

Article

# Creating Tourism Destinations of Underground Built Heritage—The Cases of Salt Mines in Poland, Portugal, and Romania

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**Abstract:** Salt mines, a significant category of local, regional, national, and/or European underground heritage, are becoming attractive tourism destinations. This paper examines three cases of salt mining in different European countries, namely Wieliczka in Poland, Campina de Cima in Portugal, and Turda in Romania. They are analyzed in the context of history, typical attributes of their attractiveness, and new uses after the salt extraction was or is going to be stopped, in order to detect their unique values as important assets for both Underground Built Heritage (UBH) and Salt Heritage Tourism (SHT). The results of their comparison show that despite a positive impact related to their protection as cultural and industrial heritage, there are also some negative aspects related to increasing costs of their maintenance and adaptation of salt mines to new functions and to meet the tourism needs. By putting in place measures to enhance the awareness of their values and for activating the local community, the three mines are showcases for the economic outputs for their sites and regions, as well as for increasing knowledge regarding UBH.

**Keywords:** salt mines; cultural and industrial heritage; Salt Heritage Tourism (SHT); cultural landscape; Underground Built Heritage (UBH); reusing and branding



**Citation:** Kimic, K.; Smaniotto Costa, C.; Negulescu, M. Creating Tourism Destinations of Underground Built Heritage—The Cases of Salt Mines in Poland, Portugal, and Romania.

*Sustainability* **2021**, *13*, 9676. <https://doi.org/10.3390/su13179676>

Academic Editors:

Ernesto Marcheggiani and  
Giuseppe Pace

Received: 31 July 2021

Accepted: 25 August 2021

Published: 28 August 2021

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## 1. Introduction

The salt mines together with other elements of the salt industry such as salt fields or salt caves explored for centuries have become a mining heritage [1]. The processes of mineral extraction were able to modify the territory in depth and leave behind scars both over and under the surface that are almost impossible to recover or backfill [2]. Many of the mines, especially those where the production has been stopped, became remnants of the past and an integral part of the cultural landscape [3]. Cultural landscape is defined by UNESCO (United Nations Educational, Scientific, and Cultural Organization) as a variety of “interactions between humankind and its natural environment”. It also “reflects specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature” [3–5]. Cultural landscapes include three main categories: (1) clearly defined landscape designed and created intentionally by man (e.g., parks and gardens, also connected to buildings and ensembles); (2) organically evolved landscape resulted from an initial social, economic, administrative, and/or religious imperative and then developed into its present form due to association with and in response to its natural environment; and (3) the associative cultural landscape, whose inclusion on the World Heritage List is usually justifiable by powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence (which may be insignificant or even absent) [6]. The third group

is related to a specificity of “traditional” land-use practices that are well embedded in the natural environment. In this context, they can be defined as capable of supporting bio-cultural diversity and ecosystem services through sustainable land use [5,7,8]. Many cultural landscapes in the third group, including those located all around Europe, belong to joint cultural and natural heritage of outstanding universal value that “(...) is so exceptional as to transcend national boundaries to be of common importance for present and future generations of all humanity” [6]. Salt mines, as well as factory complexes, steel mills, cement mills, power stations, or even entire municipalities (when devoid of their industrial functions) are called post-industrial areas [9,10].

With unique values, salt mines covering huge underground areas along with infrastructure on the surface to support mining processes may be protected at various levels of management, established locally by national governments, by an international legal instrument of UNESCO World Heritage [6,11], and unifying conceptual approaches of nature conservation and the protection of cultural properties [7,12]. At the same time, the termination/ending of industrial activities open to many salt mines the opportunity to adapt to new functions while preserving their history and shape; they can be transformed into cultural, recreational, or touristic areas. Tourism is especially found as one of most popular activities and a powerful option for preservation of different types of industrial heritage, including mining, bringing out their historical, technological, social, architectural, or scientific values [9,13].

Heritage, defined as a “legacy from the past, what we live with today, and what we pass on to future generations” [14], encompasses a variety of spatial forms and landscapes. It is a destination of heritage tourism (HT) which refers to travels focused on learning about a place’s culture and history [15,16], and includes the use of the tangible and intangible past understood as a tourism resource [17]. Underground Built Heritage (UBH), as defined by the COST Action underground4value, encompasses three types of built activities (man-made, urban, and landscape heritage) below the surface of the earth, whose use (past and contemporary) results in “cultural values”. One central issue in the conservation, valorisation, and management of an UBH asset is the community-led development. This understanding puts together two different issues: the UBH, a unique cultural resource, and the local community, which (could) greatly benefit from this resource through social innovation [18]. The COST Action underground4value (U4V) seeks to identify ways of promoting UBH as a valuable resource to celebrate the history of a place, and to preserve it, and when sustainable, to re-use it towards unfolding its full potential to support the development of the local community there are inserted in. This general goal implies in actively engaging the concerned and interested citizens in the whole process also in order to co-create knowledge and brand UBH as a tourism destination, while bringing together different disciplines, such as heritage management, geology, and spatial planning. In this work, light is shed on an additional aspect of the context of salt mines, in particular how the three mines are managing to make of them a brand for heritage tourism.

Heritage tourism (HT) as a subgroup of tourism is defined as activities based on two elements: historic attributes of a site motivated by its characteristics [19–21], or attraction understood as a phenomenon based on tourists’ motivations and perceptions rather than on specific site attributes. Regardless of the point of view, many studies argued its impact as a powerful force in the construction and maintenance of a national identity since it relies upon the historic symbols of the nation as a means of attracting tourists [22]. This kind of tourism is important for many countries as a potential tool for poverty alleviation and community economic development, including former industrial cities affected by shrinkage [15,22,23]. As a part of cultural tourism, an industrial heritage tourism, which refers to “the development of tourist activities and industries on man-made sites, buildings and landscapes that originated with industrial processes of earlier periods” [24] is directly applicable to salt mines. Many of them have been turned into tourist attractions or impose certain attributes to potentially reinvent them as tourist sites or as part of the tourist-scape [25,26]. In such wide contexts, as above-mentioned, Cultural Heritage Tourism

(CHT) is significant not only for a local but also a global market [15,27]. The contemporary progress shows also that the nature of cultural heritage tourism has changed from purely quantitative growth toward qualitative shifts in the demand, with a particular emphasis on the increasing quest for ‘cultural experiences’ [27], and at the same time is developed towards a form of experiential consumption [22,27–29].

