MEDIN Cost Benefit Analysis

Final Report

MEDIN

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Disclaimer

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Summary

The Marine Environmental Data and Information Network (MEDIN) was established in April 2008 with the objective of improving access to, and the management of, UK Marine data and information through:

- Data Archive Centres (DACs);
- A web portal to make it easy to find UK marine data; and
- A metadata standard to provide information about datasets.

The aim of this study was to obtain robust quantitative and qualitative data around the benefits that MEDIN provides to its users through its portal and other services, comparing these against the financial and other costs associated with maintaining MEDIN.

To do so an online survey was circulated to a number of marine networks in August-September 2019, primarily identifying the use and time savings that users derive from MEDIN. In order to isolate the tangible benefits of MEDIN, survey questions were specifically phrased in terms of the time savings that arise from using the MEDIN services versus the counterfactual of these services not existing through MEDIN. The benefits focussed on four main areas:

- **Benefit 1**: Reduced time searching for existing marine data due to the availability and accessibility of data on the MEDIN portal. This search time saving relates to uses of marine data such as desk-based studies, marine licence applications, research or Environmental Impact Assessments.

- **Benefit 2**: Avoiding duplication of primary marine data gathering due to the MEDIN portal, Data Archive Centres, data guidelines or workshops. This relates to the savings from primary research efforts (such as collecting new data and conducting surveys), which arise due to access to data uploaded by others via MEDIN, along with the provision of structured, consistent guidelines to ensure all relevant information about a dataset is recorded.

- **Benefit 3**: Time savings to organisations in managing their own data and external data they hold, due to the MEDIN portal, Data Archive Centres, data guidelines or workshops. This relates to improved formatting and storage processes.

- **Benefit 4**: Improved decision-making due to greater availability of marine data. This relates to both obtaining more existing data (as in Benefit 1 above), or by gathering better primary data (as in Benefit 2). Better decisions will result in more efficient use of resources for society, either obtaining greater benefit from the available resources, or reducing the costs of achieving existing outcomes. Due to the difficulty in applying monetary values to these benefits, the results are described qualitatively rather than monetised in the cost benefit analysis.

These were supplemented with information regarding the costs of MEDIN, against which the benefits were to be compared:

- **Cost 1**: User time costs involved with the upload of data and metadata. This relates to both the time spent for users to familiarise themselves with the MEDIN metadata standard and once familiar, that spent ensuring each dataset and metadata are MEDIN compliant prior to upload.

- **Cost 2**: Financial costs related to the running of MEDIN. This relates to costs of employment of the MEDIN Core Team and associated overheads, and external contracts which both contribute to the maintenance and operation of the MEDIN network.

The survey received 121 responses, of which 76 were complete and 45 were partially completed. 10 respondents were identified as being unreliable with internally inconsistent answers being given for the time saving and validation questions and were therefore dropped from the analysis. In order to identify active MEDIN users, responses were only considered from those who stated that they used at least one of the MEDIN data portal, MEDIN metadata standard, MEDIN data guidelines, MEDIN Data Archive Centres and MEDIN workshops. Where answers to the specific questions of interest were given by the respondents that only partially completed the survey, these were included in the analysis. This gave a total of 91 useable answers; a sample size with a sufficient degree of statistical reliability in order to extrapolate the results to the wider user base of MEDIN.

The individual costs and benefits were calculated for each year and aggregated to a present value (PV) for both of the appraisal periods (2014-2018 and 2019-2023) in 2019 prices and 2019 base year, the results of which are presented in **Table ES.1.1** below. As can be seen, the three benefits sum to £60.0m over the 10-year appraisal period which far outweighs the total costs of £7.3m, giving a net present value (NPV) of £52.4m and a benefit to cost ratio (BCR) of 8.2. This finding is in line with the other studies undertaken internationally on the economic effects of marine spatial data infrastructures (MSDIs) such as in Griffin et al., (2019) and highlights the high value and cost effectiveness of MEDIN. Further, these results are found to be robust to a number of sensitivity tests on the assumptions used in the analysis.

A small number of selected stakeholders from participating organisations, suggested by the MEDIN core team across a range of sectors, were approached for qualitative research interviews in follow-up to the survey. The interviews were semi-structured and designed to verify survey results and provide further qualitative understanding of stakeholders' perspectives of the MEDIN and the broader, less easily quantified, impacts it has through building networks and representing marine data providers and users. The feedback from these interviews indicated that the time estimates found from the survey are generally typical of their own experience with using MEDIN, with sensitivity analysis conducted where differences were indicated further finding that the results are not highly sensitive to these differences.

Table ES.1.1: **Cost benefit analysis of MEDIN.**

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.9m	£0.9m	£1.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.7m**	**£3.6m**	**£7.3m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.2m	£18.9m
Benefit 2 - Primary marine data gathering	£7.0m	£6.6m	£13.7m
Benefit 3 - Own data management time savings	£14.0m	£13.2m	£27.2m
Total Benefits	**£30.7m**	**£29.0m**	**£59.7m**
NPV (Benefits – Costs)	**£27.0m**	**£25.4m**	**£52.4m**
BCR (Benefits / Costs)	**8.3**	**8.1**	**8.2**

While the monetised estimates presented in **Table ES.1.1** account for a number of significant economic costs and benefits, it was not possible to quantify all potential impacts. In particular, the benefits relating to improved decision making due to greater availability of marine data were not included in the analysis. The responses in the survey and stakeholder engagement indicated that these are likely to be significant and so the overall results should therefore be considered a lower bound estimate of the benefits of MEDIN.

Recommendations for further development:

- promote greater linkages with academia and other data providers in order to increase data availability and push for better data management in the research community;
- own data management time savings should be an area of continued focus for MEDIN due to the large benefits it has delivered to date;
- time savings from the avoidance of primary data gathering could be an area of further development for MEDIN;
- benefits relating to improved decision making due to greater availability of marine data should be explored further to give a fuller picture of the overall benefit that MEDIN provides to society;
- regarding monitoring of the costs and benefits of MEDIN itself, further investigation could focus on specific limitations identified, revisiting assumptions, and further considering 'additional' and broader societal benefits;
- in future assessments, the survey could be circulated more widely and over a longer timeframe in order to increase the total number of MEDIN users in the sample, potentially targeting specific user groups to try to ensure the sample is representative of the user population.

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1.Introduction

1.1 Context

Marine data collection and science face unique challenges due to the complexity of the marine environment and high cost of data collection. At the same time, the importance of marine data is increasing as human activity in the marine environment expands requiring a stronger focus on managing human activity pressures on marine ecosystems. Therefore, any action that makes collation, analysis and access to data easier and cheaper will continue to deliver benefits for all users of the marine environment and wider society. The Marine Environmental Data and Information Network (MEDIN) was established in April 2008 for this purpose. Its objectives are to improve access to, and the management of, UK marine data and information through:

- Data Archive Centres (DACs);
- A web portal to make it easy to find UK marine data; and
- A metadata standard to provide information about datasets.

MEDIN implements a partnership approach to meet these objectives with funding from a consortium of fourteen sponsors (mainly from the government sector) and partnership agreements with various government departments, agencies, research councils and private organisations to assist with ongoing development, implementation and dissemination of MEDIN. MEDIN reports to the Marine Science Coordination Committee (MSCC) and coordinates the UK Marine Sector response to the EC INSPIRE directive, for sharing environmental information across Europe, and to data.gov.uk, the government's portal for public data.

Organisations involved in collecting marine environmental data in UK waters are encouraged to submit data to a relevant DAC and/or metadata to MEDIN. This includes both public and private sector organisations. Data and metadata can be contributed through completion of simple forms. Other organisations can then find data online through the metadata discovery portal or through searches on DAC portals. Search results can be exported, and data can be downloaded where available. In general, over 85% of the data described in the MEDIN portal is downloadable from the MEDIN DACs.

1.2 Purpose of this assessment

Like other similar programmes, spending on MEDIN needs checking and justifying against the benefits. As the benefits are not directly financial, other measurement tools must be used to provide evidence of the impact that MEDIN is having. The challenge here is in understanding the use of MEDIN and the benefits being received, quantifying them, and calculating a monetary value, to be compared against the financial and other costs associated with MEDIN. The study is designed to explicitly consider financial and time costs and savings within the assessment framework, but also considers more difficult to measure benefits qualitatively.

The results will help to better understand the overall value of MEDIN, while also identifying what is driving its value and where greater focus may achieve additional benefits.

1.3 Structure of report

The remainder of this report is structured as follows:

- **Section 2** discusses the approach to cost benefit analysis, highlighting the methodology applied and the required assumptions;
- **Section 3** presents the results of the cost benefit analysis and the limitations relating to the model;
- **Section 4** concludes, discusses the findings from the study and suggests recommendations for MEDIN;
- **Appendix 1** presents the survey used in the study;
- **Appendix 2** provides details of the net present value (NPV) approach used in the analysis, and

2. Approach to Cost Benefit Analysis

2.1 Cost Benefit Analysis

2.1.1 Principles

The objective of Cost Benefit Analysis (CBA) is to identify the positive and negative impacts that an intervention has over time and compare them against its costs. This is done with respect to a baseline or counterfactual scenario, i.e. what would have been the case had the intervention not occurred. The purpose of this is to establish whether the intervention results in a net benefit to society, meaning that the beneficial outcomes outweigh the costs, thereby justifying the intervention. The approach can also be used for option appraisal, assessing which of a range of options provides the best benefit to cost ratio.

Importantly, the outputs of a CBA are only as good as the inputs that feed in to it, including both the data and assumptions applied. The results must therefore be interpreted with an understanding of the reliability of the inputs so that the degree of confidence in the results is understood. Sensitivity analysis around various data and assumptions applied can help to provide greater understanding and confidence in the findings.

2.1.2 Steps of CBA

To undertake a cost benefit analysis, the following steps need to be taken:

1. *Scope and Baseline* - Defining the scope of the analysis involves identifying the geographical boundary, beneficiaries, list of costs and benefits and the time scale over which the costs and benefits will be assessed. In the baseline, the counterfactual scenario (i.e. the case without the intervention) against which changes in the costs and benefits are measured is defined.
2. *Identify costs and benefits* - Identify the main costs and benefits related to the intervention. The Green Book[1] recommends that "*all relevant costs and benefits which may arise from an intervention should be valued and included in Social CBA unless it is not proportionate to do so*." (HM Treasury, 2018).
3. *Quantify, monetise and measure costs and benefits* - The costs and benefits are then quantified and monetised. This allows for their comparison as they will be in the same unit of measure, money, to gain understanding of their relative scale.
4. *Compare costs and benefits* - In the CBA model, the annual costs and benefits over the assessment period are aggregated into present value (discounted) terms. The net present value (NPV) of an intervention is calculated as the difference between present value of the benefits (PVB) and the present value of the costs (PVC). A benefit to cost ratio (BCR) can also be produced which is calculated as the ratio between the PVB and the PVC.
5. *Sensitivity analysis* - Sensitivity analysis is a fundamental aspect of the assessment and is used to determine how various assumptions used can affect the overall results of the study. This can be important to provide credibility for the assessment.
6. *Reporting and interpretation* - Interpretation of the results of the analysis and ensuring that any limitations and caveats are clearly evidenced when reporting.

