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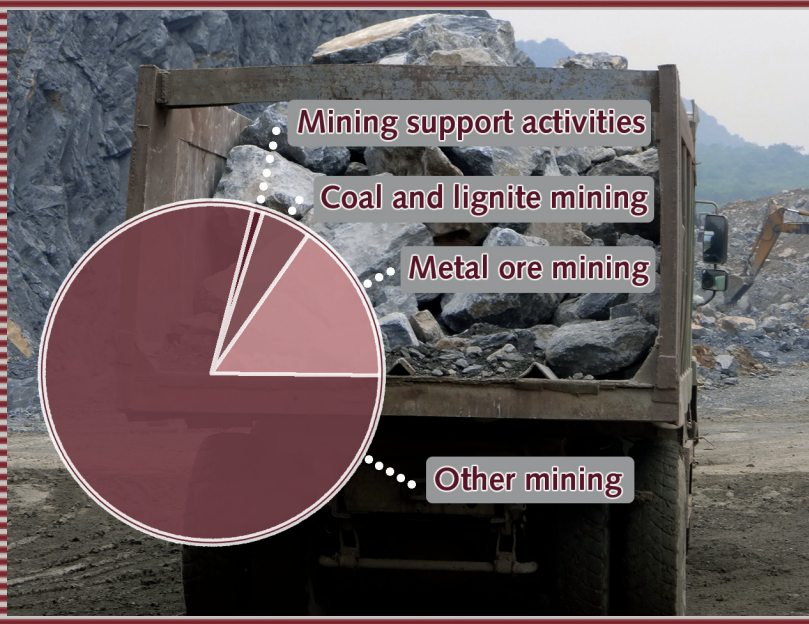

The economic impacts of construction aggregate mining on regional development

The case of Hoa Binh Region, Vietnam

MAREX Publication Series – Issue 6

Imprint

The economic impacts of construction aggregate mining on regional development –
The case of the Hoa Binh Region, Vietnam

Results of the project MAREX: Management of Mineral Resource Extraction in
Hoa Binh Province – a Contribution to Sustainable Development in Vietnam (2015-2018)

Supported by BMBF, Grant Code FKZ 033R122A

Issue 6

Internet: www.marex-project.de

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Design and Layout
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Editorial deadline August 2018

ISBN 978-3-933053-38-1

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Introduction

In Vietnam, increased industrialization is creating greater markets for the use of aggregates[1], particularly in high growth urban areas like the Hanoi Metropolitan Region. Despite the low unit value of aggregates, the construction sand and gravel industry is a major contributor to and an indicator of the economic well-being of a country (Bolen 2002; University of Leoben, 2010).

In Vietnam, the construction industry has been one of the key economic sectors since the Đổi mới reform started in 1986. "*In 2006 alone, the construction industry grew by a record of 21%, driven by increased public and private spending*" (Djandji et al., 2007: 1). Despite the sector downturn in 2012-2013, the real value of Vietnam's construction sector continued to expand at a compound annual growth rate of 10% from 2005 to 2014 (Honk Kong Trade Development Council, 2015). Among the reasons for the dynamic development of the sector are: the creation of a clear legal framework on Common Investment (2005) and Housing (2014), and the accession of the country to the World Trade Organization (WTO) in 2007, which opened new opportunities for foreign investors to participate in the real estate business (Djandji et al., 2007).

Surprisingly, although construction aggregates are mined more than any other material (Table 1), there is a lack of systematic knowledge (i.e., revenues and accounting) on how the profits of mining aggregates are collected, distributed and used in Vietnam. Moreover, neither the government nor the associations of the aggregate industry maintain statistics about their location, production and material projections by geological subtype.

Table 1: Aggregates demand for construction

(Standard/typical construction)
Homes: 400 tonnes
Schools: 3.000 tonnes
Sports stadiums: 300.000 tonnes
Roads: 1 km of motorway up to 30.000 tonnes
Railways: 9 tonnes for 1 meter railway

Source: Bleischwitz and Bahn-Walkowiak (2006: 3-4)

As the world's demand for construction materials is expected to continue, there is an increased drive to examine how potential wealth from the construction material industry can be translated into local economic, social and environmental opportunities. This is particularly relevant nowadays in Vietnam. According to available forecasts (Great Hanoi Master Plan by 2030), many investments in the construction sector (residential commercial buildings and public infrastructure) are expected.

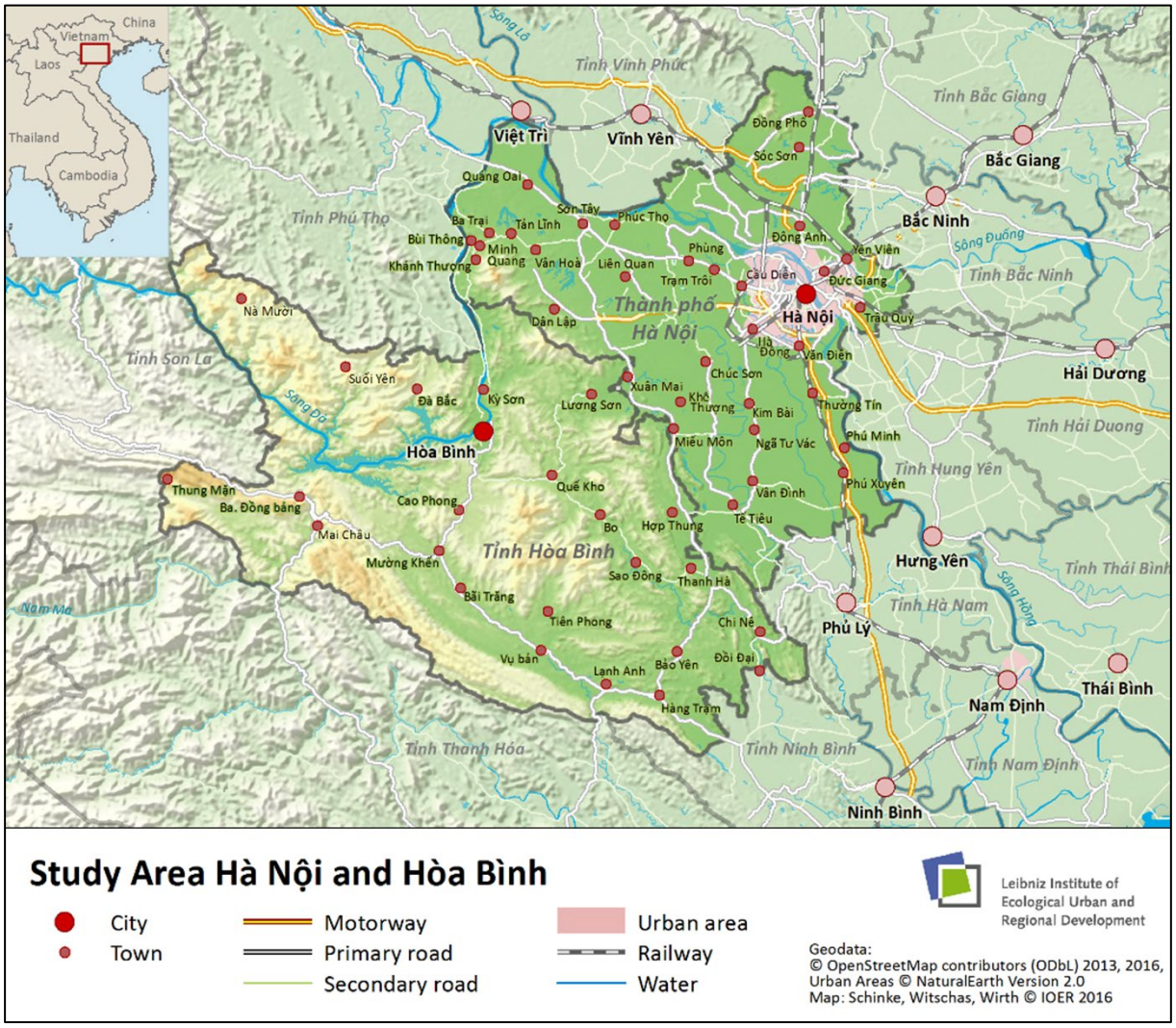
In recent years, an increasing political emphasis has been placed on promoting sustainable regional and urban management of mining resources (Decision 2427/QD-TTg/2011; Circular 02/CT-TTg/2012). In particular, it is significant to highlight that Vietnam's Long-Term Strategy for Exploitation of Mineral

[1] Aggregates are defined as "*hard and granular materials suitable to use either on their own or with the addition of cement, lime or a bituminous binder in construction*". They can be natural, manufactured or recycled. Natural aggregates are "*mineral sources which have been subject to nothing more than physical processing (crushing and sizing)*" (British Geological Survey 2013: 1).

Resources to 2020 with a vision towards 2030 (Decision 2427/QD-TTg/2011) mentions that as non-renewable resources, minerals must be managed, protected, exploited and used rationally, economically and efficiently to meet the requirements of the industrialization and modernization of the country.

Due to its proximity to the capital region, we chose the Hoa Binh Province, located in the south-west of Hanoi (Figure 1) as a research laboratory. Aggregate minerals produced in Hoa Binh supply the current and future demands of Hanoi's construction industry.

Figure 1: Study Area – Hanoi Metropolitan Area and Hoa Binh Province



The objectives of this report are fourfold:

1. To analyse the **economic relevance** of natural aggregates and the driving forces for its production.
2. To identify and analyse the **economic benefits** of aggregates extraction in Vietnam
3. To analyse the **instruments (normative and indicative)** identifying and regulating the economic, social and environmental impacts of natural aggregate mining in Vietnam
4. To identify the **financial obligations** of aggregate mining producers during exploration, exploitation and closure phases in Vietnam

A mixed-methods approach was employed to collate and synthesize data from multiple sources. Methods included a review of the international and local literature on aggregates extraction and the conducting of in-depth interviews. A total of 45 interviews were conducted in 2 rounds (November 2016 and November 2017) at different administrative levels with representatives of the Ministries of Natural Resources and Environment (MONRE), Construction (MOC), Agriculture and Rural Development (MARD), Planning and Investment (MPI), Industry and Trade (MIT), Science and Technology (MOIT), and the Vietnam Institute for Urban Planning (VIUP). The sample also included environmental private consultants, politicians, press representatives, NGOs, aggregates entrepreneurs, representatives of local associations (farmers and aggregates) and local population living around the extraction sites.

In order to accomplish the objectives, the report is organized as follows: Chapter 1 briefly reviews the economic relevance of mining aggregates. Chapter 2 analyses the economic benefits of aggregates extraction. Chapter 3 presents the instruments regulating aggregates mining while Chapter 4 identifies the financial obligations of aggregates producers.

The report was prepared by the Chair of Spatial Development (Lehrstuhl für Raumentwicklung) of the Technische Universität Dresden. The material, comments and suggestions received from the institutions and individuals mentioned below contributed valuably to the report's preparation.

- ✓ Communist Party of Hoa Binh Province, Mr. Bui Van Tinh (secretary).
- ✓ Provincial People's Committee Hoa Binh Province, Mr. Bui Van Khanh (chairman).
- ✓ Mineral Management Division (DONRE), Hoa Binh Province, Mr. Dang Van Khoa.
- ✓ Department of Land Use Planning (DONRE), Hoa Binh Province, Ms. Pham Thi Mo.
- ✓ Department of Industry and Trade, Hoa Binh Province, Mr. Pham Van Bao.
- ✓ People's Committee Luong Son District, Mr. Nguyen Dinh Dua (Vice-chairman) and Mr. Nguyen Khac Yen.
- ✓ President of the Mining Association, Hoa Binh Province, Mr. Quach Trong Ba.
- ✓ People's Committee Tan Vinh Commune, Mr. Dinh Van Loi (chairman).
- ✓ Farmer Association of Hoa Binh Province, Ms. Ho Kim Hang and Mr. Hoang Hung.
- ✓ Department of Construction, Hoa Binh Province, Mr. Khai.
- ✓ Department of Finance, Hoa Binh Province.
- ✓ Environmental Protection Fund, DONRE, Hoa Binh Province, Mr. Nguyen Khac Long.
- ✓ Quang Long Company, Mr. Nguyen Van Nien.
- ✓ Hop Tien Company, Mr. Le Quang Dang.
- ✓ Trung Son Company, Mr. Duong Thanh Binh.
- ✓ Residents of Tan Vinh Commune, Hoa Binh Province.
- ✓ Vietnam Ministry of Natural Resources, Department of Policy and Legislation.
- ✓ Vietnam Ministry of Natural Resources, Department of Control of Mining Activity.
- ✓ Vietnam Ministry of Construction, Department of Science, Technology and Environment.
- ✓ Vietnam Ministry of Construction, Department of Architecture and Construction Planning.
- ✓ Vietnam Institute for Urban and Rural Planning.
- ✓ People and Nature Reconciliation, Vietnam, Ms. Tran Thanh Thuy.

We deeply appreciate the hospitality of officials and inhabitants in Hoa Binh Province, Vietnam, and their kindness for spending time with us during the interviews. Finally, we acknowledge as well the fruitful comments, support and assistance provided by our Marex partners, the IÖR (Leibniz Institute of Ecological Urban and Regional Development), in drafting this report.

1. Economic relevance of aggregates

1.1 The Global and European market for construction aggregates

Construction aggregates (Table 2) are also termed "*primary construction materials*" (Bahn-Walkowiak, et al. 2012) as the largest proportion is used to manufacture ready-mix concrete (made of 80% aggregates), asphalt (made of 95% aggregates) and cement (Bleischwitz and Bahn-Walkowiak 2006). These minerals contribute as well to the production of other products like toothpaste, glass, pottery, household cleaners, makeup, medicines, paints, and fertilizers, among others. Every application of aggregates requires a different technical specification, some of them with extremely demanding re-quirements in respect to shape, durability, abrasion and resistance etc. (UEPG Statistical Data Review 2012).

Table 2: Construction minerals and their principal uses

Natural sand and gravel	Concrete, building sand and fill, water infiltration, purification and erosion control
Limestone	Crush-rock aggregate, cement and mortar, other industrial uses
Stone (crushed and dimension stone)	Comprises almost any competent rock-type that maybe used in the form of shaped and/or sized blocks for either structural or decorative purposes

Source: Adapted from British Geological Survey 2011

To understand the economic relevance of the industry, it is important to consider its special position as the first section of a complex value-added chain (Figure 2). According to a report published by the University of Leoben (2010: 9), to "*disregard this fact might lead to an incomplete and misleading image of the real economic importance of the sector*".

No global data on the extraction of aggregates exist. However, different researchers provide estimates. Giljum et al. (2014) suggest that global material extraction (including non-renewable and renewable material-biomass) increased by more than 90% over the last 30 years, reaching around 70 billion tons in 2009. Of this figure, minerals account for the largest share (43%) "*with the major part consisting of sand and gravel*" (Giljum et al. 2014: 325). According to UNEP (2014: 1 based on Steinberger et al., 2010 and Krausmann et al., 2009), between 47 and 59 billion tons of material is mined every year of which aggregates *"account for the largest share (from 68% to 85%) and the fastest extraction increase"*.

In regard to the specific demand for natural aggregates different approaches are used to estimate bulked materials used in the construction sector. The Freedonia Group (2012), a company specializing in industry market research, forecast an increase of 5.2% per year between 2010 and 2015, reaching 48.3 billion tons in 2015. The Asia Pacific region has the largest demand (68%) with China alone accounting for half of all worldwide demand during the period. Asia is followed by North America (8%) and Western Europe (6%).

