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Evaluation of NRC Ocean, Coastal and River Engineering (OCRE) Portfolio

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FINAL REPORT

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Executive Summary

This report presents the results of the evaluation of the Ocean, Coastal and River Engineering portfolio (OCRE) that was undertaken in 2015-16. OCRE works with its clients and partners to deliver innovative technologies that will improve Canada's competitiveness and assure safe and responsible development of Canada's marine-based resources. The evaluation assessed the value-for-money of OCRE, including relevance, performance and resource utilization. It covered the period 2012-13 to 2014-15.

The overall assessment of OCRE's performance by evaluation issue is presented in Table 1, below, followed by a longer summary of the main findings and conclusions.

Table 1: Assessment of OCRE's performance

Issue	Assessment	Associated recommendations
Relevance		
Continued need for OCRE		None
Alignment with federal government and NRC priorities		None
Alignment with other government departments		None
Appropriateness of the federal role		None
Performance		
Client engagement strategy, awareness and reach		1
Client satisfaction and outcomes		None
Resource utilization		
Adequacy of human resource critical mass and competencies		2
Adequacy of research infrastructure		None
Project management effectiveness		3
Process and tools to support project management		4, 5
Efficiency and effectiveness of operations		None

Note: Assessments are based on rubrics developed as part of the evaluation and other evaluative evidence.

Legend: Meets expectations Needs improvement Management attention

Relevance

Continued need for OCRE – The industry sectors targeted by OCRE are of strategic importance to Canada. These sectors include defence, marine energy and hydropower, shipbuilding and ship design, ports infrastructure and marine transportation, defence and offshore oil and gas. Within these sectors, there are ongoing needs that OCRE is well positioned to meet. By providing expertise, facilities and an independent third party assessment, OCRE meets the needs of its stakeholders. Within Canada, there are instances of some overlap in competencies at OCRE and in other Canadian organizations (i.e., private sector and universities). There are potentially missed opportunities for OCRE to leverage the strengths of these organizations and present a common Canadian front to capture a greater market share.

While these other national organizations do not have the facilities that OCRE has, other international organizations do. In this regard, their needs could be met in the absence of OCRE; however, it would be at a competitive loss to Canada and Canadian strategies in the offshore, north and arctic.

Alignment with federal government and National Research Council (NRC) priorities - OCRE's strategic plan is aligned with NRCs strategic outcome of "Canadian businesses prosper from innovative technologies". Likewise, OCRE's strategic objectives and activities are aligned with federal government priorities related to Canada's North, shipbuilding, environmental responsibility and economic prosperity.

Alignment with other government departments - OCRE's facilities and competencies do not overlap with those of other government departments (OGDs), and rather are complimentary. OCRE has a track record of collaboration with all federal departments with mandates related to OCRE's areas of activity. However, opportunities for further collaboration were identified.

Appropriateness of the federal role **-** There is no federal marine/offshore strategy at this time – which makes an economic strategy for NRC more difficult. However, the federal government has a role to play in the marine industry. Various factors made the federal role appropriate, including the pre-commercial nature of some technologies as well as the importance of the industry to the federal government and Canadians. NRC also has a role of supporting federal regulators. Work done at OCRE includes e.g. supporting Transport Canada. In addition, the need for a neutral third party service provider, and the private sector's inability and unwillingness to take on the role due to the expensive, cyclical nature of the work was found to require federal intervention.

Performance

Client engagement strategy, awareness and reach - Client engagement is a high priority in OCRE's strategy and is consistent with its mandate and operational model. However, in the execution of OCRE's client engagement activities, internal staff noted that there was potential for confusion about the respective roles and responsibilities of the OCRE portfolio and Business Management Support (BMS) staff.

OCRE established its reputation as a testing facility. However according to a few external interviewees OCRE was moderately successful at increasing awareness of its research expertise and technological development capabilities in a number of areas (i.e. arctic research). Still external interviewees also pointed to some improvements in outreach.

Over the evaluation time period, there was a decrease in revenues, number of projects and clients. While the decline in revenues was largely due to a decreased number of projects with OGDs, also influencing OCRE's revenues were market conditions (e.g., decline of the oil and gas sector). Despite efforts to increase OCRE's national presence beyond Ontario, and Newfoundland and Labrador, it remains an area for improvement. Regionally, since the NRC transformation, OCRE has had to overcome the expectations of the local sector for free services. Raising the cost for services has led to fewer local initiatives.

Recommendation 1: OCRE should increase its efforts to promote its expertise and facilities to stakeholders across Canada while strengthening existing collaborations in the marine sector.

Client satisfaction and outcomes - The large majority of OCRE clients were very satisfied with the services they received, indicating that they would work with OCRE in the future as well as recommend OCRE to others. Clients also reported many positive outcomes as a result of their work with OCRE, in which they said OCRE played a vital or significant role.

Resource Utilization

Adequacy of human resource critical mass and competencies – OCRE had various processes in place to ensure adequate human resource critical mass and competencies. While OCRE generally had the competencies needed to meet the needs of its hosted programs, it did not have sufficient human resource critical mass to deliver on both internal and external projects. The OCRE Strategic Plan update (2016-2021) clearly states OCRE's intent to address this situation and management is taking a more strategic approach in 2015-16.

Recommendation 2: OCRE should continue to prioritize the recruitment of staff to deliver on current and future projects.

Adequacy of scientific and engineering infrastructure - OCRE has the necessary infrastructure to deliver on its projects. In order to ensure that the portfolio had appropriate infrastructure to meet client needs, OCRE took a holistic, long-term view of its recapitalization efforts. This included using a coordinated approach to identify the infrastructure needs of the portfolio-hosted programs. Investment review/planning into new major research facilities is underway to meet the future needs of Canada's offshore sector.

Project management effectiveness - The evaluation identified opportunities to improve the effectiveness of project management at OCRE. OCRE's approach of using researchers as project managers was consistent with common practises in other similar international organizations and NRC portfolios. Project managers can also be the researcher and it does not have to be two separate people. However, OCRE did not have a defined approach to assign researchers to project management roles. In the majority of cases, researchers were not assigned to manage projects based on their project management competencies relative to project materiality and / or risk.

Recommendation 3: OCRE should define an approach for the portfolio to assign project management roles and responsibilities as well as continue to promote a project management culture and execution.

Process and tools to support project management - In order to facilitate effective project management practises within the portfolio, OCRE provided its staff with project management training and support (through a project management support office), and implemented project management processes and tools. Despite this, the evaluation identified opportunities for OCRE to improve its project management processes and tools related to change management, risk management, project monitoring and project close-out. OCRE had also established an approach to facilitate ongoing improvements to its project management processes and tools (i.e., via the portfolio Project Management Community of Practice). However, the evaluation found that improvements to OCRE's project management processes and tools had not yet materialized during the evaluation period. However, in 2015-16, OCRE management started to address these issues to some degree by looking at projects needs and adopting separate

technical and project management roles when appropriate. This project management approach is highlighted in the OCRE strategic plan.

Recommendation 4: OCRE should continue to review and adjust its processes and tools related to change management, risk management, project monitoring and project close-out (i.e., lessons learned sessions).

Recommendation 5: OCRE should ensure that the portfolio Project Management Community of Practice continues to meet on a regular basis and act on its mandate, as well as interface effectively with other Portfolio PMO's.

Efficiency and effectiveness of operations – Portfolio operations were not as efficient as originally targeted by the portfolio; OCRE did not achieve its targets for overhead efficiency, staff utilization or facility utilization over the evaluation time period (noting that the NRC cyber intrusion caused significant restrictions to OCRE's operations). Operational efficiency also decreased over the evaluation time period. While an extensive review of the NRC Common services was not conducted as part of this evaluation, the evaluation did reveal that there were opportunities for KM and DFS, in particular, to ensure more efficient and cost-effective operations. Despite these operational challenges, OCRE appears to be making progress toward achieving its objectives considering the portfolio's modest financial resources.

Acronyms and Abbreviations

AST	Automotive and Surface Transportation
ASPM	Administrative Services and Property Management
AERO	Aerospace portfolio
BMS	Business Management Support
CHC	Canadian Hydraulics Centre
CRL	Client Relationship Leader
CRM	Client Relationship Management
CB	Communications Branch
CONST	Construction portfolio
DRDC	Defence Research and Development Canada
DFO	Fisheries and Oceans Canada
INAC	Department of Indigenous and Northern Affairs Canada
DND	Department of National Defense
DFS	Design and Fabrication Services
EME	Energy, Mining and Environment portfolio
EC	Environment Canada
FB	Finance Branch
GM	General Manager
HRB	Human Resources Branch
IRAP	Industrial Research Assistance Program
ITAs	Industrial technology Advisors
ITS	Information Technology Services
IOT	Institute for Ocean Technology
IP	Intellectual property
KPI	Key performance indicator
KM	Knowledge Management
MV	Marine Vehicles
MIEWR	Marine Infrastructure, Energy and Water Resources
NSPS	National Shipbuilding Procurement Strategy
NRC	National Research Council
NRCan	Natural Resources Canada
OCRE	Ocean, Coastal and River Engineering portfolio
OAE	Office of Audit and Evaluation
OGDs	Other federal government departments
PRS	Planning and Reporting Services
PBA	Portfolio Business Advisor
PSO	Project Support Office
PWGSC	Public Works and Government Consulting Services
R&D	Research and development
S&T	Science and technology
SEC	Senior Executive Committee
SMEs	Small-and-medium-sized enterprises
TC	Transport Canada
VP	Vice-President

1 . Introduction

This report presents the results of the evaluation of the Ocean, Coastal and River Engineering portfolio (OCRE) that was undertaken in 2015-16. OCRE supports a broad cross section of industry sectors by developing creative and practical solutions to engineering challenges in rivers, lakes and marine environments. The portfolio provides expertise and tools to identify, adapt, and integrate advanced solutions into systems that improve the performance and safety of ocean, coastal and marine operations, meet the challenges of climate change, and protect infrastructure, property and people from severe weather events and other environmental risks.

OCRE was selected for evaluation based on consultations with NRC Senior Management. The portfolio had not been subject to an evaluation since it was launched in 2012. This evaluation assessed the value-for-money of OCRE, including relevance, performance and resource utilization, and covered the period 2012-13 to 2014-15. The evaluation was conducted at the portfolio level; OCRE-hosted programs were outside the scope of the evaluation. NRC common services have a strong relationship with portfolios and while the evaluation did not conduct an extensive assessment of the NRC common services per se, the evaluation did bring to light opportunities for increased efficiency in this area.

The evaluation was led by an independent evaluation team from the NRC Office of Audit and Evaluation (OAE) and assessed the core issues of the 2009 Treasury Board Policy on Evaluation (see Appendix B: Evaluation Matrix). The evaluation questions were developed following consultations with portfolio management and the NRC Vice-President (VP), Engineering as well as a review of key documents and portfolio data.

The evaluation methodology used multiple lines of evidence and complementary research methods as a means to enhance the reliability and validity of the information and data collected. The specific methods used in the study included:

- Internal and external document review
- Administrative and performance data review
- Semi-structured interviews with internal and external stakeholders (n = 40)
- Consultations with international organizations (n = 2)
- Client survey (n= 39)

A more detailed description of the study methodology, and its limitations and challenges is provided in Appendix C: Methodology.

A short profile of the OCRE portfolio is provided in Section 2 as context for this report. Sections 3 through 5 present findings organized by broad evaluation questions (relevance, performance and resource utilization), along with associated recommendations. Section 6 presents a brief conclusion drawn from the evaluation, while Section 7 lays out management's response to the evaluation's recommendations and the actions that will result.

2 . Profile

The OCRE portfolio was created in November 2012 through a merger of NRC's Canadian Hydraulics Centre (CHC) and NRC's Institute for Ocean Technology (IOT).

