and economic development are all contributing to an increase in the demand for minerals and metals. However, mining has also manifold negative impacts on the environment and the social system and it influences land use crucially [1].

Society's expectations of the sector's performance are high and continue to increase. This manifests itself in pressures for higher standards of social and environmental performance, greater transparency, and more participation in decision-making by stakeholders that have historically played only a marginal role. Simultaneously, the nature and fairness of the distribution of the benefits and costs from mining is being challenged. Clearly, the challenge for all stakeholders is to stay on top of this evolution [2].

This paper is dealing with the extraction of sand, gravel and crushed stone (aggregates) – the most important bulk material for the construction industry. Aggregates contribute 90 to 95% of asphalt processing and up to 80% of concrete [3, p. 3], [4, p. 5]. That means they can be found in all fields of construction. The more a city is growing, the more aggregates are needed to fulfill the demand of the construction sector.

This is also true for the Vietnamese capital Hanoi. The city is envisioned to become a large-scale capital as well as a political-administrative, cultural, scientific, educational, economical and trading hub until 2050 [5], [6]. In Hanoi, national urbanization policies and related land-use plans have triggered a strong growth in new neighborhoods with multi-story residential and commercial buildings. Simultaneously, the Vietnamese government has invested in the modernization and extension of the overburdened infrastructure (streets, railways, flood protection). Put it all together, this has fostered a strong demand for construction materials. As this demand cannot be satisfied only by local sources, the neighboring provinces are involved in the process as suppliers of building materials. One of them is Hoa Binh, a province with rich resources of limestone and basalt, making it an important raw material source for Hanoi.

Four aspects of this process are highlighted in this paper. Firstly, the article explains the legal fundament of aggregates mining in Vietnam. Secondly, we will describe the role of aggregates mining for regional development including economic, environmental and social questions. Thirdly, the relationship between socio-economic planning and minerals planning is characterized. Last but not least, actors and cooperation structures are under scrutiny.

The paper summarizes results from researchers of the Leibniz Institute of Ecological Urban and Regional Development (IOER), the Chair of Spatial Development of the Technische Universität Dresden (TUD), and some conclusions of a doctoral dissertation which is elaborated in the Dresden Leibniz Graduate School (DLGS), a joint doctoral program established by IOER and TUD.

2. Materials and Methods

The article uses a mixed method approach. An international literature analyses on aggregates mining including its economic, environmental and social implications and the good practice standards was conducted. Empirical work included a review on mining and its institutional background in Vietnam including the legal framework.

In Hoa Binh province the research team evaluated statistical data regarding economic performance, population development and the labor market including the mining sector. Provincial planning documents and decrees were included as well the granted mining licenses in Hoa Binh province. Moreover, about 40 interviews with experts from different societal fields were conducted at

national, provincial and local level. Additionally, a number of mining companies were consulted including site surveys at the places of extraction and processing. Lastly, some abandoned sites and former mines were visited. In many ways, the investigations were linked with the work done by the Vietnamese MAREX team, in particular regarding the measurement of air, soil and water parameters [7], [8] as well as an ecosystem analyses [9].

The review of the legal basics comprises, among others, the following documents:

- Law No. 55/2014/QH13 dated June 23, 2014, on Environmental Protection.
- Law No. 60/2010/QH12 of November 17, 2010 on Minerals.
- Circular No. 27/2015/TT-BTNMT dated May 29, 2015, on strategic environmental assessment, environmental impact assessment and environmental protection plans.
- Circular No. 38/2015/TT-BTNMT dated 30 June 2015, on environmental remediation and restoration in mineral mining activities.
- Circular No. 43/2015/TT-BTNMT dated September 29, 2015, on state of the environment report, set of environmental indicators and management of environmental monitoring data.
- Circular No. 45/2016/TT-BTNMT dated December 26, 2016, on regulations on mineral exploration and mine closure projects, and templates of reports on mineral activities, required documents included in application for mineral operation license and application for approval for mineral reserves, and mine closure procedures.
- Decree No. 158/2016/ND-CP dated November 29, 2016, on Guidelines for the Law on Mineral.
- Decree No. 164/2016/ND-CP dated December 24, 2016, on environmental protection fees on mineral extraction.
- Decree No. 18/2015/ND-CP dated February 14, 2015, on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plans.
- Decree No. 19/2015/ND-CP dated 14 February 2015, on detailing the implementation of a number of articles of the Law on Environmental Protection.
- Decree No. 24a/2016/ND-CP dated April 05th 2016, on building Material Management.

The research was carried out in the framework of the joint German-Vietnamese research project MAREX (Management of Mineral Resources in Hoa Binh – a Contribution to Sustainable Development in Vietnam) and in close cooperation between IOER, TUD and DLGS from 2015 to 2017. The authors of this paper were closely cooperating with the Technische Universität Dortmund and Consulting and Engineering Ltd. in Chemnitz. In Vietnam the Institute of Environment and Automation (IEA), the Vietnamese National University of Science (VNU) and the Vietnamese Institute of Urban and Rural Planning (VIUP) in Hanoi have been the research partners. A close cooperation with the provincial government of Hoa Binh province enabled the researchers to get insight in the management of mineral resources.

