Culture and Heritage Capital: using economic valuation methodologies and heritage science to measure the welfare impact of ongoing conservation, protection, repair and maintenance of culture and heritage assets:[1]

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This paper gives the views of the author, on potential future methods for economic valuation methods, and is not currently part of the Department for Culture, Media & Sport (DCMS) and HMT Green Book Guidance.

Introduction

DCMS's working paper sets out an innovative approach for estimating the cultural, economic and social impact of interventions that halt the loss or deterioration of cultural and heritage assets. This paper sets out possible ways heritage science and economic valuations methodology can be used to quantify the irrecoverable loss of value, a key area of investigation set out in Sagger, H., Phillips, J., and Haque, M. (2021), 'Valuing culture and heritage capital: a framework towards informing decision making' at DCMS.

Assets are subject to degradation, but an intervention may also cause or stop irreversible damage, for example conservation or maintenance of museum collections or historic buildings. Damage to assets may lead to the loss of future benefits, so it is particularly important to fully assess the costs of any irreversible damage that may arise or be mitigated from a proposal. Given the uniqueness or rarity of many cultural and heritage assets, an asset's potential loss or degradation can be seen as an irreversible risk because once the object is lost, the value is expensive or irrecoverable to reverse.

DCMS' Culture and Heritage Capital Programme will bring together the economic methodology and the work of heritage scientists, who are best placed to estimate the impact of conserving assets and, therefore, rates of degradation and irreversible loss.[2] This analysis is critical to demonstrating the value for money of ongoing conservation, protection, repair and maintenance of culture and heritage. This will allow a better understanding and articulation of how the accumulation of cost (loss of public welfare) as a result of ongoing degradation compares to the cost of repair and maintenance for the purpose of social cost benefit analysis.

Heritage science can be used to create a hypothetical counterfactual to help understand what may happen to a culture and heritage asset due to an intervention (or absence of an intervention). This scientifically based counterfactual could then be combined with economic valuation techniques so decision makers can undertake Social Cost Benefit Analysis (SCBA), to help analyse the impact and

[1] Thank you to Adala Leeson, Thomas Colwill, Jack Phillips, Jordan Mencattelli, Dr Josep Grau-Bove for their comments on the paper.

[2] Department for Culture, Media & Sport - *Culture and Heritage Capital Portal*

value for money of different options for maintenance, conservation and protection of culture and heritage assets.[3]

While the approach set out in this paper has been attempted in business cases by the author, and work by Ashely-Smith (2013) has developed definitions of damage, risk and use in cost benefit analysis further research is needed to formalise the approach within CHC and the Green Book.[4] This paper acts as a summary of the methodological approach and challenges of implementing it within Social Cost Benefit Analysis (SCBA).

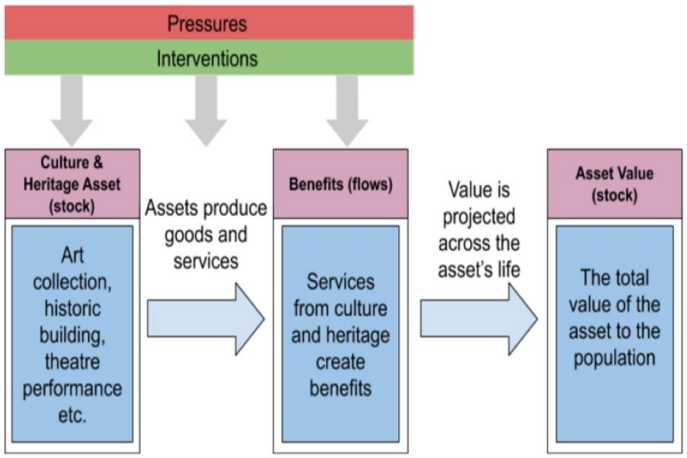
DCMS's Culture and Heritage Capital Programme

The Culture and Heritage Capital (CHC) Programme has been designed to create an agreed standard approach to enable decision-makers to allocate their resources more efficiently, leading to cost savings and better welfare outcomes for society and individuals.

It was launched in January 2021 with the publication of *'Valuing culture and heritage capital: a framework towards informing decision making'*. The framework sets out DCMS's ambition for a transformational and cultural change to assessing value for money using robust appraisal and evaluation.

