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Dediščina, ki kljubuje

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SONJA IFKO

Introduction

The 4th ICOMOS Slovenia International Scientific Symposium, held in September 2021, focused on questions related to increasing the resilience of cultural heritage. This is a topic encountered practically at every turn in the current cultural heritage protection practice. The current situation calls for immediate action in the field of cultural heritage, nature, built environment, and lifestyle – in short, in all areas of our lives.

The monograph at hand presents the contributions from the symposium, addressing various themes that are directly or indirectly related to the improvement of the state of cultural heritage in the circumstances of the increasingly intense impacts of climate change and conflicts with a broad range of backgrounds. In this context, we are also confronted with the frequently overlooked contribution of cultural heritage to the Sustainable Development Goals and people's well-being – both, of individuals and various communities. This was experienced by all during the Covid-19 pandemic.

Thematically, the monograph is divided into three sections and an introductory plenary section, which highlights the comprehensive and multifaceted role of cultural heritage in ensuring greater resilience of the planet and quality of life for everyone. The transcript of the lecture by Andrew Potts, one of the world's leading experts on cultural heritage and climate change, highlights the global climate situation and the role of cultural heritage in addressing it. It also focuses on the European Cultural Heritage Green Paper.

The first section, titled "What Is the Situation and How Prepared Are We", presents the contributions that focus on analysing and listing threats to the individual heritage areas and sites due to climate change, inappropriate land use, and politically-driven urban development, as described by Andrea Triff. Tanja Hohnec's contribution sums up the Slovenian experience in dealing with climate change in the field of cultural heritage, describing the results of the international CHEERS project. It is vital that the experience with organising interdisciplinary cooperation is presented.

The second section presents the key challenges. Here, the authors focus on the various approaches to increasing the resilience of heritage and, on the other hand, balancing the investments in energy efficiency measures, which is one of the society's funadamental priorities in the current crisis.

The third section, titled Cultural Heritage as an Example, presents the experience and examples of successful implementations and projects that increase the resilience of heritage and thus its contribution to sustainable development. The authors from Madrid outline the PROCOERS Plan of protecting the collections kept in the Museo Nacional Centro de Arte Reina Sofía. The article on the development of heritage resilience in the Mae Klong river basin presents lessons learned in Thailand, while the contribution on the revitalisation of the medieval fortress of Bijela Tabija describes the efforts of the experts from Bosnia and Herzegovina.

Photo: Idrija Mercury Heritage Management Centre.

ANŽE JAPELJ, TATJANA DIZDAREVIĆ, GIULIA PESARO, DANIELE CROTTI

Action Prioritization when Protecting/Salvaging Cultural Heritage in the Event of Natural Hazards: Development and Testing of the ATTACH Tools within the Alpine Context

SUMMARY

The Alps are a particular environment, in which long-lasting human presence had garnered prominent traces of cultural heritage. Apart from this, the mountainous terrain, the diverse altitudes and changing climate make the alpine environment especially vulnerable to an increase in numbers and intensity of natural hazard events. In combination with the great importance of tourism, which is a source of income for local businesses, this creates one of the key challenges for the future development of the Alps. Natural disasters can cause irreversible damage not only to the infrastructure and housing, but also to cultural heritage. Such events could jeopardize sections of the tourist sector that rely heavily on the assets of cultural heritage, and in order to secure as many jobs as possible, the negative consequences of the natural hazards need to be mitigated as much as possible.

One way of doing this is to improve our readiness for times of emergency. A clear action protocol, with smart allocation of human and material resources to either prevent or at least minimize damage on cultural heritage seems an important element of cultural heritage management. The CHEERS (Interregional ALPINE SPACE) project has developed ATTACH, a practical tool that sets the priorities in terms of which cultural heritage assets need to be protected / salvaged in the event of various types of natural hazards. ATTACH builds on previous know-how and additional innovative elements, and is conditional on setting values on individual cultural heritage assets. The higher the value, the higher the priority to protect / salvage. The process of setting the value comprises of five steps, which are to be completed through desk-work and involvement of various key stakeholders in a participatory atmosphere. All phases are practically implemented in a spreadsheet format that enables a clear and transparent flow of work, and which, in the end, provides a set of priorities for an arbitrary group of cultural heritage assets.

The ATTACH tool was practically tested on the case of the underground Mercury Mine Museum in the town of Idrija (Western Slovenia), with a fire event simulation that would put eight cultural heritage assets at risk, all of them key elements of Anthony's main mine road, a UNESCO work heritage site and an important tourist attraction visited by many people. The museum is managed by the public institute Idrija Mercury Heritage Management Centre (CUDHg Idrija). Several outcomes of the testing indicate ATTACH's potential to be implemented in a natural disaster protection system, focusing on cultural heritage. Suggestions for future improvements were also provided by the attendees of the valuation exercise.

Prednostna obravnava ukrepov za zaščito/reševanje kulturne dediščine ob naravnih grožnjah: razvoj in preizkušanje orodij ATTACH v alpskem okolju

POVZETEK

Alpe so posebno okolje, v katerem je dolgotrajna prisotnost človeka pustila jasne sledi v obliki kulturne dediščine. Poleg človeškega vpliva so Alpe zaradi gorskega okolja, velikih razlik v nadmorski višini in spreminjajočega se podnebja še posebno občutljive na vse pogostejše in intenzivnejše naravne grožnje. Turizem je vse pomembnejši vir prihodka za lokalna podjetja v alpskih regijah in v povezavi z vse večjo ranljivostjo Alp to predstavlja enega ključnih izzivov za prihodnji razvoj Alp. Naravne nesreče lahko nepopravljivo poškodujejo infrastrukturo in bivališča, pa tudi kulturno dediščino. Takšni dogodki lahko ogrozijo dele turističnega sektorja, ki je močno odvisen od bogastev kulturne dediščine, zato je treba čim bolj preprečiti negativne posledice naravnih nesreč, če želimo zaščititi delovna mesta.

Ena od rešitev je boljša pripravljenost na izredne razmere. Pomemben del celovitega upravljanja kulturne dediščine je jasen protokol ukrepov, v katerem so človeški in materialni viri smotrno razporejeni, s čimer se prepreči ali vsaj omili škoda, ki lahko nastane na kulturni dediščini. V okviru projekta CHEERS (Interreg ALPINE SPACE) so razvili praktično orodje ATTACH, ki se uporablja pri prednostnem določanju virov kulturne dediščine, ki jih je treba ob različnih naravnih grožnjah zaščititi/rešiti najprej. Orodje ATTACH se opira na obstoječe strokovno znanje in dodatne inovativne elemente, bistveno za uporabo tega orodja pa je, da je virom kulturne dediščine pripisana vrednost. Čim večjo vrednost ima kulturna dediščina, tem višje bo na prednostni lestvici in prej bo zaščitena/rešena. Postopek vrednotenja se opravi v pisarni, sestavljen je iz petih korakov, vključiti pa je treba tudi različne ključne deležnike in jih spodbuditi k sodelovanju. V vseh fazah postopka se uporabljajo preglednice, ki zagotavljajo jasen in pregleden potek dela, končni rezultat pa je seznam prednostnih nalog za poljubne skupine virov kulturne dediščine.

