEA 2012 recommends developing a suite of environmental accounts. The development of set of accounts would be valuable, although the level of detail for a country will be a determining factor in the usefulness of measuring the impact of mining on the environment. Hence, industry detail is priority, and if this is not available, then a satellite account approach may be more viable.

That is, environmental accounts could be developed in such a way to focus on the mining industry and its supply and use framework for energy, land, water, environmental protection expenditure, and other asset accounts.

The other important aspect of environmental accounts relates to their frequency. The SEEA 2012 recommends annual tables for its accounts, which is a similar practice for the supply and use tables in the SNA.

8.5. Data collection

Environmental statistics can be compiled from a variety of sources, including surveys, administrative data and satellite imagery. The important aspect for this handbook is to link these data sources with mining activity. While much of this linking could be down via analytical data sets such as environmental accounts, it is business surveys where environmental questions are asked that can also be a valuable instrument for data collection.

The FDES outlines succinctly the sources of environment statistics, and includes the following:

- Statistical surveys (e.g., censuses or sample surveys of population, housing, agriculture, enterprises, households, employment, and different aspects of environment management);
- Administrative records of government and non-government agencies in charge of natural resources as well as other ministries and authorities;
- Remote sensing and thematic mapping (e.g., satellite imaging and mapping of land use and land cover, water bodies or forest cover);
- Monitoring systems (e.g., field-monitoring stations for water quality, air pollution or climate);
- Scientific research;
- Special projects undertaken to fulfil domestic or international demand.

FDES2013 provides a detailed discussion on these data sources on pages 25 to 32.

CHAPTER 9. PRIORITY STATISTICS FOR ECONOMIES BASED ON NATURAL RESOURCES

This chapter highlights those indicators that NSOs should prioritise for users. This is based on discussion among the Steering Committee from consultation with key policy and decision makers. In part this follows on from discussion in previous chapters and is essentially a summary. For more details see the chapter on standard indicators.

Mining

- Total production of mining products, by value and quantity
- Share of value added of the mining industry to GDP
- Total exports and imports
- Total exports and imports of the mining products
- Export and import prices of mining products and economy-wide aggregates
- Terms of trade index (ratio of export price index to import price index)
- Intermediate consumption of the mining industry
- Total income of the mining industry, including gross operating surplus.
- Mining inventories, by value and quantity.
- Measurement of mining fixed capital investment
- Measurement of financial investment (including foreign investment, both direct and portfolio)
- Measurement of the impact of mining on government finances, including measuring of taxes on mining
- Labor productivity of mining industry
- Measurement of mining impact on national income, including balance of payments incomes associated with mining and measures of real gross domestic income and real net national disposable income
- Number of multinational enterprises in the mining industry
- Number of mining companies with FDI, percentage of FDI
- Main indicators for artisanal mining (total output, intermediate consumption, value added, taxes paid)

Society

- Number of mining industry employees
- Number of foreign employees in the mining industry,
- Number of engineering and technical employees
- Total compensation of mining employees
- Number of mining related deaths
- Number of accidents at mining operations

- Number of internal migrants, by region
- Number of international migrants, by region
- Household income and expenditure, by region
- Population, by sex, age group and region
- Number of households, by region

Environment

- Measurement of environmental inputs into mining, both market and non-market, incorporating measurement in terms of value.
- Measurement of residuals from mining
- Measurement of damage to land (including agricultural land) and ecosystems from mining activity and any subsequent rectification activity
- Asset accounts for natural resource, by resource types
- Depletion of natural resources, by resource types
- Cost of environmental protection
- Natural resource management

Priorities for NSOs will ultimately depend on the resources available to them. The priorities listed in this chapter are guidelines for where they might direct those resources.

CHAPTER 10. REMAINING ISSUES

Some of the issues that the manual is yet to consider are:

- Difficult conceptual areas,
- Difficult measurement issues, especially in relation to measuring the impacts from mining on society and the environment,
- Whether to expand the scope to other areas where natural resources are intertwined such as Agriculture, Tourism, Forestry and Fishing, and
- Implementation issues.

A dissemination strategy is potentially required although most NSOs are publishing these statistics in other frameworks, such as the national accounts and the environmental accounts. The issue to be determined is whether agencies would be willing to invest in compendiums that bring the disparate suite of statistics together or leave the status quo with data available in a range of publications. With most statistics available online, the cost of producing them is greatly reduced, especially if they are published elsewhere. Broad themes of mining statistics could be produced to cover the topics under consideration or provide links to other data publications.

An important aspect of this work will be the analytical commentary that places the data in context. This will enable users to understand and assess the impact of mining. On this basis NSOs must be acutely aware of what the user needs are, and whether their focus is on the economy, society or the environment.

At this stage the manual is not addressing green growth and green jobs, leaving this to other groups, such as the London Group to progress.

Finally the manual has not explicitly considered the Sustainable Development Goals, although the recommendations and guidelines in this handbook should not be inconsistent with these.

[**Draft Note:** At this stage of drafting the handbook manual there has been minimal discussion regarding remaining issues.]

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Annex 1.

THE STATISTICAL INDICATORS TO MEASURE THE CONTRIBUTION OF THE MINING INDUSTRY TO THE ECONOMY

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
1. Measurement of mining production in terms of quantity and value	1	Total production of mining products, by value	1	The value of production corresponds to the sum of the values of all goods and services that are actually produced within an establishment during the reference period, and become available for use outside that establishment, plus any products produced for own final use. Source: (International Recommendations for Industry statistics 2008, 4.186)	The value of production at basic prices is calculated as follows: Gross output = Value of shipments/turnover/sales of goods or services produced by the establishment + Value of sale/turnover/shipments of all goods and services purchased for resale in the same condition as received - Purchases of goods and services for resale in the same condition as received + Receipts for industrial work done or industrial services rendered to others + Other revenues + Value of own-account fixed assets + Change in work-in-progress + Change in inventories of finished goods + Change in inventories of goods purchased for resale in the same condition as received. Source: (International Recommendations for Industry Statistics 2008, 4.186).
	2	Total production of mining products, by quantity and by commodity and level of processing and contents	1	The production is understood to be a physical process, carried out under the responsibility, control and management of an institutional unit, in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. Source: (SNA-2008, 1.40)	All products produced as outputs must be such that they can be sold on markets or at least be capable of being provided by one unit to another, with or without charge. The SNA includes within the production boundary all production actually destined for the market, whether for sale or barter.
2. Measurement of prices of mineral commodities and the impact of mineral prices on the terms of trade, as well as mining-induced terms of	3	Export and import unit price of mining products	1	The export and import unit price of mining products tells the price for per unit, such as per kilogram, per ton, etc., of what homogenous mining products to exported and imported. It expresses you the cost per measurement unit of a mining product.	The export and import unit price in particular group of mining products is the total value of mining products divided by total volume of the products.
	4	Export and import price index of	2	An export price index (XPI) measures the rate of change in the prices of mining products sold by residents of that country to, and used by, foreign buyers. An import price	The two most commonly used index formulae are the Laspeyres and Paasche indices. The Laspeyres price index can be defined as the change in value of a basket of products whose

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
trade impacts on the rest of the economy		mining products		index (MPI) measures the rate of change in the prices of mining products purchased by residents of that country from, and supplied by, foreign sellers. Source: (Export and Import Price Index Manual 2009, IMF, Page: xiii).	composition is kept fixed as it was in the reference period 0. The Paasche index differs from the Laspeyres index in two respects. It uses a harmonic mean instead of an arithmetic average and the fixed period volumes or prices are those of the current period t. Source: (SNA-2008, 15.17, 15.18). The modified Laspeyres price index is used to estimate foreign trade index.
	5	Overall export and import price index	2	The higher-level indices up to and including the overall XMPIs are often calculated as young indices: that is, as weighted averages of the elementary price indices using weights derived from traded value shares in some earlier weight reference period. Source: (Export and Import Price Index Manual 2009, IMF, 1.309).	The required weight in calculation process is computed for share of each mining product, which was in base year total in export and import and define basket of foreign trade mining products. The exported and imported total value (cost) of mining products equals with quantity is multiplying by its unit price. The modified Laspeyres price index is used to estimate foreign trade index. $Vnt = P_{nt} * Q_{nt}$ V_{nt} – value (cost) n – product type t – current period P_{nt} – price of product type n in current period Q_{nt} – quantity of product type n in current period To compute price indexes for overall and group according to share of each mining commodities in the total exports and imports as considered as index weight. Share of each commodity in total export and import is calculated on comparison between value of each commodity and value of export and import in base year. $W_{no} = \frac{P_{no} \times q_{no}}{\sum p_{no} \times q_{no}}$

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
	6	Terms of trade index (ratio of export price index to import price index)	2	The indicator is obtained by dividing an export unit value index by corresponding import unit value index. To estimate terms of trade index which shows foreign trade character based on comparison between export prices overall index and import price overall index.	A terms of trade index is calculated for a country as the ratio of its XPI to its MPI—a simple enough calculation. Source: (Export and Import Price Index Manual 2009, IMF, 1.322).
3. Measurement of intermediate consumption in the mining industry, including energy inputs	7	Intermediate consumption of the mining industry	1	Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of mining production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. Of which, the cost of energy consists of value of the electricity and thermal energy consumed in the production process. Source: (SNA-2008, 6.213)	It must be measured at purchasers' prices, i.e. the prices the purchaser actually pays for it. It also, can be calculate as sum of the value for goods and services consumed for production process of mining products. It does not include expenditures by mining enterprises on valuables consisting of works of art, precious metals and stones and articles of jewellery fashioned out of them. It also does not include costs incurred by the gradual using up of fixed assets owned by the mining enterprise. However, intermediate consumption does include the rentals paid on the use of fixed assets, whether equipment or buildings, that are leased from other institutional units under an operating lease, and also fees, commissions, royalties, etc., payable under licensing arrangements. The intermediate consumption not including labor costs, capital costs and taxes on the production itself such as license fees, etc.
	8	Cost of energy in the mining industry	3	Cost of the electricity in mining industry covers the total energy used for production activity of the mining industry at the particular period. It includes the purchased, generated, and sold electricity. Source: (International Recommendation on Industry Statistics-2008)	Sum of the value of electricity consumed for all production activity.
	9	Consumption of the water in mining industry, by volume	3	Consumption of the water in mining industry covers the volume of water used for production activity of the industry at the particular period. It could not cover the drinking water.	Sum of the volume of water consumed for all production activity.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
	10	Share of the consumption of water, surface water and ground water in mining industry to total consumption of water	3	Consumption of the water covers the volume of water used for production activity of the mining industry at the particular period. It could not cover the drinking water. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. Source: (FDES-2013, 3.131) Ground water comprises water that collects in porous layers of underground formations known as aquifers. Source: (SEEA-CF, 5.481)	Sum of the volume of water consumed for all production activity.
	11	Share of the consumption of reused water to total consumption of water in mining industry	3	Reused water is wastewater supplied to a user for further use with or without prior treatment, excluding the reuse (or recycling) of water within mining industry. Source: (SEEA-CF, 3.207)	Share of the consumption of reused water to total consumption of water in mining industry is volume of reused water divided by total consumption of water in mining industry.
	12	Consumption of fuel in mining industry, by volume	3	Consumption of the fuel in mining industry covers the volume of fuel used for production activity of the industry at the particular period.	Sum of the volume of fuel consumed for all production activity.
	13	Cost of the management or consultant service in mining industry with foreign investment	3	Cost of the management or consultant service refers to all expenses in relation to management or consultant service in mining industry with foreign investment.	Total cost of management or consultant service basis cost of management and management or consultant service.
	14	Consumption of chemical products in the mining industry, by types of chemical product	3	Consumption of the chemical products in mining industry covers the volume of chemical products used for production activity of the industry at the particular period.	Sum of the volume of chemical products consumed for all production activity in particular type.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
4. Measurement of mining gross operating surplus	15	Total income of the mining industry	1	Mining gross operating surplus is the difference between total income and expenditure or income before tax of the mining activity at the current period.	
	16	Total expenditure of the mining industry	1		
5. Measurement of mining inventories	17	Inventories	2	Inventories are produced assets that consist of goods and services, which came into existence in the current period or in an earlier period, and that are held for sale, use in production or other use at a later date. Materials and supplies consist of all products that an enterprise holds in inventory with the intention of using them as intermediate inputs into production. Source: (SNA 2008, 10.131). Work-in-progress consists of output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units. Source: (SNA 2008, 10.134). Finished goods consist of goods produced as outputs that their producer does not intend to process further before supplying them to other institutional units. Source: (SNA 2008, 10.141). Goods for resale are goods acquired by enterprises, such as wholesalers or retailers, for the purpose of reselling them to their customers. Source: (SNA 2008, 10.145).	The information on inventories is required principally to measure the value of changes in inventories. Changes in inventories consist in the difference (positive or negative) between the value of inventories at the end and their value at the beginning of the reference period. They may also be measured by the value of entries into inventories less the value of withdrawals and of any recurrent losses of goods held in inventories. Source: (International Recommendations for Industry Statistics 2008, 4.167).

