

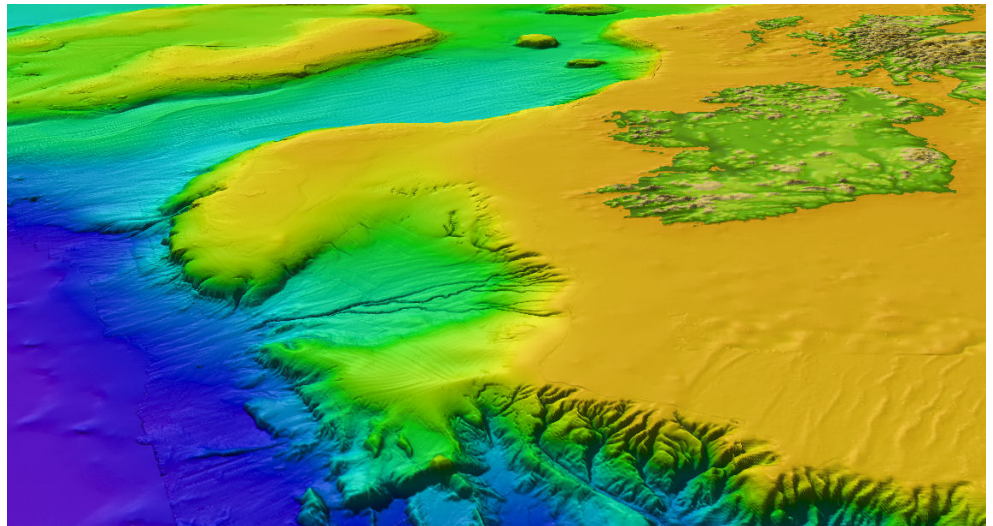
---

# ***INFOMAR***

## ***External Evaluation***

*This Report forms the output of an Interim Evaluation Study of the INFOMAR Programme.*

*11<sup>th</sup> June 2013*





PwC does not accept or assume any liability or duty of care for any other purpose for which this report may be used or in relation to any other third party or other person(s) or organisation(s), who may read and / or rely on this report, save where expressly agreed in writing with PwC. The reader is therefore advised to seek their own professional advice before placing reliance upon the contents of this report. Further this report has been produced subject to important qualifications, reservations and assumptions and, without prejudice to that set out above, it should be read in the context of those qualifications, reservations and assumptions.

In the event that, pursuant to a request which GSI/MI has received under the Freedom of Information Act 2000, it is required to disclose any information contained in this report, it will notify PwC promptly and consult with PwC prior to disclosing such report. GSI/MI agrees to pay due regard to any representations which PwC may make in connection with such disclosure and GSI/MI shall apply any relevant exemptions which may exist under the Act to such report. If, following consultation with PwC, GSI/MI discloses this report or any part thereof, it shall ensure that any disclaimer which PwC has included or may subsequently wish to include in the information is reproduced in full in any copies disclosed.

---

# Table of Contents

<b>Executive Summary</b> .....	<b>iii</b>
<b>1. Introduction</b> .....	<b>1</b>
Background .....	1
Terms of Reference .....	2
Project Overview .....	2
Evaluation Methodology .....	3
<b>2. Rationale</b> .....	<b>6</b>
Introduction .....	6
Rationale .....	6
<b>3. Efficiency</b> .....	<b>11</b>
Introduction .....	11
Economy.....	11
Efficiency.....	14
<b>4. Effectiveness</b> .....	<b>25</b>
Introduction .....	25
Developing Data & Information Products.....	25
Develop Value Added Projects .....	27
Effectiveness Conclusions .....	30
<b>5. Impacts &amp; Continued Relevance</b> .....	<b>32</b>
Introduction .....	32
Continued Relevance.....	36
<b>6. Recommendations</b> .....	<b>37</b>
Introduction .....	37
Recommendations.....	37
<b>7. Appendix</b> .....	<b>39</b>
Appendix A – International Benchmarks .....	39
Appendix B – Satellite Value Added Projects Initiative.....	42
Appendix C – INFOMAR Quality Assurance Processes .....	43
Appendix D – Case Studies .....	47
Appendix E – Survey Questions.....	49
Appendix F: INFOMAR KPIs .....	53

# Executive Summary

## Summary of Findings & Recommendations:

PwC was commissioned to undertake an independent mid-term evaluation of the INFOMAR programme 2006 to 2016. INFOMAR is Ireland's national marine mapping programme. A summary of key findings and recommendations from the PwC evaluation are now presented.

### Key Findings:

- the original INFOMAR strategy (2006 to 2016) was clear on the broad intent of the programme, but did not incorporate the level of annual detail needed to support a comprehensive interim or end-of-programme evaluation, a fact which represents a constraint on the evaluation which follows;
- there is a strong rationale for the continued public funding of the INFOMAR programme, which supports the attainment of key national and European policy objectives and regulatory obligations;
- equally, it is clear that the programme would not be progressed at the pace and (consistent) level of quality in the absence of public funding;
- using best-available information, and referencing the small number of quantified targets contained in the strategy, the review team is satisfied that the INFOMAR programme is being implemented in a cost-efficient manner with the major quantified targets of the programme being attained within a significantly reduced financial envelope (i.e. 83% of that originally specified);
- equally, programme management has been effective in the attainment of the major objectives of the programme, specifically: the acquisition, processing, development and dissemination of survey data and related products; the attraction of international project funding; the promotion of INFOMAR-related research activities; and the provision of technical advisory services to a variety of public and private sector organisations which supports them in regulatory compliance, among others;
- additionally, and crucially important for the development of the national marine economy, the programme is also clearly effective in the development of a critical mass of marine surveying expertise in Ireland, with more than 100 contractors having been engaged and/or trained on the INSS and INFOMAR since inception;
- the economic benefits of the programme have been more muted than anticipated, reflecting the drastic change in national economic circumstances as distinct from any lack of industry-related activity on the part of INFOMAR.

### Key Recommendations:

- ensure that future INFOMAR strategies are designed in such a manner as to support mid- and end-term evaluations, focusing on clear statements of targeted annual activity and incorporated quantified indicators of inputs, outputs and impacts;
- develop the existing performance management system of the INFOMAR programme to incorporate, as feasible at this juncture, quantified targets of inputs, outputs and impacts – including operational statistics derived from vessel daily progress reports as appropriate;
- appoint a business development and stakeholder engagement resource, on a full- or a part-time basis, to ensure that maximum stakeholder benefit is derived from the programme – diverting resources from the funding of third-party research projects as required;
- fast-track the integration of data acquired to date and its development into products, to ensure that Phase 1 of the programme is complete in full by end-2016;

## BACKGROUND

The Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) programme is Ireland's national marine mapping programme. It is the successor to the Irish National Seabed Survey (INSS), and is a joint venture of the Geological Survey of Ireland (GSI) and the Marine Institute (MI). The overarching objective of the INFOMAR programme is to create a range of integrated mapping products of the physical, chemical and biological features of the seabed in the near-shore, or INSS Zone 1 (0m to 50m) area and remaining Zone II area (50m to 100m), thus completing the mapping programme for the entirety of Ireland's off-shore waters.

Funding of €4 million per annum was allocated to the INFOMAR programme for the period 2006-2008. The INFOMAR programme was subsequently incorporated into the National Development Plan (NDP) 2007-2013, under the Enterprise, Science and Innovation Priority in the Geoscience sub programme, with the same annual budget of €4 million, i.e. projected to €28 million to 2013. Ireland has experienced major macro-economic changes since the initial estimates were developed. The Irish financial crisis, characterised by an 8.3% cumulative fall in GDP and 8% rise in unemployment since 2008, has led to a total required fiscal adjustment between 2008 and 2014 of approximately €30 billion. As a result, the annual INFOMAR programme budget was reduced by 16% in 2009 and by a further 10% reduction in 2010. A budget provision of €3 million was made in both 2011 and 2012. Targeted programme outputs were not, however, reduced.

## TERMS OF REFERENCE

The terms of reference for this report require an independent evaluation of the INFOMAR programme's performance against its outline objectives as specified in the INFOMAR Strategy 2006 and supplemented in a subsequent 2008 Option Appraisals (Cost Benefit Analysis) Report<sup>1</sup> on the INFOMAR programme. The sub-programmes of INFOMAR are, in broad terms, as follows:

1. **Data Acquisition, Management & Interpretation:** To contribute to the management of activities and resources in Irish inshore areas by completing a comprehensive mapping and data interpretation programme for defined priority areas and bays to the period to end-2016 followed by the remaining areas and bays in the period to 2026;
2. **Data Integration and Exchange:** To establish processes and procedures to create a mechanism for the enhanced integration of marine survey data and the dissemination of data and information products to policy makers, academia, private sector and the public;
3. **Deliver Value Added Research:** To deliver a range of value added opportunities linked to user demands, commercial markets and external funding sources.

The terms of reference for this report also require that where the programme is deemed to be under-performing, recommendations are made for improvement.

## METHODOLOGY

In accordance with the Department of Finance's Value for Money (VFM) and Policy Review Initiative Guidance Manual, the INFOMAR programme was assessed against five key evaluation criteria, details of which are shown in Table 1.

---

<sup>1</sup> hereafter referred to as the CBA 2008 Report

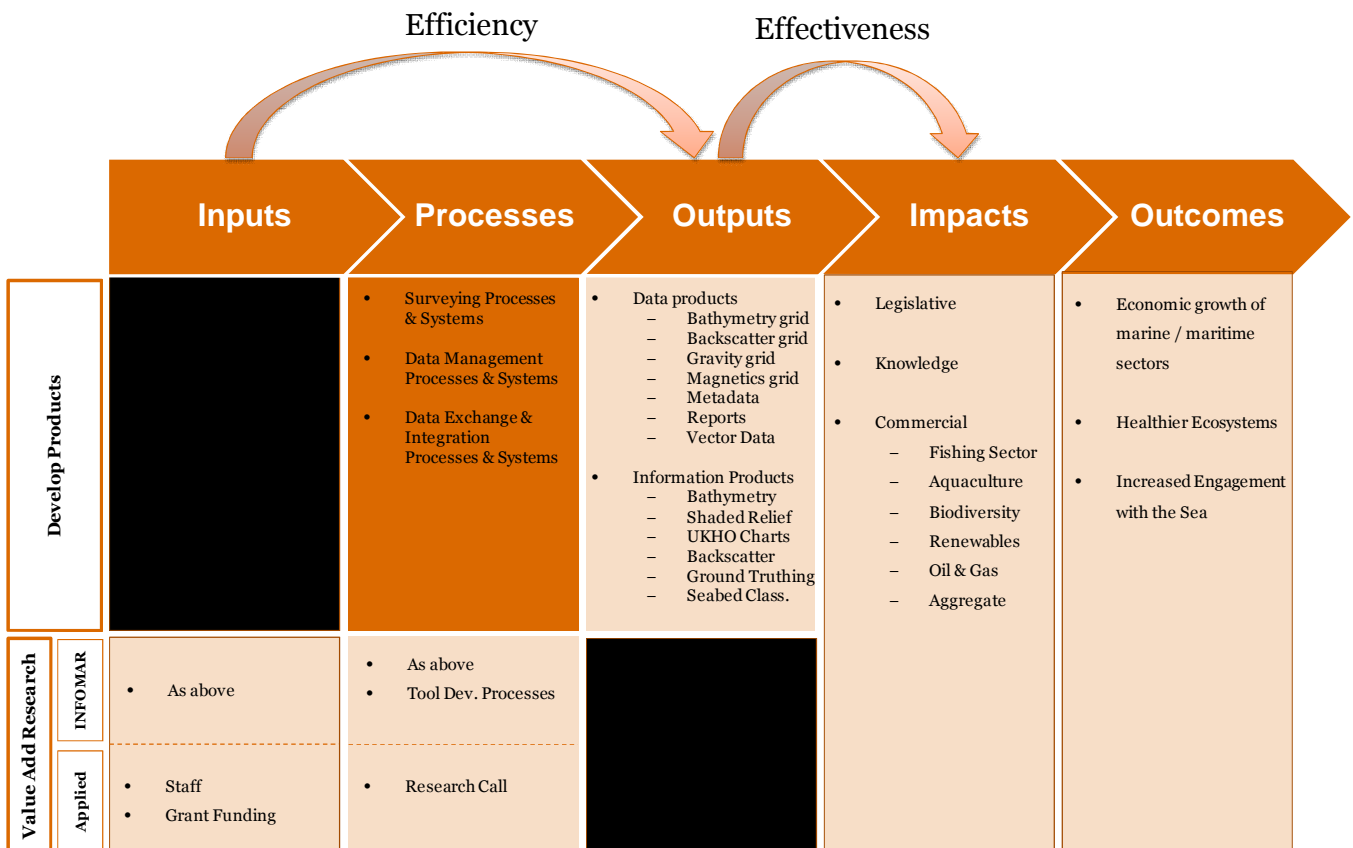
**Table 1:** Explanation of evaluation criteria

Criteria	Description
Rationale	<ul style="list-style-type: none"> <li>Whether public policy intervention in the form of INFOMAR is necessary</li> </ul>
Efficiency	<ul style="list-style-type: none"> <li>The acquisition and use of inputs and the production of outputs</li> </ul>
Effectiveness	<ul style="list-style-type: none"> <li>Short-term effects that availability of outputs have on targeted beneficiaries</li> </ul>
Impacts	<ul style="list-style-type: none"> <li>Wider sectoral effects and long term effects on targeted beneficiaries</li> </ul>
Continued Relevance	<ul style="list-style-type: none"> <li>Whether there is justification for the continued allocation of public funds</li> </ul>

A programme structure which enables a strict adherence to this approach is one where, within a single expenditure envelope, spending can be linked to inputs (e.g. vessel time), inputs to outputs (e.g. seabed area mapped), and outputs to impacts (e.g. regulatory compliance). For practical reasons at the time of its inception, this is not the case with the INFOMAR programme structure. Programme 1, for example, requires the collation and processing of seabed data alone. For this activity to generate a wider economic benefit or impact, it must be disseminated. This dissemination activity is the purpose of Programme 2.

While the rationale for this distinction at the time of inception is clear and justified, the PwC team needed to restructure the programme for the purposes of undertaking this evaluation. An overview of the Evaluation Framework applied is provided in Figure 1.

**Figure 1:** Evaluation Framework for INFOMAR Programme.



Certain other aspects of the original strategy are constraining in terms of the undertaking of a formal evaluation of economic return, specifically a very broad-based statement of aspiration under

the three programme areas with relatively little in terms of specific activities or annual targets. INFOMAR management adopted a practical approach to the interpretation of the strategy, which is clearly true to its original intent. This practical interpretation is the basis of the evaluation which follows, excluding certain of the vaguer elements of the original strategy document.

## FINDINGS OF INFOMAR EVALUATION STUDY

### 1. RATIONALE

The rationale analysis is concerned with establishing why a public policy intervention is necessary in a given area. Overall, we have found that there is a very strong rationale for the INFOMAR programme given that it is an important enabler of national and EU policy and its stated objectives could not be achieved without public funding, i.e. a clear market failure exists. This summary is based on a careful assessment of performance against three distinct criteria:

1. Is the programme consistent with national policy?
2. Are the programme objectives clear and beneficiaries apparent?
3. Could objectives be attained in the absence of State funding?

Detailed findings are as follows:

- **The INFOMAR programme is a key enabler of national marine policy:** In July 2012, the Irish Government launched an integrated plan for the realisation of the full potential of the Irish marine economy - “Harnessing our Ocean Wealth”<sup>2</sup>. The plan is specific on the major economic potential offered by the marine environment, as well on Government’s commitment to its realisation. Equally it is made clear that INFOMAR is an important enabler to full attainment of the overarching goals of the plan, namely: 1) a thriving maritime economy, 2) achieving healthy ecosystems and 3) increasing the engagement with the sea. INFOMAR also serves to support the overarching policy direction of the EU as specified in the European Commission’s ‘Marine Knowledge 2020’ initiative. There is a strong legislative rationale for INFOMAR. The Convention for the Safety of Life at Sea (SOLAS) requires a contracting government to ‘undertake to arrange for the collection of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation’. In the absence of a National Hydrographic Office, SOLAS strengthens the rationale further for INFOMAR. Also, the programme underpins a number of European Directive requirements, e.g. Strategic Environmental Assessments, Habitats & Marine Strategy Framework Directives.
- **Programme objectives are clear in broad terms but potential exists for greater quantification of targets in future strategy:** In broad terms, and at the level required, the objectives of the INFOMAR programme are clear and the management team has clearly adopted a practical, flexible and business-like approach to their attainment. For future programmes, however, and with the objective of facilitating evaluations as well as being clear of the required balance of focus across all programme areas, there would be merit in the incorporation of quantified output and (as feasible) impact targets for all programmes. The experience of the current programme should enable this significantly.
- **Objectives could not be achieved in the absence of State funding:** We have assessed whether market failure exists to support public policy intervention or whether this programme could be delivered by the market without public funding support. We have

<sup>2</sup> Hereafter referred to as “Ocean Wealth”.

found that without public policy intervention: a) data collation would not progress at the same pace or to the same quality; b) the public accessibility of the data would be radically diminished; and c) the net cost to public and private sector interests for data collation would be massively increased with implications for the rate of development of the marine economy. In the absence of government intervention, it is concluded that the project would not be undertaken at the same pace, quality or level of consistency. Both the US and the EU see a fundamental role for government in collecting and providing marine data (or funding the collection and provision of marine data) as the market will not find a solution to this market failure. International evidence also supports INFOMAR’s approach of collecting the majority of the data through state effort rather than private contracting.

## 2. EFFICIENCY

As indicated previously, the structure and content of the INFOMAR strategy (specifically the absence of quantified output indicators for programmes 2 and 3) places a constraint on the feasibility of a standard efficiency evaluation. Notwithstanding this fact, there are strong indicators that the INFOMAR programme is operating efficiently, namely:

- appropriate governance arrangements are in place for the oversight of major expenditures, and actual spend has tracked annual targeted spend closely since 2007 (see Table 2);
- project promoters are proactive and innovative in the pursuit of cost savings, and clearly committed to the task of comprehensively mapping the Irish seabed;
- related, programme measures such as the “fast-track” mapping of non-priority areas for public and private sector interests on a cost-recovery basis are innovative in terms of meeting the needs of target beneficiaries as well as in reducing life-long programme costs;
- the tendering arrangements in place for the provision of services (contractor and otherwise) to the programme appear consistent with public procurement norms, with elements of innovation embedded (e.g. graduate training programme) which simultaneously reduce overall programme costs and support the attainment of ancillary programme objectives, e.g. the development of sophisticated seabed mapping capabilities among graduates;
- the main quantified target of the programme (i.e. number of priority bays and areas mapped) which achieves the greatest share of overall programme spend is being achieved within a reduced overall financial envelope.

**Table 2:** Programme expenditure against target

	2007	2008	2009	2010	2011	2012
€ m						
Total Target Spend (NDP Original)	4.0	4.0	4.0	4.0	4.0	4.0
Total Target Spend (Annually Adjusted)	4.0	4.0	3.4	3.0	2.9	3.0
Total Actual Spend	3.8	3.8	3.5	3	2.9	3.0
Total Actual Spend (Payroll Adjusted) <sup>3</sup>	3.8	3.8	3.5	3.0	3.2	3.4
Actual Spend as % of NDP (Annual)	95%	95%	88%	75%	80%	85%
Actual Spend as % of NDP (Compound)	95%	95%	93%	88%	87%	86%
Actual Spend as % of Annual Target	106%	99%	100%	100%	99%	100%

Against these significant positives, however, it should be noted that:

<sup>3</sup> Budgeted staff costs decreased from a peak of €920,000 in 2008 to €450,000 in 2012 (a decrease of €470,000) mainly as a result of the reassignment of GSI staff costs to the core salaries budget.

- very strong performance against quantified target could be, in some part, attributable to the fact that certain of the more complex priority bays and areas have yet to be mapped, although programme management is confident that this is not the situation;
- budgetary and staffing constraints appear to be having an effect on other aspects of the programme, which are not subject to quantified targets but are material in terms of overall impact such as the lead times for data integration and product development.

Detailed findings on economy and cost-efficiency are now presented.

## Economy

The economy of the INFOMAR Programme was assessed against three key criteria<sup>4</sup>:

1. Is the INFOMAR delivery model for data acquisition cost-effective?
2. Are unit costs of the acquisition of vessels in line with commercial norms?
3. Are other major elements of spend in line with commercial norms?

Based on these three criteria, the following findings were made:

- **INFOMAR delivery model for data acquisition is in line with international norms:** The major category of cost under the programme is vessel time. It was not stipulated at the programme outset what delivery model INFOMAR should use for seabed mapping for the period 2007 to 2012, i.e. contracted vessel time versus directly-owned vessels, although two vessels were owned at the time of INFOMAR strategy finalisation (i.e. 2007) and the benefits of a legacy mixed model approach were highlighted in the strategy document. The programme is now delivered primarily through directly-owned vessels, with chartered national research vessels (charged at research rates to INFOMAR<sup>5</sup>) providing the balance of services required. Details of the vessels owned are shown in Table 3.
- The decision to procure as opposed to use contract vessels has its origin in operational as well as cost considerations. For 2012, the intensity of usage of the major<sup>6</sup> vessels (i.e. > 10 meters) is sufficient to justify outright ownership. Equally, it is clear that there are important operational benefits attaching to outright ownership. The most important of these benefits is certainty regarding vessel availability, cost and crew safety. An international review shows that the ownership as distinct from contracted model of service delivery is most common for large sea bed mapping programmes running over multiple years.

**Table 3: Profile of INFOMAR Vessels Acquired**

Vessel	Length	Type	Year Purchased	Purchase Price
RV GEO	7.5m	Minor	2007	€90,000
RV Keary	15.5 m	Medium	2006	€1,100,000
Cosantóir Bradán	17.0 m	Medium	2012	€0 <sup>7</sup>

- **INFOMAR has been innovative in its approach to cost-saving:** The INFOMAR team appear to be innovative in containing programme costs. In an example of the relatively innovative approach adopted by INFOMAR programme personnel to cost saving, the Cosantóir Bradán was seconded for use on the programme on a *pro bono* basis from Inland

<sup>4</sup> The economy evaluation is undertaken for data acquisition primarily, reflecting the fact that this accounts for the greatest share of non-payroll spend. Economy is an evaluation of the extent to which you are procuring the correct goods & services (i.e. inputs) as cost effectively as feasible. Efficiency is the relationship between spend and outputs.

<sup>5</sup> The appropriateness of these rates was independently assessed in 2007.

<sup>6</sup> For the purposes of this report, a medium vessel is one which is greater than 10 meters in length, but less than 30 metres.

<sup>7</sup> There was a refurbishment cost of €90,000.

Fisheries Ireland (where it was not being used to its full potential as a result of activity realignment) for use on the programme. Equally, at minimal cost to the programme, the use of evolving satellite technologies for data acquisition and processing has been piloted and, on foot of satisfactory results, commissioned for 5 bays in late 2012.