2.1 Mission and activities

The mission of OCRE is to work with its clients and partners to deliver innovative technologies that will improve Canada's competitiveness and assure safe and responsible development of Canada's marine-based resources. The two main objectives of this mission are to encourage growth in Canadian marine industries and to support federal government departments and agencies in the fulfillment of their marine-based mandates. The value of OCRE's mission will be realized through reduced risks and costs associated with marine operations, technology development, and natural resource development in marine and Arctic environments.

To fulfill its mission and main objectives, OCRE offers specialized consulting and applied research services to clients in marine industries (including marine transportation, offshore oil and gas, shipbuilding, and hydropower production) and federal departments and agencies (including those responsible for Canadian marine infrastructure, water resources management, marine safety, and other relevant marine policies and regulations). OCRE's main services include physical and numerical modelling (supported by unique numerical and visualization tools), engineering analysis, technology development and evaluation, as well as full scale experiments and field work that are conducted with the support of a broad suite of specialized facilities. For a more detailed list of the inputs, activities, outputs, and outcomes of OCRE, please see the portfolio's logic model in Appendix A.

2.2 OCRE clients

Over the evaluation period, OCRE worked with 80 distinct client organizations. These clients came from Canadian government, non-profit, and industrial sectors as well as from foreign organizations (e.g., consulting firms, and research and development (R&D) organizations).

2.3 OCRE programs

At NRC, portfolios are the business units responsible for managing people and facilities. These resources are then deployed to projects which supports the outcomes of the program(s) that have been approved by NRC's Senior Executive Committee (SEC). OCRE currently hosts three NRC programs:

- **Arctic:** This program develops technologies that contribute to the sustainable development of the Arctic. These technologies are designed to ensure low impact resource development, increase the efficiency of shipping operations in ice-covered waters, improve the safety of marine operations in the Arctic, and increase the quality of community infrastructure for Northerners.

- **Marine Infrastructure, Energy and Water Resources (MIEWR):** The MIEWR program offers specialized research and technology development services for the areas of water resource management, marine infrastructure engineering, and marine renewable energy.

- **Marine Vehicles (MV):** The MV program offers technologies and services that improve the operability of marine vehicles (particularly in northern environments). The program

focuses on fuel cost reduction for the Canadian marine transportation operations sector and vessel design and operation issues for the Canadian shipbuilding sector (particularly with operations in the Arctic and offshore oil and gas).

During the period under review, OCRE staff marginally supported projects/programs hosted outside of the Portfolio.

2.4 Organizational structure

The OCRE General Manager (GM) reports to the VP, NRC Engineering, and has overall managerial accountability for the portfolio. The portfolio is organized into two R&D directorates, one located in St. John's and one in Ottawa, as well as an operations department responsible for project management and administrative support. Each department comprises a number of teams that are deployed in a matrix manner to the portfolio's three programs and the projects within those programs.

2.5 Portfolio resources

2.5.1 Human Resources

OCRE had approximately 90 staff between 2012-13 and 2014-15, including scientific staff (51%), technical staff (39%), administrative staff (5%)[1] and management (5%). The majority of OCRE staff was located in St. John's (66%). OCRE has tried, without success, to hire a full time Manager for the Ottawa location. As a result, the Director R&D based in St. John's has provided the coverage in Ottawa also. The Portfolio needs to move forward as soon as possible to fully staff its management functions.

To fulfill the objectives of its hosted programs, OCRE also accessed labour from other portfolios. In total, other NRC portfolios contributed 10.3K hours (worth $628K) to these programs in 2014-15, which represented about 11% of the total labour committed to these programs. The two main contributors were the Energy, Mining and Environment portfolio (EME) and the Construction portfolio (CONST). The Arctic program in particular received a large proportion (24%) of its labour from these two and other portfolios. To support other portfolio's programs, OCRE spent 491 hours (worth $24.7K) in 2014-15.

2.5.2 Financial Resources

Total expenditures averaged $20.4M annually between 2012-13 and 2014-15. Approximately 47% of these expenditures were offset by earned revenues (~$9.6M per year), which were derived mainly from technical services (i.e. 79%).

[1] In addition, OCRE received administrative support from NRC common services staff.

Table 2: OCRE Statement of operations (2012-12 to 2014-15)

	2012-13	2013-14	2014-15
Income	**$11.3M**	**$11.0M**	**$11.7M**
NRC investment*		$2.0M	$3.1M
Income - Revenue	$11.3M	$9.0M	$8.6M
Technical services	*$9.3M*	*$7.0M*	*$6.5M*
Strategic research	*$2.0M*	*$2.0M*	*$2.1M*
Other revenue			*$0.03M*
Expenditure	**-$20.6M**	**-$18.9M**	**-$21.6M**
Indirect expenditures	-$14.2M	-$10.8M	-$11.5M
Direct expenditures	-$6.4M	-$8.1M	-$10.1M
Gains/(Losses) and other adjustments		**-$0.03M**	**-$0.01M**
Net gain or loss*	**-$9.3M**	**-$8.0M**	**-$9.9M**
Capital investment*	**-$1.0M**	**-$2.5M**	**-$2.3M**

Source: NRC Finance Branch (Statement of Operations)
Note*: NRC investment, net loss, and capital investment are fully funded by NRC.

2.5.3 Infrastructure

OCRE has extensive physical infrastructure in both its Ottawa and St. John's locations. These facilities represent an initial capital investment in excess of $120M.[1] The main physical assets of OCRE are cold test laboratories, wave basins (coastal, multidirectional, and large area), a towing tank, ice tanks, an offshore engineering basin, design and fabrication facilities, two wave flumes, and a high discharge flume. For the delivery of its programs, OCRE also relies on the physical resources located elsewhere at NRC (e.g. CONST and EME facilities for the Arctic program).

3. Relevance

The relevance of OCRE was examined by assessing whether the portfolio continued to address a demonstrable need; the extent to which it was aligned with NRC, the federal government and other government departments; and the appropriateness of the federal role.

Issues	Assessment	Associated recommendations
Continued need for OCRE		None
Alignment with federal government and NRC priorities		None
Alignment with other government departments		None
Appropriateness of the federal role		None

Legend: Meets expectations Needs improvement Management attention

3.1 Continued need

In order to assess whether the OCRE portfolio continues to address a demonstrable need in support of industry sectors related to defence, ocean, coastal and river environments, the evaluation looked at the needs of industry, OCRE's ability to address and meet the needs of stakeholders and OCRE's uniqueness and complementarity with other organizations. The evaluation also assessed the extent to which industry needs could be met in the absence of OCRE.

3.1.1 Ongoing demand in OCRE's targeted industry sectors

Finding 1: *The industry sectors that OCRE targets are of strategic importance to Canada. There are ongoing needs within these sectors that OCRE is well positioned to meet.*

The major industry sectors targeted by OCRE include marine energy and hydropower, defence, shipbuilding and ship design, ports infrastructure and marine transportation and offshore oil and gas.

According to recent estimates used by the portfolio (supplied by NRC KM), direct and indirect employment in these sectors within Canada represents one million jobs and a gross domestic product (GDP) near $100 billion annually or 6% of the nation's economy.[2] The industries that OCRE targets are of strategic importance to the nation's economy, environment and national sovereignty. Similarly, as external interviewees noted in some instances, these sectors are important to regional economy's (e.g., offshore oil and gas sector in Newfoundland and Labrador). As is discussed below, there are ongoing needs within each of these sectors that OCRE is well positioned to support.

Offshore oil and gas

Of the industries that OCRE works with, offshore oil and gas is the largest contributor to Canada's economy. Offshore oil and gas production, currently limited to Newfoundland and Labrador and Nova Scotia,[3] represented $6.6 billion in expenditures and employed 12,576 workers in 2014.[4] To date, offshore oil and gas activities in Canada's arctic have been exploratory; however, there remains much unexploited potential.[5] Climate change has further contributed to opportunities for arctic offshore oil and gas development.[6] Additionally, there are opportunities for offshore technology as the industry faces significant challenges and risks with deep water oil and gas extraction. Both arctic and deep water resource extraction results in difficult to access oil and gas fields, and requires equipment to be resistant to high pressure and cold temperatures.[7] OCRE's expertise in offshore technology, marine systems and infrastructure, and arctic and harsh environment modeling are well positioned to support the needs of the offshore oil and gas sector.

Despite these opportunities, it is important to note that the current downturn of the oil and gas sector[8] represents some challenges, but also opportunities, to OCRE going forward. As external interviewees highlighted, in the downturn of the sector, many oil and gas companies are reducing their spending on R&D. For example, when looking at the top 100 research intensive Canadian companies, research intensity (R&D as a per cent of revenue) is particularly low in the oil and gas sector and R&D (ten energy/oil & gas firms fell by -12.1% from 2013 to 2014).[9] In addition to the overall reduction in R&D investment, companies have shifted their focus to short term objectives (e.g., cost cutting and performance improvement).[10] However, addressing cost effective, and sustainable technologies for the resource sector during the current downturn will undoubtedly position the sector well into the future. In addition, OCRE also supports offshore

company operations that are funded through operations budgets and not R&D budgets (i.e. safety and environmental related projects).

Shipbuilding and design

The Canadian shipbuilding industry is not a large sector in Canada with a GDP of 0.59 (0.04% of all industries). In 2014, this industry employed 6,480 workers.[11] In an effort to revive Canada's shipbuilding industry, the Government of Canada announced the National Shipbuilding Procurement Strategy (NSPS) in 2010 whereby Canadian shipyards will build, repair, maintain and retrofit ships for the Royal Canadian Navy and the Canadian Coast Guard.[12] It is unclear how the NSPS will drive the commercial sector into the future. Despite not being a large sector in Canada, the presence of such an industry provides opportunities for Canadian small-and-medium sized enterprises (SMEs) to access the supply chains of large multinational companies and develop expertise in niche areas within the shipbuilding value chain (e.g. fuel efficiency, ballast water management, harsh environment testing, simulation, etc.).[13] The NSPS is expected to create opportunities for Canadian SMEs in these areas. According to internal interviewees, OCRE is well positioned to support the NSPS through its expertise in engineering design and performance evaluation of marine ships and marine systems, as well as for defining efficient ship operations and mitigating risks imposed on shipping due to the harsh environmental and climatic conditions existing in Arctic waters.

Ports / harbours and marine transportation

Canada has a small domestic shipping and port industry. According to Industry Canada statistics for 2011, water transportation represented only 2% of the Canadian freight transportation, warehousing and logistics industry sector.[14] Despite this, national and international shipping regulations provides a number of research and development (R&D) opportunities. For example, International Maritime Organization regulations on air pollution, greenhouse gas emissions and ballast water that have recently or are soon to come into force stimulate R&D on vessel performance monitoring systems, exhaust scrubbers, ballast water management systems and energy efficiency design for ships.[15] Additionally, there are potential R&D opportunities as ports attempt to become more "green" due to increasingly stringent emissions regulations[16] and become more automated in an effort to improve operational costs.[17] Finally, climate change adaptation for ports, transportation and coastal infrastructures also represent opportunities for technology and solutions.[18,19,20] The needs of the industry sector are well suited to the competencies and facilities available at OCRE.