3. Results and discussion

Hoa Binh province is situated in the northern part of Vietnam neighboring the capital Hanoi (Figure 1). With 824,325 inhabitants on an area of 4,608 km², Hoa Binh is a medium-sized province in Vietnam [10, p. 31]. Though the province is part of the functional Hanoi Capital Region and the travel distance between Hanoi (7.2 mill inhabitants) and Hoa Binh City (93,541 inhabitants) is only 95 kilometers, the whole province has preserved a rural character.

The provincial economy is developing dynamically with an average growth of the GDP of about 7 % since 2011. Despite the impressive growth rate, the absolute level of economic activity is comparatively low with officially only 1,500 US$ GDP per capita [13, pp. 69, 71]. The strongest economic sectors referring to the gross output are currently agriculture (23.0 % of the total GDP), energy production (22.3 %), construction (14.5 %) and manufacturing (10.7 %).

Most parts of the province have mountainous character with an altitude up to 1,430 m. In some parts, the tower-like limestone mountains form an extraordinary landscape scenery similar to the world-famous Ha Long Bay, and provide a still untapped but extremely valuable touristic potential. The geological basis is multifarious. Mainly limestone and other materials for the construction industry are of economic importance [11].

Figure 1. Location of Hoa Binh province

3.1. Legal Framework of Aggregates Mining

Mining activities are regulated by several formal laws of the national Parliament, as well as Decrees, Decisions and Circulars of the central government of Vietnam and the local government of Hoa Binh province. The most important legal source is the Law on Minerals No. 60/2010/QH12 of 17 November 2010 (in the following: MinLaw) providing specific regulations for the mining sector. The law requires that state management of minerals shall be in accordance with the objectives of sustainable socio-economic development, national defense and security strategies, and plans and regional master plans (Art. 3 and 4 MinLaw). Further regulation detailing the provisions of the MinLaw are provided in the governmental Decree No. 158/2016/ND-CP on guidelines for the Law on Mineral. Specific regulations for mining of construction aggregates are stipulated in Decree No. 24a/2016/ND-CP on building material management. In the following we will highlight some main aspects of the legal fundament, namely the mineral strategies and master plans, licensing of mining activities, and mine closure.

Mineral activities must comply with the conditions of the *mineral strategies and master plans* (Art. 4, Clause 2 MinLaw). The mineral strategies are explained in Article 9 MinLaw. They are based on the domestic minerals market and capacities therein, as well on available results of geological baseline surveys and other mineral-related information. As a result, the mineral strategy shall define guiding viewpoints and objectives, orientations of geological baseline studies, and major tasks and solutions. The Ministry of Natural Resources (MoNRE) shall assume prime responsibility for the strategy on geological baseline studies.

Mineral master plans are based on mineral strategies. The mining sector has to consider four kinds of mineral master plans (Art. 10 MinLaw):

1) The master plan on geological baseline surveys for a duration of 10 years, with a vision to 20 years under prime responsibility of the Ministry of Natural Resources and Environment (Art. 11 MinLaw).
2) The national master plan on mineral exploration and mining for a 5-year period with a 10-year vision (Art. 12 MinLaw): It is a general plan for the whole national minerals market, as they contain present results, studies, summaries, and assessments for mineral development. As prescribed in Art. 12, Clause 3, lit. e and f MinLaw 2010, the national master plans identify mineral activity areas (Art. 26 MinLaw), and areas with small-scale and scattered minerals (Art. 27 MinL). Furthermore, areas banned and temporarily banned from mineral activities are provided by maps (Art. 28 MinLaw) and national mineral reserves areas (Art. 29 MinLaw). By consulting the MoNRE and other ministries, the provincial government is responsible for delimiting and proposing to the Prime Minister to approve the areas which are banned or temporarily banned from mining activities (Art. 28, Clause 5).
3) The national master plans on exploitation and utilization of each kind or group of i) minerals for use as construction materials under the Ministry of Construction, and ii) for other kind or group of minerals for a period of 5 years, with perspective to 10 years under prime responsibility of the Ministry of Industry and Trade (Art. 13 MinLaw);
4) The provincial master plan on mineral exploration, mining and utilization which are made for a period of 5 years, with vision to 10 years (Art. 10, Clause 1, lit. d). Not mentioning any more details on the subject of this kind of master plans, Art. 10 Clause 3 MinLaw prescribes that the Government shall provide for the elaboration of such provincial master plans. Such content is now defined in Decree 158 such that the provinces and cities under control of the Central Government shall be responsible for the planning for exploration, extraction, and use of minerals concerning: normal construction material, and peat (Art. 11, Clause 1, lit. a, Decree 158); small and scattered minerals as finally announced by the Ministry of Natural Resources and Environment (MoNRE) (ibid, lit. b); mining at the dump sites of mines which are already approved for mine closure (ibid, lit. c).

The MinLaw requires that the master plans of type b) and c) shall consider the protection of the environment, natural landscape, historical-cultural relics, scenic places and other natural resources. They are subject to a strategic environmental assessment (SEA) according to the law on environmental protection (see Art. 12, Clause 2, point e, and Art. 13, Clause 2, point d MinLaw). However, Decree 24a stipulates that any kind of planning for building material development (ibid, Art. 5) which encompasses the master plan for minerals as building materials (Art. 4, Clause 1, point b), shall contain a SEA for each period of time (Art. 9, Clause 1, point k).