- Further evidence of an innovative approach to cost savings, and one which is simultaneously achieving the objective of growing seabed mapping expertise in Ireland, is the use of senior contractors and younger contractors for short duration mapping contracts. Industry norms are to hire only the highest qualified, most experienced, contractors at premium rates. However, INFOMAR (building on the INSS) employs a mixed model of permanent INFOMAR staff, senior contractors and a majority of younger contractors who trade lower rates of pay for on-the-job training. To date, more than 100 contractors have worked on both INSS and INFOMAR, which represents a significant training contribution.
- **Other major elements of spend are in line with commercial norms:** Two other major elements of non-payroll spend are: contract survey personnel; and deployment of Airborne Bathymetric LiDAR (Light Detection and Ranging) technology, i.e. ABL.
- Daily rates of pay of contracted survey personnel average approximately €160 for onshore activities and €305 for offshore activities with a minimum of €155 (onshore) and €220 (offshore). These rates of pay are broadly in line with terms paid by private sector operators, and reflect the highly flexible terms on which contractors are expected to work.
- The other major, non-payroll, expenditure is ABL. Used to cost-effectively map the sea bed in in-shore areas, the need for ABL varies significantly year-on-year depending on the profile of bays or areas being mapped<sup>8</sup>. Significant expenditures were incurred in both 2008 (€1.3m) and 2010 (€0.9m) (see Table 4). PwC is satisfied that the tender process under which LiDAR services were procured was consistent with public procurement norms and designed to generate greatest economic advantage for public spend.

**Table 4: Target LiDAR versus Actual Spend**

	2007 (€m)	2008 (€m)	2009 (€m)	2010 (€m)	2011 (€m)	2012 <sup>9</sup> (€m)
LiDAR – Target Spend	-	1.2	-	0.8	0.04	0.04
LiDAR – Actual Spend	-	1.3	-	0.9	0.05	0.1
Actual as % of Target	-	-8%	-	-13%	-25%	-150%

### Cost-Efficiency – Developing Data & Information Products

Cost-efficiency is a measure of the relationship between the inputs available to the programme and associated outputs, e.g. the relationship between vessel days and the size of areas mapped. PwC sought to evaluate cost-efficiency using the following questions:

1. Is maximum operational benefit being derived from the capital assets, i.e. vessels?
2. Have the major mapping targets been met within the agreed financial envelope?
3. Are data products being produced to target specification and within budget?

Based on these three criteria, the following findings were made:

- **Indicators of operational efficiency are systematically collated, but cost-efficiency is partially beyond the control of management:** It is clear that for the

<sup>8</sup> The technology, while allowing acquisition of the shallowest data rapidly, avoiding areas that are both difficult and dangerous to map by boat, can only be used in areas of the non-turbid (clear) waters and, therefore, its application is limited to approximately a third of the Irish coastline.

<sup>9</sup> The overspend in 2012 was due to the awarding of a tender for Satellite Data acquisition and processing that was commenced in Q4 2012.

years reviewed the level of utilisation of INFOMAR-owned vessels was in line with international norms. The productivity or otherwise of vessel days, from an operational perspective, is more difficult to forecast and evaluate in spite of the fact that detailed daily progress reports (DPRs) are available for each of the vessels<sup>10</sup>. This reflects the fact that factors beyond the control of INFOMAR management, e.g. weather, can materially impact the vessel time needed for mapping. Setting productivity targets is, therefore, a very challenging exercise. There may, however, be benefit in preparing a simple, standard, monthly report (for monitoring purposes only) which provides a clear indication of maximum potential surveying days of a vessel versus actual achieved, providing details of the factors which resulted in an over- or under-performance, e.g. equipment malfunction. All of this material is provided in the DPRs and accessible to INFOMAR management, but may need collating into a manageable format for the purpose of non-expert readers including INFOMAR Board members as well as future programme evaluators.

- **Data acquisition cost efficiency ahead of target:** The second measure of cost-efficiency is the relationship between target spend and target outputs. Fundamentally, performance to date indicates a very strong cost-efficiency to the extent that the rate of progress in attainment of mapping targets is fully in line with that set out in the original plan with actual spend on data acquisition significantly behind the annual targets for the period 2006 to 2015 set out in the INFOMAR strategy (see Table 5).

**Table 5:** Cost-Efficiency of Sea-bed Mapping Activity (2007-2012)

INFOMAR Strategy Provided - Mapping (€ m)	18.1 <sup>11</sup>
Actual Spend – Mapping (€ m)	15.1 <sup>12</sup>
Actual as % of NDP	83%
No. of Priority Bays Mapped – Target	18.2
No. of Priority Bays Mapped – Actual	18.4
Actual as % of Target	101%
No. of Priority Areas Mapped – Target	2.1
No. of Priority Areas Mapped – Actual	2.3
Actual as % of Target	109%

- While there are certain factors which make a definitive conclusion regarding cost-efficiency challenging, e.g. differences in the costs of data acquisition per sq km for the priority areas and bays, INFOMAR management is satisfied that the complexity of the areas and bays mapped to date is not materially different from those yet to be mapped.
- Going forward, an *indication* of the relative complexity and, by extension surveying resource intensity, of priority bays and areas would be required if a definitive view on cost efficiency at an interim programme stage is to be feasible, assuming that the impacts of factors as weather could be isolated. There are clear challenges in this regard<sup>13</sup>;

<sup>10</sup> These DPRs incorporate facts such as the size of area mapped, weather conditions, transit and mobilisation times, water depth, vessel and survey downtimes, among others.

<sup>11</sup> This sum was computed by subtracting €2.5 million in capital spend from the mapping programme spend for the period 2006 to 2015 (i.e. €32.5 million), dividing by 10 and multiplying by 6. It is an estimate and more precise detail is needed going forward to support evaluation.

<sup>12</sup> Based on activity-based costings provided by INFOMAR. Total estimated spend is adjusted for an assumed “notional” payroll uplift in 2011 and 2012 of approximately €400,000 in both years.

<sup>13</sup> It is, for example, challenging to estimate the time required to survey an area when little is known of water depth or turbidity pre-surveying.

- **Original strategy means that challenges exist in determining cost-efficiency with which data is processed and converted to information products:** There are also challenges inherent in determining the cost-efficiency with which the collated and processed survey data is converted to information products, notwithstanding the fact that INFOMAR programme management has innovated with the intent of enhancing the cost efficiency of processing<sup>14</sup>.
- The evaluation challenge pertains to the fact that the original strategy document was not specific on the target timelines for the production and dissemination of data and information products from the time of survey completion. It is clear at this juncture that there are avoidable time lags in the preparation of data and information products (see Table 6), a fact which may relate to a small under-spend relative to that which was envisaged in the original INFOMAR strategy. Details are shown in Figure 2.

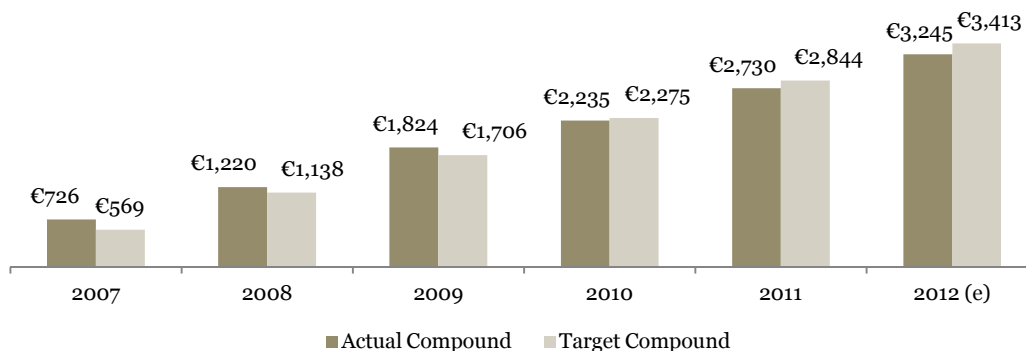
**Table 6:** Public<sup>15</sup> Availability of Data & Information Products<sup>16</sup>

Priority Bay	Survey Status	Bathymetry	Shaded Relief	Back-scatter	Ground Truth.	Seabed Class.	Baseline Data
Achill Bay	100%	√	√	√	X	X	√
Bannow Bay	0%	-	-	-	-	-	-
Bantry Bay	100%	√	√	√	√	√	√
Blacksod Bay	95%	√	√	√	X	X	√
Boyne Estuary	0%	-	-	-	-	-	-
Broadhaven Bay	70%	√	√	X	X	X	X
Carlingford Lough	20%	X	X	X	X	X	X
Cork Harbour	70%	√	√	√	√	√	√
Dingle Bay	75%	√	√	√	X	X	√
Donegal Bay	100%	√	√	√	√	√	√
Dublin Bay	100%	√	√	√	√	√	√
Dungarvan Har.	0%	-	-	-	-	-	-
Dunmanus Bay	100%	√	√	√	√	√	√
Galway Bay	100%	√	√	√	√	√	√
Killary Harbour	100%	√	√	√	√	X	√
Kinsale Harbour	100%	√	√	√	X	X	√
Lough Foyle	70%	√	√	X	X	X	X
Lough Swilly	20%	X	X	X	X	X	X
Mannin Bay	100%	√	√	√	X	X	√
Mulroy Bay	90%	√	√	X	√	X	√
Shannon Estuary	50%	√	√	√	√	X	√
Sligo Bay	100%	√	√	√	√	√	√
Tralee Bay	100%	√	√	X	X	X	√
Waterford Bay	100%	√	√	√	X	√	√
Wexford Harbour	80%	√	√	√	X	√	√
Youghal Bay	0%	-	-	-	-	-	-

<sup>14</sup> Specifically, elements of the data processing, re-levelling and merging activities were brought offshore with a view to reducing onshore contractor costs.

<sup>15</sup> The term “public” here is used in reference to that which is available on a public server. In this regard, it should be noted that INFOMAR management is flexible in terms of meeting the particular needs of a data user and re-prioritises the schedule of product development on a needs basis. Equally, processed survey data is made available almost immediately on the INFOMAR data. It is the data products which are experiencing delays.

**Figure 2: Data Management Actual versus Target Spend (€000s)**



- While seabed data does not date quickly *per se*, there are potentially very important implications of delays including: i) the programme will not be complete in full in the targeted financial envelope as cost is being carried forward at the same time as available annual budgets are fully exhausted; ii) mobilisation of Phase II may be delayed; and iii) the stakeholders are delayed in deriving benefit from the seabed mapping activity<sup>17</sup>;
- In summary, cost efficiency is challenging to evaluate in this set of circumstances, although there is an apparent relationship between a programme spend on data management which is somewhat below target and delays in the public availability of information products;
- INFOMAR management estimate that full clearance of the current backlog of work associated with the development of data and information products for areas and bays which are mapped at 41 weeks, equivalent to almost a full-time equivalent individual. This is additional to ongoing work entailed with new survey data.

### Cost-Efficiency - Deliver Value Added

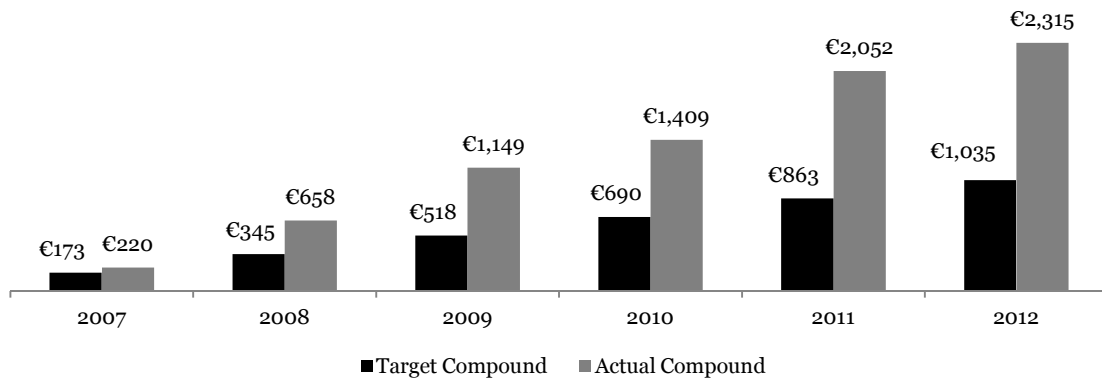
In terms of the value added stream, there are two primary components a) the INFOMAR value added projects and b) applied research. The first of these is essentially a fast-tracking of planned seabed mapping activity by INFOMAR to meet the particular needs of a strategic stakeholder on a cost recovery basis, while the latter is a programme of research funding administered by INFOMAR. Additionally, and in line with the intent of the original strategy, INFOMAR management also delivers value-added through engagement with relevant EU project funding opportunities and through the provision of technical advisory services to public service organisations in Ireland.

As for the other programmes, there were no quantified annual targets for value-added activities set out in the original strategy document which renders an evaluation of cost-efficiency relative to that envisaged at programme inception challenging. It is, however, clear that value-added research spend is tracking ahead of target – in contrast to the other two programmes.

It should be noted that research calls, or the funding of third-party research, accounts for the greatest share of “value-added” expenditure, i.e. €1.1 million or 48% since 2007.

<sup>17</sup> It should be noted that a protocol is in place for the making available of data concerning hydrographic risk directly from the survey to the UKHO. As such these delays do not pose a regulatory risk from this perspective

**Figure 3: Value Added Actual versus Target Spend (€000s)**



Cost-efficiency findings are now presented.

- **INFOMAR has delivered a significant volume of value-added mapping activity cost-efficiently:** INFOMAR has delivered nine additional areas, i.e. additional to the 26 priority bays and 3 coastal areas. These activities are undertaken at the request of other public service organisations and are reimbursed on a cost-recovery basis;
- **Clear governance arrangements are in place for Applied Research Spend:** With regard to applied research, there are no formal metrics in the original strategy against which to evaluate efficiency, i.e. target annual numbers of projects versus target spend are not defined in the original strategy. While the absence of targets renders an efficiency evaluation challenging, it is clear that governance arrangements are in place to ensure a probity of expenditure for approved projects. These include peer review practices which promote independence in selection and appropriate levels of expert input, as well as project management arrangements which minimise the cost exposure to the State associated with a failed project implementation. Targeted research areas are developed based on feedback from the INFOMAR Technical Advisory Committee, and a critical mass of research activity in certain universities appears now to be driving an efficiency of research effort.
- Table 7 provides a profile of INFOMAR-funded research projects.

**Table 7: Profile of INFOMAR-funded Research Projects (Selected Years)**

	2008	2009	2011
Total Funds Awarded	252,066	368,999	649,830
No. of Projects Funded	9	14	23
Average Project Value	28,007	26,357	28,253
Maximum Project Value	30,000	30,000	30,000
Minimum Project Value	23,800	16,170	20,130
% Approved Projects (University-Led)	77%	85%	60%
% Approved Projects (Private Enterprise Led)	11%	0%	34%
% Approved Projects (Other)	11%	14%	4%
% Approved Projects (Any University)	78%	87%	73%
% Approved Projects (Any Private Enterprise )	33%	7%	42%

- As indicated, the value-added programme incorporates two additional substantial elements, both of which were envisaged in the original strategy. The first is the attraction of international project funds and the second is the provision of specialist advisory services to public service organisations. As before, targets in respect of these activities were not set out in the strategy which renders an evaluation of cost-efficiency challenging. It is, however, clear that INFOMAR has had considerable success in both regards (see Section 3).

### 3. EFFECTIVENESS

Effectiveness considers the immediate to short term effects that the availability of outputs has on the targeted beneficiaries. Through a combination of desk-based research, stakeholder consultations and surveys of INFOMAR data users, it was concluded that INFOMAR is performing strongly in effectiveness terms. There may, however, be scope to further increase effectiveness through implementation of a number of strategic initiatives, certain of which have resource implications:

- while the INFOMAR team has put in place mechanisms to ensure a systematic engagement with its key stakeholders (e.g. six monthly meetings with a technical advisory panel and an annual conference), there may be merit in expanding the existing effort to enable a closer monitoring of the data needs of a broader set of stakeholders. To this end, the business case for the appointment of a resource on a part- or a full-time basis to a “business development” or “stakeholder engagement” role should be evaluated;
- on a related point, the INFOMAR programme offers significant potential to further develop general public awareness of our rich marine heritage and the potential which is offered by economic growth. While there are outreach measures within the programme at present, including engagement with local schools at the start of mapping activity, there may be case for its expansion as part of a marine-wide initiative – resources allowing;
- enhanced timeliness in the conversion of basic survey data to publicly available data and information products would enhance overall programme effectiveness in the period to end-2016, as current arrangements run the risk of non-processed data at programme-end when budgets have been exhausted or potentially expired<sup>18</sup>;
- finally, systems for tracking the extent to which funded research projects are converting to commercially sustainable businesses or supporting the efficiency of enterprise need to be put in place if the effectiveness of the applied research work stream is to be capable of evaluation into the future.

Key effectiveness findings are now presented.

#### Effectiveness – Developing Data & Information Products

The objective of this work stream is “to create a mechanism for the improved dissemination of information to policymakers, private sector and the public”, presumably with the intention of facilitating improved decision making be that in the public interest or for the pursuit of profit. Effectiveness is, therefore, determined by a combination of the following:

1. the public availability of processed data and information products;
2. the accessibility of the data to relevant stakeholders and, related, levels of usage; and
3. the quality and usefulness of the data once accessed.

<sup>18</sup> In this regard, it should be noted that basic processed data is made available very shortly after surveying work is completed with integrated products (e.g. charts) only feasible after full areas or bays have been mapped. Equally, it is clear that (once satisfied of an immediate need) INFOMAR management will prioritise production of a planned product to meet a user requirement.

On the basis of these criteria, the following findings were made:

- **Time lag modestly constraining short-term INFOMAR effectiveness potential:** With regard to the first of these, the short-term effectiveness of the programme is being modestly constrained by avoidable time lags between the collation of survey data and its conversion to data and information products. Should funding be exhausted or expired before these time lags are addressed, the impact on effectiveness will be much greater.
- **INFOMAR data is accessible:** The public accessibility of the data and associated information products is strong, with PwC finding the website (infomar.ie) both intuitive to navigate and fast in terms of download speeds. These conclusions are reflected in relatively high levels of usage of the data and were echoed in a survey of users of INFOMAR data (see Table 8). In terms of levels of public awareness, a more structured approach to the notification of stakeholders of the timing of the full programme of INFOMAR activities should enhance work stream effectiveness. This is presently being addressed, partially through the online posting of an INFOMAR programme of work for 2013;

**Table 8: INFOMAR Data Usage**

	#	% of Total
No. of Unique Data Users	1,119	100%
No. of Countries of Usage	27	
No. of Unique Irish Users	783	70%
Sector Distribution of Irish Users		100%
Private Industry	251	32%
Education	204	26%
Research	117	15%
General Public	94	12%
Government	63	8%
Other	55	7%

- **High levels of data quality and usefulness reported:** The PwC survey of INFOMAR users<sup>19</sup> also indicated high levels of satisfaction with the quality and presentation of the data, and found that INFOMAR was critical to the operations and / or research of a significant number of respondents. Against this, however, it should be noted that only a quarter of respondents have downloaded INFOMAR information products (i.e. charts)<sup>20</sup>.

### Effectiveness – Deliver Value Added

The objective of this work stream is “to deliver a range of value-added opportunities linked to user demands, commercial markets and external funding sources”. There was, however, no effort at quantification of the scale of this delivery at the time of strategy formulation which renders a definitive view on effectiveness challenging.

<sup>19</sup> From a total of 1,119 unique users, 131 users responded giving a response rate of 12% and a confidence interval of +/- 7.7%.

<sup>20</sup> Reflecting the relatively sophisticated nature of data users.

---

INFOMAR delivers “value-added” in four ways:

- the fast-tracking of selected seabed mapping activities to reflect particular demands of strategically important data users, predominantly public service organisations;
- the allocation of research funding to third-party organisations;
- the attraction of additional research funds from European organisations;
- the provision of technical advisory services to public service organisations.

The first two of these programme elements are potentially very beneficial in distinct ways, with the fast-tracking ensuring that the need for planning certainty in a multi-annual programme such as INFOMAR does not constrain the immediate information needs of strategic stakeholders and the research funding allocation providing a platform and incentive programme for the applied usage of INFOMAR data. Key findings on effectiveness are as follows:

- **Value Added Exploitation has had a positive effect on stakeholders:** Consultations with INFOMAR stakeholders with respect to this activity, which is funded on a cost-recovery basis, revealed high levels of satisfaction. The process by which potential beneficiaries are made aware of this potential service as well as the means by which projects are prioritised is not, however, systemised. From the perspective of ensuring effectiveness as well as fairness, there may be some merit in a degree of practical formality (proportionate to demand) in both respects. Table 9 provides a list of value-added activities.

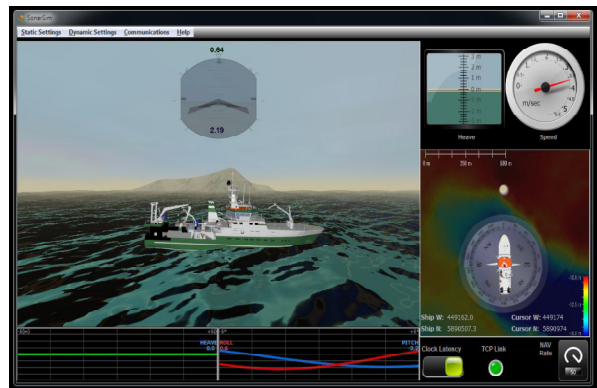
**Table 9:** Value Added Exploitation – Additional Areas Mapped

Areas Mapped	Collaboration & Effect	Completion Date
S Celtic Sea	OGS, Italy	2008
Offshore Potential SACs	NPWS: Special Areas of Conservation	2008
Offshore Belmullet	SEAI: Wave Energy Test Site	2009-11
West of Aran	MI Nephrops Grounds	2011
Dundalk Bay	InterReg: INIS HYDRO	2011-12
Inshore Clare & Achill	SEAI/ESBI: West wave Test Sites	2011
Kenmare	InterReg: Mesh Atlantic	2012
Burtonport/Rutland Island	UAU: DAHG	2011-12
Inish Boffin & Turk	BIM: Potential Deep Sea Fishing Sites	2012
Offshore Clare	SEAI: Wave Energy Sites	2012
Spit Bank/Cork Harbour	Cork coco: ISPAT Site	2012

- Not possible to conclusively assess the effectiveness of Applied Research Programme:** In terms of applied research, there are also challenges in the evaluation of effectiveness to the extent that no targets were set in respect of the number of projects to be funded or the status of these projects post-funding. While there were clearly very important challenges in setting targets in both respects, learnings garnered to the time of writing may render this more feasible going forward. Box 1 and Box 2 below provide sample case studies of Applied Research Programme projects.

**Case Study 1: Supporting the Improvement of Surveying Efficiency**

SonarSim Ltd. was founded in 2011 by two UL graduates (James Riordan & Francis Flannery) who now work in the area of developing simulation technology to improve marine survey performance. Using visualisation, data processing and simulation technologies, they have simulated real time deployment of underwater survey vehicles to assist with survey planning, system calibrations, and training. Following receipt of two separate INFOMAR value added research project awards in 2011, they are currently developing a system to improve survey efficiency in the field, through automated on the fly survey planning (Multibeam AutoPilot), and separately, they are working towards provision of a Cloud based E-learning solution for Hydrographic Operations (ECHO).



The tools under development have significant international marketable potential. Due to the extreme costs associated with real world operation of such marine survey infrastructure, delivery of training, planning and operational tools to improve efficiencies and de-risk operations through simulation is of very high marketable value.

## Case Study 2: Supporting Marine Data Visualisation and Digital Entertainment

INFOMAR funded a 2010 research project proposal by RealSIM Ltd., an NUIG campus company, which involved extending their skills acquired in terrestrial simulation applications to the marine environment. They developed and supplied a demo simulation based around Mutton Island, Galway Bay.

RealSim has a combination of personnel now capable of interpretation of marine data, and presenting them using the latest physics based simulation engine technology, typically used in the digital entertainment industry. The team include a marine geophysicist, a 3d modeller, and two programmers who are collectively able to assemble marine data, 3d CAD and the latest simulation technology to produce highly realistic and accurate simulations of the marine environment and activities within it.

