

# Mining site living with communities: geological and cultural landscapes for future industrial heritage tourist attraction (case from the Northern Thailand)

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**Abstract.** This article proposed the potentiality of a mine site as a significant geological resource and its industrial elements and associated landscapes and values, to become a mining heritage tourist attraction. The mine site as the case study is located in northern part of Thailand. Initially, the study utilized documentary research, followed by field surveys for physical records, and it was supplemented by in-depth interviews with key informants working in the related divisions of the studied mine's organization. A focus group discussion was organized with 20 local participants living in proximity to the mine site. The findings revealed the potential of mining heritage tourism existed, and conveyed that the mine could step forwards developing itself as a mining heritage tourism site, with different features covering an energy park and outdoor museum of machinery, a bike park, and a cultural space holding culture and recreational events; whose narratives should be interpreted in align of the mine's industrial and associated cultural landscapes. Limitations for future development were also addressed.

## 1 Introduction

Natural resources have value with regard to a wide range of human activities, including tourism. The geological character of a place determines the natural assets it possesses such as mountains, rivers and beaches. As part of this, in the field of heritage, the mining industries that exist or existed in an area, and which depend on those natural resources, can be a significant feature of the area's heritage, especially in the post- industrial era.

Mines thus have the potential to become significant resources for creating and developing new areas of industrial heritage tourism. The existence of Mae Mohmine in the northern province of Thailand, Lampang, underlines the extensive use of coal for electricity production and how this has benefited people nationwide. Within the site, functional integrity is especially clear given the fact that the mine complex still operates as a nationally important source of electricity, but because coal is a non- renewable resource, the mine is expected to be depleted within approximately 30 years. Geologically, the mining landscape can be viewed as an evolved landscape, which has changed as a result of

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economic activity, and this has a direct association with the natural environment, in this case, the geology of the coal deposits.

Evolved landscape can be divided into two types: Relic (or fossil) landscapes and continuing landscapes [1]; here the Mae Moh mining landscape straddles both categories. It is in fact home to the most extensive coal deposits made during the Paleogene -Neogene era 66.5 to 1.6 million years ago and the basin is dominated by massive mudstone, sandy clay, shale and coal beds laid down during this time. These now comprise the largest coal deposits in Thailand and extend 16.5 kilometers in length and 9 kilometers in depth. The geological stratigraphy is divided into three formations:

(1) The Huai King formation, which comprises a conglomeration of sand, silty sand, and clay with a thin layer of coal, lignite and which is up to 320 meters thick;

(2) the Na Khaem formation, which alternates between a series of massive claystone and lignite layers indicating lake and swamp environments and which is 420 meters thick; and

(3) the HuaiLuang formation, which appears to be a red bed formation comprised of claystone, silty claystone, indicating fluvial environments and which is up to 400 meters thick [2][3].

To the south of the Mae Moh basin, the area is dominated by rolling hills and low mountains formed by Pleistocene basaltic flows and containing distinctive ancient volcanic craters, two examples of which are Doi Pha Khok Champa Daed and Doi Pha Khok Hin Fu, which are found 2 kilometers apart from one another. Being the non- renewable resource, the site is also prone to a shortage of lignite within approximately 30 years.

Under this circumstance, developing the site using its geological and industrial landscapes, to serve the tourism purpose could be considered as to maintain a continuity of the area's functional integrity. The geological resources would be utilized and the mining culture could be interpreted from the physical remains to valorize the tourism discourse.

## **2 Literature Review**

### **2.1 The industrial heritage**

The Nizhny Tagil Charter for the Industrial Heritage defines industrial heritage as that consisting of the remains of industrial culture which are historical, technological, social, architectural or scientific value [4]. Industrial heritage reflects the profound connection between the cultural and natural environment that can be seen in industrial processes both in ancient and modern times, and evidences of industrial processes can be seen in raw material, natural resources, energy, and transportation networks to produce and distribute products to broader markets [5]. Industrial heritage tourism is a new perspective placed on values of industrialized productions to be integrated with tourism; in other words, it is to adaptively utilize tangible and intangible assets in the industrial sector as resources for tourism experience production.

It is as Zhanget. al. [6] referred to the trend of industrial heritage tourism study in China, in particular with some of China's mineral-resource exhausted cities which were suffering from mineral resource exhaustion and economic transition. It is pointed out that industrial heritage tourism can be a way to renew and transfer the resource-exhausted cities. It has been evident in China that former industrial factory sites can be creatively transformed into contemporary cultural space, as in '798' in Beijing and 'M50' in Shanghai, which places a great opportunity for the construction of creative cities. Generally, the industrial heritage for tourism can be classified into three main groups:

Industrial and technological monuments for instance sites, moveable heritage and

artifacts in museums, as well as fortifications; living industry of all types and agriculture and food production; and intangible heritage for instance cultural activities inspired by industrial development [7].