Decree 158 supplements provisions on environmental protection with respect to the planning tasks of the provinces on normal construction material, peat coal, small-scale and dispersed mining (Art. 11). Appendix I of the decree defines the type of small-scale and dispersed mining based on the mineral type and the total reserves and estimated resources at the prospective mine. Noteworthy, the MinLaw prescribes that a mineral area in which large-scale mining can be effective may not be divided for the grant of mining licenses to many organizations or individuals for small-scale mining (Art. 53, Clause 1, point b).

An important instrument for the implementation of environmental requirements is the *licensing process for mining activities*, which includes mineral exploration and mineral mining

activities, Art. 2, Clause 5 MinLaw. "Mineral exploration" relates to activities to identify mineral deposits and quality and obtaining other information for mineral mining, Art. 2, Clause 6 MinLaw. "Mineral mining" is used for activities to recover minerals, including mine infrastructure construction, excavation, classification, enrichment and other related activities, Art. 2, Clause 5 to 7 MinLaw. Both, mineral exploration and mineral mining have to be licensed.

As prescribed by Article 82, provincial-level People's Committees may grant mineral exploration licenses, licenses for mining of minerals for use as common construction materials, peat, and minerals in areas with scattered and small-scale minerals already identified and publicized by the Ministry of Natural Resources and Environment; and licenses for salvage mining (see also Art. 11, Clause 1, Decree 158/2016/ND-CP).

The preconditions for the license to mineral exploration are stipulated in Art. 34-50 MinLaw, and the preconditions for the license to mineral exploitation, including the closure of the mine, are stipulated in Art. 51-75 MinLaw. Environmental protection obligations in mining activities are regulated in Art. 30 ff. MinLaw. Thereafter, organizations and individuals engaged in mineral activities shall use environmentally friendly technologies, equipment and materials. They shall apply solutions to prevent and mitigate adverse impacts on the environment, and according to the law, invest in the upgrading and restoring of the environment, respectively (Art. 30, Clause 1 MinLaw).

The mining investors shall define these environmental measures in the environmental impact assessment (EIA) reports which are mandatory for the investment report. The reports have to be approved by competent State authorities (Art. 30, Clause 2 MinLaw). Before any mining activity is undertaken, the investor has to pay a deposit for environmental rehabilitation and restoration according to the Governments regulations (Art. 30, Clause 3 MinLaw).

Further detailed requirements of environmental protection in mining activities are stipulated in the Law No. 55/2014/QH13 on Environmental Protection of 23 June 2014 (EnvProtLaw). It prescribes that during the prospecting, extraction and processing of minerals, the miners must find preventive measures and responses to environmental emergencies and meet requirements for environmental protection, rehabilitation and remediation, and take ongoing action to rehabilitate and restore the environment in course of exploration, extraction and processing of minerals (Art. 38, Clause 1).

Detailed regulations for concretizing the Env-ProtLaw and environmental matters in mining activities are provided in Decree 19/2015/NĐ-CP. Special requirements regarding environmental protection master planning, SEA and EIA and environmental protection plans for projects outside the scope of EIA requirements are stipulated in Decree 18/2015/NĐ-CP. Circular 27/2015/TT-BTNMT provides detailed administrative forms and procedures for the instruments regulated in Decree 18. Circular 43/2015/TT-BTNMT on reporting on the environment's state, environmental indicators, environmental monitoring data supplements Decree 18, too. Last but not least, Circular 164/2016/NĐ-CP prescribes environmental protection fees on mineral extraction activities.

Art. 73 MinLaw stipulates that the approved organizations and individuals shall establish a *mine closure plan* for whole or part of the mining area when they extracted the whole mineral reserve or part of it or the mining licenses expires while the mineral deposits in the mining area are not fully exploited. The proper mine closure is an

obligatory part of the mining license, Art. 55, Clause 2, lit. i MinLaw.

The mine closure is seen as a project, and the authority that is also competent for the granting of the mining license is responsible for organizing the procedure of appraisal, acceptance, and deciding on its successful completion (Art. 75, MinLaw). State management agencies, which are competent to grant mining licenses, shall organize the appraising of results of the mine closure as it has been projected, and decide on the matter (ibid, Clause 1).

Article 75 Clause 2 of the Mineral Law requires that the government shall stipulate detailed ruling on this process. In this regard, the structure and content of the public administration, competences and procedures were promulgated by two regulations: in Art. 45-48, 56 and 57 of the Decree 158/2016/ND-CP and the Circular No. 45/2016/TT-BTNMT including an extensive Annex of 47 forms that mirror the whole cycle of a mining project, and especially the reporting requirements concerning the execution of environmental rehabilitation measures.

A regulation of peculiar importance for the practical implementation is Circular 38 on environmental remediation and restoration in mineral mining activities, which was issued by the MoNRE in 2015. For example, it provides in the Annex 02 a guidance and structure on the elaboration of content on environmental rehabilitation and reclamation including maps and cost estimates, in Annex 03 a guidance on solutions on environmental rehabilitation and reclamation for mining exploitation projects. A mining company should consider this circular and the aforementioned Circular No. 45/2016/TT-BTNMT to close its mine.