Mainstream, a global leader in renewable technology have asked RealSim to join their ISIS program to be their visualisation experts. They commissioned a demo simulation which can be seen online, with appropriate graphics card capabilities.<sup>21</sup> RealSim now aspire to become world leaders in the field of offshore renewable energy simulation. The ability to stream models online is a recent advance enabling online delivery of interactive simulations through a web player. This offers significant opportunity for marine researchers and educators to engage the public with the marine environment and the resources and activities within it. Additional advances include better tessellation algorithms for simulating complex ocean movement, and more advanced lighting physics for additional realism.

Since the 2010 project award, Gavin Duffy setup a sister company RealSIM Games, and they are working towards delivery of an online marine resource management game, on foot of another successful INFOMAR project proposal.

- INFOMAR has also been **effective in the attraction of specialist project funds** from international sources, mainly EU. An overview of current Irish participation in EU-funded projects in which INFOMAR was instrumental in securing funding is shown in Table 10.

<sup>21</sup> <http://www.realsim.ie/ireland3d/windsim3d.html>

**Table 10:** Collaborative International (EU Funded) Research Projects attracted by INFOMAR

Project	Funding	Budget	FTEs
EMODNET	EU Commission/ DG MARE	Total: €4.5 million INFOMAR: €180k	1 FTE for 3 years (3 FTEA)
GeoSea	EU FP7	Total: €5.94 million INFOMAR: €209k	2 FTEs for 2.5 years (5 FTEA)
INIS Hydro	INTERREG (IVA)	Total: €3.8 million MI/ GSI: €1 million	1 FTE for 3 years (3 FTEA)
MESH Atlantic	INTERREG (IVB)	Total: €3.5 million MI/ GSI: €352k	1 FTE for 3 years (3 FTEA)
ATLANTERRA	INTERREF (IVB), Atlantic Area	Total: €2.4 million MI/ GSI: €325k	None
NAG TEC	North Atlantic European Geological Surveys & industry	Total: €4.8 million GSI: €210k	2 FTE for 2 years (4 FTEA)
TOTALS		Total FTEs 7	Total FTEAs 18

- The current incremental value of EU-funded programmes attracted by INFOMAR is €2.2 million supporting the equivalent of 18 FTEs in a single year. As previously, the extent to which this can be considered a success is not clear given that no targets were set in the original strategy document.
- Additional, **INFOMAR has been effective in the objective of being a specialist technical resource** to a large number of Irish and international public and private sector organisations which supports them in meeting obligations under European and international obligations, among others. An overview of these organisations is presented in Figure 4 with a case study of the role played by INFOMAR provided in Case Study 3.

**Figure 4:** Profile of Beneficiaries of INFOMAR Advisory Services



### **Case Study 3: Supporting Department of Arts, Heritage and the Gaeltacht**

INFOMAR has provided a broad range of supports to the DAHG in meeting its obligations under EU and international legislation. The Department's National Parks and Wildlife Services (NPWC) division, for example, has been a significant beneficiary. Their responsibilities include: a) securing the conservation of ecosystems and maintaining and enhancing populations of flora and fauna in Ireland; b) implementation of the EU Habitats and Birds Directive; c) implementation of national and EU legislation and policies relating to the natural heritage; and d) management of State-owned national parks and nature reserves. INFOMAR has supported the NPWC as follows:

#### **A) Habitat Mapping of Geogenic Reef Offshore Ireland:**

INFOMAR undertook a study in 2009 with DAHG to provide information on the extent and distribution of Annex 1 geogenic reef under the EC Habitats Directive (92/43/EEC) in the Irish Exclusive Economic Zone.

Subsequently, and in the framework of the EC Habitats Directive, INFOMAR supported a 2013 study of the Methane-derived Authigenic Carbonates (MDACs) in the Irish Sea.

#### **B) Natura 2000 Site Assessments (2010 to 2012):**

INFOMAR data, where available, underpinned a ground truthing initiative undertaken collaboratively by Marine Institute and DAHG to determine conservation status of key habitats in coastal marine Natural 2000 sites (SACs and SPAs). Where available, INFOMAR data reportedly provided significant cost savings due to the ability to target biological sampling to key seabed types. INFOMAR data are also currently being incorporated as a baseline dataset for ongoing marine habitat mapping.

#### 4. IMPACTS

The term “impact” is used in reference to the full effects of the programme across the national economy, with the emphasis on the *enabling* capacity of the programme as distinct from direct impacts necessarily. In 2008, PwC sought to place a value of the potential full-economy impacts of the programme by evaluating the potential impact on sectors which the programme had the capacity to support. Details are contained in Table 11.

**Table 11: PwC Forecast of INFOMAR Impact (to 2026)**

<b>Forecast INFOMAR Impact (2013)</b>	<b>Low Scenario</b>	<b>Medium Scenario</b>
Commercial		
<i>Fishing Sector</i>	€47.7m	€95.4m
<i>Aquaculture</i>	€28.9m	€57.8m
<i>Biodiversity</i>	€5.6m	€11.1m
<i>Renewable Energy</i>	€20.0m	€40.0m
<i>Energy Exploration</i>	€24.7m	€49.3m
<i>Aggregates Industry</i>	€42.7m	€85.5m
Knowledge Economy		
<i>Research</i>	€5.1m	€10.2m
Legislative		
<i>Non-Compliance Fines</i>	€3.7m	€7.5m

It should be noted that this is the incremental sector value-added which will accrue as a result of full programme implementation by end-2026. They should at most be partially, i.e. 30%, met in 2012.

The INFOMAR programme has clearly impacted commercial and public sector players in all of these fields, directly through value-added research or indirectly through data availability.

See Table 12.

**Table 12: Sample INFOMAR Benefits by Sector**

	<b>Programme Activity / Action Taken</b>
<b>Commercial</b>	
Fishing Sector	<ul style="list-style-type: none"> <li>• Inclusion of INSS/INFOMAR data in OLEX Fishing Navigation systems</li> <li>• Inclusion of INSS/INFOMAR data in SODENA fishing Navigation System (Belco Marine, Cork)</li> <li>• Use of seabed classification as physical habitat maps</li> <li>• Use of data by MI Fishery research / catch calculations group</li> <li>• BIM use of data annually in seed Mussel evaluations</li> </ul>
Aquaculture	<ul style="list-style-type: none"> <li>• Use of data in UISCE Project, BIM Aquaculture modelling including Killary Harbour</li> <li>• Collaborative project, mapping with BIM on Deepwater Aquaculture</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>• Use of data in designating new Offshore SACs over Geogenic reefs, in collaboration with NPWS</li> <li>• Use of data in decision process for Marine Strategy Framework directive and Marine Atlas</li> <li>• Inclusion of data in National Biodiversity centre under INFOMAR applied Research Project</li> </ul>
Renewable Energy	<ul style="list-style-type: none"> <li>• Surveying of suitable locations for national renewable energy test sites</li> <li>• Collaborative mapping of potential sites for WestWave project</li> <li>• Use of data by offshore operators/licence applicants in renewable sector</li> <li>• Input into cable and pipeline crossings in Irish sea</li> <li>• 5 renewable energy research projects funded</li> </ul>
Energy Exploration	<ul style="list-style-type: none"> <li>• Data fed into recent Strategic Environmental Assessments</li> <li>• Use of data in pre-drilling site evaluations for Oil &amp; Gas Companies.</li> <li>• Use of data by large energy company in exploration work.</li> </ul>
Aggregates Industry	<ul style="list-style-type: none"> <li>• Limited, given collapse of the construction industry</li> <li>• Discussion ongoing with Irish developer for export to UK market</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>• Inclusion of data in Coastal Heritage Web Viewers (Heritage Council)</li> <li>• Tourism products developed through the Atlanterra Initiative (InterReg)</li> <li>• Participation of vessels in outreach; the Tall Ships in Waterford &amp; Dublin, Volvo Ocean Race events, Cork port open day etc.</li> </ul>
<b>Knowledge Economy</b>	
Research	<ul style="list-style-type: none"> <li>• INFOMAR Applied Research Programme</li> <li>• Partnering on SME and campus company developments</li> <li>• Use of data in non-INFOMAR funded research internationally</li> <li>• Development of new marine research capacity in Ireland at certain third level colleges e.g. DCU in Marine geochemistry, NUIM in Marine Data Processing</li> <li>• Recruitment of Irish and international scientists on INFOMAR and externally funded marine research projects.</li> <li>• Facilitation of INFOMAR staff participation in INFOMAR related research (1 PhD, 3 MScs earned and 1 PhD and 2 MScs pending)</li> </ul>

Notwithstanding a significant activity, the major change in Ireland's economic fortunes since these estimates were originally prepared (i.e. 2008) means that the targeted impacts (pro rata to end-2012) in certain sectors were simply unattainable.

The INFOMAR programme, for example, was to have facilitated growth in the aggregates industry of approximately €26 to end-2012. This industry has virtually collapsed since the end of the

property boom in 2008. Similarly, the fishing sector grew by an estimated €42 million between 2007 and 2011, compared with a (pro rata) targeted INFOMAR impact of close to €30 million.

While INFOMAR initiatives have clearly supported the generation of greater value in the sector (e.g. inclusion of INFOMAR data in fishing navigation systems), it is not likely to have accounted for almost 60 per cent of output growth in this period.

By contrast, however, very strong growth is underway in the renewable energy and energy exploration sectors, both of which can benefit very significantly from the INFOMAR programme.

PwC understand that INFOMAR management is presently planning a project to more clearly understand potential beneficiary needs in these high growth sectors and to incorporate these into its programme of activity, as feasible. This is a very positive development and one which characterises an innovative management approach to the delivery of value.

## 5. CONTINUED RELEVANCE

Continued relevance relates to whether there is justification for the continued allocation of public funds to the INFOMAR programme. There is a clear justification, as outlined in the rationale section of this summary document.

## RECOMMENDATIONS FOR IMPROVEMENT

This report highlights 5 recommendations for enhancing effectiveness and impact, as well as for facilitating future evaluations of programme effectiveness and efficiency.

**Table 13:** Recommendations for Improvement

Recommendation
1. Ensure future INFOMAR Strategy (i.e. 2016 to 2026) supports evaluation
2. Set quantified performance measures across all phases of the current programme
3. Appoint business development and stakeholder engagement resource
4. Fast-track development of outstanding data and information products
5. Further develop outreach programme, subject to resource availability

1. <b>Ensure future INFOMAR strategy (i.e. 2016 to 2026) supports evaluation:</b> It is recommended that the INFOMAR strategy for the period 2016 to 2026 is structured such as to support an evaluation, and that quantified annual targets are set across all programmes.
2. <b>Set quantified performance measures for major stages:</b> Related, and in order to enable a formulaic monitoring of programme efficiency and effectiveness to end-2016 (accepting that annual targets are now set with the INFOMAR Board and monitored as part of general governance), it is recommended that quantified performance measures are set across each of the major stages from inputs to outputs. The measures should range from the highly practical, such as a validated activity-based costing model for tracking spend on all of the major programme areas (e.g. data processing), to leveraging the information already available from the DPRs to generate operational reports which are very accessible to third-parties. This report outlines a set of performance measures for the major stages.
3. <b>Appoint business development and stakeholder engagement resource:</b> While the INFOMAR programme already has formal programmes in place for engagement with key stakeholders, there may be merit in the appointment (on a part or a full-time basis) of a

---

business development or a stakeholder engagement resource. This would require the provision of additional resources (staffing or financial) to the programme, which could be justified in terms of potential impact on effectiveness, or the diversion of funds available from the applied research effort, i.e. the level of funding allocation to third-party research projects;

4. **Fast-track development of outstanding data and information products:** It is recommended that required resources are made available to address a modest backlog in the processing of marine data to ensure that data and information products are produced within a reasonable degree of time from data acquisition. It will also ensure that full benefit is derived from the current programme before funding is exhausted or expire. Again, this may require additional funding or the diversion of funds from another programme area.
5. **Further develop outreach programme:** The INFOMAR programme is a potentially powerful mechanism for educating the general public on the richness of our marine heritage as well as its economic potential. Subject to resource availability, there is a case for developing the current outreach efforts of the INFOMAR programme.

# 1. Introduction

## Background

- 1.1. The Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) programme is Ireland's national marine mapping programme. It is the successor to the Irish National Seabed Survey (INSS), and is a joint venture of the Geological Survey of Ireland (GSI) and the Marine Institute (MI). The focus of the INFOMAR programme, therefore, is to create a range of integrated mapping products of the physical, chemical and biological features of the seabed in the near-shore, or Zone 1 (0m to 50m) area and remaining Zone II area, thus completing the mapping programme for the entirety of Ireland's off-shore waters.
- 1.2. Funding of €4 million per annum was allocated to the INFOMAR programme for the period 2006-2008. The INFOMAR programme has subsequently been incorporated into the National Development Plan (NDP) 2007-2013, under the Enterprise, Science and Innovation Priority in the Geoscience sub programme, with the same annual budget of €4 million, i.e. projected to €28 million to 2013. Ireland has experienced major macro-economic changes since the initial estimates were developed. The financial crisis in Ireland, characterised by an 8.3% cumulative fall in GDP and 8% rise in unemployment since 2008, has led to a total required fiscal adjustment between 2008 and 2014 of approximately €30 billion. As a result of the financial crisis, the INFOMAR programme budget was reduced by 16% in 2009 to €3.36 million and by a further 10% reduction in 2010 to €2.99 million. A budget provision of €3 million was made for the INFOMAR programme in both 2011 and 2012 resulting in a 25% reduction from the original estimates.
- 1.3. The INFOMAR programme, which commenced in 2006, was designed to be completed over a 20 year period, with an associated estimated cost of €84 million, a cost estimate based on the expenditure incurred in respect of the previous INSS programme. In 2008, a detailed Cost Benefit Analysis (CBA) was undertaken. The CBA 2008 report highlighted four options; 1) do minimum – continue the project for remainder of current funding period (Dec, 2008) and then stop; 2) Map priority areas only (26 bays and 3 priority coastal areas) by 2016; 3) INFOMAR strategy in full by 2016 (mapping of phase 1 and phase 2) and implementation of other components across Programmes 1, 2 and 3; 4) INFOMAR strategy in full phased completed by 2026. Costs and benefits of each option were identified and quantified where possible. Benefits included commercial, knowledge economy, legislative and environmental benefits. The Net Present Value of the options was calculated with Option 3 being the recommended option.
- 1.4. Given the financial crisis, the recommendations of the CBA 2008 report were not implemented in full. The original strategy of mapping phase 1 by 2016 and phase 2 by 2026 was maintained (i.e. option 4 of the CBA). Detailed cost estimates that take into the account the uplift from inflation suggest that INFOMAR will cost €94m from 2009 to the completion of the programme in 2026.

---

## Terms of Reference

1.5. The terms of reference for this report require an independent evaluation of the INFOMAR programme's performance against its outline objectives as specified in the INFOMAR Strategy 2006 and supplemented in a subsequent 2008 Option Appraisals (Cost Benefit Analysis) Report<sup>22</sup> on the INFOMAR programme. The sub-programmes of INFOMAR are, in broad terms, as follows:

1. **Data Acquisition, Management & Interpretation:** To contribute to the management of activities and resources in Irish inshore areas by completing a comprehensive mapping and data interpretation programme for defined priority areas and bays to the period to end-2016 followed by the remaining areas and bays in the period to 2026;
2. **Data Integration and Exchange:** To establish processes and procedures to create a mechanism for the enhanced integration of marine survey data and the dissemination of data and information products to policy makers, academia, private sector and the public;
3. **Deliver Value Added Research:** To deliver a range of value added opportunities linked to user demands, commercial markets and external funding sources.

The terms of reference for this report also require that where the programme is deemed to be under-performing, recommendations are made for improvement.

## Project Overview

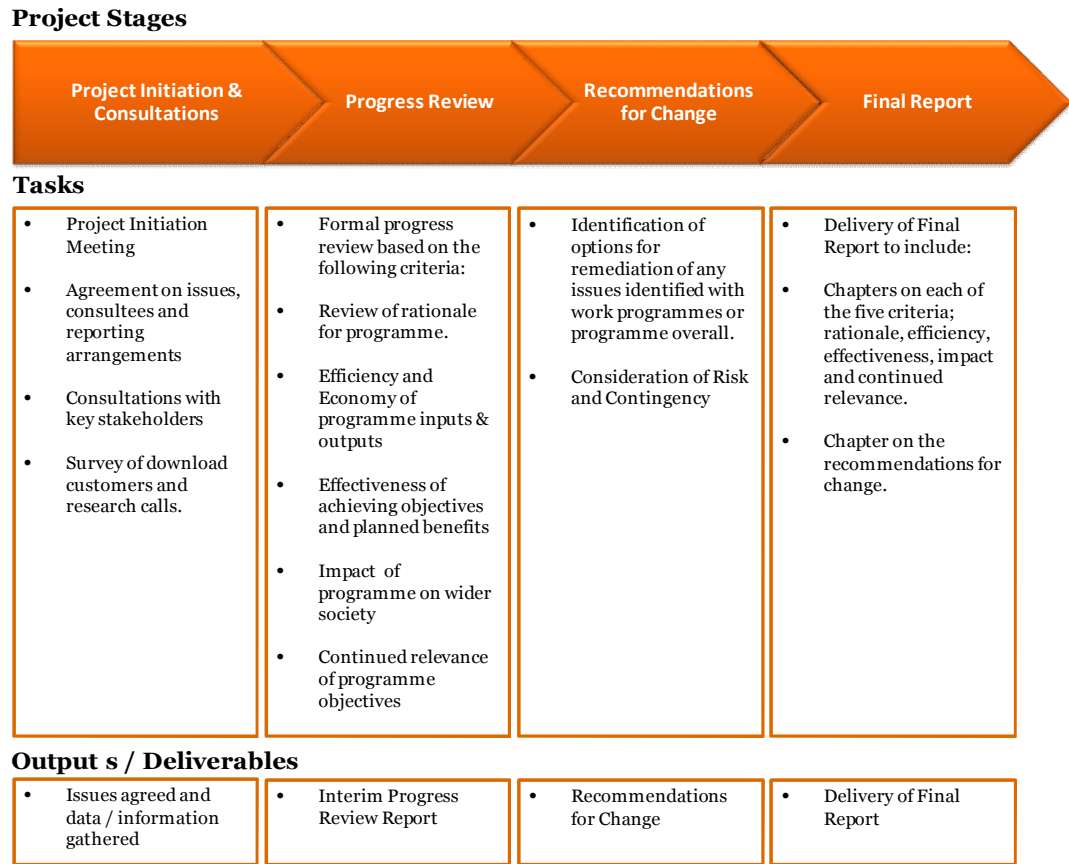
1.6. The approach to this project follows closely the guidance provided by the Department of Finance with respect to "Guidelines for the Appraisal and Management of Capital Expenditure Proposals in the Public Sector (February 2005)" and the "Value for Money Guidance (March 2007)". Figure 1.1 provides an overview of our approach. Figure 1.2 provides an overview of the Project Work Plan. The approach incorporates four stages:

- **Stage 1: Project Initiation & Consultations.** This stage involves the initiation of the project and consultations with key stakeholder groups. A survey of individuals and organisations that have downloaded INFOMAR data and a survey of research calls funded by INFOMAR were conducted. The key output with respect to this stage is the gathering of all necessary data and information to successfully complete this review.
- **Stage 2: Progress Review:** This stage involves formally reviewing the progress of the programme and its objectives under five key headings (as per Department of Finance Value for Money Guidance); Rationale, Efficiency, Effectiveness, Impact and Continued Relevance.
- **Stage 3: Recommendations for Change.** Based on the progress review and stakeholder consultations, this stage will identify options for the remediation of any issues with the work programmes or the programme overall, evaluate those options and provide considerations of risk.
- **Stage 4: Final Report.** This stage involves the development of a detailed report based on all other stages. A concise summary for senior stakeholders is also to be developed.

---

<sup>22</sup> hereafter referred to as the CBA 2008 Report

**Figure 1.1: Progress Review Approach**

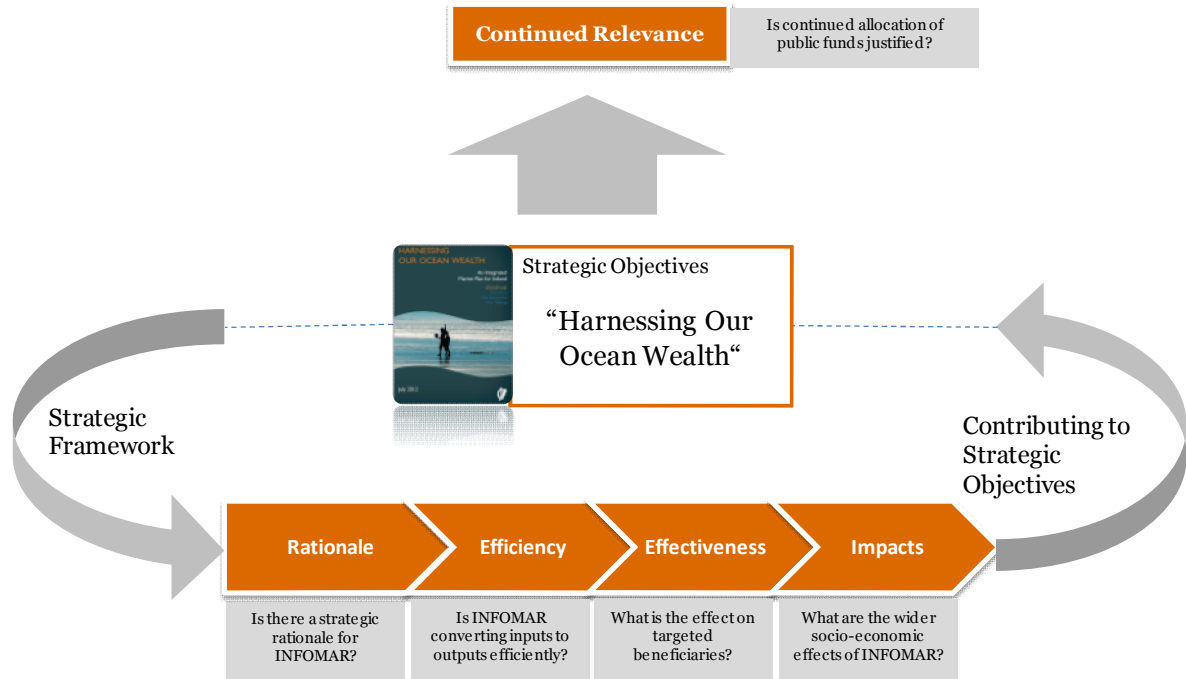


## Evaluation Methodology

- 1.7. Figure 1.2 provides an overview of the core evaluation methodology for this project. The guiding strategic framework for this project is the Ocean Wealth report developed by the Marine Coordination Group<sup>23</sup> in addition to the European Commission’s Marine Knowledge 2020 Green Paper and the Department of Communications, Energy and Natural Resources (DCENR) ’ Statement of Strategy. This strategic framework provides key guidance in our assessment of the INFOMAR programme based on five criteria as set out in the Department of Finance’s Value for Money Guidance. As specified in Figure 1.2, this report intends to provide detailed assessments of each of the questions associated with rationale, efficiency, effectiveness, impacts and continued relevance.

<sup>23</sup> Marine Coordination Group (2012) Harnessing Our Ocean Wealth – An Integrated Marine Plan (IMP) for Ireland.

