OCEAN PLASTICS

A COST ANALYSIS OF THE GLOBAL CLEANUP

Summary

This paper outline a parametric and analytical method of costing the removal of all plastic from our world oceans. Based on reasearch and real data, the problem was analysed and the uncertanties considered. Methods found that the total cost could range between £54.9 billion and £162 billion. Both estimates were based on a fully defined scope and list of assumptions. Given the level of uncertanty, it was concluded that the cost estimation should be repeated at regular intervals as more accurate data is gaethered.

Contents

Introduction 1.0

In the 1950s we developed the ability to produce plastic materials from hydrocarbons. Since then they have become commonplace. The non-biodegradable nature of plastic combined with our throw away society has lead to a growing problem of plastic waste build up in our oceans. Today we are seeing increasing efffects on wildlife caused by 'micro-plastics'. If nothing is done, by 2050 there will be more plastic than life in the oceans by weight. This paper aims to estimate the cost of removing these plastics from our oceans.

Research: Problem Identification 2.1

To develop an accurate model of any situation, whether to develop a costing method or otherwise, it is essential to properly understand the problem. Costing the removal of plastic from the ocean relies on one key question. How much plastic is in the ocean?
It has been estimated that in 2010, 4.8 - 12.7 million metric tons (MMT) [1] of plastic entered the ocean from land. This was based on conversion of mismanaged waste estimations. Comparing this with the cumulative plastic waste since 1950 [2], it was determined that 1.7% – 4.6% of cumulative plastic waste became marine waste in 2010.

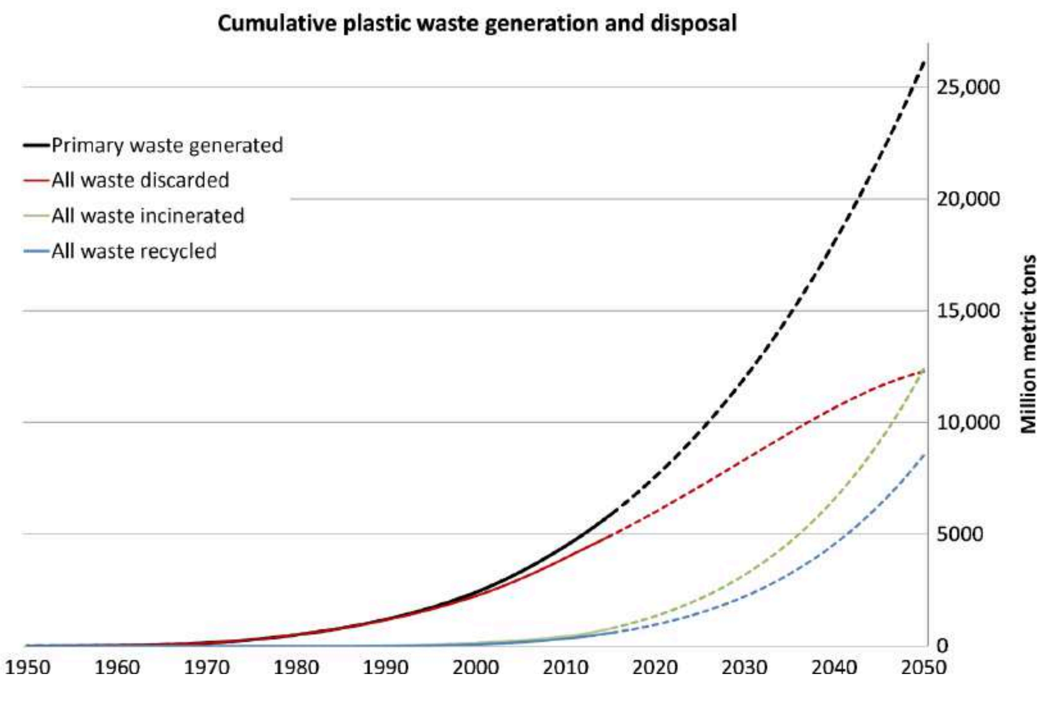

Figure 1: Cumulative Plastic waste generation and disposal ([2] Fig. 3)

Plastics in the ocean break down over time as they are weathered and eroded. Marine plastic can be broken down into 2 categories. Macroplastics (>5mm) and microplastics (<5mm) as shown in *Figure 2*.

Figure 2: Size of Oceanic Plastic

Primary research [4] analysed dated plastic material removed from the ocean. It was estimated that, on average, annually 3% of the macro-plastic in the ocean degrades into micro-plastic by mass. These micro-plastics are extremely fine so it was deemed unfeasible to remove them. Therefore, they were placed outside the scope of plastic removal.

In order to calculate the quantity of plastic in the oceans, the following assumption were made.

Plastic Quantity Assumptions 2.2

80% of plastic comes from land [3], therefore:

- It is assumed that the rate of plastic dumped directly into the oceans increases at the same rate as plastic dumped into the oceans from land.
- That the percentage of cumulative plastic production dumped in the sea for 2010 (1.7% – 4.6%) is constant from 1950 to present day.
- That the percentage of oceanic plastic, that is buoyant is constant at 65.5% [4].