[1] *HM Treasury guidance document which details how to appraise and evaluate policies, projects and programmes.*

2.2 Data collection

2.2.1 Background material

Before starting the assessment, a number of documents and studies were reviewed in order to scope the potential costs and benefits that should be included in the analysis. These fell into four main categories;

- on UK marine data needs, such as the 2013 review on UK public and private sector marine evidence needs (ABPmer et al., 2013), and the 2016 review of access to industry marine environmental data (ABPmer et al., 2016);
- on science / research sectors in the UK (which link to the volume of data entry to, and volume of use of) for example the UK Marine Industries Alliance Strategy for Growth (UKMIA, 2011);
- on MEDIN itself, such as its 2013 review (Bruin et al., 2013); and,
- on methods to quantify any costs and benefits identified such as the most recent evidence and approaches to valuing the costs of time, which is used extensively in public sector appraisals (DfT, 2019).

2.2.2 Survey

A survey was drafted by eftec and reviewed by ABPmer, MEDIN and a wider steering group. It was then tested by users in ABPmer and other stakeholders, with feedback incorporated into the final version. The survey was uploaded to SmartSurvey, an online survey software, going live for the 3-week period from 27 August, 2019 to 17 September, 2019. A link to the survey was distributed by the MEDIN core team targeting a number of marine networks[2] as well as advertising on the MEDIN portal website and Twitter page. An online survey was chosen in order to maximise the number of responses.

The survey contained seven parts:

- Part A covered general user and organisation information such as the type of organisation to which the respondent belongs and their average MEDIN usage over the last year
- Part B investigated the time savings related to searching for existing marine data
- Part C investigated the time savings related to primary marine data gathering
- Part D investigated the time savings related to data management
- Part E investigated organisational benefits related to improved decision making due to the greater availability of marine data
- Part F investigated the time costs associated with uploading metadata and data
- Part G asked concluding questions, including questions regarding the value of a commercial service similar to MEDIN.

The full survey questions are shown in Appendix 1.

[2] *National Oceanography Centre (NOC) Association, UK Integrated Marine Observing Network, The UK Marine Monitoring and Assessment Strategy Evidence Groups (Clean and Safe Seas Evidence Group; Healthy and Biologically Diverse Seas Evidence Group; Ocean Processes Evidence Group), Marine Alliance for Science and Technology for Scotland, Marine Science Coordination Committee and other MEDIN groups (Sponsors Board, Executive Team, Data Archive Centres Working Group, Standards Working Group, Portal Steering Group, Resources and Applications Working Group)*

2.2.3 Stakeholder engagement – follow-up interviews

A small number of selected stakeholders from participating organisations, suggested by the MEDIN core team to represent a range of sectors, were approached for qualitative research interviews in follow-up to the survey. The interviews were semi-structured and designed to verify survey results and provide further qualitative understanding of stakeholders' perspectives of the MEDIN and the broader, less easily quantified, impacts it has through building networks and representing marine data providers and users.

2.3 Methodology applied to MEDIN

2.3.1 Scope and baseline

The scope of the analysis was agreed with the MEDIN core team to cover direct users of MEDIN for two appraisal periods; the first relating to the previous five years (2014-2018) and the second relating to the subsequent five (2019-2024). In order to isolate the impact of MEDIN, survey questions were specifically phrased in terms of the costs and benefits that arise from using the MEDIN services versus the counterfactual of these services not existing through MEDIN. While it is not possible to know what would happen in the future in the absence of MEDIN, the analysis throughout is based on an understanding of the benefits to users from the services that MEDIN provides compared to their current processes without it.

2.3.2 Identify costs and benefits

Four main benefits were identified from the scoping stage, namely:

Benefit 1: Reduced time searching for existing marine data due to the availability and accessibility of data on the MEDIN portal. This search time saving relates to uses of marine data such as desk-based studies, marine license applications, research or Environmental Impact Assessments.

Benefit 2: Avoiding duplication of primary marine data gathering due to the MEDIN portal, Data Archive Centres, data guidelines or workshops. This relates to the savings from primary research efforts (such as collecting new data and conducting surveys), which arise due to access to data uploaded by others via MEDIN, along with the provision of structured, consistent guidelines to ensure all relevant information about a dataset is recorded.

Benefit 3: Time savings to organisations in managing their own data and external data they hold, due to the MEDIN portal, Data Archive Centres, data guidelines or workshops. This relates to improved formatting and storage processes.

Benefit 4: Improved decision-making due to greater availability of marine data. This relates to both obtaining more existing data (as in Benefit 1 above), or by gathering better primary data (as in Benefit 2). Better decisions will result in more efficient use of resources for society, either obtaining greater benefit from the available resources, or reducing the costs of achieving existing outcomes.

Due to a low response rate relating to Benefit 4, and the difficulty in applying monetary values to the benefits, the results are not monetised in this cost benefit analysis, but are described qualitatively in Section 3.

Two main costs involved with the running of MEDIN were also identified, against which the benefits above are compared:

Cost 1: User time costs involved with the upload of data and metadata. This relates to both the time spent for users to familiarise themselves with the MEDIN metadata standard and once familiar, that spent ensuring each dataset and metadata are MEDIN compliant prior to upload.

Cost 2: Financial costs related to the running of MEDIN. This relates to costs of employment of the MEDIN Core Team and associated overheads, and external contracts which both contribute to the maintenance and operation of the MEDIN network.

2.3.3 Quantify, monetise and measure costs and benefits

Benefits

Estimating the monetary value of the time savings across the analysis requires three components:

- The number of active MEDIN users
- The average annual time saving per user in hours
- The value of the saved hours

The total number of active MEDIN users was estimated as the number of unique monthly visitors to the MEDIN portal, averaged over the years 2017-2018, the values of which were provided by MEDIN via AWstats. The monthly (as opposed to annual) figure was used to help ensure that these are in fact active users of MEDIN's services as opposed to those who may just visit the portal without gaining much benefit from it. This allows the time saving estimates of the active MEDIN users of the survey (described in Section 3.1) to be applied to just those individuals who directly benefit from MEDIN (as opposed to all users). Notably this is an estimation, but is thought to be a conservative approach that helps provide confidence that the results presented are an estimate of the minimum value that MEDIN provides.

The estimate of active users (1,400) was assumed to remain constant over the appraisal period. The average annual time saving per user was calculated through data generated by the survey. For Benefits 1-3, this was quantified with survey questions[3] related to how many hours in an average week[4] the use of MEDIN saves the respondent, versus a counterfactual of doing the same work with MEDIN not existing. Users selected their time saving from a list of time brackets (0 hours, 0-4 hours, 5-9 hours etc)[5] with the mid-point value of each range being taken as the time saving. The average value across all the respondents was then taken and multiplied by the number of work weeks in a year[6] to arrive at an average annual time saving per user. Again, this time saving is assumed to remain constant over the appraisal period.

In order to monetise the time saving, a value of time is required. The Office for National Statistics (ONS) (2018) provides wage data for full-time employees split between professional types. In order to more

[3] *Benefits 1,2 and 3 are derived from survey question number 10, 13 and 17 respectively, full details of which can be seen in Appendix 1.*
[4] *The survey clarified that "if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year".*
[5] *The options were: 0 hours per week, 0 – 4, 5 – 9, 10 – 14, 15 – 19, 20 – 24, 25 – 29, 30 – 34, 35 +, I'm not sure*
[6] *This was calculated as 52 weeks minus 7 for holiday and sickness.*

accurately arrive at an estimate of this value specific to MEDIN users, a weighted average was taken using responses to a survey question relating to the profession of the respondents. This can be seen in **Table 2.1**[7]. These values were then uplifted for non-wage labour costs of 21.8% to cover additional employee benefits such as pensions, National Insurance contributions, sickness pay as well as maternity and paternity pay[8]. To calculate wage rates for the years 2019-2024, the average growth rate of the years 2016-2018 (1.8% per annum) was applied to the 2018 data. Note that the sensitivity of the overall results to this assumed growth rate is analysed in Section 3.5 where a rate of 2.5% is also tested (based on the average growth rate across all professions for the period 2016-2018)[9]. The user numbers, average time saving and value of time are multiplied to arrive at the total value of time savings per year.

Table 2.1: Value of time estimates.

			ASHE[10] median gross hourly earnings (£/hour)				
Survey Profession	**Count**	**Percentage**	**2014**	**2015**	**2016**	**2017**	**2018**
Owner or Manager	17	19%	20.1	20.3	20.6	21.3	21.6
Professional and technical	69	76%	15.3	15.4	15.4	15.8	16.2
Administrative and support	3	3%	10.8	11.0	11.2	11.5	11.7
Other	2	2%	13.1	13.3	13.6	13.9	14.3
Total	**91**	**100%**					
Weighted average			16.0	16.1	16.2	16.7	17.0
Weighted average after uplift			**19.5**	**19.6**	**19.7**	**20.3**	**20.7**

Costs

For the user time costs involved with the upload of data and metadata, two main factors are involved. First, the initial outlay of time necessary for the user to familiarise themselves with the MEDIN metadata standard and the tools that MEDIN supply to create MEDIN discovery metadata. MEDIN guidance states that this is expected to take between 3-10 days (MEDIN, 2019). For this study the mid-point was used throughout the analysis (6.5 days). To estimate the number of users who need to undertake this initial outlay, data on the number of MEDIN workshop attendees was used. The second factor is the time necessary in order to make each dataset and metadata MEDIN compliant prior to upload. A previous study conducted by MEDIN found this to take 1-3.5 hours per dataset and 15 minutes per metadata upload (MPC, 2014). Again, for this study the mid-point was used throughout the analysis (2.25 hours)[11]. These time costs were assumed to remain constant over the appraisal period. The number of uploads per year was provided by MEDIN at around 1,400 on average over the period 2015-2018. In order to monetise these time costs, ONS hourly earnings data were again used. For the analysis of future time periods, it is assumed that hourly earnings increase by the average growth rate over the period 2015-2018 (1.8% per annum).

The financial costs relating to the running of MEDIN were provided by MEDIN for the years 2014-2018 and

[7] *Where the respondent did not state their profession, the average across all professions was used.*
[8] *The uplift factor is consistent with the approach applied in Impact Assessments by BEIS (Pers. Comm. BEIS, July 2019). Source: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lc_lci_lev&lang=en*
[9] *The same 2.5% growth rate is found in for the period using the Average Weekly Earnings (AWE) dataset looking at changes in regular pay for the whole UK economy. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/averageweeklyearningsearn01*
[10] *Annual Survey of Hours and Earnings. Note that these values exclude overtime. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/ashe1997to2015selectedestimates*
[11] *Sensitivity analysis is ran on these time estimates in Section 3.5.*

an estimate for 2019. For the analysis of future time periods, it was assumed that current costs would increase by 2.3% per annum to be consistent with the long-term forecasts (GDP deflator series) from Office for Budgetary Responsibility Fiscal Sustainability Report 2017 (OBR, 2017).[12]

As with the benefits, these costs were then sense checked through the use of stakeholder interviews to verify their magnitude, as detailed in Section 3.6.