Orodje ATTACH je bilo preizkušeno v praksi v idrijskem rudniku živega srebra (na zahodu Slovenije), v katerem je zdaj podzemni muzej. V rudniku so izvedli simulacijo požara, ki bi ogrozil osem virov kulturne dediščine – ti sodijo med bistvene elemente Antonijevega rova, ki je vpisan na seznam Unescove svetovne dediščine, poleg tega pa je tudi ena od pomembnih turističnih znamenitosti, ki jo obiščejo množice obiskovalcev. Muzej upravlja javni inštitut Center za upravljanje z dediščino živega srebra Idrija (CUDHg Idrija). Različni rezultati preizkušanja kažejo, da bi orodje ATTACH lahko uporabili v sistemu zaščite pred naravnimi nesrečami, osredotočenem na kulturno dediščino. Pri evalvaciji orodja so sodelujoči pripravili tudi predloge za prihodnje izboljšave.

1 Introduction

1.1 The Alps and their cultural heritage

Despite the harsh conditions, the Alps have been populated for over a millennium and are currently home to over 14 million people. According to the areal boundaries defined by the Alpine Convention, they cover almost 200,000 km² and span across eight countries. Through time, the close co-habitation of man and nature shaped the Alps into a biodiversity-rich environment hosting approximately 13,000 plant and 30,000 animal species, which makes the Alps a regionally important area for nature conservation as well as an attractive tourist destination. This is related to the fact that over 20% of the Alps is covered by National parks and Natura 2000 sites. On the other hand, as little as 4% of the population are still active farmers.

The population drain from the Alpine area varies according to location. Some parts of the Alps experienced a substantial growth (e.g. some parts in France and Italy), whereas some were subjected to significant depopulation (e.g. some parts in Austria). People have mainly moved to larger cities because of employment possibilities, but the trend is not as negative as it was in the past due to seasonal residents. New work opportunities are emerging, especially in tourism and ecological farming. A clear pattern can be observed as the population in the vicinity of tourist centres is predominantly on the increase, which depicts the growing importance of tourism on the income.

Climate change and its effects also have an important impact on the Alps. The alpine area is facing an exceptionally high rise in average temperatures, more than twice as much as the rest of the northern hemisphere. On the other hand, the trend in precipitation is not as unambiguous. As the northern part of the Alps is to receive more precipitation in the future, the Southern Alps could become drier.[1] The increase in the frequency and intensity of natural disaster events is one of the aftereffects of climate change and since the Alps are extremely vulnerable to the shifting climate,[2] natural hazards play a crucial role. In addition to the losses of winter tourism due to the decrease in snow cover, OECD has identified increasing exposure of settlements and infrastructure as a

1 Zhongming, Z., L. Linong, Y. Xiaona, Z. Wangqiang and L. Wei. 2009. Regional Climate Change and Adaptation—The Alps Facing the Challenge of Changing Water Resources. EEA report 8/2009: 143 p.

2 EC. 2009. Adapting to Climate Change: Towards a European Framework for Action. White paper. COM(2009), 147/4 final.

leading cause of vulnerability.[3] This was showcased by extreme flooding across the Alps in 1999, 2002, 2005, 2007 and 2010 and an exceptional avalanche episode in the winter of 1999. It is therefore important to establish effective safeguarding of the Alpine population, so that people will be able to enjoy minimum risks. In this way the local population will feel safer and will not seek their homes or work elsewhere.

For centuries the Alps have been interchangeably a place of both, rapid development and quick abandonment, which meant that the inhabitants and their culture had changed several times. Farming, mining, forestry, and lately tourism have brought changes to the landscape and led to the development of the cultural landscape. At this we do not have in mind merely built elements such as churches, castles, bridges, mine shafts, built waterways, etc., but also other artefacts, which are commonly associated as those that make the cultural heritage of the Alps unique and worthy of preserving. Visiting museums, monasteries, and old village centres are a key part of the tourist arrangements that make cultural heritage crucial for sustaining a part of the locals' wellbeing. Thus, it makes sense to safeguard cultural heritage in order to preserve a part of the Alpine economy, making the Alps more attractive to live in and sustain the local society. Cultural heritage in the Alps is in a unique position as, in addition to being a source of local identity, it also represents one of its main development factors.[4] It can fit into all categories, such as material resources, intangible resources, activities and territory.

However, there is another unique element that was pinpointed in the previous section of this chapter – the high probability of natural risks, which are becoming amplified by climate change. In combination with the vulnerable and fragile objects of cultural heritage, this presents a major risk not only to the existence of the local communities, but to their economic and social development as well. Thus, there is a pragmatical need to develop and implement sound solutions for either preventing damage due to natural hazards or for mitigating the long-lasting negative effects if such events occur. Surely, complete prevention would be the best alternative, but effective preparation for emergencies that cannot be avoided is also important. Planning salvaging and rescue actions is a crucial part of being prepared to act effectively when necessary. As shown by several regional assessments, even though cultural heritage in the Alps is subject to general local protection, the specific safeguard from natural hazards during emergency and recovery phases still lacks proper regulatory settings, operational abilities and widely-shared knowledge of the socio-economic value embodied into the assets at stake. Thus, an innovative operational tool for prioritizing rescue and salvage efforts (ATTACH – ev**A**luation **T**ool for **A**lpine **C**ultural **H**eritage) in the context of Alpine cultural heritage and natural disasters has been developed and tested within the CHEERS project. It is based on both, previously generated know-how, as well as knowledge consolidated within the project.

3 OECD. 2007. Climate Change in the European Alps. Adapting Winter Tourism and Natural Hazards Management.

4 Pesaro G. 2012. Distretti culturali nelle Alpi tra omogeneità e specificità: le determinanti di esiti diversi in due casi lombardi, Acta XXXIII Italian Conference of Regional Science, Rome, September 13-15 2012

1.2 The need to act in case of natural emergencies

In cases of emergencies in which cultural heritage assets are likely to be endangered or even damaged, a team of cultural heritage experts, civil protection personnel and other actors in charge of the crisis on a local and regional level need to organize themselves and reach a decision as to where, when and to what extent do they need to intervene. The organisation of both protection and salvage operations needs to be grounded on the available human, financial and material resources and usually need to be performed swiftly. The fact that cultural heritage assets are frequently vulnerable due to their age and means of protection might be limited by their format/size, so maintaining the asset's characteristics might prove important when acting swiftly.

Thus, a rapid response tool is needed to provide a system of priorities. These include many elements, such as level vulnerability and likelihood of hazard and are to provide a clear indication of which cultural heritage assets should be saved first. The key element upon which priority can be defined is the asset's value, which can be an integral part of its vulnerability assessment. The higher the value that can be lost during an emergency, the more vulnerable the cultural heritage asset is, which means it needs to be addressed with a higher priority.