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
6. Measurement of mining fixed capital investment	18	Fixed assets, by type	2	Fixed assets are tangible or intangible assets used repeatedly or continuously in processes of production for more than one year as follows. Dwellings are buildings, or designated parts of buildings, that are used entirely or primarily as residences, including any associated structures, such as garages, and all permanent fixtures customarily installed in residences. Houseboats, barges, mobile homes and caravans used as principal residences of households are also included, as are public monuments identified primarily as dwellings. Source: (SNA 2008, 10.68). Other buildings and structures comprise non-residential buildings, other structures and land improvements. Source: (SNA 2008, 10.73). Machinery and equipment covers transport equipment, machinery for information, communication and telecommunications (ICT) equipment, and other machinery and equipment. Source: (SNA 2008, 10.82).	Gross fixed capital formation is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of nonproduced assets. Source: (SNA 2008, 10.32). The data item includes the value of all durable goods expected to have a productive life of more than one year and intended for use in the production process by the establishment (land, buildings, machinery, equipment and vehicles). Source: (International Recommendations for Industry Statistics 2008, 4.200). Fixed assets acquired from others should be valued at purchasers' prices, which should cover all costs directly connected with the acquisition and installation of the items for use. These costs of ownership transfer comprise the cost of purchase of the fixed assets on the market including taxes and fees paid to government, transport, delivery and installation charges, direct preliminary outlays, for example, for site clearance and the fees of architects, designers and engineers, and all legal costs. Indirect outlays for purposes of financing the acquisition of the fixed assets, for example, flotation costs in respect of security issues such as underwriters' commissions and registration charges, service charges in respect of loans, and expenses of special advertising campaigns are excluded. Such expenses are treated as intermediate consumption. For countries using the value added tax system, the deductible value added tax should be excluded. Source: (International Recommendations for Industry Statistics 2008, 4.202). Fixed assets acquired through barter are valued at their estimated basic prices plus any taxes payable and costs of

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
					ownership transfer. In principle, fixed assets produced on own account should also be valued in this manner. However, as this may be impracticable, particularly in the case of the construction of structures and other works and alterations, it may frequently be necessary to resort to valuing such own-account assets production at explicit cost, including any imputations that may be required in respect of the employed own-account labour. Source: (International Recommendations for Industry Statistics 2008, 4.203). Fixed assets produced by one establishment of a multi-establishment enterprise for the use of another establishment of the same enterprise should be valued by the receiving establishment as though purchased from outside the enterprise. Source: (International Recommendations for Industry Statistics 2008, 4.204). Disposal of fixed assets should be valued at the actual amounts realized rather than at book values. It should be noted that only disposal should be deducted, and not decreases in inventories of fixed assets owing to other causes. Source: (International Recommendations for Industry Statistics 2008, 4.205).
	19	Military weapons	3	Weapons systems include vehicles and other equipment such as warships, submarines, military aircraft, tanks, missile carriers and launchers, etc. Source: (SNA 2008, 10.87).	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
	20	Cultivated biological resources	3	Cultivated biological resources cover animal resources yielding repeat products and tree, crop and plant resources yielding repeat products whose natural growth and regeneration is under the direct control, responsibility and management of an institutional unit. Source: (SNA 2008, 10.88).	
	21	Costs of ownership transfer on non-produced assets	3	Purchasing a fixed asset is often a complicated procedure that may involve using lawyers to establish legal title to the asset, engineers to certify that it is in satisfactory working order and so on. There may also be taxes to be paid occasioned by the change of ownership of the item. Further, in the case of highly complex machinery there may be significant costs associated with delivery and installation that were not included in the purchase price. Source: (SNA 2008, 10.48).	
	22	Research and development	3	Research and development consists of the value of expenditures on creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and use of this stock of knowledge to devise new applications. This does not extend to including human capital as assets within the SNA. Source: (SNA 2008, 10.103).	Research and experimental development (R&D) on own account consists of the value of expenditures on creative work undertaken on a systematic basis in order to devise new applications. By convention, output of own-account R&D production by enterprises is valued at the sum of costs, including the cost of unsuccessful R&D. Source: (International Recommendations for Industry Statistics 2008, 4.220). The sum-of-costs approach for R&D undertaken on own account by enterprises is illustrated by the following identity: Output of own-account R&D = material and service costs (intermediate consumption) + Compensation of employees paid to R&D personnel + Other taxes less subsidies on production

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
					+ Depreciation of capital goods used in R&D + a net return to fixed capital Source: (International Recommendations for Industry Statistics 2008, 4.221).
	23	Mineral exploration and evaluation	3	Mineral exploration and evaluation consists of the value of expenditures on exploration for petroleum and natural gas and for non-petroleum deposits and subsequent evaluation of the discoveries made. Source: (SNA 2008, 10.106).	
	24	Computer software and databases	3	Computer software consists of computer programs, program descriptions and supporting materials for both systems and applications software. Databases consist of files of data organized in such a way as to permit resource-effective access and use of the data. Source: (SNA 2008, 10.110, 112).	The formula used to calculate output is similar to that for R&D. Source: (International Recommendations for Industry Statistics 2008, 4.224). The creation of a database will generally have to be estimated by a sum-of-costs approach. Source: (International Recommendations for Industry Statistics 2008, 4.225).
	25	Entertainment, literary or artistic originals	3	Entertainment, literary and artistic originals consist of the original films, sound recordings, manuscripts, tapes, models, etc., on which drama performances, radio and television programming, musical performances, sporting events, literary and artistic output, etc., are recorded or embodied. Source: (SNA 2008, 10.115).	Such works are frequently developed on own account which may be estimated by a sum-of-costs approach. Source: (International Recommendations for Industry Statistics 2008, 4.226).
	26	Other intellectual property products	3	Other intellectual property products include any such products that constitute fixed assets but are not captured as research and development, mineral exploration and evaluation, computer software and databases or entertainment, literary and artistic originals. Source: (SNA 2008, 10.117).	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
7. Measurement of financial investment (including foreign investment, both direct and portfolio) and associated incomes, including retained earnings	27	Financial investment	2	The financial account records transactions that involve financial assets and liabilities and that take place between residents and nonresidents. Source: Balance of Payments and International Investment Position, chapter 8.	It may be of interest to show balances for components of the financial account. For example, analysts may be interested in net flows for each functional category—such as net direct investment derived as net acquisition of direct investment assets less net incurrence of direct investment liabilities.
	28	Foreign direct investment	2	Foreign direct investment (FDI) is defined as the establishment of a lasting interest in and significant degree of influence over the operations of an enterprise in one economy by an investor in another economy. Source: Measuring International Investment by Multinational Enterprises, 4th edition, OECD, page 5, FDIStatistics, International Monetary Fund, 2003 page 23, 152, 154.	There are three main components to FDI statistics: 1) financial flows, which capture debt and equity investments between related parties in a specific period; 2) income, which represents the return on equity and debt investment to the direct investor in a specific period; and 3) positions, which are the value of the accumulated direct investment at a specific point in time—it is also referred to as the stock of FDI.
	29	Other investment	2	Other investment is a residual category that includes positions and transactions other than those included in direct investment, portfolio investment, financial derivatives and employee stock options and reserve assets. Source: SNA 2008 26.94, Balance of Payments and International Investment Position Manual 6th edition 6.61	Other investment includes the remainder of the following financial instruments: a. other equity; b. currency and deposits; c. loans (including use of IMF credit and loans from the IMF); d. non-life insurance technical reserves, life insurance and annuities entitlements, pension entitlements and provisions for calls under standardized guarantees; e. trade credit and advances; f. other accounts receivable/payable; and g. SDR allocations (SDR holdings are included in reserve assets).
	30	Cash flow	2	Cash flow is the money that comes in and goes out of a mining company. It is the generation of income and the payment of expenses. Cash inflows result from either the	Free cash flow (FCF) measures how much cash you generate after taking into account capital expenditures for such things

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				generation of revenue through the selling of goods and services, money borrowed, or money earned through investments. Source: http://study.com/academy/lesson/what-is-cash-flow-definition-calculation-example.html	buildings, equipment, and machinery. The formula is: FCF = Operating Cash Flow - Capital Expenditures Operating cash flow (OCF) is the measure of your company's ability to generate positive cash flow from its core business activities. Here's the formula: OCF = Earnings before Interest and Taxes + Depreciation + Amortization - Taxes
8. Measurement of impact of mining on trade statistics, including coherency with production statistics	31	Total sales of the domestic trade sector	2	Sales revenue is the total amount of the sales and services in the reporting time. Source: UNSD, 2008, "International recommendation of Internal Trade Statistics".	Trade sector entities shall be the sum of net sales.
	32	Total sales of the mining products at the domestic market, by types of minerals	1	Amount of sales of mining products sold in the domestic market, by type of minerals.	
	33	Total exports and imports	1	Export: A function of international trade where by goods produced in one country are shipped to another country for future sale or trade. Import: A goods or service brought into one country from another. Source: International Merchandise Trade Statistics, Concepts and Definitions 2010.	Total export: including in the country's direct exports of goods and re-export of foreign goods. Total import: including in the direct import of foreign goods and re-import of the country's goods
	34	Total exports and imports of the mining products	1	Export: Mining products produced in one country are shipped to another country for sale or trade. Import: Mining product brought into one country from another.	Total export and import of the mining products.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
9. Measurement of mineral exploration, discoveries and sub-soil reserves	35	Total output of mineral explorations, by types of mineral, by physical quantity	1		
	36	Number of discoveries, by mineral resources in physical quantity	1		
	37	Soil resource, by physical quantity	1		
10. Measurement of the impact of mining on government budget including measuring of taxes on mining	38	Corporation income tax	1	Taxes on the income of corporations consist of corporate income taxes, corporate profits taxes, corporate surtaxes, etc. Source: Glossary of Statistical Terms of OECD page 776, SNA 2008 8.58 b [OECD 1210].	Such taxes are usually assessed on the total incomes of corporations from all sources and not simply profits generated by production (GFSM2001, 1112; OECD, 1210)
	39	Value added tax, repayment of VAT	1	Value-added taxes (VAT) (11411) are taxes on goods or services collected in stages by enterprises but that are ultimately charged in full to the final purchasers. Source: SNA 2008 7.89, 6.55-6.62, GFSM2001 11411.	
	40	Royalty	1	"Royalties" is the term often used to describe either the regular payments made by the lessees of subsoil assets to the owners of the assets (these payments are treated as rents in the System of National Accounts (SNA)) or the payments made by units using processes or producing products covered by patents (these are treated as purchases of services produced by the owners of the patents in the SNA). Source: SNA 2008 7.110, 7.160	
	41	Fee for exploration and mining special	1		