Summarizing this, the mining authorities in Vietnam seem to be well equipped with a modern legislation, which addresses the protection of the environment comprehensively. Having a look at the online collection of legal documents in Vietnam (www.thuvienphapluat.vn) we have to realize that an unbelievable high number of legal documents were promulgated from January 2011 to September 2017 regarding the mining sector and its products: 104 decrees from the Central Government, 176 Decisions from the Prime Minister, 49 Decisions and 78 Circulars from the Ministry of Natural Resources and Environment etc.

After a few years of fieldwork in Vietnam, however, we can observe a large gap between the high level of regulation and the reality. There are substantial deficits in the technological and environmental performance of the companies (see the contribution of Schneider et al. in this volume). The environmental monitoring system has several shortcomings. Particularly in Luong Son District the number of land-use conflicts and health issues is occurring (see the contribution of Thinh at al. in this volume). A systematic rehabilitation of abandoned mining sites is missing. Consequently, improvements in the aggregates mining sector should concentrate mainly on the reduction of legal complexity and on the implementation of the law on provincial and local level.

3.2. Aggregates Mining and Regional Economy

Minerals such as crushed stones and sands and gravels (aggregates) are not only an indispensable material for the building and construction industries but also an important factor in regional economy [11]. Although natural aggregates are vital to social development and economic growth, mining, processing and transport of aggregates can lead to serious environmental impacts [3], [4], [12], [13]. The most important are noise, dust, blasting effects, erosion, sedimentation, landslide, destruction of habitats, pollution of surface and ground water,

and disturbances of the landscape scenery. Moreover, aggregates mining is connected with radical changes and conflicts in land-use. Typical cases are the loss of agricultural land, the reduction of life quality in neighboring residential areas, and the disturbance of natural reserves. Consequently, each regional reflection of the aggregates mining sector should include the positive as well the negative impacts. Whereas, the environmental problems are highlighted in other contributions in this volume, we will shed light here primarily on the economic performance of the aggregates mining sector.

In Vietnam, increased industrialization is creating greater markets for the use of aggregates, particularly in high growth urban areas like the Hanoi Metropolitan Region. Surprisingly, although construction aggregates are mined more than any other material, there is a lack of systematic knowledge (i.e., overview on legislations, revenues and accounting) on how the profits of mining aggregates are collected, distributed and used in Vietnam [14].

Currently, there is an increased drive to examine how the potential wealth from the construction material industry can be translated into economic, social and environmental opportunities on local level. This is particularly relevant nowadays in Vietnam, as increasing political emphasis is placed on promoting regional and urban sustainable management of mining resources. Vietnam's Long-Term Strategy for Exploitation of Mineral Resources to 2020 with vision 2030 [15] mentions that, as non-renewable resources, minerals must be managed, protected, exploited and used rationally, economically and efficiently to meet the requirements of industrialization and modernization of the country. This seems to be a good precondition to reduce the negative impacts and to use the economic output for improvements of the infrastructure in the affected regions and communes.

As already explained, Hoa Binh is one of the source areas for mineral aggregates of Hanoi. But this status is quite new. As of November 2015, there were listed a total of 51 licensed mining projects in operation, 8 in current stop of operation, and further 35 in licensing procedures, altogether 94 single activities in aggregate s mining (DoNRE, 2015). However, a closer look reveals that there are some uncertainties regarding the number of licensed and working operations, and there are also some inconsistencies between the data of different departments. Thus, we have to interpret the data carefully. Nevertheless, some trends are obvious.

Limestone is the most intensively mined raw material in Hoa Binh province (81 of the 94 approved and applied operations are limestone; [16]. The other ones are basalt, clay and river sand. Having a look now on the approved operations (Figure 2), between 1998 and 2015 a total of 59 operations in the field of aggregates mining were licensed (51 working, 8 in current stop).