Remains of the industrial heritage range from buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to industry such as housing, religious worship or education. The primary elements of the industrial heritage contributed during the early beginning of the industrial revolution include (1) railways which focus on history and physical monuments such as stations, tunnels and viaducts; (2) iron works; (3) mining and (4) salt works [8].

## **2.2 Mining heritage and tourism**

Mining heritage can be defined as the total surface and subsurface mining works, hydraulic and transport facilities, and the machinery, documents or other objects related to former mining activities that have a historical, cultural or social value [9]. Another definition is the mining heritage is as 'the sites (at) which minerals and other minerals of value were dug from the ground', and stated that 'the broader context in which mining occurred and that other places, including whole landscapes, might in themselves be of heritage significance because of mining' [10].

The cultural value of mining refers to the value associated with an area's industrial and mining activities and this extends to include the everyday lives and working experiences of miners, workers and other locals living in an industrial area. From the standpoint of tourism, both former and working mines have the potential to be sustainably developed as tourist attractions and for recreational purposes due to their geological significance and the industrial values and technological advancements that they embody.

Mining landscapes demonstrate the interaction between humanity and the Earth, and between workers and industrial machines. To interpret mining landscapes, its nature and culture in ways that is friendly to the public, creativity and innovation is required, where grandness of working objects, the machinery and landscapes that comprise the mine can be transformed into 'physical objects of attention' [11].

Tourism is one way to highlight the importance of both mine workers and machines, bringing backstage workers to the front, and they would feel positive and proud of their work and more participative. This has already been proved by many European mining heritage sites, for instance the case of Mining Area of the Great Copper Mountain in Falun, Sweden, which is a UNESCO World Heritage Site whose large, extensive mines with intactness of the physical evidence of mining and related industrial activities were successfully transformed into tourist attraction site. The copper mining town is set in a landscape that narrates the industrial and cultural fabric of the mine as it evolved during the late 17th and 18th centuries [12].

Another one is Zollverein Coal Mine Industrial Complex in Essen (in North Rhine-Westphalia in Germany), UNESCO World Heritage Site, consisting of the complete infrastructure of a historical coal mine from the 20th century, where all buildings have been preserved and the UNESCO World Heritage Convention has declared the area a site of outstanding architectural merit [13].

The mine in this current study showcases the area's outstanding character in terms of geological endowment and industrial development, and it is highly significant in terms of both the natural and the built landscape. A question that arises from this is then how this landscape can be adaptively and sustainably reused to leverage its value, while at the same time, preserving its contemporary heritage. This study thus explored possibilities and points

out challenges of Mae Moh mine, together with the area's surrounding landscape and the former mining machinery, for contemporary and future development into a tourist site based on mining heritage resources. The study surveyed the natural and built environments in relation with the mining heritage, followed by value and narrative analysis conducted by local participants, and finally it suggested possible approaches to take based on this heritage.

### 3 Research Methodology

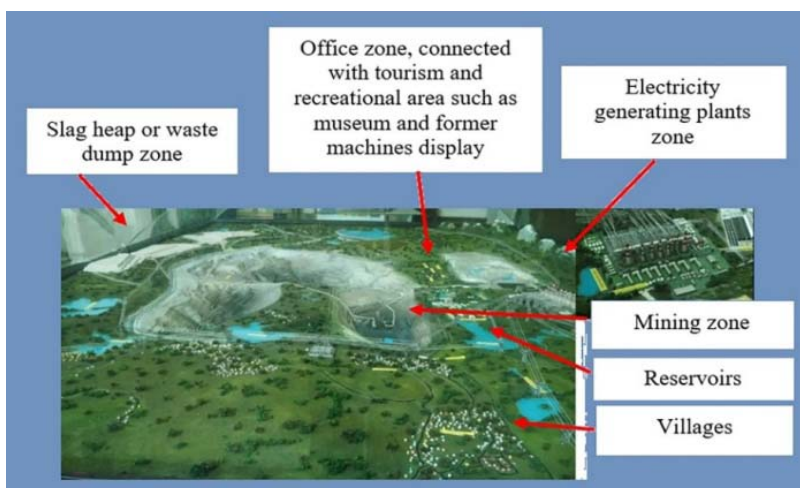
This research utilized qualitative method in its data collection. Initially, the study carried out fieldworks to physically record the landscapes, followed by in-depth interviews to gather the information regarding the present and future mine land uses. After that, a focus group discussion was conducted with 20 participants who were from 2 local communities living in proximity to the mine site, for heritage value and narrative analysis.

