Marine National Facility and RV *Investigator*

Australia has the world's third-largest marine jurisdiction, and the marine environment plays an integral role in the nation's climate, culture and economy.

The Marine National Facility (MNF) is a national facility funded by the Australian Government and operated by CSIRO to provide Australia with a dedicated blue-water research capability. A foundation element of Australia's research infrastructure, the MNF provides advanced marine research capabilities and world-leading expertise to the nation. It supports four major areas of research – oceanographic, geoscience, biological and atmospheric – to help solve our greatest challenges in protecting and managing the prosperity of Australia's valuable marine environment.

The MNF operates the multidisciplinary ocean research platform, Research Vessel (RV) *Investigator*, which was commissioned in 2014. Government, university and industry sectors, as well the public, rely significantly on this capability to obtain data and research insights for improving technology, practices, and policies for stewardship of Australia's marine resources.

Impact assessment

Approach

The assessment was conducted by RTI International, an independent, non-profit research institute, and summarises benefits being delivered by the MNF along three dimensions – research, training and economic – for the prosperity of the nation. It also furnishes critical insights to ensure CSIRO optimises the value delivered through RV *Investigator* and inform the MNF long-term strategic plan, *MNF2030*.

The assessment, conducted for the period between 2015 (year of inception) to 2020 (year of assessment), relies on an analysis of scientific papers, interviews with stakeholders, and surveys of researchers supported by the MNF and RV *Investigator*. The economic assessment was conducted as a cost-benefit analysis (CBA), completed in accordance with CSIRO's Impact Evaluation Guide (CSIRO, 2020).

The impact

Research impact

RV *Investigator* has delivered significant insights about our oceans, weather and climate, marine geology, and marine ecosystems, some of which may have remained unstudied without this capability. The uptake of new knowledge has matured the nation's situational awareness and furnished evidence-based data for improved resource and ecosystem management, as well as industry and climate policy and planning.

Training impact

MNF provides capability development opportunities to students through three formal mechanisms: involvement in research projects, CAPSTAN (Collaborative Australian Post-Graduate Sea Training Alliance Network) and ITSS (Indigenous Time at Sea Scholarship) programs. The training programs are building the next generation of marine industry leaders that come from different education levels and disciplines.

Economic impact

Public and private sectors leverage high-quality bathymetric, biological, atmospheric and geophysical data delivered by RV *Investigator* to deepen and widen their understanding about marine ecosystems, climate and weather changes in the Southern Ocean, fisheries, and to help address other key challenges for the nation. The underway data plays a critical role in evidence-based decision making, devising resource and risk management strategies, and offshore activities. The economic analysis (CBA) is performed for the time frame covered from FY2010/11 through FY2029/30.

RV *Investigator* is a valuable and productive element of research infrastructure for Australia's people and economy.

Image: Thomas Moore

Research impact

Key contributions include:

KNOWLEDGE AND SCIENTIFIC PUBLICATIONS	DATA COLLECTION CAPABILITIES	RESOURCE MANAGEMENT AND PRACTICE, PUBLIC POLICY SOLUTIONS AND TEACHING	ALTERNATIVES
• 150 peer-reviewed papers • 1280 citations • >50% published in top-tier journals • Inter-disciplinary work from domestic and global collaborations	Atmospheric sampling, geophysical survey and mapping, biological sampling, and seawater analysis capabilities.	New knowledge and evidence-based data to support and improve: • Federal, state, international public policy, regulations, and guidance • National marine park management plans • Development of SOPs to report and record shipwrecks • New teaching and research methods to support curricula	In the absence of RV *Investigator*'s robust scientific profile and MNF's staff expertise: • 92% of surveyed researchers think they could not have conducted their work • Others noted it would have meant accessing similar capabilities offered by other nations, leading to potential cost, safety and suitability barriers

Training impact

Key impacts include:

SKILL AND KNOWLEDGE ACQUISITION	CAREER OUTCOMES
>86% of surveyed students reported that it would be impossible to gain the same quality of research exposure elsewhere in Australia. The group reported significant attribution towards the development of the following top 5 skills: • Technical • Collaboration • Applied research knowledge • Acquired or further developed professional networks • Fundamental science knowledge	• The impact of training on the careers of students has been favourable • >71% students stated that MNF experience and training helped them achieve their professional goals and made their research more relevant, valuable, and publishable

Economic impact

Key benefits included in CBA:

SEABED MAPPING	ECOSYSTEM HEALTH	WEATHER FORECASTING	MARITIME HERITAGE
Monetised Value of improved ecosystem services: • Protection of fishery resources • Value to improved sector growth in aquaculture • Value to offshore development • Value of improved Great Southern Reef health • Avoided oil spill: value to fisheries • Avoided oil spill: value of tourism **Non-monetised** Expansion of the broader base of scientific knowledge: • National security and maritime sovereignty	**Monetised** • Marine protection **Non-monetised** • Value consumers derive from personal enjoyment of nature	**Monetised** • Benefits to households of improved weather forecasting • Improved weather forecasting for agricultural production **Non-monetised** National defence	**Monetised** • Discovery and protection value of SS *Macumba* and SS *Iron Crown* • Virtual tourism **Non-monetised** • Cultural value

Benefits

The total value (in 2020 dollars, discounted using 7% real social discount rate) stemming from underway data collection and on-going data collection on RV *Investigator* has been reported as $2.2 billion to $4.8 billion from FY2016/17 to FY2029/30, with $3 billion under the median scenario.

Costs

The real costs (in 2020 dollars, discounted using 7% real social discount rate) from FY2010/11 through FY2029/30 (actual: FY2010/11 to FY2019/20; projections: FY2020/21 through FY2029/30) are reported as $0.66 billion.

Economic performance indicators

Net Present Value (NPV, in billion $): 1.5–4.1
Benefit to Cost Ratio (BCR): 3.3–7.3
Internal Rate of Return (IRR, in %): 34–49

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