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		permit of the mineral resources			
	42	Other royalty	1		
	43	Cumulative royalty	2	A term that most commonly refers to a single company having to pay patent license fees/royalties to numerous companies in the same or a similar field. Source: Technology and IP law Glossary	
	44	Exports duties	2	Export duties consist of general or specific taxes on goods or services that become payable when the goods leave the economic territory or when the services are delivered to non-residents; profits of export monopolies and taxes resulting from multiple exchange rates are excluded. Source:OEDC-Glossary https://stats.oecd.org/glossary/detail.asp?ID=910, Glossary of Statistical Terms page 280.	The contributions to percent change in a real aggregate, such as real GDP, provide a measure of the composition of growth in the aggregate that is not affected by the nonadditivity of its components. This property makes contributions to percent change a valuable tool for economic analysis. The contribution to percent change (C% $\Delta i,t$) in an aggregate in period t that is attributable to the quantity change in component i is defined by the formula aggregate.
	45	Contributions and donations to the local government and individuals from the mining enterprises	2	Employers' social contributions are social contributions payable by employers to social security funds or other employment-related social insurance schemes to secure social benefits for their employees. Source: A Guide to the National Income and Product Accounts of the United States Page 28, Balance of Payments and International Investment Position Manual 6th edition 11.22	The contributions to percent change in a real aggregate, such as real GDP, provide a measure of the composition of growth in the aggregate that is not affected by the nonadditivity of its components. This property makes contributions to percent change a valuable tool for economic analysis. The contribution to percent change (C% $\Delta i,t$) in an aggregate in period t that is attributable to the quantity change in component i is defined by the formula aggregate.
11. Measurement of productivity in the mining industry	46	Total productivity of mining industry	1	Productivity expresses the relationship between the output of goods and services (real output) and the various inputs required for production.	Ratio between the output volume and the volume of inputs

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				Productivity is commonly defined as a ratio between the output volume and the volume of inputs. In other words, it measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output. Source: Measuring Productivity, OECD manual, 2001, page 12, http://statsmauritius.govmu.org/English/Documents/product.pdf, http://www.oecd.org/std/productivity-stats/40526851.pdf	
	47	Total factor productivity of mining industry	1	A measure that takes account of the contributions of both labour and capital to growth in output is multifactor productivity (MFP), which is sometimes referred to as total factor productivity (TFP). The advantage of using MFP as the measure of productivity is that it includes effects not included in the labour and capital inputs. Source: SNA 2008- 16.64, http://statsmauritius.govmu.org/English/Documents/product.pdf	multifactor productivity index= output index/ multifactor input index * 100
	48	Labor productivity of mining industry	1	Labour productivity is a revealing indicator of several economic indicators as it offers a dynamic measure of economic growth, competitiveness, and living standards within an economy. It is the measure of labour productivity (and all that this measure takes into account) which helps explain the principal economic foundations that are necessary for both economic growth and social development. Source: Labour Productivity Indicators, OECD, 2008, page from 5.	Labour productivity is equal to the ratio between a volume measure of output (gross domestic product or gross value added) and a measure of input use (the total number of hours worked or total employment). Labour productivity = volume measure of output / measure of input use
	49	Fixed capital productivity of	1	Measures of capital productivity, calculated by dividing the volume of output by an index of capital services provided, suffer from similar drawbacks since they do not capture the	The capital productivity index shows the rate of change in output per unit of capital. Capital Productivity Index= Output

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		mining industry		effects of the amount of labour employed and the efficiency and composition of the capital inputs. Source:SNA-200819.63, http://statsmauritius.govmu.org/English/Documents/product.pdf	index/ capital input index* 100
	50	Main raw material productivity of mining industry	1	The indicators "energy productivity" and "raw material productivity" are used for measurement purposes. Source: Environment-Economic Accounting (EEA), Federal Statistical Office German, Jan 2010, page from 2	Raw material productivity is derived from the ratio between gross domestic product and abiotic material used.
	51	Energy productivity of mining industry	1	International Energy Agency, Key World Energy Statistics 2014 (Paris: IEA, 2014) defines energy productivity as the volume of services or products that can be generated per unit of energy. It is not the same as energy efficiency, which measures the inverse, i.e., how much energy is needed to produce a given level of output. Source: A new approach to measuring the Energy Productivity of an Economy, Chi Yuan Liang, Research Fellow The Institute of Economics, Academia Sinia, International Energy Agency, Key World Energy Statistics 2014 (Paris: IEA, 2014)	Energy Productivity, which is defined as the ratio of output divided by energy consumption, is a useful indicator for understanding the energy efficiency of an industry or an economy. The GDP from the National Income Accounts/ The Energy Consumption from the Energy Balance Table
12. Measurement of construction activity associated with the mining industry	52	Construction, capital repairs and maintenances associated with the mining industry, by type.	2	Construction work includes the activities of building of houses, bridges, banks as engineering construction and creating of fixed capital, expansion, repairs, restoration. Residential building is a building should be regarded as residential building when more than half of the floor area is used for dwelling purposes. Non residential building is a building is regarded as a non-residential building when the minor part of the building (i.e. less than half of its gross floor area) is used for dwelling	International Recommendations for Construction Statistics, UN, 1997 and Bulletin of Housing and Building Statistics for Europe and North America, UNECE, Geneva, 2000

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				purposes. Civil engineering construction includes all construction work not classified under building construction, that is, construction of railways, roads, bridges, highways, airports, water and sewage, dams and irrigation, etc.	
	53	Capitalized repairs and maintenances, by type	2	Repairs and maintenance covers all construction work not included under new construction. Such repairs may be broken down into capital repairs and current repairs and maintenance.	International Recommendations for Construction Statistics, UN, 1997
13. Measurement of impact of mining on transportation	54	Freight turnover of the mining products, by type and mln.ton km	3	**Freight turnover** is estimated by multiplying the total amount of the weight of transported cargo by the shipping distance. **Railway**: Unit of measurement of goods transport which represents the transport of one tonne of goods over a distance of one kilometre. Source: Glossary for Transport Statistics (UNECE) AV-20 **Road**: Unit of measurement of goods transport which represents the transport of one tonne by road over one kilometre. Source: Glossary for Transport Statistics (UNECE) B.V-22 **Water**: Unit of measurement of goods transport which represents the transport of one tonne by inland waterways over one kilometer Source: Glossary for Transport Statistics (UNECE) C.V-21	The distance to be covered is the distance actually travelled on the considered network. To avoid double counting each country should count only the km performed on its territory. If it is not available, then the distance charged or estimated should be taken into account. The distance to be taken into consideration is the distance actually run. The distance taken into account is the distance performed in the

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
					reporting country.
	55	Carried freight of the mining products, by ton	3	Amount of mining products that are carried by railway, road, or water vehicles. Source: Glossary for Transport Statistics (UNECE) A.V-16 Source: Glossary for Transport Statistics (UNECE) B.V-18 Source: Glossary for Transport Statistics (UNECE) C.V-17	Total volume of mining products that are carried by railway, road, or water vehicles. This includes all packaging and equipment, such as containers, swap-bodies or pallets as well as road goods vehicles carried by railway, road, or water.
14. Measurement of other economic activity to support the mining industry, including role of input-output analysis	56	Total supply, by products and economic activities	2	The amount of a product available for use within the economy must have been supplied either by domestic production or by imports. The same amount of the product entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation (including changes in inventories) or exports. Source: SNA-2008, 14.4.	Output + imports = intermediate consumption + final consumption + capital formation + exports Total supply by product = Total use by product
	57	Total use, by products and economic activities	2	A use table can be viewed as a rectangular table with four quadrants, two in the upper part and two in the lower part. The upper left quadrant consists of a sub-matrix showing the use of different products by different groups of producing units. In other words, this quadrant contains intermediate consumption, disaggregated by product in the rows and by industries in the columns. The upper right quadrant consists of a sub-matrix showing the use of different products by final consumers, a sub-matrix for exports and a sub-matrix showing the use of different products for capital formation. Together these three submatrices show final demand. The lower left quadrant contains information on value added disaggregated to show the elements of the	Total use by product=Intermediate consumption by product and by industry+Final uses by product and by category

