UNBOXED

CREATIVITY IN THE UK

ANNEX 3: EVALUATION TECHNICAL METHODOLOGY

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CONTENTS

1 INTRODUCTION TO THE ECONOMIC EVALUATION TECHNICAL APPENDIX

As set out in the UNBOXED Evaluation and Monitoring Plan[1] included in Annex 2 to the UNBOXED Evaluation Report, the economic evaluation estimates the value of impacts (costs and benefits) and involves an analysis of the costs and benefits of UNBOXED to assess the extent to which the UNBOXED programme as a whole has delivered value for money.[2]

The economic evaluation is conducted at the programme level and does not assess each of the ten commissions individually.

As per HM Treasury Green Book[3] guidance, the economic evaluation seeks to consider the public value of all significant costs and benefits of UNBOXED that affect the welfare and wellbeing of the population, as well as market effects[4]. In line with the Green Book guidance, efforts have been made to monetise these costs and benefits where possible and proportionate to do so.

This technical annex to the UNBOXED Evaluation provides details of the methodologies used to estimate the monetised costs and benefits of UNBOXED. Non-monetisable costs and benefits have been assessed and are reported qualitatively as part of the economic evaluation.

Specifically, this technical annex details the approach to estimating the following areas of monetised costs and benefits, including assumptions applied and sources of evidence drawn upon:

- **Economic costs of delivering UNBOXED** (see Section 2);
- **Economic benefits generated from UNBOXED organiser spend** on the set-up and delivery of UNBOXED, measured in terms of GVA and employment (see Section 3);
- **Economic benefits associated with spending by attendees and participants** attending UNBOXED live events, measured in terms of GVA and employment (see Section 4);
- **Welfare benefits to attendees** to UNBOXED live events[5], associated with cultural participation and engagement (see Section 5);
- **Welfare benefits to UNBOXED participants** associated with cultural participation and engagement (see Section 6);
- **Welfare benefits to UNBOXED digital and broadcast audiences**[6] as a result of engagement with creative and cultural content (see Section 7);
- **Welfare benefits to UNBOXED volunteers** associated with the volunteering experience (see Section 8);
- **Benefits to schools and students of engagement with UNBOXED learning content and provision**7 (see Section 9)
- **Economic benefits of R&D investment** in the form of potential future economic returns to R&D (see Section 10). Note these are not included in the core results as they have not yet materialised.

Other than analysis of the potential future returns to R&D, the analysis considers costs and benefits realised between September 2018 (when UNBOXED was announced) and December 2022. All values are reported in 2022 prices, adjusted based on the GDP deflator.[8]

1 UNBOXED: Creativity in the UK. Evaluation and Monitoring Plan
2 The National Audit Office (NAO) considers value for money under 4 criteria: Economy, Efficiency, Effectiveness and Equity. Only consideration of Effectiveness and Equity are within the scope of this evaluation.
3 The Green Book (2022) - GOV.UK (www.gov.uk)
4 Market effects refer to changes that can be measured through market values.
5 Live attendance includes attending in person at indoor and outdoor events, installations, exhibitions, and community celebrations.
6 Including participation in augmented or virtual reality activities; watching artistic multimedia content produced for TV, cinema, online, streaming, and screen; listening to newly commissioned audio and visual digital artworks; participating in online creative scientific research and gaming content; and the use of digital applications created as part of the projects.
7 Learning engagement includes a wide range of educational and participatory activities, such as: school workshops; use of learning resources (e.g. lesson plans and home resources); school trips to installations and educational events; and teacher Continuous Professional Development.
8 GDP_Deflators_Autumn_Statement_November_2022_update.xlsx (live.com)

2 ANALYSIS OF THE ECONOMIC COSTS OF UNBOXED

Economic costs of UNBOXED are assessed based on the total operating expenditure incurred in delivering UNBOXED between September 2018 and December 2022.

This includes the following elements of expenditure:

- Spending by the 30 project teams on R&D activity during the R&D phase;
- Spending by the 10 commissions on project development and delivery;
- Spending by the Festival Company on:
    - programme set up and administration;
    - support for learning and participation activity;
    - programme creative engagement workstream activity;
    - programme-level marketing and communications;
- Spending by Funders and Strategic Delivery Bodies on set up and oversight of the programme.[9]

It should be noted that the total UNBOXED expenditure included irrecoverable VAT.[10] As set out in the HM Treasury Green Book[11], transfers of resources between people, including taxes, should be excluded from the overall estimate of Net Present Social Value (NPSV).

The total economic cost of UNBOXED is therefore estimated by taking the total cash value of expenditure by the UNBOXED programme, excluding unrecoverable VAT, by year. For the purposes of the analysis this is then adjusted to 2022 prices using the GDP deflator[12].

9 Investigation into the UNBOXED festival (nao.org.uk)
10 Investigation into the UNBOXED festival (nao.org.uk)
11 The Green Book (2022) - GOV.UK (www.gov.uk)
12 GDP_Deflators_Autumn_Statement_November_2022_update.xlsx (live.com)

3 APPROACH TO ESTIMATING ECONOMIC IMPACTS GENERATED THROUGH UNBOXED ORGANISER SPEND

3.1 Overview of the approach to economic analysis of UNBOXED organiser spend

The economic impacts generated through spending on the delivery of UNBOXED, in the form of GVA and employment, were estimated based on HR and procurement data provided by Festival 2022 Limited (the 'Festival Company') and the 10 creative teams.

The methodologies employed in this analysis follow recognised economic impact analysis methodologies, such as those set out in HM Treasury's Green Book[13] and approaches specified by the ONS[14, 15].

The economic impacts associated with organiser spending on the delivery of UNBOXED were estimated in terms of:

- **Direct economic impacts** arising as a result of the direct activity undertaken to deliver UNBOXED, including the activity by the individual creative teams to deliver their creative programmes and the additional activity of UNBOXED and strategic partners[16] to deliver the UNBOXED programme level activity, including Learning and Participation activity, its Creative Engagement Programme and supporting marketing and communications activity.

- **Indirect economic impacts** as a result of spending with suppliers to the Festival Company and creative teams. This supplier spending generated economic activity within the full UK supply chain to produce the goods and services used to deliver UNBOXED, generating indirect employment and GVA in the UK economy as a result.

- **Induced economic impacts** generated as a result of the spending of wages in the UK economy by those directly and indirectly employed through the delivery of UNBOXED. This spending generates additional economic activity for those businesses from which these employees buy goods and services as well as in the UK supply chains for these businesses, generating associated induced employment and GVA

All of the results of the analysis are presented in 2022 prices. The spend data received from the Festival Company and the creative teams was inflated to 2022 prices using the GDP deflator for 2020 to 2022.[17]

13 HM Treasury (2020) The Green Book; See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf
14 UK input-output analytical tables - product by product - Office for National Statistics (ons.gov.uk)
15 Regional gross value added (income approach) QMI - Office for National Statistics (ons.gov.uk)
16 Including the funders and Strategic Delivery Bodie
17 GDP_Deflators_Autumn_Statement_November_2022_update.xlsx (live.com)

3.2 Approach to estimating the GVA impacts generated through UNBOXED organiser spend

3.2.1 Approach to direct GVA impact estimates

Direct GVA was generated as a result of direct activity undertaken to deliver UNBOXED, including activity by the Festival Company to deliver the programme-level activity and the activity of the creative teams to organise and deliver the individual commissions.