2.3.4 Compare costs and benefits

In order to compare the costs and benefits of MEDIN, the annual values for the appraisal period must first be converted to the same price year (2019 prices) using the HM Treasury GDP deflator and then adjusted for social time preference (HM Treasury, 2018). To do so, in line with UK government policy, the Green Book discount rate of 3.5% was applied throughout to future values. For historic values, these were converted to 2019 prices but were not discounted. The individual costs and benefits can then be aggregated across the two appraisal periods into present value terms and directly compared to arrive at a net present value (NPV) – the present value of the benefits minus the present value of the costs, and the benefit to cost ratio (BCR) – the present value of the benefits divided by the present value of the costs. The formal calculations are given in the Appendix 2.

2.3.5 Sensitivity analysis

Sensitivity analysis was undertaken to determine how various assumptions made affect the overall results of the assessment. These include assumptions regarding the choice of survey respondents used in the analysis, the growth in hourly earnings of MEDIN users, user data upload time estimates and specific time savings related avoiding primary marine data gathering. The effects of each are discussed in Section 3.5.

2.3.6 Reporting and interpretation

The results from the cost benefit analysis are presented in Section 3, with further discussion and interpretation in Section 4.

2.4 Assumptions and variables

This section outlines the key assumptions and variables used in the analysis, the full list for which can be found in **Table 2.3** and **Table 2.2** below.

2.4.1 Assumptions

To estimate the costs and benefits over the second appraisal period (2019-2024), assumptions had to be made regarding their trends over time. The number of annual active users was assumed to remain constant for all years of the analysis (1,400) as described in Section 2.3.3 above. Time savings relating to MEDIN use estimated from the survey were likewise assumed to remain constant along with dataset and metadata upload outlays. The hourly earnings however were assumed to increase by 1.8% per annum, in line with the average growth rate over the period 2015-2018, while the MEDIN financial costs were assumed to increase by 2.3% per annum to be consistent with the long-term forecasts (GDP deflator series) from Office for Budgetary Responsibility Fiscal Sustainability Report 2017 (OBR, 2017).

[12] *Note that this is an assumption used in the analysis and does not reflect the future MEDIN budget, which is dependent on contributions from its sponsors.*

The number of datasets and metadata uploaded for the periods without available data (2014, 2019-20) was assumed to be 1,375 per year in line with the average over the period 2015-2018. A non-wage labour cost uplift was added to the hourly earnings data throughout the analysis to cover additional employee benefits such as pensions, National Insurance contributions, sickness pay as well as maternity and paternity pay[13]. Finally, the analysis assumed that there are 45 work weeks in a year; calculated as 52 weeks minus 7 for holiday and sickness.

Table 2.2: Key assumptions.

Assumption	Value	Unit
Percentage increase in active MEDIN users	0	%
Percentage increase in annual user time savings	0	%
Percentage increase in annual dataset and metadata upload outlays	0	%
Percentage yearly increase in hourly earnings (last 3 years)	1.8	%
Annual increase in MEDIN costs	2.3	%
Annual datasets uploaded	1,375	Number
Non-wage labour cost uplift	21.8	%
Work weeks in a year	45.0	Number

[13] *The uplift factor is consistent with the approach applied in Impact Assessments by BEIS (Pers. Comm. BEIS, July 2019). Source: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lc_lci_lev&lang=en*

2.4.2 Variables

The key variables used in the analysis are discussed in the report and presented below.

Table 2.3: Key variables.

Variable	Value	Unit	Year	Source
Discount rate	3.50%	%	2019	Green Book
MEDIN financial costs 2014-15	443,364	£	2019	MEDIN Annual Report
MEDIN financial costs 2015-16	557,392	£	2019	MEDIN Annual Report
MEDIN financial costs 2016-17	534,254	£	2019	MEDIN Annual Report
MEDIN financial costs 2017-18	622,026	£	2019	MEDIN Annual Report
MEDIN financial costs 2018-19	510,871	£	2019	MEDIN Annual Report
Expected MEDIN financial costs 2019-20	573,000	£	2019	MEDIN Annual Report
Datasets uploaded 2015-16	400	Number	2019	MEDIN Annual Report
Datasets uploaded 2016-17	2,100	Number	2019	MEDIN Annual Report
Datasets uploaded 2017-18	2,000	Number	2019	MEDIN Annual Report
Datasets uploaded 2018-19	1,000	Number	2019	MEDIN Annual Report
MEDIN annual active users[14]	1,400	Number	2019	MEDIN Annual Report
2014 Time saving value / hour[15]	19.5	£	2018	ONS (Table 10_SOC10)
2015 Time saving value / hour	19.6	£	2018	ONS (Table 10_SOC10)
2016 Time saving value / hour	19.7	£	2018	ONS (Table 10_SOC10)
2017 Time saving value / hour	20.3	£	2018	ONS (Table 10_SOC10)
2018 Time saving value / hour	20.7	£	2018	ONS (Table 10_SOC10)
Average dataset upload outlay	48.75	Hours	2019	MEDIN FAQs
Average time per dataset upload	2.25	Hours	2019	MEDIN FAQs
Average time per metadata upload	0.25	Hours	2019	MEDIN FAQs
MEDIN workshop attendees	108	Number	2019	MEDIN Annual Report

[14] *2018-2019 average.*

[15] *Note that a weighted average was applied to the ONS wage data according to the reported job roles of the survey participants (19% - Owner or Manager, 76% - Professional and technical, 3% - Administrative and support and 2% - Other).*

3. Results of Cost Benefit Analysis

3.1 Survey results

This section presents the data generated by the survey. It examines the response rate to the survey; describes the characteristics of respondents; reports the main costs and benefits from MEDIN and breaks this down by different sub-groups.

The survey received 121 responses in total, of which 76 were complete and 45 were only partially completed. 10 respondents were identified as being unreliable with internally inconsistent answers being given for the time saving and validation questions and were therefore dropped from the analysis. In order to identify just active MEDIN users, responses from a survey question relating to MEDIN usage (Question 4 in Appendix 1) were used. In particular only those who stated they used any of the following services (MEDIN data portal, MEDIN metadata standard, MEDIN data guidelines, MEDIN Data Archive Centres and MEDIN workshops) were identified as active users. Where answers to the specific questions of interest were given by the respondents that only partially completed the survey, these were included in the analysis. This gave a total of 91 useable answers; a sample size with a sufficient degree of statistical reliability in order to extrapolate the results to the wider user base of MEDIN.

Survey respondents

A breakdown of the respondents by organisation size and type are given in **Figure 3.1**:

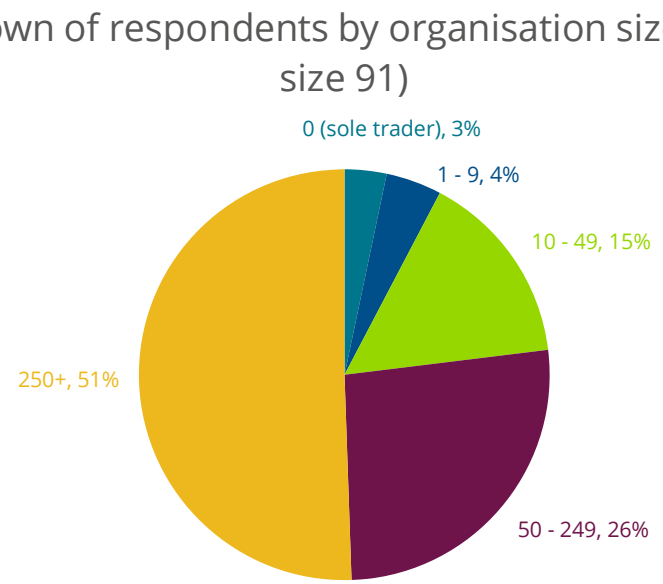

Figure 3.1: Breakdown of respondents by organisation size.

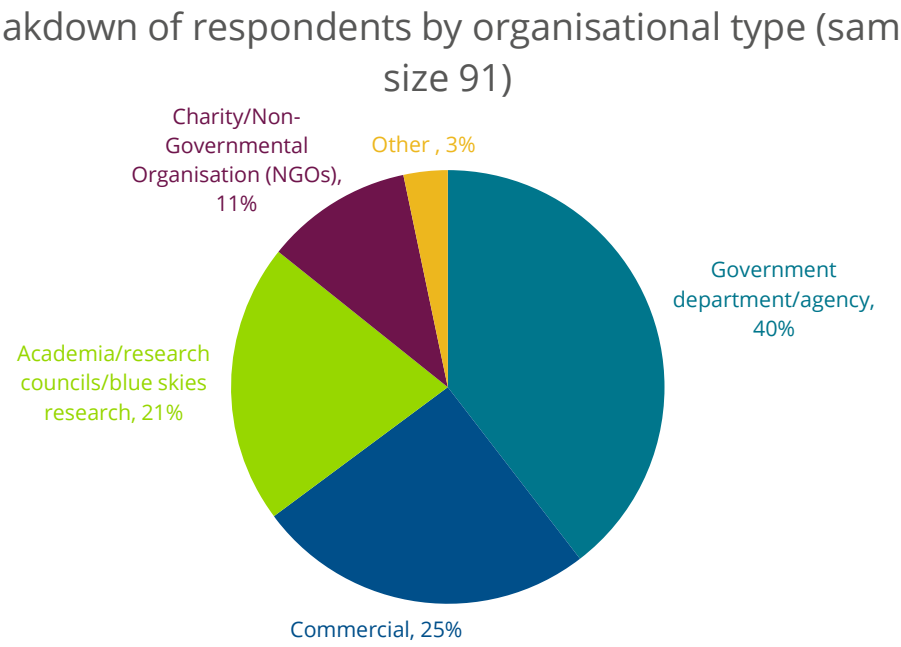

Figure 3.2: Breakdown of the respondents by organisation size and type.

Full details of the breakdown by organisation type are given in **Table 3.1** below. In particular, this splits up the share of the 'Commercial' category into the specific options available in the survey.

Table 3.1: Further breakdown of the respondents by organisation type.

Breakdown of respondents by organisational type	Percentage
Government department/agency	40%
Oil and gas industry	0%
Marine consultancy	18%
Ports and harbours	0%
Offshore surveying	3%
Offshore renewables	2%
Other commercial	2%
Academia/research councils/blue skies research	21%
Charity/Non-Governmental Organisation (NGOs)	11%
Other	3%

MEDIN usage

Figure 3.3 below shows the percentage of respondents who use the different services that MEDIN provides. Most services are used by over 40% of the active users, showing a broad spread of use.