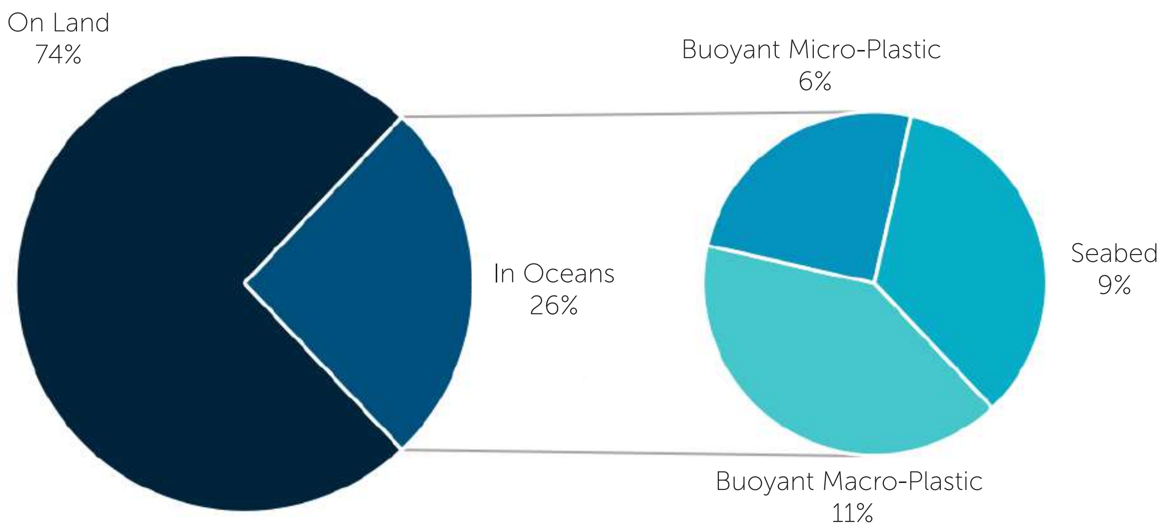

Figure 3: Where the worlds plastic is located

Based on these assumptions the amount of retrievable Macro-plastic was calculated to be between 82.4 - 223 million tons.

Oceanic Plastic Displacement 2.3

Estimates for how much plastic is thrown into the ocean each year are in the region of millions of tons [1]. However, estimates for how much plastic is on the surface of the ocean are an order of magnitude lower. As demonstrated by *Figure 3* lots of plastic in the oceans has either broken down or sunk and so is no longer observable but this doesn't account for all the missing plastic.

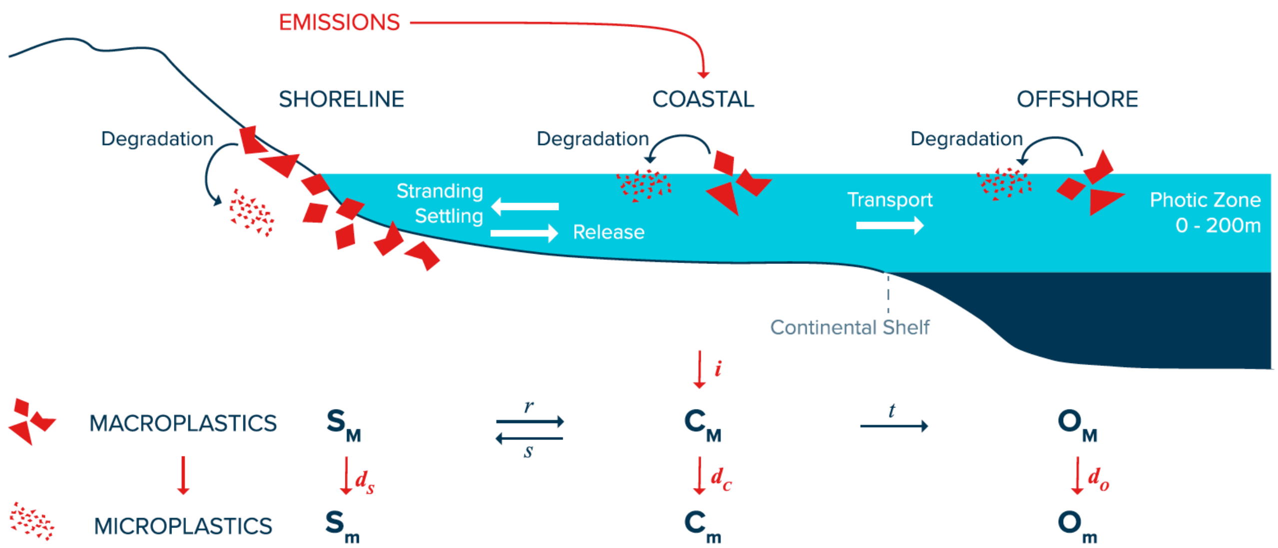

Figure 4: Modelling Plastic Movement in the Ocean ([4] Fig. 1)

Recent research [4] theorised that plastic exists in three states at sea: Shoreline, Coastal & Offshore It was suggested, based on plastic flow modelling, that the vast majority of plastic is in the shoreline and coastal categories and that it can take from five to ten years [5] for plastic to make its way offshore.
This model showed that annually 3% of coastal plastic makes its way offshore. Based on oceanic flow modelling it was also assumed that once plastic moves offshore, it doesn't move back.

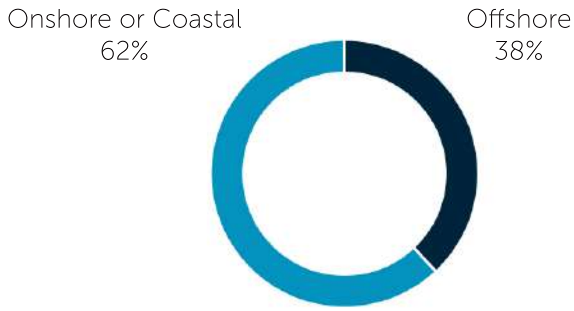

Figure 5: Plastic Displacement within Oceans

Assuming plastic flows into the oceans at the same rate used for *Figure 3* (1.7% – 4.6% of global plastic [1]), oceanic plastic flow was modelled based on the methods in *Figure 4 [4]*. The results of this are shown in *Figure 5.* This highlights that the majority of oceanic plastic is either on shore or in a coastal region.