**Figure 1.2: Evaluation Methodology Overview**



1.8. In accordance with the Department of Finance’s Value for Money (VFM) and Policy Review Initiative Guidance Manual, the INFOMAR programme was assessed against five key evaluation criteria; Rationale, Efficiency, Effectiveness, Impacts and Continued Relevance. Table 1.1 provides an explanation of these terms:

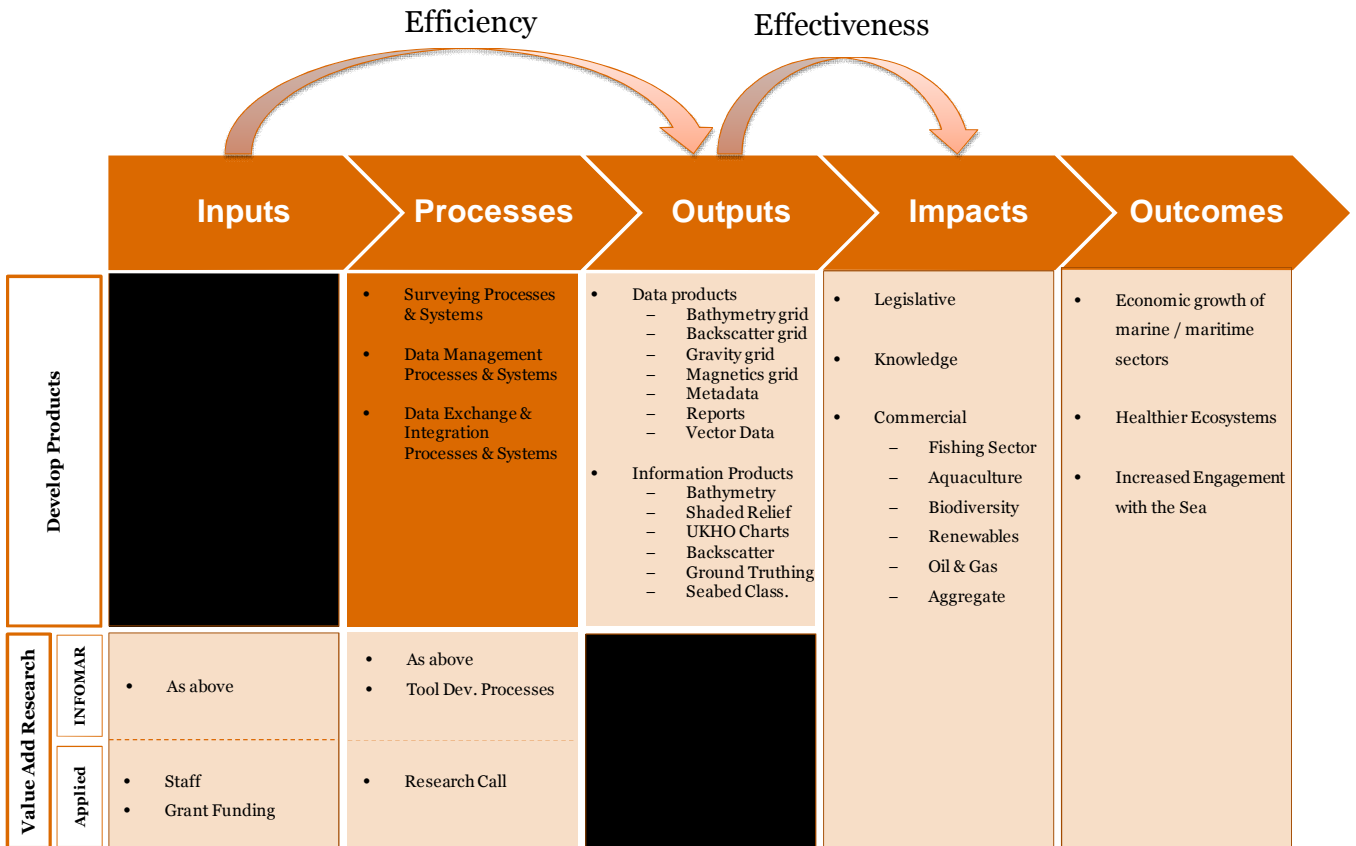
**Table 1.1: Explanation of evaluation criteria**

Criteria	Description
Rationale	<ul style="list-style-type: none"> <li>Whether public policy intervention is necessary</li> </ul>
Efficiency	<ul style="list-style-type: none"> <li>The acquisition and use of inputs and the production of outputs</li> </ul>
Effectiveness	<ul style="list-style-type: none"> <li>Short-term effects outputs have on targeted beneficiaries</li> </ul>
Impacts	<ul style="list-style-type: none"> <li>Wider sectoral effects and long term effects on targeted beneficiaries</li> </ul>
Continued Relevance	<ul style="list-style-type: none"> <li>Whether there is justification for the continued allocation of public funds</li> </ul>

1.9. A programme structure which enables a strict adherence to this approach is one where, within a single expenditure envelope, spending can be linked to inputs (e.g. vessel time), inputs to outputs (e.g. seabed area mapped), and outputs to impacts (e.g. regulatory compliance). For practical reasons at the time of its inception, this is not the case with the INFOMAR programme structure. Programme 1, for example, requires the collation and processing of seabed data alone. For this activity to generate a wider economic benefit or impact, it must be disseminated. This dissemination activity is the purpose of Programme 2.

1.10. While the rationale for this distinction at the time of inception is clear and justified, the PwC team needed to restructure the programme for the purposes of undertaking this evaluation. An overview of the Evaluation Framework applied is provided in Figure 1.3.

**Figure 1.3:** Evaluation Framework for INFOMAR Programme



---

## 2. Rationale

### Introduction

- 2.1. In this chapter, we provide an assessment of the ‘rationale’ for the INFOMAR programme. The rationale analysis is concerned with establishing why a public policy intervention is necessary in a given area. As per the Value for Money Guidelines of the Department of Finance<sup>24</sup>, this chapter provides an assessment against four key criteria:
- **Question 1:** Is the programme consistent with national policy
  - **Question 2:** Are the programme objectives clear and beneficiaries apparent?
  - **Question 3:** Could objectives be attained in the absence of State funding?
  - **Question 4:** Are programme risks and assumptions clearly identified?

### Rationale

#### *Question 1: Is the programme consistent with national & EU policy and Legislation?*

- 2.2. The Marine Knowledge 2020 initiative provides a unifying framework for all ongoing activities on marine observation in the EU. It embraces the full cycle, from initial observation through to interpretation, processing and dissemination. It enshrines basic principles such as ‘collect data once and use them for many purposes’ and ‘data should be interoperable, accessible and free of restrictions on use’. It clearly lays out the key reasons why industry, public authorities, science and civil society require this data.
- 2.3. The Ocean Wealth report<sup>25</sup> sets out the Irish government’s vision<sup>26</sup>, high-level goals and integrated actions across policy, governance and business to enable our marine potential to be realised. It specifies three ‘high-level’ goals, of equal importance based on the concept of ‘sustainable development’:
- **Goal 1:** focuses on a thriving maritime economy, whereby Ireland harnesses the market opportunities to achieve economic recovery and socially inclusive, sustainable growth.
  - **Goal 2:** sets out to achieve healthy ecosystems that provide monetary and non-monetary goods and services (e.g. food, climate, health and well-being).
  - **Goal 3:** aims to increase our engagement with the sea. Building on our rich maritime heritage, our goal is to strengthen our maritime identity and increase our awareness of the value (market and nonmarket), opportunities and social benefits of engaging with the sea.

The report highlights eight enablers that are key to creating the conditions for growth and investment and 39 associated actions. Table 2.1 highlights action number 23 of that report.

---

<sup>24</sup> Department of Finance (2007). Value for Money and Policy Review Initiative Guidance Manual.

<sup>25</sup> Marine Coordination Group (2012) Harnessing Our Ocean Wealth – An Integrated Marine Plan (IMP) for Ireland.

<sup>26</sup> The vision of the Ocean Wealth Report is that “our Our ocean wealth will be a key element of our economic recovery and sustainable growth, generating benefits for all our citizens, supported by coherent policy, planning and regulation, and managed in an integrated manner.

**Table 2.1:** Action 23 of the Ocean Wealth Report

No.	Key Actions	Supports Goals	Timeline	Responsibility
23	<p>Complete the INFOMAR seabed mapping programme, to provide data, products (e.g. databases, charts, physical habitat maps) and services (marine decision support tools) as critical inputs to maritime spatial planning and enablers of infrastructural development, research, education and value-added products.</p> <p>Further develop the role of INFOMAR in:</p> <ul style="list-style-type: none"> <li>• Training of Irish graduates in latest techniques in seabed mapping, which are applicable world-wide;</li> <li>• Utilisation of data in major research projects; and</li> <li>• Development of collaborative added-value products through engagement with SMEs and the research community.</li> </ul>	1,2,3	Short – Medium Term	DCENR (GSI) and MI

2.4. The Department of Communications, Energy and Natural Resources Statement of Strategy 2011-2014 specifies the importance of providing high quality and reliable information to underpin better-informed decision making. Table 2.2 provides the strategy – outcome – performance indicator relevant to INFOMAR.

**Table 2.2:** DCENR Statement of Strategy – INFOMAR

Strategy	Outcome	Performance Indicator
<ul style="list-style-type: none"> <li>• Provide reliable geoscience support for environmental protection and effective spatial planning and support the sustainable development of Ireland’s natural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of high quality and reliable information to inform local, regional and national physical planning and underpin better-informed decision-making nationally and by local authorities through identified potential for groundwater, aggregate resources and storage of carbon underground</li> </ul>	<ul style="list-style-type: none"> <li>• Complete mapping of 8 priority bays and coastal areas under INFOMAR (with Marine Institute). Combined bedrock and subsoil maps in priority areas.</li> </ul>

2.5. A range of legislation underpins the legislative rationale for the INFOMAR programme including Convention for the Safety of Life at Sea (SOLAS) which requires a contracting government to ‘undertake to arrange for the collection of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation’. Several other relevant pieces of legislation supporting the rationale for INFOMAR are specified in Table 2.3.

**Table 2.3:** Legislative Rationale for the INFOMAR programme

Phase	Obligation	Relation to INFOMAR Programme
Convention for Safety of Life at Sea (SOLAS)	<ul style="list-style-type: none"> <li>• Requirement of a contracting government to ‘undertake to arrange for the collection of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation’</li> </ul>	<ul style="list-style-type: none"> <li>• The INFOMAR project, which will complete the mapping of the Irish seabed, will support the fulfilment of these requirements for the Irish Government.</li> </ul>
United Nations Convention on the Law of the SEA	<ul style="list-style-type: none"> <li>• Signatory nations to define the limits of their continental shelf and to project the limits of other maritime jurisdictions</li> </ul>	<ul style="list-style-type: none"> <li>• Parts of the area that will be mapped by INFOMAR are the subject of discussion between</li> </ul>

(UNCLOS)	including the exclusive fishery zone.	Ireland, France and the UK in terms of the exact positioning of boundaries. Therefore, the availability of data from mapping of the disputed area will be essential to reconcile existing and future competing claims.
Oil Pollution of the Sea (Civil Liability and Compensation) Act (1988) MARPOL	<ul style="list-style-type: none"> <li>Exemption from liability on the owner of a vessel which causes pollution damage if the accident is due to negligence by the government or authority in the provision of navigational aids in the area in which the accident occurred.</li> </ul>	<ul style="list-style-type: none"> <li>Under MARPOL (Marine Pollution) convention, a state is liable for the total costs of clean-up, vessel and cargo loss if it can be shown that the accident was attributable to poor charting in their national waters.</li> </ul>
Water Framework Directive	<ul style="list-style-type: none"> <li>Maintaining “high status” of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least “good status” in relation to all waters by 2015</li> </ul>	<ul style="list-style-type: none"> <li>An output from the INFOMAR project will be baseline seabed geochemical information and detailed habitat maps, which will potentially assist in identifying appropriate sampling locations for the WFD monitoring programmes.</li> </ul>
OSPAR Convention and EU Habitat Directive	<ul style="list-style-type: none"> <li>Ireland has agreed to firstly identify and subsequently designate Special Areas of Conservation (SACs), including cold water coral reefs.</li> </ul>	<ul style="list-style-type: none"> <li>Many of these candidate SACs are found within the inshore area and have yet to be mapped. Information from the INFOMAR, particularly physical habitat maps, will contribute to identifying the range and nature of the seabed habitats in the inshore area.</li> </ul>
EU Marine Strategy Framework Directive	<ul style="list-style-type: none"> <li>Establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters</li> </ul>	<ul style="list-style-type: none"> <li>A key aspect of the INFOMAR programme is developing seabed classification maps based on data acquired.</li> </ul>
EU INSPIRE Directive & Environmental Information Directive	<ul style="list-style-type: none"> <li>The INSPIRE Directive obliges Member States to adopt measures for the sharing of data sets and services between public authorities for the purposes of public tasks and the Environmental Information Directive requires them to release the data when asked.</li> </ul>	<ul style="list-style-type: none"> <li>The INFOMAR programme provides its Data and Information products for free on its website.</li> </ul>

2.6. It is clear from the above that the INFOMAR programme is a key enabler of national and European marine policy.

**Question 2: Are the programme objectives clear and beneficiaries apparent?**

2.7. In broad terms, and at the level required, the objectives of the INFOMAR programme are clear and the management team has clearly adopted a practical, flexible and business-like approach to their attainment. For future programmes, however, and with the objective of facilitating evaluations as well as being clear of the required balance of focus across all programme areas, there would be merit in the incorporation of quantified output and (as feasible) impact targets for all programmes. The experience of the current programme should enable this significantly.

2.8. The INFOMAR programme may benefit from a structure that is aligned with the inputs-processes-outputs-impacts-outcomes model and focuses predominately on two results-oriented ‘streams’; 1) data and information products and 2) value added research. Two

important stakeholder groups, academia and other public authorities have been identified by INFOMAR. The INFOMAR programme may also benefit from a clearer identification of the targeted beneficiaries within industry. This identification process is facilitated by the information available to INFOMAR on industry players that are currently downloading INFOMAR data. In coordination with the DCENR and appropriate public authorities, it may also be necessary to identify target beneficiaries of the INFOMAR programme that are currently not downloading INFOMAR data and investigate the reasons.

### **Question 3: Could objectives be attained in the absence of State funding?**

- 2.9. Market failure results when private individuals or firms do not produce the optimal level of goods or services from a societal perspective. We have assessed whether market failure exists to support public policy intervention or whether this programme could be delivered by the market without public funding support. We have found that without public policy intervention there may be a) a geographically inconsistent acquisition of marine data b) the potential for data sharing and utilisation would decrease c) increased inefficiencies due to the duplication of effort and d) increased cost burden on private operators. In the absence of government intervention, it is concluded that the project would not be undertaken at the same pace, quality or level of consistency.
- 2.10. This view is supported by the US and the EU. In the US, marine data is treated as a public good and is seen as a significant contributing factor to overall economic development. Studies suggest that public information and data are fundamentally a public good.<sup>27</sup> The European Commission has followed the US lead and outlined through the Marine Knowledge 2020 Green Paper and subsequently in the design principles for the European Marine Observation and Data Network (EMODnet) that marine data should be considered as a public good. Providing marine data as a public good removes monopoly power, favours the development of the market, increases the gain to the consumer and reduces the gain to the monopoly provider. Both the US and the EU are thus making the argument that there is a fundamental role for government in providing marine data or funding private provision as the market will not find a solution to this form of market failure.
- 2.11. This proposal is also supported by leading industry figures. For example, a leading licensee of offshore wind energy has argued that European marine data should also be a public good; that businesses could be more competitive and the cost of generating offshore energy cut if there were clearer public policies on data ownership, less cost-recovery pricing from public bodies and common standards across jurisdictions and disciplines.<sup>28</sup> We support both the original CBA assessment and the European Commission in their assessment that marine data is fundamentally a 'public good', that market failure exists and on this basis that government intervention is warranted.
- 2.12. A secondary and important question is the type of government intervention that is warranted i.e. whether the government should acquire and distribute marine data itself or fund the private provision of marine data. While the approach taken by government is heavily based on the value system of the individual country, an assessment of five coastal states reveals that 87% of the marine data collected by a cross section of public institutions is either collected by the public institution itself or obtained from a third party without charge (i.e. collected by another arm of the state and provided free of charge to the public

<sup>27</sup> Joseph E. Stiglitz, Peter R. Orszag, Jonathan M. Orszag, 2000. "The Role Of Government In A Digital Age" Commissioned by the Computer & Communications Industry Association. October 2000.

<sup>28</sup> Twelfth meeting of Marine Observation and Data Expert Group, 10 March 2011

---

institution). This result provides support for INFOMAR's approach of collecting and distributing marine data itself rather than funding private provision.

***Question 4: Are the Programme Risks & Assumptions clearly identified?***

- 2.13. INFOMAR has developed a risk register in order to identify, manage and mitigate risks of the programme. The risk categories developed include a) financial risks, b) strategy and policy risks, c) project resourcing risks, d) programme operations risks, e) market risks and f) other risks. These risks are assessed relative to their stage of impact (i.e. next quarter, end of year, to 2026 and other), their impact with respect to programme budget, quality, health & safety, environmental, reputational damage, data integrity and legal / compliance, their likelihood, severity, ranking and mitigating actions. This register is managed by the INFOMAR project team on an ongoing basis and discussed at board level during the quarterly meetings. Through the mechanism of the risk register, the risks of the INFOMAR programme can be appropriately identified, managed and mitigated. It will be important to ensure that this register is continually updated and important aspects of risk such as the significant time lag in the processing of data (see Chapter 3) and the associated risks in this time lag are appropriately captured.

# 3. Efficiency

## Introduction

- 3.1. In this chapter, we provide an assessment of the ‘efficiency’ of the INFOMAR programme. The efficiency analysis is separated into economy and efficiency. Economy is concerned with securing the appropriate quality of inputs at the best price. Efficiency is concerned with the relationship between inputs (e.g. vessel hours) and outputs (e.g. seabeds mapped / products produced).

## Economy

- 3.2. The economy of the INFOMAR programme was assessed against three key criteria:<sup>29</sup>
- **Question 5:** Is the INFOMAR delivery model for data acquisition cost-effective?
  - **Question 6:** Are unit costs of the acquisition of vessels in line with commercial norms?
  - **Question 7:** Are other major elements of spend in line with expectations and commercial norms?

### Question 5: Is the INFOMAR delivery model for data acquisition cost-effective?

- 3.3. The vessels utilised for the INFOMAR programme are principally the Marine Institute (MI) National Research Vessels in deeper waters (>15 metres) i.e. the RV Celtic Voyager and the RV Celtic Explorer and the GSI vessels that carry out surveys between 0 metres and 15 metres in depth i.e. RV Keary, RV Geo and RV Cosantóir Bradán. The RV Celtic Voyager and RV Celtic Explorer, as national research vessels, are chartered for use during the INFOMAR programme, with DCENR capital budget covering associated costs. Table 3.1 provides a description of the vessels purchased by the INFOMAR programme and the year of purchase. As Table 3.2 indicates, the number of vessels that INFOMAR utilises is comparable to international benchmarks (Appendix A).

**Table 3.1:** Price paid for INFOMAR Vessels

Vessel	Length	Type	Year Purchased	Purchase Price
RV GEO	7.5m	Minor	2007	€90,000
RV Keary	15.5 m	Medium	2006	€1,100,000
RV Cosantóir Bradán	17.0 m	Medium	2012	€0 <sup>30</sup>

**Table 3.2:** Number of Vessels against International Benchmark

	Avg. No. Vessels	Avg. Medium Vessels	Avg. Minor Vessels
Benchmark	5	3.8	1.5
INFOMAR	5	4	1

<sup>29</sup> The economy evaluation is undertaken for data acquisition primarily, reflecting the fact that this accounts for the greatest share of non-payroll spend. Economy is an evaluation of the extent to which you are procuring the correct goods & services (i.e. inputs) as cost effectively as feasible. Efficiency is the relationship between spend and outputs.

<sup>30</sup> There was a refurbishment cost of €90,000.

- 3.4. The major category of cost under the programme is vessel time. It was not stipulated at the programme outset what delivery model INFOMAR should use for seabed mapping for the period 2007 to 2012, i.e. contracted vessel time versus directly-owned vessels, although two vessels were owned at the time of INFOMAR strategy finalisation (i.e. 2007) and the benefits of a legacy mixed model approach were highlighted in the strategy document. The programme is now delivered primarily through directly-owned vessels, with chartered national research vessels (charged at research rates to INFOMAR<sup>31</sup>) providing the balance of services required. Details of the vessels owned are shown in Table 3.1. The decision to procure as opposed to use contract vessels has its origin in operational as well as cost considerations. For 2012, the intensity of usage of the medium<sup>32</sup> vessels (i.e. 10-30m) is sufficient to justify outright ownership. Equally, it is clear that there are important operational benefits attaching to outright ownership. The most important of these benefits is certainty regarding vessel availability, cost and crew safety. An international review shows that the ownership as distinct from contracted model of service delivery is most common for large sea bed mapping programmes running over multiple years.

**Question 6: Are unit costs of acquisition in line with commercial norms?**

- 3.5. The INFOMAR team appear to be innovative in containing programme costs. In an example of the relatively innovative approach adopted by INFOMAR programme personnel to cost saving, the Cosantóir Bradán was seconded for use on the programme on a pro bono basis from Inland Fisheries Ireland (where it was not being used to its full potential as a result of activity realignment) for use on the programme. Equally, at minimal cost to the programme, the use of evolving satellite technologies for data acquisition and processing has been piloted and, on foot of satisfactory results, commissioned for 5 bays in late 2012 (see Appendix B). Further evidence of an innovative approach to cost savings, and one which is simultaneously achieving the objective of growing seabed mapping expertise in Ireland, is the use of senior contractors and younger contractors for short duration mapping contracts. Industry norms are to hire only the highest qualified, most experienced, contractors at premium rates. However, INFOMAR (building on the INSS) employs a mixed model of permanent INFOMAR staff, senior contractors and a majority of younger contractors who trade lower rates of pay for on-the-job training. To date, more than 100 contractors have worked on both INSS and INFOMAR, which represents a significant training contribution.

**Question 7: Are other major elements of spend are in line with commercial norms?**

- 3.6. Two other major elements of non-payroll spend are: contract survey personnel; and deployment of Airborne Bathymetric LiDAR (Light Detection and Ranging) technology, i.e. ABL. Daily rates of pay of contracted survey personnel average approximately €160 for onshore activities and €305 for offshore activities with a minimum of €155 (onshore) and €220 (offshore). These rates of pay are broadly in line with terms paid by private sector operators, and reflect the highly flexible terms on which contractors are expected to work. The other major, non-payroll, expenditure is ABL. Used to cost-effectively map the sea bed in in-shore areas, the need for ABL varies significantly year-on-year depending on the profile of bays or areas being mapped<sup>33</sup>. Significant expenditures were incurred in both 2008 (€1.3m) and 2010 (€0.9m) (see Table 3.3). PwC is satisfied that the tender process

<sup>31</sup> The appropriateness of these rates was independently assessed in 2007.

<sup>32</sup> For the purposes of this report, a medium vessel is one which is greater than 10 meters in length, but less than 30 metres.

<sup>33</sup> The technology, while allowing acquisition of the shallowest data rapidly, avoiding areas that are both difficult and dangerous to map by boat, can only be used in areas of the non-turbid (clear) waters and, therefore, its application is limited to approximately a third of the Irish coastline.

under which LiDAR services were procured was consistent with public procurement norms and designed to generate greatest economic advantage for public spend.