The Culture and Heritage Capital Framework (Figure 1) demonstrates how culture and heritage assets contribute to achieving the outcomes we seek as individuals and society and how we aim to capture these benefits in a stock and flows framework.

Figure 1: The Culture and Heritage Capital Framework[5]



The assets are the "stock", while the services that create benefits to society are regarded as "flows". Background pressures such as environmental damage, use and time actively affect the services

[3] Sagger, H., Phillips, J., and Haque, M. (2021), *'Valuing culture and heritage capital: a framework towards informing decision making'* DCMS.
[4] Ashley-Smith, J. (2013), 'Risk Assessment for Object Conservation'. Taylor Francis.
[5] Sagger, H., Phillips, J., and Haque, M. (2021), 'Valuing culture and heritage capital: a framework towards informing decision making' DCMS

provided by an asset and the demand for those services. Effective management interventions, additional inputs and policies can positively affect these stocks and flows. A more detailed explanation behind this framework is provided in Sagger et al. Further work is needed to develop this framework particularly to define services, stocks and flows.[6]

DCMS is looking to further develop this approach through its evaluation of the Public Bodies Infrastructure Fund (PBIF) and the Museum Estate and Development Fund (MEND) and AHRC and DCMS Cultural and Heritage Capital research call Strand D: *combining heritage science and economic valuation to articulate better the impact of care and sustainable usage of heritage assets.*[7]

Economic valuation methodology

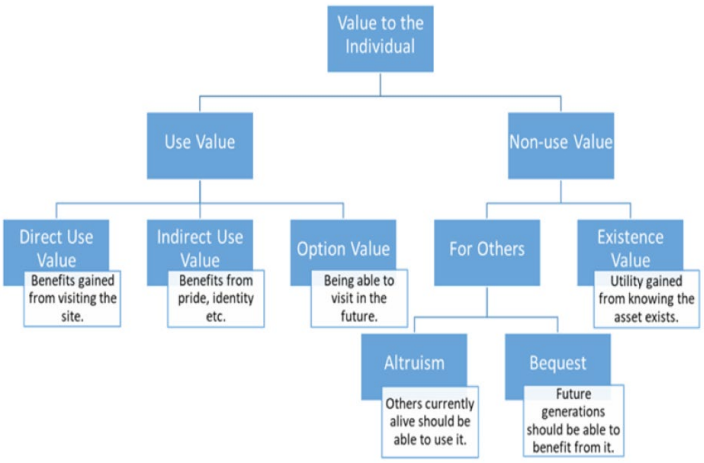
Goods and services produced by culture and heritage assets benefit society, for example, by improving wellbeing, and can create spillovers to the broader population, such as a more productive workforce. Changes to these benefits are the focus of valuation in appraisal. SCBA requires that benefits are estimated in monetary terms, however much of the evidence to date has been qualitative or focused on outputs rather than the valuation of outcomes and impacts.

DCMS's culture and heritage capital programme is aligned to HM Treasury's Green Book, which recommends expressing the total costs and benefits of a proposal in monetary terms (known as Social Cost Benefit Analysis).[8] As set out in Sagger *et al* Total Economic Value (TEV) can be used to understand cultural and heritage services and, more specifically, the conservation and maintenance of culture and heritage assets.

TEV comprises use and non-use values which add up to the total private gain in welfare from a policy intervention, as set out in Figure 2. Use values measure the direct and indirect value of consumption and the value of having the option to consume. In the case of a museum, use value measures the value of visiting the collection. Option value captures the value of having the option to visit in the future for those that have not visited in the past but intend to. Non-use value is the value to the general population of the collection even if they never intend to visit the collection now or in the future physically.