Direct GVA at the industry or organisational level can be measured through either the income approach or the production approach.[18]

To estimate the direct GVA generated by the Festival Company and the creative teams to deliver UNBOXED, the analysis used the income approach to estimation, where:

$$Direct\ GVA = Net\ pre-tax\ profit + Compensation\ of\ Employees + Depreciation + Amortisation$$

Given that UNBOXED is non-profit making, using the formula above, there is no pre-tax profit, so the direct GVA was estimated based on compensation of employees. Due to a lack of data and as the amounts would not be expected to be significant due to the nature of activity, for the purposes of the analysis is assumed that there is no depreciation or amortisation.

The data for the compensation of employees was provided by the Festival Company and each of the creative teams from the respective payroll systems and financial accounts.

The payroll data provided covered the whole period from 2020 to 2022 and was not available on an annual basis. In order to estimate the direct GVA for each year over this period (and therefore allow for the correct deflators to be applied) the total payroll costs were allocated based on the distribution of total employment over the period. The number of full time equivalent (FTE) employees in each year was divided by the sum of annual FTEs over the period and this ratio was used to distribute payroll costs (i.e. direct GVA) for UNBOXED and each commission by year.

The total direct GVA associated with the spending on the delivery of UNBOXED was then estimated by summing the direct GVA generated by the Festival Company and each of the creative teams.

3.2.2 Approach to indirect GVA impact calculations

The indirect GVA impacts referred to in the report consist of:

- The indirect GVA impact generated by the direct UK suppliers that the Festival Company contracted with to deliver UNBOXED, and the indirect GVA impact generated by the direct suppliers' own UK supply chains.
- The indirect GVA impact generated by the UK direct suppliers of the 10 creative teams to deliver their creative programmes, and the indirect GVA impact generated by the direct suppliers' own UK supply chains.

To inform the analysis of the indirect impacts generated through the procurement spend to deliver UNBOXED, the Festival Company and each of the creative teams provided data on their procurement spend between 2020 and 2022, including a description of the procurement category and the amount of spend in each category. The Festival Company assigned a SIC code[19] to the procurement category based on the sector that best aligned to the description of the spend.

18 ONS, 'Measuring the economic impact of an intervention, Paper One', 2010. Available from: http://webarchive.nationalarchives.gov.uk/20160105160709/http://ons.gov.uk/ons/rel/regional-analysis/measuring-the-economic-impact-of-an-intervention-or-investment/measuring-the-economic-impact-of-an-intervention-or-investment/economic-impact--paper-one.pdf

19 This classification is used in classifying business establishments and other statistical units by the type of economic activity in which they are engaged.. See: UK SIC 2007 - Office for National Statistics (ons.gov.uk)

Separately the Festival Company and each creative teams provided supplier data between 2020 and 2022, including a description of the services provided, the amount of spend with each supplier and where possible the location of each supplier. It should be noted however, that the supplier procurement data did not cover the full procurement spend of the Festival Company and commissions. As a result the supplier data was used to provide an estimate of the proportion of spend in each year and the proportion of spend with non-UK suppliers.

As noted above in Section 3.1, postcode data was not provided for a large proportion of the suppliers (52% of total procurement spend). To address this desktop research was undertaken to identify the postcodes for the suppliers for which postcode data was not provided, primarily using data from the Companies House. Following the completion of the desktop research, postcode data for suppliers making up 95% of supplier spend was identified. Where a supplier's location was not provided or identified through desktop research, it has been assumed that this spend followed the same geographical profile of spend for which data was available. Based on this data, the proportion of UK supplier spend was estimated and applied to the total procurement spend in order to account for any leakage outside of the UK economy.

The indirect GVA associated with this spend with direct UK (tier 1) suppliers to the Festival Company and the creative teams (indirect tier 1 GVA) was estimated by converting the spend into UK GVA using the relevant industry specific GVA to Output ratio sourced from the ONS[20].

$$\textit{Indirect tier 1 GVA generated through the Festival Company and commission team's UK activities} = \sum_{i=1}^{n} \textit{Festival Company and commission teams tier 1 UK supplier spend in sector } i * (\textit{GVA to output ratio for sector } i)$$

Where n equals the total number of suppliers

To estimate the indirect GVA associated with the wider UK supply chain, beyond the tier 1 suppliers, the relevant industry specific GVA multipliers from the ONS[21] were applied to the UK indirect tier 1 GVA, based on the SIC code of the procurement category.

$$\textit{Indirect wider supply chain GVA generated through the Festival Company and commission teams' activities} = \sum_{i=1}^{n} \textit{Indirect tier 1 GVA for sector } i * (\textit{sector Type I GVA multiplier for sector } i - 1)$$

Where n equals the total number of sectors

The total indirect GVA associated with the delivery of UNBOXED was then estimated by summing the UK indirect tier 1 GVA and indirect wider supply chain GVA.

3.2.3 Approach to induced GVA impact calculations

Induced GVA was estimated using Type II GVA multipliers derived from the ONS Input-Output tables.

Typically, Type II multipliers are applied to direct GVA and estimate the total indirect and induced GVA impact. Therefore, to isolate the induced GVA, the indirect GVA (based on the Type I multiplier) needs to be removed from the estimate.

$$\textit{Induced GVA} = \sum_{i=1}^{n} \textit{Direct GVA} * (\textit{Type II GVA multiplier for sector } i - \textit{Type I GVA multiplier for sector } i)$$

Where n equals the total number of sectors

The induced GVA was generated through two channels: the induced GVA generated through the spending of the wages and salaries of the Festival Company and commissions' direct employees; and the induced GVA generated through the spending of the wages and salaries of the employees' of suppliers (indirect employees).

20 ONS (2019) Input–output supply and use tables
21 ONS, 2015 Input-Output Analytical Tables, Multipliers and effects (product)

To estimate the induced GVA generated through the employment of the Festival Company and commissions, the above formula was applied to the estimated direct GVA for the Festival Company and commissions teams using the Type I and II multipliers for SIC code 90[22].

As the approach above also estimates the induced GVA generated through supply chain activity, to isolate the estimated induced GVA generated through the direct activities of the Festival Company and commissions, the induced GVA as estimated using the approach detailed above was scaled down to remove the element that relates to induced GVA from supply chain activity using the below formula:

$$Scale\ down\ factor = \frac{1}{Sector\ specific\ Type\ I\ GVA\ multiplier}$$

The induced GVA generated through the employment of the tier 1 suppliers and wider supply chain was estimated by applying the sector specific Type II GVA multipliers to the estimated sector specific indirect tier 1 GVA impacts (see Section 3.2.2) as per the induced GVA formula above.

The total induced GVA associated with spending on the delivery of UNBOXED was then estimated by summing each of the areas of induced GVA detailed above.

3.3 Approach to estimating the employment impacts generated through UNBOXED organiser spend

3.3.1 Approach to direct employment estimates

Direct employment was generated as a result of the Festival Company and the creative teams employing permanent employees and contractors to deliver UNBOXED.

The Festival Company and each individual commission provided data on the number of staff and contractors employed in the delivery of UNBOXED, including the number of days worked between 2020 and 2022, cost per day and total employment cost.