Salt Heritage Tourism (SHT) as a distinctive type of tourism is related to the specific nature of salt mining and includes many types of activities such as tours to/in the salt fields or underground galleries, and includes different forms of participation in the salt production or the purchase of salt-related products, etc. The theme, the salt products, and their design are mentioned as the three most important attributes that contribute to the attractiveness of a salt destination and affect tourists’ decision-making process [9]. Despite the growing number of post-industrial sites all around Europe, the research on the role of (former) salt mines as industrial heritage worldwide is still an under-developed research field. Salt mines, due to their uniqueness, are associated with particular functional consequences. Activating salt mines requires the recognition and inclusion of different values (historic, social, industrial, etc.) and put in place governance mechanisms that ensure heritage and environment protection. Depending on the form of salt extraction (salt fields or underground mines) and the pursuit or cessation of industrial activities, SHT may take different dimensions and scope. In still industrially active areas, it is commonly seen an attempt to reclaiming traditional practices and adding a contemporary twist to invite tourists to explore industrial sites and production methods [30]. However, many post-production activities performed in former salt mines provide the basis for assessment of those places as heritage as well as valuable in cultural, aesthetic, and recreational contexts. Used for the salt extraction, they can act as post-industrial service activities such as tourism related to cultural heritage [31]. Transformed historical salt mines can provide tourists with the opportunity to experience and learn about the unique history and settlement patterns associated with the mining industry. Many examples show that the development of SHT is directed towards creating holistic experiences that preserve the historical identity and spirit of the past [32]. Guided visits to the mines usually give the possibility to experience the mining and its particular atmosphere. Other mines also offer many other activities, such as exhibitions, organization of workshops and training courses for tourists to assist the appreciation of salt heritage [9], opening the possibility to learn about the cultural and natural heritage [33]. It is crucial to gain experience that involves visiting or engaging with “places, artefacts and activities that authentically represent the stories and people of the past and present” [34]. The three main reasons for visiting heritage sites by tourists are related to heritage experience, learning experience, and recreational experience. Well-developed programmes of salt mines meeting the diversity of needs and expectations of visitors representing all age groups are therefore necessary since the majority of salt heritage tourists have usually limited knowledge in mining processes, also regarding to their history as well as to the salt industry in general [9].

Using salt mines as tourism destinations provides an economic alternative, especially when transformative processes have been stopped, since they are no longer economically feasible [35]. Tourism in salt mines is also related to other activities deployed in an environment with therapeutic effects of the salt air, such as: health care, spa, cultural, and sport activities.

The interactive forms of salt tourism are more and more being appreciated, with an increase of activities being organized in the virtual sphere, driven by the advances of information and communication technologies (ICTs). ICT are gaining importance in many areas of human activities in everyday life [36], in public spaces [37,38], in the connection between heritage and augmented reality [39], and areas of historical and cultural heritage to enhance visitor interpretation [40–42] or enhance their management [43–45].

It is also worth emphasizing that SHT is an important sector with an increasing impact on the economic development of the cities and regions with salt mines. The main benefits of tourism include income generation and job creation, although in the case of mines

with completed extraction and reuse for new functions, the high cost of maintaining and providing sites for tourists is a significant limitation. At the same time, the ability to benefit from tourism depends on many aspects, including the availability of investing in necessary infrastructure and capacity to meet the needs of tourists [46]. At the same time, many tourists are interested in visiting attractive, clean and unpolluted places, and this awareness is a substantial part of sustainable tourism. The perception of a place as a cultural heritage and awareness of its unique values increases its rank and importance as well as enhances its tourist attractiveness. Encouraging visits plays a huge role in both development of internal tourism [47] and promoting heritage sites in an international context, especially for increasing the community of potential heritage tourists [16]. For many tourist destinations, including salt mines, attention is paid to their cultural assets to gain a competitive advantage in the growingly fierce tourism marketplace. Goals focused on enhancing cultural heritage tourists' experiences and satisfaction become therefore significant for recycling and reusing of many salt mines [48].

This paper attempts to broaden the knowledge on reusing of salt mines as a category of Underground Built Heritage (UBH), especially in the context of Salt Heritage Tourism (SHT) and other tourism purposes. The main aim of the study is to draw lessons from the experiences in activating those heritage sites, in terms of analyzing positive and negative aspects of interventions taking as basis cases from Poland, Portugal, and Romania.

## 2. Materials and Methods

### 2.1. Case Selection

Three salt mines (Wieliczka in Poland, Campina de Cima in Portugal, and Turda in Romania) are taken as paradigmatic cases [49,50] for achieving the study aims related to better understand how to activate UBH and the pathway in their adaptative reuse. Their selection was based on key criteria for analyzing their potential and bottlenecks. Being located in different European countries, they are flagship examples of a long tradition of salt mining. They represent the same type: an underground salt mine exploiting rock salt deposits naturally accumulated underground as a result of various geological processes. The cases are also characterized by the same salt extraction method; the process of exploitation takes place through the earlier opening of the raw material deposits with shafts and access pits, which results in the creation of an underground structure of corridors and chambers. The mines are currently at different stages of salt extraction, but this situation doesn't prevent their development into a new direction. They illustrate good practices and become leading European examples of the transformation towards touristic destinations as a part of well developing SHT. The reuse processes involve their adaptation to new functions parallel with a continuing mining process (as in the case of Wieliczka and Campina de Cima) or take place after it was finished (as in the case of Turda). At the same time, the directions of transformation are directly related to the processes of salt mines protection as important elements of UBH for present and future generations, support an economic development of the site as well as help to organize funds for their maintenance and preservation.

### 2.2. Methods

The three cases were discussed following an established common framework, consisting of three stages. In the first stage, a documentation of each salt mine based mainly on literature review and supported by the data from official web pages was organized. All information collected from different sources was divided into five main groups of aspects that reflect the complex characteristics of salt mines:

- general and territorial context—focuses mainly on the physical/structural elements used to extract and commercialize salt. Analyzed are a complex of facilities, equipment and (underground or surface) areas and their features (galleries and chambers) as well as the relationship to adjacent urban areas;

- stage of mining activity—related to history of the site, the operation of salt-industry or its post-industrial use, and considers the adaptive reuse potential towards of SHT;
- protection regime—an important aspect in the context of UBH and includes national and international forms of protection and regularization;
- salt mines reuse—considers the development and adaptation to new functions in relation to SHT, and includes possible activities offered to the public and how these are communicated;
- impacts—the role of salt mines in the development strategies and in economic growth at different levels (local and regional). In the context of SHT, one of the most important aspects deals with the development of regional and international tourism interest.

In the second stage, a comparative analysis of three cases was performed in order to identify similarities and differences among them. Based on the characteristics of salt mines from the literature review, the above-mentioned five aspects related to their functioning and contemporary transformation have been further developed to identify the key factors and features which characterize the salt mines' adaptive reuse.

Due to the fact that the salt mines are at different stages of adaptation to new functions, it was taken into account that factors and features of above-mentioned aspects may vary in their presence or intensity. Therefore, a three-level scale (applicable, partially applicable, and not applicable) was used for their detailed identification. This assessment framework is a comparison tool used to identify main similarities and differences related to the adaptation of salt mines to new functions in the context of UBH and SHT.

The third stage of the study was related to detect and explain potential positive and negative impacts of salt mines' transformation and adaptation to new functions in the context of activating UBH and promoting SHT. These issues were discussed in relationship to results obtained from the comparison of studied cases as well as in relationship to the key aspects presented in the literature review in the Introduction section of this manuscript.

### 3. Cases

#### 3.1. Wieliczka Salt Mine—Poland

##### (a) general and territorial context

The Wieliczka Salt Mine is located in the Wieliczka town, Małopolska province [51]; in the south-central part of Poland, southern part of Carpathian Foredeep and in close proximity to the Flysch Carpathian border. The mine is situated very close to the city of Cracow (about 15 km S-E), a historic capital of Poland, and this is in its metropolitan area. The Wieliczka town with an area of 13.41 km<sup>2</sup> is a part of an urban-rural municipality covering an area of 100.1 km<sup>2</sup>. It is situated close to the A4 highway (E40), which shows its high accessibility. The population of the city was estimated at 22,786 in 2020 [52].