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				generation of income account, that is compensation of employees, gross operating surplus or gross mixed income and taxes less subsidies on production. Source: SNA-2008, 14.84.	
		'IOT analysis. In which:			
	58	o Production multiplier, by economic activities	3	An output multiplier for a sector j is defined as the total value of production in all sectors of the economy that is necessary at all stages of production in order to produce one unit of product j for final demand. Source: Eurostat Manual of Supply, Use and Input-Output Tables 15.1.7	As we are assuming constant returns to scale, the effect on the economy is seen by multiplying (I-A)〗^(-1) by a final demand vector that has unity in the sector we are concerned with and zero elsewhere, i.e. the vector of value multipliers is defined as 〖i^' (I-A)〗^(-1). This is just the column sum of the Leontief inverse. Here (i) is the unit vector and a prime indicates the transpose
	59	o Income multiplier, by economic activities	3	Income multipliers attempt to identify the impacts of final demand changes on income received by households (labour supply). the static input-output models is used to calculate the direct and indirect requirements for wages which are incorporated in one unit of output for final demand. Source: Eurostat Manual of Supply, Use and Input-Output Tables 15.1.7	Z = B(I-A)(-1) Direct and indirect requirements for wages B = vector of input coefficients for wages I = unit matrix A = matrix of input coefficients for intermediates Z = vector with results for direct and indirect requirements for wages
	60	o Labor multiplier, by economic activities	3	When employment multipliers are calculated, the major difference to the calculation of the wage content of products is that this time physical labour input coefficients are used instead of monetary labour input coefficients. Source: Eurostat Manual of Supply, Use and Input-Output Tables 15.1.7	Z = E(I - A)(-1) Direct and indirect requirements for labour E = matrix of input coefficients for labour (1.000 persons per millions of DEM of output) Z = matrix with results for direct and indirect requirements for labour (persons)
	61	o Backward and forward linkages, by economic	3	Impact models can measure the effect an industry's production has on other industries in	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		activities		the economy in two ways. If an industry increases its production, there will be increased demand on the industries that produce the intermediate inputs. Models that measure impacts based on this type of relationship are called backward-linkage models. If an industry increases its production, there will also be an increased supply of output for other industries to use in their production. Models that measure impacts based on this type of relationship are called forward-linkage models. Source: Eurostat Manual of Supply, Use and Input-Output Tables 15.1.7	
15. Measurement of 'down-stream' economic impacts of mining, including the manufacturing of mineral products	62	The impacts of the mining to the other economic industries' productions, especially:			
	63	o Total production of the electricity, gas, steam and air conditioning supply	3	Total production of the electricity, gas, steam and air conditioning supply	The total amount of electricity, thermal energy and water supply sector.
	64	o Total production of the water supply; sewerage, waste management and remediation activities	3	Total production of the water supply, sewerage, waste management and remediation.	The total amount of water supply, sewerage, waste management and remediation sector.
	65	o Total production of the wholesale and retail trade;	3	Total production of the wholesale and retail trade; repair of motor vehicles and motorcycles.	The total amount of wholesale and retail trade; repair of motor vehicles and motorcycles sector.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		repair of motor vehicles and motorcycles			
	66	o Total production of the transportation and storage	3		
	67	o Total imports of the heavy machinery, mechanism and equipments	3	Total imports of the heavy machinery, mechanism and equipments.	The total value of imported heavy machinery, mechanism and equipments.
16. Measurement of infrastructure to support mining activity	68	Fixed telephone lines per 100 inhabitants	2	Fixed telephone lines refer to telephone lines that connect a subscriber's terminal equipment to the public switched telephone network (PSTN) and that have a dedicated port on a telephone exchange. Source: Core ICT indicators 2010, Partnership on measuring ICT for development, ITU, page 12, indicator A1	Fixed telephone lines per 100 inhabitants is calculated by dividing the number of fixed telephone lines by the total population and then multiplying by 100.
	69	Proportion of households with a radio	2	A radio is defined as a device capable of receiving broadcast radio signals, using common frequencies, such as FM, AM, LW and SW. A radio may be a stand-alone device, or it may be integrated with another device, such as an alarm clock, an audio player, a mobile telephone or a computer. Source: Manual for Measuring ICT Access and Use by Household and Individuals, 2014 edition, ITU, page 45, indicator HH1	The proportion of households with a radio is expressed as a percentage and is calculated by dividing the number of in-scope households with a radio by the total number of in-scope households, and then multiplying the result by 100.
	70	Proportion of households with a television	2	A television (TV) is a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. A television set is typically a stand-alone device, but it may also be integrated with another	The proportion of households with a TV is expressed as a percentage and is calculated by dividing the number of in-scope households with a TV by the total number of in-scope households, and then multiplying the result by 100.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				device, such as a computer or a mobile telephone. Source: Manual for Measuring ICT Access and Use by Household and Individuals, 2014 edition, ITU, page 46, indicator HH2	
	71	Proportion of individuals using a mobile cellular telephone	2	A mobile (cellular) telephone refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems and technologies such as IMT-2000 (3G) and IMT-Advanced. Users of both postpaid subscriptions and prepaid accounts are included. Source: Manual for Measuring ICT Access and Use by Household and Individuals, 2014 edition, ITU, page 60, indicator HH10.	The proportion of individuals using a mobile telephone is expressed as a percentage and is calculated by dividing the total number of in-scope individuals using a mobile telephone by the total number of in-scope individuals, and then multiplying the result by 100.
	72	Proportion of businesses using computer	2	A computer refers to a desktop computer, a laptop (portable) computer or a tablet (or similar handheld computer). It does not include equipment with some embedded computing abilities, such as smart TV sets, and devices with telephony as their primary function, such as smartphones. Source: Core ICT indicators 2010, Partnership on measuring ICT for development, ITU, page 36, indicator B1.	The proportion of businesses using computers is calculated by dividing the number of in-scope businesses using computers during the reference period by the total number of in-scope businesses. The result is then multiplied by 100 to be expressed as a percentage.
	73	Proportion of households with Internet	2	The Internet is a worldwide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer − it may also be by mobile telephone, tablet, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network. Source: Manual for Measuring ICT Access and Use by Household and Individuals, 2014 edition, ITU, page 53,	The proportion of households with Internet is expressed as a percentage and is calculated by dividing the number of in-scope households with Internet by the total number of in-scope ouseholds, and then multiplying the result by 100.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				indicator HH6.	
	74	Proportion of businesses using the Internet	2	The Internet is a worldwide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files. Source: Core ICT indicators 2010, Partnership on measuring ICT for development, ITU, page 37, indicator B2.	The proportion of businesses using the Internet is calculated by dividing the number of in-scope businesses using the Internet by the total number of in-scope businesses. The result is then multiplied by 100 to be expressed as a percentage.
	75	Energy and public services	1	Public service includes electricity supplied and services rendered to municipalities or divisions or agencies of State or Federal governments under special contracts, agreements, or service classifications applicable only to public authorities. Source: ISIC divisions: 33, 36-39, 45-96 and 99, excluding ISIC 8422.	
	76	Petrol and gas tubes	1		
	77	Electric adjustment assets	1		
	78	Allocation and transmission system	1	An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers or is delivered to other electric systems. Source:http://www.eia.gov/tools/glossary/index.cfm?id=T	
	79	Water supply purification	1	Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal is to produce water fit for a specific purpose. Most water is disinfected for human consumption (drinking water), but water purification may	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				also be designed for a variety of other purposes, including fulfilling the requirements of medical, pharmacological, chemical and industrial applications. Source:https://en.wikipedia.org/wiki/Water_purification	
17. Measurement of mining impact on national income, including balance of payments incomes associated with mining and measures of real gross domestic income and real net national disposable income	80	Value added of mining sector, by volume change	1	When gross domestic product (GDP) is derived by summing final domestic expenditures and exports and subtracting imports, or by subtracting intermediate consumption from output and adding taxes less subsidies on products, volume measures of GDP can be obtained provided that the volumes being aggregated are additive, (that is, are based on the Laspeyres formula). Source: (SNA 2008, 15.132-138).	The gross value added of an establishment, enterprise, industry or sector is measured by the amount by which the value of the outputs produced by that establishment, enterprise, industry or sector exceeds the value of the intermediate inputs consumed. This may be written as: where the Q's refer to outputs, P's their basic prices, q's to intermediate inputs and p's their purchasers' prices. Value added in year t at prices of year t is given by: while value added in year t at the prices of the base year, 0, is given by: This measure of value added is generally described as being obtained by "double deflation" as it can be obtained by deflating the current value of output by an appropriate (Paasche-type) price index and by similarly deflating the current value of intermediate consumption. Source: (SNA 2008, 15.134).
	81	Annual change of value added of mining sector	1	Annual changes refer to annual changes in levels expressed over the previous year. Annual growth rates are annual rates of change expressed over the previous year. Source: "Glossary of statistical terms" oecd 2007	Annual change=Xt-Xt-1; Percent_change=Xt/Xt-1*100; X-value added of mining sector; t- current year; t-1-previous year
	82	The share of value added of mining sector to the GDP	1		The share of value added of mining sector is value added of mining sector divided by GDP.
	83	GNI	1	Primary incomes generated in the production activity of resident producer units are distributed mostly to other resident institutional units; however, part of them may go to	GNI is equal to GDP less primary incomes payable to non-resident units plus primary incomes receivable from non-resident units. In other words, GNI is equal to GDP less taxes

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				non-resident units. Symmetrically, some primary incomes generated in the rest of the world may come from resident units. This leads to the definition and measurement of gross national income (GNI). Source: (SNA 2008, 2.143).	(less subsidies) on production and imports, compensation of employees and property income payable to the rest of the world plus the corresponding items receivable from the rest of the world. Source: (SNA 2008, 2.143).
	84	Annual change of GNI	1	Annual changes refer to annual changes in levels expressed over the previous year. Annual growth rates are annual rates of change expressed over the previous year. Source: Glossary of statistical terms" OECD 2007	Annual change=Xt-Xt-1; Percent_change=Xt/Xt-1*100; X-GNI; t-current yerar; t-1-previous year
	85	GNI per capita	1	Per capita growth rates in real national income or in real actual consumption generally provide a better measure of the changes in the average "welfare" of a country's population than the changes in GDP volumes. GDP is a measure of production within a country but the inflows or outflows of income from or to the rest of the world can have a significant effect on both the level and growth rates in real national income per capita. Source: (SNA 2008, 19.14).	GNI per capita is gross national income divided by midyear population.
	86	RNND /NDI/	1	Primary incomes receivable by resident institutional units may be used in part to make transfers to non-resident units and resident units may receive transfers originating out of primary incomes in the rest of the world. Gross national disposable income measures the income available to the total economy for final consumption and gross saving. By deducting the consumption of fixed capital from gross national disposal income, net national disposable income is obtained. National disposable income is the sum of disposable income of all resident institutional units or sectors. Source: (SNA 2008, 2.145).	Gross national disposable income is equal to GNI less current transfers (other than taxes, less subsidies, on production and imports) payable to non-resident units, plus the corresponding transfers receivable by resident units from the rest of the world. Source: (SNA 2008, 2.145).

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
18. Measurement of national wealth	87	Natural resource (oil, coal, natural gas, minerals etc.)	1	Natural resources are natural assets (raw materials) occurring in nature that can be used for economic production or consumption. Natural resources cover mineral and energy resources, soil, water and biological resources. Source: 'Glossary of Environment Statistics, Studies in Methods, Series F, No. 67, United Nations, New York, 1997, page 51, SNA 2008 10.15, SEEA-CF 2.101, 5.18, https://stats.oecd.org/glossary/detail.asp?ID=1740.	Natural resources are a sub-set of environmental assets. Natural resources include all natural biological resources (including timber and aquatic resources), mineral and energy resources, soil resources and water resources. All cultivated biological resources and land are excluded from scope.
	88	Produced assets (machinery and equipments, buildings and urban land)	1	Produced assets are non-financial assets that have come into existence as outputs from processes that fall within the production boundary of the SNA. Source: SNA 2008- 10.9a, 10.10, A3.51	
	89	Human resource (number of employees)	1	The resource that resides in the knowledge, skills, and motivation of people.	
19. Measurement of impact of mining on regional economies (including regional prices and regional housing markets)	90	Consumer price index, by goods and regions	2	Consumer price indices (CPIs) are index numbers that measure changes in the prices of goods and services purchased or otherwise acquired by households, which households use directly, or indirectly, to satisfy their own needs and wants. Source: (Consumer price index manual: Theory and practice 2004, 1.3)	$P^{(t/0)}=(\sum_i p_i^t \ q_i^b)/(\sum_i p_i^0 \ a \ i^b)$ p_i^t = price for i^{th} item (or product) at time t. p_i^0 = price for ith product (or item) at time 0, the price reference period (or base period) qib = quantity of ith item purchased during the weight (or basket) reference period. Source: (Practical guide for producing consumer price index 2009, 10.4)
	91	Housing price index, by regions	3	The housing price index (HPI) shows the changes of residential properties purchased by households (flats, detached houses, terraced houses, etc.) both newly-built and existing ones, independently of their final use and independently of their previous owners. Source: (http://ec.europa.eu/eurostat/statistics-	Four main methods have been suggested in the literature to control for changes in the amounts of the property characteristics: stratification or mix adjustment, repeat sales methods, hedonic regression methods, and the use of property assessment information. Stratification of transactions according to some of the price determining characteristics is a