In some instances only the total employment cost was provided by the Festival Company and commissions. In order to account for the gaps in the data, the total number of days worked across all employees was estimated based on the average cost of employment per day for those employees where data was provided. This was then applied to the total workforce costs to estimate the total number of days worked.

The total number of days worked was converted into FTE years by dividing it by the number of working days per year.

3.3.2 Approach to indirect employment estimates

The employment impacts in the tier 1 supply chain of the Festival Company and the creative teams were estimated based on the approach to estimating indirect tier 1 GVA impacts (see Section 3.2.2 for details). These indirect GVA impacts were converted into FTEs using industry specific GVA per FTE ratios.[23]

$$Indirect\ Tier\ 1\ employment\ = \sum_{i=1}^{n} Indirect\ tier\ 1\ GVA\ for\ sector\ i * (GVA\ per\ FTE\ ratio\ for\ sector\ i)$$

$$Where\ n\ equals\ the\ total\ number\ of\ sectors$$

22 SIC code 90 refers to 'Creative, arts and entertainment activities'.
23 Estimated based on GVA by sectors sourced from UK input-output analytical tables - product by product - Office for National Statistics (ons.gov.uk) and employment by sector sourced from Industry (two, three and five-digit Standard Industrial Classification) – Business Register and Employment Survey (BRES): Table 2 - Office for National Statistics (ons.gov.uk).

Employment in the wider supply chains of the Festival Company and the creative teams was estimated by taking the estimated employment for tier 1 suppliers and applying the applicable sector's Type 1 employment multiplier.[24]

$$Indirect\ Tier\ 1\ employment\ = \sum_{i=1}^{n} Indirect\ tier\ 1\ GVA\ for\ sector\ i * (GVA\ per\ FTE\ ratio\ for\ sector\ i)$$

$$Where\ n\ equals\ the\ total\ number\ of\ sectors Indirect\ wider\ supply\ chain\ employment = \sum_{i=1}^{n} Indirect\ tier\ 1\ employment\ for\ sector\ i * (Type\ I\ employment\ multiplier\ for\ sector\ i - 1)$$

$$Where\ n\ equals\ the\ total\ number\ of\ sectors$$

The total indirect employment associated with the delivery of UNBOXED was estimated by summing the indirect tier 1 employment and the indirect wider supply chain employment.

3.3.3 Approach to induced employment impact calculations

Finally, the planning and delivery of UNBOXED also generated induced employment in the UK economy. This was generated through the Festival Company employees and those employed by each of the individual creative teams, as well as the employees supported in the supply chains associated with these, spending a proportion of their wages on UK goods and services.

Similar to the estimation of induced GVA set out in Section 3.2.3, induced employment can be generated through two channels: the induced employment generated through the spending of the wages and salaries of the Festival Company and commissions' direct employees; and the induced employment generated through the spending of the wages and salaries of the employees' of suppliers (indirect employees).

To estimate the induced employment generated through the Festival Company and commissions, the below formula was applied to the estimated direct FTE employment for the Festival Company and commissions teams using the Type I and II multipliers for SIC code 90[25].

$$Induced\ employment = \sum_{i=1}^{n} Direct\ FTEs * (Type\ II\ employment\ multiplier for\ sector\ i - Type\ I\ employment\ multiplier\ for\ sector\ i)$$

$$Where\ n\ equals\ the\ total\ number\ of\ sectors$$

As the approach above also estimates the induced employment generated through supply chain activity, to isolate the induced employment generated through the Festival Company and commissions, the induced employment estimated as detailed above was scaled down to remove the element that relates to induced employment from supply chain activity using the below formula:

$$Scale\ down\ factor = \frac{1}{Sector\ specific\ Type\ I\ GVA\ multiplier}$$

The induced employment generated through the tier 1 suppliers to the Festival Company and commissions and the wider supply chains was then estimated by applying the sector specific Type II employment multipliers to the estimated sector specific indirect tier 1 employment impacts (see Section 3.3.23.2.2) as per the induced employment formula above.

The total induced employment associated with the planning and delivery of UNBOXED was estimated by summing the two areas of induced employment detailed above.

24 UK input-output analytical tables - product by product - Office for National Statistics (ons.gov.uk)
25 SIC code 90 refers to 'Creative, arts and entertainment activities'.

4 APPROACH TO ESTIMATING THE ECONOMIC IMPACTS GENERATED THROUGH UNBOXED ATTENDEE AND PARTICIPANT SPEND

4.1 Overview of the approach to analysis of attendee and participant spend

The economic impacts generated by attendees and participants to the 10 UNBOXED commissions' live events ("commission live events") were estimated based on:

- UNBOXED commission live attendee surveys: these surveys were commissioned by the Festival Company and provided information on the spending behaviour of attendees (including Green Space Dark Sky Lumenators which for the purposes of this element of analysis are treated as attendees) whilst attending the live events, to enable the estimation of additional expenditure of attendees. This data was obtained from attendees to 9 out of the 10 commission events26 (including data from Lumenators participating in the Green Space Dark skies commission). Details of the surveys undertaken and the sample sizes for each are included in Annex 4.
- Attendance and participation data: data on numbers of participants were provided through commission monitoring data whilst the number of attendees to commission live events was sourced from crowd counts. Details of the approach to estimating attendance at the live events is provided in Annex 8.
- National statistics sourced from the ONS.

The economic impacts are reported in terms of:

- estimated attendee and participant spending in the local and national economies as a result of attending the live events (see Section 4.2);
- the direct, indirect and induced GVA associated with the spend (see Section 4.3);
- the direct, indirect and induced employment associated with the spend (see also Section 4.3)

Total gross spending by attendees to the live events, and the associated gross GVA and employment impact, is adjusted to take account of what attendees estimate they would have spent anyway if they had not attended/ participated in an UNBOXED live event, and where, to arrive at the estimated net spend by attendees (see Section 4.4).

4.2 Approach to estimating total gross UNBOXED attendee and participant spend

As part of the commission live attendee surveys, respondents were asked to provide an indication of how much they (and their party i.e. the person being surveyed and the people they were attending the commission with, where applicable) had collectively spent in the following spend categories associated with their attendance:

- Accommodation;
- Food and drink;
- Entertainment;
- Travel and transport in the area;
- Shopping;
- Other.

26 Data for StoryTrails was not obtained as this survey was undertaken by the commission themselves and the relevant questions were not included.

As noted above, this data was obtained for all commissions other than StoryTrails.

From this spend data, the total average daily spend of all respondents and their party (where applicable) was calculated.

This data was then divided by the total number of respondents (including the number of people in their respective party) who provided data on spending whilst attending the events in order to give the average daily spend per attendee at the UNBOXED live events.

As stated above, the average spend for StoryTrails, by category of spend, was estimated by taking the average spend across commissions, excluding Green Space Dark Skies Lumenators. This data was excluded from the average as the length of engagement of Lumenators is not typical of the attendees to the other commissions, including StoryTrails.

The number of live attendees to each commission was provided by UNBOXED27 and used to scale up the average daily spend per attendee for each commission.