Although natural aggregates are the most mined material, reliable and detailed information on their extraction has only been available for a number of developed countries for a few years.

For instance in Europe[2], the production of aggregates (including marine, recycled and manufactured material) in 2010 was over 3.5 billion tons (Table 3). The European aggregate industry comprises some 16.500 companies (mostly SMEs) operating in 26.000 quarries and pits across Europe (UEPG statistical data Review 2012). Germany is by far the leading aggregates producer in Europe. The German Building

[2] Including 34 countries, 27 EU members plus Russia, Switzerland, Serbia, Turkey, Norway and Iceland.

Material Association (Bundesverband Baustoffe – Steine und Erden e.V.; BBS) represents the interests of 16 sub-sectors and around 4000 companies with a total of 145.000 employees, generating rates of annual turnover over €30 billion (Aggregate Business Europe 2014).

Table 3: Estimation of aggregates production by selected countries in 2010 (in million tons)

Country	Pro-ducers (No)	Extraction sites (No)	Sand and Gravel	Crushed rocks	Marine Aggre-gates	Recycled Aggregates (1)	Manufac-tured Aggregates (2)	Total Pro-duction
Germany	1400	2100	239	208	9	60	19	535
Italy	1470	2200	180	120	0	0	0	300
France	1347	2468	135	201	6	17	6	365
Poland	1542	2475	163	77	0	9	3	252
UK	885	1393	51	106	10	49	10	226
EU 27	13221	22377	1168	1323	58	180	55	2784
Europe 34	16658	26630	1426	1929	59	186	80	3680

(1) Aggregate resulting from the processing of inorganic materials previously used in construction;
(2) Aggregate of mineral origin resulting from an industrial process involving thermal or other modification (British Geological Survey 2013)
Source: Adapted from UEPG Statistical Data Review 2012

The statistics demonstrate how vulnerable the demand for aggregate is to external shocks. For instance, analysis made by the European Aggregates Association in 2012 shows the effects of the economic recession in the region. Since 2005 tonnage has declined by 0.5 billion tons and consumption went down from 7 tons per capita in 2006 to 5 tons per capita in 2010. According to a report published by the University of Leoben (2010: 6), the European demand will soon recover reaching "*4 billion tonnes in the medium term, driven mainly by economic growth in Central and South Eastern Europe*".

1.2 Location factors for mining aggregates

Aggregate mining differs in four aspects from other mining activities:

✓ Geology (Bleischwitz and Bahn-Walkowiak 2006: 5)

The quality[3] and quantity of aggregates deposits are key factors behind the long-time planning perspective assumed by companies to ensure the supply of materials and to obtain exploration and mining licenses (Wagner and Tiess 2004 in Bleischwitz and Bahn-Walkowiak 2006). Moreover, and due to high transportation prices, the location of the extraction site is determined by geology in relation to distance to areas with high population demand. As a result, and following Poulin et al. (1994: 222), aggregate is "*employed wherever any type of building*" activity takes place, mining aggregates is one of the "*most dispersed*" raw material producing activities.

✓ Development in the construction industry

Since aggregates are not an end product, the success of the sector is determined by the achievements of downstream industries like cement, concrete and the construction sector as such (Figure 4).

✓ Price

Aggregate prices are extremely sensitive to location because minerals are bulky and have a low-unit-value (Poulin, et. al 1994). Thus they are highly transport sensitive as transportation can add significantly to the final cost of the product.

[3] The quality of aggregates refers to a combination of physical properties like particle size, shape, brightness, specific gravity, hardness, strength and insulating properties (Colman 2009).

Prices may vary from country to country and region to region. Besides the construction industry development, aggregates prices depend, on the material quality and on the number of operating companies. According to Bleischwitz and Bahn-Walkowiak (2006: 8), major imperfections are founded in the aggregates market:

(a) Time needed into put a site on operation in the market: Since at least four years[4] are necessary to "*bring new supply aggregates-based material capacity on stream, shortages can persist resulting in major prices*". *Once capacity exists and fixed costs have been incurred, producers are reluctant to curb output as long as some contribution is being made to overheads*".

(b) Economic recession: Aggregates are highly affected by recession in the construction and housing market, "*since consumer demand has to pick up before new orders for plants and machinery are made*".

✓ Planning regulations:

Nowadays construction market developments and the economic and geological criteria are not the only factors affecting the location of aggregates. Legal and planning instruments regulating the social and environmental conditions in which the extraction of aggregates takes places are additional factors to take into consideration**.** New legislation and a growing green lobby are making the global mining of new resources "*difficult, time consuming and costly with no guarantee of success*" (Lusty and Pilegis 2012).

1.3 The Vietnamese market for construction aggregates

Although in the developing world sand and gravel is widely exploited as construction aggregate, reliable data is usually not available. On the one hand, governments do not invest in assessing the availability and quality of sources of aggregates, and on the other hand, as aggregate is perceived as an abundant and low-unit value commodity, its extraction is not assessed or monitored.

In Vietnam, the Mineral Law (60/2010/QH12, Article 64) defines a list of 8 minerals used as construction materials:

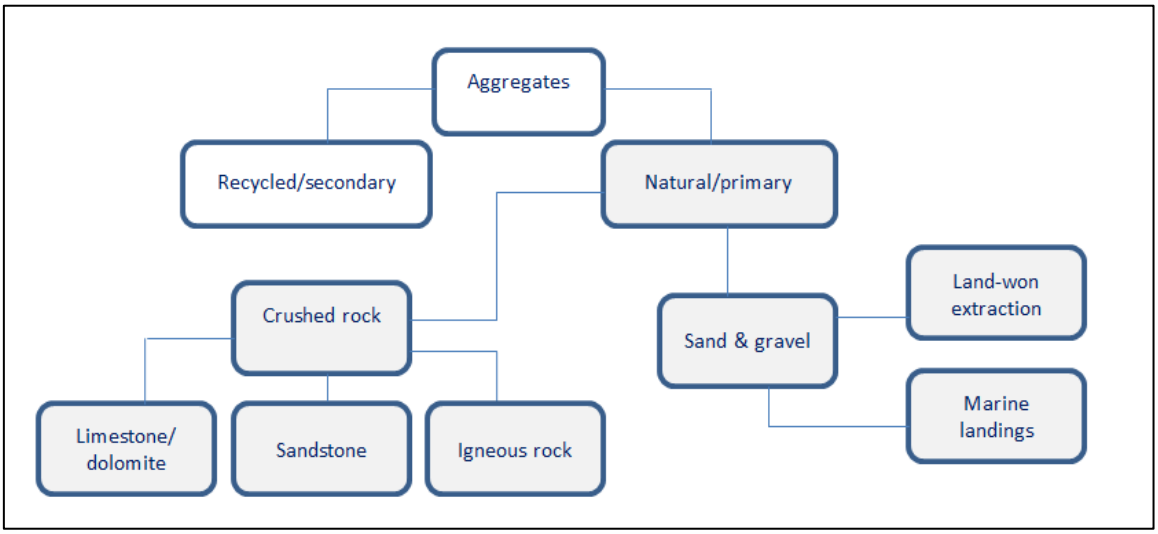
1. Sand of all kinds (except siliceous white sand) with SiO2 content of less than 85%;
2. Clay used for the production of bricks, clays (except bentonite and kaolin clays) not qualified for production of construction ceramics, fireclay materials and cement;
3. Sandstone and quartzite stone with SiO2 content of less than 85%;
4. Sedimentary rocks (except diatomite, bentonite and rock containing keramzit), magma rocks (except nepheline syenite rock, column or foam basalt), metamorphic rocks (except mica schist rich in vermiculite);
5. Schist except roofing schist, combustible schist and schist containing sericit, disten or sillimanit minerals exceeding 30% in content;
6. Pebbles, gravel and dust not containing gold, platinum, gemstones and semi-gemstones; laterite not containing native metals or metallic minerals;
7. Limestone, chalky clay and marbles (except limestone stalactites, white limestone and white marble) not qualified for use as materials for cement production;
8. Dolomite stone with MgO content of less than 15%, dolomite stone not qualified for the production of construction glass or for use as materials for the production of facing stones or fine-art stones according to Vietnamese standards and technical regulations.

[4] For the United States, Bolen (2002: 65.3) estimates the length of time needed for putting a "*new operation into production from 5 to 8 years, including the time required to prove the reserve base, to receive zoning and permit approvals, and to deliver and install the necessary equipment".*

Only in 2008, the country approved the National Master Plan[5] for "Exploration, Mining, Processing and Use of Minerals as Construction Materials" (Decision 152/2008/QD-TTg)[6]. The document provides figures regarding the total mineral reserves[7] and the expected demand for construction materials. In January 2012, Decision 45/QD-TTg adjusted and supplemented the figures on exploration, exploitation and use of eight (8) minerals for construction materials: Kaolin, White clay, Feldspar, Fire clay, White sand, Dolomite, Limestone and Granite.

As we can see, the National Master Plan does not list the same minerals as those mentioned in the law. Moreover, kaolin (white clay), fireclay and white sand are not considered natural (primary) aggregate, i.e. extracted specifically for use as aggregate and used for the first time. These minerals are classified as secondary aggregate, as they are obtained as a by-product of natural quarrying operations. From the National Master Plan list, only limestone, dolomite and igneous rocks (granite) are recognized by international organizations as natural aggregates and minerals for construction (Table 2 and Figure 3). Finally, it is important to highlight that sand and sandstone (one of the most common sedimentary rock) are not included in National Master Planning. Furthermore, although the text of the document mentions limestone, dolomite and igneous rocks (granite), national statistics make reference only to limestone and stone in general.

Figure 2: Classification of aggregates



Source: Adapted from British Geological Survey 2013

In 2012, 761 sites for the extraction of limestone and stone were identified in Vietnam and 73% of them have been surveyed (Table 4). As in the international discussion the word "reserve" refers to a mineral resource that has a valid planning permission for extraction (British Geological Survey 2013),

[5] National Mining Planning is elaborated for the exploitation and use of each kind or group of minerals. The Ministry of Construction is responsible for elaborating the Master Plan of Minerals for Use as Construction Materials (Decree 15/2012/ND-CP). They are made for a 5 year period with a 10-year vision.

[6] Since the release of the National Master Plan, only Decision 45/QD-TTg (2012) has been approved to adjust and supplement some articles of Decision 152/2008. Adjustments are incorporated in the analysis.

[7] In the international discussion the word "reserve" refers to a mineral resource that has a valid planning permission for extraction. Without this permission no mineral work can take place (British Geological Survey 2013). Thus, permitted aggregated resources are also called reserves (Kholer 2006 in Langer 2011).

it is unclear if any of the 557 "surveyed sites" are currently under exploitation. Statistics on mineral reserves (Table 4) and the expected material demand until 2020 (Table 5) are very generalized.
National Mineral Planning (Decision 45/QD-TTg) provides projections by macro-regions (Northwest, Northeast, Red River Delta, North Central Coast, South Central Coast, Central Highlands, Southeast and Mekong River Delta), provinces, districts and communes. The document also provides, the site location (grid reference), and sometimes the description and the year of discovery. For the Hoa Binh Province, only the Master Plan version from 2008 (Decision 152 replaced later by Circular 45 from 2012) indicates the exploitation of dolomite in the Da Bac District (2 sites) without providing figures.

Table 4: Vietnam: Mines and mineral reserves for selected aggregates in 2012

Mineral	Total mines	Of these mines		Mineral reserves		
		Not surveyed	Surveyed	Total	B+C1+C2	Natural reserves Category P
Limestone (million tons)	351	77	274	4.473,8	1.255,7	3.218,0
Stone (million tons)*	324	127	197	1.056,0	800,0	1.048,0

B: Reserves in place have been explored but are only known in fair detail. The quality and properties of the ore are known in sufficient detail to ensure the basic reliability of the projected exploitation.
C1: Reserves have been estimated by a sparse grid of trenches, drill holes or underground workings.
C2: Reserves are based on an extremely loose exploration grid, with little data.
P: Resources estimated outside the limits of areas explored in detail and often based on data from trenches.

*Original figures provided in m^3. To convert volume figures into mass figures, it was assumed that stones are in their natural state. As no information is provided regarding the type of stone (basalt and granite), the average factor of both minerals was used for conversion (2811 kg/ m^3).
Source: adapted from Decision 152/2008/QD-TTG and Decision 45/QD-TTg from 2012 - Master Plan for Exploration, Mining, Processing and Use of Mineral for Construction Material

Table 5: Vietnam: Minerals for construction planned to be exploited to meet demand to 2020

Mineral	2008-2010	2011-2015	2016-2020	Total
Limestone	n.i	n.i	n.i	n.i
Stone (million tons)*	281	843	843	1.967,7

n.i: no information

*Original figures provided in m^3. To convert volume figures into mass figures, it was assumed that stones are in their natural state. As no information is provided regarding the type of stone (basalt and granite), the average factor of both minerals was used for conversion (2811 kg/m^3)[8].
Source: Adapted from Decision 45/QD-TTg from 2012.

In Vietnam, statistics on the supply/production of minerals for construction do not exist. Therefore we indirectly estimated the use of sand and gravel through the production of cement for concrete (UNEP 2014). The cement[9] consumption in the country reached 50.8 million tons in 2014, while the exported volume was 21.1 million tons (Vietnam Cement Market Report 2015). Compared with the total capacity of 89.6 million tons year, the utilization rate was considerably low at 60%, excluding export sale volume (PR Newswire 2016)). For each ton of cement, the building industry needs about six to seven times

[8] www.simetric.co.uk
[9] Vietnam has a Plan for Exploitation and Use of Minerals to produce cement during 2011 to 2020 and a vision towards 2030 (Decision 105/2008/QD-TTg). It is planned to exploit nearly 1.5 million tons of minerals from 2011 to 2020, specifically: 1.1 billion tons of limestone (for cement), 261 million tons of clay and 129.6 6 million tons of additives.

more tons of sand and gravel (USGS 2013 in UNEP 2014). Thus, the mined sand and gravel during 2014 can be estimated at between 431.4 million and 503.3 tons a year. The figure is similar to the total production of aggregates in some European countries (Table 3).

Among all the minerals used for construction, only limestone must have a detailed development plan. Currently, the Ministry of Construction is elaborating the Plan for Industrial Lime Production Development to 2020, with a vision to 2030 (Vietnam Chamber of Commerce and Industry 2013). The plan aims to "*lay the cornerstone for abolishing backward lime production facilities"*. To this end the Ministry of Construction (MOC) asked the Provincial People's Committees to stop licensing new lime production projects if they do not have permits from the MOC. Besides, local authorities have been told to revoke investment licenses for lime production if the registered lime exploitations are not suitable for construction material production (Decision 45/QD-TTg), "*or do not have assessment reports on technological level, environmental assessment reports and reports on compliance to land use and construction plans"* (Vietnam Chamber of Commerce and Industry, 2013).

In 2012, the Ministry of Construction published a circular on Guiding the Export of Minerals as Building Materials (Circular 04/2012/TT-BXD). Surprisingly, the circular lists minerals banned from export in detail including, in some cases, spatial references. Minerals banned from export are: limestone and additives in the planning of minerals for producing cement; building stone from the mines in Southeast and Southwest Provinces; stone blocks; salted sand; building sand (natural sand); gravel; feldspar and clay (Table 6).