Hydropower and marine energy

The hydropower and marine energy sectors are small within Canada. Despite this, they are important and have undeveloped energy potential. For example, in Canada hydropower is an important source of energy. In 2013, Canada generated 60.1 % of its domestic electricity generation from hydropower, ranking fourth worldwide.[21] There is also capacity for growth in Canada as the total undeveloped Canadian hydropower potential is 160,000 MW, more than double the current installed capacity.[22]

In terms of marine energy, Canada's wave, tidal and river current resources hold about 36 gigawatts (GW) of potential extractable power.[23] While Canada's marine renewable energy sector is small and not as developed as other hydropower sectors, it appears to be a leader in R&D and capacity potential.[24] By 2030, Marine Renewables Canada's roadmap is targeting Canadian involvement in 50% of world projects and $2 billion in annual economic value

assuming that Canada can establish and maintain a leadership role.[225] As such, there is evidence that the marine renewable energy is an emerging sector both nationally and internationally, and in this regard, there are R&D opportunities to develop engineering solutions to support the commercialisation of marine renewable energy technologies, including the assessment of wave, tidal and hydrokinetic resources and the reduction of project costs.[26,27,28] However, government support and monetary incentives for marine energy projects and R&D is crucial to attract private investment given the high costs associated with these projects. From 2004 to 2010, the federal government provided approximately $54 million to marine energy projects, roughly 72% of total public funding.[29]

3.1.2 Stakeholder needs addressed by OCRE

Finding 2: *OCRE meets the needs of its stakeholders by providing a trusted and independent source of expertise along with world class research, engineering and testing facilities.*

Overall, stakeholders felt that OCRE was able to meet their needs. Of those clients and stakeholders surveyed, nearly all respondents were satisfied or very satisfied with OCRE's ability to understand and meet their needs (n=35). This satisfaction level is comparable to that of previous satisfaction survey results in 2014-2015 with OCRE (n=6) clients and all NRC clients (n=116).[3]

When clients were asked if the services rendered by OCRE met their expectations nearly 100% (n=38) were very satisfied (97% very satisfied and 3% satisfied). Again, this high satisfaction level is comparable to that of previous satisfaction survey results in 2014-2015 with OCRE clients (100% were very satisfied, n=6) and all NRC clients (88% very satisfied and 7% satisfied, n=113).

Interviews with internal and external stakeholders revealed differences in the objectives of the private and public sector organizations, however, similarities in their needs. Where private sector stakeholders tend to focus on minimizing costs (capital and operational), other government departments (OGDs) tend to focus on the efficacy of regulations and on the adequacy of technologies to allow private sector (marine industry) to meet those regulations. In order to address these objectives, the private and public sector both have needs for expertise, facilities and a neutral, third party service provider. These needs, and the way in which OCRE meets them, are discussed below.

> *"OCRE has the scientific excellence in technology development in the area of ocean, coastal and river environments …. OCRE has both the facilities and the expertise … you can't just have the facilities, you need the expertise too."*
>
> *External interviewee*

- **Expertise:** Internal and external interviewees noted that OCRE provides scientific and technical expertise to its stakeholders, particularly through its involvement in technology design testing and in codes and standards. OCRE's ability to draw on competencies from other NRC Portfolios was highlighted by internal stakeholders as enabling the portfolio to address a greater range of sector needs. The importance of expertise to stakeholders is reflected in findings from the client survey - the majority of clients and

[2] Marine Renewables Canada aligns industry, academia and government to ensure that Canada is a leader in providing ocean energy solutions to a world market.

[3] When asked how satisfied they were with NRC's level of understanding of their needs and objectives, 97% were satisfied or very satisfied. Within this survey, 100% of OCRE clients were very satisfied (n=6). Please note that that this NRC client survey were not asked about the level of satisfaction on NRC's ability to meet client's needs.

stakeholders (85%) cited that NRC researchers recognized scientific knowledge was the main factor in their decision to move forward with OCRE services. The vast majority of clients surveyed (92%), (n=38) were very satisfied with OCRE's knowledgeable scientific staff.[4]

- **Facilities:** Internal interviewees highlighted that OCRE provides industry and OGDs with large facilities that they do not have or cannot acquire themselves (e.g., due to large capital and / or operational costs). Evidence that OCRE met the facility needs of its stakeholders is found from the survey findings where 94% of respondents (n=31) reported they were very satisfied with access to appropriate facilities, laboratories and equipment.[5]

- **Independent, neutral third party service provider**: Internal and external interviewees highlighted the importance of having an independent and neutral third party for testing. For example, OCRE's involvement in a flood mapping project with Pubic Safety and Natural Resources Canada (NRCan) was said to be important because the guidelines produced will be used by insurance companies, each of which has different interests.

3.1.3 Stakeholder needs not addressed by OCRE

Finding 3: *There is a need for oil in ice testing facilities and deep water basins, which are not met by other Canadian organizations or OCRE.*

Internal and external interviewees highlighted two areas in which OCRE could potentially play a role, should it be deemed relevant to the strategic objectives of the portfolio. Examples include:

- **Oil in ice test facility –** While there is an oil in ice testing facility in Ottawa, some external interviewees were not aware of it. External interviewees noted that oil and gas companies expressed interest in an oil and ice testing facility as this is an area that represents an emerging need as resource extraction moves to arctic waters (e.g., clean up of oil spills in arctic waters).
- **Deep water basin[6] –** Internal and external interviewees highlighted that deep water research is an emerging need, particularly given that more and more work is being done offshore. NRC recently initiated a pre-engineering design study for a Harsh Environment Basin to address this gap.

Finding 4: *While SMEs are not deliberately excluded from working with OCRE, the cost of doing business with them is often out of their reach.*

Internal and external interviewees as well as OCRE client data indicate that OCRE does not regularly provide services to SMEs. This is somewhat driven by the pricing model adopted / policy initiatives or NRC Corporate. OCRE management was of the opinion that this may improve as programs make better use of NRC investment and OCRE moves toward smarter pricing strategies and product development/commercialisation.

An external interviewee was of the opinion that OCRE should involve Canadian SMEs in their work as there is often an innovation that can be commercialized. This may facilitate Canadian

[4] This satisfaction level is comparable to 2014-2015 BMS client satisfaction survey results (n=114): 95% of NRC clients were very satisfied; within this dataset, 100% (n=6) of OCRE clients were very satisfied.
[5] Comparable data for this category is not available from previous BMS client satisfaction surveys.
[6] OCRE is in the early stages of assessing the need of a deep water harsh environment facility.

SME integration in the supply chain of multinational enterprises (MNEs) and position them for exports. Also, SMEs often need help with proposals, business plans and market analysis, which is outside of OCRE's mandate.

As confirmed by internal interviewees, OCRE generally does not meet the needs of SMEs in part because SMEs do not have the financial capacity for OCRE services. An additional factor influencing OCRE's limited work with SMEs is the characteristics of the two sectors that the Portfolio primarily targets (i.e., shipbuilding, and oil and gas). Within these sectors, global MNEs, and Canadian and international consulting firms (acting as intermediaries for MNEs), play a large role. As a result, these are the types of organizations with which OCRE mainly works.

Notwithstanding the particular needs of SMEs, OCRE does work with the NRC Industrial Research Assistance Program (IRAP) to encourage SMEs to contact OCRE. According to internal interviewees, the challenge with IRAP is that they don't have a dedicated Industrial Technology Advisor (ITA) in the marine sector.

In addition to IRAP, there are several other federal and provincial programs that aim to support SMEs, and could help them develop projects with OCRE. Examples include:

- **Atlantic Canada Opportunities Agency (ACOA)** – has funding programs to help businesses become more innovative, productive and competitive.[30] However, ACOA funding cannot be currently used by companies to support their engineering/research at NRC.

- **Research and Development Corporation of Newfoundland and Labrador** - provides R&D funding programs for business that focus on the R&D needs of companies located in Newfoundland and Labrador to foster innovation and commercialization.[31]

- **Federal Economic Development Agency for Southern Ontario** – provides support to SMEs with innovation through commercialization programs (e.g., Applied Research and Commercialization Initiative).[32]

3.1.4 OCRE's uniqueness and complementarity with other organizations

Finding 5: *Nationally, OCRE's facilities are unique; however, there are instances of some overlap in competencies with other Canadian organizations (i.e., private sector and universities).*

The evaluation assessed the extent to which the Portfolio's facilities and competencies were unique, both nationally and internationally.

Facilities

All internal and external interviewees confirmed that OCRE's facilities (i.e., ice tank, wave basin and offshore basin to simulate harsh environments) were unique nationally but not internationally. However, OCRE offers the fullest spectrum of facilities[7] relative to five comparable international organizations (i.e., Hamburg Ship Model Basin, Force Technology, SSPA, Marin and Marintek).

[7] Large, coastal wave and off-shore engineering basins, towing tank, ice tanks, large wave flume and cavitation tunnel

OCRE management confirmed that OCRE markets itself as a one-stop shop, with clients typically drawing on two of OCRE's major facilities in their projects. While other international organizations have similar facilities as OCRE, it is worth highlighting that OCRE is one of very few that has an ice testing facility (i.e., compared to the five aforementioned organizations, Hamburg Ship Model Basin is the only other one with ice testing facilities).

Within Canada, internal and external interviewees highlighted the location of some of OCRE's facilities in St. John's as unique given the close proximity to offshore oil and gas resources in a northern / harsh environment.

Competencies

While OCRE's competencies were viewed as generally unique in Canada, internal and external interviewees identified a few organizations in Canada, and in particular, St. John's, that have some similar competencies and services as OCRE. The following organizations in St. John's were noted as having some overlapping competencies as OCRE: C-Core, Marine Institute, Memorial University of Newfoundland and Oceanic Consulting Corporation. These organizations, however, differ in that they do not have the facilities that OCRE has and, in fact have made use of OCRE facilities through technical service projects and some research service projects. These organizations also have some unique competencies, making them ideal collaborators for OCRE. However, internal and external interviewees commented that OCRE does not collaborate with these organizations to the fullest extent possible and in some cases, competes with them for private sector clients. Internal interviewees acknowledged that there have been missed opportunities for OCRE to develop project proposals with the other organizations in St. John's that would make them stronger as a group, enable them to capture a larger share of the market, and generate greater benefits for the region and for Canada. OCRE management noted that every organization is competing for the same R&D dollar. In an attempt to resolve some of the collaborative gaps, NRC and Memorial University signed a Memorandum of Understanding in 2015.

On the international scene, clients surveyed and external interviewees highlighted several organizations working in similar research areas with similar competencies and services as OCRE.[8] Despite other national and international organizations with some similar competencies as OCRE, external interviewees indicated that OCRE was viewed as a valued supplier of R&D services and as having scientific excellence in technology development, both nationally and internationally. External interviewees noted in particular that OCRE was a leader internationally in ice and arctic related research. A strong indication of OCRE's strong expertise in ice and arctic related research is the fact that two international organizations that do not have ice-testing facilities (Marin and Marintek) sought to partner with OCRE as opposed to other international organizations such as Hamburg Ship Model Basin.

[8] i.e., Aker Artic (Finland), Marin (The Netherlands), Deltares (The Netherlands), HR Wallingford (United Kingdom), Texas A&M (United States of America), Oregon State University (United States of America), U.S. National Ice Center (United States of America), Atresia/Sogreah (France), DHI (Worldwide), the Hamburg Ship Model Basin (Germany) and Council for Scientific and Industrial Research (South Africa)

3.1.5 Ability to meet needs in the absence of OCRE

Finding 6: *Stakeholder needs could be met by other international research organizations, however, it would be at a competitive loss to Canada.*

External interviewees highlighted that in the absence of OCRE, stakeholder needs could be met by other international research organizations (e.g., as was discussed in the previous section). However, external interviewees lamented that working with international organizations would be at a competitive loss to Canada because of the technology transfer to other countries.

> "*Without this expertise being available locally, modelling for offshore structures would have been done in Europe (Norway/ Finland) and it is doubtful that the Ocean Technology cluster would have had as rapid growth."*
>
> *External interviewee*

External interviewees also highlighted the role and importance of OCRE in the growth of the Newfoundland and Labrador ocean technology sector, and the resulting innovation and economic impacts. OCRE's presence in St. John's is an integral component of the local sector with other major stakeholders (e.g., C-Core, Marine Institute and Memorial University of Newfoundland) that makes it an appealing location for oil and gas companies.

3.2 Alignment with federal roles and responsibilities

The evaluation assessed the extent to which the strategic objectives and activities of OCRE were aligned with federal government priorities, NRC's mandate, and mandates of OGDs. It also looked at the appropriateness of the federal role.