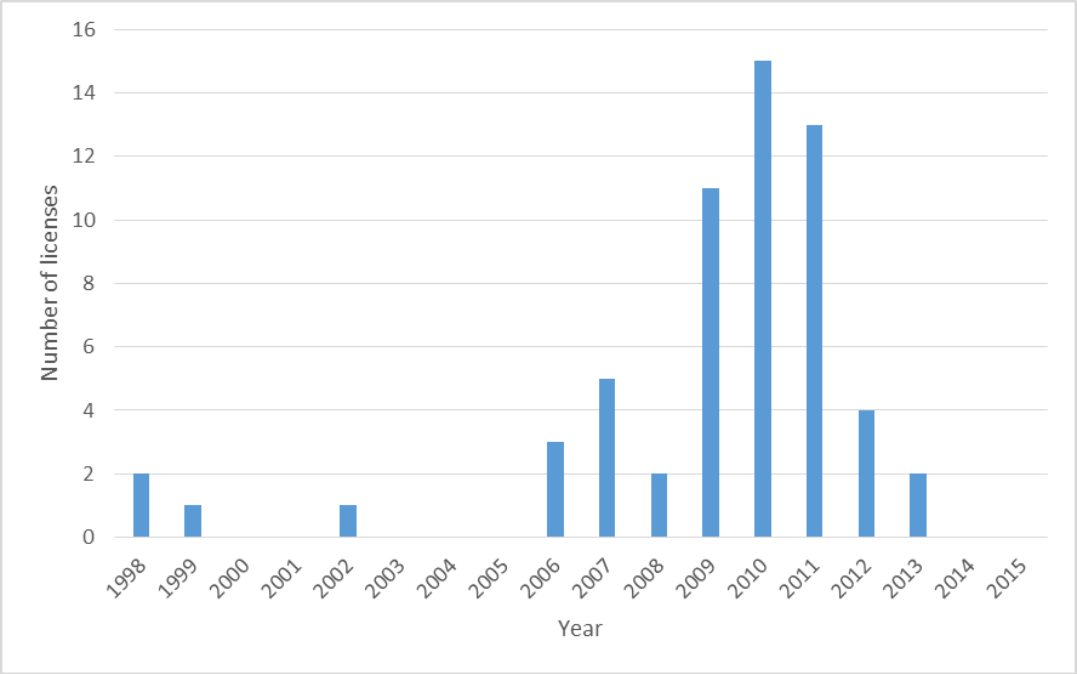

Figure 2. Approved licenses for aggregates mining in Hoa Binh province 1998 to 2017 (IOER on the basis of *[16]*)

When we look at the chronology it becomes obvious that 53 of the 59 operations (90%) were approved from 2006 to 2012, and in these years mainly from 2009 to 2011. Here we can see that aggregates mining is a quite new development in Hoa Binh province with a short boom. We can explain the upswing with the Vietnamese urbanization policies and in particular with political decisions of the Vietnamese Prime Minister regarding the Urban development of the Vietnamese Capital Region [5], [6]. Since 2008, Vietnam's economy has cooled off with high inflation, mounting public debts, mass liquidations of private businesses and a tight real estate market [17, p. 3]. This may help to explain the fast downswing of the aggregates mining licenses after 2011.

What does this mean for the regional economy and employment? The aggregates mining sector in Hoa Binh employed 1,832 people in 2015 [10]. The number of employees was falling since 2011. This process was combined with the reduction of the employment rate of the sector in the provincial economy from 6 to 4 % [10]. After a minimum employment in 2013, the number of employees is increasing again slightly.

The contribution of the mining sector to the provincial GDP nearly halved from 2011 to 2015 (Figure 3). And the share of the sector in relation to the total provincial GDP reduced from 1.42 % (2011) to only 0.55 % (2015). This does not only mean that the importance of the sector in the regional economy is only minor. It becomes also obvious that the productivity of mining is very low: 4 % of the employees produced 2015 only 0,55 % of the provincial GDP.

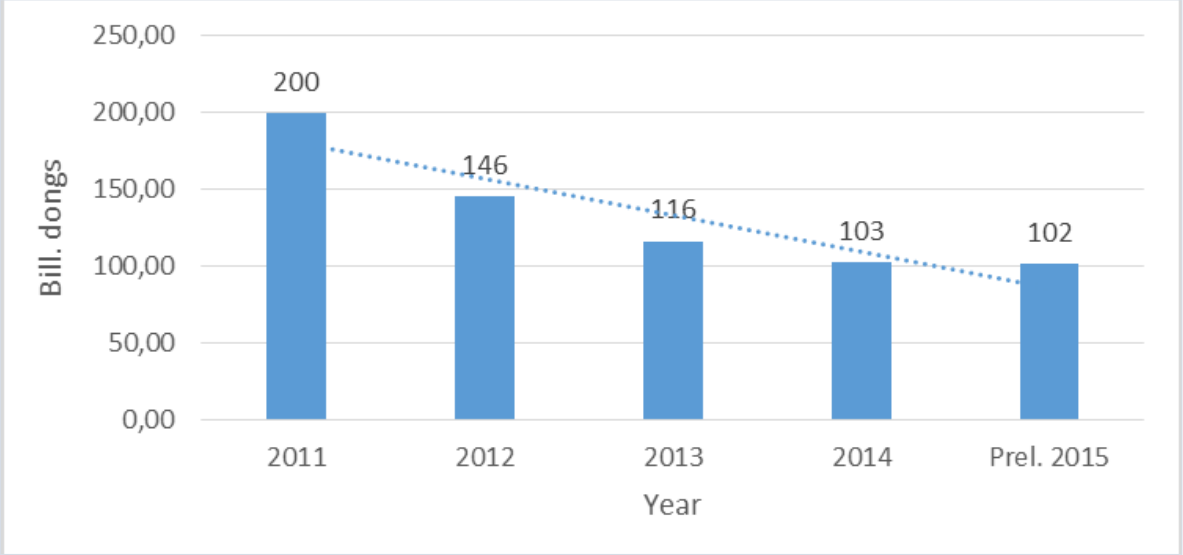

Figure 3. GDP at constant 2010 prices in the Hoa Binh quarrying sector 2011-2015 *[10]*

Not surprisingly, we can see that 75 of the 81 companies in the quarrying sector have less than 50, and 39 less than 10 employees [10]. Thus, the sector is characterized by small and a few medium-sized enterprises. Also the capital endowment of the companies is meaningful regarding the structure of the branch. We learn here that 40 of the 81 companies in the quarrying sector have a capital endowment of less than 5 bill. VND (about 200,000 €).