Summarizing, despite the government protecting natural aggregates from export, no detailed information regarding production, consumption, transportation and/or trade (prices) is available at the national level. Figures publicly available are either not consistent or incomplete (Tables 3 and 4).

Table 6: Vietnam: List of minerals for use as building materials banned from export

Limestone and additives included in the Master Plan or minerals for use as material for cement production
Building stone exploited from mines in Southeast and Southwest Provinces
Stone blocks
Salted sand
Building sand (natural sand)
Gravel
Feldspar
Clay, hill earth

Source: Ministry of Construction, Circular 04/2012/TT-BCT

1.4 The Hoa Binh Province market for construction aggregates

The information available about minerals used for construction is more detailed at the provincial level. In 2015, the Hoa Binh Register of Legal Mining Business reported 48 operation sites for natural aggregates allocated in a total surface of almost 500 hectares[10] (Table 7).

[10] Hoa Binh Province has an area of 4662 km². Thus the land destined for mining activities represents 0.1%.

Table 7: Hoa Binh Province: Operating sites for exploration and exploitation of aggregates in 2015

Type of Material Districts	Operating Sites (No)	Operating Area (ha)	Mine reserve (million tons)	Annual production
Stone for Construction (Basalt)	**2**	**25.2**	**3.57**[1]	**840.220 tons**[2]
Luong Son	2	25.2	3.57	840.220
Stone for Construction (Limestone)	**45**	**376.2**	**49.6**[3]	**12.251.519 tons**[4]
Cao Phong	3	8.0	0.92	193.628
Da Bac	1	3.0	0.30	62.160
Kim Boi	3	8.0	0.70	138.306
Ky Son	1	5.6	0.93	54.390
Lac Son	1	3,0	0.24	62.160
Lac Thuy	1	10.0	0.80	15.540
Luong Son	26	2982.2	40.47	10.502.370
Mai Chau	1	4.7	0.20	62.160
Tan Lac	3	6.1	0.50	163.014
Yen Thuy	3	21.0	3.86	866.283
Hoa Binh	1	3.7	0.60	69.347
n.i	1	4.9	0.33	62.160
Sand (Da river)	**1**	**20**	**1.72**[5]	**51.894 tons**[5]
Ky Son	1	20	1.72	51.894
Total	**48**	**492.55**		

[1]Original figures are provided in m^3. To convert volume figures into mass figures, it is assumed basalt is in a natural state. Conversion factor: 3011 kg/m^3 [11]
[2]Original figures are provided in m^3. To convert volume figures into mass figures, it is assumed basalt is broken. Conversion factor: 1954 kg/m^3 [12]
[3]Original figures are provided in m^3. To convert volume figures into mass figures, it is assumed limestone is solid. Conversion factor: 2611 kg/m^3 [13]
[4]Original figures are provided in m^3. To convert volume figures into mass figures, it is assumed limestone is broken. Conversion factor: 1554 kg/m^3 [14]
[5]Original figures are provided in m^3. As no information is provided regarding the type of sand (wet/dry), the average factor of both was used: 1922 kg/m^3 [15]
Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

Limestone is the most mined material in the province and it is commonly used to make crushed stone. It is widely available and suitable for a great diversity of uses (for cement and as a primary ingredient of concrete). Most of the extraction sites are located in Luong Son (70%), the northwest gateway to the province (Figure 3). The “stone heart” of the province is located only 40 kilometres away from Hanoi. Besides 26 operation sites for limestone, 2 sites for basalt extraction are located there.
In 2013, the Hoa Binh Province published the Master Plan for the Exploration, Exploitation and Use of Minerals for Construction Materials (Resolution 76/2013/NQ-HDND). According to the document (Table 8), 1373 hectares will be used for mining stones and 95 for sand. The Register of Mining Business from the province reports (Table 7) somewhat lower figures for the end of 2015 (401 hectares for

[11] www.simetric.co.uk
[12] www.simetric.co.uk
[13] www.simetric.co.uk
[14] www.simetric.co.uk
[15] www.simetric.co.uk

mining stones and 20 for sand). According to interviews conducted with mining entrepreneurs and DONRE officials, the impact of the financial crisis and the introduction of additional taxes and compensation regulations have discouraged further aggregate investments[16]. Moreover local actors (from the private and public sector) do not believe that Mining Master Planning projections will be accomplished in the province. Official information recognizes tighter controls introduced by MONRE in 2014. New regulations compelled firms to pay for the granting of mining rights and to set up processing facilities, preventing players with financial and technological constraints from venturing into the business.

Table 8: Hoa Binh Province: Plan for the exploration, exploitation and use of three types of minerals used as construction material: 2014-2019 with a vision towards 2024

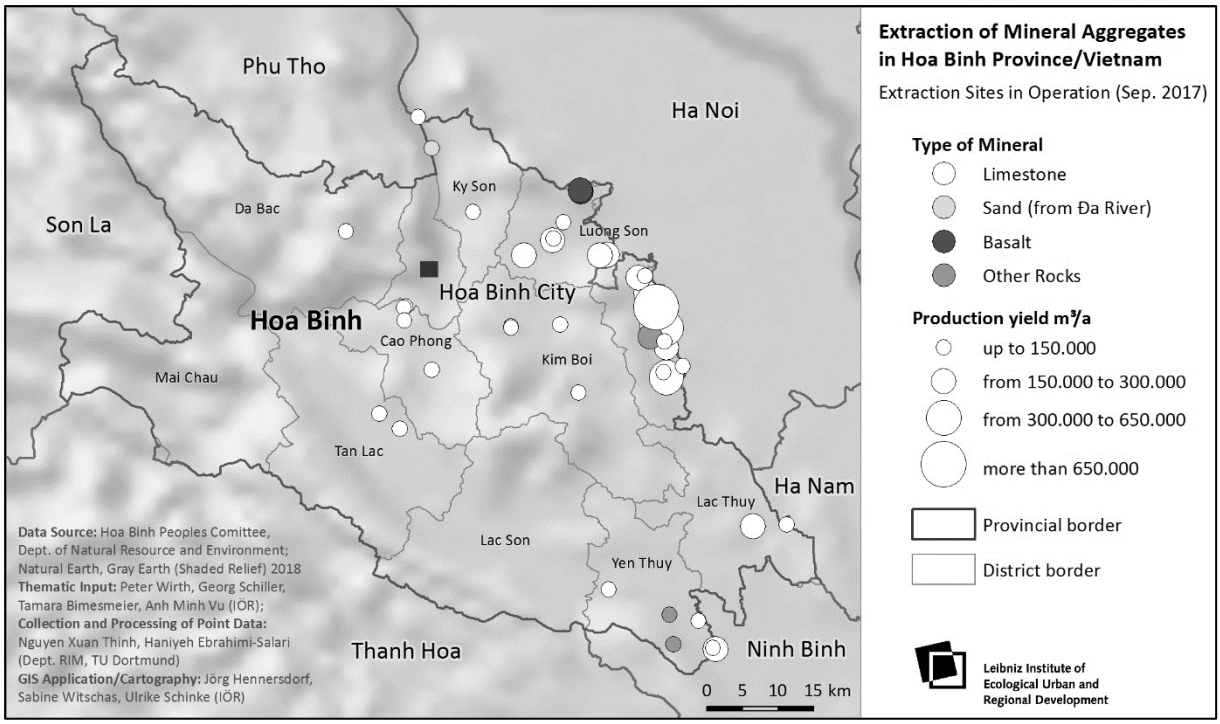
Type of Material Districts	**Area for exploration and exploitation**			**Planned area (ha)**	**Expected production 2019 (tons/year)**
	In use (ha)	**Projected 2019 (ha)**	**Increased in 2019 (%)**		
Stones for construction	**1373.45**	**2406.19**	**63,6**	**3779,64**	**32.180.328***
Da Bac	3.0	88.9	96.7	91.9	224.880
Ky Son	91.3	166.39	64.5	257.7	2.811.000
Luong Son	965.89	1.189.34	55.1	2155.23	23.789.493
Mai Chau	7.3	79.7	91.6	87.0	281.100
Tan Lac	22.4	32.6	59.2	55.0	421.650
Hoa Binh	20.64	6.86	24.9	27.5	365.430
Cao Phong	14.84	53.96	78.4	68.80	702.750
Kim Boi	14.0	227.91	94.2	241.91	801.135
Lac Son	8.0	84.78	91.3	92.78	421.650
Yen Thuy	51.2	162.95	76.0	214.15	885.465
Lac Thuy	164.87	321.37	66.0	486.24	1.475.775
Sand for construction	**95.0**	**195.3**	**67.2**	**290.3**	**1.105.150****
Ky Son	95.0	178.0	65.2	273.0	1.057.100
Lac Thuy	-	17.3	100	17.3	48.050

*Original figures provided in m^3. To convert volume figures into mass figures, it was assumed that stones are in their natural state. As no information is provided regarding the type of stone (basalt and granite), the average factor of both minerals was used for conversion (2811 kg/m^3)[17].
**Original figures are provided in m^3. As no information is provided regarding the type of sand (wet/dry), the average factor of both was used: 1922 kg/m^3 [18].

Source: Adapted from the Hoa Binh Master Plan for Exploration, Exploitation and Use of Minerals for Construction Materials (Resolution 76/2013/NQ-HDND)

[16] Interviews conducted with 3 small/medium aggregate entrepreneurs during their visit to Germany (June 26-July 3, 2016).
[17] www.simetric.co.uk
[18] www.simetric.co.uk

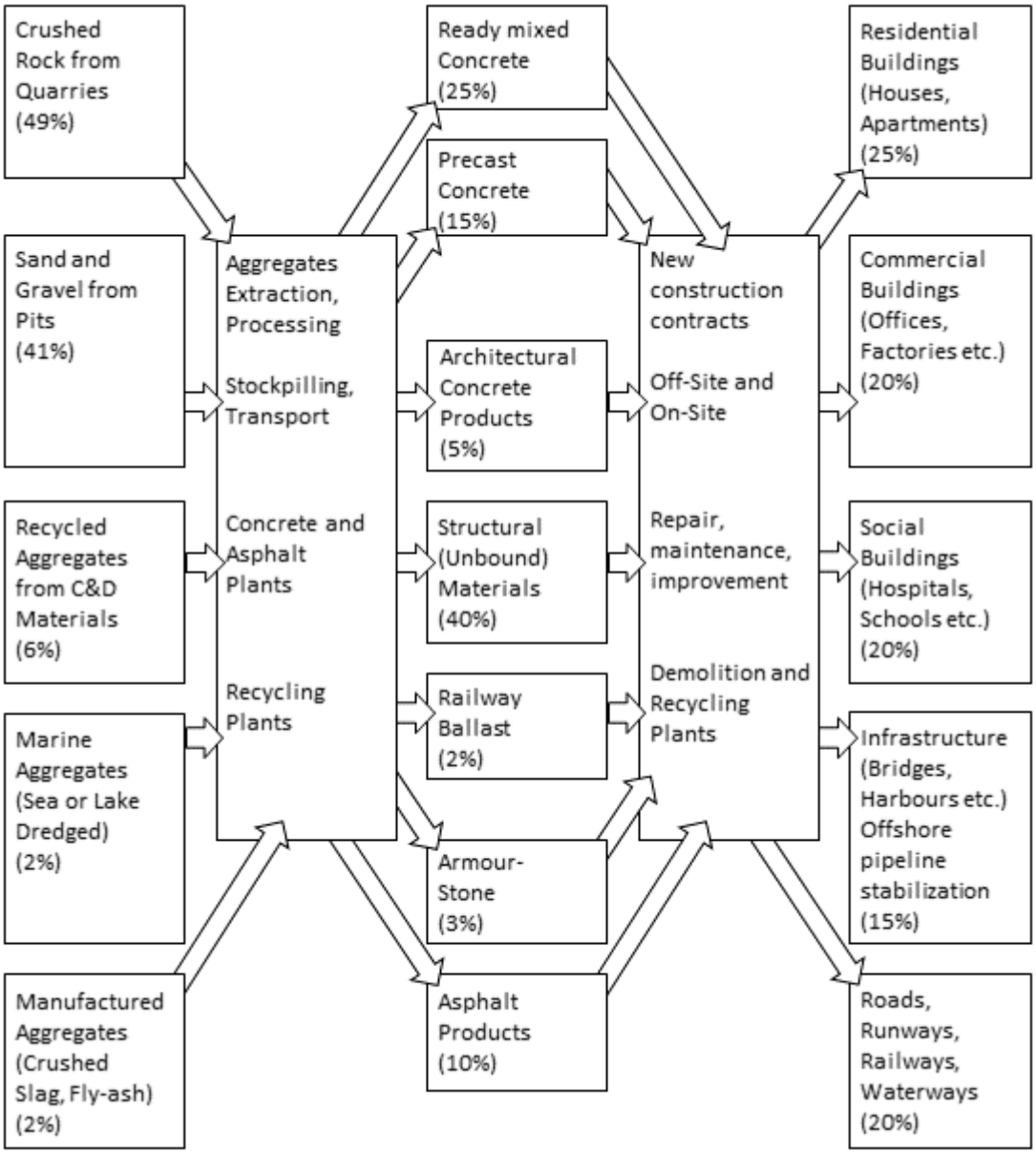
Figure 3: Extraction of aggregates in Hoa Binh Province/Vietnam



2. The economic contribution of mining aggregates in Hoa Binh Province

The community where mineral extraction occurs, usually experiences a combination of economic benefits and local environmental disruptions (Langer et al., 2004). The economic benefits of aggregate for national economies are extensively discussed in the literature. Aggregates are an essential input to many other industries, making significant contributions to GDP (Figure 4). According to the Phoenix Center for Advanced Legal & Economic Public Policy Studies (2017), each dollar of earnings (i.e., wages) in aggregates extraction creates another $4.19 of earnings in other sectors, and each dollar of sales in the industry produces another $3.47 of sales in other industries. In this section we concentrate on the analysis of aggregates extraction as a contributor to the economic wellbeing of Hoa Binh Province. Unfortunately the lack of accurate and disaggregated data on aggregates prices, sales, location and revenues makes difficult to conduct an exhaustive analysis on the economic impacts of the activity.

Figure 4: Natural aggregates: value chain raw material, intermediate products and final usages

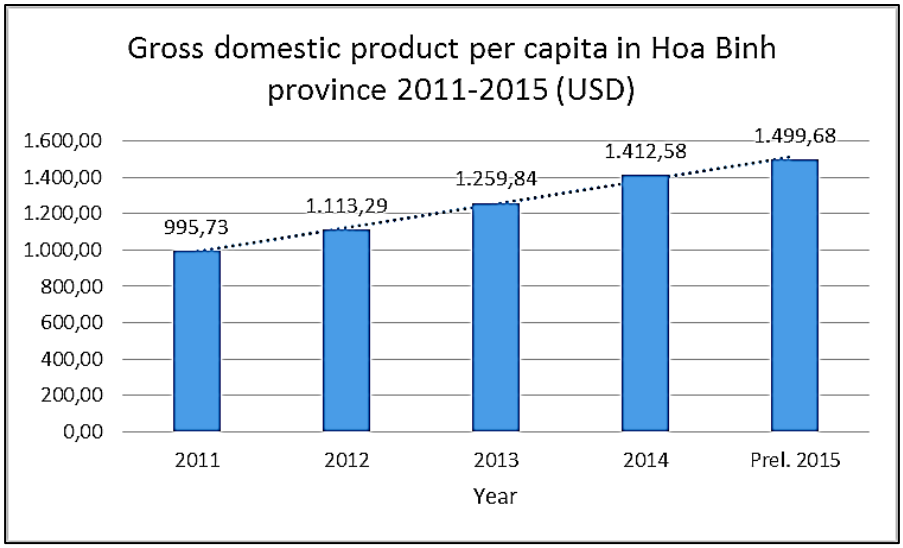


In parenthesis, % tonnage of aggregates
Source: University of Leoben 2010

2.1 The role of the aggregates industry in the economy

Hoa Binh is one of the poorest mountainous provinces in northwest Vietnam, especially Da Bac District (Figure 3). As Figure 5 shows, the provincial GDP per capita in 2015 was much lower (1500 U$) than national figures (2111 U$) reported by the World Bank in 2017. Poverty is a critical provincial issue, with an alarming rate of 33.86%, leading to with high rates of malnutrition in children[19].