3.2.1 Alignment with NRC and federal government priorities

Finding 7: *OCRE's objectives and activities are aligned with NRC's strategy as well as federal government priorities related to Canada's north, shipbuilding, environmental responsibility and economic prosperity.*

OCRE aligns with the Government of Canada's priorities in a number of ways. The first is via its alignment to NRC's strategic outcome of "Canadian businesses prosper from innovative technologies", which is in turn aligned with the Government of Canada's outcome area of "strong economic growth."[33] In addition, OCRE aligns well with current federal strategies as well as with federal priorities in the areas of Canada's north, shipbuilding, environmental responsibility and economic prosperity. Each is discussed below:

- **Federal S&T Strategy***:* OCRE aligns well with the 2014 Federal Science and Technology (S&T) Strategy, *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation 2014*, because it:
  1) Partners with Canadian industry to take research impacts from the lab to the marketplace, which is covered by the strategy's core principle of "Fostering Partnerships".
  2) Conducts research and supports federal policy objectives, which is covered under "Focusing on Priorities" (e.g. *National Shipbuilding Procurement Strategy* and *Canada's Northern Strategy;* see below).
  3) Provides facilities and capabilities for conducting world-class research, which is covered under "Promoting World-Leading Excellence."[34]

4) Aligns with the 'natural resources and energy' and 'environment and agriculture' priorities of the strategy.

- **Canada's North***:* Federal priorities related to Canada's North are outlined in *Canada's Northern Strategy.* OCRE aligns well with three of the four pillars in the Northern Strategy, including: 'exercising our Arctic sovereignty'; 'protecting our environmental heritage' and 'promoting social and economic development'. More specifically, OCRE's work in the area of arctic supports *Canada's Northern Strategy* by undertaking activities related to the development of technologies that contribute to the sustainable development of the Arctic. These technologies are designed to ensure low impact resource development, increase the efficiency of shipping operations in ice-covered waters, improve the safety of marine operations in the Arctic and increase the quality of community infrastructure for Northerners. Despite the presence of a northern strategy, internal and external stakeholders highlighted that there is limited coordination at the national level and alignment across government departments working in the area of the arctic. They noted that, should a coordinated approach to the arctic emerge, OCRE is well positioned to respond.

- **Shipbuilding:** Evidence of OCRE's alignment with another government priority, shipbuilding, is found in OCRE's work related to the *National Shipbuilding Procurement Strategy* (NSPS). In regards to the NSPS, OCRE is helping with the research and development required to build Canada's newest polar icebreaker and other Arctic marine vessels, which have a total estimated acquisition cost of $37.7 billion.[35,36] Despite OCRE's involvement with the arctic offshore ships, internal interviewees highlighted that OCRE was not involved in many projects supported by the NSPS, particularly for the surface combatants. While both internal and external interviewees highlighted that there are opportunities for OCRE under the NSPS, one external interviewee noted that one of the challenges for OCRE to get contracts under the NSPS is that they still have to compete to be the service provider for the prime contractor. Future involvement will also depend on whether OGDs (e.g., Department of National Defense and the Canadian Coast Guard) continue to seek expertise from OCRE.

- **Environmental responsibility:** Evidence of the federal government's priority of environmental responsibility is found in the federal S&T strategy (i.e., 'natural resources and energy' and 'environment and agriculture' priorities of the strategy) as well as in speeches from the throne and budgets over the evaluation time period that address issues related to climate change, and the development and deployment of clean energy technologies.[37] OCRE's work related to water resource and marine renewable energy as well as its work related to reducing fuel consumption and greenhouse gas emissions is aligned with the government's priority in environmental responsibility. Further evidence of OCRE's alignment is found in the fact that it received funding from NRCan's Energy Research and Development program, a federal, interdepartmental program that funds R&D designed to ensure a sustainable energy future for Canada in the best interests of Canada's economy and environment.

- **Economic prosperity:** Recent Speeches from the Throne, Budgets and the S&T strategy emphasized the importance of innovation, science, technology and research in positioning Canada for future prosperity. By supporting R&D projects, OCRE aligns with the federal priority of innovation as a means to sustain Canada's prosperity.[38]

3.2.2 Alignment with mandates of other government departments

Finding 8: *While OCRE collaborated with all the main federal government departments that are related to OCRE's areas of activity, there are opportunities for further collaboration. OCRE's facilities are unique and its competencies do not overlap with those of other government departments.*

Findings from interviews and an analysis of OCRE's financial data suggest that OCRE had relationships with other government departments with interests in the arctic and marine environment. These departments included the Department of National Defense (DND), Natural Resources Canada (NRCan), Public Safety, Joint International Commission, Transport Canada (TC), Canadian Coast Guard, Public Works and Government Consulting Services (PWGSC), Fisheries and Oceans Canada (DFO), Environment Canada (EC) and the Department of Indigenous and Northern Affairs Canada (INAC). Internal interviewees highlighted that there were opportunities for OCRE to work more with these departments.

Findings from the documents reviewed, and internal and external interviews indicate that overall there was no overlap between OCRE's mandate and that of OGDs. Rather, OCRE supported the work of OGDs and enabled them to fulfill their mandates. Interviewees from OGDs were of the general sentiment that OCRE was 'the place to go'. While some potential areas of overlap were identified (discussed below), these are limited to competencies as OCRE's facilities are unique in Canada. Internal and external stakeholders highlighted efforts to ensure that potential duplication of competencies between OCRE and select OGDs is minimized and synergies are recognized.

- **Polar Knowledge Canada** – One of the purposes of Polar Knowledge Canada is to establish a hub for scientific research in the Canadian Arctic.[39] While this is very similar to OCRE's focus on R&D in the arctic, internal and external representatives noted that Polar Knowledge Canada will collaborate with OCRE in an effort to leverage each of the two organizations' relative strengths as opposed to duplicating efforts.

- **Defence Research and Development Canada (DRDC)** – DRDC, an agency of the Department of National Defense (DND), provides integrated science and technology (S&T) advice and technical solutions to DND.[40] DRDC's focus on navy related research (e.g., sensors and control systems for above water and underwater vessels; safe operation of naval platforms) appears to overlap to some degree with some of the competencies housed within OCRE. One internal interviewee noted that DND makes decisions to use DRDC versus OCRE for a number of reasons including capability, security and capacity.

- **Natural Resources Canada (NRCan)** – NRCan has programs that conduct scientific work related to Canada's North (e.g., Climate Change Geoscience Program; Polar Continental Shelf Program).[41] Despite the potential for overlap, internal and external interviewees noted differences in expertise at NRCan and OCRE. For example, NRCan's work in the Arctic focuses on ocean floors (geological surveying), which is complimentary to OCRE's work in the arctic on ice loads of ships, and requires very different expertise. Likewise, they also noted that efforts are made to avoid duplication of efforts and rather build on complementarities.

3.2.3 Appropriateness of federal government role

Finding 9: *The federal government role was deemed to be appropriate.*

NRC's specific role in supporting the marine industry is appropriate because it is consistent with the National Research Council Act. Section (5) (1) (c) of this Act states that NRC may "undertake, assist or promote scientific and industrial research." Under this section of the act, NRC is specifically mandated to undertake, assist and promote research within the areas of natural resource utilization, the improvement of technical process and methods used by Canadian industries, and the discovery of processes and methods that may promote the expansion of existing or new industries. OCRE's activities, as described in Section 2, are aligned well with these portions of the Act.

Consultations with international organizations also revealed that comparable organizations in other countries with similar programming as OCRE had some degree of public financial support. It should be noted that international organizations examined received more support from the industry than OCRE (i.e., 26% of industry revenues at OCRE versus 80% at Marin and 80% at Marintek). While OCRE had the greatest degree of public financial support (i.e. NRC) and revenues from governmental organizations (i.e., 74% at OCRE versus 20% at Marin and 20% at Marintek),[9] consultations with representatives from comparable international organizations revealed the importance of public money in supporting their operations. A representative from Marin, for example, highlighted the importance of federal funding for maintaining its facilities. An interviewee from Marintek also noted that Marintek, despite currently being an arm's length organization, was originally created by the government. Taken together, these findings suggest the appropriateness of the federal role in such investments (e.g., facilities, expertise).

The appropriateness of the federal role was reinforced by stakeholders interviewed. Of those internal and external interviewees that were asked about the appropriateness of the Canadian federal government in conducting R&D in the area of ocean, coastal and river environments, all considered it to be appropriate. Reasons highlighted by internal and external interviewees as to the appropriateness of the federal role included:

- **Nature of the technology (i.e., pre-commercial technology) -** In some cases, such as marine energy, there is a role for the federal government as the technology is pre-commercial and therefore riskier given that the viability of the technology is not known.

- **Issues of importance to the federal government –** The government's responsibility in areas of health, safety and environment were highlighted as evidence in support of the federal role. As an example, the federal government was said to have a role in R&D related to the development of safety evacuation systems (e.g., life boat launching and vessel design). External interviewees also noted that private companies do not want to invest in research infrastructure to support the public interest. Likewise, the appropriateness of the federal role was said to stem from issues of importance to the federal government in which there has been limited resources invested by private sector (e.g., arctic).

- **Need for a neutral third party** - The importance of having a neutral third party perform R&D and / or testing was provided as justification for the federal government's involvement. As one external interviewee highlighted, the NRC stamp of approval is preferred to that of a consultant because of the associated objectivity from an

[9] Source: Data obtained from the consultations with representatives of international organizations.

organization that has no bias or vested interest in the performance of a product and / or test.

- **Private sector unable or unwilling to take on the role due to the expensive, cyclical nature of the research** - In the absence of OCRE, the private sector would not take on the role of OCRE (if anything, it would be universities or other research organizations). The cost and risks of maintaining large scientific infrastructure is beyond what the private sector is willing to and can take on. For example, as a result of the cyclical nature of the research and demand for large scale facilities, government is often needed to support the infrastructure during down times.

4. Performance

OCRE's performance was assessed by examining the portfolio's client engagement strategy; the effectiveness of the portfolio's outreach activities (i.e., awareness); clients reached; and client satisfaction and outcomes.

Issues	Assessment	Associated recommendation
Client engagement strategy, awareness and reach		1
Client satisfaction and outcomes		None

Legend: Meets expectations  Needs improvement  Management attention 

4.1 Client engagement strategy and reach

In order to assess the extent to which the portfolio reached clients and stakeholders, the evaluation examined outreach mechanisms used by OCRE. It also assessed the number of national and international clients reached by the portfolio and the types of engagements it had with them (e.g., technical services and research services).

4.1.1 Mechanisms to reach and engage clients

Finding 10: *Client engagement is a high priority in OCRE's strategy and is consistent with its mandate and operational model.*

'Client and market focus' is one of the two guiding principles of the portfolio's five year strategic plan for fiscal years 2015-2020. Client engagement is recognized as a key component that will have a significant impact on OCRE's success. Client engagement strategies are presented in OCRE's strategic plan, including key client accounts, prospects and collaborators for major sectors. Target audiences and key messages are articulated in the operational plan together with resource requirements to implement the communication activities. Responsibilities are divided between OCRE, BMS and NRC Communications Branch (CB). OCRE's client engagement strategy for 2014-15 targeted 26 organizations in four customer segments: major industrials, small-and-medium-sized enterprises (SMEs), government and non-governmental organizations, and associations.

Finding 11: *There was confusion over the roles and responsibilities of portfolio and Business Management Support staff for OCRE's client engagement.*

To implement the client engagement strategy, the program leads work with key research staff with the assistance of NRC's Business Management Support (BMS). The roles and responsibilities of BMS and portfolio staff vary across engagement activities. In some cases BMS staff (i.e., Portfolio Business Advisor and Client Relationship Leader), participate in the development of the client engagement strategy as well as in actual client outreach. In other cases, these activities are largely limited to portfolio staff such as researchers, group leads, program leads and directors of research.