[6] DCMS and AHRC CHC research call *Strand A: developing a taxonomy of cultural and heritage capital services (associated stocks and flows)* looks to further explore the gaps in the evidence base.
[7] DCMS 2022) Public Bodies Infrastructure Fund (PBIF) and the Museum Estate and Development Fund (MEND), Evaluation Framework. Historic England and DCMS and AHRC CHC research call
[8] HM Treasury, *'The Green Book: appraisal and evaluation in central government'*

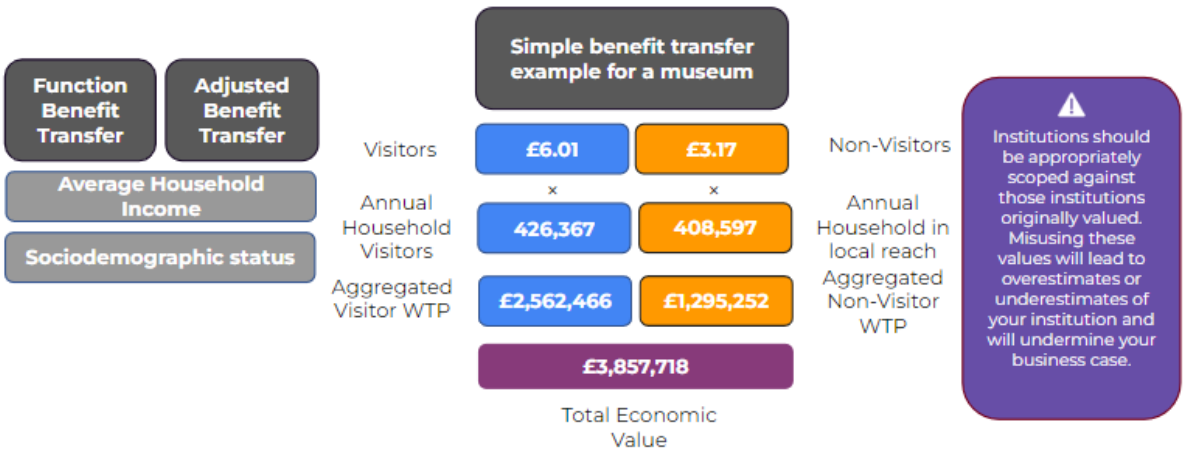
Figure 2: Total Economic value



Source: Sagger *et al*

DCMS have now published several studies that have looked to monetise use and non-use values using contingent valuation. DCMS's 'Rapid Evidence Assessment: Culture and Heritage Valuation Studies' looked at the following methods: contingent valuation; choice modelling, hedonic pricing, travel cost, wellbeing and Quality Adjusted Life Years.[9] Although further work is needed to understand the range of benefits these techniques are measuring, it provides a valuable starting point to understanding how to measure the welfare impact of irrecoverable loss.

Figure 3: Annual use and non-use value of regional museums[10]



[9] Lawton, R., Fujiwara, F., Arber, M., Maguire,H., Malde, J., O'Donovan, P., Lyons, A., Atkinson, G., (2021), *Rapid Evidence Assessment: Culture and Heritage Valuation Studies*, Simetrica Jacobs, DCMS.

[10] Figure 3 is adapted from Bakhshi, H., and Fujiwara, F., (2022) , *'Methods and guidance of measuring use and non-use value: The Economic Value of Culture and Heritage'*, presented at the Culture and Heritage Capital Conference March 11th, 2022.

Source: Guidance Note: How to quantify the public benefit of your Museum using Value estimates, Arts Council England, 2021.[11]

Figure 3 is an example of use and non-use values for regional museums, these values represent the welfare value of the use and non-use value of museums assets. If combined with expected deterioration/damage of museum assets, we could estimate the value of the welfare loss to society of these assets over time.

However, what these values represent needs further research. Very few of the studies in DCMS REA have articulated what is being valued e.g. knowledge, history, reflection, emotions, aesthetics, spirituality, health, pride, wellbeing. To avoid double counting of impact, understanding what use and non-values represent will be important if they are to be combined with other techniques and values e.g. health economics or externalities. This has been identified as a key strand of work in AHRC and DCMS's joint CHC research call.[12]

Heritage Science

As set out in Sagger et al, heritage science focuses on using scientific techniques to understand the care and sustainable usage of objects to allow them to enrich people's lives, both today and in the future. English Heritage Science Strategy (2013) defines Heritage Science as:

Heritage science encompasses all technological and scientific work that can benefit the heritage sector, whether through improved management decisions, enhanced understanding of significance and cultural value or increased public engagement. It covers both conservation research and archaeological science, including remote sensing techniques, scientific dating, environmental archaeology, investigative conservation and materials science. (English Heritage Science Strategy, Jim Williams, Edmund Lee, Gill Campbell 29 October 2013, page 7)

Heritage science will play an essential role within the Culture and Heritage Capital Programme, providing the evidence to estimate the condition of physical assets, how this condition changes over time and how the condition affects the flow of benefits the assets produce. Assets are subject to degradation and damage, but interventions may also cause or stop irreversible damage. It is therefore essential to fully assess the costs of any irreversible damage that may arise or be mitigated from a proposal.