### 4 Findings

Mae Moh mine is an open pit mine with a total mining area of 9,260 acres and an external dumping area covering a further 10,240 acres. The mine can be separated into the principal functional areas as shown in Figure 1, including the mining area, the slag heap or waste dump zone, the electricity generators, the reservoirs, areas for offices and machinery maintenance, the residential zone, and the tourism and recreational zone.

This vast site is situated in a natural setting that connects with tributaries, forest plantations, and villages located in Mae Moh Basin and are set against a backdrop of limestone mountains. The entire area encompasses industrial buildings, facilities and machines, and these represent the industrial landscape of the site. Around the mine, one can find 3 main reservoirs, while outside the mine, other related areas are the location for training institute and offices that provide technical and educational support.

According to the data supplied by the survey, most of these machines were manufactured in Germany, the United States of America, Japan and Australia, and had been used for more than 20 years, but despite their age and usage, these are still in good condition, thus reflecting the quality of their construction and the longevity of Thai mining operations.



**Fig. 1.** Map of Functional Areas within Mae Moh Mine, Lampang, Thailand.

**Table 1.** Data Presentation for Some Former Machines.

	Name	Series	Year Received	Year Dismissed	Years Of Operation	Brand	Production Country
1	Dragline	BUCYRUS ERIE 54B	1959	1991	32	RUSTONE 6 YEX MKII	United States Of America
2	Locomotive	KYOSAS/DHG 15B	1976	1987	21	CUMMINS/ NH22OBI	Japan
3	Blast Hole Drill	MOBILE DRILL	1958	1986	28	FORD/B8PD -600L-BE	Japan (In 1957)
4	Feeder Hopper	N/A	N/A	N/A	N/A	N/A	Germany (In 1976)
5	Mobile Crusher	RUSTON HORNSBY	1963	1980	17	RUSTON HORNSBY	Australia (Australia- Thailand)
6	Locomotive	TASMANIAN RAILWAYS/1 0-102	1961	1989	26	GARDENE R/LW6A	Australia

According to the in-depth interviews with the division of civil and mine reclamation of The Electricity Generating Authority of Thailand (EGAT) in Mae Moh, Lampang, the main objective of the mine's landscape management is to manage the mined areas and to dispose of waste generated from mining and electricity production, and to increase the area's productivity during its approximately 30- year life span.

Reclamation processes typically commence while active mining is still occurring and so at Mae Moh, mining and restoration through reclamation have run side by side throughout the life of the mine. Plans also exist to reclaim mine land using a landscape design that incorporates future recreation and tourism uses and under this, fly ash and bottom ash dump sites will be converted into an eco- park, while the buildings located at the power generating zone may be developed into an alternative energy park and museum.

However, there are concerns about the high cost of adaptive reuse of the mine site and related safety issues, and these plans will also require an environmental impact assessment. Generally, there is a variety of possible end uses for mine sites but for the current mine, three general categories have been planned and implemented at the site: (1) Reforestation; (2) water storage; and (3) recreation.

As was discussed in the in-depth interviews, there is an initial plan for the mine to become a learning site where tourists can find out about energy, alternative energy and the environment. Following this, more elaborate and refined ideas for tourism and recreational activities will be needed for detailed planning and development but the scope of these will be determined by the legal requirements set out in the Minerals Act B.E. 2560 (A.D. 2017), as well as by the regulations of the Royal Forest Department (RFD) and Department of Primary Industries and Mines (DPIM), and the rules on rehabilitation and environmental impact assessments set out by the Office of Natural Resources and Environmental Policy and Planning (ONEP) [14].

Recreation is also one of the main reclamation strategies being put in place since in addition to tree- planting, turning an inactive mine into a recreational or public park is a common way of satisfying the requirements for reclamation and rehabilitation.

The main issue here is how the mine, the power plant and its workshops and offices, and the ash dump sites may be adapted to tourism and recreational purposes. General factors that support the possibility of a given site being developed as a tourist attraction

include: (1) The attractiveness of the resources at the site; (2) the activities on offer to visitors; (3) the amenities provided for visitors; and (4) the accessibility of the site. There is no doubt regarding the accessibility of the mine as it takes only 15 minutes to reach it from the centre of Lampang city, and it is both very close to the area's main highway and connected to the northern railway line. At present, Mae Moh mine has opened some zones for public recreational, including the Botanical and Mexica Flower parks, a scenic tower and a sky-walk bridge from where visitors can see the mine and its reservoirs. For future use of mining land, a redesign of the mine landscape is badly needed and there is ample scope for tree plantations and trails for biking, which would then offer views of the countryside and of the reservoirs as an associated water heritage. Beyond this, the mine machinery will also be a valuable reminder of the area's industrial heritage and in the mining industry, and old machines that embody older technologies that reflect their lengthy service.