	Maximum	Minimum
Onshore and Coastal Plastic	138.3 million tons	51.1 million tons
Offshore Plastic	84.8 million tons	31.3 million tons

Table 1: Buoyant Macro-Plastic Displacement within Oceans

Defining Scope 2.4

Within Scope

1. Macro-Plastic
2. All Seas and Oceans
3. Prevention of future plastic flow to oceans
4. Coastal and shoreline plastic
5. Offshore plastic

Outside Scope

1. New Technology research
2. System Implementation
3. Plastic processing once on land
4. Non buoyant plastics
5. Micro-Plastics
6. Education about plastic disposal
7. Better waste management on land

Figure 6: Project Scope and Exclusions

Plastic collection Method 2.5

In order to clean up all buoyant macro-plastic, various different methods will be required as the plastic is dispersed in a variety of different environments.

- To clean the offshore plastic, this costing method will be based on the use of the The Ocean Cleanup's 'Passive Cleanup system'. This works by placing arcs in the ocean that act as artificial coastlines which collect plastic. This plastic is the collected by a ship and transported to shore.
- To clean the onshore and coastal regions, this model will be based on a piecework method. Where people are payed per kg collected. e.g. 'The Plastic Bank'.
- Finally, future plastic flow will be prevented using 'Interceptors'. A collection method placed at the mouth of rivers again developed by 'The Ocean Cleanup TM'.

Costing Assumptions 2.6

1. No third parties are involved in the clean up.
2. Any plastic cleaned up to date is negligible.
3. No benefits are applied based on charitable status, i.e. no volunteers

Shore side clean up

4. Rate of pay based on minimum wage
5. A working day is 8 hours
6. 220 working days in a year
7. People will use there own Boats
8. Ocean Conservancy organised clean ups last for one day (8 hours)

Ocean Clean up

9. Ocean Clean up is based on a 20 year plan as suggested by 'The Ocean Cleanup' [10]
10. For mass production, costs are reduced by a scaling factor of 0.6 [5].
11. Ocean Cleanup have calculated how many clean up systems they need based on kg/system
12. All plastic collection boats are fitted with crushers to reduce volume
13. When crushed average plastic density is equal to that of crushed plastic bottles
14. Average journey for boats collecting plastic is half way across the pacific ocean
15. All ships used are 'Maersk Launchers', this ship currently used by 'The Ocean Cleanup'
16. Maersk will charge based on current rates for 'east-west' cross Atlantic rates

'Closing the tap' : Preventing further flow from land to sea

17. Implementation costs are negligible

Cost Estimates: Analytical - Top Down 3.1

The primary cost drivers were highlighted in the project scope and these have been used in *Figure 7* to develop cost estimation approach.

- Cost Drivers
  - Coastal & Onshore Plastic
    - Manual Workforce
  - Offshore Plastic
    - Passive Cleanup systems
    - Boats
  - 'Closing the Tap' - Preventing future plastic flow to oceans
    - Interceptors
    - Labour Cost

Figure 7: Top down estimating approach

Coastal & Shoreline Plastic Collection Estimate 3.2

The Cost Estimate for the coastal and onshore regions was calculated based on the payment for the workforce. Data sourced from the Ocean Conservancy was used to determine on shore plastic density based on km covered and kg collected [6]. Appendix A shows data for individual countries. All the worlds countries were sorted into four economic classification as outlined by the World Bank [7]. The total coastline [8] distance was then determined for these four classifications. Based on Ocean Conservancy data [6], a normalized fraction of the world plastic distribution per economic classification was determined. This can be seen in *Table 2*.

Economic Classification	Upper	Upper-mid	Lower-mid	Lower
Total Coastline/ km	535799.50	327027.90	339362.00	339362.00
Total Distance cleaned/ km	26461.80	4864.50	2549.50	1664.70
Total Plastic collected/ Kg	8679393.00	897108.50	486898.00	497044.00
kg/ km searched	328.00	184.42	190.98	298.58
Relative Plastic/ kg	175 million	60 million	64 million	101 million
Normalised fraction	0.44	0.15	0.16	0.25
Maximum Plastic/ tons	60.9 million	20.7 million	22.1 million	34.6 million
Maximum Plastic/ tons	22.5 million	7.7 million	8.2 million	12.8 million

Table 2: Normalisation of Coastlines for Different economic regions

The shoreline and coastal collection method is based on self-employed "piece work", where people organise their own equipment and collection methods and are then paid per kilogram collected. Wages are calculated based on the averages annual minimum wages taken from the World Bank [7]. Based on assumption 5 & 6, an hourly rate was calculated.

Economic Classification	Upper	Upper-mid	Lower-mid	Lower
Normalised fraction	0.44	0.15	0.16	0.25
Maximum Plastic/ kg	60.9 billion	20.7 billion	22.1 billion	34.6 billion
Minimum Plastic/ kg	22.5 billion	7.7 billion	8.2 billion	12.8 billion
Minimum wage $/hour	7.03	2.27	0.58	0.17

Table 3: Plastic and average minimum wage in each economic region

Rates of collection where calculated from two sources. Ocean conservancy [6] data was plotted for number of people vs the kilograms collected, which can be seen in *Figure 8*. From this an average hourly rate of collection was calculated based on assumption 5.

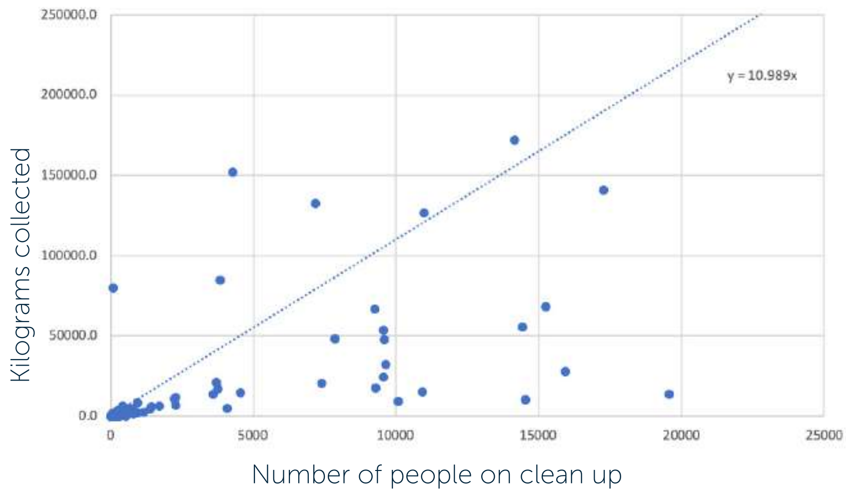

Figure 8: Ocean Conservancy [6] organised clean up rates

The gradient in *Figure 8* refers to the kilograms collected per person per day. Data was also collected from two projects being run by 4Ocean [9]. The results are shown in *Table 3.*