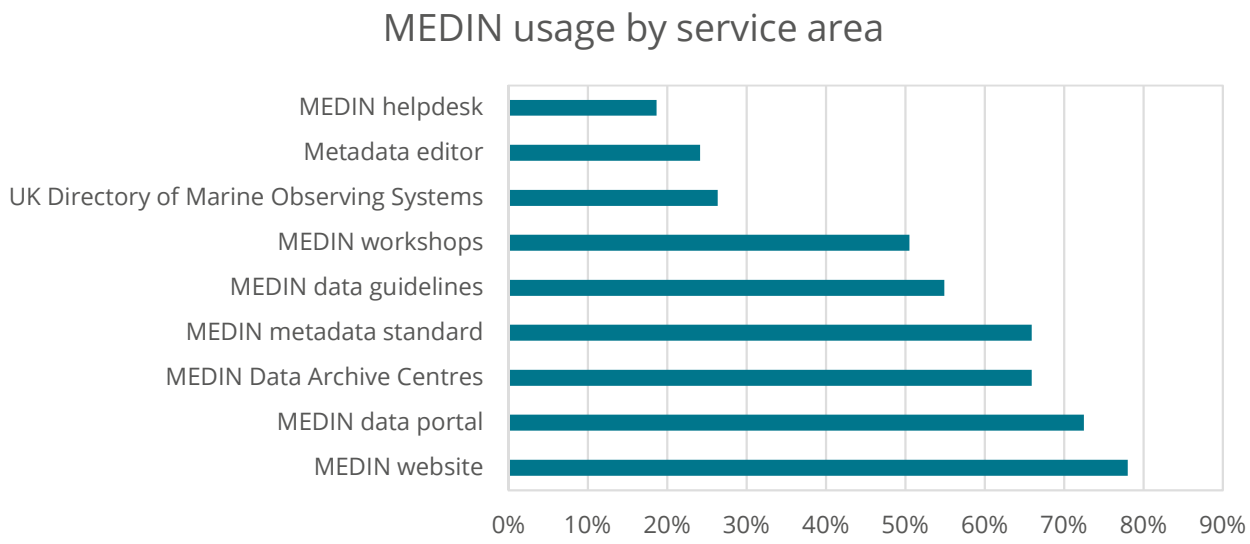

Figure 3.3: MEDIN usage by service area.

Figure 3.4 and **Figure 3.5** below show how often respondents in the survey use MEDIN to search for and help manage data. As can be seen there is more regular use for data management (35% of users do so at least monthly) than search purposes (15%).

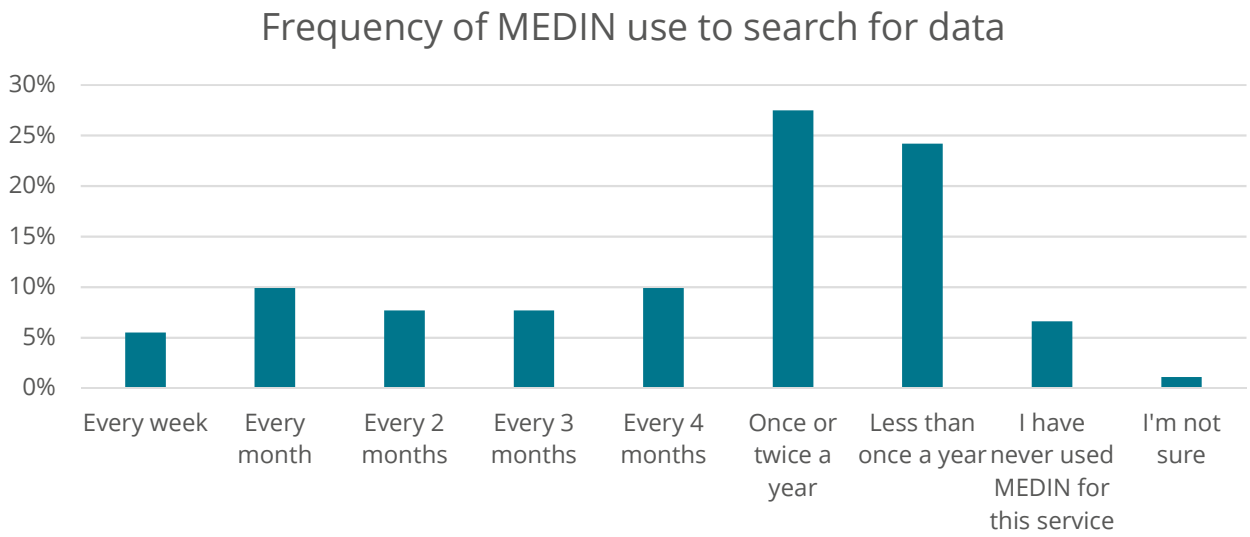

Figure 3.4: Frequency of MEDIN use to search for data.

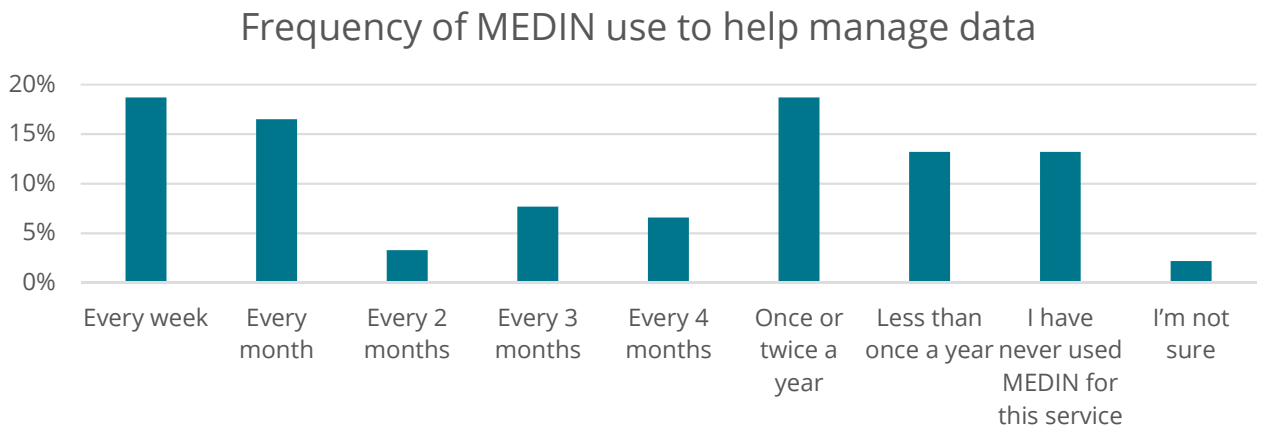

Figure 3.5: Frequency of MEDIN use to help manage data.

3.2 Benefits

This section summarises the four benefits included in the analysis.

Benefit 1 - Existing marine data search time savings

Figure 3.6 below shows the distribution of time savings for the three benefits (benefits 1 – 3 in Section 2.3.2) included in the cost benefit analysis. As can be seen, the majority of respondents give time saving estimates for the three benefits below 5 hours a week, with very few giving higher estimates (3%, 4% and 5% respectively)[16].

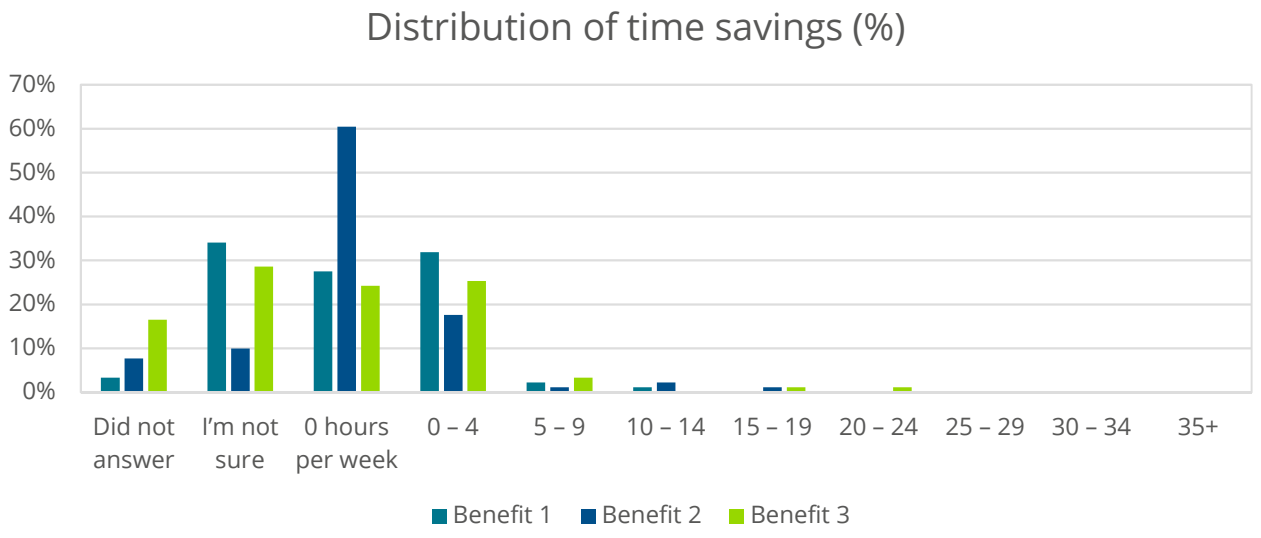

Figure 3.6: Distribution of time savings (%).

Regarding Benefit 1, once respondents who either did not answer or answered with 'I'm not sure' were removed from the analysis (leaving 57 in total), the average time saving per user per week was 1.5 hours. This equates to 66.3 hours over the course of the year. This figure is then multiplied by the total number of active MEDIN users and the year specific wage rates, to arrive at the total value of existing marine data search time savings. For 2018, this value is £2.0m in 2019 prices.

[16] *It should be noted that 47 (51.6%) individuals reported positive time savings for at least one of the benefits.*

Analysis was conducted of the specific organisation types - Government department/agency, Commercial, Academia/research councils/blue skies research and Charity/NGOs and Other (aggregated together due to low sample sizes) to determine whether the benefits were concentrated in the specific sector. The number of respondents for each sector is given in **Table 3.2** and average weekly time savings is given in **Figure 3.1** below. For both, two samples are distinguished, the first ("With answers only") where respondents who either did not answer or answered with 'I'm not sure' were removed and the second ("Including non-responses"), which includes all respondents. Margins of error are also given indicating that there is a 95% probability that the true value lies within the range shown. Note however that due to low sample sizes and the lack of a truly random sample, these should be taken as indicative values. Whilst average time savings are greatest for the last two sectors, again care should be taken when drawing inferences due to the low sample size when splitting the data in this way. It can also be seen that including non-responses has the effect of bringing down the average time savings per user per week.

Table 3.2: Number of responses by organisation type.