The Salt Mine in Wieliczka, together with Bochnia Salt Mine and Cracow Saltworks Museum located close to another, constitutes a huge complex of salt mining industry heritage. The area covered by the Wieliczka Salt Mine is 969 ha, and the size of its buffer zone reaches 224 ha. Both mines were explored by the same enterprise, which had a royal status ("Cracow Saltworks") for a long period of time and then managed to the Saltworks Castle in Wieliczka. As former "Royal Salt Mines" they illustrate the historical stages of the development of mining techniques in Europe, from the 13th C to the 20th C. With sidewalks and decorated underground chambers they reflect socio-religious mining traditions. Tools, machines, and other elements of old infrastructure provide a unique testimony to the socio-technical system related to rock salt mining [53]. The mine is a modern management enterprise that employs over 250 full-time workers and over 300 tour guides [54].

##### (b) history

Małopolska province is an area of the oldest saltworks and rock salt mining in Poland. First activities of producing salt from surface brines, in the area next to the old trade road from Cracow to east, are dated back to the middle Neolithic period (3500 BC) [55]. In the 11th–12th C, Wieliczka became the largest brewing center in the region. It was mentioned



for the first time as “Magnum Sal” [56] in an official document of the Idzi papal legate (dated to 1124–1125). The salt exploitation resulted in the granting of municipal rights to the town of Wieliczka in 1290.

The exploitation of rock salt from the Miocen age began in 13th C, making it one of the oldest operating salt mines in the world. Both mines (Wieliczka and Bochnia) are managed by the enterprise “Cracow Saltworks” established at the end of the 13th C and operated for nearly 500 years. During its history, the highest rise of the industry covers a period from the 16th to the mid 17th C, e.g., in the 1870s the mine was considered as the most efficient around the world; up to 500,000 t of salt per year were mined at that time [57]. Wars, plagues, and disasters shook the salt economy in the second half of the 17th C, and the leaseholders who managed the mines neglected the protection works, leading them to ruin. In the 18th C, specialists from Saxony headed by J. G. Borlach managed to improve the organizational and technical activity of the enterprise. The Austrian times (1772–1918) were associated with the salt production increase and spatial development of the Wieliczka mine. This brought mechanization of mining works, employment of professional engineering staff and the marking the first tourist route for visitors. Intensive exploitation affected the decrease of the rock mass stability and the condition of the mine. After the Second World War the mining in Wieliczka was ceased, and the exploitation of the salt deposit was finished at the end of 20th C [51].

#### (c) descriptive data

Salt has been the most important mineral in Poland since ages. Salt exploitation was initiated in 13th C in the Wieliczka Salt Mine and continued for over 700 years, since the salt deposit (which covers an area of 5.5 km E-W, with a width of 0.5 to 1.5 km N-S) was finished in 1996. Today, Wieliczka is still an active mining plant, with salt products made after the process of disposal of saline waters. The company takes measures to protect the earth’s surface, groundwater and surface water resources against the negative effects of exploitation activities. By managing salt water leaks, the mine protects the environment.

Altogether, 26 mining shafts (6 still active) and 180 inter-level shafts were drilled on mine underground levels, starting at 57 m and reaching 327 m in depth; 2391 chambers and 245 km of galleries were dug. At present approx. 2 per cent of underground area is open to the public. Since the works in the mine are very durable, the chambers craved since the end of the Middle Ages have survived to this day. For the better protection of the old mine, a historic zone has been created [51]. The occasional touring started in the Renaissance times (16th C) for visitors guested by the Royal Court or stakeholders of Cracow Saltworks. However, the Wieliczka Salt Mine became a renowned tourist site only at the end of 18th C. A dynamic development of SHT, underground health care, and various social and political events created an excellent opportunity for the mine’s activity and development at present [55]. The mine is managed by Kopalnia Soli “Wieliczka” S.A.—a state-owned company of the Minister of State Assets.

The mine is one of the most valuable monuments of material and spiritual salt culture in Poland. It is also one of the most popular heritage areas. Over 1 million people have visited the Wieliczka Salt Mine annually since decades [54], the number of tourists (national and foreigners) has increased and exceeded 1,862,000 in 2019. Related to its balneological values, an increase is also observed in the Wieliczka salt mine as a health resort [58,59].

#### (d) protection regime

The Wieliczka Salt Mine has been listed in the register of national monuments since 1976 (No. A-580, 1976). Its unique value has been appreciated two years later by UNESCO in the First List of the World Cultural and Natural Heritage (ID: 32bis-001, 1978). Since 2010, together with the Bochnia Salt Mine (the oldest salt mine in Poland) the two sister salt mines have been on the list of UNESCO World Heritage sites as “Wieliczka and Bochnia Royal Salt Mines”. In 2013 the Saltworks Castle was also added to the list, giving the birth of a heritage complex of mining industry in the region. They represent a heritage of a high level of authenticity whereas the “most parts of the preserved structure are

from 18th C, the technical testimony relates essentially to 18th, 19th and 20th C. Technical knowledge about earlier periods stems mainly from historic records, and from the resulting reconstructions, which in some cases are slightly over-interpreted, rather than from direct evidence" [53]. The protection of the mines is the responsibility of the Conservator's Office for Protecting Historic Monuments, and the application of mining laws and regulations is the responsibility of the Cracow District Mining Office. The Wieliczka Salt Mine was also recognized as National Monument of History on the decision of the President of the Republic of Poland in 1994. In 1997 Małopolska province issued a decree comprising legal protection of 40 documented sites of geological value. In 2000 the Natural Reserve "Crystal Caves" in Wieliczka was established [55]. The mine in Wieliczka is also applying for a status of National Geopark in Poland as one of the most valuable geological areas [60].

(e) rearrangement and reuse, functions

Rescue works in the historic areas of the Wieliczka Salt Mine and the dismantling of non-monumental parts are constantly carried out in order to extend the offer for visitors. Currently, the mine is used for touristic, museum and healing purposes. The reuse processes were partially initiated in the 19th C, when the first touristic route was organized, and further developed in the 20th C after the salt mining was finished. The two main elements of SHT are the underground routes and the Cracow Saltworks Museum [61].

Two underground routes (Tourist Route and Mining Route) are offered in Polish and English (other languages are also available). The Tourist Route with a length of 3.5 km runs through a system of galleries, chambers, and other mine works from the first to third level (from 64 m to 135 m below the surface). The visit includes the three underground salt lakes, monumental carpentry structures, sculptures and bas-reliefs made of salt. All accessible chambers are located at the depths from 64 to 135 m. They have different sizes, functions, and facilities. Many of them are named after cities, e.g., Janowice, Sielec, Michałowice, Drozdowice, Warsaw, etc. Others were named after Polish kings, famous persons, or people associated with the mine, e.g.:

- The Chamber of Casimir III the Great—owing its name after the creator of the Statute of Cracow Saltworks, opened in 1968 on its 600th anniversary.
- The Nicolaus Copernicus Chamber—with a salt sculpture of the astronomer, who was probably a guest of the Wieliczka mine.
- The Józef Piłsudski Chamber—established in the 19th C and divided into two excavations connected by a tunnel.

There are also chambers with religious functions where messes and other services are celebrated, e.g.:

- The St. John Chamber—with one of the most beautiful wooden finish, polychromes and an altar with a crucifix.
- The St. Kinga Chamber with holy relics—an underground temple considered as one of the greatest attractions of the Wieliczka mine (54 m long, 18 m wide, and 12 m high), located 101 m underground. Due to the excellent acoustics the chamber is also used for concerts.
- The St. Cross Chamber—an example of a traveling chapel. It could be transferred by miners to other chambers. Usually mines brought it closer to their workplaces.