**Table 3.3: Target versus Actual Spent**

	2007 (€m)	2008 (€m)	2009 (€m)	2010 (€m)	2011 (€m)	2012 <sup>34</sup> (€m)
LiDAR – Target Spend	-	1.2	-	0.8	0.04	0.04
LiDAR – Actual Spend	-	1.3	-	0.9	0.05	0.1
Actual as % of Target	-	-8%	-	-13%	-25%	-150%

- 3.7. The INFOMAR programme has 6 staff members and 1 half-time administrative GSI staff member. No explicit targets have been set with respect to staffing levels year on year. Effective from January 2011, GSI staff salaries were no longer funded from the INFOMAR programme budget and were assigned to core DCENR salaries budget. The INFOMAR programme also has nine Marine Institute staff members and three vacant positions (i.e. research support, hydrographic surveyor and underwater engineer). Three Marine Institute temporary staff members with contracts to mid-2013 are also part of the INFOMAR programme, with a fourth research project temporary staff member contracted until mid 2014. As Table 3.4 illustrates, budgeted staff costs have decreased from a peak of €920,000 in 2008 to €450,000 in 2012 (a decrease of €470,000) mainly as a result of the reassignment of €368,000 in GSI staff costs to the core salaries budget. Overspend in 2009 figures was the result of overheads such as marketing and training costs and underestimation of GSI salaries and the exclusion of the PRSI component in estimates received. The targets shown in Table 3.4 are annual planned as distinct from those agreed at programme outset. A higher degree of annual budgetary compliance speaks to good financial management.

<sup>34</sup> The overspend in 2012 was due to the awarding of a tender for Satellite Data acquisition and processing that was commenced in Q4 2012.

**Table 3.4: Target versus Actual Spent**

	2007 (€m)	2008 (€m)	2009 (€m)	2010 (€m)	2011 (€m)	2012 (€m)
<b>Total Target Spend</b>	4.0	4.0	3.4	3.0	2.9	3.0
Major Items Target Spend						
Salaries	0.9	0.9	0.9	0.8	0.5	0.5
Shiptime (State)	1.1	0.5	0.9	0.7	0.9	0.9
LiDAR	-	1.2	-	0.8	0.04	0.04
Data Management	0.3	0.3	0.1	0.08	0.08	0.1
Value Added Research	0.1	0.2	0.3	0.2	0.45	0.3
Other Items Target Spend	1.6	0.9	1.2	0.4	0.9	1.2
<b>Total Actual Spend</b>	4.2	3.9	3.4	3.0	2.9	3.0
Major Items of Spend:						
Salaries	1.0	0.9	1.0	0.8	0.5	0.4
Shiptime (State)	1.1	0.5	1.1	0.7	0.8	1.1
LiDAR	-	1.3	-	0.9	0.05	0.1
Data Management	0.3	0.2	0.2	0.1	0.1	0.2
Value Added Research	0.03	0.3	0.3	0.1	0.5	0.2
Other Items Actual Spend	1.87	0.7	0.8	0.4	0.95	1.0
<b>Actual as % of Target</b>	-8%	3%	0%	0%	0%	0%

## Efficiency

3.8. In this section we assess the efficiency with which INFOMAR delivers on the Develop Data & Information Products objective and the Deliver Value Added Research objective. We begin with an assessment of the efficiency of Developing Data & Information Products.

### Developing Data & Information Products

- 3.9. The efficiency of Developing Data & Information Products was assessed against six key criteria:
- **Question 8:** Is actual spend in line with target spend year on year?
  - **Question 9:** Is maximum operational benefit being derived from the capital assets?
  - **Question 10:** Have the major mapping targets been met within the agreed financial envelope?
  - **Question 11:** What data and information products are produced and are products consistently produced per bay and area?
  - **Question 12:** Are data and information products cost-efficiently produced?

#### Question 8: Is actual spend in line with target spend year on year?

3.10. In mid 2006 approval was given for €12 m for the first three years of the project (2006-2008). An additional €2.2 million for capital purchases was made available in 2006 to purchase a launch and equipment, (with related €0.2m capital in 2007). As a result of the financial crisis, the INFOMAR programme budget was reduced by 16% in 2009 to €3.36 million and by a further 10% reduction in 2010 to €2.99 million resulting in a 25% reduction from original estimates. A budget provision of €3 million was made for the INFOMAR programme in both 2011 and 2012. Table 3.5 provides a comparison of the

original estimates of spend, actual spend and payroll adjusted actual spend given the allocation of GSI salaries to the core budget. Actual spend is in line with target spend year on year for major components of spend apart from 2007. In 2007, an overspend is apparent due to additional launch payment of 0.2m.

**Table 3.5:** Programme expenditure against target

	2007	2008	2009	2010	2011	2012
€ m						
Total Target Spend (NDP Original)	4.0	4.0	4.0	4.0	4.0	4.0
Total Target Spend (Annually Adjusted)	4.0	4.0	3.4	3.0	2.9	3.0
Total Actual Spend	3.8	3.8	3.5	3	2.9	3.0
Total Actual Spend (Payroll Adjusted) <sup>35</sup>	3.8	3.8	3.5	3.0	3.2	3.4
Actual Spend as % of NDP (Annual)	95%	95%	88%	75%	80%	85%
Actual Spend as % of NDP (Compound)	95%	95%	93%	88%	87%	86%
Actual Spend as % of Annual Target	106%	99%	100%	100%	99%	100%

**Question 9: Is maximum operational benefit being derived from the capital assets?**

- 3.11. Evaluating the utilisation of capital assets given the area of seabed mapped is constrained by the differing levels of complexity between the areas mapped i.e. difficult to navigate bays with relatively low Sq Km are not comparable to open waters where a large relative level of Sq Km can be covered. As described in Table 3.7 and Table 3.8, the average number of days at sea for major vessels is 173 days and 170 days for minor vessels. As above, the RV Cosantóir Bradán only became operational in Sept. 2012. Excluding this launch results in an average of 215 days at sea. This is comparable to the international benchmark of 221 days at sea. The average cost per day for major vessels (excluding RV Cosantóir Bradán) is €9,500 which is low relative to the international benchmark of €12,620 (see Appendix A).

**Table 3.7:** INFOMAR Days at Sea and Cost per Day

Vessel	Depth Range	Vessel Type	Days at Sea (end 2012)	Cost per Day
RV GEO	0-30m	Minor	170	€1,500
RV Keary	0-30m	Medium	170	€4,500
RV Consantoir Brandon	0-30m	Medium	48*	€3,500
RV Celtic Voyager	10-100m	Medium	391	€8,000
RV Celtic Explorer	50-5000m	Medium	83	€16,000

\* Operational in Sept. 2012

**Table 3.8:** INFOMAR Major Vessels against International Benchmarks

	Avg. Days at Sea	Avg. Cost per Day
Benchmark	221	€12,620
INFOMAR	215	€9,500

<sup>35</sup> Budgeted staff costs decreased from a peak of €920,000 in 2008 to €450,000 in 2012 (a decrease of €470,000) mainly as a result of the reassignment of GSI staff costs to the core salaries budget.

- 3.12. With respect to RV Celtic Voyager and RV Celtic Explorer, the large more costly vessels, additional equipment was augmented as appropriate to ensure survey cost efficiencies were optimal i.e. maximum seabed coverage at required resolution achieved in a 24-hour period. For example, in 2007, a dual head high frequency multibeam system was installed which improved seabed coverage by approximately 120%, from 2.5 times water depth to 6-8 times water depth. In 10m water depth, this equates approximately to increasing a given survey corridor from 25m to 60-80m depending on sea conditions. The replacement of DGPS navigation systems has increased survey time available, reduced back-deck operations required and associated personnel H&S risk, and also de-risked data quality issues associated with loss of tide gauges, a common problem in the marine survey environment often relating to trawled gear. Loss of tide gauges leads to reduction in output data quality, and in a worst case scenario to re-survey requirements. It is clear that for the years reviewed INFOMAR-owned vessels were intensely utilised. The productivity or otherwise of vessel days, from an operational perspective, is more difficult to evaluate reflecting the facts that; the unpredictable nature of mapping conditions, particularly weather, mean that there can be little certainty regarding the relationship between vessel days and size of area mapped.
- 3.13. Setting productivity targets is, therefore, a very challenging exercise. There may, however, be benefit in preparing a simple, standard, monthly report (for monitoring purposes only) which provides a clear indication of maximum potential surveying days of a vessel versus actual achieved, providing details of the factors which resulted in an over- or under-performance, e.g. equipment malfunction. All of this material is provided in Daily Progress Reports (DPRs) and accessible to INFOMAR management, but may need collating into a manageable format for the purpose of non-expert readers including INFOMAR Board members as well as future programme evaluators.

**Question 10: Have the mapping targets been met within agreed financial envelope?**

- 3.14. The INFOMAR programme consists of two phases as specified in Table 3.9. Clear output targets and associated timelines are specified in the INFOMAR strategy with respect to the mapping of 26 priority bays and 3 priority coastal areas by 2016 (see Figure 3.1 for an illustration). The bays and areas were selected on the basis of a stakeholder consultation exercise in 2002 and a feasibility study in 2004. While the CBA 2008 report recommended that the most cost-effective option was to complete the INFOMAR programme (i.e. Phase 1 & 2) by 2016, this option was not implemented given the financial crisis. The Integrated Marine Action Plan for Ireland 2011-2016 specifies the original output targets of completing Phase 1 by 2016 and it is the progress toward this target that is assessed.

**Table 3.9: Target out for Phase 1 & Phase 2**

Phase	Target Output	Sq. km
Phase 1	<ul style="list-style-type: none"> <li>Mapping of 26 priority bays by 2016</li> <li>Mapping of 3 priority coastal areas by 2016</li> </ul>	c. 27,000 sq. km
Phase 2	<ul style="list-style-type: none"> <li>Mapping of the Irish marine territories by 2026</li> </ul>	c. 100,000 sq. Km

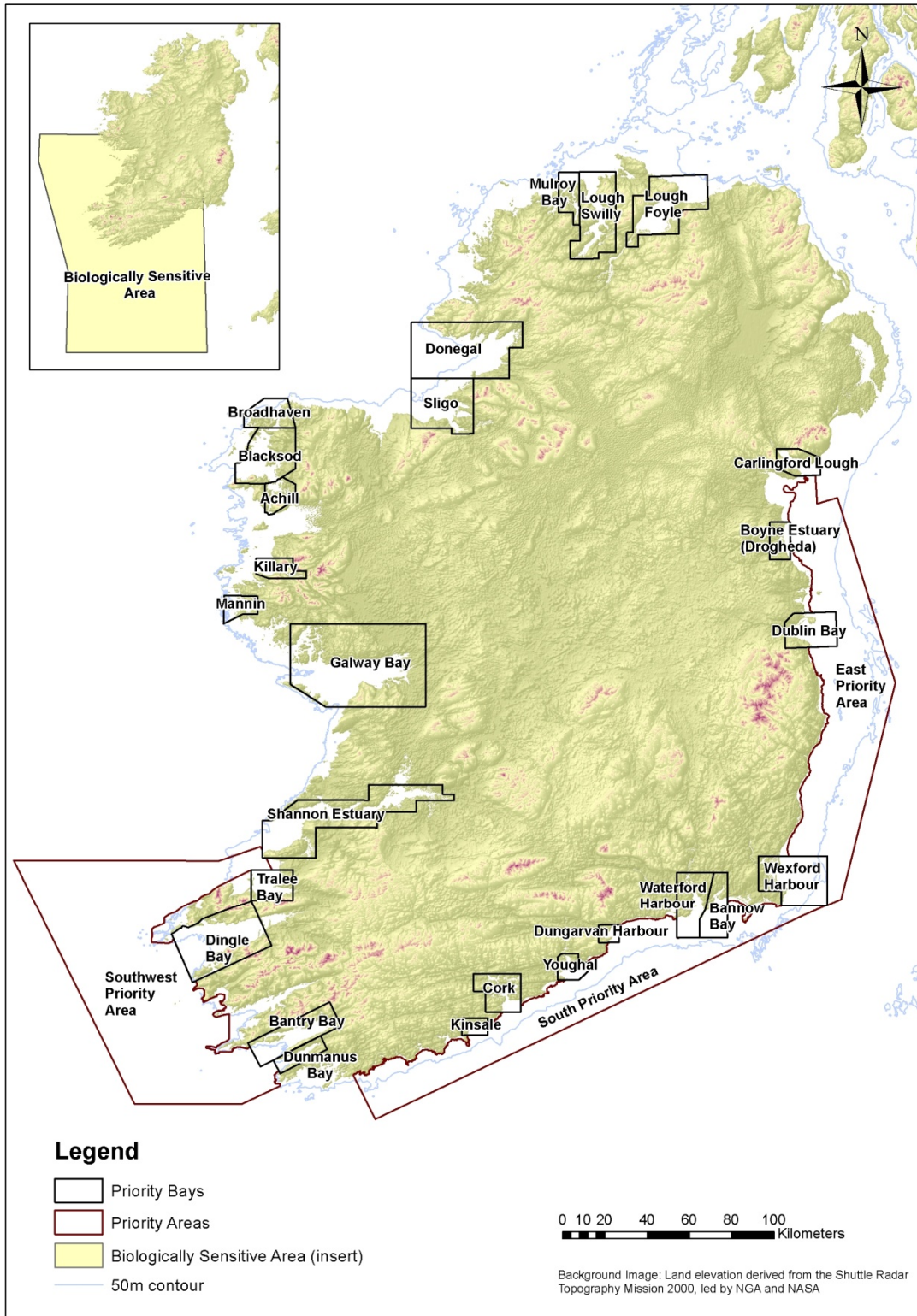
- 3.15. Given that Sq Km per day fails to capture the complexity of the area surveyed, we utilise the % of the bay / coastal area surveyed as our assessment measure. Based on this measure, Phase 1 requires, on average, 2.6 priority bays and 0.3 priority coastal areas per year in order to meet the overall target of 26 bays and 3 coastal areas by 2016. The INFOMAR programme has mapped approximately 18.4 priority bays against a target of 18.2 and 2.28

priority coastal areas against a target of 2.1 (see Table 3.10). It is clear that INFOMAR is on target to meet its objective of mapping 26 priority bays and 3 priority coastal areas. While this is an important target to meet, the restructuring of the programme in accordance with the 'logic model' places the focus on the development of Data & Information Products as the key output target. We now turn to this important point through the next measure.

**Table 3.10:** Target out for Phase 1 & Phase 2

	<b>Priority bays</b>	<b>Priority Areas</b>
Target	18.2	2.1
Actual	18.4	2.28

**Figure 3.1: 26 Priority Bays and 3 Priority Coastal Areas**



- 3.16. Fundamentally, performance to date indicates a very strong cost-efficiency to the extent that the rate of progress in attainment of mapping targets is fully in line with that set out in the original plan with actual spend on data acquisition significantly behind the annual targets for the period 2006 to 2015 set out in the INFOMAR strategy (see Table 3.11). There are, however, factors which make a definitive conclusion regarding cost-efficiency challenging. For example, there are potentially important differences in the costs of data acquisition per sq km for the priority areas and bays to be mapped as part of the INFOMAR programme, with the implication that an assumption of cost-efficiency may be erroneous if it is the case that mapping costs per sq km of the outstanding bays and areas are disproportionately high relative to those already mapped. The following will be required going forward to support a definitive conclusion on mapping efficiency; a ring-fenced annual budget for the mapping element (including high level assumptions on collation methods as well as on assumed annual capital spend) and an assumed cost or resource weighting for each of the bays and areas, to the extent that this is feasible.

**Table 3.11: Cost-Efficiency of Sea-bed Mapping Activity (2007-2012)**

INFOMAR Strategy Provided - Mapping (€ m)	18.1 <sup>36</sup>
Actual Spend – Mapping (€ m)	15.1 <sup>37</sup>
Actual as % of NDP	83%
No. of Priority Bays Mapped – Target	18.2
No. of Priority Bays Mapped – Actual	18.4
Actual as % of Target	101%
No. of Priority Areas Mapped – Target	2.1
No. of Priority Areas Mapped – Actual	2.3
Actual as % of Target	109%

**Question 11: What Data & Information Products are produced and are they consistently produced per bay and area?**

- 3.17. The INFOMAR strategy provides an outline of the types of data and information products to be delivered by the INFOMAR programme. These include “hydrographic maps, seabed classification and habitat maps and baseline data to underpin the delivery of requirements including, management plans for inshore fishing, aquaculture, coastal protection and engineering works, environmental impact assessments related to licensing activity, Water Framework Directive requirements and to support evolving needs in the coastal zone management”.<sup>38</sup>
- 3.18. With respect to data products, INFOMAR has produced 1.75 Tb of downloadable data, 40 Tb of disk data for the period 2006-2013 and 50Tb of disk data for the period 2000-2013. With respect to Information Charts, INFOMAR aims to produce 5 specific chart products for the following data type; bathymetry, backscatter, shaded relief and seabed classification

<sup>36</sup> This sum was computed by subtracting €2.5 million in capital spend from the mapping programme spend for the period 2006 to 2015 (i.e. €32.5 million), dividing by 10 and multiplying by 6. It is an estimate and more precise detail is needed going forward to support evaluation.

<sup>37</sup> Based on activity-based costings provided by INFOMAR. Total estimated spend is adjusted for an assumed “notional” payroll uplift in 2011 and 2012 of approximately €400,000 in both years.

<sup>38</sup> INFOMAR (2007). Proposal & Strategy. Version 2. p. 14

at three separate scales (1:50k, 1:100k, and overview scale). Table 3.12 outlines that for priority bays with 90% or greater survey completion, INFOMAR have produced 53% (i.e. 32) of products. The basis of this discrepancy is outlined in the next section on timelines. Table 3.13 outlines the availability of data and information products for each bay.

**Table 3.12:** Priority Bays Information Products Produced

Information Products	Bathymetry	Backscatter	Shaded Relief	Seabed Classification	Total
Target	15	15	15	15	60
Actual	8	8	8	8	32
% Actual of Estimate	53%	53%	53%	53%	53%

**Table 3.13:** Public<sup>39</sup> Availability of Data & Information Products<sup>40</sup>

Priority Bay	Survey Status	Bathymetry	Shaded Relief	Backscatter	Ground Truth.	Seabed Class.	Baseline Data
Achill Bay	100%	√	√	√	X	X	√
Bannow Bay	0%	-	-	-	-	-	-
Bantry Bay	100%	√	√	√	√	√	√
Blacksod Bay	95%	√	√	√	X	X	√
Boyne Estuary	0%	-	-	-	-	-	-
Broadhaven Bay	70%	√	√	X	X	X	X
Carlingford Lough	20%	X	X	X	X	X	X
Cork Harbour	70%	√	√	√	√	√	√
Dingle Bay	75%	√	√	√	X	X	√
Donegal Bay	100%	√	√	√	√	√	√
Dublin Bay	100%	√	√	√	√	√	√
Dungarvan Har.	0%	-	-	-	-	-	-
Dunmanus Bay	100%	√	√	√	√	√	√
Galway Bay	100%	√	√	√	√	√	√
Killary Harbour	100%	√	√	√	√	X	√
Kinsale Harbour	100%	√	√	√	X	X	√
Lough Foyle	70%	√	√	X	X	X	X
Lough Swilly	20%	X	X	X	X	X	X
Mannin Bay	100%	√	√	√	X	X	√
Mulroy Bay	90%	√	√	X	√	X	√
Shannon Estuary	50%	√	√	√	√	X	√
Sligo Bay	100%	√	√	√	√	√	√
Tralee Bay	100%	√	√	X	X	X	√
Waterford Bay	100%	√	√	√	X	√	√
Wexford Harbour	80%	√	√	√	X	√	√
Youghal Bay	0%	-	-	-	-	-	-

3.19. It is important to note that the INFOMAR programme has produced other information products. For example, INFOMAR have produced book products detailing the morphology of the seabed along the continental margin of the North-East Atlantic entitled “Atlas of the Deep-Water Seabed”. In terms of heritage, the INFOMAR programme, building on the work

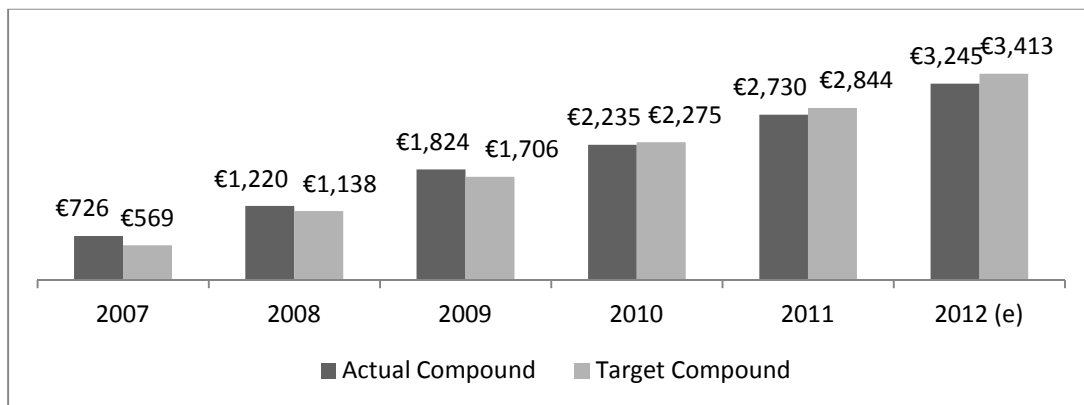
<sup>39</sup> The term “public” here is used in reference to that which is available on a public server. In this regard, it should be noted that INFOMAR management is flexible in terms of meeting the particular needs of a data user and re-prioritises the schedule of product development on a needs basis. Equally, processed survey data is made available almost immediately on the INFOMAR data. It is the data products which are experiencing delays.

of the INSS and working in conjunction with the Underwater Archaeology Unit of the National Monuments Service, has developed a database of over 300 shipwrecks, containing detailed information regarding each wreck’s condition on the seafloor, its extent, dimensions and water depth, along with a short background history and the reason for its loss. Based on the data collected by the INFOMAR and INSS project, and in collaboration with other state bodies, a book entitled “Warships, U-boats & Liners – A Guide to Shipwrecks Mapped in Irish Waters” was published in Oct 2012.

**Question 12: Are Data and Information Products cost-efficiently produced?**

- 3.20. The evaluation challenge pertains to the fact that the original strategy document was not specific on the target timelines for the production and dissemination of data and information products from the time of survey completion. It is clear at this juncture that there are avoidable time lags in the preparation of data and information products, a fact which may relate to a small under-spend relative to that which was envisaged in the original INFOMAR strategy (see Figure 3.2). While seabed data does not date quickly *per se*, there are potentially very important implications of delays including: i) the programme will not be complete in full in the targeted financial envelope as cost is being carried forward at the same time as available annual budgets are fully exhausted; ii) mobilisation of Phase II may be delayed; and iii) the stakeholders are delayed in deriving benefit from the seabed mapping activity<sup>41</sup>. INFOMAR management estimate that full clearance of the current backlog of work associated with the development of data and information products for areas and bays which are mapped at 41 weeks, equivalent to almost a full-time equivalent individual. This is additional to ongoing work entailed with new survey data.
- 3.21. In summary, cost efficiency is challenging to evaluate in this set of circumstances, although there is an apparent relationship between a programme spend on data management which is somewhat below target and delays in the public availability of information products.