The total spend incurred by attendees to the UNBOXED live events, for each commission, was estimated as follows:

$$\textit{Total attendee spend per commission} = \textit{Average daily spend per commission attendee} * \textit{Live commission attendees}$$

In terms of participant spend, a subset of participants that were expected to have incurred costs in participating in the commissions were identified by UNBOXED based on the nature of their engagement (excluding Green Space Dark Skies Lumenators already captured in the attendee analysis). As per the approach for StoryTrails, the average spend across all commissions was applied to the subset of participants.

The total spend incurred by participants to the UNBOXED live events was estimated as follows:

$$\textit{Total participant spend} = \textit{Average attendee spend} * \textit{Live commission participants who incurred costs}$$

The total attendee spend for each commission and the total participant spend were then combined to estimate the total spend for the UNBOXED live events:

$$\textit{Total attendee and participant spend for UNBOXED live events} = \textit{Total attendee spend} + \textit{total participant spend}$$

4.3 Approach to estimating gross GVA and employment impacts from UNBOXED attendee and participant spend

To estimate the GVA impacts associated with the spending of UNBOXED live attendees, the estimated total attendee spend for each commission was used.

In order to convert the attendee and participant spend into direct GVA, SIC codes were assigned to each category of attendee spend (see Table 1 below).

27 See Annex 8 for details of the methodology used to estimate live attendance at commission events.

Table 1: SIC spend categories

Survey categories	SIC Code	Description of SIC Code
Accommodation	55	Accommodation services
Food and drink	56	Food and beverage serving services
Entertainment	93	Sports services and amusement and recreation services
Travel and transport in the area	49.3	Other passenger land transport[28]
Shopping	47	Retail trade services, except of motor vehicles and motorcycles
Other	96	Other personal service activities[29]

Source: ONS

The total value of attendee spend in each spend category was then converted into direct GVA using the relevant industry specific GVA to Output ratio for the associated SIC Code sourced from the ONS[30].

Indirect and induced GVA were estimated by applying the relevant sector specific Type I and Type II GVA multipliers to the estimated direct GVA associated with each spend category.

To estimate the direct employment associated with the attendees' spending, the sector specific GVA per FTE31 ratios were applied to the estimated direct GVA impacts associated with the spend.

Indirect and induced employment were then estimated by applying sector specific Type I and Type II employment multipliers to the estimated direct employment associated with each spend category.

4.4 Approach to estimating the total net spend of UNBOXED attendees and participants and the associated net GVA and employment impacts

Section 4.2 above details the approach taken to estimate the actual (gross) spending of UNBOXED live attendees and participants. However, some of this spending may have occurred at the expense of spending on an alternative activity which would have been undertaken instead. Since individual spending is constrained by personal budgets, particular attention is made to control for the displacement of impacts associate with such spending. HM Treasury describes displacement as 'the extent to which an increase in economic activity […] is offset by reductions in economic activity,' giving the example of one business capturing market share from another.

In order to understand the additional economic impact for the UNBOXED live events locations and the UK, the level of expenditure incurred by UNBOXED live attendees and relevant participants that was over and above what would otherwise have been spent on any alternative activities has been assessed.

This assessment is based on evidence obtained via the UNBOXED live attendee survey. Respondents were asked about what, if anything, they would have spent in each category of spend had they not attended UNBOXED live events, and where geographically (within the UNBOXED live event location, elsewhere in the nation/ wider area, or elsewhere in the UK) this spend would have been.

28 This includes urban, suburban or metropolitan area passenger railway transportation by underground, metro and similar systems; urban, suburban or metropolitan area passenger land transport other than railway transportation by underground, metro and similar systems; and taxi operation. This is considered appropriate given the range of transport used to attend the events. Whilst this does not explicitly include private car transport, the supply chains associated with this would be expected to be similar to taxi operation.
29 This includes hairdressing and beauty treatments.
30 ONS (2019) Input–output supply and use tables
31 To estimate the sector average GVA per employee, in FTE terms, we had to first estimate the number of FTEs for each SIC code as the ONS does not publish FTE breakdown by industry. We estimated this using total employment figures from the ONS Business Register and Employment Survey 2019, which states both full-time and part-time employment figures which was converted to FTE using an FTE conversion factor based on the average number of hours work per week by part-time workers sourced from the ONS. This figure was then used to estimate the GVA per FTE.

Based on this, by taking the difference between the actual spend of the respondents, and what they would have otherwise spent had they not attended UNBOXED live events, the additional non-displacing spend of the UNBOXED live attendees and participants was estimated.

The additional spend was estimated at the local level of the UNBOXED live events and at the UK level by taking into consideration where the UNBOXED live attendees would have otherwise spent money had they not attended UNBOXED live events.

The additional spend at the local level of the UNBOXED live events and UK level was then converted into GVA and employment following the methodology detailed in Section 3.

It should be noted that in terms of the UK level impacts, the analysis is based on the responses of respondents to the survey in terms of alternative spending had they not attended the live events. However, it is recognised that as attendees have finite incomes and budgets available for discretionary spending and any spending incurred attending the UNBOXED events is likely to a large degree to replace spending on other activities within the UK.

5 APPROACH TO ESTIMATING THE WELFARE VALUE OF UNBOXED ATTENDANCE

5.1 Survey methodology

To inform the estimation of the welfare value of the UNBOXED creative programme, based on the use value of the programme, a contingent valuation approach was adopted to elicit the willingness to pay (WTP) of users for their UNBOXED experience.

To provide the data inputs to the WTP analysis UNBOXED commissioned an independent research agency to conduct a survey of attendees including application of a contingent valuation survey methodology in order to provide validated results to inform the WTP analysis.

Annex 4 provides details of the methodology implemented by an independent research agency as part of this study.

Surveys for the WTP approach were gathered via both interviewer-led (face-to-face surveys) and self-completion methods (e.g. online). In total a sample of 1,542 was achieved for the WTP survey questions with responses obtained from attendees across 8 of the 10 commissions. Whilst the total sample of meets the threshold for high quality WTP analysis (based on the criteria set out in the DCMS Rapid Evidence Assessment: Culture and Heritage Capital Valuation Studies32) samples for individual commissions are not large enough to provide robust results on a commission-by-commission basis.

5.2 Tests undertaken to check the validity of survey results

5.2.1 Review of survey data

The WTP analysis used a scorecard approach, with incremental values used from £0 to £80. As a scorecard approach can be seen as collecting a lower bound of attendee use value. For final estimation of the welfare value the average between the value given and the next highest value on the scorecard was used. For instance, where a response of £5 was given and the next highest value was £6, this was transformed into an estimated use value of £5.50. This approach has been adopted across many recent WTP studies. [33]

The results of the analysis were reviewed looking at unweighted data and weighted data for mean welfare value, mean non-zero welfare value and the share of sample with non-zero welfare value. This analysis showed that the applications of weights had a modest impact on the use values and the share of those recording zero welfare values.

Weighted welfare values34 obtained from the an independent research agency surveys ranged from £6.02 to £14.75 across the eight studied commissions, with five of the studied commissions having values clustered around £6.50 (lower-WTP-commissions), and three commissions having average use values above £10 (higher-WTP-commissions).