Furthermore, the focus group discussion was also conducted with 20 participants from 2 communities located in proximity to the mine site. The discussion had the aim of gathering local people's reflections towards the mining site and associated heritage landscapes by value types and narratives, by asking them to share their opinions and to rank the given narratives. This was summarized in Table 2, whereas a chart to visualize the data was supplemented, as in Figure 5. The participants generally had similar memories about life before they moved from the mine site to the new land allotted to them.

Most recalled a rural and agricultural lifestyle, lived in close kinship groups and based on rice farming, vegetable cultivation and domestic household economies. Their central spiritual site is the spiritual wooden hall, which was disassembled in order to be moved from the original site (within the current area of the mine) and reassembled in the new community.

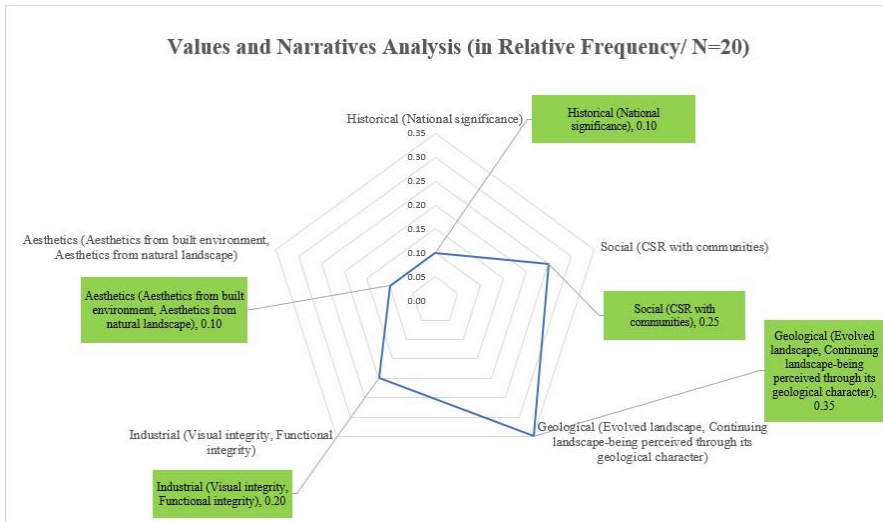
This now displays pictures of the community's Tai Yai ethnic ancestors and their cultural traditions. Significantly, all participants expressed the belief that the mine and the reservoirs were part of their heritage, stating that the mine had been with them for a very long time, before those buildings and machines were there ('those buildings' refers to the office buildings and the plant and machines used to generate electricity). This may thus indicate that participants feel connected to the area's land and water resources. Some participants made reference to the size of the vehicles and electricity-generating units as amazing by their gazes.

Even though the participants could not say whether they saw any beauty in the industrial landscape, some related the mine landscape to feelings of loneliness, nostalgia and memories of their old homes, as well as comparing the new (totally transformed) landscape of the mine as seen today with the old landscape that they remembered. Some also commented on how the layers of the mine show its movement and how the reservoirs were beautiful and that these were part of the communities' heritage. Notably, most participants viewed that the natural and geological resources greatly represent their community landscape characters and identity, which has high potential for them to use as a gear to community tourism, such as caves and extinct volcanoes. The discussion drew positive responses and suggested improvements to the mine landscapes and the use of old, abandoned vehicles and machines as points of interest, and this should be integrated with cultural and agricultural resources and activities of the communities.

**Table 2.** Values and narratives analysis towards Mae Moh mining site and associated heritage landscapes, Lampang, Thailand- resulted from on the focus group discussion with 20 participants.