**Figure 3.2: Data Management Actual versus Target Spend (€000s)**



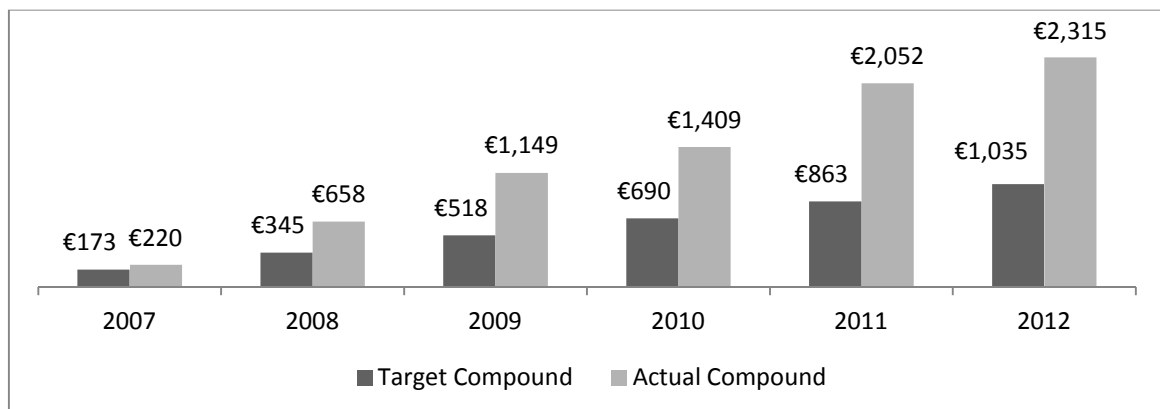
<sup>41</sup> It should be noted that a protocol is in place for the making available of data concerning hydrographic risk directly from the survey to the UKHO. As such these delays do not pose a regulatory risk from this perspective

## Deliver Value Added

3.22. In terms of the value added stream, there are two primary components a) the INFOMAR value added projects and b) applied research. The first of these is essentially a fast-tracking of planned seabed mapping activity by INFOMAR to meet the particular needs of a strategic stakeholder on a cost recovery basis, while the latter is a programme of research funding administered by INFOMAR. Additionally, and in line with the intent of the original strategy, INFOMAR management also delivers value-added through engagement with relevant EU project funding opportunities and through the provision of technical advisory services to public service organisations in Ireland. As for the other programmes, there were no quantified annual targets for value-added activities set out in the original strategy document which renders an evaluation of cost-efficiency relative to that envisaged at programme inception challenging. It is, however, clear that value-added research spend is tracking ahead of target – in contrast to the other two programmes. It should be noted that research calls, or the funding of third-party research, accounts for the greatest share of “value-added” expenditure, i.e. €1.1 million or 48% since 2007.

3.23. As context, an overview of actual spend by year versus the annual target contained in the INFOMAR 2007 strategy is shown in Figure 3.3:

**Figure 3.3:** Value Added Actual versus Target Spend (€000s)



3.24. The efficiency of delivery of value added projects was assessed against two key criteria:

- **Question 13:** Is INFOMAR value added projects cost-efficiently delivered?
- **Question 14:** Is the applied research programme cost-efficiently delivered?

### **Question 13: Is INFOMAR value added projects cost-efficiently delivered?**

3.25. Value Added Exploitation is survey work that is outside of the core priority bays and areas and is conducted at the request of another agency. 9 additional areas have been surveyed funded by 7 different institutions (see Section 4.9 for an overview of the survey work conducted). Similarly, 8 research collaboration projects that INFOMAR have been involved in are funded by the EU to a total value of €1.98 million. Line item spend for the Value Added Projects component relates to specific projects or research commissioned which did not go to open call, e.g. Shannon estuary noise study of echo sounder systems which had to be undertaken to deal with Department of Environment (NPWS) concerns that dolphins would be injured by acoustic transmissions outside of their hearing range. The nine additional areas surveyed are undertaken at the request of other public service organisations and are reimbursed on a cost-recovery basis.

**Question 15: Is the applied research programme cost-efficiently delivered?**

- 3.26. With regard to applied research, there are no formal metrics in the original strategy against which to evaluate efficiency, i.e. target annual numbers of projects versus target spend are not defined in the original strategy. While the absence of targets renders an efficiency evaluation challenging, it is clear that governance arrangements are in place to ensure probity of expenditure for approved projects. These include peer review practices which promote independence in selection and appropriate levels of expert input, as well as project management arrangements which minimise the cost exposure to the State associated with a failed project implementation. Targeted research areas are developed based on feedback from the INFOMAR Technical Advisory Committee, and a critical mass of research activity in certain universities appears now to be driving an efficiency of research effort.
- 3.27. 46 projects have been funded across 18 different institutions (9 public and 9 private sector) in 10 separate ‘themes’ i.e. geoscience, environment, technology, ocean energy, data visualisation, data integration, education, fisheries and data management. The profile of INFOMAR-funded Research Projects is described in Table 3.15. A selection of themes are proposed and an open theme is also included (see Table 3.16 for 2011 research call themes) relevant to INFOMAR in a given year and, dependent on quality, a percentage of proposals are funded. Appropriate processes are in place to ensure cost efficiency with each project receiving 50% funding initially, 20% as a mid-point payment subject to satisfactory progress and 30% as a final payment upon final deliverable acceptance.
- 3.28. As indicated, the value-added programme incorporates two additional substantial elements, both of which were envisaged in the original strategy. The first is the attraction of international project funds and the second is the provision of specialist advisory services to public service organisations. As before, targets in respect of these activities were not set out in the strategy which renders an evaluation of cost-efficiency challenging. It is, however, clear that INFOMAR has had considerable success in both regards.

**Table 3.15: Profile of INFOMAR-funded Research Projects (Selected Years)**

	<b>2008</b>	<b>2009</b>	<b>2011</b>
Total Funds Awarded	252,066	368,999	649,830
No. of Projects Funded	9	14	23
Average Project Value	28,007	26,357	28,253
Maximum Project Value	30,000	30,000	30,000
Minimum Project Value	23,800	16,170	20,130
% Approved Projects (University-Led)	77%	85%	60%
% Approved Projects (Private Enterprise Led)	11%	0%	34%
% Approved Projects (Other)	11%	14%	4%
% Approved Projects (Any University)	78%	87%	73%
% Approved Projects (Any Private Enterprise )	33%	7%	42%

**Table 3.16: 2011 Research Call Themes**

Theme	Sub-theme
Data Integration, Analysis & Visualisation	<ul style="list-style-type: none"><li>• Satellite Remote Sensing Coastal Mapping</li><li>• LiDAR &amp; Aerial Photographic Coastal Mapping</li><li>• 4D Data Integration</li><li>• Marine Data Integration / Offshore Aquaculture &amp; Ocean Energy</li></ul>
Tools & Technology Development	<ul style="list-style-type: none"><li>• Biodiversity Mapping</li><li>• Survey Data Integration with Navigation Systems</li><li>• Information and Communication Interface for Seabed Mapping Data (Marine Leisure, Tourism, Fisheries, Education )</li></ul>
Cross Cutting	<ul style="list-style-type: none"><li>• Economic impact assessment</li><li>• Value Added Exploitation Programme Development Studies</li></ul>
Open Call	<ul style="list-style-type: none"><li>• Open.</li></ul>

### *Efficiency Conclusions*

3.29. As indicated previously, the structure and content of the INFOMAR strategy (specifically the absence of quantified output indicators for programmes 2 and 3) places a constraint on the feasibility of a standard efficiency evaluation. Notwithstanding this fact, there are strong indicators that the INFOMAR programme is operating efficiently, namely:

- appropriate governance arrangements are in place for the oversight of major expenditures, and actual spend has tracked annual targeted spend closely since 2007;
- project promoters are proactive and innovative in the pursuit of cost savings, and clearly committed to the task of comprehensively mapping the Irish seabed;
- related, programme measures such as the “fast-track” mapping of non-priority areas for public and private sector interests on a cost-recovery basis are innovative in terms of meeting the needs of target beneficiaries as well as in reducing life-long programme costs;
- the tendering arrangements in place for the provision of services (contractor and otherwise) to the programme appear consistent with public procurement norms, with elements of innovation embedded (e.g. graduate training programme) which simultaneously reduce overall programme costs and support the attainment of ancillary programme objectives, e.g. the development of sophisticated seabed mapping capabilities among graduates;
- the main quantified target of the programme (i.e. number of priority bays and areas mapped) which achieves the greatest share of overall programme spend is being achieved within a reduced overall financial envelope.

---

## 4. Effectiveness

### Introduction

- 4.1. In this chapter, we provide an assessment of the ‘effectiveness’ of the INFOMAR programme. Effectiveness considers the immediate to short term effects that the availability of outputs has on the targeted beneficiaries. In order to develop our conclusions, a range of stakeholders from approximately 13 different institutions were consulted for their views on the INFOMAR programme. These stakeholders included direct beneficiaries of the data, private companies involved in the international surveying industry, stakeholders involved in the delivery of similar programmes in other countries and senior stakeholders from the Department of Communications, Energy and Natural Resources who oversee the delivery of the programme. The stakeholder consultations provided evidence that there is a high-level of satisfaction with the INFOMAR programme, a high level of responsiveness of INFOMAR staff and the programme is recognised internationally as having successfully achieved the engagement and buy-in of senior stakeholders. We also assessed the effectiveness of the INFOMAR programme surveys of INFOMAR data users and INFOMAR funded applied researchers. In our assessment, we considered the effects on targeted beneficiaries with respect to both the Develop Data & Information Products objective and the Value Added Projects objective.

### Developing Data & Information Products

- 4.2. The objective of this work stream is “to create a mechanism for the improved dissemination of information to policymakers, private sector and the public”, presumably with the intention of facilitating improved decision making be that in the public interest or for the pursuit of profit. The effectiveness of Developing Data & Information Products was assessed against two key criteria:
- **Question 16:** What is the public availability of processed data and information products?
  - **Question 17:** What is the accessibility of the data to relevant stakeholders and, related, levels of usage?
  - **Question 18:** What is the quality and usefulness of the data once accessed?

#### *Question 16: What is the public availability of data and information products?*

- 4.3. The short-term effectiveness of the programme is being modestly constrained by avoidable time lags between the collation of survey data and its conversion to data and information products. Should funding be exhausted or expired before these time lags are addressed, the impact on effectiveness will be much greater.

#### *Question 17: What is the accessibility of the data to relevant stakeholders and, related, levels of usage?*

- 4.4. There have been 1,119 unique user downloads of data products from 27 different countries with 70% of users based in Irish institutions. Seven countries, Ireland, Great Britain, USA, France, Austria, New Zealand and Canada are responsible for 96% of the downloads of INFOMAR data. Approximately 70% of stakeholders that have downloaded INFOMAR data work in Irish based institutions while 17% are from Great Britain, 4% from the US, 2% from

France and 1% from Austria, Netherlands and Canada. The users have completed over 50,000 downloads in excess of 2,000GB of digital data.<sup>42</sup> The largest take-up has come from Irish institutions in the private sector i.e. 32% of all downloads and in public education i.e. 26%. Other sectors include ‘Research’ (15%), ‘General Public’ (12%), ‘Government’ (8%) and ‘Other’ (7%) (see Table 4.1).

**Table 4.1: INFOMAR Data Usage**

	#	% of Total
No. of Unique Data Users	1,119	100%
No. of Countries of Usage	27	
No. of Unique Irish Users	783	70%
Sector Distribution of Irish Users		100%
Private Industry	251	32%
Education	204	26%
Research	117	15%
General Public	94	12%
Government	63	8%
Other	55	7%

- 4.5. The public accessibility of the data and associated information products is strong, with PwC finding the website (infomar.ie) both intuitive to navigate and fast in terms of download speeds. These conclusions are reflected in relatively high levels of usage of the data and were echoed in a survey of users of INFOMAR data. In terms of levels of public awareness, a more structured approach to the notification of stakeholders of the timing of the full programme of INFOMAR activities should enhance work stream effectiveness.

**Question 18: What is the quality and usefulness of the data once accessed?**

- 4.6. In order to better understand the effects of the availability of data on beneficiaries, we conducted a survey of all users (see Appendix E). Of the 1119 unique users of the INFOMAR data, 12% (131 data users) responded to our survey giving a confidence interval +/- 7.72%. Users were asked to rate the quality of the data, whether the data is integral to their operations / research and presentation of the data available for download on a scale of 1 (low) to 5 (high). Table 4.2 presents the results of the survey across the three main categories for data products. It is clear from the results that respondents view the data provided by INFOMAR as useful, of high quality and well presented. Users were also asked whether they download the ‘Information Products’ (i.e. charts) provided by INFOMAR. The survey suggests that out of the sample of data users, only 25% have downloaded INFOMAR Information Products (i.e. charts). The high level of quality referenced by INFOMAR users has been achieved due to standardised quality assurance processes of the INFOMAR programme (see Appendix C).

**Table 4.2: Results of survey of INFOMAR data users**

Category	% Rating 4 or 5	Confidence Interval
Quality of Data	90%	+/- 7.72%
Data integral to operations / research	63%	+/- 7.72%
Presentation of Data	77%	+/- 7.72%

<sup>42</sup> Significant data is also delivered to stakeholders by disk upon request.

## Develop Value Added Projects

4.7. The objective of this work stream is “to deliver a range of value-added opportunities linked to user demands, commercial markets and external funding sources”. There was, however, no effort at quantification of the scale of this delivery at the time of strategy formulation which renders a definitive view on effectiveness challenging. INFOMAR delivers “value-added” in four ways:

- the fast-tracking of selected seabed mapping activities to reflect particular demands of strategically important data users, predominantly public service organisations;
- the allocation of research funding to third-party organisations;
- the attraction of additional research funds from European organisations;
- the provision of technical advisory services to public service organisations.

The first two of these programme elements are potentially very beneficial in distinct ways, with the fast-tracking ensuring that the need for planning certainty in a multi-annual programme such as INFOMAR does not constrain the immediate information needs of strategic stakeholders and the research funding allocation providing a platform and incentive programme for the applied usage of INFOMAR data.

4.8. The effectiveness of Deliver Value Added Projects objective was assessed against two key criteria:

- **Question 18:** What have been the effects of the INFOMAR Value Added Projects Programme?
- **Question 19:** What have been the effects of the Applied Research Programme?

### *Question 18: What have been the effects of the INFOMAR Value Added Projects Programme?*

4.9. INFOMAR has mapped 9 additional areas as part of the value added exploitation programme which has led to a diverse range of effects including the facilitation of a revised route for cable installation, mapping of priority areas for marine renewables and the identification of sea aquaculture sites (see Table 4.3). For example, a significant area was mapped around Inis Turk and Inis Bofin, having been identified by BIM for potential development of deep sea aquaculture. Survey work was undertaken by the R.V.s Keary & Geo, and data acquired will underpin oceanographic modelling work for final site selection, as well as supporting benthic sampling plans, and providing seabed characterisation for environmental impact assessment and anchoring purposes.

**Table 4.3:** Value Added Exploitation Programme

Additional Areas Mapped	Collaboration & Effect	Completion Date
S Celtic Sea	OGS, Italy	2008
Offshore Potential SACs	NPWS: Special Areas of Conservation	2008
Offshore Belmullet	SEAI: Wave Energy Test Site	2009-11
West of Aran	MI Nephrops Grounds	2011
Dundalk Bay	InterReg: INIS HYDRO	2011-12
Inshore Clare & Achill	SEAI/ESBI: West wave Test Sites	2011
Kenmare	InterReg: INIS HYDRO	2011-12
Burtonport/Rutland Island	UAU: DAHG	2011-12

Inish Boffin & Turk	BIM: Deep Aquaculture Sites	2012
Offshore Clare	SEAI: Wave Energy Sites	2012
Spit Bank/Cork Harbour	Cork coco: ISPAT Site	2012

- 4.10. Consultations with INFOMAR stakeholders with respect to this activity, which is funded on a cost-recovery basis, revealed high levels of satisfaction. The process by which potential beneficiaries are made aware of this potential service as well as the means by which projects are prioritised is not, however, systemised. From the perspective of ensuring effectiveness as well as fairness, there may be some merit in a degree of practical formality (proportionate to demand) in both respects.

**Question 19: What have been the effects of the Applied Research Programme?**

- 4.11. There are challenges in the evaluation of effectiveness to the extent that no targets were set in respect of the number of projects to be funded or the status of these projects post-funding. While there were clearly very important challenges in setting targets in both respects, learnings garnered to the time of writing may render this more feasible going forward. As stated above, a process is in place whereby INFOMAR sets relevant ‘themes’ for research that directly relate to the INFOMAR programme. Project proposals are screened and a subset of projects are selected for funding. Appendix D provides case studies of two projects supported by the INFOMAR applied research programme. It also includes an example of the support that INFOMAR provides with respect to industry collaboration.
- 4.12. We conducted a survey of the stakeholders that participated in INFOMAR’s applied research programme. Given participants are funded by INFOMAR, results should be treated with due caution. Of the 46 research projects funded by INFOMAR, 52% (24 research calls) responded to our survey. Given the response rate and hence sample size, at the 95% confidence level, there is a sampling error (confidence interval) of approximately +/- 13.99%. With respect to the overall rating of the INFOMAR applied research programme, 96% of respondents rated it highly (i.e. either a 4 or 5 out of 5). Approximately 83% of respondents utilised the INFOMAR data during their research with approximately 94% giving the data the highest rating of 5. In terms of the presentation of data, 72% of respondent gave the highest rating of 5 with the remaining 28% rating the presentation a 4.
- 4.13. INFOMAR has also been effective in the attraction of specialist project funds from international sources, mainly EU. An overview of current Irish participation in EU-funded projects in which INFOMAR was instrumental in securing funding is shown in Table 10. The current incremental value of EU-funded programmes attracted by INFOMAR is €2.2 million supporting the equivalent of 18 FTEs in a single year. As previously, the extent to which this can be considered a success is not clear given that no targets were set in the original strategy document.

**Table 4.4:** Collaborative International (EU Funded) Research Projects attracted by INFOMAR

Project	Funding	Budget	FTEs
EMODNET	EU Commission/ DG MARE	Total: €4.5 million INFOMAR: €180k	1 FTE for 3 years (3 FTEA)
GeoSea	EU FP7	Total: €5.94 million INFOMAR: €209k	2 FTEs for 2.5 years (5 FTEA)
INIS Hydro	INTERREG (IVA)	Total: €3.8 million MI/ GSI: €1 million	1 FTE for 3 years (3 FTEA)
MESH Atlantic	INTERREG (IVB)	Total: €3.5 million MI/ GSI: €352k	1 FTE for 3 years (3 FTEA)
ATLANTERRA	INTERREF (IVB), Atlantic Area	Total: €2.4 million MI/ GSI: €325k	None
NAG TEC	North Atlantic European Geological Surveys & industry	Total: €4.8 million GSI: €210k	2 FTE for 2 years (4 FTEA)
TOTALS		Total FTEs 7	Total FTEAs 18

4.14. Additional, INFOMAR has been effective in the objective of being a specialist technical resource to a large number of Irish and international public and private sector organisations which supports them in meeting obligations under European and international obligations, among others. An overview of these organisations is presented in Figure 4 with a case study of the role played by INFOMAR provided in Case Study 3.

**Figure 4.1:** Profile of Beneficiaries of INFOMAR Advisory Services



**Figure 4.2:** Supporting Marine Data Visualisation and Digital Entertainment

### **Case Study 2: Supporting Marine Data Visualisation and Digital Entertainment**

INFOMAR funded a 2010 research project proposal by RealSIM Ltd., an NUIG campus company, which involved extending their skills acquired in terrestrial simulation applications to the marine environment. They developed and supplied a demo simulation based around Mutton Island, Galway Bay.

RealSim has a combination of personnel now capable of interpretation of marine data, and presenting them using the latest physics based simulation engine technology, typically used in the digital entertainment industry. The team include a marine geophysicist, a 3d modeller, and two programmers who are collectively able to assemble marine data, 3d CAD and the latest simulation technology to produce highly realistic and accurate simulations of the marine environment and activities within it.

Mainstream, a global leader in renewable technology have asked RealSim to join their ISIS program to be their visualisation experts. They commissioned a demo simulation which can be seen online, with appropriate graphics card capabilities.<sup>43</sup> RealSim now aspire to become world leaders in the field of offshore renewable energy simulation. The ability to stream models online is a recent advance enabling online delivery of interactive simulations through a web player. This offers significant opportunity for marine researchers and educators to engage the public with the marine environment and the resources and activities within it. Additional advances include better tessellation algorithms for simulating complex ocean movement, and more advanced lighting physics for additional realism.

Since the 2010 project award, Gavin Duffy setup a sister company RealSIM Games, and they are working towards delivery of an online marine resource management game, on foot of another successful INFOMAR project proposal.

## **Effectiveness Conclusions**

4.15. Through a combination of desk-based research, stakeholder consultations and surveys of INFOMAR data users, it was concluded that INFOMAR is performing strongly in effectiveness terms. There may, however, be scope to further increase effectiveness through implementation of a number of strategic initiatives, certain of which have resource implications:

- while the INFOMAR team has put in place mechanisms to ensure a systematic engagement with its key stakeholders (e.g. six monthly meetings with a technical advisory panel and an annual conference), there may be merit in expanding the existing effort to enable a closer monitoring of the data needs of a broader set of stakeholders. To this end, the business case for the appointment of a resource on a part- or a full-time basis to a “business development” or “stakeholder engagement” role should be evaluated;
- on a related point, the INFOMAR programme offers significant potential to further develop general public awareness of our rich marine heritage and the potential

<sup>43</sup> <http://www.realsim.ie/ireland3d/windsim3d.html>

---

which is offered by economic growth. While there are outreach measures within the programme at present, including engagement with local schools at the start of mapping activity, there may be case for its expansion as part of a marine-wide initiative – resources allowing;

- enhanced timeliness in the conversion of basic survey data to publicly available data and information products would enhance overall programme effectiveness in the period to end-2016, as current arrangements run the risk of non-processed data at programme-end when budgets have been exhausted or potentially expired;
- finally, systems for tracking the extent to which funded research projects are converting to commercially sustainable businesses or supporting the efficiency of enterprise need to be put in place if the effectiveness of the applied research work stream is to be capable of evaluation into the future.

# 5. Impacts & Continued Relevance

## Introduction

5.1. In this chapter, we first provide an assessment of the ‘Impacts’ of the INFOMAR programme before subsequently assessing the continued relevance of the programme. Impacts are the wider effects of the programme, from a sectoral or national perspective, in the medium to long term. Impacts include the medium to long term effects on the targeted beneficiaries. The impacts of the INFOMAR programme were assessed with respect to the following:

- **Question 20:** What have been the impacts of INFOMAR?
- **Question 21:** What actions have INFOMAR taken to facilitate programme impact?

### Question 20: What have been the impacts of INFOMAR?

5.2. In 2008, PwC sought to place a value of the potential full-economy impacts of the programme by evaluating the potential impact on sectors which the programme had the capacity to support. Details are contained in Table 5.1. It should be noted that this incremental sector value-added which will accrue as a result of full programme implementation by end-2026. They should at most be partially, i.e. 30%, in 2012. The INFOMAR programme has impacted commercial and public sector players in all of these fields, directly through value-added research or indirectly through data availability. Please see Table 2

**Table 5.1:** PwC Forecast of INFOMAR Impact (to 2026)

Forecast INFOMAR Impact (2013)	Low Scenario	Medium Scenario
Commercial		
<i>Fishing Sector</i>	€47.7m	€95.4m
<i>Aquaculture</i>	€28.9m	€57.8m
<i>Biodiversity</i>	€5.6m	€11.1m
<i>Renewable Energy</i>	€20.0m	€40.0m
<i>Energy Exploration</i>	€24.7m	€49.3m
<i>Aggregates Industry</i>	€42.7m	€85.5m
Knowledge Economy		
<i>Research</i>	€5.1m	€10.2m
Legislative		
<i>Non-Compliance Fines</i>	€3.7m	€7.5m

5.3. The CBA 2008 report calculated the present value of these benefits based on the value of the sector given the most recent figures available at the time. For example, the CBA 2008 report utilises figures from the Cawley Report which suggests that in 2005, the contribution of the fishing sector to the Irish economy was €702m. More up to date figures suggest that the domestic market in 2012 is valued at €315m while exports are approximately €517m for a total value of €745m, a 19% increase on 2005.<sup>44</sup> In terms of Aquaculture, the CBA 2008 report, utilising 2003 figures estimated the value of the aquaculture market to be €131

<sup>44</sup> <http://www.bim.ie/about-the-seafood-industry/>

million. The Ocean Wealth report estimates a value of €104m in 2009, a 21% decrease. The CBA 2008 report estimates the value of biodiversity from the proxy measure of the value of the seaweed sector. Utilising 2003 figures, the value was estimated to be €10million. The Ocean Wealth report estimates the value of the sector in 2011 as €18 million, an 80% increase.