Internal interviewees noted varying experiences with regards to the involvement and expectations of BMS staff in client engagement activities. Overall, while internal interviewees described client engagement activities as a team effort, some highlighted concerns about the clarity of the expected roles and responsibilities of BMS staff and portfolio staff. For example, confusion over the roles of the Portfolio Business Advisor (PBA) versus the Client Relationship Leaders (CRLs) was noted as well as confusion over the roles of BMS staff (i.e., PBA and CRL) versus those of program leads or research staff in securing client engagements.

Finding 12: *OCRE had some success at increasing awareness of its expertise and capabilities as well as engaging with clients.*

Internal interviewees highlighted that OCRE participated in trade shows, conferences, workshops and trade initiatives, and held one-on-one meetings with potential clients to identify industry needs and to facilitate industry awareness of OCRE. Other OCRE activities include sharing success stories and branded literature. According to program documents and internal interviewees, OCRE's representation at main events and meetings facilitated links between government and industry. However, internal interviewees acknowledged that OCRE's success in raising awareness and engaging clients was slower than expected. Along similar lines, external interviewees highlighted that OCRE had not distinguished itself as a leader in technology development in core areas (i.e. Arctic) and needs to increase the extent to which it promotes its capabilities to stakeholders and potential clients.

> *"… clients may not know exactly what OCRE is doing and how it can fit with their company. They may know about the equipment/ facilities but are not aware of the specific services that are available. OCRE still has more work to do to tell clients what OCRE's competencies are."*
>
> *External interviewee*

However according to a few external interviewees OCRE has some success at increasing awareness of its research expertise and technological development capabilities in a number of areas. (i.e. arctic research). External interviewees also pointed to some improvements in outreach over the evaluation period.

Two factors were highlighted by internal and external stakeholders as contributing to the lack of awareness of OCRE, and its research and technical competencies:

1) **Transformation of NRC in 2012** (i.e., the OCRE portfolio was created through the merging of an Institute and a Technology Center)
2) **External confusion over the business relationship with Oceanic Consulting Corporation** when NRC operated the Institute of Ocean Technology

Internal and external interviewees also highlighted several strategies to increase industry's awareness of OCRE. These included:

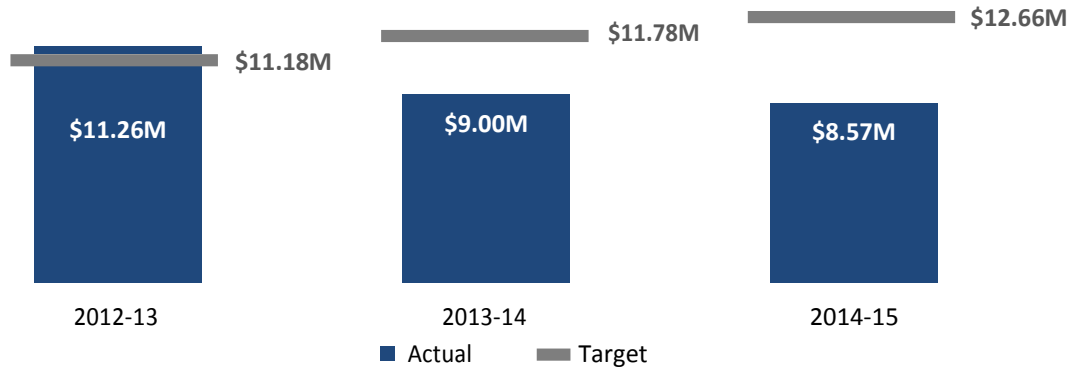
- Creating an advisory board for programs with industry representation to facilitate a continuum between OCRE and industry[10]
- Involving past clients in conference presentations
- Enhancing linkages with NRC Industrial Research Assistance Program (IRAP) Industrial Technology Advisors (ITAs) to facilitate engagement with industry (e.g., ITAs could provide information to OCRE on the needs of SMEs)

4.1.2 Clients reached

Finding 13: *Programs hosted by OCRE did not meet revenue targets for 2013-14 and 2014-15. The decline in OCRE's revenues was largely explained by a decrease in revenues from projects with other government departments. The majority of OCRE's revenue came from clients located in Ontario as well as Newfoundland and Labrador.*

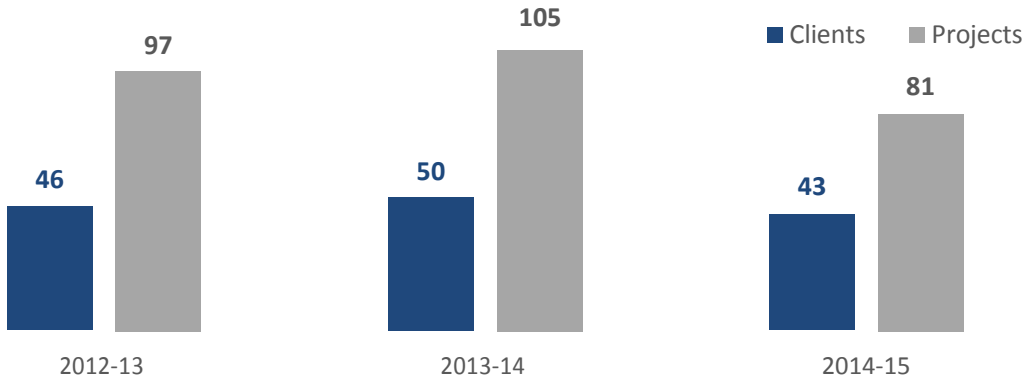
OCRE's revenues fell short of the 2013-14 target by $2.8M and the 2014-15 target by $4.1M. Over the period targets increased by 13% and the amount of revenue received actually decreased by 9% (see Figure 1). The decline is associated with a decrease in the number of projects and clients (see Figure 2). Senior management commented that the cyber intrusion caused most of this shortfall.

Figure 1: OCRE's actual revenues and targets (2012-13 to 2014-15)



Source: NRC corporate KPI data

Figure 2: Number of OCRE clients and projects (2012-13 to 2014-15)



Source: OCRE financial data

[10] Currently advisory boards are held at the VP level and not at the portfolio level.

The overall decline in revenues of $2.69M can be largely explained by a decrease in revenues from OGDs (-$2.52M). OGDs represented 51% of revenues in 2013 and 28% in 2015 ($5.69M to $3.18M; see Table 3). The decline in revenues from OGDs is attributable to a decrease in the number of projects and project size with three major clients: DND, DFO and NRCan (See Table 12, in Appendix D). Internal and external interviewees noted that this was largely due to financial constraints within federal departments. Overall, OGD funders of research have continued over the evaluation period to maintain the same level of funding in natural sciences and engineering.[11] As was discussed in Section 3.2, internal interviewees also highlighted that there were opportunities for OCRE to work more with OGDs.

A decrease in revenues from Canadian industry (-$0.74M) and foreign clients (-0.78M) also contributed to the overall decline. In addition, internal interviewees consistently highlighted that countervailing market conditions were contributing factors in revenue shortfalls.

Table 3: Sources of OCRE's revenues (2012-13 to 2014-15)

Source of revenues	2013		2014		2015		Change
Canada - Total	**$9.23M**	***82%***	**$7.60M**	***84%***	**$7.69M**	***90%***	**-$1.54M**
Other federal government departments	$5.69M	*51%*	$4.93M	*44%*	$3.18M	*28%*	-$2.52M
Industry	$3.23M	*29%*	$1.88M	*17%*	$2.49M	*22%*	-$0.74M
Other (e.g. Non-profit)	$0.31M	*3%*	$0.65M	*6%*	$2.02M	*18%*	$1.72M
Provincial government		*0%*	$0.13M	*1%*		*0%*	--
Foreign - Total	**$1.74M**	***15%***	**$1.43M**	***13%***	**$0.95M**	***8%***	**-$0.78M**
Not assigned	$0.29M	*3%*	-$0.03M	*0%*	-$0.07M	*-1%*	-$0.36M
TOTAL	**$11.26M**	***100%***	**$9.00M**	***100%***	**$8.57M**	***100%***	**-$2.69M**

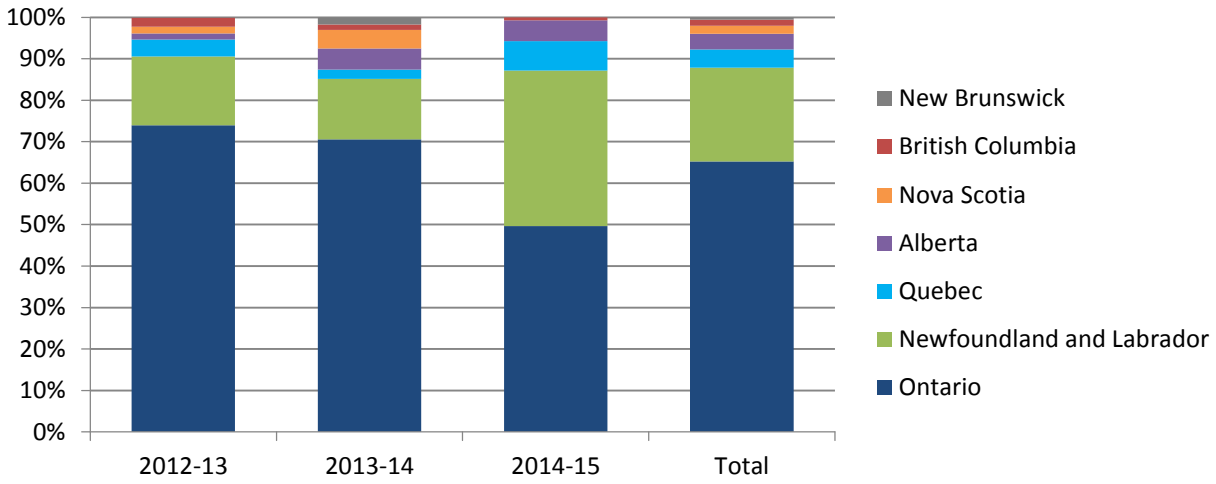
Source: OCRE financial data

The revenue distribution from Canadian clients by province indicates that the majority of OCRE's clients were from Ontario, and Newfoundland and Labrador (see Figure 3). While OCRE had some clients from Quebec and Alberta, it had limited connections in other provinces. An internal interviewee mentioned that efforts were underway to connect with other provinces and that OCRE had a CRL dedicated 50% of the time to developing project opportunities in British Columbia.

Despite efforts to increase OCRE's national presence, it remains an area for improvement. In building its national presence, OCRE must also be cognizant of and engage with the regional cluster within which it operates. As was discussed in Section 3.1, stakeholders noted that there are instances where OCRE did not collaborate to the extent possible with local St. John's marine sector organizations (e.g., C-Core, etc.), resulting in missed opportunities to access funding that is available to provincial organizations.

[11] Statistics Canada. (2011-2015). Gross domestic expenditures on research and development, by science type and by funder and performer sector (Table CANSIM-358-001)

Figure 3: OCRE revenue distribution by province (2012-13 to 2014-15)



Source: OCRE financial data

Recommendation 1: OCRE should increase its efforts to promote its expertise and facilities to stakeholders across Canada while strengthening existing collaborations in the marine sector.