Organisation type	With answers only	Including non-responses
Government department/agency	19	36
Commercial	18	23
Academia/research councils/blue skies research	11	19
Charity/NGOs/Other	9	13
Overall	**57**	**91**

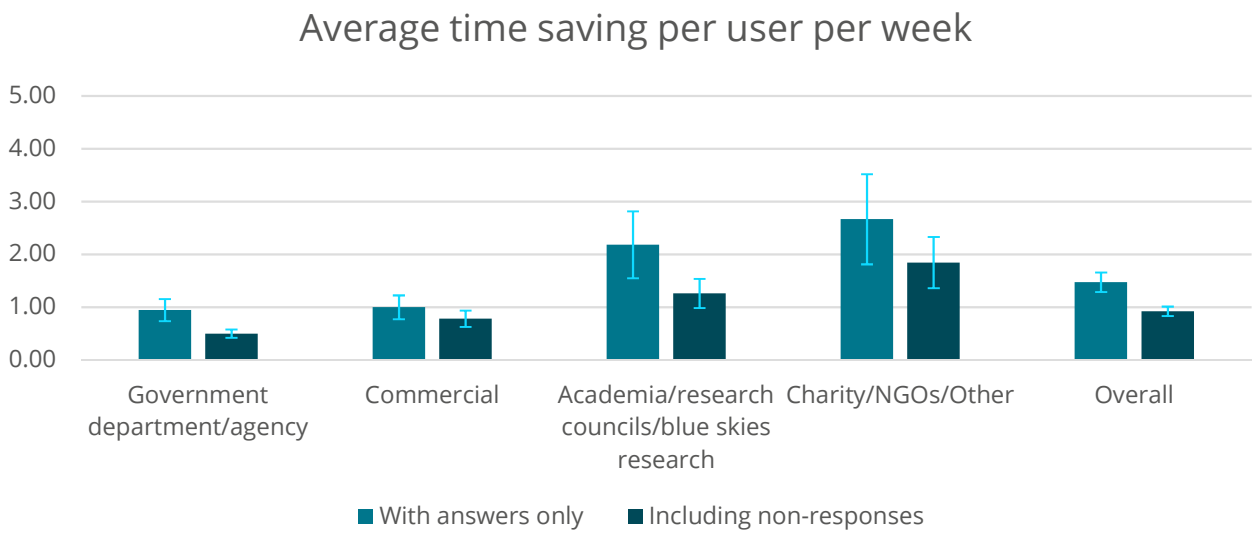

Figure 3.7: Average weekly existing marine data search time savings by organisation type.

Benefit 2 - Primary marine data gathering

For Benefit 2, as before, respondents who either did not answer or answered 'I'm not sure' were removed from the analysis, giving an average time saving per user per week that was 1.1 hours. This equates to 48.0 hours over the course of the year. This figure is multiplied by the total number of active MEDIN users and the year specific wage rates, to arrive at the total value of existing marine data search time savings. For 2018, this value is £1.4m.

The number of respondents for each sector is given in **Table 3.3** and average weekly time savings is given in **Figure 3.8** below.

Table 3.3: Number of responses by organisation type.

Organisation type	With answers only	Including non-responses
Government department/agency	28	36
Commercial	19	23
Academia/research councils/blue skies research	18	19
Charity/NGOs/Other	10	13
Overall	**75**	**91**

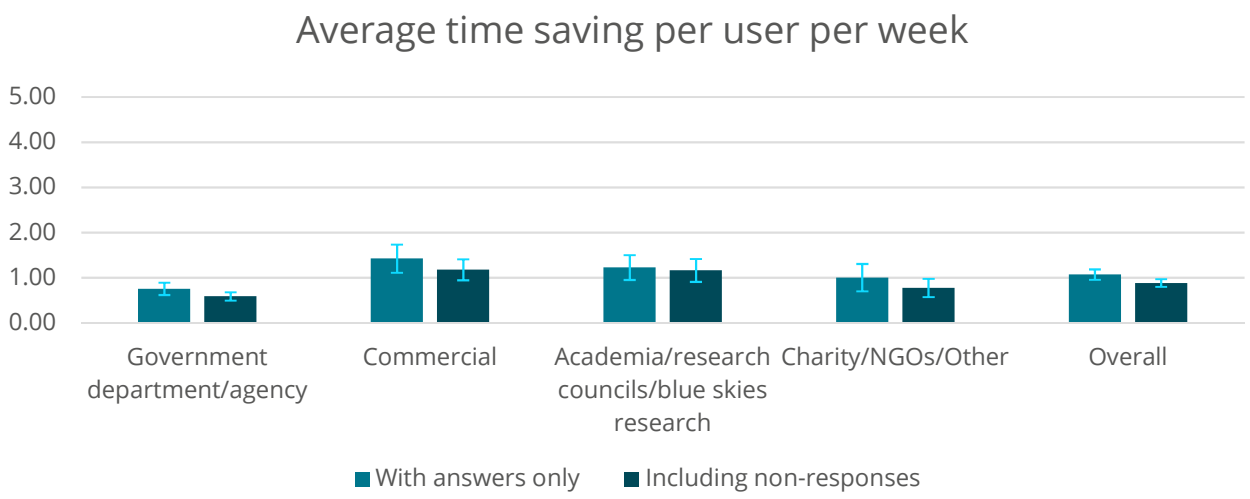

Figure 3.8: Average weekly primary marine data gathering time savings by organisation type.

Benefit 3 - Own data management time savings

For Benefit 3, again respondents who either did not answer or answered with 'I'm not sure' were removed from the analysis, giving an average time saving per user per week of 2.1 hours. This equates to 95.4 hours over the course of the year. This figure is then multiplied by the total number of active MEDIN users and the year specific wage rates, to arrive at the total value of existing marine data search time savings. For 2018, this value is £2.8m.

The number of respondents for each sector is given in **Table 3.4** and average weekly time savings is given in **Figure 3.9** below.

Table 3.4: Number of responses by organisation type.

Organisation type	With answers only	Including non-responses
Government department/agency	19	36
Commercial	11	23
Academia/research councils/blue skies research	12	19
Charity/NGOs/Other	8	13
Overall	**50**	**91**

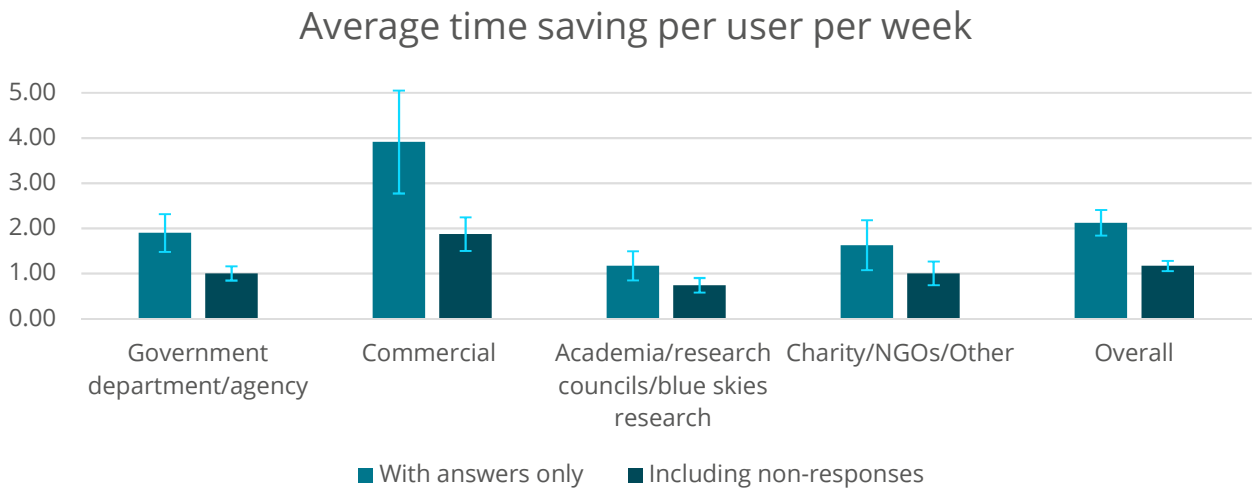

Figure 3.9: Average weekly data management time savings by organisation type.

Benefit 4 - Improved decision making

The fourth benefit regarding improved decision making, while included in the survey, is not monetised in the overall cost benefit analysis due to difficulties in applying monetary values to these benefits. For this reason, the overall net present value (NPV) and benefit to cost ratio (BCR) presented in this report should therefore be seen as a lower estimate of the true value. A summary of the responses is given in **Table 3.5** below. 'Count' refers to the number of respondents who said that they benefit from the given benefits and 'Percentage' is the proportion of the overall respondents (76) who said they benefitted. Note that due to the default answer being "No" to this question, it is not possible to determine whether those partially responding either do not benefit from these or did not reach the question. Therefore, only data on the 'full' respondents is used.

Table 3.5: Improved decision making.

Benefits	Count	Percentage
Improved organisational management of marine data	42	55%
Improved support of marine science	37	49%
Improved meeting of statutory reporting obligations	26	34%
More effective marine surveying and recording	22	29%
More effective marine spatial planning	18	24%
Improved climate change mitigation	2	3%
Improved risk assessment for navigation	1	1%
More effective disaster management	1	1%
More efficient energy generation	1	1%
Reduced mineral exploration costs	1	1%
Improved food security	0	0%
Reduced defence budgets	0	0%
Other	3	4%
No, MEDIN has not benefitted me	11	14%

The three 'Other' benefits given in written in responses were "Networking", "Improved UKMMAS knowledge of available data" and "Data submission meets funding requirements".

3.3 Costs

This section calculates the two costs included in the analysis.

Cost 1 - User time costs involved with the upload of data and metadata

Table 3.6 summarises the average time cost associated with different parts of the upload of data and metadata to the MEDIN portal for the year 2018. This is assumed to require familiarisation with the MEDIN metadata standards. It is assumed that this takes on average 6.5 days (of a 7.5 working hour day) as the mid-point of the estimated 3 to 10 day requirement suggested by MEDIN. It is further assumed that 108 users need to undertake this outlay, based on the number of attendees to MEDIN workshops per year.

The second and third costs relate to time spent ensuring that the data and metadata uploaded (after having already created them) is MEDIN compliant, with the time estimates based on a previous study run for MEDIN (MPC, 2014). This time cost is assumed to be incurred for each dataset upload per year. These numbers are based on changes in the number of datasets described in the MEDIN portal at the end of each financial year. For 2018, 1000 extra datasets and metadata records were uploaded. The total time spent is the product of the average time and frequency of uploads. To arrive at a monetary value, the total time is multiplied by the weighted average hourly earnings of the occupations of the survey respondents, uplifted for non-wage labour costs (as described previously). Applying an hourly earning rate in 2018 of £20.7, the annual cost to users of uploading data and metadata is estimated to be £160,814. This value is then converted to 2019 prices using the HM Treasury GDP deflator to give a value of £163,315. The process is then repeated for each of the years of the analysis based on the actual or predicted frequencies of upload.

Table 3.6: User upload costs (2018).