- 5.4. In terms of renewable energy, the CBA 2008 report estimates the value of the sector to be approximately €18 million in 2002. This sector has seen a substantial increase in activity to €101 million in 2007, a 461% increase. The energy exploration sector was estimated to have a value of €81 million in the CBA 2008 report utilising 2002 figures. 2007 figures suggest a value of €197m, a 143% increase. Given the economic conditions that existed at the time, the CBA estimated the value of the marine aggregates industry of €1 billion. Given the collapse of the construction sector in Ireland and the resulting significant affect on demand for aggregates, we assume a 65% reduction to €350m. The CBA 2008 report estimated a direct economic benefit of continued research of €2 million per annum. Recent figures indicate that Irish Marine Research Expenditure underpinning the Sea Change Strategy Objectives averages approx €18m pa.
- 5.5. Notwithstanding a significant activity in some sectors, the major change in Ireland's economic fortunes since the CBA 2008 estimates were originally prepared (i.e. 2008) means that the targeted impacts (pro rata to end-2012) in certain sectors were simply unattainable. The INFOMAR programme, for example, was to have facilitated growth in the aggregates industry. This industry has virtually collapsed since the end of the property boom in 2008. Similarly, the fishing sector grew by an estimated €42 million between 2007 and 2011, compared with a (pro rata) targeted INFOMAR impact of close to €30 million. While INFOMAR initiatives have clearly supported the generation of greater value in the sector (e.g. inclusion of INFOMAR data in fishing navigation systems), it is not likely to have accounted for almost 60 per cent of output growth in this period. By contrast, however, very strong growth is underway in the renewable energy and energy exploration sectors, both of which can benefit very significantly from the INFOMAR programme. PwC understand that INFOMAR management is presently planning a project to more clearly understand potential beneficiary needs in these high growth sectors and to incorporate these into its programme of activity, as feasible. This is a very positive development and one which characterises an innovative management approach to the delivery of value.

***Question 21: What actions have INFOMAR taken to facilitate programme impact?***

- 5.6. In this section, we will review the specific programme activities or actions taken by INFOMAR in order to facilitate programme impact with respect to the benefit categories highlighted in Table 5.1 above. Overall, a more coherent approach to the facilitation of programme impacts may be required. It is understood that INFOMAR is initiating a project to understand target beneficiary requirements and explore the resulting business opportunities. This is a positive development and may provide the necessary structure for ongoing facilitation of programme impacts. The following sections provide an overview of the programme activities and actions that have been taken to facilitate programme impact with respect to the benefit categories identified in Table 5.1. Given the collapse of the construction sector, the aggregates industry is not included in our analysis as little impact could be made by INFOMAR.

**Table 5.1: Sample INFOMAR Benefits by Sector**

	Programme Activity / Action Taken
<b>Commercial</b>	
Fishing Sector	<ul style="list-style-type: none"> <li>• Inclusion of INSS/INFOMAR data in OLEX Fishing Navigation systems</li> <li>• Inclusion of INSS/INFOMAR data in SODENA fishing Navigation System (Belco Marine, Cork)</li> <li>• Use of seabed classification as physical habitat maps</li> <li>• Use of data by MI Fishery research / catch calculations group</li> <li>• BIM use of data annually in seed Mussel evaluations</li> </ul>
Aquaculture	<ul style="list-style-type: none"> <li>• Use of data in UISCE Project, BIM Aquaculture modelling including Killary Harbour</li> <li>• Collaborative project, mapping with BIM on Deepwater Aquaculture</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>• Use of data in designating new Offshore SACs over Geogenic reefs, in collaboration with NPWS</li> <li>• Use of data in decision process for Marine Strategy Framework directive and Marine Atlas</li> <li>• Inclusion of data in National Biodiversity centre under INFOMAR applied Research Project</li> </ul>
Renewable Energy	<ul style="list-style-type: none"> <li>• Surveying of suitable locations for national renewable energy test sites</li> <li>• Collaborative mapping of potential sites for WestWave project</li> <li>• Use of data by offshore operators/licence applicants in renewable sector</li> <li>• Input into cable and pipeline crossings in Irish sea</li> <li>• 5 renewable energy research projects funded</li> </ul>
Energy Exploration	<ul style="list-style-type: none"> <li>• Data fed into recent Strategic Environmental Assessments</li> <li>• Use of data in pre-drilling site evaluations for Oil &amp; Gas Companies.</li> <li>• Use of data by large energy company in exploration work.</li> </ul>
Aggregates Industry	<ul style="list-style-type: none"> <li>• Limited, given collapse of the construction industry</li> <li>• Discussion ongoing with Irish developer for export to UK market</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>• Inclusion of data in Coastal Heritage Web Viewers (Heritage Council)</li> <li>• Tourism products developed through the Atlanterra Initiative (InterReg)</li> <li>• Participation of vessels in outreach; the Tall Ships in Waterford &amp; Dublin, Volvo Ocean Race events, Cork port open day etc.</li> </ul>
<b>Knowledge Economy</b>	
Research	<ul style="list-style-type: none"> <li>• INFOMAR Applied Research Programme</li> <li>• Partnering on SME and campus company developments</li> <li>• Use of data in non-INFOMAR funded research internationally</li> <li>• Development of new marine research capacity in Ireland at certain third level colleges e.g. DCU in Marine geochemistry, NUIM in Marine Data Processing</li> <li>• Recruitment of Irish and international scientists on INFOMAR and externally funded marine research projects.</li> <li>• Facilitation of INFOMAR staff participation in INFOMAR related research (1 PhD, 3 MScs earned and 1 PhD and 2 MScs pending)</li> </ul>

5.7. **Fisheries:** INFOMAR data have been used to reduce gear loss and enable improved confidence in water depth for gear deployment. This has been achieved through INFOMAR data being embedded in fisheries navigation products. INFOMAR data has also been utilised in support of BIMs ongoing assessment / evaluation of seed Mussel distribution. Lobster potting fisherman have reported signification reduction in fuel consumption due to their ability to better select sites for gear deployment based on clearly defined seabed rock

outcrop. In addition fishermen currently trialling new navigation products with embedded INFOMAR data have reported strong correlation between digital INFOMAR habitat data and known fishing grounds, which again will improve fishing efficiency. (Note: this work is coordinated by Belco Marine Ltd, Cork.) INFOMAR data has also supported fisheries scientists engaged in annual Data Collection Regulation (DCR) groundfish stock assessment surveys. In terms of habitat mapping projects, a herring spawning ground web mapping interface decision support tool has been delivered to MI Fisheries Scientists in 2010, and publication is near completion on subsequent research correlating known spawning grounds with certain seabed habitats. This information was recently used to support a decision on selection of a dredge spoil dumping site near Dunmore East, to avoid any impact on the adjacent spawning site, and associated fishery. Separately, acoustic seabed mapping has been undertaken of known Nephrops grounds which has facilitated determination of the spatial extent of the habitat, which again is critical for sustainable stock management. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.

- 5.8. **Aquaculture:** Data acquired and products developed by INFOMAR have a variety of impacts on Aquaculture activity and efficiency including BIM site selection for Deep Sea Fish Farming (Galway Bay, Inishbofin & Inishturk and additional work proposed at Gola Island, NW Donegal in 2013). In terms of policy and decision support, INFOMAR data have supported Natura2000 reporting, monitoring, and SAC conservation objective setting with decision support tools developed by INFOMAR now embedded in the DAFM aquaculture licensing process. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.
- 5.9. **Marine Renewable Energy:** INFOMAR provides ongoing support role to SEAI with respect to seabed mapping support, technical expertise, data acquisition, and product development in the development of the ocean energy test sites. In recent years INFOMAR has provided baseline hydrographic, geophysical and geological mapping and advice for SEAI in support of development of test sites. Mapping, advice and GIS spatial analysis has also been provided to SEAI, in support of development plans and the NER300 submission for the first Irish grid connected 5MW wave energy site which was recently awarded €21m NER300 funding. In terms of policy and decision support, INFOMAR has provided data and advisory input to the Strategic Environmental Assessment process and specification for marine survey and geotechnical work programmes. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.
- 5.10. **Oil & Gas:** INFOMAR support to the Oil and Gas sector has largely been through advisory and survey support to DCENR Petroleum Affairs Division (PAD), and provision of access to marine survey infrastructure, survey coordination support, and charting and reporting. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.
- 5.11. **Tourism:** INFOMAR data, acquired offshore of Waterford and to be acquired in the estuary, will be incorporated with onshore data to produce new 3D and interpreted products with respect to the ATLANTERRA project. This project is aimed at linking former mining areas based on highlighting their shared and comparable geological and mining heritage. In addition, RV Keary participated in the Tall Ships event in Waterford, promoting INFOMAR, MI & GSI. INFOMAR hosted stands at both Volvo events in Galway, while the Keary participated in the 2012 Volvo event, and two recent Tall Ships events, promoting programme products. To promote update by tourism beneficiaries, specific topics were

---

scoped and included in the 2011 research call. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.

- 5.12. **Knowledge Economy:** Directly and indirectly, INFOMAR has had a large impact on Irish marine research as well as international marine research activities taking place within Irish marine territory. The free availability of extensive high resolution seabed survey data facilitates targeted research activity. Access to marine survey infrastructure enables multidisciplinary site investigations and improvements in marine research project outputs and quality. The availability of expert operator and scientific advice for training and up-skilling has led to an increase in national expertise in marine geosciences, habitat mapping, and survey related disciplines. INFOMAR have also supported a diverse array of research activity in recent years, with 46 projects directly funded (€1,270,895) since 2008. Value Added Programme contributed also through international research partnerships and the support of 3<sup>rd</sup> party survey and research activity. In terms of policy and decision support, the technical expertise developed through INFOMAR has input to national policy development in areas of marine resource management and development. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.
- 5.13. **Legislative Requirements:** Advisory support, survey and data support has been provided with respect to; IOSEA1-IOSEA4: Steering group for Irish Offshore Strategic Environmental Assessments for Oil & Gas development, PAD; SEAI SEA Steering group for Strategic Environmental Assessment for Marine Renewables development, SEAI, and production of the Ocean Energy Development Plan (OEDP); Marine Strategy Framework Directive Technical Working Group (MSFD TWG); HOOW MSP Enablers Task Force; Habitats Directive geogenic reef designation requirements during 2009; Natura2000, Strategic Environmental Assessments. These activities and actions to facilitate programme impacts are summarised in Table 5.12 below. These activities and actions to facilitate programme impacts are summarised in Table 5.2 above.

## *Continued Relevance*

- 5.14. Continued relevance relates to whether there is justification for the continued allocation of public funds to the INFOMAR programme. Through an extensive review of the INFOMAR programme across each of the major VFM review evaluation criteria, we have found that there is justification for the continued allocation of public funds to the INFOMAR programme at the current level of expenditure of €3m per annum. The extent of work achievable on reduced budget (against profile) may have long term impacts affected accordingly. There are a number of recommendations with respect to improving the efficiency, effectiveness and rationale of the INFOMAR programme. These recommendations are laid out in the following chapter.

# 6. Recommendations

## Introduction

- 6.1. In this chapter, we provide recommendations for improvement for the INFOMAR programme based on the analysis of Rationale, Efficiency, Effectiveness and Impact. Based on this analysis, there are six recommendations that, if implemented, may serve to improve the efficiency, effectiveness and impact of the INFOMAR programme. Table 6.1 provides an overview of the six recommendations for improvement. The following sections provide a more detailed look at each recommendation.

**Table 6.1:** Recommendations for Improvement

Recommendation
1. Restructure programmes in accordance with the public 'logic model'
2. Set quantified performance measures across phases of the programme
3. Clearly identify target beneficiaries and develop engagement plan
4. Refocus on the processing of marine data
5. Publish detailed project plan timelines on INFOMAR website

## Recommendations

### **Recommendation 1: Ensure future INFOMAR strategy supports evaluation**

- 6.2. It is recommended that the INFOMAR strategy for the period 2016 to 2026 is structured such as to support an evaluation, and that quantified annual targets are set across all programmes.

### **Recommendation 2: Set quantified performance measures for major stages**

- 6.3. Related, and in order to enable a formulaic monitoring of programme efficiency and effectiveness to end-2016 (accepting that annual targets are now set with the INFOMAR Board and monitored as part of general governance), it is recommended that quantified performance measures are set across each of the major stages from inputs to outputs. The measures should range from the highly practical, such as a validated activity-based costing model for tracking spend on all of the major programme areas (e.g. data processing), to leveraging the information already available from the DPRs to generate operational reports which are very accessible to third-parties. This report outlines a set of performance measures for the major stages. Appendix F provides a non-exhaustive set of operational performance measures across resources, inputs, outputs and outcomes.

### **Recommendation 3: Appoint business development and stakeholder engagement resource**

- 6.4. Related, while the INFOMAR programme already has formal programmes in place for engagement with key stakeholders, there may be merit in the appointment (on a part or a full-time basis) of a business development or a stakeholder engagement resource. This

---

would require the provision of additional resources to the programme, which could be justified in terms of potential impact on effectiveness, or the diversion of funds available from the applied research effort, i.e. the level of funding allocation to third-party research projects.

***Recommendation 4: Fast-track development of outstanding data and information products***

- 6.5. It is recommended that required resources are made available to address a modest backlog in the processing of marine data to ensure that data and information products are produced within a reasonable degree of time from data acquisition. It will also ensure that full benefit is derived from the current programme before funding is exhausted or expire. Again, this may require additional funding or the diversion of funds from another programme area.

***Recommendation 5: Further development outreach programme***

- 6.6. The INFOMAR programme is a potentially powerful mechanism for educating the general public on the richness of our marine heritage as well as its economic potential. Subject to resource availability, there is a case for developing the current outreach efforts of the INFOMAR programme.

# 7. Appendix

## Appendix A – International Benchmarks

With respect to the international benchmarks, we utilise data from 5 EU coastal states; Spain, France, Netherlands, Sweden and the United Kingdom. Table A1 provides information on the larger sample of institutions involved in marine mapping activities. From this long list, organisations with similar missions and objectives to the INFOMAR programme have been selected. This has resulted in 12 organisations across the 5 coastal states as described in Table A2. A survey conducted by the European Commission<sup>45</sup> provides information of the total turnover of these organisations and the component of spend relevant to this study; the annual spend on collecting, processing, maintaining and distributing marine data.

**Table A1:** Sample of institutions involved in marine mapping activities

MS	Organisation	No. of Vessels	Major Vessels	Days at Sea	Minor Vessels	Days at Sea	Avg. Cost per Day	Annual Spend
Spain	IHM / Armada	4	4	1320	0	0	19,333	25.5
	CEMMA	1	1	30	0	0	1,666	0.05
	Uni. De Oviedo	1	1	24	0	0	0	0
	IRTA	1	1	150	0	0	1,233	0.18
	IEO	7	7	1540	0	0	4,440	5.9
	Other Vessels	3	3	267	0	0	9,300	1.8
	CSIC	2	2	440	0	0	7,500	3.3
	<b>Total</b>	<b>19</b>	<b>19</b>	<b>2,771</b>	<b>0</b>	<b>0</b>	<b>9,739</b>	<b>36.7</b>
France	SHOM	12	5	900	7	1,540	29,000	26.3
	IRD	2	2	504	0	0	8,762	4.4
	IPEV	3	3	n/a	0	0	18,500	8.6
	INSU CNRS	12	4	1227	8	1,695	1,102	3.9
	Avg. Others	2	2	310	0	0	0	0.9
	IFREMER	7	7	1477	0	0	15,333	18.7
	<b>Total</b>	<b>38</b>	<b>23</b>	<b>4,418</b>	<b>15</b>	<b>3,235</b>	<b>8,212</b>	<b>62.9</b>
Netherlands	Rijkswaterstaat	25	10	2220	15	3,300	12,380	68.1
	Hydro. Services	3	3	765	0	0	1,475	11.3
	NIOZ	2	2	440	0	0	6,818	3.0
	<b>Total</b>	<b>28</b>	<b>13</b>	<b>3,425</b>	<b>15</b>	<b>3,300</b>	<b>12,623</b>	<b>82.3</b>
Sweden	Sven Loven	3	3	175	3	0	4,937	0.9
	GSS	1	1	100	0	0	8,000	0.8
	Coast Guard	1	1	220	0	0	15,000	3.3
	Hydro. Office	2	2	290	2	0	1,472	4.3
	SMHI	2	2	78	1	0	14,916	1.2
	Fisheries Board	1	1	200	1	0	7,458	1.5
	<b>Total</b>	<b>10</b>	<b>10</b>	<b>1,063</b>	<b>7</b>	<b>0</b>	<b>11,184</b>	<b>11.9</b>
UK	Marine Scot.	2	2	600	0	0	23,529	6.0
	CEFAS	1	1	250	0	0	10,000	4.5
	NERC	3	3	900	0	0	9,281	8.4

<sup>45</sup> European Commission Marine Affairs and Fisheries (2010). Socio-economic studies in the field of the integrated Maritime Policy for the European Union. Marine Data Infrastructure.

	Coastguard	3	3	570	0	0	10,000	6.0
	UKHO/Navy	2	1	250	0	0	20,000	5.0
	<b>Total</b>	<b>6</b>	<b>6</b>	<b>1,670</b>	<b>0</b>	<b>0</b>	<b>9,281</b>	<b>23.9</b>
<b>Total</b>		<b>101</b>	<b>71</b>	<b>14,347</b>	<b>30</b>	<b>6,535</b>	<b>11,887</b>	<b>217.7</b>

**Table A2:** Short List of institutions with a similar mission to INFOMAR

State	Organisation	Description	Total Turnover	Marine Data Expenditure
Spain	IEO	Instituto Español de Oceanografía (IEO) is the principal Spanish institute responsible for the collection of many different types of marine data	€68m	€21m
France	SHOM	The Service Hydrographique and Océanographique de la Marine (SHOM) is the French Hydrographic Office.	€75m	€24.8m
	IFEMER	French institute for exploitation of the sea IFREMER	€230m	€70m
	GENAVIR	Genavir carries out oceanographic campaigns in the disciplines of geology, physics, biology and living resources.	-	€40m
Netherlands	Hydrographic Services of the Royal Navy	The Netherlands Hydrographic Office	€5.3m	€5.3m
	Rijkswaterstaat	Government agency responsible for all of the large waterways in the Netherlands.	€3,500m	€26m
Sweden	Swedish Maritime Administration	Swedish Hydrographic Office	€192.6m	€13.5m
	Geological Survey, Sweden	Geological Survey of Sweden	€22.8m	€2.16m
UK	Marine Scotland	Responsible for the integrated management of Scotland's seas.	€29.4m	€10.9m
	UKHO	UK Hydrographic Office	€109m	€5.45m
	CEFAS	Centre for Environment, Fisheries and Aquaculture Science	€62.74	€35.12m
	National Environment Research Council	NERC includes the British Geological Survey and the National Oceanography Centre	-	€40m
	British Oceanographic Data Centre	BODC is a national facility for maintaining and distributing marine data.	€1.5m	€1.5m

Table A3 provides an overview of the allocation of resources across the major phases of the marine mapping process; data acquisition (collecting), data processing, maintaining the data and distributing the data relative to international benchmarks. A fifth category 'other' includes aspects of expenditure such as the development of new products.

**Table A3:** Short List of institutions with a similar mission to INFOMAR

MS	Organisation	Collect €m	Process €m	Maintain €m	Distribute €m	'Other' €m
Spain	IEO	-	0.653	-	-	0.469
France	SHOM	20	-	-	-	-
Netherlands	Hydrographic Office	1.59	2.12	1.59	-	-
	Rijkswaterstaat	24	-	-	-	12.9
Sweden	SMA, HO	7.39	1.16	2.15	1.66	1.17
	Geological Survey	1.55	0.43	0.05	0.01	0.12
UK	Marine Scotland	8.8	1.43	0.55	0.22	-
	CEFAS	19.36	7	3.52	3.52	1.76
	BODC	1.53	0.18	0.018	0.036	0.036
Total		84.22	12.97	7.88	5.44	16.46
% of Total (Benchmark)		66.3%	10.2%	6.2%	4.3%	13.0%

Table A4 provides a description of the number of vessels in operation, the number of major vessels, and the number of days at sea, the number of minor vessels, the number of days at sea for minor vessels and the average cost per day across five EU coastal states involving 11 of our benchmark organisations.

**Table A4:** Average Cost per Day for Benchmark Organisations

MS	Organisation	No. of Vessels	Major Vessels	Days at Sea	Minor Vessels	Days at Sea	Avg. Cost per Day
Spain	IEO	7	7	1540	0	0	4,440
France	SHOM	12	5	900	7	1,540	29,000
	IFREMER	7	7	1477	0	0	15,333
Netherlands	Rijkswaterstaat <sup>46</sup>	15	10	2220	7	1,665	16,285
	Hydro. Services	3	3	765	0	0	1,475
Sweden	Hydro. Office	2	2	290	2	0	1,472
	GSS	1	1	100	0	0	8,000
UK	Marine Scot.	2	2	600	0	0	23,529
	CEFAS	1	1	250	0	0	10,000
	NERC	3	3	900	0	0	9,281
	UKHO/Navy	2	1	250	0	0	20,000
Average (Benchmark)		5	3.8	844.7	1.5	304	12,619

<sup>46</sup> The original data source states that Rijkswaterstaat has a fleet of 25 vessels including 15 vessels <10m utilised for its fresh water activities. As it is likely that some of this fleet is also utilised for shallow water marine data acquisition we include approximately half the minor vessels and calculate the associated average cost per day.

Table A5 provides an overview of the income gained from data sales by our benchmark institutions for those that information was available.