In order to pinpoint the value, we need to consider the asset's characteristics, which include unicity/rarity, age, material, historical and artistic relevance and the importance for the local communities. The availability of this information for each cultural heritage asset would therefore enable one to contextualize the salvage operation and support the in-the-field decision maker to minimize heritage value losses during emergencies.

2 Theoretical framework and development of ATTACH

2.1 Notion of risk

Risk is one of the key concepts ATTACH has been built on, at least in the part where it relates to vulnerability. Risk is commonly defined as a product of the hazard (physical and statistical characteristics in a specific environment) and vulnerability of an exposed asset,[5, 6, 7] although alternative views (figure below) exist as some define risk with a triangle in which hazard, exposure and vulnerability contribute independently.[8]

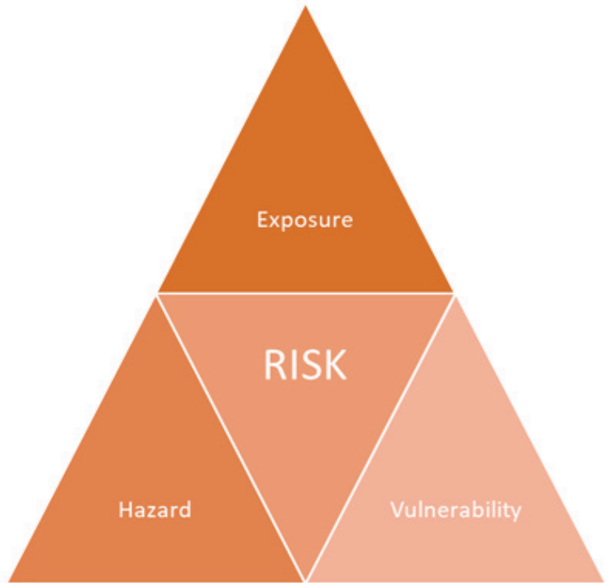
5 Wisner B, Blaikie PM, Cannon T, Davis I. 2004. At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge; 471 p.

6 Apel H, Aronica GT, Kreibich H, Thieken AH. 2009. Flood Risk Analyses—How Detailed Do We Need to Be? Natural Hazards 49: 79-98.

7 Vojinovic Z, Hammond M, Golub D, Hirunsalee S, Weesakul S, Meesuk V, Medina N, Sanchez A, Kumara S, Abbott M. 2016. Holistic Approach to Flood Risk Assessment in Areas with Cultural Heritage: A Practical Application in Ayutthaya, Thailand. Natural Hazards 81: 589-616.

8 Dewan A. 2013. Floods in a Megacity: Geospatial Techniques in Assessing Hazards, Risk and Vulnerability. Springer: 199 p.

Fig. 1: *The risk triangle (Crichton 2002)*



Hazards are determined upon the probability of past events and are commonly represented by hazard maps. Hazard maps have a fundamental role in the design and dimensioning of mitigation structures and land planning as well as in the definition of risk and hazard management policies.[9] Hazard maps allow both, the recognition of areas affected by the hazard with different levels of intensity, and the establishment of the presence of hazard hot spots.

Vulnerability refers to the conditions and capacity to make an asset susceptible to harm as an effect of a hazard (Vojinovic et al. 2016). It is based on human-nature interaction and is viewed as an outcome of the hazard which is determined by exposure, sensitivity and the potential consequences of a hazard[8]. Consequences result in damage due to physical, social, institutional, economic and environmental effects.

There are a few types of causal structures of vulnerability, which can be 'parameterized' by either qualitative or quantitative indicators, which suggest the extent of potential damage. For example,[10] there are three suggested factors upon which vulnerability depends: exposure (location relative to hazard), resistance (livelihood), and resilience (adjustments, preparations), while[11] defines vulnerability as a function of exposure, sensitivity (likely effect of the hazard) and adaptive capacity (ability to cope).

9 Lari S, Frattini P, Crosta GB. 2014. A Probabilistic Approach for Landslide Hazard Analysis. Engineering Geology 182: 3-14.

10 Pelling M. 2012. The Vulnerability of Cities: Natural Disasters and Social Resilience. Routledge: 212 p.

11 McCarthy JJ, Canziani OF, Leary NA, Dokken DJ, White KS. 2001. Climate Change 2001: Impacts, Adaptation, and Vulnerability: Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Parallel to the causal structure, there are various ways to assess vulnerability (Dewan 2013), which usually differ in terms of the scale used in the study.[12, 13, 14] However, in general, two basic approaches exist – biophysical and social.[15] According to the first one, vulnerability is conceptualised as a pre-existing condition, which is determined by exposure and sensitivity to the hazard, and is similar to risk, but differs in the absence of probability as a function. In the second one, vulnerability depends upon social, political and economic factors, which determine the resistance and recovery – i.e. adaptive capacity. Several authors combine both aspects, and one of the exemplary cases[16] suggests the use of an alternative six-step protocol to estimate vulnerability, where the first one is to define the value of the cultural heritage, which is the aim of the ATTACH approach presented in this paper.

Types of cultural heritage value

The value of cultural heritage is captured through a system of different types of values, which are to some extent adopted from the ABC method[17] on cultural heritage assessment, and to some degree adjusted to fit the specific social and ecological circumstances of the Alps. This adjustment is obvious from the list of different types of values, which is to comprehensively outline the total value of the cultural heritage asset. It consists of seven types of values, which are presented in the table below.

Table 1: *Types of values used in the ATTACH approach.*

Type of value	Definition
Evidential value	Potential of the cultural heritage unit to yield evidence of past human activity (physical remains, written records, archaeological deposits, etc.).
Historic value	Relates to the ways in which past people, events and aspects of life can be connected through the cultural heritage unit to the present. This type covers several aspects such as an illustrative dimension indicating whether it illustrates something particular or distinctive, associative meaning referring to whether the asset relates to a notable family, person, event or movement, and historical importance depicting the historical period which it originates from.
Aesthetic/artistic value	Relates to ways in which people draw sensory and intellectual stimulation from cultural heritage assets either as a result of conscious design or the seemingly fortuitous outcome of the way in which cultural heritage has evolved and has been used over time.

12 Adger WN. 2006. Vulnerability. Global Environmental Change 16: 268-281.

13 Eakin H, Luers AL. 2006. Assessing the Vulnerability of Social-Environmental Systems. Annual Review of Environment and Resources 31: 365-394.

14 Birkmann J. 2007. Risk and Vulnerability Indicators at Different Scales: Applicability, Usefulness and Policy Implications. Environmental Hazards 7: 20-31.

15 Ford JD, Smit B. 2004. A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change. Arctic 57: 389-400.

16 Daly C. 2014. A Framework for Assessing the Vulnerability of Archaeological Sites to Climate Change: Theory, Development, and Application. Conservation and Management of Archaeological Sites 16: 268-282.

17 Michalski S, Pedersoli JL. 2016. The ABC Method: A Risk Management Approach to the Preservation of Cultural Heritage. Ottawa, Canada: Canadian Conservation Institute. 163 p.