Alongside the average welfare values, it is important to understand the distribution of welfare values recorded. Review of the distribution of use values showed a high proportion of values given were for values of £5 and £10 for all but two commissions (which were also two of the commissions with higher use values associated with them). It could be suggested that this indicates that the decision of the respondents selecting £5 as their highest use value perceived £10 as the next highest value (ignoring any intermediate options). This would suggest a true welfare value somewhere between the £5 and £10. However, it was considered that there was insufficient evidence to be certain of this behaviour. Therefore, as a conservative assumption £5 answers have not been re-coded at the £7.50 level but remain at £5.50.

32 DCMS 2020, See: https://www.gov.uk/government/publications/rapid-evidence-assessment-culture-and-heritage-valuation-studies
33 These studies include: DCMS (2018) The Economic Value of Culture: A Benefit Transfer Study (publishing.service.gov.uk); and Arts Council England (2021) Regional Galleries and Theatres Benefit Transfer Report
34 See Annex 9 for more details of the approach taken to weighting of the data.

In general, the analysis of the different distributions of welfare values observed across the commissions was considered consistent with the nature of each commission, and supportive of the view that the WTP surveys were successful in capturing the actual welfare values of attendees.

Analysis was also undertaken of outliers in the results. Where outliers were identified, consideration was given to the reasons provided by the relevant respondents as to why they were willing to pay the value stated. Based on this analysis, it was considered that the outliers which remained within the cleaned data35 provided represented valid responses and were justified based on the reasons provided in the survey responses for being willing to pay the amount stated (e.g. based on the fact attendees reported that they had experienced a full day at the location and also based on the nature of the experiences).

5.2.2 Expectations-based validity

To further explore the validity of the welfare values gathered, the relationship between the reported values and the following commonly identified variables that are typically positively correlated with welfare values was examined:[36]

- Household income; and
- Self-reported certainty of welfare value estimate (by survey respondents).

When estimating willingness to pay values statistically, the resulting equations are known as a 'bid function'.[37] A bid function estimating positive welfare values was generated using the above variables, along with seven of the eight commissions as dummy variables.

Bid Function Equation:

$$\log_{10}\widehat{WTP_i} = \alpha + \beta_1 \log_{10} Income_i + \beta_2 Certainty_i + \beta_3 D_{i,1} + \cdots + \beta_9 D_{i,7} + \varepsilon_i$$

Where $D_{i,j}$ are dummy variables taking the values 0 or 1, indicating the relevant commission and $WTP_i > 0$

Table 2: Factors associated with welfare values

Coefficient	Estimate	Std. Error
Intercept	0.523***	0.076
Certainty (dummy variable for certainty greater than 70%).	0.086***	0.021
Log Income	0.124**	0.039
Commission #1	0.225***	0.042
Commission #2	0.348***	0.067
Commission #3	0.293***	0.045
Commission #4	0.065	0.053
Commission #5	-0.002	0.044
Commission #6	-0.085†	0.048
Commission #7	-0.022	0.050

*** significance at <0.1%, ** significance at <1%, * significance at <5%, † significance at <10%. Two-sided t test. Adjusted R-squared: 0.219. Observations, 1,032. Reference group = commission #8 attendees.

35 See Annex 9 for more details of the approach taken to data cleaning.
36 14.13, HMT (2013), Green Book supplementary guidance: stated preference techniques - GOV.UK (www.gov.uk)
37 15.14, HMT (2013), Green Book supplementary guidance: stated preference techniques - GOV.UK (www.gov.uk)

The coefficients of the bid function were estimated with the R Stats package.[38] Six coefficients[39] were found to be statistically significant with a significance level below 1%,[40] including those for:

- the three higher-value-commissions (commissions #1-3);
- the log of income (taken from the midpoint of income bands);
- reported certainty of the provided estimate being above 70%; and
- the intercept.

The positive relationships found between the reported use values and higher levels of certainty and income support the validity of the reported use values collected through the survey. This is because these relationships are expected to be present in valid WTP data. These relationships are observed across many WTP studies[41] and testing for the presence of such relationships is recommended in the Green Book Supplementary Guidance.[42]

5.2.3 Convergent validity

Checking for convergence with other measures of value is a further test for the validity of the results of a WTP study.[43]

The Culture and Heritage Capital Evidence Bank[44] provides summaries and values from a large number of studies employing 'economic approaches for monetary valuation of culture and heritage assets.' There were 181 values in the April 2022 version of the evidence bank.[45]

These 181 values were filtered to capture only those where:

- a stated preference contingent valuation approach is applied;
- individual (as opposed to aggregate or household) values are reported;
- values relate to full experiences, rather than incremental changes to the experience;
- the valuation frequency is 'per visit';
- international values have been adjusted for purchasing power parity; and
- the overall quality rating is medium or high,

Following this filtering there are 7 remaining values for reference - see Table 3 below.

These reported use values range from £2.39 for access to a botanical garden to £12.40 for entrance to a gallery. Across the studies the mean welfare value is £6.79. This value is consistent with the mean welfare values observed across the 5 lower value commissions, whilst the observations in higher-value-commissions were more consistent with the upper limit of the 7 studies in the evidence bank. However, the commissions to which these higher values relate are those with more unique or intensive experiences and therefore the higher reported use values associated with them are considered to be consistent with the nature of engagement.

38 R Core Team (2022), R: A language and environment for statistical computing
39 The coefficient for commission #6 was found significant at below the 5% level, due to the high number of commission specific variables included and the multiple testing problem the 5% significance level is insufficient for the identification of statistically significant results.
40 Using a two-sided t test.
41 Studies include DCMS (2018) The Economic Value of Culture: A Benefit Transfer Study (publishing.service.gov.uk); and Arts Council England (2021) Regional Galleries and Theatres Benefit Transfer Report
42 14.17, HMT (2013), Green Book supplementary guidance: stated preference techniques - GOV.UK (www.gov.uk)
43 14.11, 14.12 HMT (2013), Green Book supplementary guidance: stated preference techniques - GOV.UK (www.gov.uk)
44 Rapid Evidence Assessment: Culture and Heritage Valuation Studies - GOV.UK (www.gov.uk)
45 DCMS (2022), Rapid Evidence Assessment: Culture and Heritage Valuation Studies - GOV.UK (www.gov.uk)

Table 3: Extract from Culture and Heritage Capital Evidence Bank

Study	Country	Asset type	Valuation	Method	Overall study quality rating	Study year	Value (GBP, PPP)	Value GBP 2022 prices
Fujiwara et al (2018) The Economic Value of Culture: A Benefit Transfer Study	United Kingdom	Museum	Average WTP to visit museum	Benefit Transfer: Stated Preference: Contingent Valuation	High	2017	6.94	7.68
Bakhshi et al (2015) Measuring Economic Value in Cultural Institutions	United Kingdom	Gallery	Mean visitor donation for work inside the gallery (WTP)	Stated Preference: Contingent Valuation	High	2015	10.83	12.40
Bakhshi et al (2015) Measuring Economic Value in Cultural Institutions	United Kingdom	Museum	Mean compensation for closure (per visit) (WTA)	Stated Preference: Contingent Valuation	High	2014	6.89	7.89
Bakhshi et al (2015) Measuring Economic Value in Cultural Institutions	United Kingdom	Museum	Mean combined WTP for access to the NHM (entrance fee)	Stated Preference: Contingent Valuation	High	2014	6.65	7.61
Mwebaze, Bennett (2012) Valuing Australian botanic collections: a combined travel-cost and contingent valuation study	Australia	Garden	Mean WTP for access to a botanic garden through entry fee / parking fee	Stated Preference: Contingent Valuation	Medium	2010	1.87	2.39
Lawton et al (2021) Regional Galleries and Theatres Benefit Transfer Report	United Kingdom	Art Gallery	WTP to visit the Art Gallery	Stated Preference: Contingent Valuation	High	2019	5.40	5.74
Lawton et al (2021) Local Museums Benefit Transfer Report	United Kingdom	Local Museums	WTP Individual entry fee for access	Stated Preference: Contingent Valuation	High	2021	4.44	4.55