Figure 5: Hoa Binh Province: GDP/capita (U$), 2011-2015



Source: HB StatYB, Table 39, page 71

The economic structure of the provincial economy is rather heterogeneous and the service sector is the strongest economic branch (Figure 6). Agriculture, forestry and fishing (23%) are still very important as many local people depend on these activities for their livelihoods. According to the information obtained from the Provincial Socioeconomic Department, 85% of the population is ethnic Muong, a national minority. Due to the mountainous and hilly geographic conditions, most communes do not have much land for farming as terrain is rugged and the poor quality soil is difficult to farm. During the months in between crops, many households are severely affected by food shortages, which leads to an unstable quality of life for the local people in general and children in particular. Moreover, the province is affected by frequent landslides and severe cold weather, causing the deaths of animals and destroying crops.

The high rate of energy production (21%) results mainly from the Da River Dam power station located close to Hoa Binh city. The hydroelectric dam is the largest in Vietnam and the second largest in South Asia. Financed and built by the Russians, the dam was completed in 1994, producing approximately 27% of Vietnam's electricity and employing more than 800 people. The hydropower is the main source of the province's income, representing approximately 50% of the total provincial government revenue[20].

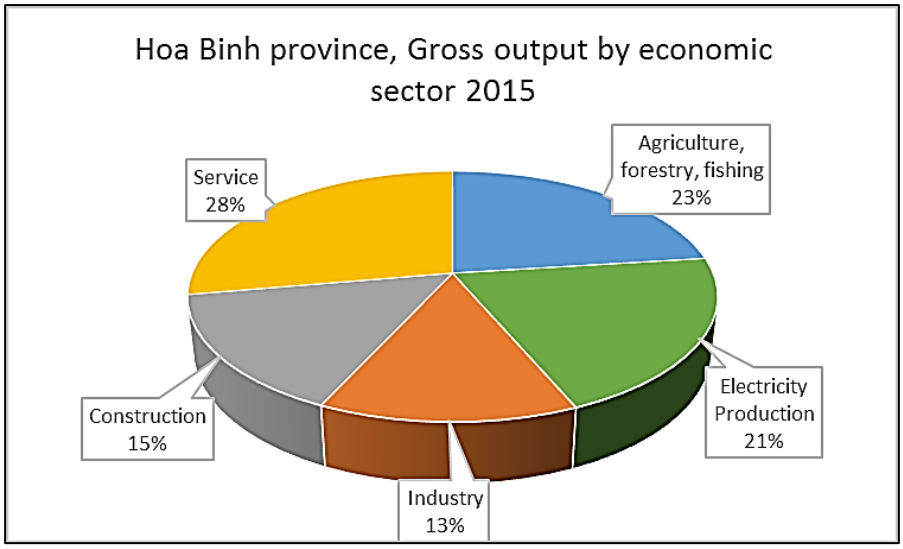
The industry (including manufacturing and mining) and construction sectors have a low impact in the province contributing 13% and 15% respectively to the provincial gross output. As around 90% of aggregates production is closely linked to the construction and maintenance industry, it is important

[19] Aide et Action Vietnam. Website: http://vietnam.aide-et-action.org/where-we-work/ (retrieved August 15, 2018).

[20] Information gathered in the Finance Department, Hoa Binh Province. November, 2016.

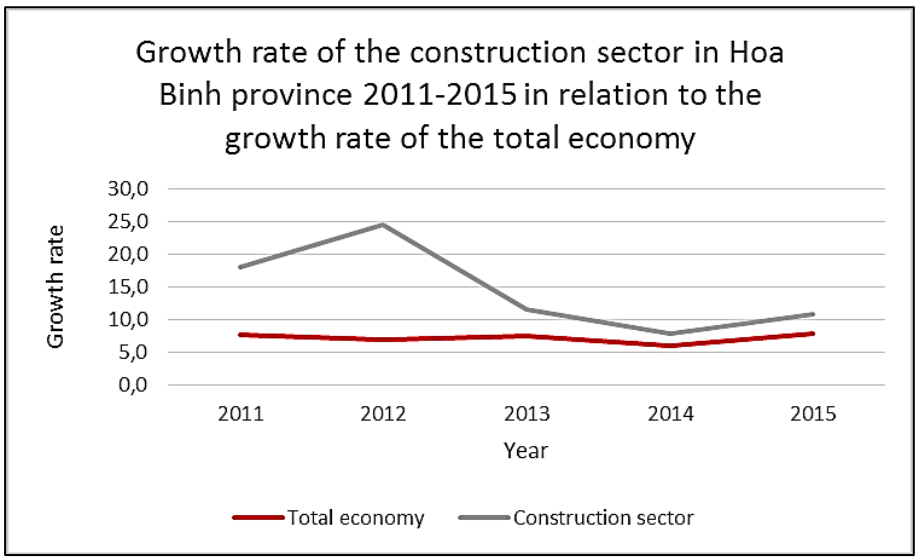
to analyse the development of the provincial market in more depth (Figure 6). During 2011 and 2015, the construction sector underwent a constant growth, representing around 7% of GDP. Nevertheless in 2012 the sector experienced interesting growth followed by a sharp drop. It can be assumed that this development is associated with a late market response to the economic crisis. Beginning in 2008, Vietnam's economy cooled off with high inflation, mounting public debts, mass bankruptcies of private businesses and a tight real estate market (Benedicter, 2016: 3). The ups and downs in the construction sector are coincident with the development of the exploitation licenses granted to mining companies during the same period (Section 4.2, Figure 7).

Figure 6: Hoa Binh Province: Gross output by economic sector, 2015



Source: HB StatYB, Tables 28 and 31, pages 52 and 57/58

Figure 7: Hoa Binh Province: Growth rate of the construction sector, 2011-2015



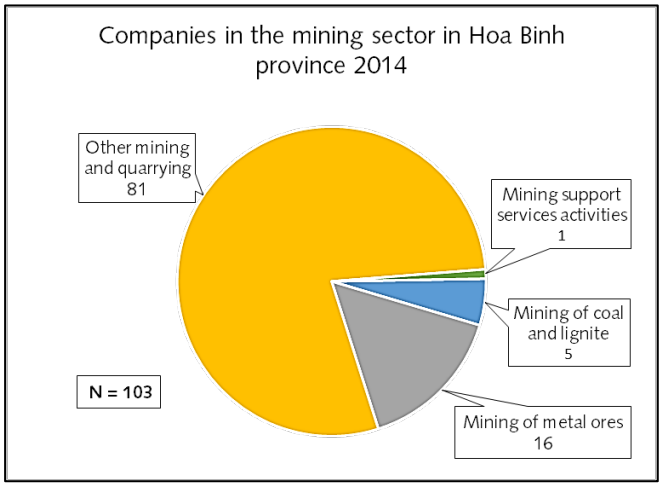
Source: HB StatYB, Tables 28 and 32, pages 52 and 59

Summarizing, electricity production and services provision are the vital economic sectors in Hoa Binh. The mining and construction sectors play a minor role. Given the high transportation costs, quarries in Vietnam are spatially dispersed, operating in all provinces. Since much of the economic impact of aggregates is based on induced effects (Figure 4), the economic impact at the commune and district level is much smaller than the provincial or national multipliers.

2.3 The impact of aggregates extraction in local employment

The mining industry in Hoa Binh is mainly oriented to blasting and quarrying stone as 81 (79%) of the 103 registered companies belong to this branch (Figure 8).

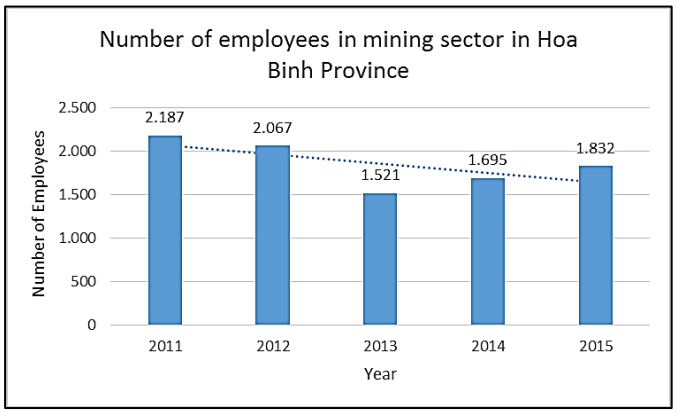
Figure 8: Hoa Binh Province: Companies in the mining sector (Number), 2014



Source: HB StatYB, Table 75, page 180

In theory, concerning benefits, firms extracting aggregates offer direct and indirect employment through industries and contractors, providing machinery, equipment and services. However, statistics in Vietnam do not provide such details, referring only to the number of employees working in the mining sector as a whole. The number of employees has fallen over recent years, representing nowadays only 4% of the total employed persons in the province (Figure 9).

Figure 9: Hoa Binh Province: Employees in the mining sector (No), 2014

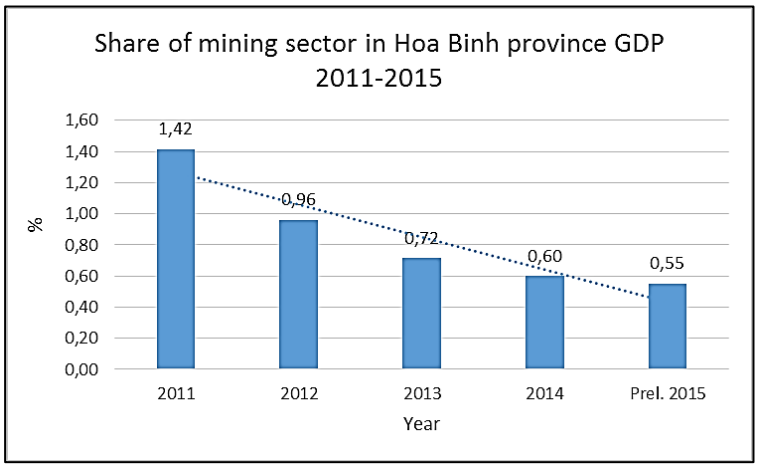


Source: HB StatYB, Table 69, pages 151 ff

According to international standards, each job in the aggregates industry supports an additional 4.87 jobs throughout the economy (Phoenix Center for Advanced Legal & Economic Public Policy Studies 2017). These jobs are widely spread across industries and occupations. If we considered that all employees in the mining sector in 2015 worked in aggregates extraction (1832), 8189 persons were working in industries supporting aggregates. This number represents only 18% of the population employed in the province.

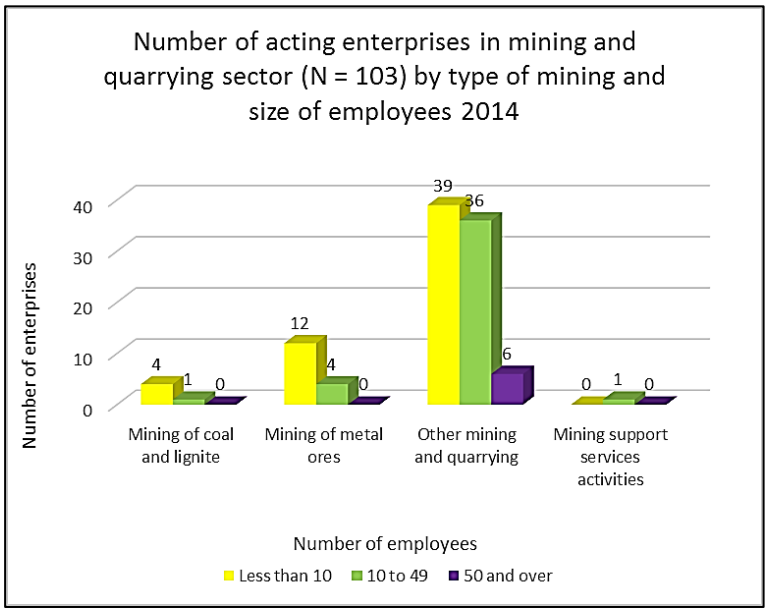
Moreover, the contribution of the mining sector to the provincial GDP nearly halved from 2011 to 2015 (Figure 10). Evidence shows that aggregates extraction plays a marginal role in Hoa Binh Province. Most of the quarrying companies (92%) are small and medium sized enterprises (Figure 11) with small annual extraction volumes per mine, i.e. less than 50,000 m^3/year against a benchmark average of 300.000 m^3/year (Schneider et al. 2018)

Figure 10: Hoa Binh Province: Mining contribution to GDP, 2011-2015



Source: HB StatYB, Table 37, pages 67/68

Figure 11: Hoa Binh Province: Mining enterprises by type and size, 2014



Source: HB StatYB, Table 73, pages 169 ff

Despite the marginal economic impact of aggregates mining in the province, the industry plays a pivotal role in alleviating poverty. According to the provincial authorities[21], even if small-scale mining tends to be low-paid and highly precarious, it provides direct employment, though often at subsistence level, and reduces rural-urban migration. When viewed in this light, it is possible to understand why any attempts to restructure and improve the sector operations (increasing taxes, environmental regulations, operation size, etc.) are seen with extreme caution by the local authorities.

2.4 The impact of aggregates extraction in land use

Regarding economic disruptions, an important one is related to land use, as the extraction of aggregates comes at the expense of other sectors (agriculture, tourism, recreation and residential uses), even if the quarry has a temporary character.

Local conflicts are characterized by discrepancies regarding localized environmental costs to communities versus the dispersed economic benefit for the whole society (Baker and McLellan 1992). However, it is often argued that if mining operations are prevented, regional costs will increase, shifting the problems to more truck traffic, noise, accidents, and more hydrocarbons being released into the atmosphere (Robinson and Brown 2002; Langer et al., 2004).

In Hoa Binh, farmers living and working close to quarries use negative environmental (traffic, noise, vibration dust) and socioeconomic impacts (fears regarding lowered property values) together with nature protection arguments (visual intrusion and landscape damage) to oppose mining operations[22]. However there are not too many opponents to mining aggregates in Hoa Binh. Quarries are scattered and located in low density areas, confirming Robinson and Brown's (2002) findings, opposition to quarries "often grows in proportion to the size and intensity of the operation".

Some researchers (Drew et al., 2002; Bloodworth et al., 2009) argue that this discussion is highly influenced by public perceptions or "socio-cultural constraints" (Robinson and Brown 2002) and the NIMBY (Not in My Back Yard) syndrome, often exceeding reality as the industry has incorporated technology to reduce and eliminate hazards associated with extraction. However in Hoa Binh, since the small scale aggregate industry cannot afford the use of technology to reduce and eliminate many of the environmental impacts associated with the extraction activities, such impacts are experienced primarily by farmers and local residents.