Communal value	Derives from the meanings of the cultural heritage asset for those who relate to it or for whom it figures in their collective experience or memory. Communal value refers to three aspects such as the symbolic meaning of a place for those drawing their identity from it or having emotional links to it, social importance of places people perceive as a source of identity, distinctiveness, social interaction and coherence, and spiritual value, which emanates from the beliefs and teachings of an organised religion or reflect the past or present-day perceptions of the spirit of the place.
Economic value	Derives from the potential of the cultural heritage asset to produce financial dividends for society as a result of direct or indirect economic activities connected to the use and function of the cultural heritage asset.
In-use/fruition value	Relates to the fact that an asset is accessible/open to the community and used rather freely.
Scientific/educational value	Derives from the asset having information or data that (might) contribute significantly to scientific research and academic studies.

2.2 The ATTACH approach

The ATTACH (evAluaTion Tool for Alpine Cultural Heritage) methodology is designed as a five-step process, in which the first three steps frame the valuation context and the last two involve the actual valuation of the cultural heritage asset. To a certain extent it relates to the concept of the ABC method (Michalski & Pedersoli 2016), however it also includes several new aspects. All steps are practically implemented in a spreadsheet format which involves populating the pre-defined forms with data (Annex 1). This data is collected either by desk-research or in a participatory manner by involving stakeholders in focus groups, workshops or interviews. Each step is illustratively described below.

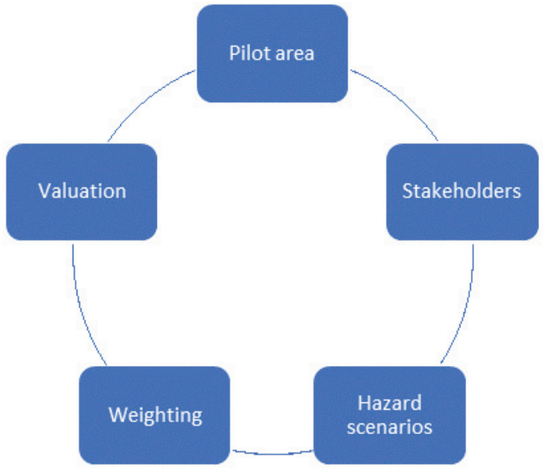


Fig. 2: *An outline of the five-step process of the ATTACH approach*

Location of cultural heritage (pilot area)

The first step of the ATTACH approach is to come up with a general description of the area containing the locations of the cultural heritage assets. Having information on past events, terrain features and the size of the population might bring a broader general understanding of the area's local character and a wider consideration of the context in which the valuation is to be performed. Of course, the size of the pilot area depends on the overall aim of the valuation and the bundle of cultural heritage assets we wish to consider – from the size of a small settlement or even a single building, up to a region of several hundred square kilometres.

Involving stakeholders

Including people from different professional backgrounds such as curators, civil protection personnel, representatives of local communities, and owners of the cultural heritage assets is a key element when implementing ATTACH. One of the innovative aspects is that a variety of stakeholders take part in the valuation process so that a wide representation of opinions and knowledge is blended and finally consolidated in a common set of values. This also increases the validity of the valuation outcomes and makes it more likely for them to be used by the decision-makers.

Selecting who to involve is a critical step in managing stakeholders and needs to be planned carefully. Thus, ATTACH offers a template to map stakeholders according to their perceived interest in the valuation of cultural heritage, their power in implementing either valuation outcomes in practice or introducing changes into the existing valuation system according to the lessons-learnt through the valuation exercise, and their attitude towards the valuation of cultural heritage. Approaching stakeholders depends on this characterization, which is illustratively represented in the image below.

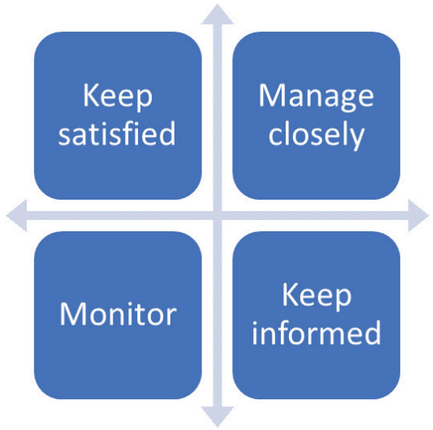


Fig. 3: *The concept of mapping stakeholders according to their power and interest.*[18]

18 Bourne L. 2009. Stakeholder Relationship Management: A Maturity Model for Organisational Implementation, Routledge: 246 p.

The aim of this step is to define the stakeholders that need to be focused on most intensively, i.e. those with high levels of motivation and power – key players that have the capacity to introduce changes and make a valuation either a success or a failure. However, others should not be neglected. Stakeholders with high interest but low power (residents, some NGOs, etc.) also need to be involved, as one of the key assumptions for developing the ATTACH valuation tool is to broaden the group of stakeholders as having only professionals or officials might produce biased valuation outcomes.

A special section of the spreadsheet tool is devoted to documenting all information related to the stakeholders as this eases the selection process so that one implementing the ATTACH tool is able to argue why each stakeholder was selected and involved in the valuation and why some were omitted. In addition to the aspects of interest and power, five more elements, which might be valuable to furthermore describe the individual stakeholder are integrated – stakeholder's (1) attitude, (2) role in valuation (attendee, coordinator, animator, ...), (3) significance to the project as in how can one contribute to the success of ATTACH, stakeholder's (4) requirement from the ATTACH, and (5) some additional issues and comments one might rise during the implementation of ATTACH and might help in the fine tuning of the tool.

Designing hazard scenarios

When alternative hazard scenarios are defined it is possible to pinpoint cultural heritage assets that might potentially be exposed to different natural hazards. This step is case-specific and depends on the pilot area characteristics, the relevant types of natural hazards and the cultural heritage asset under assessment. It is also related to the available data and the analytical approach of designing hazard scenarios. They usually combine information on the possible extent and intensity of the natural hazard event and relate this with the probability of the event. The expression of the extent of the event depends upon the type of natural hazard being assessed and is exhibited by the e.g. flooded area, size of the landslide etc., whereas the intensity (severity) is related to the depth of inundation, the kinetic energy of rockfall, fire intensity and so on. Probability is commonly expressed by return periods of events of various magnitudes. Combining this data provides the information on the level of the hazard.

A section of the ATTACH tool allocated to this part allows to simply input relevant information describing the extent and intensity of the natural hazard scenario it is depicting. Both aspects are to be described in a narrative format so that anyone can retrieve the information at a later stage. The number of scenarios described, and possibly implemented is unlimited and one can actualize numerous different sequences of natural hazard events. Additionally, there is a column in which cultural heritage assets exposed to a natural hazard according to a specific scenario can be listed. In this way the actual list of the assets relevant for the valuation is defined.