Given the uniqueness or rarity of many culture and heritage assets the loss or degradation of an asset can be seen as an irreversible risk, because once the object is lost the value is irrecoverable or expensive to reverse.

[11]Arts Council Guidance: Culture and Heritage Capital: Lawton, R., Fujiwara, D., Bakhshi, H., Mourato, S., Arber, M., Davies, J. (2021). *'How to quantify the public benefit of your Museum using Value estimates'*, Simetrica Jacobs and Creative Industries Policy and Evidence Centre PEC. Arts Council England.
[12] https://www.ukri.org/opportunity/research-culture-and-heritage-capital-with-an-interdisciplinary-team/

The concept of irrecoverable loss can be examined through the lens of Heritage Science, where the main task is to define "unacceptable change".[13] This can be looked at in two ways:

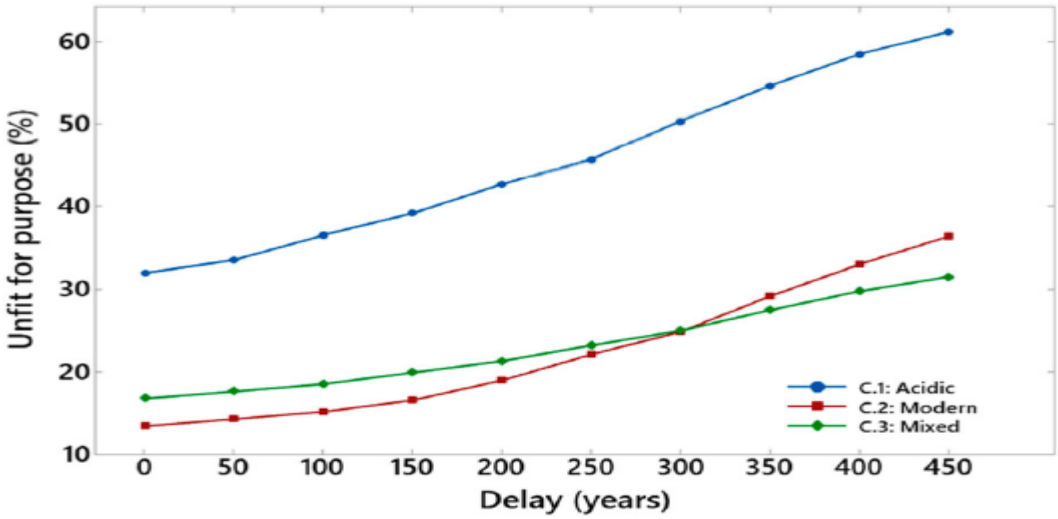
- **Degradation:** is the chemical or physical change of materials. It is expressed as loss of a physical property.

- **Damage:** is the effect of degradation on the value of a material. It is usually expressed as the time taken by a material to reach an unacceptable level of degradation or change.

Culture and heritage assets deteriorate naturally over time. For example, the degradation of museum collections will depend on the materials of which objects are comprised, but also on the conditions in which the objects are stored and or displayed. Without adequate storage conditions and care of the collection the natural deterioration rates could be faster.

Damage functions are used to predict the lifetime for material under different conditions. Figure 4 presents an example of a damage function, which estimates the impact of delaying intervention of treating a collection. In Figure 4 the collection loss predicted by the damage function rises over time to reflect the fact that the longer the delay the higher the damage to the asset collection.

Figure 4: Damage Functions for paper collections



Source: A Comparison of Preservation Management Strategies for Paper Collections, Studies in Conservation[14]

As shown in the next section, these damage functions could be linked to economic valuation, such as use and non-use, to estimate irrecoverable loss and, therefore the impact on the welfare value to society.

[13] These concepts were presented by Professor May Cassar CBE, Professor of Sustainable Heritage, UCL, as part her presentation on Heritage Science and Cultural Value at Valuing Culture at Heritage Capital Conference, March 11, 2022.