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				explained/index.php/Housing_price_statistics_-_house_price_index)	straightforward and computational simple way to adjust for changes in the quality mix of the samples in different time periods. By defining a number of reasonably homogeneous strata or cells, the average selling price within each cell can be used as a (proxy to a) constant quality price for that type of property. Regular index number theory can then be applied to aggregate up the average prices by cell into an overall index. Such stratification methods are also known as mix adjustment methods. The repeat sales method addresses the quality mix problem by comparing properties that have sold more than once over the sample period. Restricting the comparison to units that have sold repeatedly ensures that the price relatives compare like with like, provided that the quality of the houses remained unchanged. The standard repeat sales method is based on a regression model where the repeat sales data pertaining to all periods are pooled. Hedonic regression methods can in principle adjust for such quality changes in addition to changes in the quality mix of the samples. These methods utilize information on the relevant property characteristics to estimate quality adjusted price indices using regression techniques, though it may prove difficult to sufficiently control for location. Many countries tax real estate property and are likely to have an official property valuation office that provides periodic appraisals of all taxable real estate properties. Assessment-based methods combine selling prices with appraisals to compute price relatives (sale price appraisal ratios) and control for quality mix changes. Source: (Handbook on Residential property prices indices (RPPIs), 2013, 3.20, 3.21, 3.22, 3.23, 3.24)
20.General measurement issues, including dealing with multinational	92	Number of multinational enterprises at the mining industry	3	Number of multinational enterprises in mining sector that is an organization that owns or controls production of goods or services in one or more countries other than their home country.	Total number of multinational enterprises in mining sector.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
enterprises, dealing with confidentiality issues, correction of 'off year' reporting, ensuring coherence of information from different sources and consistency thereof, by developing a coordinated approach to large mining projects, measuring informal mining activity)	93	Number of mining companies with FDI, percentage of FDI	3	Number of mining companies with FDI that are registered in Business Register. A foreign direct investment (FDI) is an investment made by a company or entity based in one country, into a company or entity based in another country.	Total number of mining companies with FDI.
	94	Main indicators of the artisanal mining (total output, intermediate consumption, value added, total tax paid, contributions to the local government, number of employees, land damage, remediation)	3	A citizen who is not a member of any partnership but explores mineral resources through artisanal mining. Of them total output, intermediate consumption, value added, total tax paid, contributions to the local government, number of employees, land damage, remediation.	
21. Measurement of the procurement of nationally produced goods and services	95	Total procurement of nationally produced goods and services of the mining enterprises	2		

THE STATISTICAL INDICATORS TO MEASURE THE IMPACT OF THE MINING INDUSTRY ON THE SOCIAL SECTOR

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
1. LABOR FORCE					
1.1. Measuring employment in the mining industry	96	Number of employees at the mining sector	1	Employees are all those workers who hold the type of job defined as "paid employment jobs" in mining industry. Paid employment jobs are those jobs where the incumbents hold explicit (written or oral) or implicit employment contracts which give them a basic remuneration which is not directly dependent upon the revenue of the unit for which they work (this unit can be a corporation, a non-profit institution, a government unit or a household). Some or all of the tools, capital equipment, information systems and/or premises used by the incumbents may be owned by others, and the incumbents may work under direct supervision of, or according to strict guidelines set by the owner(s) or persons in the owners' employment. Persons in "paid employment jobs" are typically remunerated by wages and salaries, but, may be paid by commission from sales, by piece-rates, bonuses or in-kind payments such as food, housing or training. Source: International Labour Organization (ILO) Resolutions Concerning International Classification of Status in Employment Adopted by the 15th International Conference of Labour Statisticians, January 1993, para. 6.	(a1) "at work": persons who during the reference period performed some work for wage or salary, in cash or in kind; (a2) "with a job but not at work": persons who, having already worked in their present job, were temporarily not at work during the reference period and had a formal attachment to their job. This formal job attachment should be determined in the light of national circumstances, according to one or more of the following criteria: (i) the continued receipt of wage or salary; (ii) an assurance of return to work following the end of the contingency, or an agreement as to the date of return; (iii) the elapsed duration of absence from the job which, wherever relevant, may be that duration for which workers can receive compensation benefits without obligations to accept other jobs;
	97	Number of foreign employees at the mining sector, by nationality	1	A person who migrates or who has migrated from one country to another with a view to being employed in mining industry other than on his own account. Source: ILO	
	98	Number of engineering and	1	Physical and engineering science technicians perform technical tasks to aid in research on and the practical	Tasks performed usually include: undertaking and carrying out technical work related to chemistry, physics, geology,

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		technical staffs		application of concepts, principles and operational methods particular to physical sciences including such areas as engineering, technical drawing or economic efficiency of production processes. Source: International Standard Classfication of Occupation ISCO-08, International Labour Office, Geneva, 2012, page 170	meteorology, astronomy, engineering, or technical drawing; setting up, operating, and maintaining laboratory instruments and equipment, monitoring experiments, making observations, and calculating and recording results; preparing materials for experimentation; conducting tests of systems; collecting and testing samples; recording observations and analyzing data; preparing, revising and interpreting technical drawings, wiring diagrams, circuit board assembly diagrams, or layout drawings.
1.2. Measuring the demographic characteristics of the mining labor	99	Mining labor, by working age	2	For statistical purposes, the working age population comprises all persons above a specified minimum age threshold for which an inquiry on mining activity is made. Source: https://www.ilo.org/ilostat/faces/home/statisticaldata/conceptsdefinitions?_afrLoop=4284023318850814#%40%3F_afrLoop%3D4284023318850814%26_adf.ctrl-state%3D303iff4lm_4	For purposes of international comparability, the working age population is commonly defined as persons aged 15 years and older, but this varies from country to country. In addition to using a minimum age threshold, certain countries also apply a maximum age limit. Adoption of a specified upper age limit means that all persons above that age limit are excluded from the count of the working age population. Most countries, however, do not use a maximum age limit. Data by age are provided according to 5-year: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74 and 75+. Whenever this data was not available, 10-year age bands are used: 15-24, 25-34, 35-44, 45-54, 55-64 and 65+.
	100	Mining labor, by sex	2		
	101	Mining labor, by level of education	2		
	102	Mining labor, by occupation	2	Information on occupation provides a description of the set of tasks and duties which are carried out by, or can be assigned to, one person. Persons are classified by	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				occupations through their relationship to a present job, for employed persons, or a past job, for persons who are unemployed. Topics disaggregated by occupation are provided according to the latest version of the International Standard Classification of Occupations (ISCO) available for that year. Data may have been regrouped from the national occupational classification, which may not be strictly compatible with ISCO. Source: https://www.ilo.org/ilostat/faces/home/statisticaldata/conceptsdefinitions?_afrLoop=4284023318850814#%40%3F_afrLoop%3D4284023318850814%26_adf.ctrl-state%3D303iff4lm_4	
1.3. Measuring of the impact of the supply of labour on other parts of the economy due to changes in the demand for labour from the mining industry.	103	Employment elasticity of mining industry	1	The employment elasticity is defined as the average percentage point change in employment for a given employed population group associated with a 1 percentage point change in output over a selected period.	
2. INCOME					
2.1. Measuring mining wages and salaries, total and averages; 2.2. Measuring the distribution of mining incomes, including gender distributions.	104	Total compensation of employees of the mining industry	1	The concept "Compensation employees" which is defined as: The total renumeration, in cash or in kind, payable by enterpirse to an employee in return for work done by the latter during the accounting period. Source: SNA 2008	The aggregate of compensation received by all the employees of the mining sector. Compensation of employees has two main components: 1. Wages and salaries payable in cash or in kind, 2. the value of the social contributions payable by employers.
	105	Monthly average wages and salaries of employees of the mining industry, by sex and type of	2	Wages and salaries include the values of any social contributions, income taxes, etc.., payable by the employee even if they are actually withheld by the employer for administrative convenience or other reasons and paid directly to social insurance schemes, tax authorities, etc,.., on behalf	The monthly average wage and salaries employees of the mining sector is calculated by weighted wage and salaries of employees of the mining sector dividing by it by the total number of employees of the mining sector.

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
		occupations		of the employee. Wage and salaries payable to employees in cash regular intervals including: Direct wages and salaries, renumeration for time not worked, bonuses and gratuities, food, drink, fuel and other payment in cash. It can be disaggregation by sex and type of occupations. Source: SNA 2008, ILO resolution 1973	
	106	Real wage index of the employees of the mining industry	2	Real wages are goods and services which can be purchased with wages or are provided as wages, must be distingished from the broader concept of real income and the complex concept of level of living to which they are related. Source: ILO resolution 1954	The real wage index is calculated by the nominal wage index dividing it by the consumer price index and multiply by 100.
	107	Labour cost of the empoyees of the mining industry	2	The statistics of labour cost comprises renumeration for work performed, payment in respect of time paid for but not worked, bonuses and gratuities, the cost of food, drink and other payment in kind, cost of workers' housing borne by employer, employers' social security expenditures, cost to the employer for vocational training, welfare services and miscellaneous items, such as transport of workers, work clothes and requitment, together with taxes regarded as labour cost. Source: ILO, Resolution concerning statistics of labour cost, adopted by the 11th International Conference of Labour Statisticians, Geneva, 1966	The aggregate of labour cost received by all the employees of the mining sector.
3. HEALTH AND PRODUCTIVITY					
3.1. Measuring workers conditions and industrial relations in the mining industry	108	Occupational safety of the mining employees (safety workwear and facilities etc.)	1	The protection of workers' lives and physical well-being by eliminating or controlling risks in the working environment or the system of work within which workers operate. Source: http://www.ilo.org/thesaurus/default.asp	
3.3. Measuring the	109	Life expectancy at	1	Life expectancy at birth is defined as how long, on average, a	According to statistics, it suggests that the mortality rate at