[21] Interviews conducted with the Secretary of the Communist Party and the Chairman of the Provincial People's Committee in Hoa Binh Province, November, 2016.

[22] Interviews conducted with the farmers, residents and tour operators in Tan Vinh Commune, Hoa Binh. November, 2016 and December 2017.

3. Instruments regulating the impacts of mining aggregates in Vietnam

3.1 Environmental impacts

The debate regarding the responsible extraction of aggregates is diverse, complex and multi-layered. On one hand, the "*ecocentrist"* vision (Drew et al., 2002) argues that aggregates have to be protected as they are formed by processes lasting over millions of years, and they are "*currently extracted at a rate far greater than their renewa*l" (UNEP 2014: 1). In this view, aggregates are considered locally unwanted land uses (LULU) and a source of conflicts due to their undesirable environmental impact. On the other hand, the "*anthropocentric vision"* (Drew et al., 2002) sees aggregates as an essential component of economic development, vital to promote and provide societal benefits (McEvoy et al., 2004; West and Cho 2006). From this perspective mining is encouraged and environmental problems are acknowledged and identified before mining begins.

The anthropocentric vision is well reflected in the current relevance given to the environmental impacts associated with aggregate extraction. However, for some scholars, the depletion of the aggregate resource is not considered a major problem, rather the environmental impacts associated with the extraction, processing and transportation of aggregates (McEvoy et al., 2004; Bahn-Walkowiak et al., 2012: 2). The debate concerning the promotion of responsible extraction of aggregates is well summarized by Drew et al., (2002: 19) when they argue: "*ironically, the utility created for mankind by the use of natural aggregate is rarely compared favourably with the environmental impacts of mining it".*

Table 9: Potential environmental impacts from aggregate extractive activities

Activities	Potential impacts					
	Habitat loss, deterioration, disturbance and fragmentation	Drawdown and pollution of the water table	Noise, vibrations, dust and fumes	Loss of soils and agriculture	Landslides and collapse	Landscape aesthetics
Stripping of soil and vegetation	x	x		x	x	x
Blasting to release ores/rocks	x	x	x	x		x
Surface and groundwater discharge	x	x			x	x
Transport of materials	x	x	x	x		x
Infrastructure development (roads, conveyor belts, crushers, storage sites)	x	x	x	x	x	x

Source: based on European Commission 2010; Langer et al., 2004; Toronto Environmental Alliance 2009

Commonly the mining of aggregates starts with removing the overburden to expose the material. This process is undertaken by a bulldozer and followed by building haul roads, settlement ponds, and infrastructure. The method of extraction depends on the specific material (sand, gravel or crushed stone) and the conditions at the site (Langer et al., 2004). Since aggregates are extracted principally from surface mines, the main direct impacts are on landscape aesthetics and in the conversion of land use (Langer and Arbogast 2002). For instance, many abandoned stone mines can be seen from the road connecting Hoa Binh Province and Hanoi Metropolitan Area. Although most probably these mines made the highway construction less expensive, their impact on the valuable scenery is significant.

Other impacts associated with the removal of surface soil are erosion and the loss of habitat (Table 9).

Blasting rock deposits can produce ground vibrations, noise and dust (Langer, Drew and Sachs 2014). Blodgett (2004: 5) mentions that "public nuisance" is a very important effect of the operations of aggregates as "*nearby homes can be covered with a fine layer of perlite or mica dust from the mill".* In addition, the groundwater levels and the filtration of the rocks might be affected, modifying or interrupting natural water recharge (Toronto Environmental Alliance 2009). Finally, although we do not want to describe these impacts in detail, the transportation of aggregates to the point of use is another concern of the industry as it can generate several impacts (danger, dust, vibration, congestion, noise and use of roads unsuitable for the size of the vehicles).

Environmental impacts depend on a range of factors like the type of resources (mining limestone is different from granite or sand), the extraction methods, the scale of the process, and on the particular characteristics of the location site. For instance quarries located in a wetland, near a river or a lake might experience heavier impacts than those located in already altered environments (European Commission 2010). Moreover impacts can be temporary (noise, dust) or permanent (landscape alteration), on-site or off-site and can occur at different moments during the extraction activities (SARMa Project 2011: 25).

Although impacts associated with the extraction of aggregates have been qualified by some scholars as "*benign*", "*easy to predict and observe*" and manageable with the use of appropriate technology (Langer and Arbogast 2002: 151), they are difficult to measure, especially landscape degradation. Additionally, documenting the environmental impacts produced by aggregates is problematic because data are fragmentary, inconsistent, and commonly there is no "baseline" that would allow comparisons of pre-mining activities and active mining conditions (Blodgett 2004). In the next section we analyse how Vietnamese regulation considers and regulates the potential environmental impacts of mining activities.

Environmental Impact Assessment (EIA) and Environmental Protection Plan (EPC)

According to the Law on Environmental Protection (No. 55/2014, Chapter 3, Article 37) a permit for exploration, extraction and use of mineral resources must include information about environmental protection in accordance with the law. A mining company intending to undertake mining activities must submit an **Environmental Impact Assessment (EIA)** or an **Environmental Protection Plan (EPP)** to the Ministry of Natural Resources (MONRE) or the Department of Natural Resources (DONRE), depending on the size of the investment project for approval (Table 10). Additionally, projects mining solid minerals must present a **Report of Environmental Protection Works.**

Figures provided by the Register of Legal Mining Business of Hoa Binh Province (November 2015) report that from 48 sites exploiting natural aggregates, 25 produce less than 50.000 m^3 (small operations) and 23 over 50.000 m^3 (Table 10). However, as there is no information available regarding the use of industrial explosives, according to the law (Tables 10/11), 22 mining projects (companies) must have presented an EIA Report.

Table 10: Vietnam: Selected mineral exploitation projects subject to EIA Reporting

Project	Size	Report of environmental protection works
Project for extraction of sand, gravel, levelling materials	Crude sand or gravel: at least 50.000 m^3/year	No
Projects for solid mineral extraction (not using toxic chemicals, industrial explosives)	Mineral or earth and stone waste: at least 50.000 m^3/year	All

Source: Decree 18/2015/ND-CP

Table 11: Hoa Binh Province: Sites under aggregate exploitation by type of mineral and size, 2015

Mineral	Annual production size			Number of extraction sites
	Less than 50.000 m^3	50.001-99.999 m^3	Over than 100.000 m^3	
Basalt	-	-	2	2
Limestone	24	-	21	45
Sand	1	-	-	1

Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

In Vietnam an EIA report has the following major content (Decree 29/2011/ND-CP, Article 17):

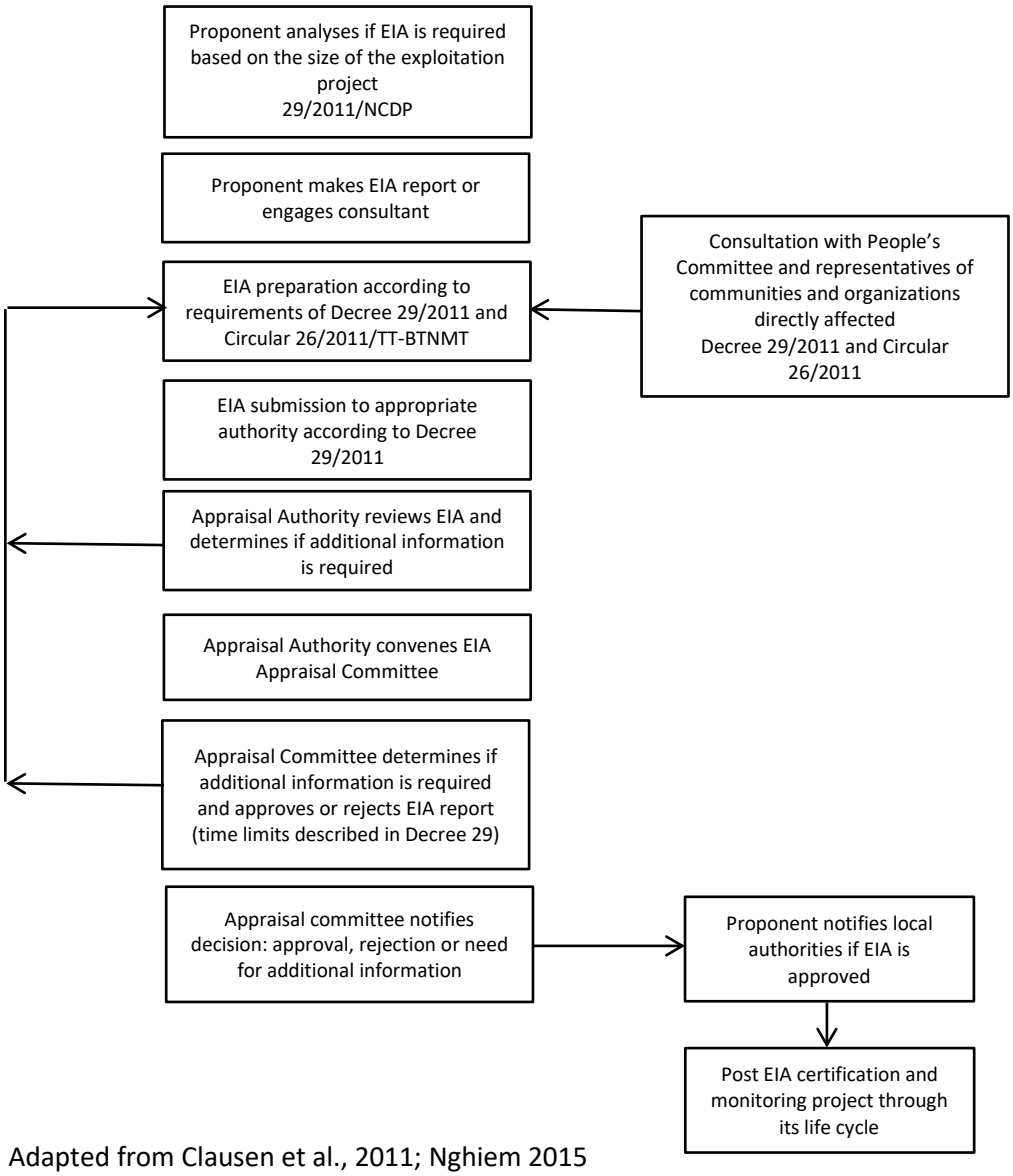
a) Indication of the project owner, agency competent to approve the project; sources of information; data and methods used and information regarding the consultation process with the community;
b) Listing and detailed description of the project's activities and work items which are likely to have adverse environmental impacts, indicating the size in terms of space and time, construction volume, operational technology of each work item and the entire project;
c) General assessment of the current status of the environment of the project site and its neighbourhood, level of environmental sensitivity;
d) Assessment and prediction of the project's impacts on natural conditions, natural environment components, the community and related socio-economic elements; results of consultation with the community (Article 14);
e) Proposal of measures to mitigate adverse impacts on natural conditions, natural environment components, community health and related socio-economic elements;
f) Listing of works and programs for managing and controlling environmental issues in the course of project implementation;
g) Estimation of costs for construction of environmental protection works in the project's total cost estimate;
h) The owner's commitment to taking environmental protection measures in the course of project construction and operation proposed in the EIA report.

EIA reports for mining aggregates shall be appraised by the Provincial People's Committees (Decree 29/2011/ND-CP, Article 18 b). During the assessment process the People's Committee Council shall perform the following tasks: (Circular 27, Article 8)

- Survey and verify information and figures of current environmental conditions at the place where the project is carried out and the adjacent area;
- Collect sample(s) for analysis and verification;
- Hold consultation with experts, social organizations, professional organizations which criticize the contents of the EIA report;
- Hold assessment seminars

Aggregate mining projects below the standard sizes described in Table 10 have to present an Environmental Protection Plan (Decree 18/2015/ND-CP). The contents of a written EPC are: a brief introduction of the production plan; generated waste, and a commitment to taking measures to reduce and treat waste. The registration dossier of a written EPC comprises the EPC document and the investment project (feasibility study report).

Figure 12: Vietnam: EIA Process for projects on mining aggregate



Source: Adapted from Clausen et al., 2011; Nghiem 2015

The Vietnamese government not only recognizes and incorporates the EIA as an important management tool for approving and implementing mining projects (Figure 12). The major EIA contents allow the identification and assessment of all the potential environmental impacts associated with the mining process of aggregates (Table 9). Additionally the EIA reviewing and appraisal process is clearly described in the legislation (Figure 12). Although the government has made significant efforts to institutionalize environmental protection - including the adoption of a new Law on Environmental Protection - an *"important gap remains between EIA theory and practice"* (Clausen et al., 2011: 136). The gap is mainly reflected in the capacity, skills and independence of the practitioners involved and in the effectiveness of public participation in the decision making process (Clausen et al., 2011).

According to the public consultation, the UNDP (2015) described it as "formalism" because it is often skipped.

Plan of Environmental Rehabilitation

According to the Law on Environmental Protection (55/2014, Article 38) organizations or individuals exploiting minerals must present an Environmental Rehabilitation Plan, to prevent environmental emergencies. The plan should meet the following requirements:

- Description of the process of collection and disposal of wastewater and solid wastes in accordance with the relevant laws
- Include measures to prevent and control the spread of hazardous waste, dust and emissions threatening the surroundings
- Present a Plan including actions to rehabilitate and restore the environment during the process of exploration, extraction and processing of minerals

The plan has to be enclosed and approved together with the EIA reports. After completing rehabilitation activities, exploiters shall send dossiers (including community consultation) requesting certification of the completion of activities to MONRE or DONRE. In case rehabilitation activities are not appropriate, competent agencies shall decide about the use of the deposits for environmental restoration, selecting the specific areas to restore the environment in accordance with the law.

Unfortunately, and despite the existence of a comprehensive national environmental protection normative framework, at least until 2011, environmental rehabilitation activities were not implemented in many localities (VCCI and CODE 2011).

Post Mining Rehabilitation

Mining and quarrying legacies can persist long after aggregate extraction ends. Often pushed, out by urbanization or infrastructure developments, quarries for crushed stones and mining sand constantly move to new places. In this process, abandoned open pits remain on hills, in the case of quarries, or along the river valleys from where sand was exploited (Damasceno and Damasceno, 2000). For a long time mining reclamation[23] has attracted the interest of researchers and planners. In the 1990s a first movement of lignite mines closures begun in Eastern Europe, especially in Germany. However, and although many successful rehabilitation experiences have been introduced (European Union 2012), many old pits and quarries worldwide are not being properly rehabilitated (Canadian Institute for Environmental Law and Policy 2011).

In Vietnam, mining rehabilitation activities were mentioned for the first time 10 years ago in the second Environmental Law (52/2005-QH11, Article 44-d). Nevertheless only in 2008, the government decision on mining rehabilitation was defined and described in detail (Decision 71/2008/TTg). As Decision 71 details the process of making deposits for mining environmental rehabilitation and restoration it was necessary to define both, the meaning of the concepts[24] and the main requirements for closing a mine (Table 12). One year later, Circular 34/2009/TT-BTNMT was published detailing a number of provisions of Decision 71 with respect to the formulation, appraisal and certification of rehabilitation and restoration projects.