[14] Cited by Professor May Cassar, as part her presentation on Heritage Science and Cultural Value: Cristina Duran-Casablancas, Matija Strlič, Gabriëlle Beentjes, Gerrit de Bruin, Jaap van der Burg & Josep Grau-Bové (2021) A Comparison of Preservation Management Strategies for Paper Collections, Studies in Conservation, 66:1, 23-31, DOI: 10.1080/00393630.2020.1790264

Further research will be needed to create a range of damage functions to measure the deterioration of assets without intervention (counterfactual) and the impact of intervening, e.g. care of collection or repair and maintenance of a historic building. These rates will differ from a matter of months to centuries. Therefore determining these damage functions will be a challenge, especially as assets comprise different materials. e.g. stone has a long life (affected by atmospheric pollutants, dust, fluctuations in relative humidity, inappropriate storage) while others such as prints & drawings may have shorter lives (affected by pest attack, mould, atmospheric pollutants, dust, excessive light, ultraviolet radiation, fluctuations in relative humidity, inappropriate storage). These two examples are common to museums, but damage functions would be needed for a range of culture and heritage assets.

The challenge for SCBA is how to bring economic valuation methodology and scientifically based estimates, such as damage functions, together to measure the loss of welfare value, i.e. the counterfactual of not intervening.

AHRC and DCMS's CHC research call has set out the need for further work in this area under strand D: "*combining heritage science and economic valuation to articulate better the impact of care and sustainable usage of heritage assets".*

Apply economic valuation methodologies to heritage science

The Culture and Heritage Capital Programme will bring together the economic methodology and the work of heritage scientists, who are best placed to estimate the impact of protecting assets and therefore rates of degradation and irreversible loss. Damage functions could be combined with economic valuation such as use and non-use to estimate irrecoverable loss and, therefore the impact of welfare value to society.

The welfare value of preventing damage to assets can be estimated by the value of the irrecoverable loss that can be prevented. This can be formulised as:

$$W = N \quad (r_w - r_i)$$

Where:

W = Total welfare gain from avoiding irrecoverable loss.
N = Use and non-use value of assets (other values, e.g. GVA, would need to be added to fully account for the full public welfare).
r_w = rate of irrecoverable loss without an intervention.
r_i = rate of irrecoverable loss with an intervention.

The rate of irrecoverable loss could be replaced by damage functions and applied to the value of welfare of a culture and heritage asset. Adjustments could also be made to account for the proportion of the collection that is avoiding loss.

This method could be applied, for example, to a heritage building or museum storage, where investment in maintenance and conservation is needed to arrest the deterioration to a building or collection. An estimate of the counterfactual would need to estimate the marginal impact of new investment in maintenance. This would need the estimation of damage functions without

maintenance (r_w = rate of irrecoverable loss without intervention) and a new damage function with maintenance (r_i = rate of irrecoverable loss with intervention).

Worked Example 1 - The Welfare Gain of Maintenance:

Assume a hypothetical scenario whereby;

- The use and non-use value of an asset (per annum), $N = £10{,}000{,}000$,
- The rate of irrecoverable loss without an intervention, $r_w = 2\%$,
- The rate of irrecoverable loss with an intervention, $r_i = 1\%$.

The total welfare gain (per annum) from avoiding irrecoverable loss, W , can be calculated by;

$$W = £10{,}000{,}000\ (\ 0.02 - 0.01\ ) = £100{,}000$$

Alternatively;

$W_{no\ intervention} = £10{,}000{,}000 * 0.02 = £200{,}000$ (welfare lost per annum)
$W_{intervention} = £10{,}000{,}000 * 0.01 = £100{,}000$ (welfare lost per annum)

The difference between the two is equivalent to the avoided welfare loss;

$$W = £200{,}000 - £100{,}000 = £100{,}000$$

Also, the welfare impact of avoiding deterioration through a new maintenance would be:

$$\begin{aligned} W &= N\ [(\ r_w - r_n\ ) - (\ r_w - r_i\ )] \\ &= N\ (\ r_i - r_n\ ) \end{aligned}$$

Where:

W = Total welfare loss avoided, with new investment in maintenance and conservation.
N = use and non-use value of collection.
r_w = rate of irrecoverable loss without maintenance and conservation.
r_i = rate of irrecoverable loss with status quo maintenance and conservation.
r_n = rate of irrecoverable loss with improved maintenance and conservation investment.