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
impact of mining on workers' health and the health of the community generally		birth, by sex and regions		newborn can expect to live, if current death rates do not change. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. If rates are falling, actual life spans will be higher than life expectancy calculated using current death rates. Life expectancy at birth is one of the most frequently used health status indicators. Gains in life expectancy at birth can be attributed to a number of factors, including rising living standards, improved lifestyle and better education, as well as greater access to quality health services. This indicator is presented as a total and per gender and regions and is measured in years. Source: https://data.oecd.org/healthstat/life-expectancy-at-birth.htm	the time of a child's birth, might remain the same during his/her lifetime.
	110	Number of mining related deaths, by sex, age group, level of education and occupations	1	Number of died employees die to mining activities.	
	111	Crude death rate, by regions	1	The crude death rate is the number of deaths occurring among the population of a given geographical area during a given year, per 1,000 mid-year total population of the given geographical area during the same year. Source: https://stats.oecd.org/glossary/detail.asp?ID=491	The total number of people who died during the period compared with the annual average number of the population and multiplied by 1000.
	112	The sex ratio at death, by regions	1	The number of death males per 100 death females and estimated as a ratio of males to females.	Death population of man compared to the death population of women and multiplied by 100.
	113	Number of inpatients, by classification of disease, by regions	3	The number of people suffering from the disease. Source: Inpatient morbidity recorded statements Health Report-503 (MHS)	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
	114	Number of prevalence and deaths of malignant neoplasms, by regions	3	International Classification of Diseases (ICD) according to classification M800-M969 Report morbidity listed in the clinic HC-502, Report of inpatient morbidity registered Health Report-503 (MHS)	
	115	Diseases of the mining employees, by type of diseases	3		
4. MEASURING THE IMPACT OF MINING ON SOCIAL ISSUES					
4.1. Measuring internal and international migration flows associated with mining (including remittances);	116	Number of internal migrant	1	A migrant is a person who has changed his usual place of residence from one migration-defining area to another (or who moved some specified minimum distance) at least once during the migration interval. An in-migrant is thus a person who enters a migration-defining area by crossing its boundary from some point outside the area, but within the same country. Source: Methods of measuring internal migration, Manual 6, UN.	With respect to a given area, the sum of in-migration and out-migration, or of in-migrants and out-migrants, is turnover. Number of migrant = Number of emigrant + Number of immigrant
	117	Number of international migrant	1	The definition of the word can be "international migrant" is defined as any person who changes his or her country of usual residence. Country of usual residence: The country in which a person lives, that is to say, the country in which he or she has a place to live where he or she normally spends the daily period of rest. Temporary travel abroad for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage does not change a person's country of usual residence. Source: (Recommendations on Statistics International	Short-term migrant: A person who moves to a country other than that of his or her usual residence for a period of at least 3 months but less than a year (12 months) except in cases where the movement to that country is for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage. For purposes of international migration statistics, the country of usual residence of short-term migrants is considered to be the country of destination during the period they spend in it. Long-term migrant: A person who moves to a country other than that of his or her usual residence for a period of

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				Migration 1998, 4.186)	at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence. From the perspective of the country of departure the person will be a long-term emigrant and from that of the country of arrival the person will be a long-term immigrant. (Recommendations on Statistics International Migration 1998, 4.186). Source: (Methods of measuring internal migration, Manual 6, UN).
	118	Workers' remittances	2	Workers' remittances are current transfers made by employees to residents of another economy. Source:https://www.imf.org/external/pubs/ft/bop/2007/pdf/bpm6.pdf, 12.22	Total workers' remittances are the sum of personal remittances and social benefits.
4.2. Measuring the impact of mining on poverty;	119	Household income and expenditure, by regions	1	Household income is a measure of the combined incomes of all people sharing a particular household or place of residence. It includes every form of income, e.g., salaries and wages, retirement income, near cash government transfers like food stamps, and investment gains. Household expenditure is included the amount paid for lodging, food consumed within the home, utilities paid and other expenses. Source: World bank	The total income (expenditure) of a household is defined by the sum of the household's monetary income (expenditure) and the value of consumed commodities from own farming and received from others free of charge.
	120	Poverty headcount index, by regions	2	The poverty headcount index is the share of the population whose consumption /expenditure/ is below the poverty line. This is a most widely used poverty index, that is comparably easy to interpret and understand, while other two more indices poverty gap and severity of poverty are used in order to get more comprehensive pictures of poverty. Source: World bank	By far the most widely-used measure is the headcount index, which simply measures the proportion of the population that is counted as poor, often denoted by P0. Formally, $P0 = \frac{Np}{N}$ where Np is the number of poor and

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
					N is the total population (or sample).
4.3. Measuring social impacts of population dislocation associated with mining activity;	121	Number of population	1	The total number of persons inhabiting a country, city, or any district or area. Source: Population Handbook, USA, Handbook for Population and Housing Census, UN, Principles and Recommendations for Population and Housing Census, UN, Principles and Recommendations for Vital Statistics, UN	Pt = P0 + B – D + In – Out B - the live births that occurred during the time, D - deaths that occurred during the time , In - in-migration during the time interval, Out - out-migration during the time interval, P0 - population number beginning of the year
	122	Number of households	1	The household is the group of people who live together in one house, with a joint budget and jointly provide their food and other basic needs. Members of the household should be family members or relatives; there can be some members in the household with no relation to the other members. Source: Handbook for Population and Housing Census, UN, Principles and Recommendations for Population and Housing Census, UN	
4.4 Measuring the impact of mining on education and training.	123	Number of students in higher educational institutions, by level of education and sex	2	Higher education institutions are universities, colleges and technical schools. Characteristics of University are research, training and production or research and training based, colleges are education and research based, technical schools are academic or vocational training are based.	Total number of students studying in higher education institutions of that year.
	124	Graduates of domestic universities, institutes and college, by professional areas	2	Number of person who has received a degree or diploma on completing a course of study, as in a domestic universities and colleges.	The number of students who have graduated with that profession.

THE STATISTICAL INDICATORS TO MEASURE THE IMPACT OF THE MINING INDUSTRY ON THE ENVIRONMENT

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
1. Measurement of the direct and indirect demand from the mining industry for environmental inputs, both market and non-market, incorporating measurement in terms of value	125	Mineral resource, by mineral types	1	In the context of this classification, mineral resources means all inorganic or organic substances in the earth that may be exploited, wholly or partly, for the benefit of mankind. Water resources are not a subject of this classification. Source: United Nations Framework Classification for Fossil Energy and Mineral Resources, page 3,15, SNA-2008 17.340	
	126	Soil resource	1	Soil resources are a fundamental part of the environment. They provide the physical base to support the production and cycling of biological resources, provide the foundation for buildings and infrastructure, are the source of nutrients and water for agriculture and forestry systems, provide a habitat for diverse organisms, play an essential role in carbon sequestration, and fulfil a complex buffering role against environmental variability (ranging from dampening diurnal and seasonal change in temperature and water supply to the storage and binding of a range of chemical and biological agents). Source: SEEA-CF 5.318-5.342	A first stage of accounting for soil resources is to measure the area of different soil types within a country. In order to focus on soil resources that are available as a biological system the scope of this account should be restricted to land used for agriculture and forestry and also volumes of soil extracted to be used as a biological system. (Table 5.7.1 Physical Asset Account for Area of Soil Resource /Hectares/ SEEA-CF)
	127	Water resource	2	Water resources consist of surface and groundwater resources used for extraction to the extent that their scarcity leads to the enforcement of ownership or use rights, market valuation and some measure of economic control. Water resources consist of fresh and brackish water in inland water bodies including groundwater and soil water.	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				Source: SEEA-CF 5.471-5.498, SNA-2008 10.184	
	128	Energy resource (oil, natural gas, coal, peat, uranium)	1	Mineral and energy resources are defined as known deposits of oil resources, natural gas resources, coal & peat resources, non-metallic minerals and metallic minerals. Mineral and energy resources consist of mineral and energy reserves located on or below the earth's surface that are economically exploitable, given current technology and relative prices. Source: SEEA-CF 5.173, SNA-2008 10.179	
2. Measurement of emissions (air and water) and waste products from the mining industry;	129	Emissions from the mining activities	1	Emissions are substances released to the environment by mining industry as a result of production, consumption and accumulation processes. Source: SEEA-CF 3.88, 3.89	Generally, emissions are analyzed by type of receiving environment, (i.e. emissions to air, emissions to water bodies, emissions to soil) and by type of substance.
	130	• Emissions to water	1	Emissions to water are substances released to water resources by mining industry as a result of production, consumption and accumulation processes. Source: SEEA-CF 3.92, 3.257	Water emission accounts record the quantity of substances added to water by mining industry during an accounting period. The quantities are expressed in terms of mass (kilograms or tonnes, depending on the substance under consideration). Water emission accounts cover: (a) substances added to wastewater and collected in the sewerage system; (b) substances added to wastewater discharged directly to water bodies; and (c) substances from non-point sources, for example, emissions and releases from urban runoff and emissions from agriculture.
	131	• Emissions to air	1	Emissions to air are gaseous and particulate substances released to the atmosphere by mining industry as a result of production, consumption and accumulation processes. Source: SEEA-CF 3.91, 3.233	
	132	• Emissions to soil	1	Emissions to soil are substances released to the soil by mining industry as a result of production, consumption and accumulation processes. Source: SEEA-CF 3.95	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
	133	Solid waste	1	Solid waste covers discarded materials that are no longer required by the owner or user. Solid waste includes materials that are in a solid or liquid state but excludes wastewater and small particulate matter released into the atmosphere. Source: SEEA-CF 3.84, 3.85	
3. Measurement of damage to land (including agricultural land) and ecosystems from mining activity and any subsequent rectification activity	134	Land area of mining exploration and production	1	Land is a unique environmental asset that delineates the space in which economic activities and environmental processes take place and within which environmental assets and economic assets are located. Source: SEEA-CF 5.239, 5.241	A particular feature of statistics on land use and land cover is the means by which data are collected. Broadly, two methods are used – field surveys and satellite images. Field surveys are important as they can provide a high level of specificity regarding the land cover and, in particular, the land use in a particular area. Satellite images are important as they enable a broader assessment of all areas in a country and, over time, more detailed resolutions of the images are permitting new forms of analysis. (SEEA-CF 5.244)
	135	Land area, water, soil and biodiversity with remediation	1	Protection and remediation of soil, groundwater and surface water refers to measures and activities aimed at the prevention of pollutant infiltration, cleaning up of soils and water bodies and the protection of soil from erosion and other physical degradation as well as from stalinisation. Monitoring, control of soil and groundwater pollution is included. Protection of biodiversity and landscape refers to measures and activities aimed at the protection and rehabilitation of fauna and flora species, ecosystems and habitats as well as the protection and rehabilitation of natural and semi-natural landscapes. The separation between 'biodiversity' and 'landscape' protection may not always be practical. For example, maintaining or establishing certain landscape types, biotopes, eco-zones and related issues (hedgerows, lines of trees to re-establish 'natural corridors') have a clear link to biodiversity	

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
				preservation. Source: SEEA-CF Annex 1, CEA, I. Environmental Protection	
	136	Land area, water, soil and biodiversity without remediation	1	All actions that making land in previous shape, recovering by soil, thickening soil, planting, caring are the environmental restoration actions.	
	137	Land degradation	1	Degradation considers changes in the capacity of environmental assets to deliver a broad range of contributions – known as ecosystem services (e.g. air filtration services from forests) and the extent to which this capacity may be reduced through the action of economic units, including households. In this sense, since depletion relates to one type of ecosystem service, it can be considered as a specific form of degradation. Source: SEEA-CF 5.90, 5.91	The measurement of degradation is complicated because the capacity of environmental assets to deliver ecosystem services is not solely attributable to individual assets, and because individual assets may deliver a number of different ecosystem services. Further, while individual environmental assets, such as water and soil resources, may have been degraded over time, separating the extent of degradation of the individual asset from the broader degradation of the related ecosystem may not be straightforward.
	138	Soil damage	1	Soil erosion is the wearing away of the land surface by physical forces such as rainfall, flowing water, wind, ice, temperature change, gravity or other natural or anthropogenic agents that abrade, detach and remove soil or geological material from one point on the earth's surface to be deposited elsewhere. (European Commission) Source: European Commission, http://esdac.jrc.ec.europa.eu/esbn/Plenary_esbn_2007/Workshop/ESBN_SoilErosion.pdf , http://eusoils.jrc.ec.europa.eu/projects/scape/uploads/108/Benyamini.pdf	The trend to use models in erosion evaluation is attractive. As a result, potential soil erosion rates are typically modeled from empirical and functional relationships driven by factors related to soil properties, climate, and landscape position. These models do not yet represent the actual soil erosion losses and only provide estimations of potential erosion under specified climatic conditions. Without repeated field-based measurements, there is currently no way to determine accurate erosion losses. Soil erosion can occur in two stages: 1) detachment of soil particles by raindrop impact, splash or flowing water; and 2) transport of the detached particles by splash or by the flowing water. Therefore, soil erosion is a physical process requiring energy, and its control requires certain measures to