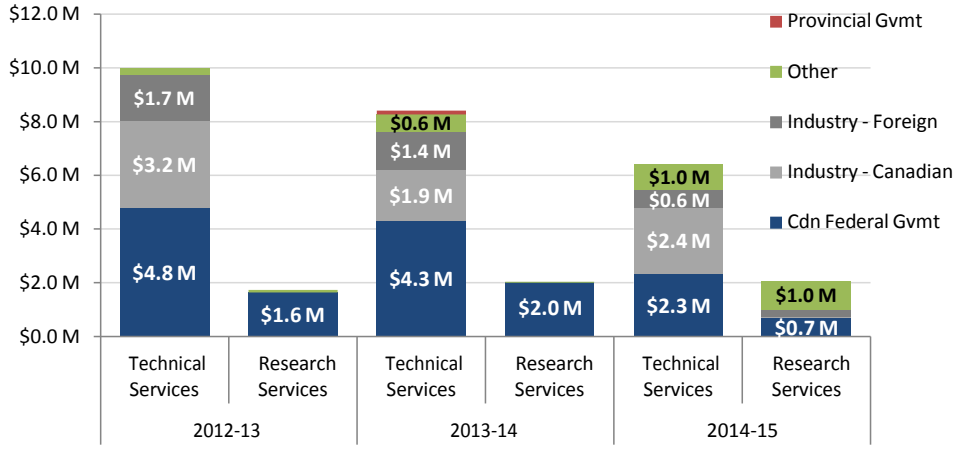
4.1.3 Types of engagements with clients

Finding 14: *Between 2012-13 and 2014-15, the majority of OCRE's client engagements were for technical services.*

Between 2012-13 and 2014-15, 79% of OCRE's revenues were from technical services (near 70% of projects and clients). Revenues from technical services, however declined over the three year period (see Figure 4). During the same period, revenues from research services (i.e., collaborative R&D projects) were stable, accounting for 21% of revenues (near 25% of projects and 20% of clients). Revenues from research services remained stable over the evaluation time period. In 2014-15, OCRE diversified its client base for research services by engaging in projects with universities, colleges, industry and other types of organizations as opposed to just OGDs (see Figure 4), which reduced risks associated with heavy reliance on one client type.

Consultations with international organizations revealed that OCRE's proportion of technical service projects was comparable to two international organizations, Marin and Marintek (i.e., 70% technical service projects). However, different than these two organizations, OCRE had approximately 50% fewer research service projects and more than twice the number of internal R&D projects. There is an opportunity for OCRE to better market their internal projects.

Figure 4: OCRE's revenues from technical services and research services by client type (2012-13 to 2014-15)



Source: OCRE financial data

4.2 Client satisfaction and outcomes

In order to assess OCRE's impact on its clients and collaborators, the evaluation first examined client satisfaction with portfolio services followed by outcomes for clients and stakeholders as a result of their work with OCRE.

4.2.1 Client satisfaction

Finding 15: *OCRE's clients were very satisfied with the services provided by the portfolio.*

The majority of OCRE's clients and stakeholders who were surveyed for this evaluation were very satisfied (77%) or satisfied (18%) with the services provided by OCRE).[12] When looking at the new clients (n=7), 85% were very satisfied and only one client was unsatisfied (15%). OCRE client's overall level of satisfaction was similar to NRC client's overall level of satisfaction (i.e., in 2014-15, 78% of NRC clients reported being very satisfied and 15% were satisfied).

The overall level of client satisfaction for contract negotiation and financial processes are also quite high (78% (n=32) were very satisfied and 12% (n=32) were satisfied)[13] The positive overall satisfaction with OCRE services is further reflected in the satisfaction levels that surveyed clients reported for specific aspects of OCRE services (see Figure 5 in Appendix D).

Further exemplifying the high satisfaction rates of OCRE's client is the finding that the majority of clients surveyed (90%) reported that it was very likely they would work with the portfolio again in the future (10% said somewhat likely) and were very likely to recommend NRC to others (87%; 13% said somewhat likely).[14] Consistent with this is the finding that between 2012-13 to 2014-15, 63% of OCRE clients had more than one project over the period, which compares to

[12] 2014-2015 BMS client satisfaction survey: 100% (n=6) of OCRE clients were very satisfied.
[13] This satisfaction level is comparable to 2014-2015 BMS client satisfaction survey results (n=114): 67% of NRC clients were very satisfied and 21% were satisfied and with contract negotiation and financial processes; within this dataset, 100% (n=6) of OCRE clients were very satisfied.
[14] This satisfaction level is comparable to 2014-2015 BMS client satisfaction survey results (n=112): 88% of NRC Clients reported that it was very likely they would work with the portfolio again in the future (6% said somewhat likely); within this dataset, 100% of OCRE clients (n=6) reported that it was very likely they would work with OCRE again in the future.

69% for the NRC Engineering Division as a whole. The majority of OCRE repeat clients who were surveyed (n=26) reported being equally satisfied (69%) or more satisfied (19%) with their most recent interactions with the portfolio.[15]

Despite the high degree of client satisfaction for the majority of OCRE clients, qualitative responses from survey respondents and interviews with clients revealed a few sources of dissatisfaction. For example, ineffective project management and competency gaps were highlighted as contributing factors to some project delays. In two instances, a lack of improvements to equipment and / or facilities at OCRE was cited by clients as a source of dissatisfaction. One client noted that despite OCRE meeting its needs, equipment and test methods were essentially the same over time at OCRE whereas other ice basin competitors had improved. Another noted that the "OCRE wave tank facility should improve on: video recording synchronization with test data, expand data acquisition capacity to accommodate larger number of pressure transducers, wave probes." OCRE management confirmed that they are focusing its minor capital investments on equipment to improve capability.

4.2.2 Client outcomes

Finding 16: *OCRE played a vital or significant role in client outcomes.*

The majority of OCRE clients (90%) who were surveyed reported a positive outcome as a result of the services provided by the portfolio. The most commonly reported outcomes included increased knowledge / ability to plan and execute R&D projects, increased R&D, improved product / service in market and increased competitive advantage. The majority of survey respondents who reported impacts indicated that the portfolio played a vital or significant role in achieving the outcome (see Table 4 below for the top 5 reported outcomes and Table 13 in Appendix D for additional outcomes). Likewise, the majority of survey respondents felt that these impacts were important to the future of their business (i.e., 90% ranked the importance as 7 or higher out of 10).

[15] This satisfaction level is comparable to 2014-2015 BMS client satisfaction survey results (n=83): 66% (n=83) of NRC clients were equally satisfied, 18% were more satisfied and 12% less satisfied; within this dataset, 60% of OCRE clients (n=5) were equally satisfied and 40% were more satisfied.

Table 4: Role of OCRE in top five reported client outcomes

Client outcome	# and % of clients who reported outcomes		Extent to which OCRE played a role in achieving the outcome				
			Minimal	Somewhat of a contribution	Significant	Vital	Don't know
Increased knowledge/ability to plan and execute R&D projects	**18**	**47%**	0%	**28%**	**28%**	**44%**	0%
Increased R&D	**13**	**34%**	0%	**8%**	**38%**	**46%**	8%
Improved product/services in market	**10**	**26%**	0%	**20%**	**50%**	**30%**	0%
Increased competitive advantage	**8**	**21%**	0%	**25%**	**25%**	**50%**	0%
Accelerated technology development (get to market faster)	**5**	**13%**	0%	**60%**	**20%**	**20%**	0%

Source: Client survey; n=39

The impact of OCRE's work with clients is further exemplified by examples of various outcomes that were provided during interviews with external stakeholders and a review of documents. Examples include:

- **Increased safety for stakeholders -** OCRE's work on the verification of conventional lifeboat operation, funded by NRCan's Program of Energy Research and Development, introduced ideas and ways to improve the capabilities of current lifesaving appliances in a stepwise manner until new guidelines or regulations are introduced for lifeboat designs in ice covered waters.

- **Technology and knowledge used in codes, standards and regulations** - OCRE's work on the determination of ice forces on related to structures to address gaps in standards was used for the revision of the International Organization for Standardization 19906 Arctic Offshore Structures standard. As another example, OCRE staff participated on committees that were involved in developing the Polar Code through the International Maritime Organization.

- **More efficient and economical design and infrastructure development -** OCRE's work on the effect of ice loads on structures enabled important infrastructure such as the Confederation Bridge to be designed and built in such a way that uses less material.

5. Resource Utilization

In order to assess OCRE's resource utilization, the evaluation looked at processes to support program delivery, including the adequacy of human resource critical mass, competencies and infrastructure; project management effectiveness; and processes and tools to support project management. The evaluation also assessed the efficiency and effectiveness of portfolio operations.

Issues	Assessment	Associated recommendations
Adequacy of human resource critical mass and competencies		2
Adequacy of research infrastructure		None
Project management effectiveness		3
Process and tools to support project management		4, 5
Efficiency and effectiveness of operations		None

Legend: Meets expectations  Needs improvement  Management attention 

5.1 Processes to support program delivery

In order to assess the extent to which the OCRE portfolio implemented processes that support the efficient and effective delivery of the programs its hosts, the evaluation looked at the adequacy of OCRE's human resource critical mass and competencies, and research infrastructure. It also examined OCRE's processes for maintaining and enhancing critical mass and competencies, and infrastructure as well as project management practices within OCRE.

5.1.1 Human resource critical mass and competencies

Finding 17: *OCRE did not have sufficient human resource critical mass to achieve portfolio objectives. OCRE management recognized this and beginning in 2015-16 started recruiting for strategic succession and growth. OCRE did, however, generally have the competencies needed to meet the needs of the portfolio-hosted programs.*

Between 2012-13 and 2014-15, the number of employees at OCRE ranged from 88 to 90. Internal and external interviewees were unanimous in their opinion that OCRE did not have the human resource critical mass necessary to achieve portfolio/program objectives. According to internal interviewees, a lack of critical mass at the portfolio is not a recent occurrence. This is supported by a stable and low turnover rate at OCRE (e.g., averaged 5% per year between 2012-13 and 2014-15), indicating that insufficient critical mass was not due to a recent increase in employee turnover. Insufficient critical mass was cited as particularly problematic by internal interviewees in three areas - computer scientists, programmers and staff with expertise in numerical modeling.

Interviews with internal and external stakeholders revealed several impacts resulting from OCRE's lack of critical mass. These included: inability to deliver on projects and overtaxing of human resources. In addition, one external interviewee highlighted that the lack of critical mass may result in the loss of future projects with his organization due to the absence of suitable replacements for departing staff.

Additional human resources required to achieve portfolio/program objectives and meet client needs were recognized by the management team. Efforts are currently underway to deal with the lack of critical mass in the portfolio. For example, at the time of the evaluation the portfolio was hiring for 16 positions. The important role of sufficient critical mass in the portfolio's success makes it an area of high priority.

While internal interviewees indicated that generally OCRE had the competencies needed to meet the needs of the programs, improvements in several technical areas were highlighted and

included: numerical modeling, full scale testing, computational fluid dynamics, finite element analysis, and electronics and design. If OCRE decides that additional competencies in these areas are necessary, consideration should to be given to the most appropriate approach to obtain these competencies (i.e. have the competencies internally at OCRE or procure the competencies from external sources on an as needed basis). In addition to the technical competencies, internal and external stakeholders reflected that OCRE could improve on its competencies in project management (which is discussed in greater detail below in Section 5.1.3).

In discussing the appropriateness of OCRE's critical mass and competencies, internal interviewees highlighted several challenges. These included:

- **2014 NRC cyber intrusion** – The cyber intrusion made it difficult to fill continuing positions in 2014-15 (e.g., due to human resource systems being offline). However, internal interviewees noted that OCRE employed one-year terms as a work-around during the cyber-intrusion.

- **Leave without pay** – Parental leave and sick leave contributed to gaps in competencies and critical mass.

- **Challenges of many of the OCRE staff working a 1950 hour schedule**

- **Uncompetitive salaries** – NRC's salaries were not competitive with the private sector, particularly when compared to the oil and gas industry.

- **Limited labour market with the expertise needed –** The presence of people with the expertise needed by OCRE was limited.

With regards to the last two challenges, uncompetitive salaries and limited labour market, interviewees from comparable international organizations and other NRC portfolios also noted similar challenges in recruiting human resources. This suggests that these two challenges are not unique to OCRE when the oil and gas sector economy is strong. With recent changes in this sector, recruiting human resources may be easier.

Finding 18: *OCRE had various processes in place to ensure human resource critical mass and competencies (e.g., annual strategic planning process, labour capacity plan, succession plan).*

Despite the challenges faced by OCRE in maintaining critical mass, the portfolio had various processes in place in an effort to ensure adequate critical mass and competencies. Internal interviewees highlighted the following processes in place / used at OCRE: *a*nnual strategic planning process; labour capacity plan; use of resources from other NRC portfolios; succession plan; leveraging retired staff through the post-retirement program; and conduct of internal R&D projects.