Clean up project	Collection Rate: kg/ hour per person
Ocean Conservancy- 2019 Average	1.38
4Ocean - Bali project	3.49
4Ocean - Haiti project	7.51

Table 4: Normalisation of Coastlines for Different economic regions

Table 4 shows that collection rates are variable. Ocean Conservancy data [6] is based on collection rates of volunteers so it can be assumed that workers on a piecework scheme would collect plastic at a faster rate than this. Ocean Conservancy data [6] also showed that plastic density in Caribbean countries is much higher than the global average, therefore the global rate of collection is likely to be much lower than that of the Haiti project. Given both these factors the collection rate in Bali was considered to be an acceptable estimate for a global average.

Global Collection rate	3.5 kg/ hour per person

Table 5: Global Collection rate

Economic Classification	Upper	Upper-mid	Lower-mid	Lower
Maximum required man hour	17.4 billion	5.9 billion	6.3 billion	9.9 billion
Minimum required man hour	6.4 billion	2.2 billion	2.3 billion	3.65 billion
Maximum collection cost/ $	122.2 billion	13.5 billion	3.7 billion	1.7 billion
Minimum collection cost/ $	45.2 billion	5.0 billion	1.4 billion	0.6 billion

Table 6: Man hours and cost for collection by economic classification

The global plastic collection rate is shown in *Table 5*. The quantity of plastic and the average minimum wage in each economic classification are shown in *Table 3*. Using these values the required man hours for each economic region and the cost of employment for these hours were calculated. These are shown in *Table 6*.

Total Cost of Coastal and Shoreline clean up	
Maximum	£108.6 billion - $141.1 billion
Minimum	£40.1 billion - $52.1 billion

Table 7: Total Cost of Coastal and Shoreline clean up

Offshore Plastic Collection Estimate 3.3

The Ocean Cleanup project [10] aims to clean up the "Great Pacific Garbage Patch" (GPGP) which is considered to be the largest area of concentrated plastic in the oceans. They have estimated the GPGP contains 0.8 million tons of plastic [10]. To complete this clean up over 20 years, they have predicted they will require 60 Passive cleanup systems [10].

	Maximum	Minimum
Offshore plastic	84.8 million tons	31.3 million tons
GPGP Percentage	5.1%	1.6%
No. of systems for all oceans	3756	1174

Table 8: Number of required cleanup systems

The scaling of the required number of passive cleanup systems is based on assumption 11. In order to cost the production of these clean up systems, assumption 10 was used. Assume a scaling reduction of 0.6 for mass production [5].

	Maximum	Minimum
Quoted system price	$5.8 million [11]	
Mass production price	$3.5 million	
Total Cost	$13.1 billion	$4.1 billion

Table 9: Cost for Passive cleanup systems

Costing for the ships used to collect the rubbish from the passive systems is based on assumptions 13-16.

Maersk Launchers Cubic storage volume	8100 m^3 [12]
Crushed plastic density	42.5m^3/ton [13]
Maersk Launchers Plastic capacity by Volume	190.6 tons

Table 10: Loading capabilities of Boats

	Maximum	Minimum
Maersk Charge per journey	$88000 [14]	
Total required journeys	444,938	164,228
Total boat costs	$39.2 billion	$14.5 billion

Table 11: Cost of boats

Maersk charge per journey is based on cost for an individual container scaled up to the whole boat.

	Maximum	Minimum
Passive Cleaning system	$13.1 billion	$4.1 billion
Boats	$39.2 billion	$14.5 billion
Total Offshore costs	$52.3 billion/ £40.3 billion	$18.6 billion/ £14.3 billion

Table 12: Total Offshore costs

'Closing the Tap' 3.4

The final primary cost driver is preventing any future flow of plastic from the land into the sea. 80% of the plastic flowing from land to oceans flows through 100 rivers [6]. The other 20% isn't sourced from any one issue. The real solution is better land management of waste and education of its importance but these are outside the scope of this cost estimate.

The 80% will be dealt with by using 'The Ocean Cleanup' Interceptors as shown in *Figure 9*.

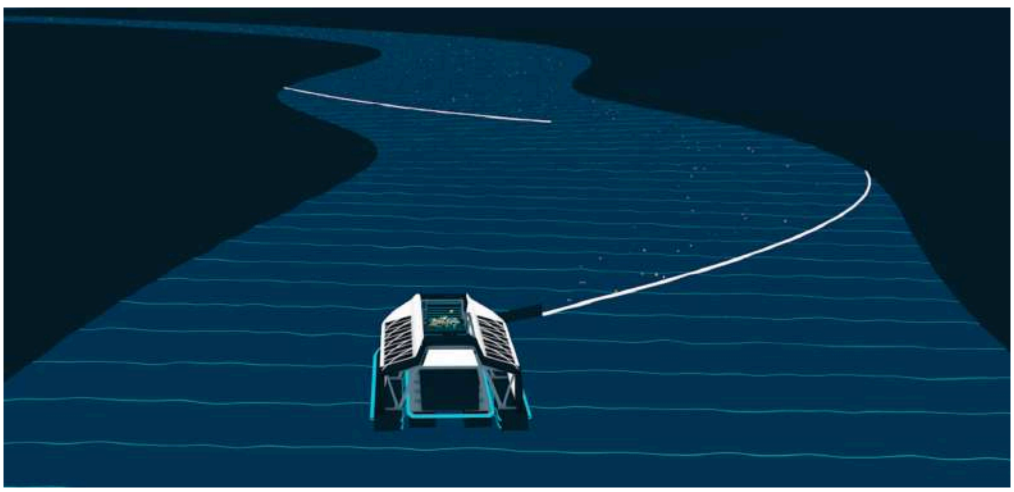

Figure 9: The Ocean Cleanup Interceptor [10]