Very important healing activities are realised in the Teodor Wessal Chamber. It functions as a treatment room intended for active rehabilitation, making use of the unique microclimate of the mine to treat upper respiratory diseases, asthma and allergies. The brine graduation tower is also accessible in the St. Kinga Park located outside the mine.

The Cracow Saltworks Museum in Wieliczka, managed by the Ministry of Culture and National Heritage, is one of the largest mining museums in Europe. The museum conducts scientific research, publishing, as well as educational activities aimed especially at children and adolescents (presentations, workshops, lessons, lectures, competitions and outdoor events). The relics are presented in many thematic collections on permanent and temporary exhibitions. The well known permanent Underground Exhibition is situated on a depth

of 135 m. The collection is divided into thematic sections presented in 14 chambers, and related to the purpose of the mine, used tools and devices for salt extraction and transport, as well as the history of the city itself [51].

(f) impacts

The Wieliczka Salt Mine is one of the world's most famous tourist attractions of rich and diverse touristic offer [54]. On the one hand, traditional forms of exposition and presentation of the main themes related to the mine, its history and transformations are displayed. The accessibility of a part of the oldest route for people on wheelchairs and implementation of an elevator which takes tourists outside after the visit to the mine have a positive social dimension [51]. On the other hand, the program is constantly being developed including extension of accessible areas and opening of new routes to the public, such as the created "Mining Route" running through historical excavations and showing salt mining over many centuries. The route opened in 2012 was created as a part of the project "Routes of a new adventure in the historic Wieliczka Salt Mine", financed by the EU.

The high tourist attractiveness of the Wieliczka Salt Mine as natural and cultural heritage, also listed as UNESCO World Heritage, translates into a continuously increasing interest of tourists, both Polish and foreigner, with a growing number towards 2 million per year. This calls for developing tourist facilities in the town of Wieliczka and its vicinity. Together with other tourist attractions, such as the Bochnia Salt Mine and the city of Cracow, the impact of Wieliczka's UBH acquires a wide dimension in the context of regional SHT, including its new international forms e.g., related to wedding destinations [62]. It also has an impact on increasing jobs for the local community related to the operation of the mine as a post-industrial area and its new program, and this results in local economic growth. The mine's potential in those contexts is considered as one of the main factors of the development strategies applied on local and regional levels in 2008 [63] and 2015 [64].

Many innovative ideas related to making use of ICTs such as virtual tours and mobile applications, and the development of official webpage have been put into practice last years in the process of the Wieliczka development to meet the needs of tourists. The covid-19 pandemic (2020–2021) has caused a change in the approach of presenting the mine heritage at the regional, national and international levels, and it is now more focused on the development of innovative educational tools and new forms of promotion via ICTs tools.

### 3.2. *Campina de Cima—Portugal*

(a) general and territorial context

The mine Campina de Cima is located in the municipality of Loulé in the Portuguese region of Algarve. Algarve with its 200 km coastline, sandy beaches, and resort towns, is one of the most popular summer destinations in Europe, bringing the population to triple in the peak of the season [65]. This makes Algarve particularly reliant on tourism and vulnerable to market situation, such as the global pandemic. In the era of interconnectedness, due to efforts to halt the spread of COVID-19, severe travel restrictions and lockdowns, the overnight stays Portugal decreased of more than 60 per cent [66], provoking an unprecedented economic crisis that exposed a generated vulnerability of jobs in tourism.

The municipality has a population of 70,240 (2021) in an area of approximately 76,513 ha [67] and has two towns Loulé and Quarteira, surrounded by dozens of small villages, some with historic fabric. While the coastline is heavily occupied by tourist complexes, the arid interior of Algarve is sparsely populated. The town of Loulé, situated about 20 km away from the coast on a hill at the foot of a mountain range Monchique, although not inside of the main tourist routes, counts on several monuments such as churches, pieces of the city wall and a castle (protected as national monument since 1924).

(b) history

The mine was discovered around the 1940s when farmers and cattle farmers started the search for capturing water from deep aquifers [68], in order to minimize drought periods that frequently plagues the region. Prospectors with a set of soundings unintentionally



struck rock salt at nearby Loulé. Since the salt being “saltier” as (kitchen) table salt is not suitable for human consumption, the extraction was concentrated on sodium salt for agrochemical industries. The exploration is established by concession of the Portuguese government; the last contract was fixed in 1992 and allows the exploration of an area of approximately 1200 ha. In 1989 the mine had the production peak with 124,000 t salt/year and employed 70 workers. In 2005, the former extracting company started to import rock salt from abroad with a higher degree of purity. The salt production was reduced and since 2007 it produces only salt for animal feed and deicing roads in winter periods, being therefore mainly exported to northern Europe. However, it is the only mine still active in the region.

After decades of increased production, the Campina de Cima mine is experiencing a constant decrease in its production. To overcome this negative trend, Tech Salt is making efforts to include the mine in the tourist route of Algarve. The industrial exploration is a result of 50 years and reached 45 km of galleries, making the Campina de Cima mine the largest man-made underground space that can be visited in Portugal [67,69].

(c) descriptive data

In Loulé, salt has been mined since ancient times, however the industrial exploration began in the second half of the 20th C [68]. The rock salt mine emerged 250 million years ago, in the Jurassic period and it is believed to have been formed with the creation of the Mediterranean Sea that separated Europe from Africa. In a relatively short period of time an enormous mass of salt water was covered by land, with a thickness around 1000 m [70]. Extending east of the town Loulé, the full extension of mine is unknown. Salt can be found from around 100 to 1030 m below the surface, after a layer of limestone (1 to 45 m) and gypsum and anhydride (45 to 90 m) [65].

The Campina de Cima mine is located within a residential area in the east of the town. The mine consists today of about 40 km of underground galleries reaching up to 313 m deep, the main galleries are however located on two levels, 230 and 260 m deep, i.e., about 30 m below the sea level [71]. On the surface there are only few buildings and the collieries (one of 12 m high), with skips for transporting the salt to the surface, here are also posted the ventilators that provide the flow of air through the underground. Salt is loaded onto conveyor belts before being crushed and packed to be delivered to customers.

(d) protection regime

The Campina de Cima mine is currently preparing an application to be listed by UNESCO as the 6th Portuguese geopark [72]. In 2015 it has been accepted as a candidate by the Portuguese Forum of Geoparks, which consists of the five listed geoparks in Portugal [73]. The colliery and the mine are still in operation and salt is mined in its original form using traditional mining techniques. During its history the mine had different operators and owners. Since 2019 it is managed by Tech Salt, a company created in 2018 to continue the salt extraction [67].

(e) rearrangement and reuse, functions

Tech Salt started in 2019 to offer guided visits to the mine, investing in making it possible to access any point of exploration in perfect safety conditions. The central idea of the visitor program is to reuse the mining space in an innovative way, contributing to the dissemination and promotion of Earth Sciences, Mining Industry and Art [72]. Besides the guided visits to the mine there is very little (or almost none) touristic infrastructure.

For the touristic purpose, a guided route with about 1.3 km inside the mine was created, where, with the help of trained guides, visitors can learn about ancient and current mining processes, and geology at a depth of 230 m below the town. The visitor can explore the history of the rock salt mine and admire the geological formations dating back 230 million years by walking inside the mine.