Weighting types of values

All types of values are not equally present in different socioeconomic and environmental settings, thus ATTACH introduces a system of value weighting. This

step enables one to fine-tune the relative significance of each value type by having key stakeholders (locals, decision-makers, cultural heritage managers, asset owners, civil protection personnel, etc.) assign the relative weights to all seven types of value according to the best of their knowledge and expert judgment. This is to be done via a participatory involvement of the stakeholders which is highlighted as important in the previous step of 'involving stakeholders', where they are mapped according to their interest, power, attitude, role, significance and requirements.

Methodologically, weighting is performed with the Analytic Hierarchy Process[19] in which one makes a set of pairwise comparisons of relative importance for each possible combination of types of values. For each comparison one assesses how much more important one type of value is compared to another by selecting a mark from 1 (indicating that both types are equally important), 2 (indicating that one type is slightly more important than the other one), with marks progressing towards the highest mark of 9 (indicating that one type yields significantly more importance than the other one). Mathematically, the method aggregating all comparisons is based on the Eigen value problem, where the solution of the problem provides the ratio scale (weighting) for each factor under assessment. Using AHP brings several benefits, such as getting a better insight into the complexity of preferences in terms of valuating cultural heritage and by making it possible to assess the overall inconsistencies of comparisons to review individual valuations and to consolidate different stakeholders' opinions. It also helps make the valuation more rational and bolster its transparency, which leads to a higher level of democracy.

ATTACH enables us to document the relative weights of individual types of values in the same section as the value score is recorded. It assumes one set of weights for each case study, thus the weighting process needs to be achieved within a group of stakeholders and consolidated into a single unique set.

In order to do this, several tools (not a part of ATTACH) that support the AHP process can be used. Some even enable simultaneous input from many actors and subsequent aggregation of weighting on a group level. Weights gathered within ATTACH are already integrated into a system of underlying equations related to the actual score of values by individuals, which in turn calculates the overall weighted value for each cultural heritage asset being assessed in the case study – as described in the following sub-section.

Valuation

The pinnacle of the process implemented in ATTACH is the actual value scores. These are performed individually by each stakeholder for each cultural heritage asset under assessment and depict individual point-of-views on the value of a specific cultural heritage asset. This step is especially useful for multi-stakeholder engagement and ensures a participatory format when defining priorities for salvaging operations in case of emergency.

19 Saaty TL. 1980. The Analytic Hierarchy Process. New York, McGraw-Hill: 287 p.

Scoring is performed on a geometric scale, which shows exponential growth as opposed to linear growth, is exceptionally suitable and accommodates the high values by keeping the ratio between neighbouring points on an equal scale throughout the scale. This is also beneficial for the valuation, in cases when some assets/items have extremely high values. The scale has seven scores (points) from 0 to 243 (see the table below). Practically, each stakeholder selects one of the seven scores for each type of value for each cultural heritage asset. These scores are inserted into the tab (4)-section of the ATTACH spreadsheet where a system of pre-defined equations automatically generates a value estimate for each asset. These estimates are weighted by a previously defined set of relative weights.

Table 1: *Types of values used in the ATTACH approach.*

Score on a geometric scale	Definition of the score
0	The item does not possess a contributing value.
1	The occurrence of this contributing value in the item is very small.
3	The occurrence of this contributing value in the item is small (of the order of 3 times greater than that corresponding to score "1").
9	The occurrence of this contributing value in the item is medium (of the order of 9 times greater than that corresponding to score "1").
27	The occurrence of this contributing value in the item is large (of the order of 27 times greater than that corresponding to score "1").
81	The occurrence of this contributing value in the item is very large (of the order of 81 times greater than that corresponding to score "1").
243	The occurrence of this contributing value in the item is exceptional (of the order of 243 times greater than that corresponding to score "1"). This score indicates the maximum intensity of the occurrence of this feature throughout all components of the heritage asset.

Estimates from the stakeholders can be used individually or can be aggregated to provide a joint estimate - depending on the goals of the valuation. There are also different ways of aggregating, either by calculating the mean or mode.

3 Testing ATTACH on the Idrija Mercury Mine Pilot Case

ATTACH was consistently tested according to all 5 steps outlined above on the case of the tourist mine in the town of Idrija, which is located in the mountainous part of western Slovenia. The testing process was performed by two Slovenian CHEERS project partners, namely CUDHg Idrija (Idrija Mercury Heritage Management Centre) and SFI (Slovenian Forestry Institute).

3.1 Area of the pilot case

Due to its rich history in mercury mining, the municipality of Idrija is covered with numerous monuments and cultural heritage assets. This has profoundly shaped the community and the environment. From the beginning of the 16th century onwards, mining has been a key economic activity involving miners who started arriving in the formerly unsettled Idrija valley and later a large share of the local population. It has provided a living to many and in the course of development garnered several impressive manmade constructions such as the main mine entrance, Anthony's Main Road (from the beginning of the 16th century) and artefacts of predominantly technical/engineering origin. The latter refer mostly to mining tools and didactic objects aimed to present the different aspects of mercury mining. There are indeed other objects/buildings related to the mining history of Idrija such as water dams, artificial water canals, a smelting plant, a water pump. etc, however the mine represents the central element.

After the closing of the mine in 2008 (due to economic reasons and the growing environmental awareness), a part of the mine and some of its auxiliary technical infrastructure were gradually transformed into a museum. The entrance into the mine in Šelštev was redesigned with a welcome desk, a presentation room with an educational video as a paramount element that introduces the visitors to the history of the mine, and a mercury display, which is a down-scaled model representation of the amount of mercury that had been extracted during the active period of the mine. Apart from the historic and evidential importance of the mine there are also economic aspects, which cannot be ignored. Guided tours into the underground mine museum bring a substantial number of tourists to Idrija and its surroundings, thus creating income opportunities for local business.

Thus, the mine is extremely important for the local community that is likely to put substantial effort into safeguarding it against various threats, which include natural hazards. Earthquakes, floods, landslides and fire are noteworthy in the area due to several reasons. Steep terrains with considerable heterogeneity in elevation, relatively deep soil, abundant precipitation and a well-spread network of mine tunnels and shafts create an environment ripe for the first three types of hazards. In addition, fires are typical for mines, where naturally occurring flammable gases are common. The combination of all these threats presents a great risk which is to be minimized as much as possible. Additionally, the hazard protection plan of the mine has merely a limited focus devoted to protecting and/or salvaging cultural heritage in cases of emergency. They do not have a detailed and fully developed plan of actions for such events, but only general guidelines which might not suffice.

This makes the Idrija mercury mine museum a perfect example to test the ATTACH approach and highlight the potential benefits of introducing such a tool into cultural heritage management and/or protection system. Anthony's road is a part of the mine and is a key touristic attraction with abundant cultural heritage assets. As such, it was selected as a case study within the pilot area.

3.2 Stakeholders

Identifying the relevant stakeholders that are to be involved in the valuation was the first step, carried out in late 2019. Initially, a draft list of all potentially relevant stakeholders was created, and then all individuals on that list were pre-mapped according to their power, interest and attitude towards innovative valuation approaches (Figure 4). Based on this, those with very low levels of power and low interest were omitted, while the rest were mapped with additional indices such as their role in the valuation, significance to the project, and their requirements from the pilot case testing.