Source: DCMS (2022) Culture and Heritage Capital Evidence Bank.
Adjustment to 2022 prices made using CPI inflation. Source: ONS, OBR (November 2022 forecast

5.2.4 Aggregation of results

For the estimation of the total welfare value of UNBOXED live attendance, the weighted mean reported use values for each of the eight commissions studies were multiplied by total live attendance figures for their respective commission. For the two commissions for which use values were not obtained through the primary research (referred to as commissions #9 and #10), a 'benefits transfer' approach was taken with the average use value across the eight studied commissions being used and scaled by attendance data from the non-studied commissions.

The aggregation of use values across the ten commissions is represented as follows.

$$Total\ Attendee\ Use\ Value = \sum_{i=1}^{10} Attendance_i \overline{WTP_i}$$

$$Where\ Attendance_i\ is\ the\ total\ live\ attendance\ for\ Commission\ i;$$

$$For\ i \in (1, \dots, 8):\ \overline{WTP_i}\ is\ the\ weighted\ mean\ willingess\ to\ pay\ for\ Commission\ i;$$

$$and\ for\ i \in (9, 10):\ \overline{WTP_i} = \frac{1}{8}\sum_{j=1}^{8} \overline{WTP_j}$$

For the benefits transfer of values from the studied commissions to the non-studied commissions, a simple mean was taken of the eight WTP estimates from the studied commissions as this is considered to be the average WTP for attendance at a generic UNBOXED event.

This simple method of benefit transfer was adopted in light of Fujiwara et al's the economic value of culture: a benefits transfer study.[46] The 2018 study tested different benefits transfer approaches in the context of English cultural sites using WTP contingent valuations. Use values for four 'study sites' were estimated in two ways:

- Directly, through the use of WTP studies of attendees of the study sites;
- indirectly, though three different benefits transfer approaches where welfare values from attendees of 'policy sites' were transferred to the study sites. The three approaches were:
    - **Simple unit value transfer:** where a point estimate of individual benefit (e.g. mean WTP) is taken from study site(s) and applied to the policy site.
    - **Adjusted unit value transfer:** where the transferred value of benefit controlled for some differences between the sites (typically income) which may affect reported welfare values.
    - **Benefit function transfer:** where a number of explanatory variables (e.g. socio-economic characteristics) are used to estimate a benefit function estimating willingness to pay for the study site(s). The resulting benefit function is then combined with data on the (expected) characteristics of the study site to generate estimated benefits.

The estimates from the benefits transfer approaches were compared with the direct estimates to assess their accuracy. The simple unit transfer was found to produce the smallest errors of the three approaches when estimating welfare values through WTP. The mean error for the method was found to be 9.5% with a range between 0% and 18%, which was considered to be within the acceptable range.

46 Fujuwara et al (2018) The economic value of culture: a benefit transfer study - GOV.UK (www.gov.uk). See Table 2: Extract from Culture and Heritage Capital Evidence Bank.

Table 4 summarises the selection criteria for a simple unit transfer approach - which involves transferring the average welfare value from studied examples to a non-studied example (referred to below as the policy site).

Table 4: Simple Unit Value Transfer: Data Requirements and Selection Criteria

Data required from study sites	Mean WTP
Data required at policy site	Information on the policy site allowing for comparability of the policy and study sites to be assessed.
When to use this method	When it is believed that the study and policy sites are relatively homogenous in characteristics. When data on relevant populations do not exist or do not vary between sites.
When not to use this method	When the populations of the study and policy sites differ in important ways.

Source: Adapted from Table 4.8 in Fujuwara et al (2018)
The economic value of culture: a benefit transfer study - GOV.UK (www.gov.uk).

Whilst it is recognised that each UNBOXED commission is different, the method of benefit transfer is used as a measure of the value of engagement in UNBOXED overall rather to estimate the value of an individual commission. Therefore, the as the studied commissions are considered to broadly represent the spectrum of activity delivered through UNBOXED, the use of the average WTP from these in order to scale over the full impact across commissions is consider appropriate.

6 APPROACH TO ESTIMATING THE WELFARE VALUE TO UNBOXED PARTICIPANTS

UNBOXED participants engaged with the UNBOXED programme in a number of different ways. To reflect this, different types of participation have been identified and different approaches have been taken to estimating the welfare value associated with each form of participation each.

The main groups identified, and associated methods are detailed below:

1. Participants who engaged over short periods and who experienced the live events as part of their engagement, for example individuals who participated in the Our Place in Space Guinness World Record attempt[47] or who recorded music at a Tour de Moon event. These participants were assigned the average reported attendee use value of £9.05. This is considered to be most appropriate as their engagement tends to encompass elements similar to that of an attendee. However, given that this type of participation tends to enhance standard attendance, it would be expected that the attendee WTP may underestimate the welfare value to these participants.

2. Participants engaged intensively over an extended period of time. These participants include the Green Space Dark Skies Lumenators. These participants were assigned the WTP of Green Space Dark Skies Lumenators (see Section 5) as their level of engagement was considered to be similar to this group.

3. Participants that took part in in person workshops or continuous professional development (CPD) activity. These participants were assigned the average per person learning workshop value estimated based on the data collected on learning programme activity (see Section 9).

4. Participants that volunteered as part of UNBOXED. The value to these participants is captured within the valuation of volunteering activity (see Section 8).

For groups of participants detailed in points 1-3 above, these values were multiplied by the number of participants within each category, as provided by the Festival Company, and summed, to estimate the total welfare value to UNBOXED participants.

47 The goal was to break a new Guinness World Record for the greatest number of humans gathered in one place dressed as astronauts.

7 APPROACH TO ESTIMATING THE WELFARE VALUE OF DIGITAL ENGAGEMENT

7.1 Overview of approach to digital analysis

Cultural activities have a value to those who use the good or services. Available literature provides evidence that this applies to both in person engagement as well engagement with digital content.[48, 49]

Digital audiences include those watching artistic multimedia content online; listening to newly commissioned audio and visual digital artworks; participating in online creative scientific research and gaming content; and the use of digital applications created as part of the projects.

The nature of the engagement with digital content as part of UNBOXED (with no requirement to register for access), and constraints associated with the evaluation primary research, meant that direct data could not be obtained on the WTP for digital content provided as part of the UNBOXED programme.

The value to those that engaged with digital content has therefore been estimated based on evidence from secondary sources using a benefit transfer approach[50] (see also section 5.3.4). Note that this analysis only relates to digital engagement and not the broadcast engagement, the benefits of which are not quantified or monetised as part of the evaluation due to a lack of available evidence.