<b>Value Type</b>	<b>Character</b>	<b>Narratives</b>	<b>Number of Participants Perceiving the Narratives as First Rank (in Frequency) (N=20)</b>
Historical	National significance	Siam's royal command for the use of the mine land as the national natural resource for national development during the time the country was in high demand of national social and economic development.	2
Social	CSR with communities	Shifting from the old discourse to be more socially and environmentally friendly activity, the mine site has been finding solutions to the environmental problems which inevitably occur from the electricity production and has been helping the communities around the mine through its CSR activities and offering various jobs for the locals to work in the mine, and the quality of living of local people are very much better.	5
Geological	Evolved landscape Continuing landscape (being perceived through its geological character)	The mine represents the geology of the coal land, viewed as an evolved landscape: relic (or fossil) landscape and continuing landscape. It is highly significance as the most extensive landscape of coal deposit with the Paleogene-Neogene sediments being preserved, by the formation of fossiliferous beds and the calcification process, becoming the great source of natural coal. Mae Moh Basin is dominated by rolling hill terrain and some short mountains of Pleistocene basaltic flows with some distinctive forms of ancient volcanic craters such as Doi Pha Khok Champa Daed and Doi Pha Khok Hin Fu.	7
Industrial	Visual integrity Functional integrity	Huge-size trucks and machines amaze visitors. Most machines had been used for more than 20 years, marking the quality of materials used in industrial production in the past. The mine's visual integrity is represented by the spectacle of the vast landscape of the site that connects with forests, streams and reservoir. The functional integrity is viewed by the physical continuity of both the geological characters, mountains and the mine itself, as well as the rurality that incorporates a mix of agricultural and industry, and the fact	4

		how the geological resources have influenced on local character and cultural context.	
Aesthetics	Aesthetics from built environment Aesthetics from natural landscape	Through human gazes, the mine visualizes the panoramic scenes that are so continuing. The ideology explaining strong, undeniable and reciprocal relationships between humanity and nature emphasizes the truth that the boundaries between natural and cultural landscape are becoming so blurred that separation of these two landscapes is impossible [15]. The so-called ‘natural’ landscape that remain until today (heritage) has become dependent on humans for their survival—this conveys a significant message that ‘it is the survival of both the given natural landscapes and humans’. As ‘heritage’ is a human construct- associated as it is with human memories and narratives, thereafter we could feel right to say that the cultural landscape heritage exists to serve human ways to feeling and narrating ‘aesthetics’ of the past, as well as when individual at that moment, is gazing at and is being deep into the landscape [16].	2



**Fig. 5.** Radar Chart Visualizing the Values and Narratives Analysis.

## 5 Discussion and Recommendations

The research findings, supplemented with references to examples of successful international case studies on former industrial heritage transformation, conveyed that Mae Moh could be developed as a heritage tourism site with three different features: (1) An energy park, where former mining machinery decorates the landscape; (2) a bike park, with cycle routes crisscrossing the site; and (3) an area for events and fairs that will be set



against the backdrop of the mine's industrial heritage.

The extended landscape that is accessible on site supports the possibility for the reuse (and perhaps transformation) of the machinery. The potential for developing the mining heritage tourist attraction is underlined, in which the mine has much more potential as it is home to many historic vehicles and machines, which could be developed as an outdoor park or museum of machinery. In addition, the site has potential as a recreational playground, an industrial landscape park or an eco-park, but it is not necessary to wait until mining operations cease for work on this to be started. In fact, this development could be initiated today. The current limitations on moving ahead with this are laws and regulations related to land uses, which requires further considerations and refinement.

The mine should also start to better manage its data and then produce content on the sewage treatment technologies that are used to clean the waste water that results from the site's mining and electricity generating activities, and put this in the museum interpretation plan. Huge structures with minimal or no decoration may not be perceived as attractive to general local visitors, and this poses a challenge; how should these unused structures and machines be used so that they are both attractive and enjoyable, while at the same time, being a source of knowledge? Strategies that promote social interactions with the built structures and that creatively transform the landscape will thus be helpful in attracting visitors, while because local communities also see the sites' reservoirs as part of their heritage, the concerned authorities could stimulate a tourist retelling of these that explains their significance and value as part of the area's geology-related resources.

Utilizing tourism perspective as a cultural sector, as a new injection to this heavy industrialized sector could then open the way to the possibility of future conservation and development projects for preserving the mining landscapes as well as of other industrial heritage types, and creating harmony between the industrial, the environmental and the cultural sectors. Given this, active consideration and discussions of the relevant laws and policy on land use and industrial heritage conservation are required.

For many people, the image of coal mining is not entirely positive and developing tourism based on mining would be considered a challenge but once taken onboard for further policy development and future planning, this type of development could create a positive image for the industry, while offering an alternative form of tourism. In addition, developing Mae Moh mine into an industrial heritage tourist attraction will bolster the existing cultural and agricultural tourism activities of communities near the mine and so the city's tourism authority would be able to integrate the city's current attractions with this new cultural and industrial heritage tourism, offering a new experience for visitors to the city.

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