Internal interviewees also highlighted several opportunities for improvement to ensure adequate critical mass and competencies. These included:

- **Training in business skills** - While OCRE provided ongoing training and professional development for staff as a strategy to maintain or enhance competencies, a need for additional training in business skills needed for the new NRC was highlighted (e.g.,

networking, client engagement, proposal writing, managing client expectation, client relationship management, and marketing).

- **Cross–training staff** - Cross- training staff in scientific / technical areas was suggested as a solution to deal with staff leaves.

- **Hire junior staff and promote from within** - Opportunities were identified for OCRE to hire more junior staff, including graduate students, and to grow them internally and promote from within as opposed to looking externally to fill gaps. Promoting from within was cited as particularly important to fill vacancies at higher levels (e.g., management).

- **Comprehensive employee engagement strategy** - It was noted that despite OCRE having some components of what would typically define an employee engagement strategy (e.g., a formal onboarding package for new recruits and an employee recognition program), this was as an area for improvement that OCRE management wanted to address.

Recommendation 2: OCRE should continue to prioritize the recruitment of staff to deliver on current and future projects.

5.1.2 Infrastructure

Finding 19: *OCRE had the necessary research infrastructure to deliver on its projects.*

Internal interviewees felt that OCRE has adequate infrastructure to deliver on its projects, and that despite the aging facilities (i.e., average of 32 years old), investments had been made as evidenced by an increase in requests for major capital investment over the evaluation period as well as an increase in major and minor capital expenditures. Between 2012-13 to 2014-15, the total expenditures on capital investments to enhance existing infrastructure and purchase new equipment increased from $1M to $2.3M and totaled $5.8M over that three-year period. As an example of improvements to OCRE's physical infrastructure, an internal interviewee highlighted two improvements to an Ottawa-based large area basin: 1) increased wall height and 2) addition of a new wave machine to increase the wave conditions that can be simulated. Capital projects were tracked and monitored on a monthly basis by the OCRE GM, as well as by the NRC Engineering Division VP through the monthly GM reports.

Finding 20: *OCRE had various processes in place to ensure the adequacy of its infrastructure.*

Internal interviewees noted that in order to ensure that OCRE had the infrastructure needed to deliver on its projects; recapitalization efforts were strategic and based on a holistic, long-term view of the portfolio's suite of infrastructure. Internal interviewees highlighted that OCRE had a coordinated approach to identify the capital infrastructure needs of its programs (e.g., the program business and implementation plans indicate what the capital needs were, and these in turn were incorporated into portfolio plans). Documentation and internal interviewees also indicated that OCRE had a process to track and plan the utilization of its infrastructure.

Despite this, internal interviewees noted several barriers to maintaining appropriate infrastructure, including:

- **Funding for major capital infrastructure was outside of the portfolio's direct control** (i.e., funding is awarded by NRC SEC as part of the annual NRC investment

planning process and in relation to other investment needs and future program opportunities)

- **Balancing capital infrastructure projects with client projects** (i.e., upgrading or adding capabilities to the infrastructure may make it unavailable for client needs during that time)

- **Shortage of staff** (i.e., staff must focus on client deliverables as opposed to tasks needed to maintain or upgrade infrastructure). Recently OCRE's minor capital spending strategy has emphasized the use of turnkey or off-the-shelf capital items as much as possible.

5.1.3 Project management

Finding 21: *OCRE's project management was not as effective as it could have been, resulting in approximately half of OCRE's projects being over budget.*

Internal interviewees identified challenges with project management at OCRE, particularly in delivering projects on time and budget. Similarly, corporate key performance indicator (KPI) data indicates that, on average, 55% of OCRE's projects were delivered on or under budget between 2012-13 and 2014-15. While the percentage of OCRE's projects delivered on or under budget increased somewhat from 2012-13 to 2014-15 (i.e., 47% to 64%), it was still below the NRC target of 90%. Likewise, OCRE's percentage of projects delivered on or under budget was lower than that for the NRC Engineering Division as a whole between 2012-13 and 2014-15 (i.e., 58% to 69%).

Contributing to the ineffectiveness of OCRE's project management may be the project management culture within the portfolio – this includes effective project proposal development and costing, as well as effective project execution (management of time, scope, budget). Internal interviewees noted that despite some improvements to the culture, there is much work that needs to be done. A main challenge for achieving this in an R&D environment is reconciling the rigidity of controls required by project management with the culture of exploration that is inherent within the scientific field.[42] Despite this challenge, NRC's applied mandate and service delivery business model requires effective project management.

Finding 22: *OCRE does not have a defined approach to assign researchers to project management roles. In the majority of cases, researchers were not assigned to manage projects based on their project management competencies relative to project materiality and / or risk.*

OCRE uses research staff as project managers as opposed to having dedicated project managers.[16] OCRE's approach is consistent with the approach used by other NRC portfolios that were interviewed as part of the evaluation (i.e., Aerospace portfolio (AREO), CONST and EME) as well as one international organization.[17] Despite the commonality of this approach, literature reviewed as part of the evaluation suggests that requiring managerial tasks of a highly science-oriented individual may result in the organization losing a very motivated scientist and gaining an unfulfilled, mediocre manager. [43] The literature also suggests that this may put a

[16] OCRE research staff, however, does not manage major capital projects. According to internal interviewees, as of six months ago dedicated project managers from NRC's central Planning and Reporting Services were assigned responsibility for major capital infrastructure projects across NRC.
[17] The other international organization interviewed uses dedicated project managers that have a scientific background.

project at risk[44] and have a negative impact on the project.[45] Consistent with this, internal interviewees reflected that not all researchers have the competencies needed to effectively manage projects, nor will they ever have the competencies (despite training and / or experience). Internal interviewees also highlighted that some researchers are simply not interested in managing projects and/or do not respect PM as a tool, making it a second priority to the research itself.

Despite the limitations of using researchers as project managers, internal and external interviewees highlighted various pragmatic considerations for this approach. For example, there is a high overhead cost of having dedicated project managers, and the cost needs to be justified relative to the materiality and level of risk of projects. This in part explains OCRE's use of researchers as project managers; the average annual value of OCRE projects with external clients / collaborators between 2012-13 and 2014-15 was $98K, of which approximately three quarters were less than $100K. Internal interviewees also noted that having researchers manage projects makes them accountable, for both the projects they manage and ones they are a team member on.

Interviewees from other NRC portfolios and international organizations revealed that when using researchers as project managers, it is a best practice to assign management responsibility based on competencies in project management relative to the size and risk of the project. This, however, was not the approach used by OCRE. Rather, in the majority of cases at OCRE the researcher who secured the opportunity managed the project. OCRE management described the approach used by the portfolio to assign project management responsibilities as organic and not formally defined. They also commented that there are opportunities for the process to be more formalized and transparent.

Integral to matching project materiality and / or risk with the appropriate project manager requires an awareness of staff competencies in project management. OCRE management noted that it has a general awareness of researcher's project management competencies from experience working with the staff. While recently the OCRE PSO started tracking the performance of its project managers to provide an evaluation of their skills, the assessment was still informal. According to OCRE management, the portfolio would benefit from having a better understanding of each researchers skills as a project manager, particularly if they are to make decisions about who manages which project.

Recommendation 3: OCRE should define an approach for the portfolio to assign and support project management roles and responsibilities as well as continue to promote a project management culture.

Finding 23: *OCRE provided its staff with project management training and support, and had processes and tools in place to manage projects. There is a growing project management culture at OCRE, but it varies by group and individuals. There were gaps in processes and tools related to change management, risk management, project monitoring and holding lesson learned sessions as part of the project close-out.*

In support of project management, OCRE provided its staff with training in project management and offered mentoring opportunities. This is consistent with best practices identified in the literature[46] as well as interviews with representatives from other NRC portfolios and international organizations.

Likewise, and consistent with best practices, OCRE provided project management support services through its PSO. The OCRE PSO was viewed by internal interviewees as having provided the support needed by staff to manage projects.

Finally, OCRE had a project management process (e.g., as defined in the OCRE Project Management Standard Quick Guide) and associated tools. According to internal interviewees, the process and tools was communicated to staff and followed by the majority of staff. Despite this, internal interviewees highlighted some specific gaps in OCRE's project management processes and tools, including:

- **Culture** – According to a number of internal interviewees, there is a growing project management culture at OCRE, but it varies by group and individuals. Also, it was noted that the culture is much stronger and tools are more available than prior to the NRC transformation. While all project managers are required to follow OCRE project management standards, it is recognized that changing behavior take time, that many researchers still need training and that not all scientists are interested in developing and improving their project management knowledge and skills. A process for the identification and nomination of a number of skilled project managers as well as the creation of reward mechanisms for good project management performance and the use of a full cost-recovery model were mentioned as enablers of this culture.

- **Change orders** – Change orders usually happened after the fact (e.g., after the hours were used up), which may have been the result of in ill-defined process and / or misunderstanding of what the process should be.

- **Risk management** – Aside from the required risk assessment at the beginning of a project (i.e., the Project Complexity and Risk Assessment), risk registrars were not generally maintained and managed throughout the course of the project.

- **Project monitoring** – Several challenges were noted with the ability of OCRE project managers to monitor projects. While OCRE created a project dashboard to monitor the health of its projects, information from the dashboard appeared to be used by higher level management more so than research project managers themselves. Challenges with SAP to monitor projects were also noted (e.g., SAP was not viewed as user-friendly and as overly complex). Likewise, challenges were highlighted with understanding real-time human resource capacity, and opportunities for improvement with communications around resource conflicts and assessing priorities were identified.

- **Project close-out (lessons learned)** - Lessons learned sessions were only periodically held at the end of a project and there are opportunities to learn from previous experiences and share lessons with other staff.

Recommendation 4: OCRE should continue to review and adjust its processes and tools related to change management, risk management, project monitoring and project close-out (i.e., lessons learned sessions).

Finding 24: *Consistent with best practices, OCRE established a portfolio Project Management Community of Practice to assess its project management tools and processes, and engage in ongoing improvements. Despite this initiative, changes to OCRE's project management processes and tools have not yet materialized.*

Interviews with international organizations and other NRC portfolios, as well as literature reviewed[47], revealed that having a defined process to assess project management tools and processes is a best practice. Consistent with this best practise, OCRE participates on the NRC Engineering Division Harmonization Committee, whose mission is to harmonize tools and processes to improve efficiency and effectiveness of cross-portfolio projects. This contributes to OCRE's ability to enhance its project management processes and tools by sharing and learning of best practices from others.

OCRE also established a portfolio Project Management Community of Practice in September 2014 whose mandate is to support the development, implementation and continuous improvement of project management practices and processes. Examples of the committee's focus to date have included discussions on improvements to the Project Complexity and Risk Assessment so that it more accurately captures project risks, and on approaches to gather feedback on project management processes and tools more broadly from OCRE staff. Changes to OCRE's project management processes and tools, however, have not yet materialized due in part to the relative early phase of the initiative and the fact that as of the Fall of 2015 the committee had not been meeting regularly.

Recommendation 5: OCRE should ensure that the portfolio Project Management Community of Practice continues to meet on a regular basis and act on its mandate.

5.2 Efficient and cost-effective use of resources

In order to assess the extent to which OCRE used its resources in a cost-effective way, the evaluation looked at the portfolio's value for money as well as the efficiency of its internal operations. While the evaluation did not conduct an extensive review of the NRC common services, some of its effect on efficient operations were observed. At a later date, common services could be themselves evaluated or reviewed. For example, a separate review of DFS may be carried-out subject to a future NRC departmental evaluation plan.