7.2 Sources of willingness to pay for digital content

Evidence on the public value of digital cultural content is limited at present, although it is recognised that Arts and Humanities Research Council (AHRC) and DCMS published a research call in 2022 with one strand of research on the valuation of digital assets.

A review of currently available literature, supported by input from DCMS, identified two main sources of evidence relating to the value of digital cultural content.

The first is a study[51] from 2021 by the British Film Institute (BFI) which undertakes a contingent valuation WTP survey of Britain on Film and provides evidence on the benefits of online access to film heritage.

The second is a Creative Industries Policy and Evidence Centre study[52], also undertaken in 2021, which included a WTP survey designed to elicit use values from users relating to the digital offer of four museum sites.

Across the two studies, the mean welfare value per month for the digital content (based on a monthly subscription payment vehicle) ranged from £2.54 to £3.21 per unique user. These figures relate to new and existing users respectively from the BFI study, with the mean value identified from the Creative Industries Policy and Evidence Centre study falling within this range.

Based on the nature of the digital content offered and the BFI study definition of unique users (those that had watched over 30 seconds of content (the same as the definition used by UNBOXED to define a user of digital content) it was considered that the Britain on Film digital offer and the nature of engagement was most closely aligned to that of the digital content provided by the UNBOXED commissions.

48 Britain on Film impact study | BFI
49 Creative Industries Policy & Evidence Centre (2021) Arts Council England: Digital Offer Research Report.
50 Fujuwara et al (2018) The economic value of culture: a benefit transfer study - GOV.UK (www.gov.uk). See Table 2: Extract from Culture and Heritage Capital Evidence Bank.
51 Britain on Film impact study | BFI
52 Creative Industries Policy & Evidence Centre (2021) Arts Council England: Digital Offer Research Report.

As noted above, within the Britain on Film study, two user groups were surveyed – 'existing users' and 'new users' (members of the public who had not previously used the online service and who were asked to explore Britain on Film prior to the survey). Given that UNBOXED aimed to attract both those who would not normally engage with the creative content offered through the programme, alongside those that would typically engage, an average of the mean WTP from the BFI study across the two user groups (existing and new users) was considered most appropriate to use in the central case analysis.

Sensitivity around the central case estimates was tested by applying the lower 95% confidence interval for the lower value (associated with new users) and the upper 95% confidence interval for the higher value (associated with existing users).

Table 5: Willingness to pay sourced from BFI, Britain on Film Impact[53]

Source	Welfare values		
	Low	Central	High
Britain on Film, new users (2017)	£2.01	£2.54	£3.06
Britain on Film, existing users (2017)	£2.49	£3.21	£3.93
Values applied in UNBOXED analysis	£2.01	£2.88	£3.93

Source: BFI Britain on Film (2017) A case study on the public value of online public access to film heritage

Whilst the results of the Creative Industries Policy and Evidence Centre study were considered less directly transferable to the context of UNBOXED digital content and are therefore not used in the evaluation, the consistency of the mean values identified through this study with those identified by the Britain on Film study provides some comfort of the external validity of the BFI results in terms of benefits transfer to UNBOXED digital engagement.

7.3 Aggregation of results across UNBOXED digital users

Data was available on the total users of the UNBOXED digital content, however, availability of data on unique users varied across the UNBOXED digital content. Where data on unique users was unavailable for the full period, the data available (typically for the last 90 days) was used to estimate the ratio of unique users to total users for that period, and the same ratio was applied to the total number of users over the full period the content was available (up to end December 2022). This was combined with the data on actual unique users where this data was available.

As noted in Section 7.2, the welfare values reported in the Britain on Film study relate to the value of a monthly subscription among unique users of the digital offer.

All UNBOXED digital content was available for at least a month, and whilst in many cases, digital content offered by UNBOXED was available for more than one month, to take a conservative approach, the monthly subscription value was applied only once per unique UNBOXED digital user.

Therefore, in order to estimate the total value of engagement with digital content, the estimated WTP for digital content obtained from the Britain in Film study presented in Table 5 above was inflated to 2022 prices using the GDP deflator for 2017 to 2022[54] and multiplied by the total estimated number of unique users of UNBOXED digital content.

53 Britain on Film impact study | BFI
54 GDP_Deflators_Autumn_Statement_November_2022_update.xlsx (live.com)

8 APPROACH TO ESTIMATING THE WELFARE VALUE OF UNBOXED VOLUNTEERING

Given the relatively small scale of volunteering involved in the delivery of UNBOXED (relative to the scale of other forms of engagement) primary research that could help to value these benefits was not undertaken. Therefore, the value of volunteering to the individual volunteer is estimated based on the opportunity cost of the time spent volunteering – assumed to be either leisure or working time.

Wages can be used to value the opportunity cost of volunteers in employment whilst an approach used in the valuation of leisure time is also the use of wage rate as the opportunity cost, or price, of leisure.55 Following this approach, the analysis uses the average UK hourly wage as a proxy for the opportunity cost of volunteers' time (and therefore the minimum personal benefit they are assumed to gain from volunteering).

In 202156 the mean ONS UK hourly wage rate was £13.5757 and relates to the average hourly pay for all employees across the UK in 2021. This was inflated to 2022 prices, reflecting when the volunteering activity took place, using the GDP deflator for 2021 to 2022.58

This inflated value was multiplied by the total number of hours spent volunteering by volunteers and participants as part of the UNBOXED programme, to arrive at the total value of volunteering conducted as a result of the programme

55 Surdam, David George, 'The Economics of Leisure', Century of the Leisured Masses: Entertainment and the Transformation of Twentieth-Century America (New York, 2015; online edn, Oxford Academic, 22 Jan. 2015), https://doi.org/10.1093/acprof:oso/9780190211561.003.0004, accessed 16 Jan. 2023.
56 ONS. 2022. 'Average hourly pay'.
57 Average hourly pay - GOV.UK Ethnicity facts and figures (ethnicity-facts-figures.service.gov.uk)
58 GDP_Deflators_Autumn_Statement_November_2022_update.xlsx (live.com)

9 APPROACH TO ESTIMATING THE VALUE TO SCHOOLS AND STUDENTS OF UNBOXED LEARNING CONTENT

9.1 Overview of the approach to analysis of the value UNBOXED learning content

A range of learning content and activity was delivered through the UNBOXED commissions and Learning and Participation programme. This included the provision of bespoke lesson plans, virtual learning opportunities and in person facilitator led workshops, all of which provided unique learning opportunities for students, as well as teacher CPD.

This learning content and activity was delivered free of charge at the point of use.

Whilst there is a breadth of evidence in relation to the value of skills and education provision, in terms of the monetisation of this value, studies tend to focus on longer term learning and attainment of qualifications.59 The returns to individual students from marginal learning activities such as specific workshops and learning content, would challenging to measure due to the small size of the effect expected and the long timeframes over which benefits would be expected to accrue.

Therefore, for the purpose of this evaluation, primary research was conducted in order to provide evidence to estimate the value of the UNBOXED learning content and activity, based on the market value of similar content. This is used as a proxy for the minimum that users would pay for the product, but would be expected to, underestimate the true welfare value to students of engagement. Details of this research are set out in the sections below.