Measurement issues	№	Appropriate indicators	Priority (high-1; medium-2; low-3)	Definition of indicator	Calculation method
					dissipate this energy. (Soil Conservation And Protection for Europe)
4. Measurement of the environmental impact of economic activity 'downstream' from the mining industry;	139	Fee on usage of road from the mining companies	1		
	140	Environmental damages (water, animal, plant etc) from the transportation, consignment and discharge of the mining products	1		
	141	Cost of environmental protection	1	Environmental protection expenditure refers to all operating and capital expenditure in relation to compliance or in anticipitation of environmental regulations/conventions in country. This includes expenditure for preventing, reducing and rehabilitation of environmental degradation or preserving the environment. Source: Environmental protection expenditure survey of Malaysia, 2013	Total cost of environmental protection basis cost of management and environmental monitoring.
	142	Natural resource management	1	Resource management includes all actions and activities that are aimed at preserving and maintaining the stock of natural resources and hence safeguarding against depletion. This includes actions and activities aiming at reducing the withdrawals of natural resources (recovery, reuse, recycling, substitution of natural resources) as well as restoring natural resource stocks (increases/ recharges of natural resource stocks). Source: SEEA-CF- II.Resource management, 10.	

Annex 2.

GOVERNMENT REVENUES FROM NATURAL RESOURCES

The *Government Finance Statistics Manual 2014* (*GFSM 2014*) provides national authorities and data users with a conceptual framework suitable for analysing and evaluating fiscal policy, especially the performance of the general government sector and the broader public sector. Specifically, the *GFSM 2014* describes a specialized macroeconomic statistical system that covers all flows (revenue, expense, financing, and other economic flows) and stock positions (in nonfinancial assets, financial assets, and liabilities) associated with government units. The information to be collected from natural resource enterprises is broad and the government and other parties may be interested not just in data on revenues from natural resources, but also in data on assets, expenses, and other economic flows associated with natural resources. However, for the purposes of the natural resource revenues template described in Chapter 6, this annex describes the tax and non-tax revenue classifications to be used in compiling data on the revenue streams that accrue to government from mining activities.

It is worth noting that in the government balance sheet the *GFSM 2001* category subsoil assets is replaced in the *GFSM 2014* by mineral and energy resources. To be an economic asset, a resource must also be able to supply economic benefits given the technology, scientific knowledge, economic infrastructure, available resources, and relative prices existing at a given time or expected in the foreseeable future. Thus, a known deposit of minerals is an economic asset only if it is already commercially exploitable or is expected to become commercially exploitable in the foreseeable future.

In the GFS system, mineral and energy resources consist of mineral and energy reserves located on or below the earth's surface that are economically exploitable, given current technology and relative prices. Ownership rights to the mineral and energy resources are usually separable from those to the land itself. The deposits may be located on or below the earth's surface, including deposits under the sea, but they must be economically exploitable. Mineral and energy resources are known reserves of oil, natural gas, coal, metallic ores (including ferrous, nonferrous, and precious metal ores), and nonmetallic mineral reserves (including stone quarries, clay and sand pits, chemical and fertilizer mineral deposits, and deposits of salt, quartz, gypsum, natural gem stones, asphalt, bitumen, and peat). The tax and non-tax revenue classifications outlined below may therefore be applied to the revenue streams that accrue to government from mining activities

1. **Taxes on extraordinary profits payable by natural resource enterprises:** These are specific taxes applied to natural resource enterprises. These are taxes generally classified as profit taxes, for example, resource rent taxes, which are often imposed on profits earned above a defined rate of return allowed by the government for the corporation to earn. These taxes could be imposed pre- or post-corporate income tax. These taxes differ from royalties as they take into account the profit of the mining/energy operation, whereas a royalty is generally imposed on the production level irrespective of profitability. The taxes on profits are levied on revenue less allowable deductions. The amounts recorded under this line item

are part of the *GFSM 2014* category Taxes on income, profits, and capital gains payable by corporations and other enterprises (1112).

2. **Taxes on payroll and workforce payable by natural resource enterprises:** These are taxes paid by natural resource enterprises either as a proportion of payroll size or as a fixed amount per person, and are not earmarked for social security schemes. If governments are able to identify general corporate income taxes paid by natural resource enterprises, they should be able to determine the same for payroll based taxes. The amounts recorded under this line item are part of the *GFSM 2014* category Taxes on payroll and workforce (112).

3. **Taxes on property payable by natural resource enterprises:** These are taxes payable on the use, ownership, or transfer of wealth. The taxes may be levied at regular intervals, one time only, or on a change of ownership. The amounts recorded under this line item are part of the *GFSM 2014* category Taxes on property (113).

4. **Value-added taxes payable by natural resource enterprises:** In many countries, businesses are subject to VAT. A value-added tax is a tax on goods and services collected in stages by enterprises, but which is ultimately charged in full to the final purchaser. Enterprises usually collect the VAT from purchasers on their sales, and deduct the VAT paid on their purchases. The amounts recorded under this line item are part of the *GFSM 2014* category Value-added taxes (11411).

5. **Unrequited value-added taxes (VAT) payable by natural resource enterprises:** In the majority of cases, enterprises are able to claim input tax credits as the enterprises' purchases are for intermediate and not for final consumption. In some countries, natural resource enterprises do not have input tax credits available to reclaim any value-added taxes paid, and therefore receive no refunds. Hence, a category is required for unrequited value-added taxes paid by these enterprises. The amounts recorded under this line item are part of the *GFSM 2014* category Value-added taxes (11411).

6. **Excise taxes payable by natural resource enterprises:** Excises are taxes levied on particular products (e.g., hydrocarbon oils, tobacco goods, sugar), or on a limited range of products, that are not classifiable under general taxes on goods and services (1141); profits of fiscal monopolies (1143); customs and other import duties (1151); or taxes on exports (1152). The amounts recorded under this line item are part of the *GFSM 2014* category Excises (1142).

7. **Profits of natural resource fiscal monopolies: This item covers that part of the profits of fiscal monopolies that is transferred to the government.** Fiscal monopolies are public corporations or quasi-corporations that exercise the taxing power of government by the use of monopoly powers over the production or distribution of a particular kind of good or service. The monopolies are created to raise government revenue that could otherwise be gathered through taxes on private sector production or distribution of the commodities concerned. Typical commodities subject to fiscal monopolies are tobacco products, petroleum products, salt, etc. The amounts recorded under this line item are part of the *GFSM 2014* category Profits of fiscal monopolies (1143). Depending on the specific

circumstances of a given country, the profits transferred to the government by a public corporation would be classified as dividends (when no monopoly exists) or as profits of fiscal monopolies (when a monopoly exists).

8. **Fiscal monopolies are distinguished from public enterprises such as rail transport, electricity, and post offices.** These latter may enjoy a monopoly but normally exist primarily to promote or advance the interests of public economic or social policy, rather than to raise revenue for government. Transfers to government from such public enterprises are treated as dividends (1412) or withdrawals of income from quasi-corporations (1413). Profit transfers from export and import monopolies are similar to fiscal monopoly profits but have their own category (see below).

9. **While in principle only the excess of the monopoly profits over "normal" profits should be treated as taxes, it is difficult to estimate this amount.** Thus, in practice, the value of the taxes should be taken to be equal to the amount of the profits actually transferred to government. The taxes are recorded when the transfer takes place rather than when profits are earned.

10. **Business and professional licenses payable by natural resource enterprises:** These are payments where no specific service is attached or, in general, the amount of the fee is significantly disproportionate to the service provided. Possible examples are license fees, rental fees, and entry fees. Some licenses might be for exploration or extraction. The amounts recorded under this line item are part of the *GFSM 2014* category Other taxes on use of goods and on permission to use goods or perform activities (11452). If there is a specific service attached to the fee and the payment is proportionate to the service, it should be recorded as a sale of a service under the subcategory Administrative fees for government services supplied to natural resource enterprises (1422).

11. **Pollution taxes payable by natural resource enterprises:** These are taxes levied on the emission or discharge of noxious gases, liquids, or other harmful substances. Amounts payable to government for the collection and disposal of waste or noxious substances are excluded from this category, as they constitute sales of goods and services. The amounts recorded under this line item are part of the *GFSM 2014* category Other taxes on use of goods and on permission to use goods or perform activities (11452).

12. **Other taxes on goods and services payable by natural resource enterprises:** This item includes taxes on the extraction of mineral fossil fuels, and other exhaustible resources from deposits owned privately or by another government. Taxes on the extraction of exhaustible resources usually are a fixed amount per unit of quantity or weight, but can be a percentage of value. Payments for the extraction of exhaustible resources from deposits owned by the government unit receiving the payment are recorded under rent. The amounts recorded under this line item are part of the *GFSM 2014* category Other taxes on goods and services (1146).

13. **Taxes on imports payable by natural resource enterprises:** This items covers revenue from all levies collected on goods because they are entering the country or services because

they are delivered by nonresidents to residents paid by natural resource enterprises. The amounts recorded under this line item are part of the *GFSM 2014* category Customs and other import duties (1151).

14. **Taxes on exports of natural resources:** This category includes all levies on resource commodities transported out of the country. The amounts recorded under this line item are part of the *GFSM 2014* category Taxes on exports (1152).

15. **Profits of natural resource export monopolies:** Governments may establish enterprises with the exclusive right to export natural resource products to nonresidents to raise revenue that could be gathered through taxes on exports. When such monopolies exist, the profits remitted to governments by the monopolistic enterprise or marketing board are considered to be taxes. Such profits are recorded as tax revenue when transferred to the government and do not include the retained reserves of the enterprises or marketing boards. The amounts recorded under this line item are part of the *GFSM 2014* category Profits of export or import monopolies (1153).

16. **Profits received from export enterprises or marketing boards that do not represent monopoly profits are recorded as property income (dividends).** Profits transferred to the government from public enterprises or marketing boards dealing in commodities domestically, outside of international trade are recorded under property income (dividends, 1412) or profits of fiscal monopolies (code 1143). For further information, refer to paragraphs 5.63-5.68 of the *GFSM 2014*.