This calculation can be made more accurate by using damage functions for different types of material and assets. This method assumes a relationship exists between values captured in economic valuation methodologies and damage functions; further research is needed to examine the relationship between damage functions and economic valuation together.

Worked Example 2 - The Marginal Welfare Gain of Improved Maintenance:

Assume a hypothetical scenario whereby;

- The use and non-use value of an asset (per annum), $N = £10{,}000{,}000$,
- The rate of irrecoverable loss without an intervention, $r_w = 2\%$,
- The rate of irrecoverable loss with an intervention, $r_i = 1\%$.
- The rate of irrecoverable loss with new maintenance and conservation, $r_n = 0.5\%$.

The total welfare gain (per annum) from avoiding irrecoverable loss through new maintenance, W, can be calculated by;

$$W = £10{,}000{,}000\ (\ 0.01 - 0.005\ ) = £50{,}000$$

Alternatively;

$W_{no\ intervention} = £10{,}000{,}000 * 0.02 = £200{,}000$ (welfare lost per annum)
$W_{old\ intervention} = £10{,}000{,}000 * 0.01 = £100{,}000$ (welfare lost per annum)
$W_{new\ intervention} = £10{,}000{,}000 * 0.005 = £50{,}000$ (welfare lost per annum)

The difference between the two intervention scenarios (old and new) is equivalent to the avoided welfare loss;

$$W = (£200{,}000 - £100{,}000) - (£100{,}000 - £50{,}000) = £50{,}000$$

Risk assessment and real options analysis

Further research could also consider the inclusion of risk assessments into this approach to create risk-based Net Social Present Value. This would add a welfare approach like CCI/ICC and ICCROM's *ABC Method*.[15] This approach could be used to value situations where the probability of loss increases over time due to increased probability of a one off event leading to a catastrophic loss (e.g. fire) or a series of events.

The ABC method looks to estimate the probability (likelihood) of an event occurring, and the severity and scale of impact in terms of the fraction or whole of asset. When combined with financial cost and welfare values (impact) the approach could be used to estimate a risk adjusted NSPV. The latter is important when dealing with interventions that may require a high financial costs, but the loss of social welfare is depended on probability of an event occuring.

[15] Michalski, S., & Pedersoli Jr. J.L. (2016), *'ABC Method'*, Canadian Conservation Institute and ICCROM.

This approach could draw on Real Options Analysis. This can be useful where decisions are complex and help clarify alternatives where decisions taken are either irrevocable or expensive to reverse. Decision trees can be used to map out the sequence of interventions/decision points, they require probabilities and can be combined with social costs and benefits to estimate impact.

Conclusions

The Culture and Heritage Capital Programme aims to bring together economic methodology and the work of heritage scientists.

As well as the need to develop damage functions for a range of assets, more research is needed to understand how economic methodology can be appropriately linked to these functions. This was a key challenge set out in Sagger *et al* and the AHRC and DCMS' scoping study on culture and heritage capital. [16] The specific challenges of taking forward this method are:

- Research to construct a definition of 'r' (irrecoverable loss).
- Developing a range of damage functions to cover different assets and situations.
- Understanding the link between damage functions and value i.e how valuation of assets through economic valuation link are affected by marginal changes in deterioration and interventions to mitigate loss. The relationship is unlikely to be linear.
- How the approach can be applied to non-use values. The challenge is how non-users react to marginal changes to assets that they do not visit. More generally non-use values need further research and AHRC and DCMS have included this as Strand C in the CHC call: *"defining and incorporating non-use values into social cost benefit analysis and cultural and heritage capital accounting".*
- How risk assessments and real options analysis approach set out in the HMT's Green Book could be included within this analysis.

However, despite these challenges an approach linking heritage science and economic methodology is critical to demonstrate value for money of ongoing conservation, protection, repair and maintenance of cultural and heritage, when organisations are required to undertake social cost benefit analysis.

[16] AHRC and DCMS Scoping culture and heritage capital research AHRC and DCMS Scoping Culture and Heritage Capital Report: Kaszynska, P., Coyle D., Dwyer E., Lawton R., Riganti P., Watson S., Dâmaso M., Wang Y., (2022), '*Scoping culture and heritage capital report',* AHRC & DCMS.