Summarizing, it becomes obvious that the quarrying sector in Hoa Binh province won importance since 2006. A lot of mining licenses were granted and the sector developed a few years properly. This led to a moderate employment. Since 2010 licensing went back and so did the whole economic importance of aggregates mining. Very small, small and only a few medium sized companies, most of them with a low capital endowment, characterize the branch today.

3.3. Aggregates Mining in a Planning Context

Two main concerns regarding the sustainable extraction of natural aggregates have been raised in the last years [18]: (a) aggregates are non-renewable minerals, which might imply that they will not be available for future generations, and (b) the environmental impacts associated to the extraction are of high relevance (e.g. inefficiencies in transport, energy usage, CO_2 emissions, and mainly landscape alterations). To face these challenges it is important to count with a comprehensive legal and planning framework for the extraction of aggregates. Whereas the legal framework is explained in 4.1, we concentrate here on a few main aspects of planning in Vietnam and the Hanoi Metropolitan Region (HMR).

As the demand for construction material in Vietnam is expected to continue, there is an increasing drive to examine how the planning mechanisms for the extraction of aggregates operate in Vietnam. This is particularly relevant nowadays as increasing political emphasis is placed on promoting a sustainable management of mining resources in the country [15], [19]. Vietnam's Long-Term Strategy for Exploitation of Mineral Resources to 2020 with vision 2030 [15] mentions that as non-renewable resources, minerals must be managed, protected, exploited and used rationally, economically and efficiently

to meet the requirements of industrialization and modernization of the country.

Here we provide a short overview of the policies and planning instruments affecting aggregates' extraction in the HMR and one of its provinces, Hoa Binh. We concentrate on the secondary legislation and the implementation tools. All explanations are based on a separate research report [20].

Mainly, four planning strands are influencing the extraction of construction materials: Strategies and masterplans in the field of mining, construction planning, socio-economic planning and land-use planning. Figure 4 does not only demonstrate the structure of the planning system, but also the logical connections in between the single fields of planning.

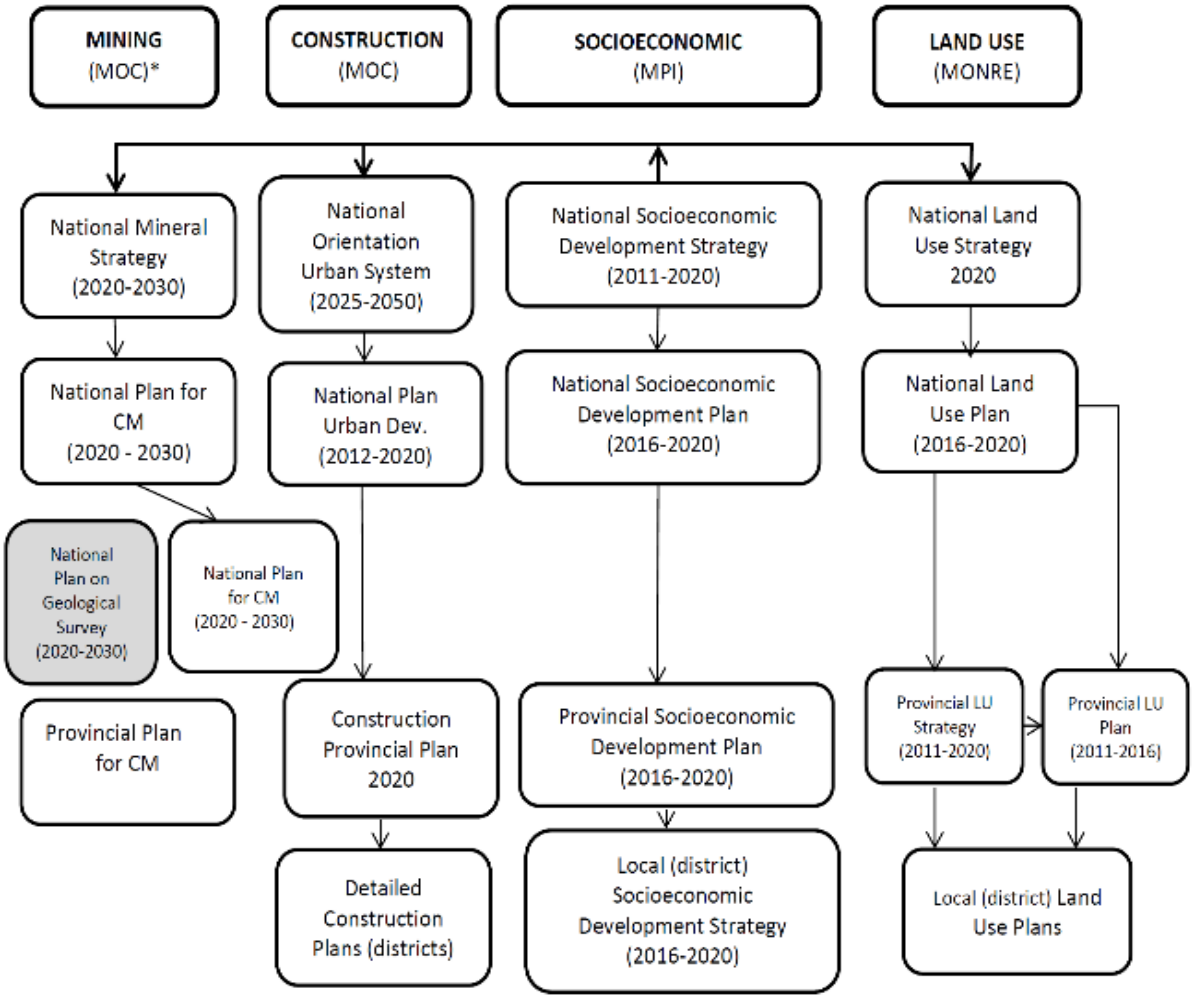

Figure 4. Relationship between socio-economic planning and construction materials planning in Vietnam [20]