Visiting the Campina de Cima mine is part of the Roteiro das Minas e Pontos de Interesse Mineiro e Geológico de Portugal (Route of Mines and Geology in Portugal) [74],

created by the Portuguese Directorate General of Energy and Geology with the aim to bring mines together under an institutional framework and lend visibility to a set of local initiatives related to geological and mining issues already under development across the country. The route provides an itinerary, with information about the mines, their history, the surrounding landscapes and further cultural, pedagogical, scientific background. Establishing a web platform was the first step to give the single mines a public dimension, it provides support to visitors with a wide range of information through different digital devices, although the provided information is the responsibility of the partners who manage the different mines.

The Activity Program of the mine is offered in English, French, and Portuguese, and consists of:

- Visitor's program—it is versatile and offers different opportunities, starting with regular visits through the fixed route with a duration of 2 h and for groups of 12 to 30 people. The Mining Experience Visit, which includes the visit to current extraction sites and points of geological interests, takes 4 h, for groups up to 12 people. This visit is granted only for people aged 16 or over.
- Study program—the mine, due to its heritage and geological characteristics has a potential for being subject of studies and research in the areas of geology, mining (including technical and/or economic aspects) and sociology. The mine manager is for example interested in research for testing robotics dedicated to mining as well as in areas related to geophysics. This “technical” visit is guided by technicians and engineers working in the mine and takes 4 h.
- School Program—the mine also offers a 3-h pedagogical visit to school classes and students, which has to be scheduled in advance.
- Access and restrictions—currently the mine does not count on facilities to enable the access to people with reduced mobility. The visit is not advised to people with scotophobia (fear of the dark) or claustrophobia (fear of confined spaces).

(f) impacts

Economic, social, development impacts of the Campina de Cima Mine covers the local and regional territory. The mine is a geological legacy of the shallow salt marshes formed 230 million years ago and an industrial/technological legacy in a region with very little manufacturing tradition. The salt production is an economic asset of the municipality offering industrial jobs, although also a factor of heavy traffic in the city. Mining is not a relevant economic activity in Portugal; from the 4 mining concessions granted by the government, the Campina de Cima mine is the only one still in operation [68]. In Loulé, although mining is one of few industrial activities, the mine inserted in an urban area combines urban, industrial and landscape features [69]. The area occupied by the mine is not landscaped and consists of derelict areas, with a development potential as a heritage site. The mine can be one the most important space for the social, economic and cultural practices in Loulé, as it offers a dive into the history of salt and the hidden world of mining.

Interesting is that the mine's management processes are related seeking for development alternatives besides the industrial production, which has been declining over the years, and using a wide visitor's program to make the mine more visible and known as tourist attraction. The Campina de Cima mine also hosted in 2008 and 2009 exhibitions organized under the Algarve program, a government program launched in 2007 to boost the tourism destination, offering a set of cultural, artistic and sports events in the summer season. According to Valle et al. [75] the Algarve Program was mostly targeted at tourists, rather than residents, this can be changed with new more permanent program devoted to the residents.

One idea that has not been put into practice is the use of the salt mine for health purposes, in particular in preventing and for the treatment of respiratory system disorders and diseases. This can be easily combined with the visitor's program.

### 3.3. Turda Salt Mine—Romania

#### (a) general and territorial context

In recent years, several underground salt mines in Romania—Turda, Praid, Slănic, Cacica, Ocnele Mari—have been rearranged and transformed into spectacular, highly appreciated tourist destinations. They have been restructured to offer different services to local and tourist interest, such as health care facilities (halotherapy, speleotherapy, etc.) [76], cultural and religious facilities (creation of mining museums, facilities for artistic events, and churches) and recreational facilities (for leisure and sport activities e.g., mini golf, bowling, billiard, table tennis, team games on sport field). Turda Salt Mine has been significantly redesigned as the first mine in Romania, and thus it became well-known and visited.

Within “Sărăturile Ocna Veche” nature reserve around Turda city, there are 16 anthropic saline lakes, with balneal-therapeutic properties. Turda capitalized on this special resource building the Salty Baths spa complex, which is now privatized. The Turzii Gorge, at 6 km distance from the city of Turda, is a beautiful canyon, one of the richest and most scenic karst landscapes in Romania with more than 1000 plant and animal species (some of them rare or endangered, such as the wild garlic or some species of eagle).

All these, along with many buildings classified as monuments, constitute a rich, diversified natural and anthropic heritage within the city of Turda and its surroundings, with high potential for growing tourist interest, if appropriate strategies will be implemented.

The Turda Salt Mine is a spectacular UBH example and is located in the north-western part of Romania, in Durgau-Valea Sarata area, at about 6 km from Turda city, which with 47,744 inhabitants (at the 2011 census) is the second largest city in Cluj County. Turda city has good accessibility at the national and even at the European level, benefiting from the proximity of the A3 highway (under construction) and A1 highway (on the Rhine-Danube TEN-T corridor).

In the area of Turda, the evidence of human activities dates back over 60,000 years. In Turzii Gorge there are 29 paleo-Christian caves. After the Roman conquest, around the year 100, Turdava settlement (on today Turda's location) was renamed Potaissa. The vestiges of the Roman camp Potaissa, residence of the fifth Macedonian legion, being now the most important historical-archaeological monument of the city, are inscribed on the list of the historical monuments in Cluj County elaborated by the Romanian Ministry of Culture in 2015 (LMI code CJ-ImA-07210.03).

#### (b) history

It is considered that the exploitation of the salt deposit from the Turda Mine has begun in the Roman period and that the mine continuously produced table salt from the Middle Ages. Surface exploitation has started in Roman times and gave rise to salty lakes in the area. Later, a subterranean exploitation has begun too, but the deployment and salt transport on the Aries River has started in the 1850s. The mine was first mentioned in 1075 in a document that refers to Transylvania Region, but was specifically documented only on 1 May 1271 [77].

Turda Salt Mine, which at the beginning was one of the most important salt mines in Transylvania, starting with 1840 has entered a decline process caused by competition from Ocna Mureș Salt Mine, which had a higher efficiency at that time. In 1932 the Turda Salt Mine has been closed [78]. During the Second World War the mine has been used by the population as an anti-aircraft shelter, and then as a warehouse. In 2008, the salt mine has undergone an extensive modernization and rearrangement process, altogether 6 million euros have been invested, that has been financed through the PHARE 2005 CES large regional (a local infrastructure program). The mine has been returned to the tourist circuit in January 2010 [46].

#### (c) descriptive data

The mine in Turda covers an area of about 45 km<sup>2</sup> with an average salt thickness of about 400 m, has a depth of 112 m and consists of several chambers: Joseph Mine, Horses

Room, Extraction Well Room. Altar Room, Terezia Mine, Rudolph Mine, Gizela Mine, Anton Mine, all being connected by galleries, such as, for instance, Franz Josef Gallery.