Component of upload	Average time (hours)	Frequency per year	Total time (hours)	Wage (£/hour)	Cost
Familiarisation of MEDIN metadata standard	48.75	108	5,265	20.7	£109,058
Average time per dataset upload	2.25	1,000	2,250	20.7	£46,606
Average time per metadata upload	0.25	1,000	250	20.7	£5,178
Total cost					**£160,843**
Total cost in 2019 prices					**£163,345**

Cost 2 - Financial costs related to the running of MEDIN

The second cost considered in the analysis is the financial costs related to the running of MEDIN. The actual values for the years 2014-2018 were provided by MEDIN along with the expected cost for 2019. Estimated costs from 2020 onwards assume that costs will increase by 2.3% per annum as described in Section 2.4.[17] **Table 3.7** below shows the actual and expected MEDIN costs over the two appraisal periods (2014-2019 and 2019-2024) in 2019 prices.

Table 3.7: MEDIN costs (2019 prices).

MEDIN Costs	2014[18]	2015	2016	2017	2018
Actual	£477,276	£597,577	£561,315	£641,347	£518,817

MEDIN Costs	2019	2020	2021	2022	2023
Expected	£573,000	£576,685	£580,031	£582,758	£582,758

3.4 Benefit to cost ratio

The individual costs and benefits were calculated for each year and aggregated to a present value (PV) for both of the appraisal periods (2014-2018 and 2019-2023) in 2019 prices and 2019 base year, the results of which are presented in **Table 3.8** below. As can be seen, the three benefits sum to £60.0m over the 10-year appraisal period which far outweighs the total costs of £7.3m, giving an NPV of £52.4m. The benefit to cost ratio (BCR) is also given which divides the total benefits by the total costs. With a value of 8.2 for the entire appraisal period, this again highlights the cost effectiveness of MEDIN. It should be noted that this only includes the benefits to active MEDIN users (of the three stated benefits) and so is likely to be an underestimate of the true overall value that MEDIN provides to society.

[17] *Note that this is an assumption used in the analysis and does not reflect the future MEDIN budget, which is dependent on contributions from its sponsors.*
[18] *Note that 2014 relates to the financial year 2014-15 and 2015 to the financial year 2015-16 etc.*

Table 3.8: Cost benefit analysis of MEDIN.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.9m	£0.9m	£1.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.7m**	**£3.6m**	**£7.3m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.2m	£18.9m
Benefit 2 - Primary marine data gathering	£7.0m	£6.6m	£13.7m
Benefit 3 - Own data management time savings	£14.0m	£13.2m	£27.2m
Total Benefits	**£30.7m**	**£29.0m**	**£59.7m**
NPV (Benefits – Costs)	**£27.0m**	**£25.4m**	**£52.4m**
BCR (Benefits / Costs)	**8.3**	**8.1**	**8.2**

3.5 Sensitivity analysis

This section details a number of sensitivity tests undertaken to determine how some of the main assumptions applied can affect the overall results of the study.

3.5.1 User base

One of the main risks with this study is the reliability of the survey responses. One way in which this was addressed was to validate the internal consistency of the responses, and remove individuals from the analysis where inconsistencies were found, as described in Section 3.1. These inconsistent responses were all found from the subset of respondents who did not complete the survey, casting doubt over the reliability of the rest of the respondents who only partially completed it. In order to check the sensitivity of the results of the inclusion of partial responses, the analysis was re-run using only the time saving estimates from those 64 active individuals who completed the survey. As seen in **Table 3.9**, the NPV and BCR are only slightly reduced when compared to the main analysis, providing evidence that the inclusion of the remaining partial responses is not significantly altering the results.

Table 3.9: Cost benefit analysis of MEDIN – Complete responses.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.9m	£0.9m	£1.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.7m**	**£3.6m**	**£7.3m**
Benefit 1 - Existing marine data search time savings	£8.0m	£7.5m	£15.6m
Benefit 2 - Primary marine data gathering	£6.2m	£5.9m	£12.1m
Benefit 3 - Own data management time savings	£15.4m	£14.5m	£29.9m
Total Benefits	**£29.6m**	**£27.9m**	**£57.6m**
NPV (Benefits – Costs)	**£25.9m**	**£24.4m**	**£50.3m**
BCR (Benefits / Costs)	**8.0**	**7.8**	**7.9**

3.5.2 Growth rate of gross hourly earnings

The growth rate of gross hourly earnings is assumed to be 1.8% for the years 2019-2024 throughout the analysis based on a weighted average of the responses to a survey question relating to the profession of the respondents, as detailed in Section 2.3.3. To test the sensitivity of the overall results to this assumption, the analysis was repeated instead using a higher growth rate of 2.5% (based on the average growth rate across all professions for the period 2016-2018). As seen in **Table 3.10**, the results are not greatly sensitive to this assumption with the whole appraisal period NPV only rising slightly from £52.4m to £53.0m and the BCR from 8.2 to 8.3 as a result of using the higher growth rate.

Table 3.10: Cost benefit analysis of MEDIN – 2.5% growth rate of gross hourly earnings.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.9m	£0.9m	£1.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.7m**	**£3.6m**	**£7.3m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.3m	£19.1m
Benefit 2 - Primary marine data gathering	£7.0m	£6.8m	£13.8m
Benefit 3 - Own data management time savings	£14.0m	£13.4m	£27.4m
Total Benefits	**£30.7m**	**£29.5m**	**£60.3m**
NPV (Benefits – Costs)	**£27.0m**	**£26.0m**	**£53.0m**
BCR (Benefits / Costs)	**8.3**	**8.2**	**8.3**

3.5.3 User data upload time estimates

Another test performed was to check the sensitivity of the final NPV and BCR to assumptions used in the analysis regarding the time necessary for MEDIN users to upload datasets and metadata to the MEDIN portal (Cost 1). A range of time estimates were found based on MEDIN core team experience and a previous study run for MEDIN (MPC, 2014) whereby familiarisation time was found to take between 3-10 days and dataset compliance between 1-3.5 hours. For this report, the mid-point of these ranges was used in the analysis (6.5 working days for familiarisation of MEDIN standards, 2.25 hours per dataset upload and 15 minutes per metadata upload for ensuring MEDIN compliance).

The analysis undertaken in the report was subsequently repeated using the lower bound of the range (3 working days for familiarisation of MEDIN standards and 1 hour for dataset compliance) as seen in **Table 3.12** and the upper bound (10 working days for familiarisation of MEDIN standards and 3.5 hours for dataset compliance) as seen in **Table 3.12**. As expected, the NPV and BCR rise when using the low estimates due to the decreased overall costs, resulting in an NPV for the whole appraisal period of £53.3m and a BCR of 9.4, and decrease when using the high estimates to an NPV of £51.5m and a BCR of 7.3. This range shows the sensitivity of the results to assumptions regarding data upload costs however it is not large enough to question the overall conclusions of this report.

Table 3.11: Cost benefit analysis of MEDIN – low data upload costs.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.4m	£0.4m	£0.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.2m**	**£3.1m**	**£6.3m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.2m	£18.9m
Benefit 2 - Primary marine data gathering	£7m	£6.6m	£13.7m
Benefit 3 - Own data management time savings	£14m	£13.2m	£27.2m
Total Benefits	**£30.7m**	**£29m**	**£59.7m**
NPV (Benefits – Costs)	**£27.5m**	**£25.9m**	**£53.4m**
BCR (Benefits / Costs)	**9.5**	**9.3**	**9.4**

Table 3.12: Cost benefit analysis of MEDIN – high data upload costs.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£1.4m	£1.3m	£2.7m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£4.2m**	**£4m**	**£8.2m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.2m	£18.9m
Benefit 2 - Primary marine data gathering	£7m	£6.6m	£13.7m
Benefit 3 - Own data management time savings	£14m	£13.2m	£27.2m
Total Benefits	**£30.7m**	**£29m**	**£59.7m**
NPV (Benefits – Costs)	**£26.5m**	**£25m**	**£51.5m**
BCR (Benefits / Costs)	**7.3**	**7.2**	**7.3**

3.5.4 Avoided primary marine data gathering time saving estimates

A key aspect of the analysis undertaken was the stakeholder interviews, as detailed in Section 3.6, in order to validate the results of the survey. One insight which came out of this process was that the time savings related to avoided primary marine data gathering may be overestimated, thereby increasing the overall benefits of MEDIN in the analysis. One potential reason for this may be that the survey respondents were asked to select a time-bracket for their saving, and that the mid-point (used in the analysis) may not be appropriate. For instance, 16 out of the 91 respondents (18%) indicated that MEDIN saved them on average 0-4 hours per week, and so each was assumed to have saved 2 hours, however the true value may have been lower for each. In order to test whether this would have a material impact on the overall results, a time saving of 1 hour was assigned to each of these 16 individuals. As seen in **Table 3.13**, the final results are not highly sensitive to this change with the overall NPV falling from £52.4m to £49.7m and the BCR from 8.2 to 7.8, a finding which reinforces the overall results and conclusions of this report.

Table 3.13: Cost benefit analysis of MEDIN – lower avoided primary data gathering time savings.

Cost/Benefit	2014-2019 PV (2019 prices)	2019-2024 PV (2019 prices)	Total PV (2019 prices)
Cost 1 - User data upload costs	£0.9m	£0.9m	£1.8m
Cost 2 - MEDIN financial costs	£2.8m	£2.7m	£5.5m
Total Costs	**£3.7m**	**£3.6m**	**£7.3m**
Benefit 1 - Existing marine data search time savings	£9.7m	£9.2m	£18.9m
Benefit 2 - Primary marine data gathering	£5.6m	£5.3m	£10.9m
Benefit 3 - Own data management time savings	£14m	£13.2m	£27.2m
Total Benefits	**£29.3m**	**£27.6m**	**£57m**
NPV (Benefits – Costs)	**£25.6m**	**£24.1m**	**£49.7m**
BCR (Benefits / Costs)	**7.9**	**7.8**	**7.8**

3.6 Stakeholder interviews

A small number of selected stakeholders from participating organisations were approached for qualitative research interviews in follow-up to the survey. These were suggested by the MEDIN core to represent a range of sectors that use their services, from academia and research groups to commercial organisations. These organisations varied in their size and MEDIN use to again represent a wide range of views. Seven were selected in total to verify the survey results from the perspective of their personal use and that of their organisation, and to provide further qualitative understanding of stakeholders' perspectives of the MEDIN and the broader, less easily quantified, impacts it has through building networks and representing marine data providers and users.

In general, the stakeholders found the time saving estimates of the survey respondents reasonable, in particular around data management. The majority found the average time saving of 2 hours per week from the survey respondents aligned with their own experiences as MEDIN users, and to be the most significant of the three monetised benefits of the analysis. Some of the aspects they reported to have gained from with respect to this benefit include the use of the Metadata Maestro tool for validating metadata and checking xml schema. Moreover, one stakeholder discussed how by uploading metadata to the MEDIN portal with a link to the data, their organisation benefitted from not having to manually deal with data requests in house, providing a time saving of roughly 1 FTE employee.