17. **Other taxes payable by natural resource enterprises:** This item covers revenue from taxes levied predominantly on a base or bases other not elsewhere classified under the preceding tax headings payable by natural resource enterprises. Also included is revenue from unidentified taxes and interest and penalties collected for late payment or non-payment of taxes but not identifiable by tax category. Stamp taxes that do not fall exclusively or predominantly on a single class of transactions would be included here. The amounts recorded under this line item are part of the *GFSM 2014* category Other taxes paid solely by business (1161).

18. **Social contributions:** Social contributions (12) are actual or imputed receipts either from employers on behalf of their employees or from employers, self-employed, or unemployed persons on their own behalf that secure entitlements to social benefits for the contributors, their dependents, or their survivors. The contributions may be compulsory or voluntary. Social security contributions are compulsory social contributions to social security schemes.

19. **Employee contributions from natural resource enterprises:** These contributions are payable directly by employees or deducted from employees' wages and salaries and other compensation and transferred by employers on their behalf. The amounts recorded under this line item are part of the *GFSM 2014* category Social security employee contributions (1211).

20. **Employer contributions from natural resource enterprises:** These contributions are payable directly by employers engaged in natural resource activities on behalf of their employees. The amounts recorded under this line item are part of the *GFSM 2014* category Social security employer contributions (1212).

21. **Other revenue:** Other revenue (14) includes property income, interest, sales of goods and services, and miscellaneous other types of revenue.[10] For natural resource-based revenues, this will predominantly be property income. Property income earned by governments from natural resource products includes mainly rent and dividends.

22. **Dividends:** Dividends refer to payments to general government units, in their capacity as shareholders in and/or owners of an enterprise, for example, as a result of placing equity funds at the disposal of the enterprise. Equity funds do not entitle shareholders to a fixed or predetermined income. Dividends are recorded either on the date they go ex-dividend, or if the enterprise is 100 percent owned by government the date the dividends are payable or, if no prior declaration occurs, on the date the payments are made.

23. **General government units may receive dividends from private or public enterprises.** Distributions of profits by public enterprises may take place irregularly and may not be explicitly labeled as dividends. Dividends include all distributions of profits by enterprises to their shareholders or owners (except withdrawals of equity). Dividends from natural resource enterprises are likely to take two forms: dividends from public resource enterprises, and dividends from government participation in natural resource enterprises (equity).

24. **When payments are received from public enterprises (e.g., oil companies), it can be difficult to decide whether they are dividends or withdrawals of equity.** An enterprise may, however, smooth the dividends it pays from one period to the next so that in some periods it pays more in dividends than it earns from its productive activities. Withdrawals of equity may take the form of distribution of proceeds from accumulated retained earnings and reserves for the consumption of fixed capital.

25. **A complication may arise when a government requests payment from a public enterprise. In many cases, the government requests the enterprise to pay a dividend that is set by the government.** According to the *GFSM 2014*, this is not revenue if the payments are not made from current income. These payments are a financial transaction that should be classified as a withdrawal of equity. According to the *2008 SNA*:

    It is important to distinguish between the return of the equity investment by the corporation to its owner and the payment of income in the form of dividends. Only regular distributions from the entrepreneurial income are recorded as property income either as dividends or withdrawals of income from quasi-corporations. Large and irregular payments, based on

[10] Interest earned by governments from the investment of funds originally generated from natural resources is not included in the template because they are not considered to constitute direct government revenues from natural resources. Revenues earned by entities such as sovereign wealth funds are not considered to be government revenues from natural resources.

accumulated reserves or sale of assets are recorded as a withdrawal of equity (*2008 SNA* 22.136).

26. **Dividends from government owned natural resource enterprises:** These are dividend payments by public enterprises declared by the board of directors or other managers of the enterprise of their own volition that are paid to general government. General government will in most instances have 100 percent equity in the public enterprise. The amounts recorded under this line item are part of the *GFSM 2014* category Dividends (1412).

27. **Dividends from government participation in natural resource enterprises (equity):** These are dividend payments, as described above, from natural resource enterprises where the government has an equity position. In some cases, the government may receive dividend payments in kind. These should be valued at the market price for the goods in kind at the time of the transaction. The amounts recorded under this line item are part of the *GFSM 2014* category Dividends (1412). Note that for in-kind transactions to be recorded under this item, the amount should be set by the enterprise of its own volition and not mandated by the government. If the amount of in-kind payment is predetermined or fixed, it should be recorded under the subcategory production entitlements payable by natural resource enterprises under the *GFSM 2014* category Rent (royalties, 1415).

28. **Rent is the property income received from certain leases of subsoil assets and other naturally-occurring assets**. The ownership of subsoil assets is dependent on how property rights are defined by law. General government units may grant leases that permit other units to extract deposits over a specified period of time in return for a payment or series of payments. These payments are often described as "royalties," but they are rents that accrue to owners of the assets in return for putting the assets at the disposal of other units for specified periods of time.[11] The rents may take the form of periodic payments of fixed amounts or, more usually, will be derived according to the quantity, volume, or value of the asset extracted. Enterprises engaged in exploration may make payments to general government units in exchange for the right to undertake test drilling or otherwise investigate the existence and location of subsoil assets. Such payments are also treated as rents even though no extraction may take place. Rents are the sum of royalties, bonuses, production entitlements, and compulsory social infrastructure payments; and, in most cases, rent from natural resources will be equal to the total rent revenues received by government. The amounts recorded under this line item are part of the *GFSM 2014* category Rent (1415).

29. **The *2008 SNA* recommends that payments by an extractor to the owner of the mineral resources corresponding to a share of the resource rent be shown as property income, even if they are described as taxes and treated as such in the government's accounts.** It also recommends that when the legal owner of a mineral reserve contracts with another unit to undertake extraction, on pragmatic grounds the resource may continue to be shown on the balance sheet of the legal owner, with payments by the extractor to the owner treated as property income (rent). The proper recording of rent presents practical challenges because

[11] The *GFSM 2014* states that when owners of a natural resource put the resource at the disposal of another institutional unit, and this other unit can use the resource to extinction, the transaction be treated as a sale of the resource asset.

payments to governments described as rent or royalties often include a mix of payments. Some may effectively be rent and others may be taxes or fees. The latter should be classified in the corresponding sub-category and not under rent. A further complicating factor for the proper recording of rent is that in some cases payments to government not described as rent or royalties (e.g. taxes, fees) should actually be classified as rent. The key to determine whether a given payment is rent is whether the payment is made to the government as owner of the natural resource.

30. **The nonfinancial enterprises exploring and exploiting natural resources may be public enterprises.** These enterprises will reflect in their financial statements the flows and stocks associated with their operations. These flows may include flows to and from government units, which would not be consolidated when compiling GFS for the general government sector, but would be subject to consolidation when compiling GFS for the public sector (or nonfinancial public sector). A classification issue may arise concerning payments to government by a public enterprise for the right to explore a natural resource. These payments are treated by government as revenue (rent, 1415), and by the enterprise as an operating expense (rent, 2814). The distribution of profits (residual between all operating revenues and operating expenses) by the enterprise to government as owner of the enterprise is treated as dividends by both entities (1412 and 2811, respectively).

31. **Royalties payable by natural resource enterprises: Royalties are rents earned by the government (as owner of the subsoil asset) based on the production or extraction levels of a commodity.** The royalties will usually be derived according to the quantity, volume, or value of the asset extracted. For example, the royalty will be levied as a dollar amount per ton (or equivalent) or as a percentage of the value of the resource extracted. The amounts recorded under this line item are part of the *GFSM 2014* category Rent (1415). If the general government does not own the subsoil assets but similar taxes are levied, then these payments should be recorded under Other taxes on goods and services (1146).

32. **Bonuses payable by natural resource enterprises:** These are payments to general government units that are related to awards, grants, or transfer of extraction rights. These payments are sometimes called signature, discovery, or production bonuses. In the case of signature payments, these do not have to be linked to either the discovery or extraction of resources. Payments can also be tied to the achievement of certain production levels or targets. Bonus payments can also be for the discovery of additional mineral reserves or deposits. Payments can be in the form of periodic payments or a fixed amount. Bonuses are payments made to the government because it is the owner of the subsoil asset and has given a corporation the right to extract the resource. The amounts recorded under this line item are part of the *GFSM 2014* category Rent (1415).

33. **Production entitlements payable by natural resource enterprises:** Production entitlements are the volumes of output the general government is entitled to receive as mandated in any agreement or license. These mandated volumes can be paid in cash or in kind, and can be net of any other royalty payments. For in-kind payments, these should be valued at market price (or cost of extraction). The amounts recorded under this line item are part of the *GFSM 2014* category Rent (1415).

34. **If a public enterprise receives production entitlements from private enterprises, the revenue from production entitlements should be attributed to the general government.** Production entitlements are generally stipulated in Production Sharing Contracts or Production Sharing Agreements. These contracts can be with either the general government or a government-owned corporation. In either case, the revenue from production entitlements should be attributed to the general government. Any production entitlement that is received by a public enterprise should be rerouted to be shown as being received by the general government unit. The rerouting is done to properly record the underlying economic event that it is the government as owner of the resource that is the true recipient of the production entitlements, which it then chooses to transfer to a public enterprise. Otherwise, the market value of the production entitlements would not be reflected in the government accounts, which would only show the revenues eventually transferred by the public enterprise to the government.

35. **Compulsory social infrastructure payments payable by natural resource enterprises:** These are payments where natural resource enterprises are required to provide social infrastructure as part of their contractual arrangements to exploit the resource. Payments can either be cash or in-kind (completed infrastructure). The value of the payment should in principle be equal to the value of the infrastructure. The amounts recorded under this line item are part of the *GFSM 2014* category Rent (1415).

36. **For social infrastructure payments, the timing of the recording of the payment should be as the work on the infrastructure is being performed.** If this is not feasible, the recording of the transaction may occur on completion of the infrastructure project, or when ownership is handed to the government. The compulsory nature of the infrastructure payments means that they are not grants, because grants are non-compulsory transfers.

37. **Other rent.** This item covers any payment to the government as owner of the resource not included in the previous four sub-categories of rent.

38. **Administrative fees for services supplied to natural resource enterprises:** This item includes fees for compulsory licenses and other administrative fees that are considered a sale of services by government. Most are applicable to all sectors and industries of an economy. There may be specific licenses that apply only to resource extraction. Typical examples are licenses for specialized equipment operation or licenses linked to qualifications to operate a mine. For these fees to be considered a sale of a service, the general government unit must exercise some regulatory function—for example, checking the competence or qualifications of the person concerned, checking the efficient and safe functioning of equipment in question, or carrying out some other form of control that it would otherwise not be obliged to do. The amounts recorded under this line item are part of the *GFSM 2014* category Administrative fees (1422).

39. **Voluntary social infrastructure payments payable by natural resource enterprises:** This category includes gifts and voluntary donations from enterprises. These include transfers for the construction or purchase of cultural centers, hospitals, museums, schools, and theatres, and gifts of land, buildings, or intangible assets such as patents and copyrights.

Buildings could be extended to include roads, bridges, dams, and other civil infrastructure. If the transfer is in the form of a gift that is a completed structure rather than a voluntary payment for construction work, the value recorded should be at either the cost of producing the structure or a fair market value. The amounts recorded under this line item are part of the *GFSM 2014* category Capital transfers not elsewhere classified (1442).