Interceptor Costing	
Quoted unit cost	$777,000
Mass production cost	$598,290 *(assumption 10)*
Total Cost	$598.3 million/ £460.7 million

Table 13: Interceptor Costing

	Maximum	Minimum
Shoreline Clean up	£108.6 billion	£40.1 billion
Total Offshore costs	£40.3 billion	£14.3 billion
Future Prevention cost	£460.7 million	
Total Cost	£149.4 billion	£54.9 billion

Table 14: Total Costing

Monte Carlo simulation was used to determine where in the analytical costing range the most probable cost would fall. The three primary cost drivers where modelled based on assumptions made in part 2.6 and then combined to find the probability range for the total costs.

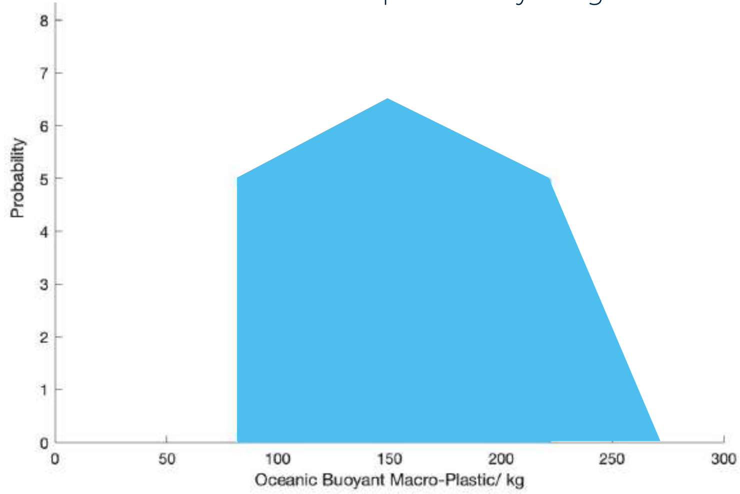

Figure 10: Ocean Plastic Probability

Figure 10 shows probability model for the total mass of buoyant macro-plastic in the world oceans. The total current plastic was modeled as a normal distribution between the upper and lower limits in *Table 1*. A normal distribution from 2-20 years was also used to model the time it would take us to prevent any additional plastic flow.

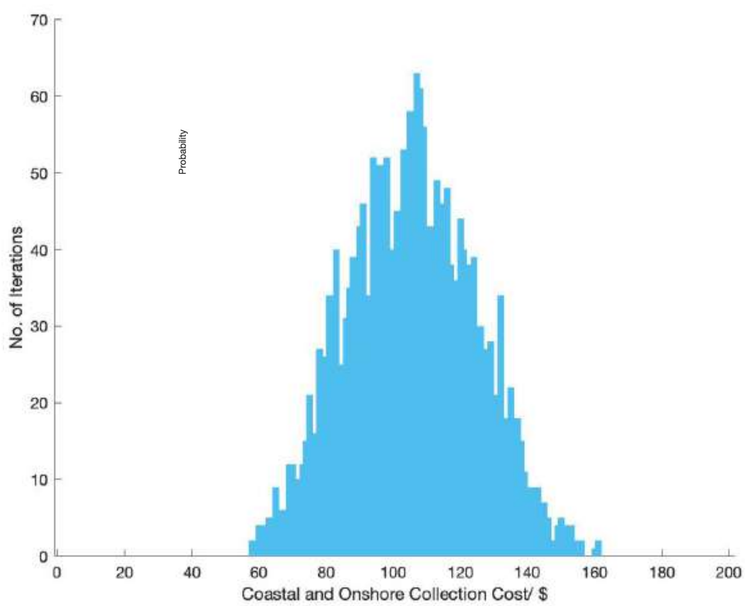

Figure 11: Normal distribution for Coastal Plastic costing

Figure 11 was developed based on the four economic classifications used in section 3.2 and sourced from the World Bank [7]. The distribution of plastic between these four classifications was randomly generated and then normalized so that the total was equal to the total plastic value generated from *Figure 10.* The total coastal collection cost was then determined based on the minimum wages for the four classifications outlined in *Table 3*. Plastic ocean distribution was assumed to be eual to that shown in *Figure 5.*

The offshore cost was modelled using uniform distribution between the values shown in *Table 12.*