- The Terezia Mine is a conical mine (bell mine). Salt mining in this type of chamber left underground halls of impressive dimensions: 90 m height and 87 m diameter. The depth from the mouth of the shafts to the base of the mine is 112 m. The enormous bell contains a “cascade of salt”, an underground lake, stalactites, and salt efflorescence. The underground lake is between 0.5 and 8 m deep and occupies about 80 percent of the operating room hearth area. In the center of the lake there is an island formed from residual low-grade salt deposited here after 1880, when salt mining ended in this room. A boat ride on the lake is available.
- The Joseph Mine is a conical chamber 112 m deep and 67 m wide at the base, that can be visited through two balconies carved in salt. In this mine, the powerful sounds have a surprising reverberation up to 16 echoes and this particularity leads to it being called the “Echoes Room”.
- The Rudolf Mine is a large trapezoidal hall, 42 m deep, 50 m wide, and 80 m long. The access to the mine hearth is done through 172 stair steps. On the walls of each of the 13 “floors” is marked the year when the respective level was opened. There are salt stalactites, some even 3 m long.
- The Gizela Mine and the technical rooms in the northeastern extremity of the salt mine. Infiltrations of water in the extraction pit determined the deposits of efflorescence and formation of stalactites. In the lake that partially covers the hearth of the room are salt crystals, providing its current named “Crystal Hall”.
- The Crivac Chamber, a museal octagonal room hosts a winch called “crivac” or “gepel”, rudimentary machinery dating from 1881, used to lift salt rocks on the surface. It is the only machine of its kind, in all the salt mines in Romania and probably in Europe, that remains in its original location.
- The Extraction Shaft Chamber—an old wooden pulley used for digging the shaft is still preserved here. In the ceiling of this chamber, above the shaft, there is a place where a 10.5 m tower was dug, in which two knurls were mounted—they are functional even today, although were placed there for more than 150 years ago, in 1864.

(d) protection regime

The Turda Salt Mine is registered on the list of historical monuments (LMI) in Cluj County, elaborated by the Romanian Ministry of Culture in 2015 (LMI code Cj-II-m-A-07801). It is classified as a category A monument of national and universal interest. The protection rules for the monuments in Romania are set in the Law (No. 422 of 18 July 2001) on the protection of historical monuments.

The Durgău-Valea Sărată area, where the main access to Turda Salt Mine is located, together with Băile Sărate micro-depression, is part of the Natura 2000 Site Ocna Veche Salt Lakes with halophilic vegetation.

(e) rearrangement and reuse, functions

In the 2000s the strategies for Turda city development proposed the restructuring and reusing the spectacular underground spaces of the Turda Salt Mine. The idea has been implemented through a Phare project which worth 6 million euros and was co-financed by the Turda City Hall. The project was carried out by a young and creative team of architects. In 2008, the Turda Salt Mine underwent an extensive redevelopment process and was subsequently reintroduced into the tourist circuit in January 2010.

The mine has been transformed into a fantastic underground universe, where the modern interventions, with futuristic aesthetics, complement the beauty of the gigantic spaces carved in the translucent salt. The changes have been conceived in respect to the exigencies of preserving the natural elements and the old mining tools and equipment. The Turda Salt Mine has been turned into a multifunctional underground park, with facilities for recreational and play activities, cultural, sports, health services, in a saline environment [79], with recognized curative and prophylactic properties.

The modernization project gathered the following interventions:

- Entrance pavilion—a second saline entrance was set up, from the Sărată Valley, in the Durgău area.
- The Rudolf mine has been arranged as the main recreational area, through the construction of a mini golf course, two mini-bowling courts, a sports field, a 180-seat amphitheater, a carousel and a playground for children. The carousel is probably the only underground Ferris wheel in the world. In the main hall, a panoramic elevator offers tourists an overview of the whole mine.
- In the Terezia mine, the underground lake was arranged to provide tourists with beautiful boat rides, 112 m deep in the salt mountain, starting from a new underground wharf.
- The Ghizela mine, called “the stationary room”, has been arranged to serve exclusively as a spa treatment area, with natural aerosols, for salt therapy and balneary treatments. A lesson on the “history of Salina” was also organized in this mine.
- The museum part of the mine—the Crivac Chamber, the Extraction Shaft Chamber—have been preserved.

The Turda Salt Mine is managed by the company Salina Turda SA, which is 100 percent owned by the local administration. The company also manages the Durgău swimming pool, the Potaissa Hotel, the Spa center at the Potaissa Hotel and the swimming pool [77].

#### (f) impacts

The result of the modern interventions is remarkable, spectacular, and Salina Turda has become not only a brand for Turda city, but also one of the most beautiful underground places in the world, which attracts a constantly growing number of tourists from various countries. (Re)opened for tourists in 2010, the mine has been visited by about 618,000 Romanian and foreign tourists in 2017, 690,000 in 2018 (an increase of 12 per cent in relation to the number of visitors in 2017). If in April 2018 there were 57,713 tourists, in April 2019 their number reached 63,011 tourists (an increase of almost 9 percent) [46,80].

Through its modernization the Turda Salt Mine has become a place of international tourism, ranked in 2013 by Business Insider among the “25 hidden gems around the world that are worth the trek” [81], and described as “one of the most spectacular tourist destinations revealing Romania’s underground wonders, and probably one of the most beautiful such places in the world” placed on the US magazine Smithsonianmag.com’s list of “subterranean wonderlands” in 2018.

This fast-growing number of tourists has triggered a development process of a more complex tourist offer in Turda city and its surroundings, such as the creation of the new “La Saline” wine vault, Salina Equines riding center among many others, that lead to an economic growth of Turda city.

The mine has become a principal element of the various local and regional development strategies [82,83], including the Sustainable Urban Mobility Plan for Turda city [84], which established projects to expand the tourist part of the salt mine, develop the Turda spa area, and planned the improvement of the mine accessibility. A real tourist pole of regional and even international interest is about to be developed, capitalizing on the rich natural and anthropic heritage of the area. Other salt mines in Romania have also been transformed, inspired by this modernization of the Turda Salt Mine [85].

## 4. Results of Comparison

The main aspects of the transformation and adaptation process in the three salt mines, including the assessment of their main factors and features related to the characteristics and specificities in the context of UBH and SHT, are presented in Table 1.



**Table 1.** Main characteristics of salt mines—a comparison.

Aspects	Factors/Features	Wieliczka Salt Mine (Poland)	Campina de Cima Mine (Portugal)	Turda Salt Mine (Romania)
general and territorial context	- basic salt mine equipment	XX	XX	XX
	- complex of salt mine and supporting facilities/areas	XX	X	XX
	- underground galleries and chambers	XX	XX	XX
	- underground salt lakes	XX	-	XX
	- salt lakes in the surrounding area	-	-	XX
	- saline baths and medical elements	X	X	XX
	- other natural and/or anthropogenic areas/resources	XX	XX	XX
	- amidst urban setting	XX	XX	XX
stage of mining activity	- active salt-industry mining along with new functions	XX (end of salt mining in 1996; active disposal of salt from saline waters at present)	XX	-
	- post-industrial area with new functions	-	-	XX (end of salt mining in 1932)
protection regime	- national register of monuments	since 1976	-	-
	- national historical monument	since 1994	since 1924	XX
	- UNESCO World Heritage	since 1978 (First List of UNESCO World Heritage)	application being prepared	-
	- geopark	application being prepared	application being prepared	-
reuse, new functions	- underground tours	XX	XX	XX
	- virtual tours	XX	XX	-
	- museum/permanent exhibition	XX	X	XX
	- art exhibitions/sculptures	XX	XX	X
	- health purposes	XX	-	XX
	- religious function	XX	-	-
	- events (meetings, conferences, concerts, etc.)	XX	XX	X
	- sport facilities/events	X	-	XX
	- scientific research	XX	XX	X
	- educational programs	XX	XX	X
impacts	- digital layer (webpage, virtual tours, mobile apps, etc.)	XX	XX	X
	- local and/or regional development strategies	XX	X	XX
	- local and/or regional economic growth	XX	XX	X
	- local community activation strategy	XX	-	X
	- job opportunities	XX	XX	X
	- regional tourist interest	XX	XX	XX
	- international tourist interest	XX	-	XX
	- inspiration for other mines transformation in the country	XX	X	XX

XX = applicable; X = partially applicable; - = not applicable.