[23] Reclamation is the process of converting derelict land to usable land and may include engineering as well ecological solutions (European Union 2012).

[24] Environmental rehabilitation and restoration are defined in Decision 71/2008/Article 2, as "activities to rehabilitate and restore the environment to meet restoration requirements" (Table 11).

Table 12: Vietnam: List of requirements for open-cast mines

Mines not threatening to generate acid mine drainage
a) To fill up the pits according to pit-mining regulations; b) For mined areas under construction works, cities, towns or residential areas prone to collapse or subsidence where the pit-filling method is applied, to fill all the remaining pits after finishing exploitation in order to maintain works on the surface; c) For spoil and tailings dumps as well as civil and industrial works, to restore the environment as for open-cast mining;
For river bed sand, gravel and spread mineral exploitation
a) To level the ground and clean up sand in order to restore the ground or cultivation land for areas already used as riverside warehouses and yards or makeshift roads linking sand warehouses or yards with public roads; b) To level and clean up makeshift landfills for burying daily waste during the mining process; c) To dismantle investors' civil structures after the riverbed sand exploitation in order to restore the ground for local activities; d) To deal with riverside or dike-bank erosion caused by riverbed sand, gravel or spread mineral exploitation (if any)

Source: Adapted from Decision 71/2008/TTg

According to the Mineral Law (60/2010/QH12, Articles, 74 and 75), MONRE stipulates the contents and procedures for approval and takeover testing of results of the implementation of mine closure plans and decisions. Funds for implementing mine closure plans come from the environmental rehabilitation and restoration deposits of organizations or individual licenses for mining. The contents of appraisal of a mine closure scheme include (Decree 15/2012/ND-CP, Article 26):

- Reason for the closure
- The quantity, volume and level of safety of the mine's works, including its tailings sites at the time of closure
- The current exploited mineral volume, the remaining mineral deposit in the licensed mineral area at the time of closure
- The method of closing the mine, measures to protect unexploited minerals, measures to assure safety for the mining field after the closure, including measures to rehabilitate land and the environment.
- The volume and schedule of performance of jobs of the scheme and the time of completion of the closure.

The rehabilitation and restoration project must be enclosed, considered and approved together with the EIA report, EPC commitments or the Environmental Protection Schemes. To enforce this obligation, according to Article 30 of the Mining Law, mining companies must deposit a certain amount of money prior to mineral exploitation (see Chapter 3).

In summary, Vietnam shows a comprehensive legal framework for mine closure. Mining companies and individuals know their obligations and potential future liabilities. However, local communities are not incorporated in the process. This important shortage combined with other deficiencies (clarity about time lines, risk assessment to set priorities, cost-benefit analysis, monitoring arrangements) is evidence that mine closure seems to be understood as the end of mining rather than one step in a long process of environmental recovery for ecosystems and communities (World Bank and International Finance Corporation 2002). An additional question is whether the different government units at the

provincial, district and communal levels are (fully) aware of the established legal framework. According to information provided by the Register of Legal Mining Business of the Hoa Binh Province, 8 mining sites are currently scheduled for closure (Table 13). All of them are located in the Luong Son District (Figure 3). No antecedents are available regarding the reasons for closing and the existence and implementation of Mining Rehabilitation Plans.

Table 13: Hoa Binh Province: Aggregate Mining Projects in current stop of operation, 2015

District	Approval date	Mineral	Mine reserve (tons)	Operating Area (ha)	Annual production (tons)
Luong Son	31.07.09	Basalt[1]	22.647.519.534	12.90	4.894.770.000
Luong Son	14.10.10	Limestone[2]	2.060.525.481	3.60	55.167.000
Luong Son	22.06.10	Limestone[2]	1.808.527.427	2.40	57.342.600
Luong Son	23.05.11	Limestone[2]	16.806.563.130	12.00	372.960.000
Luong Son	14.10.10	Limestone[2]	23.125.720.996	10.00	310.800.000
Luong Son	10.05.11	Limestone[2]	17.552.813.040	15.00	357.420.000
Luong Son	09.01.09	Limestone[2]	54.059.911.647	14.81	932.400.000
Luong Son	07.06.11	Limestone[2]	652.750.000	2.90	54.390.000

[1] Original figures provided in m^3. To convert volume reserve figures into mass figures, it is assumed basalt is in a natural state. Conversion factor: 3011 kg/ m^3[25]. For production figures it is assumed basalt is broken. Conversion factor: 1954 kg/m^3[26].
[2] Original figures provided in m^3. To convert volume reserve figures into mass figures, it is assumed limestone is solid. Conversion factor: 2611 kg/m^3[27]. For production figures it is assumed limestone is broken. Conversion factor: 1554 kg/m^3[28].
Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

3.2 Socioeconomic impacts

The rights of local people living in mining areas have for long time been legally safeguarded in Vietnam. Decision 219/1999/QD-TTg ("Protection of the interests of people in localities where minerals are exploited"), issued by the Prime Minister, is shaped by 12 articles covering aspects like compensation in case of displacement, the development of an investment plan for localities and the prioritization of local employment. However, the social responsibility of the mining company was not specified (VCCI-CODE 2011). In practice, many localities did not implement this decision and no official information is available about its current status (UNDP 2015).

Presently, the benefits of localities and people in areas in which minerals are exploited are only mentioned in one article of the last Mineral Law (60/2010, Article 5: "Benefits on localities and people in areas in which minerals are exploited"). According to this article:

1. The State shall allocate part of revenues from mineral mining activities to support socioeconomic development in localities in which minerals are exploited under the state budget law.
2. Mining organizations and individuals shall:
   a. Partially cover investment costs for upgrading, maintaining and building technical infrastructure facilities used in mining activities and building welfare works under law for localities in which minerals are exploited;

[25] www.simetric.co.uk
[26] www.simetric.co.uk
[27] www.simetric.co.uk
[28] www.simetric.co.uk

b. Combine mining activities with the building of technical infrastructure and environmental protection and restoration under investment projects on mineral mining; and repair, maintain or build new facilities or pay compensation under law depending on the degree of damage, if causing damage to technical infrastructure facilities or other works and properties;

c. Give priority to employment of local labour in mining activities and related services;

d. Coordinate with local administrations in assuring a change of jobs for local people whose land is used for mining.

3. Compensation, support and resettlement for land users whose land is used for mineral mining projects in compliance with the land law and other relevant regulations.

To date, Article 5 has not been implemented in Vietnam as the national government "*has not assigned any ministries or relevant offices to develop guidelines for those regulations*" (UNDP 2015:1). Although the Mineral Law of 2010 the different institutional and administrative responsibilities are defined (Chapter 3: Protection of Unexplored Minerals), those in charge of developing the guidelines contained in Article 5 are not mentioned. *"In addition to directly negotiating with and persuading enterprises to perform their commitments and mitigate adverse impacts to the community, the local authorities usually cannot do anything but submit the unsolved problems to higher level, explaining that they do not have enough authority to solve these problems"* (UNDP 2015: 1).

The Research Center for Gender, Family and Environment during a workshop organized in November 2012 qualified[29], the current compensation regulation as "*improper and ineffective*", contributing to poverty and rural urban migration: "*during the evaluation process for compensation, how to mitigate the negative impacts of mineral mining on the community hasn't been addressed thoroughly and comprehensively. For that reason, most of the local community is dissatisfied with the compensation for cultivation land, damaged crops and secondary crops, cracked houses, dangers for road users, etc*."

[29] Available on line at http://en.cgfed.org.vn/gender-the-blind-factor-in-mining-in-vietnam/ (retrieved on January 29, 2015).

4. Policies and taxes affecting the extraction of aggregates in Vietnam

Although aggregates constitute a limited and non-renewable resource of high economic relevance[30] in Vietnam, a clear analysis of future supply and demand is not incorporated in National and Provincial Planning.

In 2012, the Central Government of Vietnam, through a Prime Minister Directive (02/CT-TTG on "Enhancing the State Management for Exploration, Mining, Processing, Use and Export Minerals") recognized the necessity to reorganize and strengthen State management for the exploration and exploitation of minerals, taking into account the short and long term necessities to achieve economic development, social efficiency and environmental protection. Several years later no new mining planning document has been published.

In this context the analyses of the permission procedures for exploring and exploiting aggregate at the provincial level become crucial. The lack of national mineral planning influences the operative provincial planning process. In other words, the way of conducting the process of granting (rejecting) mineral licenses determines the access to aggregates and may contribute positively or negatively to local socio-economic and environmental development (Table 14). This section includes the review of both mining license procedures for aggregates in Vietnam and, the analysis of the current licensing situation in the Hoa Binh Province.

4.1 Mining Licenses

According to the last Mineral Law (60/2010), only two licenses – exploration[31] and mining[32] which now encompass the mineral processing – must be obtained for starting a mining project in Vietnam.

The Provincial People's Committee is the most relevant institution for planning (exploration, exploitation and use), licensing and monitoring aggregates. Additionally, it is responsible for guaranteeing the environmental conditions and prevents illegal exploitation, transport and export (Directive 02/CT-TTG).

Mining exploration license procedures in Vietnam

To obtain a license to explore minerals **for use as construction materials**, individuals and organizations must meet the following conditions (Mineral Law (60/2010):

- Being selected by the Provincial People's Committee (Decree 15/2012, Article 13) or winning an auction[33].

[30] The State shall invest in the exploration and mining of important minerals for socioeconomic development, defence, or security tasks (Mineral Law 60/2010, Article 3, Clause 5).

[31] A mineral exploration license is granted for no more than 48 months and may be extended for a multiple times for a total duration of 48 months (Mineral Law 2010, Article 41).

[32] The duration of a mining license is determined by the feasibility study submitted as part of the application for the investment license, but it cannot exceed 30 years. It may be extended several times not exceeding 20 years (Mineral Law, Article 41).

[33] Minerals not subject to auction are: those assuring energy security (coal, uranium and thorium); limestone and clay stone which can be used as cement material or minerals which can be used as adjustment additives of cement; areas within the national border; minerals which can be used as common construction material already determined to be mined for the maintenance and repair of technical infrastructure facilities (Decree 15/2012, Article 12).

- Having a Mineral Exploration Project in conformity with the National (elaborated by the Ministry of Construction) and Provincial (elaborated by Provincial People's Committee) Master Plan for Exploration, Mining, Processing and Use of Minerals for Construction Materials (Decree 15/2012, Articles 8 and 9).
- Having equity capital at least equal to 50% of the total investment capital for the implementation of the mineral exploration project

Table 14: The importance of regulating mining through licensing

	Why regulate?	Why license?	Problems (Vietnam)	Good practices
Exploration Licenses	. Encourage investment . Control mineral type and volume . Control exploration method . Control plan of environmental protection, safety and sanitation	. Ensure clarity & accountability . Facilitate collection of taxes and royalties . Better planning of mineral resource development	. Lack of transparency . Insecure rights . Poorly defined claims . Excessive documentary requirements and proof of capabilities	. Create secure and transferable property rights via licensing . Install GIS-based mapping & claim registration system . Transparent licensing requirements and procedures
Exploitation Licenses	. Encourage investment . Control employment . Control technology and mining methods . Protect the environment . Ensure labour safety and sanitation . Collect information . Compensate damage and control rehabilitation	. Ensure accountability . Facilitate collection of taxes and royalties . Ensure clean-up & rehabilitation . Better planning of mineral resource development	. Lack of transparency . Insecure rights . Non automatic transferability of exploration to exploitation license . Conflict between national and subnational interests and/or authorities . May not focus on health, safety and other key risks	. Create a secure and transferable property right via licensing . Install GIS-based mapping & claim registration . Transparent licensing requirements and procedures . Clear environmental, planning law & regulations . Ensure exclusivity over licensed claims

Source: adapted from World Bank Group 2009

With respect to the contents of the Mineral Exploration Projects, Decree 16/2012 issued by MONRE mentions the following contents: (a) description of location, coordinates, boundary and area of exploration zone, (b) basis of existing geology and mineral documents in order to select the exploration area, (c) basis of classification of mine groups under complex degree, selection of network of works to explore and evaluate reserves level, combined technical methods, volume of various works; types of samples for analysis; method to test quality of analysis of basic sample, (d) impact of the exploration on the environment; labour safety and handling measures; measures to protect minerals not mined in the course of the exploration, (e) estimated norms to calculated reserves, basis of reserves calculation methods; estimated reserves and feasibility of reserves objectives, (f) the rationality and feasibility of the organization for implementation of works, the schedule and time for implementation, (g) budget estimation for exploration items.

The application process for an exploration license includes the following documents (Mineral Law 2010, Article 47 and Decree 15/2012, Article 29):

- The application form,
- A map of the mining area,
- Mineral Exploration project,
- The Environmental Protection Plan document only applicable for hazardous minerals (mentioned in Mineral Law 2010 and Decree 15/12),
- Business registration certificate,
- A document certifying the company's capital equity

Mining exploitation license procedures in Vietnam

A Vietnamese mining license for extracting minerals for construction contains the following details (Mineral Law 2010, Article 54):

- Name of the licensed organization or individual,
- Kind of mineral, location and size of the mining area,
- Mineral deposits, capacity and method of mining,
- Mining duration,
- Financial and other relevant obligations,

The conditions to obtain a license to mine minerals for use as common construction materials are (Mineral Law 2010, Article 53 and Decree 15/2012, Article 23):

- To have a **Mining Investment Project** in conformity with the National and Provincial Master Plan. Projects must contain a Plan on Employment of specialized personnel, and use appropriate technologies and mining methods
- To have an **Environmental Protection Plan** or Environmental Impact Assessment document (see Table 10)
- To have equity capital at least equal to 30% of the total investment capital of the mining investment project

The application dossier includes: (Mineral Law 2010, Article 59 and Decree 15/2012, Article 31):

- The application form,
- Business registration certificate,
- Decision approving mineral deposit,
- A document certifying the company's capital equity,
- A map of the mining area,
- A mining investment project and a copy of the investment certificate,
- The Environmental Protection Plan or Environmental Impact Assessment,

Additionally, organizations licensed for mining have the following obligations (Mineral Law 2010, Article 55):

- To pay a licensing fee, royalties, a fee for granting mining rights, and other environmental financial obligations (see Section 3.2);
- To ensure the schedule of infrastructure construction and mining activities stated in the mining investment project and mine design;
- To protect mineral resources, to ensure labour safety and sanitation and take measures to protect the environment;
- To collect and store information on results of further exploration for mineral deposits and on mining results;
- To report mining results to state management agencies under the regulations of MONRE;

- To compensate for damage caused by mining activities;
- To close mines, restore the environment and rehabilitate the soil when the mining license expires.

A mining license is granted only in areas in which no organizations or individuals are lawfully exploring or mining minerals. Family businesses which are registered to undertake the mining of minerals will be eligible to mine minerals as common construction materials if the mining capacity does not exceed 3000m^3/year. Although they do not apply for licenses, they must pay the fee for granting mining rights. Organizations and individuals that mine minerals for use as common construction materials are not required to apply for licenses when (Mineral Law, 2010, Article 64 (2):

- Mining minerals in the area of an approved or licensed investment project to build, using mined products only for such building work. Before mining they shall register the mining area, capacity, volume, method, equipment and plan with the Provincial People's Committee.
- Mining minerals in the residential area under the use of rights of a household or an individual for building works for such households or individuals within the area.