Regarding existing marine data search time savings, there was a consensus that the 1.5 hour per week time saving again seemed reasonable, though likely slightly higher than their own experiences. The same was found for avoided primary data gathering search time where the 1 hour per week saving was larger than their own experiences. For existing data search time savings, this could be due to our sample of stakeholders being more experienced than the typical MEDIN user, with many indicating that they have a good knowledge of where to find data and so generally search for data on the originator's data portal as opposed to through the MEDIN Data Discovery portal. For avoided primary data gathering search time this could reflect that the 18% of respondents who answered '0-4 hours per week' of time saving in the survey may have received benefits at the lower end of the time bracket but were averaged up to the mid-point of 2 hours, as discussed in Section 3.5.4. Since the sensitivity test showed little change to the overall conclusions to this report, without evidence that this is the case and in order to be consistent with the other

benefits analysed, the mid-point estimate is used throughout the benefits assessment.

The stakeholders also broadly agreed with the upload costs used throughout the analysis. They found the process to be time consuming though many considered it less so than creating INSPIRE metadata using ArcGIS. Moreover, while these costs are valid initially for the organisations in order to familiarise themselves with the process and standards required, some noted that these time costs are reducing over time and that for them the process is "now running without much input".

Alongside sense checking the survey results, the stakeholders also provided examples of wider benefits that they gain from using MEDIN which are not included in the analysis of this report. The main benefits included the provision of MEDIN workshops and guidelines as well as the networking opportunities created, both from the platform itself through events organised by MEDIN. Other key benefits included the international representation that MEDIN provides to organisations and setting a great example with regards to data management for all disciplines to follow.

Finally, some suggestions were made by the stakeholders for MEDIN to consider for further improvements to the service. These included recommendations to promote greater linkages with academia and other data providers in order to increase data availability. Moreover, it was suggested that MEDIN should push for better data management in the research community as well as continuing its same excellent efforts with university students.

3.7 Limitations

The results presented in Section 3 can be interpreted with a reasonable degree of confidence; however, there are limitations to the approach, in particular with survey derived data. In collecting data via surveys, there is a trade-off between targeting the specific info needed for evaluation, and the complexity of the survey that makes getting a reasonable sample of completed responses more difficult. As it is only feasible to collect data from a limited sample of users who chose to participate through online surveys, this particular format may lead to a self-selection bias and therefore not be representative of all MEDIN users. So while the survey sample size is sufficient to have a confidence level of 90%[19] with a margin of error of 10% given a random sample, as the sample is not purely random, this value should be viewed as indicative as the respondents who chose to complete the survey may disproportionally represent a subset of all MEDIN users, for example those who are more active or gain greater benefit. However, it is noted that the sample includes a broad range of frequency of use, with a large portion of respondents indicating that they use the service infrequently, indicating that the sample is not only picking up on one particular subset, or only frequent users.

Furthermore, as anonymity is required both in MEDIN's tracking of users, and in the survey conducted for this assessment, only limited 'identifying' data is available, and so accurate re-weighting of survey respondent sample to represent the user population is not feasible. Sensitivity analysis is undertaken in Section 3.5 to help address this by testing what effect variation in responses to key variables would have on the overall results, in particular looking at the sample of survey respondents and the user data upload costs. This informs the level of confidence in the evidence presented in this report and helps with interpretation of results.

[19] https://www.calculator.net/sample-size-calculator.html?type=1&cl=90&ci=10&pp=50&ps=1200&x=38&y=11

4. Conclusions and Discussion

4.1 Conclusion

MEDIN provides a beneficial service to marine data providers and users. The CBA conducted in this study provides quantified evidence on the costs as well as the type and value of the benefits. The analysis finds that the benefits far outweigh the investment in providing the service. This report outlines the steps of the CBA and how it was applied to MEDIN, presents the results of the assessment, including sensitivity analysis to provide greater understanding of what is driving the results and confidence in the values presented, and finally gives additional insight from follow-up stakeholder engagement.

The individual costs and benefits were calculated for each year and aggregated to a present value (PV) for both of the appraisal periods (2014-2018 and 2019-2023) in 2019 prices and 2019 base year. The three benefits sum to £60.0m over the 10-year appraisal period which far outweighs the total costs of £7.3m, giving a net present value (NPV) of £52.4m and a benefit to cost ratio (BCR) of 8.2. This finding highlights the high value and cost effectiveness of MEDIN. Further, these results are found to be robust to a number of sensitivity tests on the assumptions used in the analysis. Below, the findings are discussed along with recommendations for MEDIN and further monitoring off its impact. Overall, the study concludes that MEDIN is a valuable service which enhances the ability of marine-focused organisations to effectively conduct their activities and support their aims.

4.2 Discussion

The research and results of the CBA indicate that MEDIN is having a significant positive impact on its users. This is evidenced both by the results of the CBA and the qualitative feedback collected. The overall estimated BCR of 8.2 indicates that significant returns on the investment are being realised. In cost savings from searching for secondary research, avoiding duplication of research, and better data management, MEDIN is providing an eightfold benefit over the costs of providing the service and cost of user input. When broader benefits around the network and representation of the interests of creators and users of marine data are considered, including support for better decision-making, these benefits are even greater.

The most significant quantified benefit is the savings from improvements in organisations' own data management resulting from MEDIN guidelines and training. Both savings from searching for existing marine data and from primary data gathering are also substantial, and overall the contribution from all three benefits is significant. On the cost side, the value of any individual one of the three quantified benefits is greater than the financial cost of MEDIN, and although there is an initial outlay in time for users of MEDIN to familiarise themselves with it, the overall cost to users is relatively limited compared to the benefits received.

Of the other benefits regarding improved decision making, several were reported by multiple respondents, these are:

- Improved meeting of statutory reporting obligations;
- More effective spatial planning;
- Improved support of marine sciences;
- More effective marine surveying and recording; and,
- Improved organisational management of marine data.

Organisationally the biggest users of MEDIN are governmental departments and agencies (40%), the commercial sector (25%), and academia and research institutes (21%). The respondents indicated a fairly broad usage of the various MEDIN services, with the website and portal the most used (78% and 73% of respondents respectively), to the MEDIN helpdesk the least used (19%).

While the results are based on a limited sample size which is subject to self-selection bias, the descriptive data on the respondents does present a varied sample group approximately in line with expectations of the population as held by MEDIN, and cross-verified with a limited number of follow-up interviews. This includes responses from across the participating organisation types and sizes, and from people using the variety of services on offer. Importantly, the sample includes a broad range of frequency of use, with a large portion of respondents indicating that they use the service infrequently, indicating that the sample is not only picking up on one particular subset, or only frequent users.

Where a high level of confidence in the assumptions applied are not possible, conservative estimates have been used. This ensures that the results are robust and can be regarded as a lower bound estimate of the benefits of MEDIN. The sensitivity analysis conducted shows that no single factor or assumption has a disproportionate impact on the overall results; however, in combination they do lead to some degree of uncertainty and so the results must be interpreted with this understanding. As such, further monitoring of the service users and the costs and benefits of MEDIN would provide additional useful information to help maintain and improve the value of the service over time.

The results of this study are in line with similar ones undertaken internationally in recent years. A review of the economic effects of marine spatial data infrastructures (MSDIs) by Griffin et al., (2019) found that investing in MSDIs delivers benefit to cost ratios of between 2:1 and 18:1, with a mean of 7:1. While the costs and benefits assessed in these studies do not overlap perfectly with those detailed in this report, they support the results found in this study and help support the conclusion that MEDIN can and does provide far greater benefits to its users than the associated costs.

4.3 Recommendations

Active monitoring of the costs and benefits of MEDIN helps to identify where value is being created, and potentially where investment is not leading to as great a return as would be expected. This information can help to guide management of MEDIN in a way which maximises the benefits provided given the level of investment, or may justify an increase in investment where better than expected results are achieved, or at least the maintenance of current levels of investment by increasing with inflationary costs. Therefore, it is recommended that regular monitoring and engagement with users occurs. While this does not necessarily require the development of a full CBA, annual monitoring can help to identify trends and emerging areas for focus.

Recommendations:

- During the stakeholder engagement, the individuals made some suggestions for MEDIN to consider for further improvements to the service. These included recommendations to promote greater linkages with academia and other data providers in order to increase data availability. Moreover, it was suggested that MEDIN should push for better data management in the research community as well as continuing its same excellent efforts with university students;
- Regarding the results of the analysis undertaken, the largest monetised benefit comes from own data management time savings, making up almost 50% of the total benefits. Looking to the future, this should therefore be an area of continued focus for MEDIN due to the large benefits it has delivered to date;
- The analysis also highlighted that the smallest benefit (just under 20%) comes from time savings from the avoidance of primary data gathering. This could therefore be an area of development for MEDIN;
- It had not been possible to quantify all potential benefits that MEDIN provides. In particular, the benefits relating to improved decision making due to greater availability of marine data were not included in the analysis. The responses in the survey and stakeholder engagement indicated that these are likely to be significant and so should be explored further to give a fuller picture of the overall benefit that MEDIN provides to society. For example, for the most frequent categories of 'improved decision making' as reported in the survey, research could look at the size of the activity or sector (e.g. annual UK marine science spend), and what percent efficiency on the total value is realised due to MEDIN;
- Relating to the monitoring of the costs and benefits of MEDIN itself, further investigation into the impacts of MEDIN could focus on specific limitations. Assumptions could be revisited, in particular around profiling costs and benefits over future time periods. Another area which could benefit from further research is the consideration of 'additional' benefits, such as focus on the network effects that MEDIN enables, and broader societal benefits through improved management and use of marine resources resulting from use of the service;
- Finally, if impact analysis is to be repeated, the survey could be circulated more widely and over a longer timeframe in order to increase the total number of MEDIN users in the sample, potentially targeting specific user groups to try to ensure the sample is representative of the user population. If successful, the increase in the overall sample size would allow for a more detailed disaggregated assessment of the benefits to the different types of users and organisations.

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Appendix 1: Survey

MEDIN Survey

MEDIN is a partnership of UK organisations committed to improving access to UK marine data.

As a user of MEDIN we value your opinion on the services it provides and would appreciate your help with a 5-10 minute user survey. This survey is designed to gather information on how you use this service and how, if at all, you benefit from it. Your help is gratefully received and will be used to improve the future services provided by MEDIN. All responses will be kept confidential and we do not ask for your name or the name of your organisation.

Please note that there is no intention to use this information to make MEDIN a paid service, it is solely to understand the benefits it provides.