As a rule, Vietnam has a coherent, strictly hierarchical planning system from the national over the provincial (regional) to the local level. The most important field is socio-economic planning, basing on the National Socioeconomic Development Strategy. Approved by the National Assembly, it defines the goals to be attained within a 10-year period. The instrument serves as the basis for the formulation of sectoral and local development plans like mining, transportation, energy, telecommunication and tourism. It is in the responsibility of the Ministry of Planning and Investment (MPI). The Master Plan on Socio-economic Development of Hoa Binh province is giving an orientation on the modernization of the economy and infrastructure and on the improvement of quality of live.

The planning of minerals for the building industry is in the hands of the Ministry of Construction (MoC). There is a number of strategies and master plans stipulated in the Minerals Law (see 4.1). Here we concentrate on the Masterplan for Exploitation and Use of Minerals for Three Types of Minerals Used as Construction Materials in Hoa Binh Province from 2013. It provides mainly targets reflected in figures to be achieved in 2020.

Accordingly to the plan, 1,373 hectares of land are already being used in the province for the exploration and exploitation of stones for construction and 95 for sand. The Plan expects to increase these figures in 63% and 67% respectively by 2020. This impressive growth is planned to take place in the 11 districts shaping the Province. Luong Son district is expected to produce the highest volume of stones for construction in the Province (74%).

In accordance to the ambitious socio-economic objectives of Hoa Binh province and the neighboring capital Hanoi, it does not wonder that minerals planning acts on the assumption that there is a growing need for construction materials. Nevertheless, there are a number of challenges for socio-economic and sectoral planning visible [20, p. 43]: Firstly, mineral planning is undertaken at a high spatial level in Vietnam. Documents promote the management, protection, and the efficient use of minerals to meet the requirements of industrialization and modernization. Although Vietnam has a National Master Plan for on Geological surveys, the document does not have a spatial expression. Secondly, Planning for aggregates is considered in the National Master Plan for Exploration, Mining, Processing and Use of Minerals as Construction Materials. The document provides general and incomplete figures concerning aggregates' reserves and the medium term expected demand for different construction materials. Thirdly, planning for aggregates has been decentralized up to the Provincial levels (Master Plans). Documents do not address the importance of aggregates and the necessity to assess (environmentally and socially) the exploration and development of extractive activities. Last but not least, planning for aggregates is based on insufficient understanding of current situation (demand) and does not consider actors' participation at any administrative level.

3.4. Actors and Cooperation in the Field of Aggregates Mining

The management of mining is a multi-actor task. According to Östensson [21], governments at national and sub-national level, the mining industry, local communities, and non-governmental organizations (NGOs) are the key actors in this field of activity. *Governments* have the responsibility for finding a balance between protecting the natural environment and promoting material economic growth. For that reasons a strong regulative system is necessary. Therefore, mining is "one of the most heavily regulated industries in most countries" [21, p. 437]. Furthermore, the distribution of authority

and responsibility between national and lower government levels is an important issue. Often the question has to be asked how local governments can get a satisfying part of the government revenues [22].

Mining companies are profit-oriented like other companies. Normally, the locations of their activities are determined by raw material deposits. In the extraction areas the mining companies are often confronted with the interests of local communities and NGOs. Today, *local communities* articulate their interests more clearly than before regarding transparency, participation, and communication [23]. And this contains "tensions, conflicts and opposing interests" [21, p. 440]. Last, but not least, the importance and influence of *NGOs* have increased in many parts of the world. Often they provide a platform for common action. They are advocacy groups with the objectives of protecting the environment and of giving local people an opportunity to advance an opinion [21, p. 442/443].

Against this background, the actor constellation of aggregates management in Hoa Binh province was investigated. The most important actors are:

- The mining companies. Officially there are listed 81 companies in the field of aggregates [10]. Most of them are members of a registered association called "Stone Mining Association".
- The central government of Vietnam with a number of ministries having different legislative responsibilities: Ministry of Natural Resources and Environment (MoNRE), Ministry of Construction (MoC), Ministry of Planning and Investment (MPI), Ministry of Finance (MoF).
- The People's Committee at provincial level, responsible for the planning of construction materials, licensing of the most aggregates extraction operations, as well as other management tasks (see 4.1). Also here, several departments are involved: Department of Natural Resources and Environment (DoNRE), Department of Construction (DoC), Department of Finance (DoF), Department of Planning and Investment (DPI), Department of Communication and Transport (DoCT), Department of Industry and Trade (DoIT), and Department of Culture, Sports, and Tourism (DoCST).
- The People's Committees at district and commune level with its related sub-units.
- The local residents, among them farmers and land owners as well as people which are affected by mining in different ways.
- Mass organization with a close relation to the communist party of Vietnam, namely the Fatherland Front with its members including Women Union, Hochiminh Communist Youth Union, Farmer Association and others.