4.2 Mining licenses in Hoa Binh Province

From the 48 aggregate extraction sites operating in the province, 45 licenses were issued by the Provincial Government (Annex 1) and 3 by MONRE (Annex 2). The reasons behind why the permitting authority varies are not clear. According to the available data, the permitting process was not related to mine reserves, annual production, and type of mineral, date of approval or project periods (Table 15).

Table 15: Hoa Binh Province: Characteristics of the mining licenses according to the government institution responsible for assignment

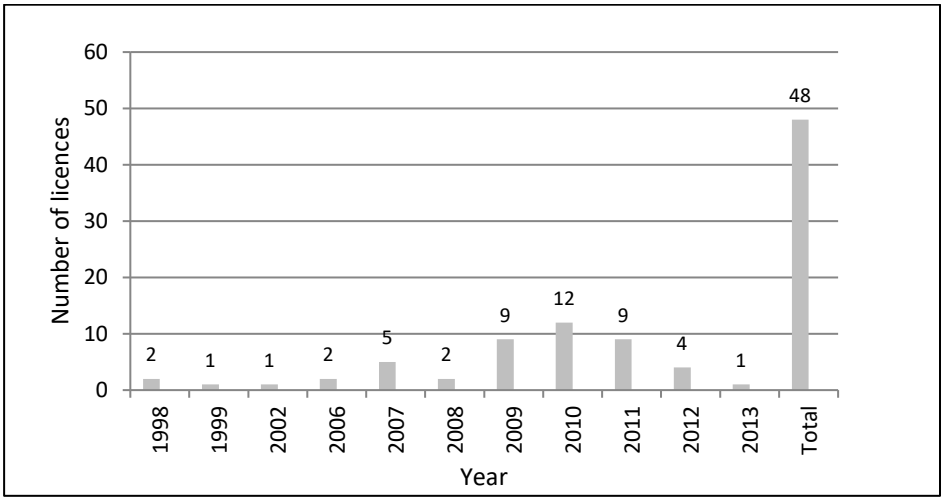
Government Level	Type of mineral	Mine reserves (m^3)	Annual production (m^3)	Date of approval	Area
MONRE (3)	Limestone	From 2.550.000 to 28.259.600	From 85.000 to 1.172.600	From 12.2008 to 04.2012	From 3,7 to 23,19
Province (45)	Limestone, Basalt and Sand	From 219.080 to 14.170.000	From 27.000 to 1.385.000	From 06.1999 to 12.2013	From 1,2 to 26,0

Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

Present licenses for mining aggregates were allocated between 1998 and 2013. During 2009 and 2011 more than the 50% were assigned (Figure 13). Since 2013 no licenses for aggregates have been allocated. Perhaps the argument behind this situation is found in the preparation of the Industrial Lime Production Development Plan 2020 with a vision towards 2030 prepared by the Ministry of Construction. To realize this plan MOC asked the Provincial People's Committees to "*halt licensing new production projects if they do not have permits from the MOC*". Besides, local authorities were told to "*revoke investment licenses for lime production if the registered lime exploitations are not suitable for construction material production, or do not have assessment reports on technological level, environmental assessment reports and reports on compliance to land use and construction plans*" (Vietnam Chamber of Commerce and Industry, 2013).

Currently there are 34 mining projects under licensing procedures (Annex 3), 29 for extracting limestone, 4 for basalt, and 1 for sand. 83% of the applications are for conducting mining activities in Luong Son District. The rest are projects planned in Ky Son (3), Kim Boi (1), Yen Thuy (1) and Lac Thuy (1) Districts.

Figure 13: Hoa Binh Province: Existing licenses for allocating aggregates for construction



Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

From the 34 projects under licensing procedures, 5 got their exploration license in 2009, 12 between 2010 and 2011, 12 between 2012 and 2013, 4 in 2014 and 1 in 2015. According to Decree 15 (Article 37), the total time limit for appraisal of a dossier of application for a mineral mining license is 109 days. The reasons behind why the time for granting or rejecting mining licenses mostly surpassed legal requirements are not clear.

According to UNDP 2015: 1*, "it is common knowledge that local authorities often play a passive role in providing licenses for mineral mining companies in their areas. The consultation conducted by local authorities is sometimes also described as 'formalism'. The stages of consulting the community or conducting environmental impact assessments are often skipped. Local authorities have recognized that mineral mining activities bring 'more harm than good' but they are ostensibly trapped in a state of 'dilemma'".*

4.3 Mining fiscal taxation

Some authors suggest that fiscal taxation on natural resources is part of a national sustainable strategy, as a high levy might be an incentive to reduce use and consumption. "*Resource taxes provide a clearer price signal, as the volatile market prices do not reflect resource scarcity*" (Eckermann et al., 2012: 7). An additional message of some recent national taxation schemes on natural resources is that a proportion of the revenues must be used for promoting innovation and cleaner production technologies.

Another interesting issue is to examine the level of centralization of taxation structures on natural resources. Following Otto (2001), fiscal decentralization[34] and revenue sharing[35] might be used as a means to distribute mining economic benefits derived from tax revenues. Many nations provide special treatment to the mining sector in terms of the type and level of taxes and incentives. The reasons justifying such exceptions are: compensation should be paid to the mineral owner (the State in the case of Vietnam expects compensation for a permanent loss), mining expenses (exploration, equipment, price fluctuation) and environmental impacts during and post mining (Otto 2001).

[34] The way in which a nation empowers the levels of its government to impose and collect taxes and fees (Otto 2001: 1).

[35] The budgeting process whereby revenues collected by one or more part of the government is allocated for distribution to other governmental entities (Otto 2001: 1).

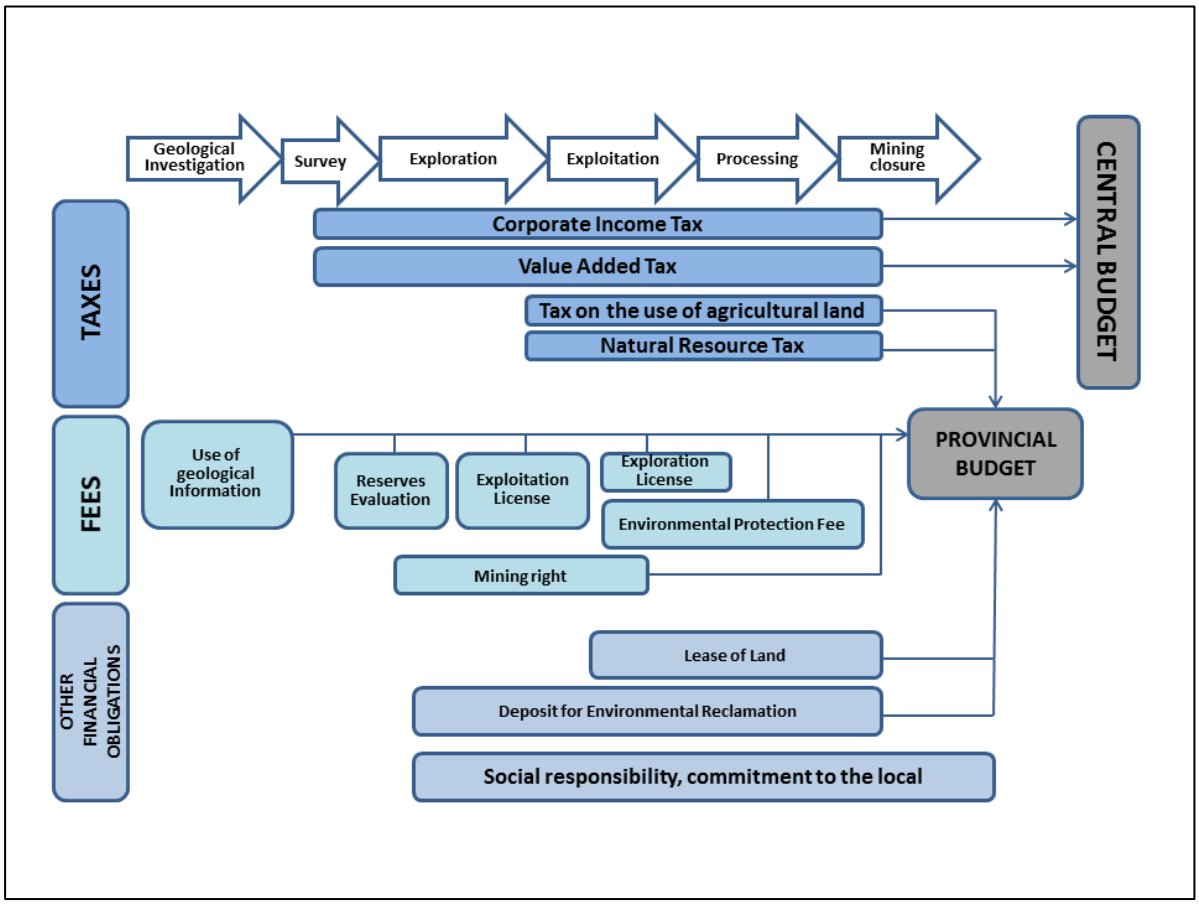
Although Vietnam decentralized the allocation of mining licenses in 2005 (Mineral Law), this process has been accompanied only partially by a fiscal one. Major taxes are set by Central Government (Corporate Income Tax and VAT) and minor ones by the provinces (Figure 14). The Provincial People's Committees have the responsibility to manage, on behalf of the State, the mineral exploration and extraction activities, and the revenues in the localities.

Central Government empowers the provincial level to impose and collect taxes and fees from mining companies; nevertheless revenue sharing is not oriented to loans, services and/or facilities to for the local communities where mines are allocated. Additionally, the bases for the calculation of each tax type are not clear enough, especially regarding the environmental levy.

Corporate Income Tax

Corporate income taxpayers are any organization conducting activities of production (and/or) business in goods and services which earns taxable income. It is a direct tax imposed on the profits earned by companies. The standard corporate tax rate in Vietnam was 22% for domestic and foreign-invested enterprises from January 2014. However, the tax rate dropped further to 20% from 1 January 2016 (KPMG 2015). Some companies that engage in mineral exploitation in specific locations may enjoy tax exemptions or reductions in the first years. The exemption shall be specified by the Provincial People's Committees (VVCI-CODE 2011: 27).

Figure 14**:** Financial obligations for minerals use for construction material



Source: Developed based on VVCI and CODE 2011

Value Added Tax (VAT)

Under the Vietnamese Law on Value Added Tax, aggregates are subject to an average rate of 10%.

Tax on the use of agricultural land (Non-Agricultural Land Use)

Mining activities are subject to non-agricultural land usage tax (Law 48/2010/QH12). The tax is calculated by taxable land area with the price (determined by the Provincial People's Committees) and the applicable tax rate. The taxable land area is the total land area allocated by or leased from the government. Tax rates are in the range of 0.03% to 0.2% depending on the type of land. Law 48 provides for cases of tax exemption with a view to promoting investment and developing the national economy (e.g. areas with especially poor socio-economic conditions).

Natural Resource Tax

The natural Resource Tax is the biggest tax revenue received from mining activities (VVCI-CODE 2011: 26). Under the Law on Taxation of Natural Resources (or royalties 45/2009/QH12), organizations and individuals allowed to carry out mineral activities are required to pay a Natural Resource Tax. Final rates are determined in Resolution 105/2010/TT-BCT based on the mining output (weight or volume) that is declared by the company, the price of a unit of the natural resource and the royalty rate (Table 16).

Table 16: Royalty tariff for selected non-metallic minerals

Mineral	Royalty rate (%)
Soil exploited for ground levelling and work construction	4
Rock and gravel	7
Rock used for lime banking and cement production	7
Sand	11
Granite	10

Source: National Assembly, Resolution 712/2013/UBTVQH13

4.4 Fees for conducting mining activities

Use of geological information

In case information related to mineral potential assessment or mineral exploitation belongs to the State, users of such information shall reimburse invested expenses to the State (Decree 15/2012/ND-CP, Article 3). In Vietnam, the State usually carries out the geological survey and exploration in regions (VVCI-CODE 2011: 23).The payment of this fee is stipulated on the basis of the volume and items of work performed and current unit prices[36]. The reimbursement of expenses must be completed before organizations or individuals receive mineral exploration or mining licenses. The reimbursement of expenses for geological baseline surveys must be completed before receiving mineral exploration or mining licenses.

[36] The Ministry of Finance shall assume the prime responsibility for and coordinate with MONRE.

Issuing the exploration license

The National Government, through the Ministry of Finance, collects the fees for exploration licenses based on the size of the property (Circular 129/2011/TT-BTC). For an explored area with less than 100 ha, the fee is about VND 4 000 000; for explored areas between 100 and 50 000 ha, the fee is about VND 10 000 and for areas greater than 50 000 ha the fee is about VND 15 000 000 (Circular 129/2011, Article 2).

Reserve's evaluation

When the company carries out mineral exploration activities and obtains indication of a mineral reserve, MONRE and DONRE will establish a committee to evaluate the mineral reserve. Under Decision 27/2005/QD-BTC on governing the collection, payment, management, and use of mineral reserve assessments, issued by MOF, the fee for appraisement and valuation of mineral reserves is based on the total expenses of the geological survey.

Issuing the exploitation license

According to Circular 129/2011/TT-BTC, Article 2, fee rates for granting a mining license are calculated based on figures specified in Table 17. Calculation includes multiple criteria such as the size of the production area, the type of mineral, the volume of production, the method of extraction and the level of risk involved.

Table 17: Rates for granting a mining license

Groups of mining licenses for exploitation	Fee rate (VND million/license)
1. Of stream bed sand and gravel	
1.1 Output under 5.000 m^3/year	1
1.2 Output between 5.000 m^3 and 10.000 m^3/year	10
1.3 Output over 10.000 m^3/year	15
2. Of minerals for use as cement material or ordinary construction material without using explosive materials	
2.1 Area under 10 ha and output of under 100.000 m^3/year	15
2.2 Area with 10 or more ha and output of under 100.000 m3/year or areas of under 10 ha and an output of 100.000 m3/year or more, and peat (except exploitation of stream bed sand and gravel)	20
2.3 Area of 10 ha or more and of an output of 100.000 m3/year or more, (except exploitation of stream bed sand and gravel)	30
3. Of minerals for use as cement material or ordinary construction material using explosive materials, wall covering stones and mineral water	40
4. License for open-cast exploitation of minerals, except minerals listed under 1, 2, 3, 6 and 7 of this table	
4.1 Without using industrial explosive materials	40
4.2 Using industrial explosive materials	50
5. License for underground exploitation of minerals, except minerals listed under 2, 3, and 6 of this table	60
6. License for exploitation of precious and rare minerals	
7. License for exploitation of special and hazardous minerals	

Source: Ministry of Finance, Circular 129/2011/BTC

Granting mining rights

According to the Mining Law (Article 55) organizations and individuals licensed for mining have the obligation to pay the fee for the grant of mining rights. This fee is in addition to the mining royalty. Decree 203/2013/NDCP describes the method for collecting the fee and its uses. The fee is calculated as a percentage of the value of crude ore in the licensed mineral area (Table 18). The final value is determined on the basis of the geological reserves, the royalty taxable price, mineral recovery factor related to the mining production method and socio-economic conditions.

If the mining license is granted by the Central Government the revenues are distributed between central and local budgets (70% / 30%). If licenses are granted by the Provincial People's Committee 100% of revenues go to the local budget. Local authorities must provide information of mining rights payment to the Department of Geology and Minerals of MONRE. Mines licensed before 1 July 2011 have to pay the fee for granting mining licenses for the unexploited reserve.