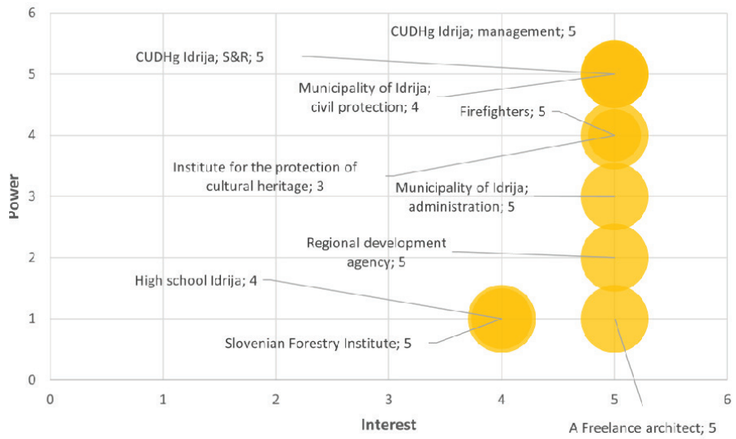


Fig. 4: *Graphical representation of the stakeholders' mapping according to their interest in the topic of cultural heritage and natural disasters (x-axis), power to implement changes to the current cultural heritage evaluation system (y-axis), and their attitude towards introducing innovative evaluation approaches in cultural heritage management (the larger the circle, the higher the support – the value is on the right-hand side beside the indication of the organization).*

3.3 The fire hazard scenarios

The decision on which type of hazard the test should be grounded upon was reached following a thorough review of the past hazard events in the mercury mine and a consultation with the safety and protection staff in the mine. The fire hazard seemed to be the most relevant, particularly in terms of how many cultural heritage assets it would jeopardize and how likely it is to happen. Two possible fire hazard scenarios were drafted, one describing the possible development in the upper part of the mine (the entrance building and the first mine level), while the second covers a fire event in the lower levels of the mine. Considering the fact that most cultural heritage assets are located in the upper section of the mine, it was decided to focus only on the first scenario. This scenario predicts a break out of a fire due to the ignition of flammable gases in the upper level of the mine, which gradually progresses upwards, passes the cast iron entrance doors and captures the entrance building. A simple plan of the mine is given below.

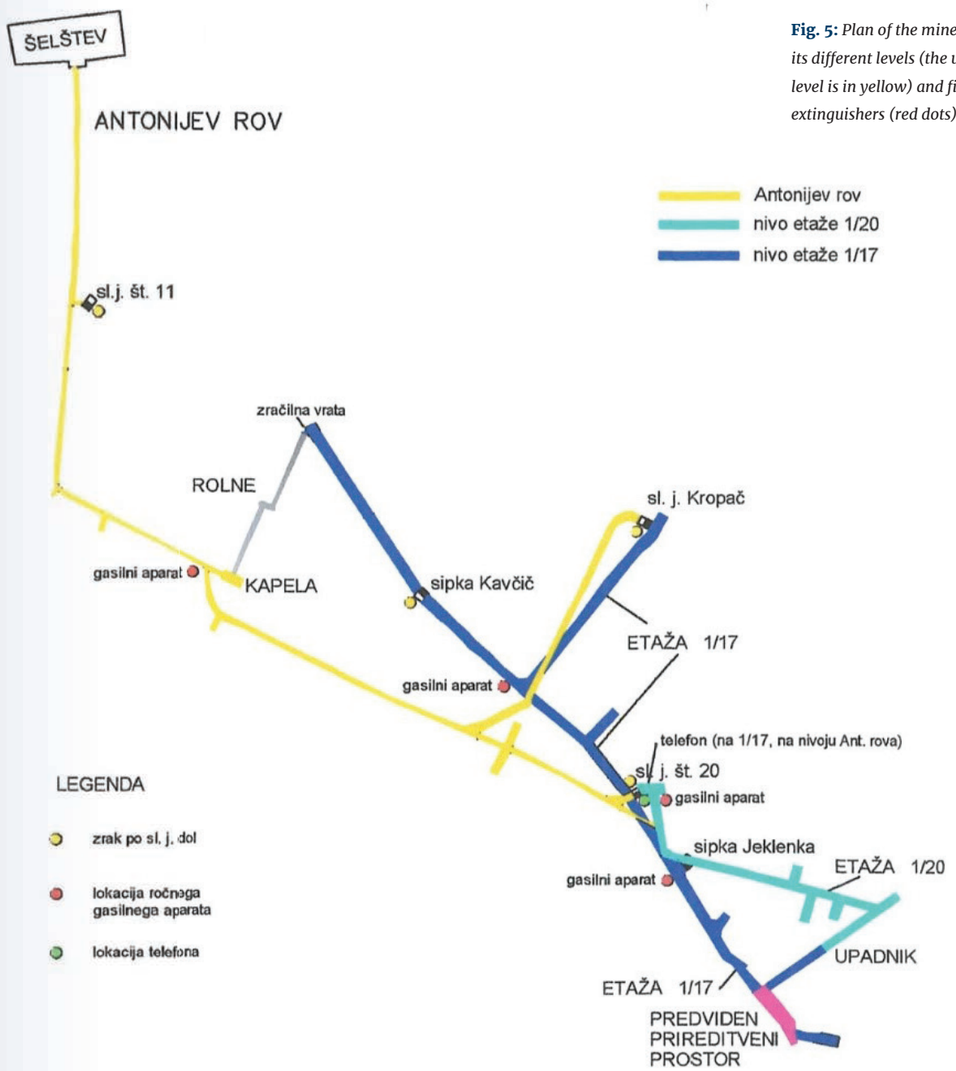


Fig. 5: *Plan of the mine, with its different levels (the upper level is in yellow) and fire extinguishers (red dots).*

In addition to the scenario design, an analysis of the cultural heritage exposure was performed in order to define the assets that would be potentially at risk if a fire occurred. The list of the eight assets is given in the table below and all were included in the ATTACH test.