The territorial context of the three cases shows a complex of salt mines connected to other supporting facilities and areas of tourist interest. The spatial-functional specific of the sites and their unique history make them heritage sites. They are representative in their countries for an exceptional man-made underground asset, although in different stages of exploration of rock salt, protection status, and “marked” cultural landscapes.

In the Turda Salt Mine the mineral excavation was finished in 1932. The two other cases are still operating mining plants. While in the Campina de Cima in Portugal the harvesting continues, in the Wieliczka in Poland the salt deposits are exhausted, but salt is still obtained in the process of disposal of saline waters, which is conditioned by the need to protect the environment against contamination of surface and ground waters with

salt excess. At the same time, those two examples show that the continuation of industry function does not limit the possibility of introducing different forms of SHT.

These three mines are valuable in terms of cultural and/or natural heritage, although they differ in the forms of protection they have at national and international levels, as well as in terms of advancing a process for becoming a protected heritage. The mines in Wieliczka, Campina de Cima, and Turda are considered as national historical monuments. Wieliczka is the only one of the three cases that is formally recognized as a world heritage site. It has enjoyed this status since 1978 and continues to meet the number of required criteria. This evidences its unique values related to the illustration of historic stages of the development of mining techniques in Europe from the 13th to the 20th C. The Portuguese mine is just aspiring to this status. Together with Wieliczka, both of them are also in the process of applying to the status of geoparks due to their high geological values.

The three salt mines, due to their rich history, individual site features, and diversity of natural and man-made infrastructure, have a great potential to be transformed and adapted to new functions. Their specific features are adapted mainly to tourist, museum, art, educational, and research functions. The priority in the context of SHT is the organization of interesting sightseeing routes to underground mines. Cultural functions related to the organization of events, shows, concerts, and conferences are organized in the three mines, as well as the possibility of visiting a museum, permanent, and temporary exhibitions. Health services are developed especially in Wieliczka and Turda, both mines use underground or surface salt lakes, and the specific microclimate of the mines for health improvement. Sport activities are also organized, intensively in Turda and occasionally in the case of Polish mine. Additionally, a religious function is a characteristic of Wieliczka, conditioned by its long history, tradition and legends.

The development of all three salt mines follows new trends focused on visitors' needs and expectations related to the use of information and communication technologies (ICTs), e.g., there are very well-organized web pages accessible in different languages. The virtual thematic routes are offered in Wieliczka and Campina de Cima. In the Polish mine mobile apps also offer new tools for increasing the accessibility to information and knowledge of the site and its history. A rich educational program focused mainly on children and youth activities as well as a research program is also implemented in the three mines, although in Turda such activity is in its nascent stages. An interesting issue in all cases is that the mine chambers are not being used as storage for various purposes, especially not for dangerous materials, such as radioactive waste. This facilitates their discovery as a tourist attraction.

All above-mentioned functions are carried out with a special respect to the values of those unique heritage sites and their facilities, even if the new tourist infrastructure is innovative and restructuring them to new functions is intensive.

The management of salt mines is focused on their potential as cultural heritage assets. They are already anchored in local and regional strategies development in the cases of Poland and Romania, while in Portugal this remains unexplored. The tourist use of salt mines significantly affects the economic development of the regions in which they are inserted, as well as it increases the job opportunities for local community. At the same time, the heritage sites impact mostly the local community activation strategy in Poland and Romania. The regional tourist interest is very high in the case of all three salt mines. At the same time, Wieliczka has the biggest impact on international tourist interest due to its range as UNESCO World Heritage, being well known all around the globe. Turda, due to its spectacular improvements, is also gaining popularity as touristic destination at international level. Undeniably, the three cases (but in particular Wieliczka and Turda), due to their values and potential as historical and cultural heritage as well as the diversity of new functions and ideas implemented in their programs, are perceived as good practices and become the inspiration to the transformation processes for other salt mines. The way these three mines are also branding the concept of salt mines as touristic destinations shows a wide range of promotional activities, that could be a model of effective salt mines promotion.

Summing up, all cases are examples of how interventions can be put in place towards an adaptation to new functions and sustainable re-use. They show a wide range of activities of SHT connected to UBH and its protection. They provide examples of how making use of spectacular and unique ambiances, enable different ways to experience the UBH values and mixed, natural and man-made, aesthetics. Increasing the attractiveness of salt mines, in the processes of their transformation, have an impact on the site, within the region and on people (locals and tourists) with generally positive outputs.

## 5. Discussion

When considering the impact of SHT to the contemporary salt mines transformation based on an overview of three cases from European countries, it should be noted that it may concern both positive and negative aspects. At the same time, they are related to many spheres of each salt mine development [9].

According to Mata-Perelló et al. [19], transformation of mining areas towards heritage tourism destinations usually results from the number of similar factors such as circumstances that obliged the conversion of these plant units. Adaptation to new functions is an alternative form of development and economic reactivation of mining areas towards alleviating the economic, social, and demographic crisis. The cases discussed in the manuscript are examples of multidirectional adaptation to new functions focused on many touristic purposes. Their rich programs include protection and use of historical elements of the salt industry, with implementation of new infrastructure and innovative tools towards making them touristic attractions. This kind of reuse is addressed in different publications, both as typical and as leading in transformation processes of mining areas [24,86], following European trends and including so-called creative tourism [86–91]. Contemporary designs, regardless of their diversity and scope, are related to new activities, which increase the tourism interest on heritage sites, as highlighted by Xie et al. [92], and translated by an increasing number of visitors. New infrastructure together with evidencing historic features made salt mines accessible for different tourism purposes.

Different forms of tourism become platforms and tools for making heritage more visible to the public. Protecting heritage values also guarantees the economic and social viability of recycling uses [91]. The stimulation of economic growth of the cities and the sites on local and regional levels [93] due to the presence of salt mines is an especially relevant issue that guarantees further development.

The positive aspects are related to their openness to new, complementary services of tourist interest. The capitalization processes of other local natural and cultural resources in their surroundings can also create new tourist destinations which, in turn, supports the investments of public and private sectors. At the same time, the role of heritage sites in the branding processes of the sites as a well-known strategy to increase their value has been observed [47,94,95]. The development of salt mines with new functions and facilities for industrial heritage tourism also improves the diversity of economic activities and helps enhance the regional image. An improved image is a powerful public relation tool to counteract common (public) prejudices against industrial areas in decline. Thus, reusing salt mines and its branding create a favorable image of the site and region [96–98], since it is also related to the development of new, complementary services of tourist interest in the surrounding areas.