Table 18: Charges for granting mineral exploitation rights

Mineral group	R (%)
Building materials	
White sand, fire resistant clay	3
Original ashlars	1
The remaining minerals of building materials	2

Source: Government Decree 203/2013/ND-CPm

Environmental Protection Fee

Following Decree 74/2011/NCDP on "Environmental Protection Charge for Mineral Exploitation", organizations and individuals have to pay an environmental protection fee. Circular 158/2011/TT-BCT on "Guiding the implementation of Decree 74" states that fees are calculated on the basis of cubic metres (m^3) or ton of raw mineral multiplied by a corresponding charge rate. The Provincial People's Council shall decide on a specific environmental protection charge rate for each type of exploited mineral suitable to their local practical conditions (e.g. mining of aggregates).

Environmental fees shall be used to support environmental protection and investment activities in localities in which mineral exploitation is carried out. They cover (Decree 74/2011/NCDP):

- Preventing and mitigating negative impacts on the environment in such localities
- Remedying environmental degradation or pollution caused by mineral exploitation activities
- Maintaining sanitation, protecting and restoring landscape and the environment in these localities.

The Environmental Protection charge shall be declared on a monthly and annual basis. The Ministry of Finance shall guide the implementation of this decree and direct tax offices in coordinating with local natural resources and environment agencies in managing charge collection.

Summarizing, the calculation of the environmental fee is based on the mineral output without taking into account the pollution level caused by each mine. This regulation discourages mining companies from investing in technology to protect the environment.

In the last Law on Environmental Protection (55/2014/QH13), confusion on fee calculation prevails.

On one hand, Article 35 states that the value of a natural resource must be investigated and evaluated to serve as the basis for defining the limit on permitted extraction levels, environmental protection fees, environmental restoration deposits, environmental damage and other measures for the environmental protection. As aggregates have a relatively low unit price, their environmental

protection fee is rather low and does not reflect the deemed adverse landscape impacts. On the other hand, Article 148 mentions that the rate of the environmental protection fee depends on the:
a) Amount of waste discharged into the environment, scale of negative effects on the environment; b) Levels of toxicity, levels of hazard for the environment; c) Capacity of waste-receiving environment. Likewise this regulation does not comprise the most important impact of mining aggregates: landscape alteration. Additionally the Environmental Law reinforces Decree 74 establishing that "*collected environmental protection fees **shall be** used for environmental protection activities"*. However, the use and allocation of the funds is rather unclear, resulting in people blaming companies for the environmental impacts even if they have fulfilled the financial obligations for protecting the environment.

4.5 Other financial obligations

Lease of Land or Transfer Rights

Land is regulated as the common property of the people for which the State is the representative of the owner. According to the Land Law (45/2013/QH13), the State may lease and collect annual land rental or full one-off rental for the entire lease period in case of organizations and individuals that use the land for mining activities, production of construction materials, and non-agriculture production establishment. The land price (i.e., the land rent or land use fee) for a specific piece of land is calculated based on the table of land prices annually published by the Provincial People's Committee. The 2013 Land Law, however, requires the land price to be determined on a case-by-case basis by the Provincial Committee. Where the designated use of the land is something other than "non-agricultural production and business", a mining company will also need to apply for a change in the designated use of land.

Deposits for Environmental Recovery and Rehabilitation

According to the Mineral Law (2010, Article 30), entities and individuals that are allowed to engage in mineral activities are required to:

- Use environmentally friendly technologies, equipment and materials; apply solutions to prevent and mitigate adverse impacts, and upgrade and restore the environment.
- Apply solutions and bear all costs for environmental protection, rehabilitation and restoration. Solutions and costs must be identified in Investment Projects and in the Environmental Impact Assessment Reports and Environmental Protection Commitments (see below) approved by competent agencies.
- Before conducting mining activities, mining organizations and individuals shall pay a deposit for environmental rehabilitation and restoration according to the Government's regulations.

Rehabilitation deposits are regulated by Decision71/2008/QD-TTg. Making a deposit for environmental rehabilitation and restoration means that a licensed entity deposits a sum of money for a certain period in the Vietnam National or Local Environmental Protection Fund (Annex 4) in order to financially secure post-mining restoration. Article 7 of Decision 71 states that the environmental deposits shall be calculated based on the **most** adverse impacts expected to be caused on the environment. The method for estimating the deposit is described in Annex 2 of Decision 71. The estimation includes the list of 13 potential costs.

5. Conclusions and recommendations

- Mineral planning is undertaken at a high spatial level in Vietnam. Documents promote management, protection and the efficient use of minerals to meet the requirements of industrialization and modernization. Although the Vietnamese government protects natural aggregates from export, no detailed information regarding production, consumption, transportation and/or trade (prices) is available at the national level. Moreover, figures publicly available are either not consistent or incomplete.
- In this regard, the Vietnamese government has to orient the provincial decision making process, providing not only a legal framework and capacity building to implement aggregates extraction. The provision of adequate and transparent information regarding current and future market needs becomes crucial (e.g. National Mineral Policy). It is fundamental to establish a national geological and mineral database and to adopt a clear method for aggregates identification (quality-quantity), and a means by which this information can be translated into a spatial plan. Additionally a method for estimating the long term demand for aggregates minerals is needed.
- The production and direct contribution of aggregates mining to provincial GDP and local employment is marginal. Quarrying activities in the province are performed by many small-scale companies causing widespread environmental damage. The low economic benefits of small-scale operations do not favour the consolidation of companies and the development of sustainable high-volume production sites that might serve large regions. This stage of development has been defined as “immature industry” (Scott et al. 2003).
- The main question to be considered in the provincial decision making and political process of permitting the extraction of aggregates is how the benefits and disruptions (environmental, social and economic) of making aggregate available are adequately weighed in the mining license approval or denial.
- Official information recognizes the tighter financial controls introduced by MONRE since 2014. New regulations compel firms to pay for grants of mining rights and to set up processing facilities, preventing players with financial and technological constraints from venturing into the business. According to interviews conducted with mining entrepreneurs and DONRE officials, the impact of the financial crisis and the introduction of additional taxes and compensation regulations have discouraged further aggregate investments. Moreover local actors (from the private and public sector) do not believe that Mining Master Planning projections will be accomplished by 2020.
- Taxes on mineral extraction are low, representing around 15% of the total collected tax payments in the province. The hydropower plan is the main source of income, contributing 50% of total revenue. The method of calculating the environmental fee is unclear, depending nowadays mainly on the total production declared by companies. Additionally, fees have been often used incorrectly or not received. Taxation schemes are definitely not a stimulus towards environmental improvements in the province. No evidence shows that the landscape has been improved since the introduction of taxes.
- It is recommended to implement a systematic monitoring of aggregates extraction, processing, reclamation, and mitigation operations. Monitoring activities must include: regular field inspections, mapping surveys and measurements; written reports by operators; collection and analysis of data from operators; investigation and documentation of complaints and calculation and collection of fees and payments.

- Despite the marginal economic impact of aggregates mining in the province, the industry plays a pivotal role in alleviating poverty. According to provincial authorities, even if small-scale mining tends to be low-paid and highly precarious, it provides direct employment, though often at subsistence level and reduces rural-urban migration. When viewed in this light, it is possible to understand why any attempts to restructure and improve the sector's operations (increasing taxes, environmental regulations, operation size, etc.) are seen with extreme caution by the local authorities.
- Mining projects can contribute to local development through a number of initiatives, ranging from employment provision to community investment projects. In this respect, many international good practices have been considering the use of foundations, trusts and funds (FTSs) as platforms for sharing the benefits of mining operations with local communities. These entities can provide opportunities for joint governance in cases where local capacities are limited.

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Annex 1 Hoa Binh Province: Current aggregate projects licensed by DONRE

District	Approval Date	Mineral	Operating Area (ha)	Mine reserve (m³)	Annual Production (m³)	Project period (years)
Luong Son	16.01.2006	Limestone	25,99	11.219.000	1.385.000	25
Luong Son	10.05.2011	Limestone	16,0	11.638.632	400.000	30
Luong Son	28.10.2009	Limestone	9,8	9.500.941	380.000	30
Luong Son	08.04.2011	Limestone	14,0	14.088.768	350.000	30
Luong Son	16.06.2010	Limestone	19,0	8.584.657	323.705	30
Luong Son	11.11.2010	Limestone	19,2	11.007.192	300.000	30
Luong Son	30.01.2011	Limestone	20,0	8.145.899	300.000	29
Luong Son	29.10.2009	Limestone	13,48	8.405.087	285.000	28
Luong Son	01.06.2006	Limestone	7,5	5.005.048	250.252	22
Luong Son	13.05.2009	Limestone	14,76	7.086.000	250.000	30
Luong Son	18.06.1999	Limestone	16,0	4.314.000	211.500	22
Luong Son	12.02.2007	Limestone	5,27	4.095.000	210.000	29
Luong Son	08.05.2008	Limestone	15,0	14.170.000	169.000	30
Luong Son	20.05.2002	Limestone	11,0	1.800.000	110.000	23
Luong Son	06.07.2009	Limestone	15,19	6.210.762	100.500	30
Luong Son	16.12.2009	Limestone	3,8	1.011.695	100.000	12
Luong Son	22.09.2010	Limestone	6,0	3.048.323	100.000	30
Luong Son	22.10.2007	Limestone	9,72	7.672.000	49.825	30
Luong Son	14.03.2007	Limestone	5,0	2.323.000	49.000	25
Luong Son	06.02.2007	Limestone	5,0	2.562.000	48.000	30
Tan Lac	15.12.2010	Limestone	4,0	1.360.000	48.000	n.i
Luong Son	09.07.2008	Limestone	5,0	1.746.000	47.000	30
Luong Son	29.06.2007	Limestone	5,0	6.660.400	45.000	30
Luong Son	19.05.2009	Limestone	5,8	2.714.000	45.000	30
Cao Phong	31.12.2010	Limestone	3,0	1.695.594	45.000	30
Yen Thuy	18.03.2010	Limestone	10,0	4.478.481	44.654	30
Hoa Binh	10.02.2010	Limestone	3,7	2.230.072	44.625	30
n.i	11.01.2011	Limestone	4,9	1.297.117	40.000	30
Luong Son	17.01.2011	Limestone	2,2	1.186.793	40.000	30
Kim Boi	31.12.2010	Limestone	4,0	1.238.476	40.000	30
Cao Phong	08.04.2011	Limestone	1,8	496.056	40.000	14
Lac Son	22.04.2011	Limestone	3,0	944.450	40.000	5
Mai Chau	09.03.2011	Limestone	4,7	789.654	40.000	5
Da Bac	09.12.2010	Limestone	3,0	1.160.932	40.000	5
Cao Phong	15.09.2010	Limestone	3,34	1.339.992	39.600	30
Luong Son	29.06.2012	Limestone	4,94	825.169	36.900	4
Tan Lac	17.01.2011	Limestone	0,9	219.080	36.900	5
Ky Son	25.10.2010	Limestone	5,6	3.589.000	35.000	30
Kim Boi	10.12.2009	Limestone	2,0	915.272	30.000	30
Tan Lac	08.12.2010	Limestone	1,2	353.350	20.000	13
Kim Boi	22.04.2013	Limestone	n.i	548.476	19.000	30
Lac Thuy	20.09.2012	Limestone	10,0	3.064.881	10.000	30
Luong Son	31.07.2006	Basalt	17,4	6.660.400	250.00	23
Luong Son	28.06.2012	Basalt	7,8	5.210.156	180.00	30
Ky Son	11.12.2013	Sand	20,0	898.000	27.000	24

*Projects approved between 1999 and 2014
Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

Annex 2 Hoa Binh Province: Current aggregate projects licensed by MONRE

District	Approval Date	Mineral	Operating Area (ha)	Mine reserve (m^3)	Annual Production (m^3)	Project period (years)
Luong Son	21.12.2009	Limestone	23,19	28.259.660	1.172.600	30
Yen Thuy	25.04.2012	Limestone	7,7	7.784.188	427.000	20
Yen Thuy	14.12.1998	Limestone	3,7	2.550.000	85.000	20

Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

Annex 3 Hoa Binh Province: Aggregate Mining Projects in Licensing Procedures

District	Approval Date	Mineral	Operating Area (ha)	Annual production
Ky Son	01.12.09	Basalt	16,7	25.000
Ky Son	22.10.14	Limestone	1,31	65000
Luong Son	23.11.09	Basalt	40,06	330.000
Luong Son	26.07.13	Limestone	4,2	55.000
Luong Son	19.01.11	Limestone	19	350.000
Luong Son	14.01.11	Limestone	20	350.000
Luong Son	27.04.10	Basalt	14	30.000
Luong Son	06.07.10	Limestone	27	300.000
Luong Son	29.03.10	Limestone	4,83	200.000
Luong Son	28.12.10	Limestone	15,7	350.000
Luong Son	28.12.10	Limestone	11	250.000
Luong Son	12.01.11	Limestone	15	200.000
Luong Son	26.01.11	Limestone	8	180.000
Luong Son	22.06.11	Limestone	15	320.000
Luong Son	30.08.12	Limestone	7,5	65.000
Luong Son	27.09.12	Limestone	5,4	12.000
Luong Son	23.10.12	Limestone	10	20.000
Luong Son	16.11.12	Limestone	11	250.000
Luong Son	05.12.12	Limestone	7,5	190.000
Luong Son	20.12.12	Limestone	13,5	180.000
Luong Son	28.12.12	Limestone	8,17	10.000
Luong Son	19.02.13	Limestone	11	80.000
Luong Son	14.03.13	Limestone	13,4	150.000
Luong Son	16.07.14	Limestone	9,5	195.000
Luong Son	26.04.13	Limestone	n.i	40.000
Luong Son	06.06.14	Limestone	6,7	96.000
Kim Boi	30.07.13	Limestone	n.i	80.000
Lac Thuy	30.06.11	Limestone	12,4	145.000
Yen Thuy	01.12.10	Limestone	9,6	87.000
Luong Son	06.10.09	Basalt	10	250.000
Luong Son	05.10.09	Limestone	6	120.500
Luong Son	10.12.09	Limestone	19	150.000
Ky Son	21.04.15	Sand	75	180.000
Luong Son	15.01.14	Limestone	0,13	10.000

Source: Register of Legal Mining Business Hoa Binh Province, Vietnam (November 2015)

Annex 4 The Vietnam Environment Protection Fund (78/2014/QD-TTg)

The Vietnam National Environment Protection Fund (VNEPF) is a state-owned financial organization directly under the MONRE account at the State Treasury and a credit establishment under regulation of law. Its function is to give soft loans, sponsorship and interest-rate support for programs, projects, activities, environment protection missions and climate change responses which are not included in state budget plans. According to the Law on Environment Protection (Article 149), besides the National Environment Protection Fund, there are two additional funds to support environmental protection activities: The Environment Protection Fund of Ministries and specialized authorities, and the Provincial Environment Protection Funds. The National and Provincial Protection Funds are derived from the following sources:

- State Budget
- Environment protection fees
- Compensation to the State for environmental damage
- Grants, aids, and entrusted investments from domestic and overseas entities

The Prime Minister decides the establishment, organization and operation of the national and ministerial funds, while the Provincial People's Committees decide on their own funds.

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This booklet is a result of MAREX project:
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ISBN 978-3-933053-38-1