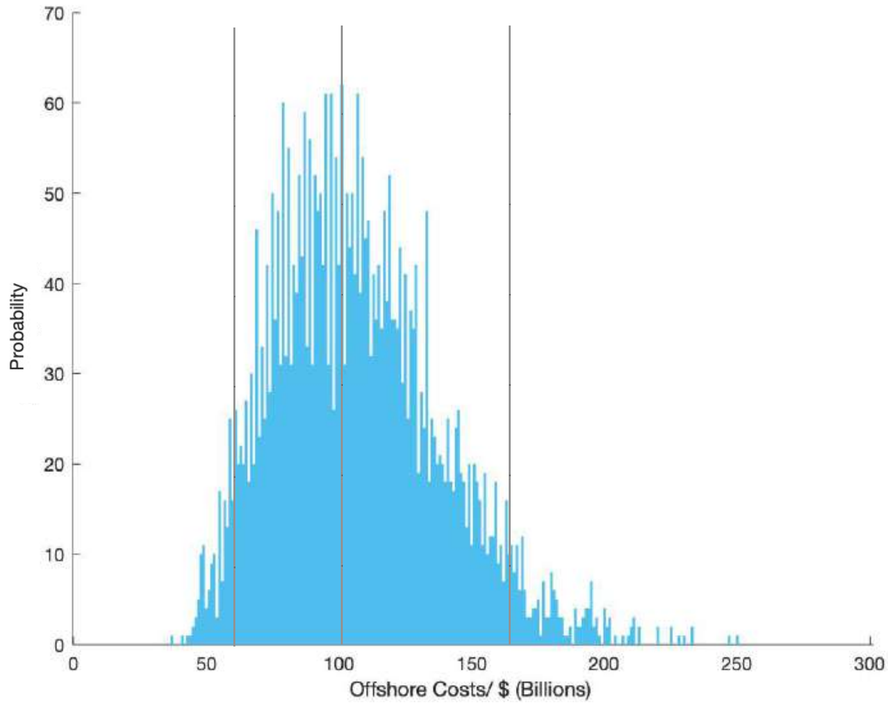

Figure 12: Total Cost Monte Carlo Modelling

Figure 12 shows the simulation for the total cost of cleaning the oceans. This is the sum of the models shown in figures 10, 11 and the offshore model. It shows a positively skewed result with a mean of 150 but a modal average of 100 and a standard deviation of 86.75. The probability results are displayed in *Table 15*.

Probability	Maximum	Minimum
90%	£162 billion	£61 billion
50%	£128 billion	£74 billion

Table 14: Monte Carlo Costing

Discussion 5.1

Figure 14 shows the cost breakdown of the primary and secondary cost drivers. It clearly shows that the vast majority of expenditure is for the piecework collection of coastal & shoreline areas. As a result it is clear that the rate of pay will be the most important variable for affecting the cost output. The rate of pay per kg could be adjusted based on more detailed research.

The second largest cost is the boat charge, which could be reduced by coming to some form of agreement with Maersk. However given the nature of this task, it was unrealistic to attempt to cost the outcome of such a deal. If this project were to be undertaken, serious consideration should be given to purchasing boats depending on cash flow.

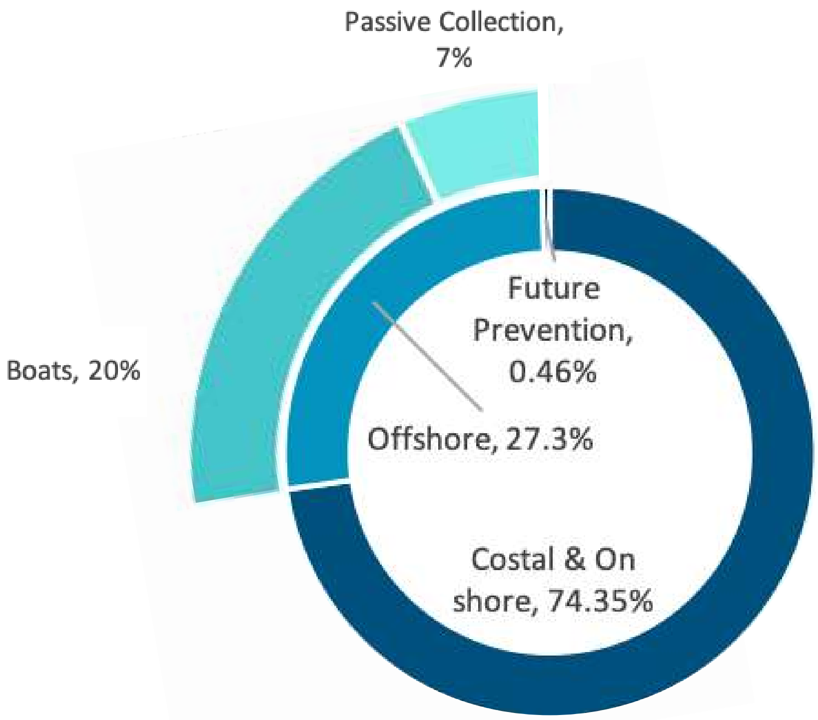

Figure 14: Primary and Secondary Cost Drivers

Data Maturity 5.2

The proportion of data maturity used in this report can be seen in *Figure 15*. The scoring system was as follows.

1. Low Quality: Forums and Social Media
2. Medium-Low Quality: Publicly sourced websites e.g. Wikipedia
3. Medium Quality: Independent sources such as journalistic articles
4. High Quality: Company data, publications, goverment data and respected bodies
5. Excellent Quality: Scientific papers