After having had a closer look at aggregates mining in Hoa Binh province there are some specific aspects to be considered regarding the system of actors:

1. Companies in the aggregates mining sector are – in the majority of cases – small industrial operations with low capital endowment and low employment effects. For that reason, they perform low technological standards and they miss minimum standards regarding environmental protection as well as work safety.
2. Although the mining sector in Vietnam is highly regulated in different fields of law, there are several weaknesses in the implementation of the law (see 4.1). The overall impression is that the provincial administration, which is responsible for licensing of aggregates mining operations has several problems to cope with this task.
3. Local communities are less involved in the approval procedures of mining operations. As regulated, the communities can give their opinions through their representatives

(usually communal people's committees) and are informed about the plans after the provincial decision was made. Local people can address their opinions to the Fatherland Front.

4. NGOs are relatively young in Vietnam. They are mainly organized at national level, whereas the local influence is weak. In Hoa Binh, we could not find a NGO struggling for environmental goals and community interest in the field of mining.

At the moment, there are already regular informal meetings between the provincial government and the Stone Mining Association, discussing mainly economic issues of the mining industry. Having in mind a sustainable development concept including environmental issues and the solution of land-use conflicts, the research consortium recommended to build up a broader based cooperation network of the public and private actors in the sense of a Business-Policy-Society Interface (Figure 5).

This network was founded 2016 to coordinate the activities of the Hoa Binh provincial government and the companies in the field of aggregates mining. Its name is "MAREX Alliance".

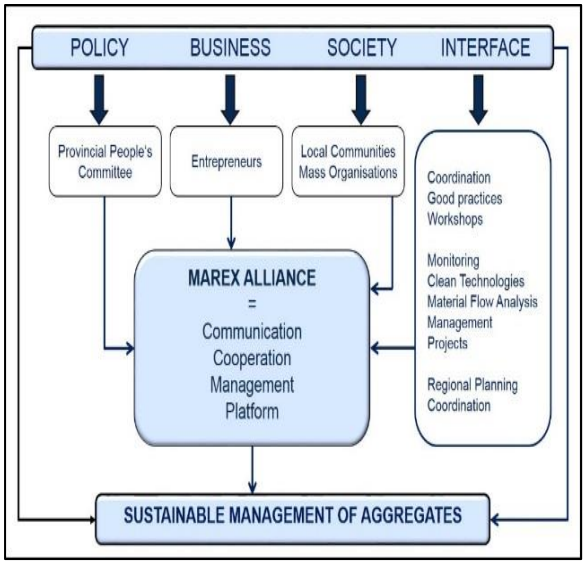

Figure 5. Functional scheme of the Business-Policy-Society Interface for aggregates mining in Hoa Binh province

The MAREX Alliance is designed as a platform to facilitate the voluntary cooperation and communications between state management bodies (policy), businesses, the concerned localities and representatives of the civil society for promoting the sustainable management of aggregates in Hoa Binh Province. The idea is that all stakeholders work together to implement an action program which is serving the common objective of sustainable aggregates mining in the province. In particular, the approach is aiming at an effective way to extract raw materials, to reduce environmental and social impacts as well as health and safety risks of mining, to improve the knowledge of the stakeholders, and to implement an action program.

Under consideration of the political and legal framework conditions of aggregates exploration, extraction, processing, and use, the MAREX Alliance has several emphasis. The most important ones are the designation of priority areas of aggregates mining within the framework of regional planning, the rehabilitation of mining sites, knowledge transfer and training, information to the public, the adoption of cleaner production (CP) technologies and of methods of material flow assessment (MFA), and the initiation of common projects to foster sustainable development in the sector. The first work program was adopted for the timeframe 2016-17, including 3 expert seminars, supported by Vietnamese and German experts.

All in all, the recommended platform could contribute to the improvement of the whole management system of aggregates mining in Vietnam. It will depend on the willingness and capacities of the provincial representatives in the Government and in the business sector to implement the goals. When there are positive results it could become a role model for whole Vietnam.

4. Conclusions

Aggregates extraction has won importance in the last years in Hoa Binh province. It generates moderate employment effects and tax revenues, and it contributes to the ambitious socio-economic development goals in the province and in whole Vietnam. On the other hand, it is responsible for landscape alteration, air, soil and water pollution and several land-use conflicts. Consequently, it should be paid more attention to the cost-benefit relations of aggregates mining. Although, the mining sector is highly regulated in Vietnam, there are several shortcomings in the implementation of the law. In the field of planning there is an urgent need to coordinate sectoral planning (in our case urban, land-use and mineral planning) closely with socio-economic planning. To make minerals planning more effective, the figures for single minerals should be connected closer with real development in the construction sector. Lastly, there is a lack of cooperation of public and private actors in the field of aggregates mining in general. For that reason, the research consortium suggests to initiate a cooperation platform in the province to promote aggregates planning, information exchange, and knowledge transfer.

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