PART A: ORGANISATION CHARACTERISTICS AND MEDIN USE

1. How many people does your organisation employ (full time equivalent)?
    - 0 (sole trader)
    - 1 - 9
    - 10 - 49
    - 50 - 249
    - 250+
2. Which category does your organisation come under?
    - Government department/agency
    - Oil and gas industry
    - Marine consultancy
    - Ports and harbours
    - Offshore surveying
    - Offshore renewables
    - Other commercial
    - Academia/research councils/blue skies research
    - Charity/Non-Governmental Organisation (NGOs)
    - Other [field to type answer]
3. What is your role in the organisation?
    - Owner or Manager
    - Professional and technical
    - Administrative and support
    - Other

4. Which parts of MEDIN do you, or have you ever, used? Please tick all that apply[20]
    - MEDIN website
    - MEDIN data portal
    - MEDIN metadata standard
    - Metadata editor
    - MEDIN helpdesk
    - MEDIN data guidelines
    - MEDIN Data Archive Centres
    - MEDIN workshops
    - UK Directory of Marine Observing Systems
    - None
5. How often do you use MEDIN to search for data (e.g data portal, UK Directory of Marine Observing Systems, MEDIN Data Archive Centres)
    - Every week
    - Every month
    - Every 2 months
    - Every 3 months
    - Every 4 months
    - Only once or twice a year
    - Less than once a year
    - I have never used MEDIN
    - I'm not sure
6. How often do you use MEDIN to help you manage your data (e.g. data guidelines, metadata standard, metadata editors, Data Archive Centres, helpdesk, workshops)
    - Every week
    - Every month
    - Every 2 months
    - Every 3 months
    - Every 4 months
    - Only once or twice a year
    - Less than once a year
    - I have never used MEDIN
    - I'm not sure
7. Roughly how many people in your organisation use MEDIN (e.g. website, data portal, data guidelines,

[20] *Note that the Data Archive Centres (DACs) are as followed: British Oceanographic Data Centre (BODC), British Geological Survey (BGS), DASSH, Met Office, UK Hydrographic Office (UKHO), Centre for Environment, Fisheries and Aquaculture Science (Cefas), Marine Scotland, Archaeology Data Service, Historic Environment Scotland, Royal Commission on the Ancient and Historical Monuments of Wales.*

metadata standard, metadata editors, Data Archive Centres, helpdesk, workshops, UK Directory of Marine Observing Systems etc)? If unsure, please leave blank.

- [field to type answer]

PART B: SEARCHING FOR EXISTING MARINE DATA

8. How much time in total (including MEDIN and other sources) do you spend on searching for existing marine data, in an average week? e.g. for carrying out desk studies, marine license applications, research, Environmental Impact Assessments, scoping future work, etc.

   Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

   - 0 hours per week
   - 0 – 4
   - 5 – 9
   - 10 – 14
   - 15 – 19
   - 20 – 24
   - 25 – 29
   - 30 – 34
   - 35 +
   - I'm not sure

9. How much time do you spend **using the MEDIN portal** to search for existing marine data in an average week?

   Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

   - 0 hours per week
   - 0 – 4
   - 5 – 9
   - 10 – 14
   - 15 – 19
   - 20 – 24
   - 25 – 29
   - 30 – 34
   - 35 +
   - I'm not sure

10. Do you think using the MEDIN portal has helped you **save time on a regular basis** searching for existing marine data? If so, how many person-hours in an average week?

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 hours per week
    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 – 24
    - 25 – 29
    - 30 – 34
    - 35 +
    - I'm not sure
    - [Please give example(s) of what is driving this estimate]

PART C: PRIMARY MARINE DATA GATHERING

11. How much time do you spend on **primary data gathering** efforts (e.g. collecting new data, conducting surveys) in an average week?

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 hours per week
    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 – 24
    - 25 – 29
    - 30 – 34
    - 35 +
    - I'm not sure

12. Do you think using MEDIN (portal, Data Archive Centres[21], data guidelines, workshops) has helped you avoid duplication of **primary data gathering** efforts **on a regular basis**? For example, this could

[21] *British Oceanographic Data Centre (BODC), British Geological Survey (BGS), DASSH, Met Office, UK Hydrographic Office (UKHO), Centre for Environment, Fisheries and Aquaculture Science (Cefas), Marine Scotland, Archaeology Data Service, Historic Environment Scotland, Royal Commission on the Ancient and Historical Monuments of Wales.*

be by providing access to data collected by others to support your work, by providing structured, consistent guidelines to ensure all relevant information about a dataset is recorded etc.

- Yes
- No (skip to question 14)
- [Comment - If Yes, please provide any relevant examples]

13. If you answered Yes to Question 12, how many hours do you estimate you save from avoiding duplication of primary data gathering efforts in an average week?

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 – 24
    - 25 – 29
    - 30 – 34
    - 35 +
    - I'm not sure

14. Do you think using MEDIN (portal, Data Archive Centres, data guidelines, workshops) has helped your organisation save any **one-off costs** through **avoiding duplication of primary data gathering** efforts? For example the cost saving from not having to conduct/commission a specific survey to obtain the data. If so, what do you estimate the saving to be?

    - I'm not sure
    - No, MEDIN has not helped my organisation make any one-off savings.
    - Yes, likely one-off yearly cost saving is £ [field to type answer]
    - [Comment – please give example(s) of the types of costs involved]

PART D: DATA MANAGEMENT

15. How much time do you spend on **managing data** in an average week? This could be managing your own data, or other data owned or held by your organisation.

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 hours per week
    - 0 – 4
    - 5 – 9

- 10 – 14
- 15 – 19
- 20 – 24
- 25 – 29
- 30 – 34
- 35 +
- I'm not sure

16. How much time do you spend **using MEDIN** (portal, Data Archive Centres, data guidelines, workshops) for managing data in an average week? This could be managing your own data, or other data owned or held by your organisation.

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 hours per week
    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 – 24
    - 25 – 29
    - 30 – 34
    - 35 +
    - I'm not sure

17. Do you think using MEDIN (portal, Data Archive Centres, data guidelines, workshops) has allowed you to **benefit from time savings in terms of data management**? If so, how much time do you estimate that your use of MEDIN saves you in an average week?

    Note, if there is no such thing as an average week, please approximate across the year. For example, if you have shorter periods of high use and longer periods of moderate or no use, please consider how this would average out over the course of a year.

    - 0 hours per week
    - 0 – 4
    - 5 – 9
    - 10 – 14
    - 15 – 19
    - 20 – 24
    - 25 – 29
    - 30 – 34

- 35 +
- I'm not sure
- [Please give example(s) of what is driving this estimate]

PART E: DECISION MAKING DUE TO AVAILABILITY OF MARINE DATA

18. Do you think using MEDIN (portal, Data Archive Centres, data guidelines, workshops, UK Directory of Marine Observing Systems) has allowed your organisation to benefit from any of the following? [Tick all that apply]

    - Improved meeting of statutory reporting obligations
    - Improved risk assessment for navigation
    - More effective marine spatial planning
    - Improved support of marine science
    - Reduced mineral exploration costs
    - More effective disaster management
    - Improved food security
    - Improved climate change mitigation
    - More efficient energy generation
    - More effective marine surveying and recording
    - Improved organisational management of marine data
    - Reduced defence budgets
    - No, MEDIN has not benefitted me
    - Other [please specify]

19. For each potential benefit selected, how much do you estimate that your organisation benefits from this in £ in an average year? *If you are either unsure of the value or the benefit does not apply, please leave blank.*

    - [field to type answer]
    - [Comment – please give example(s) of these benefits]

20. For each potential benefit selected, what is the likelihood that your organisation would have been able to benefit from it without the use of MEDIN? *If this benefit does not apply, please leave blank*

    - Very likely (100%)
    - Quite likely (75%)
    - Somewhat likely (50%)
    - Not very likely (25%)
    - Not at all likely (0%)
    - I'm not sure

PART F: UPLOADING METADATA AND DATA

21. Have you created and uploaded metadata to the MEDIN portal or deposited data with the MEDIN Data Archive Centres? Please tick all that apply

    - Yes, I have uploaded metadata to the portal
    - Yes, I have uploaded data to one or more DACs
    - No [skip to Question 24]

22. How many metadata records do you upload to the MEDIN portal in an average month? *If you are either unsure of this number or the question does not apply, please leave blank.*

    - [field to type answer]

23. How many times you deposit data with the MEDIN Data Archive Centres in an average month? *If you are either unsure of this number or the question does not apply, please leave blank.*

    - [field to type answer]

PART G: ESTIMATING MARKET PRICE OF SUBSTITUTES

24. Looking at MEDIN as a whole package (offering an overall service that includes data discovery and access, data standards and tools, knowledge and expertise, workshops and training) if MEDIN didn't exist, would your organisation pay for an equivalent service from a commercial provider? *Please note that there is no intention to use this information to make MEDIN a paid service, it is solely to understand its value.*

    - Yes, probably would pay for an equivalent service
    - No, probably would not pay for equivalent service [skip to Question 26]
    - [Comments]

25. How much would your organisation be willing to pay for such a service per year in £s? *If unsure, please leave blank*

    - [field to type answer]

26. Breaking MEDIN into approximate parts, are there elements of the service that your organisation would be willing to pay for? Please fill in how much would your organisation be prepared to pay for each element of the service per year, leaving blank any your organisation would not pay for or you are unsure about. *Please note that there is no intention to use this information to make MEDIN a paid service, it is solely to understand its value.*

    - Data discovery and access portal
    - Access to data standards, guidelines and metadata preparation tools
    - Training workshops
    - [Comments]

27. If you have any comments to share with us on any aspect of this survey or about the services MEDIN provides, please enter them here:

    - [Text box for character entry]

Appendix 2: Net present value calculations

In developing the CBA model, the annual benefits and costs over the assessment period are aggregated in present value (discounted) terms. The formal calculations are presented below.

$$\mathbf{PVB} = \sum_{\mathbf{i=0}}^{\mathbf{5}} (\frac{\mathbf{1}}{\mathbf{1+r}})^{\mathbf{i}} * \boldsymbol{Benefits}_{\boldsymbol{i}}$$

Where PVB is present value benefit, i is an index for the year and r is the discount rate.

$$\mathbf{PVC} = \sum_{\mathbf{i=0}}^{\mathbf{5}} \left(\frac{\mathbf{1}}{\mathbf{1+r}}\right)^{\mathbf{i}} * \boldsymbol{Costs}_{\boldsymbol{i}}$$

Where PVC is present value cost, i is an index for the year and r is the discount rate.

Costs and benefits are compared in present value terms. The net present value (NPV) of an intervention is calculated as the difference between Present Value of the Benefits (PVB) and the Present Value of the Costs (PVC):

$$\mathbf{NPV} = \mathbf{PVB} - \mathbf{PVC} = \left[\sum_{\mathbf{i=0}}^{\mathbf{5}} \left(\frac{\mathbf{1}}{\mathbf{1+r}}\right)^{\mathbf{i}} * \boldsymbol{Benefits}_{\boldsymbol{i}}\right] - \left[\sum_{\mathbf{i=0}}^{\mathbf{5}} \left(\frac{\mathbf{1}}{\mathbf{1+r}}\right)^{\mathbf{i}} * \boldsymbol{Costs}_{\boldsymbol{i}}\right]$$

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