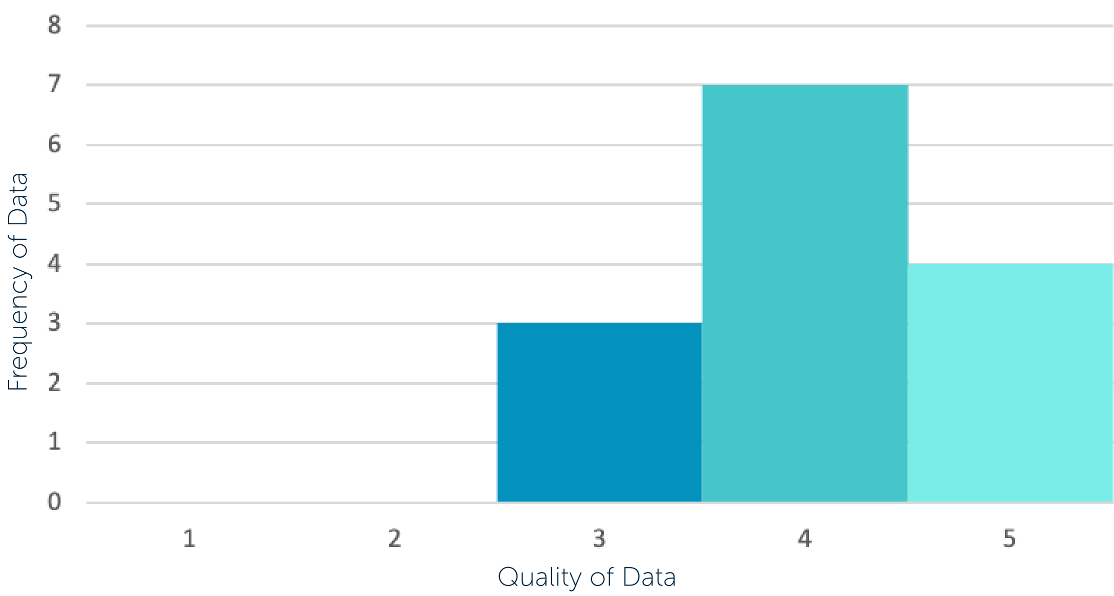

Figure 15: Data Maturity

Reflection 5.3

This task has taught me skills that are useful in a costing scenario as well as more general scenarios.

- When faced with a task that initially looks daunting, breaking it down into manageable sections can help one better consider the problem.

- Thorough research is essential when considering a task in which one doesn't have prior experience.

- Parametric methods at an early stage of a project can give a better result and take far less time. For this project, the parametric method was far more time efficient for the accuracy of the result .

- Properly defining the scope and making accurate assumptions can have a far greater effect on the end result than in depth analysis.

- By adding cost drivers, an estimation can be improved but not all are relevant when scale is considered.

Conclusion 6.0

The cost of cleaning the world oceans was estimated to be between £54.9 billion and £149.4 billion by analytical method and 90% accurate between £61 billion and £162 billion by parametric method. Both estimations were based on a defined scope that included all buoyant macro-plastics in the worlds' oceans but excluded any method of dealing with the plastic. This methodology should be repeated as more data becomes available to narrow the estimate to a more reasonable level of uncertainty. Despite this entire analysis, cleaning the oceans must be completed regardless of the cost in order to ensure the continued survival of our marine environment.

References 7.0

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COUNTRY/LOCATION	PEOPLE	KILOGRAMS	KILOMETERS	KG/KM	Costline / km	Total Kg in country
ALBANIA	1	0.5	0.2	2.5	362	905
ALGERIA	10	44	0.4	110	998	109780
ARGENTINA	781	4,223	6.2	681.1290323	4,989.00	3398152.742
ARUBA	11	3	2.7	1.111111111	68.5	76.11111111
AUSTRALIA	1,707	6,257	236.7	26.43430503	25,760.00	680947.6975
AZERBAIJAN	598	4,782	1.6	2988.75	0	0
BANGLADESH	520	1,201	5.0	240.2	580	139316
BARBADOS	389	886	5.6	158.2142857	97	15346.78571
BELGIUM	122	527	19.3	27.30569948	66.5	1815.829016
BELIZE	1,433	6,002	44.4	135.1801802	386	52179.54955
BERMUDA	725	3,808	26.5	143.6981132	103	14800.90566
BONAIRE	210	596	8.8	67.72727273	20	1354.545455
BRAZIL	2,265	11,617	124.7	93.159583	7,491.00	697858.4362
BRUNEI	935	8,160	157.0	51.97452229	161	8367.898089
BULGARIA	14	13	0.2	65	354	23010
CAMBODIA	109	1,402	2.1	667.6190476	443	295755.2381
CAMEROON	530	183	0.4	457.5	402	183915
CANADA	14,427	55,722	1,565.0	35.60511182	202,080.00	7195080.997
CAYMAN ISLANDS	2	8	5.3	1.509433962	160	241.509434
CHILE	14,156	171,951	30.1	5712.657807	6,435.00	36760952.99
CHINA	10,991	126,580	199.8	633.5335335	14,500.00	9186236.236
COLOMBIA	778	3,592	26.3	136.5779468	3,208.00	438142.0532
COSTA RICA	585	1,390	9.3	149.4623656	1,290.00	192806.4516
CROATIA	33	500	14.8	33.78378378	5,835.00	197128.3784
CURAÇAO	236	639	18.2	35.10989011	364	12780
CYPRUS	210	148	3.1	47.74193548	648	30936.77419
CZECH REPUBLIC	4	4	0.4	10	0	0
DENMARK	8	5	3.8	1.315789474	7,314.00	9623.684211
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EGYPT	57	219	2.9	75.51724138	2,450.00	185017.2414
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ETHIOPIA	5	14	0.4	35	0	0
FIJI	21	117	1.6	73.125	1,129.00	82558.125
FINLAND	16	220	1.2	183.3333333	1,250.00	229166.6667
FRANCE	34	374	3.4	110	3,427.00	376970
GERMANY	1,156	2,382	100.3	23.74875374	2,389.00	56735.77268
GHANA	3,829	84,809	33.1	2562.205438	539	1381028.731
GIBRALTAR	8	150	0.6	250	12	3000
GREECE	4,082	4,709	45.2	104.1814159	13,676.00	1424785.044
GRENADA	129	496	4.4	112.7272727	121	13640
GUAM	1,373	4,373	4.7	930.4255319	125.5	116768.4043
GUATEMALA	43	180	1.4	128.5714286	400	51428.57143
GUERNSEY	187	14	1.6	8.75	50	437.5
GUYANA	323	1,498	3.4	440.5882353	459	202230
HONDURAS	66	806	9.6	83.95833333	823	69097.70833
HONG KONG	188,922	6,194,581	2,208.9	2804.37367	733	2055605.9
ICELAND	13	95	0.3	316.6666667	4,970.00	1573833.333
INDIA	7,393	20,250	387.0	52.3255814	7,000.00	366279.0698
INDONESIA	10,081	9,182	345.9	26.54524429	54,716.00	1452449.587
IRELAND	3,707	20,767	269.6	77.02893175	1,448.00	111537.8932
ISRAEL	253	893	4.5	198.4444444	273	54175.33333
ITALY	236	2,604	16.0	162.75	7,600.00	1236900
JAMAICA	9,573	47,566	213.9	222.3749416	1,022.00	227267.1903
JAPAN	4,541	14,585	301.6	48.35875332	29,751.00	1438721.27
JERSEY	43	42	1.7	24.70588235	70	1729.411765
KENYA	9,564	24,162	1,510.8	15.99285147	536	8572.168388
KUWAIT	101	79,833	0.2	399165	499	199183335
MACAU	100	358	0.5	716	41	29356
MACEDONIA	1	0.5	0.2	2.5	0	0
MALAWI	353	4,426	10.5	421.5238095	0	0
MALAYSIA	9,280	17,649	1,768.2	9.981336953	4,675.00	46662.75025
MALDIVES	103	492	12.7	38.74015748	644	24948.66142