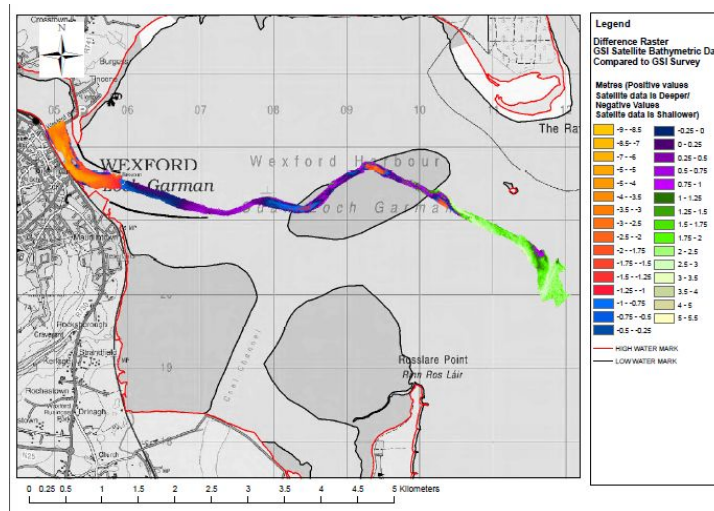
**Table A5: % Income to Turnover Benchmark**

State	Organisation	Total Turnover	Income from Data Sales	% Income to Turnover
Spain	IEO	€68m	€0.001m	0.00%
France	SHOM	€75m	€4.0m	5.33%
	IFEMER	€230m	-	0%
Netherlands	Hydro. Services	€5.3m	€1.0m	18.87%
	Rijkswaterstaat	€3,500m	-	0%
Sweden	Hydro Office	€192.6m	€2.4m	1.25%
UK	UKHO	€109m	€109m	100%
	CEFAS	€62.74	-	0%
	BODC	€1.5m	€0.01m	0.67%
Total		€4,244m	€116.4m	3%

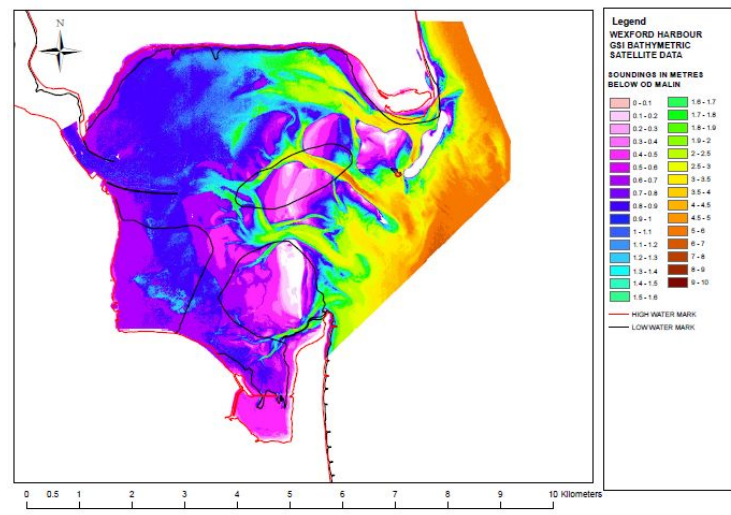
## **Appendix B – Satellite Value Added Projects Initiative**

Proteus FZC approached the GSI in Jan 2012 wanting GSI to allow them to do a trial of their Satellite acquisition technology as a proof of concept at a minimal cost of \$10,000 for a one bay trial. There were four proposed test areas that INFOMAR asked Proteus to acquire satellite data for on the Irish coast. Proteus chose to survey Wexford Harbour. INFOMAR had a boat survey of the main approach channel (see Figure C1) which they did not disclose to Proteus until they had completed and returned their satellite work to us. INFOMAR used their boat data to QA/QC the Proteus data and got a greater than 90 correlation. On the basis of these test results (see Figure C2) INFOMAR went to eTenders with an RFT for 11 Bays to be acquired by satellite. Of 15 expressions of interest only 1 actually tendered and that was Proteus, as they were the only company in that space presently capable of doing the work. INFOMAR have signed a contract with Proteus for the acquisition of 5 Bays by Satellite: Carlingford, Dundalk, Dingle, Shannon and Cork at a cost of €119,900 in total. The GSI will evaluate the efficacy of further use of satellite to acquire mapping in the remaining near shore Irish difficult surveying areas.

**Figure C1: Test of the Proteus 2012 Wexford Data**



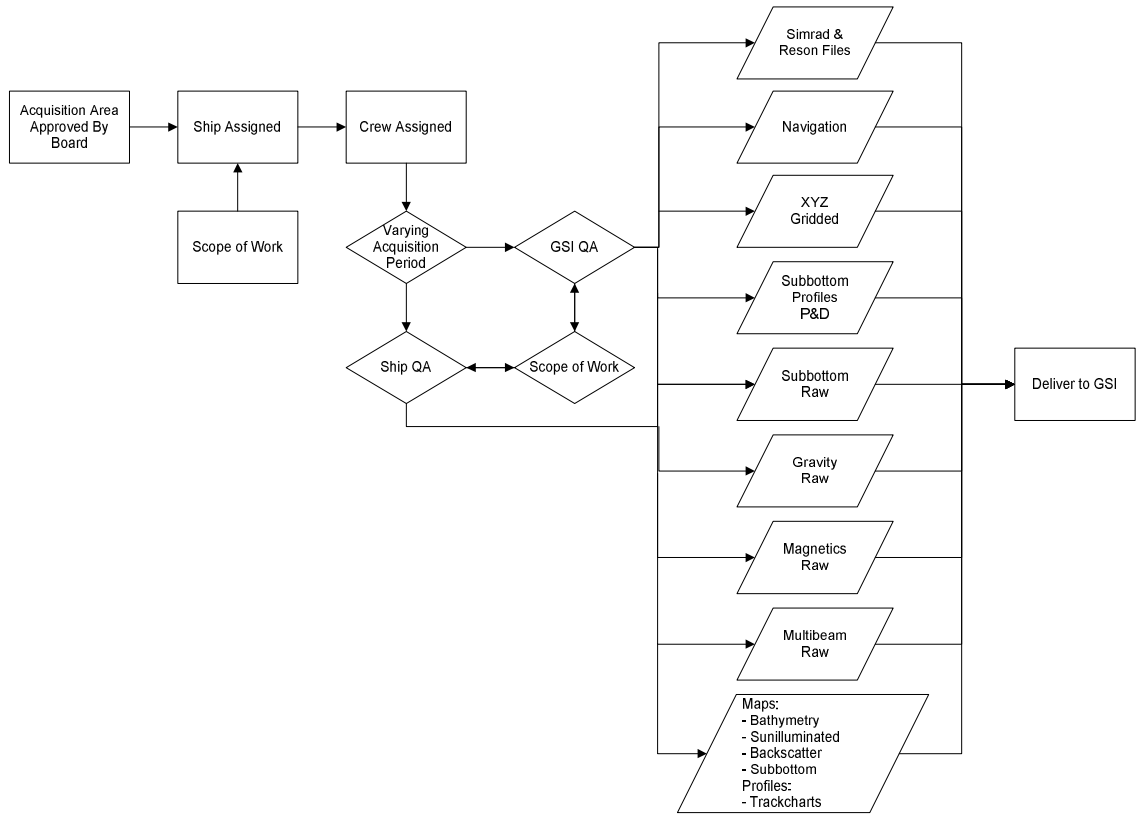
**Figure C2: Test of the Proteus 2012 Wexford Data**



## **Appendix C – INFOMAR Quality Assurance Processes**

Data is acquired in accordance with the following standardised ship-side data flowchart. The flowchart includes two QA stages a Shore QA stage and a Ship QA stage to ensure that data collected meets minimum standards of quality (see Figure D1). In addition, there are more detailed procedure manuals for different types of surveying conducted. Table D1 provides an overview of the standardised operational procedures in place. Standardised procedures are also in place with respect to the appropriate management and backup of data on the GSI, DCENR and MI servers, it's copying to the Marine Institute and IWDDS and transfer to the National Oceanic and Atmospheric Administration (NOAA) and UKHO. Figure D2 describes this standardised procedure.

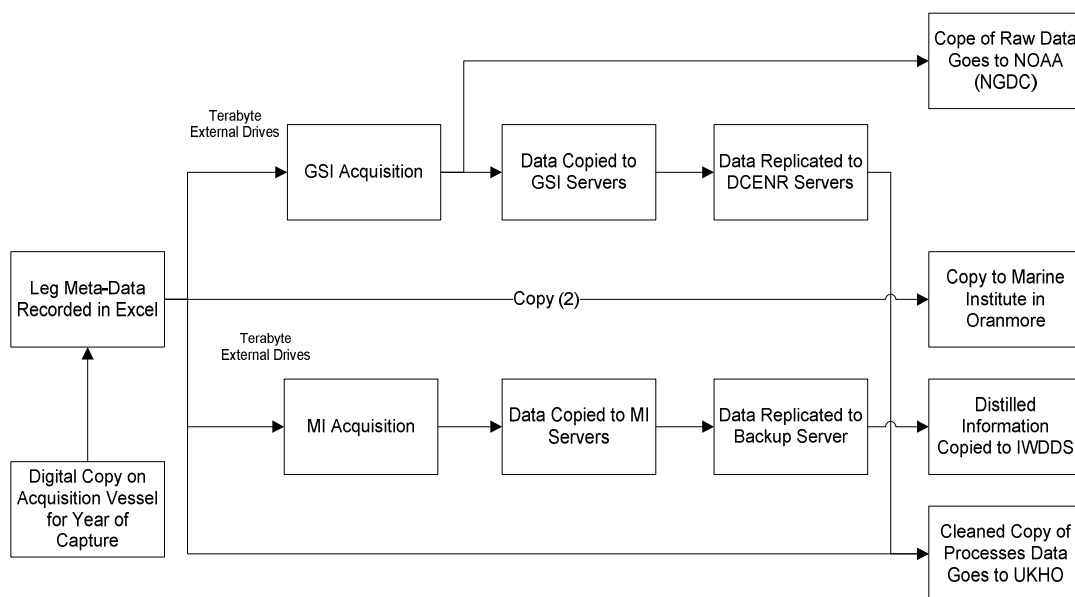
**Figure D1: Standardised Data Acquisition Process**



**Table D1: INFOMAR Operating Procedure Manuals**

Operating Procedure Manual	Description
RV GEO Operational Setup and Procedures	This manual describes the hardware, software, data acquisition, data management and data processing procedures on the R/V Geo vessel configured for very shallow water
RV GEO SEA Swath+ Processing and Procedures – SXI Edition	This manual provides advanced guidance Swath+ processing and procedures. Swath+ is an interferometric, wide-swath sonar system for surveying underwater surfaces providing co-registered, high density bathymetric data and seafloor imagery
RV Keary Science Operational Procedures – Version 1	This manual is describes the operational procedures (acquisition, surveyor protocols, calibration, sound velocity, processing and data management) to be followed on the RV Keary.
RV Celtic Voyager Online Surveyor Handbook – Version Operational	This manual describes the operational procedures (setup, acquisition, calibration, sound velocity, processing and data management) to be followed using Kongsberg Simrad EM3002D/EM1002 and SIS on the RV Celtic Voyager.
RV Celtic Voyager Data Processing Procedures –Version 06/12	This manual provides guidance for data processing and manipulation in CARIS for MBES data acquired on the RV Celtic Voyager. Processing of SVP and Navigation/RINEX data is covered.
Advanced Mapping Services GIS, Data Management and Chart Production Procedures –Version 5	This manual provides standardised processes, procedures and flows for data management and manipulation in GIS and chart creation.

**Figure D2: Standardised Procedure for Data Management**



---

The International Hydrographic Organisation is an intergovernmental consultative and technical organisation with a mission to “create a global environment in which States provide adequate and timely hydrographic data, products and services and ensure their widest possible use”. On this basis, SS-44 IHO Standards for Hydrographic Surveys specifies ‘minimum standards for hydrographic surveys in order that hydrographic data collected according to these standards is sufficiently accurate and that the spatial uncertainty of data is adequately quantified to be safely used by mariners (commercial, military or recreational) as primary users of this information.<sup>47</sup> Four orders of survey are defined for accuracy requirements (see Table D2). INFOMAR carries out surveys to “IHO Special Order hydrographic survey standard” for all designated harbours, harbour approach channels that it surveys. INFOMAR carries out surveys to “Order 1a hydrographic survey standard” for all other areas surveyed outside of harbours, harbour approach channels. INFOMAR hydrographic data must meet IHO minimum standards in order to be accepted by the UKHO to update their Admiralty charts. The UKHO does not independently assess the INFOMAR data upon submission. INFOMAR declare to the UKHO that the submitted meets IHO minimum standards.

**Table D2:** IHO Summary of Minimum Standards for Hydrographic Survey

---

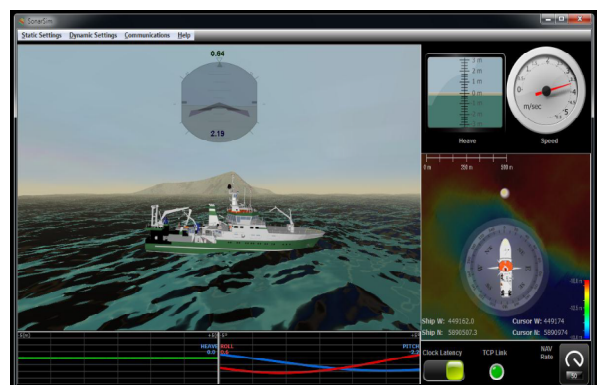
<sup>47</sup> IHO (1998). IHO Standards for Hydrographic Survey. Special Publication No. 44. p. 4

Order	Special	1a	1b	2
Example of Typical Areas	Areas where under-keel clearance is critical	Areas shallower than 100 metres where under-keel clearance is less critical but features of concern to surface shipping may exist.	Areas shallower than 100 metres where under-keel clearance is not considered to be an issue for the type of surface shipping expected to transit the area.	Areas generally deeper than 100 metres where a general description of the sea floor is considered adequate.
Maximum allowable THU 95% Confidence level	2m	5m + 5% of depth	5m + 5% of depth	20m + 5% of depth
Maximum allowable TVU 95% Confidence level	a = 0.25 metre b = 0.0075	a = 0.5 metre b = 0.013	a = 0.5 metre b = 0.013	a = 1.0 metre b = 0.023
Full Sea floor Search	Required	Required	Not required	Not required
Feature Detection	Cubic features > 1 metre	Cubic features > 2 metres, in depths up to 40 metres; 10% of depth beyond 40 metres	Not Applicable	Not Applicable
Recommended maximum Line Spacing	Not defined as full sea floor search is required	Not defined as full sea floor search is required	3 x average depth or 25 metres, whichever is greater. For bathymetric LiDAR a spot spacing of 5 x 5 metres	4 x average depth
Positioning of fixed aids to navigation and topography significant to navigation.	2 metres	2 metres	2 metres	5 metres
Positioning of the Coastline and topography less significant to navigation	10 metres	20 metres	20 metres	20 metres
Mean position of floating aids to navigation	10 metres	10 metres	10 metres	20 metres

## Appendix D – Case Studies

### Case Study 1: Supporting the Improvement of Surveying Efficiency

SonarSim Ltd. was founded in 2011 by two UL graduates (James Riordan & Francis Flannery) who now work in the area of developing simulation technology to improve marine survey performance. Using visualisation, data processing and simulation technologies, they have simulated real time deployment of underwater survey vehicles to assist with survey planning, system calibrations, and



training. Following receipt of two separate INFOMAR value added project awards in 2011, they are currently developing a system to improve survey efficiency in the field, through automated on the fly survey planning (Multibeam AutoPilot), and separately, they are working towards provision of a Cloud based E-learning solution for Hydrographic Operations (ECHO).

The tools under development have significant international marketable potential. Due to the extreme costs associated with real world operation of such marine survey infrastructure, delivery of training, planning and operational tools to improve efficiencies and de-risk operations through simulation is of very high marketable value.

### **Case Study 2: Supporting Marine Data Visualisation and Digital Entertainment**

INFOMAR funded a 2010 research project proposal by RealSIM Ltd., an NUIG campus company, which involved extending their skills acquired in terrestrial simulation applications to the marine environment. They developed and supplied a demo simulation based around Mutton Island, Galway Bay.

RealSim has a combination of personnel now capable of interpretation of marine data, and presenting them using the latest physics based simulation engine technology, typically used in the digital entertainment industry. The team include a marine geophysicist, a 3d modeller, and two programmers who are collectively able to assemble marine data, 3d CAD and the latest simulation technology to produce highly realistic and accurate simulations of the marine environment and activities within it.

Mainstream, a global leader in renewable technology have asked RealSim to join their ISIS program to be their visualisation experts. They commissioned a demo simulation which can be seen online, with appropriate graphics card capabilities.<sup>48</sup> RealSim now aspire to become world leaders in the field of offshore renewable energy simulation. The ability to stream models online is a recent advance enabling online delivery of interactive simulations through a web player. This offers significant opportunity for marine researchers and educators to engage the public with the marine environment and the resources and activities within it. Additional advances include better tessellation algorithms for simulating complex ocean movement, and more advanced lighting physics for additional realism.

Since the 2010 project award, Gavin Duffy setup a sister company RealSIM Games, and they are working towards delivery of an online marine resource management game, on foot of another successful INFOMAR project proposal.

<sup>48</sup> <http://www.realsim.ie/ireland3d/windsim3d.html>

### Case Study 3: Supporting Department of Arts, Heritage and the Gaeltacht

INFOMAR has provided a broad range of supports to the DAHG in meeting its obligations under EU and international legislation. The Department's National Parks and Wildlife Services (NPWC) division, for example, has been a significant beneficiary. Their responsibilities include: a) securing the conservation of ecosystems and maintaining and enhancing populations of flora and fauna in Ireland; b) implementation of the EU Habitats and Birds Directive; c) implementation of national and EU legislation and policies relating to the natural heritage; and d) management of State-owned national parks and nature reserves. INFOMAR has supports the NPWC as follows:

#### C) Habitat Mapping of Geogenic Reef Offshore Ireland:

INFOMAR undertook a study in 2009 with DAHG to provide information on the extent and distribution of Annex 1 geogenic reef under the EC Habitats Directive (92/43/EEC) in the Irish Exclusive Economic Zone.

Subsequently, and in the framework of the EC Habitats Directive, INFOMAR supported a 2013 study of the Methane-derived Authigenic Carbonates (MDACs) in the Irish Sea.

#### D) Natura 2000 Site Assessments (2010 to 2012):

INFOMAR data, where available, underpinned a ground truthing initiative undertaken collaboratively by Marine Institute and DAHG to determine conservation status of key habitats in coastal marine Natural 2000 sites (SACs and SPAs). Where available, INFOMAR data reportedly provided significant cost savings due to the ability to target biological sampling to key seabed types. INFOMAR data are also currently being incorporated as a baseline dataset for ongoing marine habitat mapping.

## Appendix E – Survey Questions

The following questions are applicable across both:

Component	No.	Question	Type of Answer
Background Information	1.	Provide your name	Free Text
	2.	In what organisation do you work?	Free Text
	3.	In what sector do you work?	Education General Public Government Private Industry Research Other

4.	In what sub-sector do you work?	Agriculture Archaeology Communications Defence Emergency Services Energy and Water Environment Finance and Insurance Forestry and Fisheries Geography Geology Health and Community Services Heritage and the Gaeltacht Marine Media and Publishing Minerals Exploration Mining (except Oil & Gas) Mining support services Oil and Gas Production Other Petroleum Exploration Planning/Land Development Public Administration Research Spatial information services Tourism/Recreation Transportation
----	---------------------------------	--

Download Customers:

Component	No.	Question	Type of Answer
Use of Data	5.	Did you use the data for marine or terrestrial purposes?	Marine/ Terrestrial
	6.	What have you used the data for? Please provide details.	Free Text
Presentation of data	7.	On a scale of 1 to 5 with 5 being 'high', how would you rate the presentation / format of the data?	1,2,3,4,5
	8.	In what way can the format of the data presented be improved in your opinion?	Free Text
Quality of data	9.	On a scale of 1 to 5 with 5 being 'high quality', how would you rate the quality of the data downloaded?	1,2,3,4,5
Value of data	10.	Is the data integral to your operations / research? If yes, please provide details.	Yes / No Free Text
	11.	If you are private business, has the use of the data helped your business to grow? If yes, in what way?	Yes / No Free Text
	12.	Are there additional uses for the data that, in your opinion, we could be exploring? Please provide details.	Free Text

Comparison	13.	Have you downloaded the mapping products? If yes, what are you using the mapping products for? If no, please skip to question 19.	Yes / No Free Text
Use of mapping products	14.	Have you downloaded the mapping products? If yes, what are you using the mapping products for? If no, please skip to question 19.	Yes / No Free Text
	15.	Are your needs met with the current mapping products provided?	Yes / No
	16.	Are there additional mapping products that you would like to see produced? If yes, what types?	Yes / No Free Text
Quality of mapping products	17.	On a scale of 1 to 5 with 5 being 'high', how would you rate the quality of the mapping products provided?	1,2,3,4,5
Value of mapping products	18.	Are the mapping products integral to your operations / research? If yes, in what way?	Yes / No Free Text
Comparison	19.	Have you downloaded mapping products from other marine mapping programmes? If yes, please provide details of the mapping products you found the most useful.	Yes / No Free Text
Website	20.	Please provide a rating of how you found the data download website in terms of ease of navigation with 5 being very easy to navigate.	1,2,3,4,5

Research Calls Survey:

Component	No.	Question	Type of Answer
Research	5.	What was the focus of your research effort?	Free Text
	6.	Describe the use of the data in your research effort?	Free Text
Value of research	7.	Describe the potential wider benefits of your research effort in terms of economic, social and environment benefits	Free Text
	8.	If you are a private business, has the use of the data helped your business to grow? If yes, in what way?	Yes /No Free Text
	9.	What is the future outlook for your business based on the products produced through the research?	Free Text
Use of data	10.	Did you use INFOMAR's data in your research effort? If yes, please provide details. If no, please skip to question 14.	Yes/ No Free Text
Quality of data	11.	On a scale of 1 to 5 with 5 being 'high quality', how would you rate the quality of the data downloaded?	1,2,3,4,5
Presentation of data	12.	On a scale of 1 to 5 with 5 being 'high', how would you rate the quality of the data downloaded?	1,2,3,4,5
	13.	In what way can the presentation / format of the data be improved?	Free Text
Additional use of data	14.	Are there additional uses for the data that, in your opinion, we	Free Text

		could be exploring? Please provide details.	
Comparison	15.	Have you used similar data from other marine mapping programmes? If yes, please provide details of the data format you found most useful.	Yes/ No Free Text
Research Programme	16.	Please provide a rating of how you found the research programmes in terms of ease of engagement.	1,2,3,4,5
	17.	Any further comments that you would like to provide?	Free Text

## Appendix F: INFOMAR KPIs

OBJECTIVE	RESOURCES	INPUTS	OUTPUTS	OUTCOMES
<b>Develop Data &amp; Information Products</b>	Total Annual Spend (T&M) Annual Capital Spend (M) Annual Operating Spend (M)  Mapping Approach by Bay & Area (M)  Resource Weighting of Bay & Areas (M)	Staffing Levels (M) Profile of Capital Assets (M) Total Vessel Days (M)  INFOMAR Vessel Days By vessel(M) Chartered Vessel Days (M)  Average Cost of Chartered Vessel Day Total Contractor Days Average Contractor Days per Vessel Day Average Rate for Contractor Days LiDAR/Satellite Days Average Rate for LiDAR/Satellite Days	Total Sq. Km. Area Mapped (T&M) Bays & Areas Mapped by Year (T&M) Products Produced (i.e. Publicly Available) by Year (T&M) Average Timeline to Product Publication (T&M) No. of UKHO chart corrections yr. No. of “Special Product” Requests Met (M) Vessel Days Lost at Sea by Factor	Levels of Public Data Access (M) Profile of Public Data Users (M) Survey Feedback from Users (M)  Feedback from Key Stakeholder Groups (M)
<b>Value-Added Programme</b> INFOMAR Value-Added   Applied Research Programme	Total Annual Spend (T&M) Net Annual Spend (T&M)   Annual Spend (T&M)	No of Vessel Days (M) No. of Contractor Days (M) Profile of Target Beneficiaries (M) Staffing Levels)  No. of Projects Funded (M) No. of FTE Researchers Funded (M) No. of SMEs in Receipt of Funding (M) No. of Universities Funded (M) Staffing Levels on Exploitation of Applied Projects	Total Sq. KM Area Mapped (M) Locations Mapped by Year (M) No. of VAE Support Requests Handled by Year Profile of Actual Beneficiaries (M) No. of Projects Completed (M) Post-Funding Status of Projects (M) No. scientific publications from data Additional funding / no. projects leveraged by Year by INFOMAR data users, related to Programme links / infrastructure and/or data access	Significant Project Developments Feedback from Beneficiaries (M)