The name of the asset	Description	Indication of vulnerability
The call room 'Šelštev' (entrance building, 18th Century)	The call room on the right side is nowadays used as a lecture room, projection room and visitors' collection point before entering the pit.	The wooden parts, which make most of the call room, would probably be completely destroyed.
Mercury model, 20th Century	The modern sculpture (author: Marko Pirih) symbolises the discovery of mercury. According to the legend, mercury was discovered in Idrija in approximately 1490 by a tub maker while soaking a wooden bucket in the stream. An unknown, glittery substance found its way into his bucket, and this substance turned out to be mercury.	The electronic system of the sculpture would be destroyed, mercury would evaporate into the environment.
Ore cart, beginning of the 19th Century	The ore transport mine cart "trugca" has been preserved, secured and presented as an important monument of Idrija's mining technical heritage with exceptional universal values. It is a part of the CUDHg Idrija mining collection. Visitors can view it within the permanent museum display on Anthony's Main Road. It is a part of the presentation that represents the entire story of mining in the Idrija Mercury Mine.	The wooden part of the cart would probably be completely destroyed, while the iron frame and the wheels might be slightly smeared but not severely damaged.
Mining phone, middle of the 20th Century	The medium-size, metal pit telephone is vertically mounted and consists of five parts. The housing consists of three parts. There is a circuit in the largest bottom part. There is a dynamo for signal generation in the middle part and a rotating handle connected to the dynamo on the opposite side of the receiver. The upper part is a protective cover. The other two parts are a telephone cord and a receiver.	The plastic part of the pit telephone would probably be completely destroyed, while the iron frame and other iron parts might be slightly smeared but not severely damaged.
Mining detonator (ignition), middle of the 20th Century	The electric detonator is composed of a square metal housing and a cover. The electric mechanism is mounted in the housing. Buttons for triggering the explosion are on the cover (pressing the button will generate electricity, which runs to the clamps or the conductor). On the side of the housing, two conductors are mounted, to which the conductive mining wire is attached, which connects the detonator with the explosives in the mining field.	The plastic part of the electric detonator and additional wires would probably be completely destroyed, while the iron frame and other iron parts might be slightly smeared but not severely damaged.
Drilling machine CRAELIUS XC 42, middle of the 20th Century	The Craelius drilling set served for research drilling and detection of mineralisation areas in the main levels of the Idrija ore deposit. Obtaining the core during research drilling was particularly challenging in the rocky conditions characteristically found in Idrija.	The drilling set is made of iron and a fire would not cause any severe damage.
Theodolite on a wooden stand, middle of the 20th Century	The theodolite consists of a wooden base with a triangular stand. Under the stand, there are foot screws and a horizontal circle with an angular division, which allows measurements of horizontal angles of 0° or 360°. The top part consists of a binocular with a bracket and a supporting axle. This part also contains a vertical circle with an angular division, which allows measurements of vertical angles from -90° or 90° or zenith distances from 0° to 180°.	The wooden, glass and plastic parts of the theodolite would probably be completely destroyed, while the iron frame and other iron parts might be slightly smeared but not severely damaged.
Clay mannequins of miners (models), end of the 20th Century	All clay mannequins of miners are the work of the academic sculptor Boni Čeh and represent the different types of mining work through the years.	All mannequins of miners are made of clay and dressed in original miner's dresses (hats, helmets, shirts, trousers, boots) and equipped with original self-protective devices and therefore would be completely destroyed in a fire.

Table 3: *The list of cultural heritage assets included in the test of the ATTACH evaluation tool with a short description of each asset and the general indication of vulnerability of each asset in the event of a fire.*

3.4 The evaluation workshop

The process of assigning weights to value types and scoring values of all 8 cultural heritage assets was performed during two separate workshops in the premises of the Cerkljanska development agency in the town of Idrija: on 7th December 2019 (10 attendees and two presenters/instructors); on 11th December 2019 (5 attendees and two presenters/instructors). All assets were presented to the attendees of both workshops in a standard way by indicating:

- location of the asset in the mine,
- state they are in in terms of being original, refurbished or replicated,
- management regime in terms of maintenance and monitoring,
- vulnerability aspect by illustrating the potential damage on the asset.

Given 7 types of value of the cultural heritage asset each workshop attendee had to make 21 pair-wise comparisons and thus implicitly scale the importance of each type of value relative to all other types of value on a 1-9 Saaty scale, commonly used within the AHP process. Individual comparisons were aggregated via a n-balanced approach and are provided in the table below. A freely available online AHP application system was used for weighting the types of values (https://bpmsg.com/ahp/).

Table 4: *Results of the weighting of individual types of values performed by the attendees of both workshops.*

Type of value	Relative weight [%]
Evidential	26.9
Historic	22.5
Aesthetic and artistic	6.7
Communal	12.9
Economic	3.0
In-use/fruition	9.0
Scientific/educational	7.5

Evidential and historic values have both been assigned by far the highest weights, followed by communal, while the economic value yielded the lowest value. However, the distribution of values is secondary in the test as the main goal was to assess the performance of ATTACH. Several issues were highlighted by the attendees during the test:

- evidential and historic value overlap in their definitions and it was hard for the attendees to distinguish between them,
- making 21 pair-wise comparisons can be quite demanding and might require several attempts to achieve the desirable consistency,
- knowing the object/asset being evaluated can have a significant effect on the weighting process and this needs to be acknowledged,
- coming from different sectors might also affect the results, as those being closely related to the conservation and management of cultural heritage tend to put higher weights to historical, evidential and communal values.

One of the suggestions made by the attendees was to integrate the weighting application into the spreadsheet file so that they would not need to switch from one application to the other.

In the second phase, the actual scoring of the individual value type was performed for each cultural heritage asset. Each attendee created a unique score, which was weighted by a common set of weights. The overall score was calculated for the entire group of attendees as the arithmetic mean of the individual scores. The results are presented in the graph below (Figure 6).

The scores clearly indicate that the entrance building has the highest value and would thus, in line with the ATTACH approach, have the highest priority in case of emergency. In terms of decreasing values, the entrance building would be followed by the trolley, the drilling machine and the mine phone, which are all relatively close in their scores. Ignition, theodolite and the miners' models are again very close in priorities, whereas the mercury model received the lowest overall score, which is also significantly lower than its score-wise closest assets

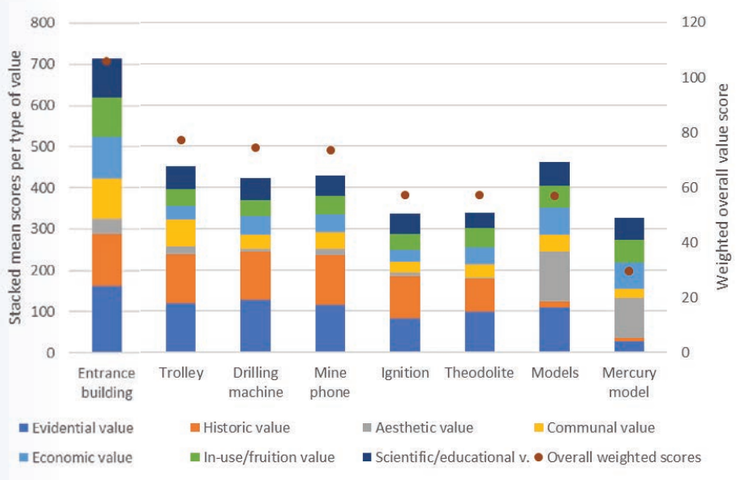


Fig. 6: *Distribution of the value scores for eight cultural assets of the Idrija Mine in two-fold representation; mean score for individual types of values (left axis; stacked bars), and weighted overall score (right axis; dots).*

A clear distribution pattern of the scores was observed. Evidential and historic values garner high scores with the first six assets, while high aesthetic value was attributed to the miner's models and the mercury model. Both scored very low in historic value. High scores for evidential value are also characteristic for the models. Relating to the specific evaluation outcome of the models, a relatively high sum of mean scores and low overall weighted score is a result of their high score on aesthetic value, which has a low weight and that lowers the overall score. Following the issue of aesthetic value, it scored by far the lowest among all types of values for the first six assets. However, the models were given relatively high scores on economic value, which was weighted very low in general. Thus, the two assets seem to be important for the potential of generating income.