9.2 Evidence of the market value of UNBOXED learning content

In order to estimate the market value of UNBOXED learning content and activity, a group of teachers and UNBOXED contacts with experience in the education market were identified and asked a series of questions to obtain data on the typical price paid by schools or teachers for equivalent content and activity to that provided through the UNBOXED programme.

The validity of responses was assessed based on the respondents basis for the estimates provided and cross checked with publicly available data on the price of downloadable resources and of school workshops where organisations published prices of these.

59 See: Skills and lifelong learning: investment in skills - GOV.UK (www.gov.uk); GCSE attainment and lifetime earnings - GOV.UK (www.gov.uk)

9.3 Aggregation of results across use of UNBOXED learning content

Based on the data received, the average market values of lesson plans and workshops were derived.

The estimates provided are presented in Table 6 below.

Table 6: Estimated value of learning content/ activity

Learning content/activity	Primary	Secondary
Lesson plans (cost per lesson plan)	£3	£3
In person workshop (cost per student per hour)	£6.67	£6.67

These values were then scaled based on

- the number of UNBOXED lesson plan downloads;
- the number of primary/secondary students engaged in UNBOXED virtual/ in person workshops and length of workshops.

By aggregating over these values this provides the total estimated value generated from use of or engagement with UNBOXED learning content.

It should be noted that due to its reliance on the market value of the learning content delivered through UNBOXED, and the limited sample that the estimates of market value were based on, the estimation of these benefits should be considered indicative only.

10 APPROACH TO ESTIMATING THE POTENTIAL FUTURE RETURNS TO UNBOXED R&D INVESTMENT

10.1 Overview of the approach to analysis of the potential future returns to UNBOXED R&D investment

As part of the UNBOXED evaluation it has not been possible to obtain direct data on the returns to R&D activity undertaken as part of the project. This due to a combination of commercial sensitivities in relation to commercial returns to date to the R&D activity undertaken (including among projects not commissioned as part of UNBOXED), and the fact that many of the expected returns have not yet materialised yet and would be expected to be seen over a longer-term period.

Therefore, in order to estimate the potential value to the UK economy of the R&D activity undertaken as a result of the UNBOXED programme, evidence has been drawn from a study commissioned by the Department for Business Energy and Industrial Strategy (BEIS) on the rates of return to investment in science and innovation.[60] Findings from this study are applied to the value of R&D investment due to UNBOXED, as detailed further below.

10.2 Determining the value of R&D investment made as part of UNBOXED

In terms of the definition of R&D investment, the BEIS study uses the Frascati Manual definition[61] – this is a standard way in which R&D is classified and defined by the Organisation for Economic Co-operation and Development (OECD) in order to be consistently measured and collected across countries.[62] The Frascati Manual defines research and experimental development (R&D) as *"creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge."*

Based on this definition, the evaluation of UNBOXED identified two main sources of R&D investment as part of the programme:

- R&D undertaken by the 30 projects which participated in the R&D phase of the UNBOXED programme;
- R&D undertaken by commissioned projects as part of their project development phase or to support legacy activity following the close of UNBOXED-commissioned events. This was identified as relevant for two commissions – Green Space Dark Skies and Dreamachine.

The level of R&D investment undertaken as part of the R&D phase of the programme is equal to the total funding provided to creative teams by UNBOXED for the R&D phase of the programme. Data was not available on the specific timing of this funding being spent, in terms of distribution across years. However, the R&D programme ran from late 2020 through to March 2021, and, based on consultation with UNBOXED, most of the activity ramped up in early 2021. On this basis for the purposes of the analysis the funding was assumed to have all been in 2021, although a small amount may have been spent in 2020.

Data on the expenditure on R&D investment (using the Frascati Manual definition) undertaken by Green Space Dark Skies and Dreamachine was provided by these commissions,, split by year of expenditure, excluding expenditure during the R&D phase to avoid double counting, and including budgeted expenditure for 2023.

60 Rates of return to investment in science and innovation (publishing.service.gov.uk)
61 Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development | en | OECD
62 Rates of return to investment in science and innovation (publishing.service.gov.uk)

10.3 Estimates of the returns to R&D investment

The BEIS commissioned study presents results and evidence for the rates of return to various categories of R&D, including across sources of R&D investment (private and public sector funded); channels for public sector R&D investment (including through research councils, government departments and higher education); and the type of R&D investment (basic, applied or experimental[63]).

In terms of the nature of the R&D investment undertaken as a result of UNBOXED, based on input from UNBOXED commissions the R&D undertaken as part of UNBOXED could be considered largely experimental research[64]. In addition, although the investment was publicly funded, the nature of the research was considered more akin to private investment in terms of closeness to market.

Results from the BEIS study, specific to this type of R&D investment, were therefore considered to be most appropriate to use in the context of the UNBOXED R&D investment.

It is noted in the BEIS commissioned study that the research results suggest returns to experimental research can be substantially higher than for applied or basic research. However, the study notes concerns about the *'implausible'* size of the coefficients identified (which find returns of in the region of 3,000%) therefore the robustness of the value of the coefficients. Therefore, for the purpose of the UNBOXED evaluation a conservative approach is taken and the overarching figures presented in the conclusions of the BEIS study (which suggest annual returns to private investment in R&D of 30% per annum) are used rather than results for the returns to experimental research.

The BEIS study also reports a lag of 1 to 3 years between R&D investments being made and returns.

While the BEIS study reports an average depreciation rate of 20% per annum, it notes that the literature estimating the rate of depreciation is not fully integrated with the literature from which the rates of return are estimated. The BEIS study notes that a 15% rate of depreciation commonly adopted in the estimated of firm-level returns on R&D investment.[65] This view is supported by a Hall et. al.'s 2009 review of the econometric literature on returns to R&D, where it is also noted that a 15% rate of depreciation is typically used as an assumption during the econometric estimates of returns to R&D.[66]

Therefore, in line with the BEIS report. the estimation of returns to UNBOXED R&D investments include a depreciation rate of 15% per annum and a lag of 2 years between investments and returns is used. This means that all returns to UNBOXED R&D investments are expected to be delivered from 2023 onwards and therefore, fall outside of the value of the UNBOXED programme delivered to date (as of December 2022).

The estimated future annual returns to R&D investment are deflated to 2022 prices using the forecast GDP deflator[67] and the Office for Budget Responsibility long-term GDP deflator[68], discounted by the Green Book social discount rate of 3.5%[69] and summed over the 10-year period (from 2021) to obtain the net present value of estimated future returns.

63 Basic research is defined as experimental or theoretical work designed to acquire new knowledge, but without particular applications in mind. Applied research is defined as work to acquire new knowledge which is directed primarily towards specific practical objectives. Experimental research is defined as systematic work building on existing knowledge directed at producing new product or process innovations.

64 Experimental research is defined as systematic work building on existing knowledge directed at producing new product or process innovations.

65 See page 152 - Frontier Economics, 2014. Rates of return to investment in science and innovation

66 Hall, B., Monhen, P., Mairesse, J. (2009) Measuring the Returns to R&D | NBER

67 GDP deflators at market prices, and money GDP November 2022 (Autumn Statement) - GOV.UK (www.gov.uk)

68 Fiscal risks and sustainability – July 2022 - Office for Budget Responsibility (obr.uk)

69 The Green Book (2022) - GOV.UK (www.gov.uk)