The development of heritage sites towards multifunctional attractions stimulate tourism [86], and this has a positive impact on society. This is a desired phenomenon and a goal of many local and regional development strategies. SHT itself is recognized as one of the new forms of activity resulting in the development of the tourism market. In the context of heritage sites, the added value of salt mines is provided by connecting the past and present by different forms of cognition as well as giving the access to the unique tangible and intangible features of culture and technology of the salt mining industry. The innovative and diverse offer for visitors, which is present in all three cases, become an attractive alternative to conventional heritage tourism and serial reproduction of culture in

many similar destinations, as discussed by Ramos et al. [91]. The positive impact of tourism has many social dimensions. It is manifested by increasing chances for development of local society, in a material way by creation of new jobs which helps decreasing disparities in terms of revenues [1,46,99], as well as mentally, including the increasing satisfaction of people living in (close vicinity to) heritage sites [10,100,101]. It also increases a common knowledge of elements of UBH, and their values result in the creation of a positive local identity for these sites and their communities [9,102,103]. Those processes contribute to building positive local peoples' attitudes towards protection of the cultural environment and heritage salt mines [103–106] and help in creating historical memory. This approach may promote an attitude oriented to a “greater awareness of society, a sharpened appetite for active engagement, new competences and confidence to play a part” [93] in many processes in the transformation of salt mines. Another important positive process observed in the heritage sites is the impact of their growing tourist interest on reviving local cultural values, developing national creativity, and traditions as a part of promoting cultural lifting of local population [47]. At the same time, a positive impact of SHT on tourists (domestic and foreign) may be also considered as one of key aspects of heritage sites' further development or transformation. As Frew et al. 2011 [107] highlighted, it not only brings the industrial past to life but also engages tourists in the present by interpretation of a destination's history and transforms its culture and heritage into “popular images palatable for tourist consumption”. An added value of this kind of tourism is related to offer visitors a unique experience which empowers them to produce their own narratives of culture and heritage [9].

Especially for areas on the status of UNESCO World Heritage Sites, as it is in the case of the Wieliczka Salt Mine, but also in Turda, the social and economic growth of their vicinity becomes a driver of positive changes. Similar phenomena apply to many different UBH sites of similar importance—it is a common process assessed as a positive change, which is discussed in many publications. The sites themselves are perceived as more attractive than before being listed [108,109]. Visits to salt mines listed by UNESCO influence direct the perception of tourists to their main values, namely their features and history. The results of studies addressing this approach have often been discussed based on experiences from different European countries with a number of sites on the UNESCO list [109–113]. However, to increase the understanding of the impact on the local community is a relevant issue to make both cities and the salt mines more safe, inclusive, resilient, and sustainable. Providing an ecosystem to facilitate the process of creating a heritage community and promoting their engagement is the first step. As the Faro Convention emphasizes, a heritage community besides promoting a wider understanding of heritage also helps sustain and transit heritage to future generations [45]. In engaging the community and providing services for tourists' though innovative communication technologies become one of positive factors. The use of ICTs as tools of smart tourism development [114–116], and for gathering knowledge and information about heritage sites [40], is a part of similar activities carried out in many countries and has a positive dimension [117,118]. Gathering information is very relevant in the case of UBH; it is a way to overcome issues of concerns and fears to be in the underground [18]. ICTs range is growing especially in times of various threats and limited physical access such as in the current covid-19 pandemic. Such tools may become a solution for dealing with heavy losses that the world of cultural heritage is suffering with the restrictions [119]. Reusing salt mines allows especially activities related to experiencing a unique ambience and education. ICTs provide new and useful tools to support the development and management strategies of SHT [43,44,116].

Conservation of cultural heritage and tourism are closely related since historic monuments and sites constitute basic resources to attract visitors. The dedication of cultural heritage to tourism is beset with some risks, e.g., the excessive pressure of use may be unbearable by the heritage site. Over-tourism, perceived as congestion or overcrowding from an excess of tourists, is one of typical negative results and becomes one of threats on

heritage sites, as discussed in many publications. Jimura [103] and Adie et al. [120] have presented main factors related to negative impact on people, e.g., resulting in conflicts with local communities as well as domestic tourists due to extensive and rapid tourism development related to the high level of appeal of UNESCO World Heritage Sites status (as in the example of Wieliczka). Increasing usage may also damage salt mines and their tourist infrastructure, endangering the safety of visitors, which generates high costs of both maintenance and conservation works. According to above-mentioned processes, tourism, which should be used as a balancing mechanism that keeps and protects the heritage itself, is often perceived as a threat to conservation of heritage sites, especially World Heritage Sites.

Apart from the positive impacts on the economic development of the surrounding areas and regions, salt mines as heritage sites generate their own costs related to their usage, which are in many cases not covered by industrial activities. These residual costs need to be covered by further activities related to the adaptation of salt mines to new functions such as tourism, education, or business events, which if not enough, need further financial support, i.e., from the government or EU funds. High maintenance and conservation costs include two main aspects. At first, they cover the activities related to elimination or minimization of natural hazards resulted from the mining processes such as water influx and wall or ceiling collapses, which often accompany each other [121,122]. Exploitation costs result also from safety and conservation measures. These are well-developed systems but include renovation and modernization of shafts, machines and devices ensuring the proper and safe functioning of the enterprise, as well as the maintenance and protection of communication networks among others.

## 6. Conclusions

The cases of salt mines addressed in this manuscript, shedding light on their adaptation and re-use process, allows us to broaden the knowledge about a peculiar and interesting element of UBH. On the one hand, the studied cases require special protection due to their unique values for present and future generations. On the other hand, their restructuring and transformation, as an ongoing process, can assume a spectacular and very wide dimension, making them an important witness of industrial development as well as a tourism destination. Both aspects are closely linked and determine the continuity of the salt mines use. In many cases the coexisting conditions of exploitation, maintenance, and protection affects the development of salt mines in different spheres (from economic and social, to their role in the community), and this in the end can result in an increased local, regional, and even international brand awareness.

A multidirectional development of salt mines might affect their present and future. Especially for tourism, despite its positive impacts, it seems like a possible threat for many heritage sites. In that context, the phenomenon of over tourism may become a key destructive agent. At the same time, natural as well as other independent of human activity factors, such as the coronavirus pandemic, may also intensify the threats on salt mines as tourist destinations. Therefore, the management of SHT requires a very conscious and holistic approach. The diversity of positive impacts from the salt mines transformation is their asset and should be definitely highlighted in their development processes. In this case, the holistic approach is needed to keep the balance between the opportunities and limitations of their development. It should also include the dynamics of possible threats including their appearance and intensity. The management process of reusing salt mines requires a long-term planning based on many potential scenarios; the aspects listed as crucial for heritage salt mines are discussed in this manuscript. Fast and efficient action is key to maintaining the authenticity of salt mines as important elements of UBH. It allows to mitigate the negative effects of over tourism, excessive commodification and commercialization, and a possible generalization in favor of promoting the unique features and qualities that determine the salt mines values and attractiveness. At the same time, each tourism destination should identify and sustain the level of an acceptable visitation



intensity. Therefore, the study here initiated may serve as a starting point for further detailed analysis on the salt mines adaptation to new functions and their relations to UBH and SHT.

**Author Contributions:** Conceptualization, study design, K.K. supported by C.S.C.; methodology, K.K., C.S.C. and M.N.; literature overview, K.K. and C.S.C.; data collection of cases, K.K., C.S.C. and M.N.; data comparison, K.K. and C.S.C.; writing—original draft preparation, K.K., C.S.C. and M.N.; writing—review and editing, C.S.C. and K.K.; supervision, K.K. All authors have read and agreed to the published version of the manuscript.

**Funding:** This article has been supported by the funds of the COST Action CA18110 “Underground Built Heritage as Catalyser for Community Valorisation”.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data are contained within the article or available from referenced sources.

**Conflicts of Interest:** The authors declare no conflict of interest.

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