The attendees also gave some clear observations on the valuation process:

- the 7-level geometric progression-based scoring scale is non-intuitive and hard to comprehend – a linear scale would be more appropriate,
- the initial presentation of individual assets can have a significant effect on their scores, especially if the presenter highlighted the specific attributes more in case of some assets and less for others,
- the overall design of the evaluation approach seems to be reasonable and well grounded.

4 Conclusion

Following the test valuation, a simple SWOT analysis was performed in order to provide a consistent assessment of the ATTACH approach. The assessment was performed immediately after the valuation through an open, but guided, discussion. The synthesis was performed by the CHEERS project partners who coordinated the workshop. The outcomes are presented below.

SWOT analysis

	Positive	*Negative*
Internal	**Strengths**	**Weaknesses**
	→ professionally and scientifically grounded methodological approach → very easy to adapt to larger/smaller sets of assets under assessment and/or a different scoring scale → 'open-source' format makes it easy to refit it to different analytical settings → relatively easy to comprehend by end-users (quick learning process) → it is user friendly (expressed by the attendees of the workshop) → does not require extensive human or material resources to be implemented	→ the user needs to switch between the AHP web tool and the score spreadsheet file → not the most comprehendible geometric progression-based score scale → potential for biases in both weighting and scoring as a result of people's previous knowledge/preferences, etc. → a pre-defined set of seven value types can affect the evaluation → the predetermined weighting and scoring system omits the possible additional aspects of the evaluation which might be important in some cases
External	**Opportunities**	**Threats**
	→ as tourism is a very lucrative sector in the Alps and much of it depends on cultural heritage, its protection seems reasonable; in combination with climate change and the increasing threat of natural disasters this urgency is even more critical → the need for innovative evaluation approaches was pinpointed also by the relevant national experts from the Institute for the Protection of Cultural Heritage of Slovenia → CHEERS consortium offers a network of experts with rich experience needed to further develop the tool as well as connections with relevant professionals who can distribute information as regards the tool	→ there might be a reluctance to purely quantitative evaluation approaches over mixed qualitative/quantitative approaches → the limited duration of CHEERS might not secure sufficient time to refine the tool to the extent where it would provide a competitive advantage over other already available tools → the tool was designed (theoretical underpinnings endorsed from the already available approaches and then adjusted to the needs of the Alpine space) by an organisation not previously involved in cultural heritage management, which might hamper the chances of being widely accepted → we are uncertain as to how receptive civil protection systems are to accommodating this tool within the current arrangement

Table 5: *The outcomes of the SWOT assessment of the AT-TACH testing in the context of the Idrija mercury mine cultural heritage*

ANNEX 1:
Graphical representation of individual tabs within the ATTACH tool

Tab (1) *Pilot area*

General Information		**Information on cultural assets****	**Description of CH**	**Vulnerability***
Name of the pilot area	name	asset #1		
Size (km²)	xx, xxx	asset #2		
Population (n)	xx, xxx	asset #3		
		asset #4		
		asset #5		
Past events	(Please provide a narrative description of significant past events of natural hazards, which are important for the prediction of the possible outcomes of future events and indicate the main aspects of vunerability)		*	please provide which of the CH asset are vulnerable and in what way. Refer only to physical vulnerability.
Terrain specific	(please provide information on the terrain and other geologic specifics of the pilot area, which significantly affect the occurence of relevant natural hazards)		**	please list the assets you plan to assess in the valuation
Governance aspects	(please provide information on who is managing (conservation, protection in events of natural hazards, commercialisation) cultural heritage in the pilot area, what is the role of the local residents, who owns the heritage assets, who provides technical guidance on managements and who provides the funds)			

Tab (2) *Stakeholders*

Name	**Role**	**Significance to project**	**Requires from project**	**Issues & Comments**	**Interest**	**Power**	**Attitude**
stakeholder #1							
stakeholder #2							
stakeholder #3							
stakeholder #4							
stakeholder #5							
stakeholder #6							
stakeholder #7							
stakeholder #8							
stakeholder #9							
stakeholder #10							
stakeholder #11							
stakeholder #12							
stakeholder #13							
stakeholder #14							
stakeholder #15							
stakeholder #16							
stakeholder #17							
stakeholder #18							
stakeholder #19							
stakeholder #20							

Tab (3) *Hazard scenarios*

	Type of natural hazard	Who designed the scenario	How was it designed	Extent	Intensity	Cultural heritage assets
scenario #1		(please provide a narative description of who designed the scenarios - professionals, wider groups of stakeholders, etc.)	(please provide a narrative description on the methodological aspects of design; reliability check is also relevant)	(please provide a narrative description of the extent oh the NH event in terms of affected area/ percentage of the pilot area; the number of CH assets being affected)	(please provide a narrative desciption of intensity of the NH event; depth of inundation, kinetic energy of rockfall, fire intensity, etc.)	(list all cultural heritage assets that are exposed to the natural hazard according to the scenario)
scenario #2						
scenario #3						
scenario #4						
scenario #5						

Tab (4) *Weights and scores*

		Cultural heritage assets (individual scoring)								Weights*
Types of values	***Stakeholder #1***	**asset #1**	**asset #2**	**asset #3**	**asset #4**	**asset #5**	**asset #6**	**asset #7**	**asset #8**	
	Evidental									
	Historic									
	Aesthetic/artistic									
	Communal									
	Economic									
	In-use/fruition									
	Scientific/educational									
		#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0
										(either up to 1 or 100)
Types of values	***Stakeholder #2***	**asset #1**	**asset #2**	**asset #3**	**asset #4**	**asset #5**	**asset #6**	**asset #7**	**asset #8**	
	Evidental									
	Historic									
	Aesthetic/artistic									
	Communal									
	Economic									
	In-use/fruition									
	Scientific/educational									
		#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	

(Add as many stakeholders and assets as needed)

*Those are to be generated by an AHP implementation tool such as (link below), using a n-balanced aggregation method

https://bpmsg.com/ahp/

Score	Definition of the score
0	The item does not posses a contributing value
1	The occurrence of this contributing value in the item is very small
3	The occurrence of this contributing value in the item is small (of the order of 3 times greater than that corresponding to score “1”)
9	The occurrence of this contributing value in the item is medium (of the order of 9 times greater than that corresponding to score “1”)
27	The occurrence of this contributing value in the item is large (of the order of 27 times greater than that corresponding to score “1”)
81	The occurrence of this contributing value in the item is very large (of the order of 81 times greater than that corresponding to score “1”)
243	The occurrence of this contributing value in the item is exceptional (of the order of 243 times greater than that corresponding to score “1”). This score indicates the maximum intensity of the occurrence of this feature throughout all components of the heritage asset.