MALTA	123	1,718	16.6	103.4939759	253	26183.9759
MAURITIUS	422	6,554	18.4	356.1956522	177	63046.63043
MEXICO	15,257	68,415	310.0	220.6935484	9,330.00	2059070.806
MONTENEGRO	1	0.5	0.2	2.5	293.5	733.75
MOROCCO	34	701	1.4	500.7142857	1,835.00	918810.7143
MOZAMBIQUE	557	1,412	37.0	38.16216216	2,470.00	94260.54054
NEPAL	3	30	0.2	150	0	0
NETHERLANDS	435	358	40.7	8.796068796	451	3967.027027
NEW ZEALAND	177	569	23.3	24.42060086	15,134.00	369581.3734
NICARAGUA	304	848	10.0	84.8	910	77168
NIGERIA	269	970	2.3	421.7391304	853	359743.4783
NORTHERN MARIANA ISLANDS	941	2,043	150.8	13.54774536	1,482.00	20077.75862
NORWAY	7,871	48,146	259.2	185.7484568	83,281.00	15469317.23
OMAN	28	14	0.2	70	2,092.00	146440
PALAU	15	200	1.0	200	1,519.00	303800
PANAMA	9,267	66,554	46.2	1440.562771	2,490.00	3587001.299
PARAGUAY	70	1,226	5.0	245.2	0	0
PERU	7,178	132,413	19.6	6755.765306	2,414.00	16308417.45
PHILIPPINES	276,120	362,014	1,731.9	209.0270801	36,289.00	7585383.709
POLAND	30	63	0.7	90	440	39600
PORTUGAL	259	542	15.6	34.74358974	1,793.00	62295.25641
PUERTO RICO	9,557	53,405	440.4	121.2647593	501	60753.64441
QATAR	55	349	1.4	249.2857143	563	140347.8571
RUSSIA	142	224	6.0	37.33333333	37,653.00	1405712
SABA	29	115	1.0	115	0	0
SAMOA	34	26	0.3	86.66666667	403	34926.66667
SAUDI ARABIA	29	126	1.5	84	2,640.00	221760
SENEGAL	68	670	5.6	119.6428571	531	63530.35714
SEYCHELLES	317	182	225.7	0.806380151	491	395.932654
SIERRA LEONE	200	600	1.6	375	402	150750
SINGAPORE	3,580	13,730	32.0	429.0625	193	82809.0625
SINT MAARTEN	151	799	0.8	998.75	0	0
SLOVENIA	340	1,911	2.1	910	46.6	42406
SOUTH AFRICA	19,563	13,758	361.6	38.04756637	2,798.00	106457.0907
SOUTH KOREA	4,276	152,052	82.4	1845.291262	2413	4452687.816
SPAIN	2,284	6,835	49.8	137.248996	4,964.00	681304.0161
SRI LANKA	9,649	32,336	110.1	293.6966394	1,340.00	393553.4968
ST. HELENA	178	1,485	3.1	479.0322581	0.00	0
ST. KITTS & NEVIS	286	691	6.4	107.96875	0.00	0
ST. LUCIA	223	3,557	6.1	583.1147541	0.00	0
ST. VINCENT AND THE	27	1,025	0.9	1138.888889	0.00	0
SURINAME	96	550	1.3	423.0769231	386	163307.6923
SWEDEN	2,227	10,671	253.3	42.12791157	3,218.00	135567.6194
SWITZERLAND	525	2,454	66.0	37.18181818	0	0
TAIWAN	15,939	27,651	48.9	565.4601227	1,566.30	885680.1902
TANZANIA	31,361	466,400	104.2	4476.007678	1,424.00	6373834.933
THAILAND	10,933	15,057	203.2	74.09940945	3,219.00	238525.999
THE BAHAMAS	902	2,080	63.0	33.01587302	3542	116942.2222
TRINIDAD AND TOBAGO	3,767	17,277	41.4	417.3188406	362	151069.4203
TURKEY	793	1,395	22.1	63.12217195	7,200.00	454479.638
U.S. VIRGIN ISLANDS	643	1,612	28.6	56.36363636	85.7	4830.363636
UKRAINE	48	1,264	3.0	421.3333333	2,782.00	1172149.333
UNITED ARAB EMIRATES	578	3,447	34.9	98.76790831	1,318.00	130176.1032
UNITED KINGDOM	14,527	10,103	230.6	43.81179532	12,429.00	544536.804
UNITED STATES	226,889	1,754,164	19,250.8	91.12161573	19,924.00	1815507.072
URUGUAY	2,001	4,000	107.8	37.10575139	660	24489.79592
VANUATU	223	505	23.0	21.95652174	2,528.00	55506.08696
VENEZUELA	6,230	31,940	123.6	258.4142395	2,800.00	723559.8706
VIETNAM	859	2,398	10.3	232.815534	3,444.00	801816.699
GRAND TOTAL			35,890.3	294.899764		343408522
						343.408522 million