5.2.1 Value-for-money

Finding 25: *OCRE appears to be making progress toward achieving its objectives when the modest financial resources of the portfolio are considered.*

External interviewees felt that OCRE had made good progress towards achieving its objectives, particularly when the modest financial resources of the portfolio were considered. The modest nature of OCRE's resources is exemplified when compared to other international organizations. For example, OCRE's expenditures and staff were approximately 50% less than those at Marin and Marintek (see Table 5). One external interviewee commented that "for oil companies, this [OCRE's expenditures of $20.4M annually] would be chocolate bar money".

Table 5: Resources for OCRE and comparable organizations in 2014-15

	OCRE	Marin	Marintek
Total expenditures	$21.6M	$51.21M	$41M
Total number of full time equivalents (FTEs)	90	380	200
Percentage technical / scientific FTEs	92% (83)	84% (320)	90% (180)
Percentage non-technical / scientific FTEs (*e.g., administrative staff*)	8%* (7)	16% (60)	10% (20)

Source: OCRE human resource data and consultations with international organizations. Note: *Does not include support provided by NRC common services to OCRE.

5.2.2 Efficiency of internal operations

Finding 26: *OCRE's operations were not as efficient as originally targeted by the portfolio; OCRE did not achieve its targets for overhead efficiency, staff utilization and facility utilization between 2012-13 and 2014-15. Operational efficiency also decreased over the evaluation time period.*

In order to assess the internal operations of OCRE, the evaluation looked at the portfolio's performance on a number of corporately tracked KPIs, including portfolio overhead efficiency, staff utilization, operational efficiency and facility utilization. In addition, strategies and barriers to efficient operations at OCRE were assessed.

Overhead efficiency

Corporate KPI data indicates that between 2012-13 to 2014-15, OCRE's overhead efficiency improved (i.e., indirect costs decreased from 69% to 53%).[18] At the same time, the portfolio adjusted its overhead efficiency targets from 13% in 2012-13 to 37% in 2014-15. Despite these portfolio specific improvements, OCRE did not meet its targets for each of the three years and had higher overhead efficiency rates compared to the Engineering Division overall (seeTable 6).

Table 6: Overhead efficiency targets and rates (2012-13 to 2014-15)

	2012-13		2013-14		2014-15	
	Actual	Budget	Actual	Budget	Actual	Budget
ENGINEERING DIVISION	**65%**	**20%**	**52%**	**28%**	**51%**	**37%**
AEROSPACE	55%	21%	44%	32%	47%	36%
AUTOMOTIVE & SURFACE TRANSPORTATION	70%	36%	53%	25%	49%	36%
CONSTRUCTION	71%	14%	47%	19%	45%	36%
ENERGY, MINING AND ENVIRONMENT	77%	10%	69%	29%	69%	39%
OCEAN, COASTAL AND RIVER ENGINEERING	69%	13%	57%	32%	53%	37%

Source: Corporate KPI data

[18] The overhead efficiency indicator calculates indirect costs (that is, any costs that are not directly charged against a project) as a percentage of total expenditures.

However, this indicator should be considered in the context of the organization-wide initiative to encourage more diligent time-keeping which took place over the evaluation period. In this context, the improvement in overhead efficiency may also be emblematic of employees coding time to projects more diligently which shifted expenses from indirect to direct. This is supported to some degree by the similarities in the shifts in staff utilization rates recorded across the division.

Staff utilization

Between 2012-13 to 2014-15, OCRE's staff utilization rates increased from 37% to 55% which is nearly identical to the shifts in staff utilization rates across the six portfolios (see Table 7). While this suggests that OCRE has increased its business efficiency, OCRE did not achieve the labor utilization target it set in 2014-15 of 65% by a difference of approximately 10%.

Table 7: Staff utilization for NRC Engineering portfolios (2012-13 to 2014-15)

	2012-13 Actual	2013-14 Actual	2014-15 Actual
ENGINEERING DIVISION	**32%**	**51%**	**55%**
AEROSPACE	33%	50%	52%
AUTOMOTIVE & SURFACE TRANSPORTATION	31%	49%	56%
CONSTRUCTION	31%	63%	67%
ENERGY, MINING AND ENVIRONMENT	32%	48%	49%
OCEAN, COASTAL AND RIVER ENGINEERING	37%	46%	55%

Source: Corporate KPI data

In 2015-16, OCRE tracked its own staff utilization to reflect the fact that some staff activities are critical to portfolio operations but are categorized as an indirect expense. Calculating staff utilization using billable staff only, OCRE reported that its staff utilization rate was 62.5% as of January, 2015, closer to the target of 65%.

With regards to staff utilization, internal interviewees noted that some staff were highly utilized while others were not as they may not have had the required competencies for particular projects. Project selection was also referenced by internal interviewees as influencing labour utilization rates. Specifically, internal interviewees noted that while there needs to be a balance between client demands and internal R&D projects to maintain / enhance competencies, the current balance may have contributed to the portfolio not meeting its labor utilization targets.

Operational efficiency

Looking at the portfolio's operational efficiency over the reporting period suggests that operations are becoming less efficient (see Table 8). Overall, revenues declined in each fiscal year while expenditures increased.

Table 8: OCRE operational efficiency (2012-13 to 2014-15)

Fiscal year	Operational Efficiency	Total Earned Revenue	Expenditures
2012-13	55%	$ 11.3M	$ 20.6M
2013-14	47%	$ 9.0M	$ 19.0M
2014-15	40%	$ 8.6M	$ 21.5M

Source: Corporate Financial Reports

Facility utilization

NRC also tracked facility utilization as one of its KPIs in 2014-15.[19] In 2014-15, OCRE's facility utilization rate was 65%. While OCRE's facility utilization was higher than the NRC Engineering Division in general (i.e., 53%), OCRE did not meet its target of 88%. With the exception of Automotive and Surface Transportation (AST), other portfolios in the NRC Engineering Division also did not meet targets for 2014-15.

Data collected by OCRE on the utilization of its major facilities for 2012-13 to 2014-15 suggests that OCRE's facility utilization decreased. In 2012-13, the average facility utilization rate for major facilities was just over 100%. In 2013-14 and 2014-15, the portfolio's utilization rate decreased and remained stable at 65%. Facility utilization is driven by client demand for certain types of OCRE services, and as was demonstrated in Section 4.1, the decrease in revenues for technical services may indicate less client demand overall. However, not all revenue generating projects require the use of OCRE's facilities (e.g., numerical modelling), the project selection and type of projects also impacts facility utilization.

Strategies and barriers to efficient operations

Internal interviewees felt that OCRE operated in an efficient manner and highlighted examples of strategies used by the portfolio to ensure efficient use of resources. These included the project dashboard used by OCRE to track the health of project and harmonized processes such as those implemented for project management.

Despite this, internal interviewees highlighted several barriers to the efficient use of resources and may be areas that OCRE chooses to address in its ongoing efforts to improve efficiency. Factors previously discussed in the evaluation report include insufficient human resources, the 2014 cyber intrusion at NRC and using researchers as project managers. In addition to these three factors, the following barriers were highlighted by internal interviewees:

- **Increased administrative requirements** - Greater accountability and administrative requirements (e.g., project tracking, time tracking, overhead required from being a government agency) were said to contribute to inefficiencies. Despite this, benefits to increased accountability were noted (e.g., better planning from project tracking) as was the fact that the burden is lessened over time as people become familiar with the process.

- **Matrix management** - Confusion over roles and responsibilities under the matrix management approach was highlighted as contributing to inefficiencies.

[19] Facility utilization is the proportion of facility cost recoveries to total Portfolio facility costs.

- **Absence of a centralized electronics group with a single team lead** – The fact that electronic support staff reported to different people as opposed to one team lead contributed to inefficiencies in allocating electronics resources to projects.

5.2.3 Common services

As indicated previously, an extensive evaluation of the NRC common services was not conducted as part of this evaluation. Still the evaluation did observe some ineffeciencies with some of the services provided to OCRE.

Finding 27: NRC Knowledge Management services are not used to a large extent by OCRE. NRC Knowledge Management and Business Management Support did not provide coordinated services to the portfolio.

The Common Service Transformation at NRC has had an impact on how services are delivered to portfolios. KM provides NRC with information from its National Science Library, including competitive and technical intelligence. Interviews with internal staff revealed that KM was largely underutilized by OCRE staff which may be explained by the closure of St-John's library. There was a general sense from both OCRE and KM that there are opportunities for greater use of KM and the BMS staff supporting the portfolio. Several factors were identified as contributing to the underutilization of KM by OCRE, including a lack of awareness of KM, and the services / competencies available, a perceived lack of capacity or of time at KM and perceptions that KM had a limited understanding of the business that OCRE was in. That said, in the instances where KM services had been used by OCRE, they were viewed positively.

In addition, interviews with OCRE, KM and BMS revealed that BMS and KM generally did not work together to leverage the expertise available in each branch when providing services to OCRE. Interviewees specifically noted that where KM has expertise in gathering information (i.e., through the Information Specialists), BMS has expertise in analyzing information from a business perspective (i.e., through the Technical Business Analysts). Given the complimentary nature of these two skill sets, a coordinated approach between KM and BMS would ensure that the needs of the portfolio are met and prevent the duplication of efforts between KM and BMS (e.g., either party could draw on information / work previously completed by the other).

Finding 28: *Services provided to OCRE by NRC Design and Fabrication Services (DFS) were not viewed as cost-effective as was possible.*

In order to provide services to its clients, OCRE relies on the work of DFS (e.g., to build model naval architecture and marine structures for testing). Both OCRE staff and DFS noted that services provided by DFS were not as cost-effective as those of the private sector, and contributed to higher prices for OCRE clients. According to internal interviewees, OCRE continued to make use of DFS as opposed to outsourcing work to the private sector because of the specialized nature of the work OCRE does and the confidentiality of some work. In addition, OCRE management stated that they were "forced" to work with DFS because of delays in contracting incurred as a result of working with the Public Works and Government Services Canada. In only a few instances were less risky / lower value pieces of work outsourced (e.g., when DFS could not handle the workload).

Perceptions from both OCRE and DFS were mixed as to reasons for the higher costs of DFS services. Where some interviewees highlighted aging equipment and out of date processes at DFS as contributing to higher rates, others countered that the majority of equipment at DFS had been modernized in recent years. However, interviewees from both OCRE and DFS

consistently noted that DFS generally used a 'one rate applies to all projects' approach, in which rates were typically based on past projects as opposed to considering the specifics of the current project and possible innovative approaches to meet current needs. In addition, DFS offered a very high quality service, when this was not always required. Related to this was the finding that DFS was often involved in the project after design elements were created and a financial budget arrived at. This was said to add risks to the project and create challenges for DFS in terms of delivering tailored, cost-effective services. In July 2015, with the objective of decreasing costs, DFS launched a project to explore different ways to build ship models. As a result DFS are now working with clients to find options with respect to quality and cost. Finally since the two groups in St. John's are so interrelated, it may be worth investigating the possibility of combining them instead of having two separate groups, i.e. DFS staff roll into OCRE.

In addition to the challenges discussed above around KM, BMS and DFS, internal interviewees noted that untimely responses for support from Information Technology Services (ITS), Administrative Services and Property Management (ASPM) and BMS contributed to inefficient portfolio operations. Likewise, OCRE staff highlighted the length of time to recruit people at NRC as problematic and as having negatively affected the portfolio's ability to operate efficiently. Both HR and portfolio hiring appear to be at the center of this issue. Finally, internal interviewees noted that the use of different formats for similar data requests from Finance Branch and Planning and Reporting Services (PRS) created inefficiencies.

6 . Conclusion

Within the industry sectors targeted by OCRE, there are ongoing needs that the portfolio is well positioned to meet. Likewise, there is a need for stakeholders to access the type of competencies and facilities offered by OCRE. While OCRE's facilities are unique in Canada, instances of overlapping competencies with other organizations were identified. Opportunities were also identified for OCRE to expand its reach by better promoting its expertise and facilities to stakeholders across Canada as well as improving collaborations with key marine sector players in St. John's. Of those clients that OCRE reached, the majority reported high levels of satisfaction with OCRE services as well as positive outcomes.

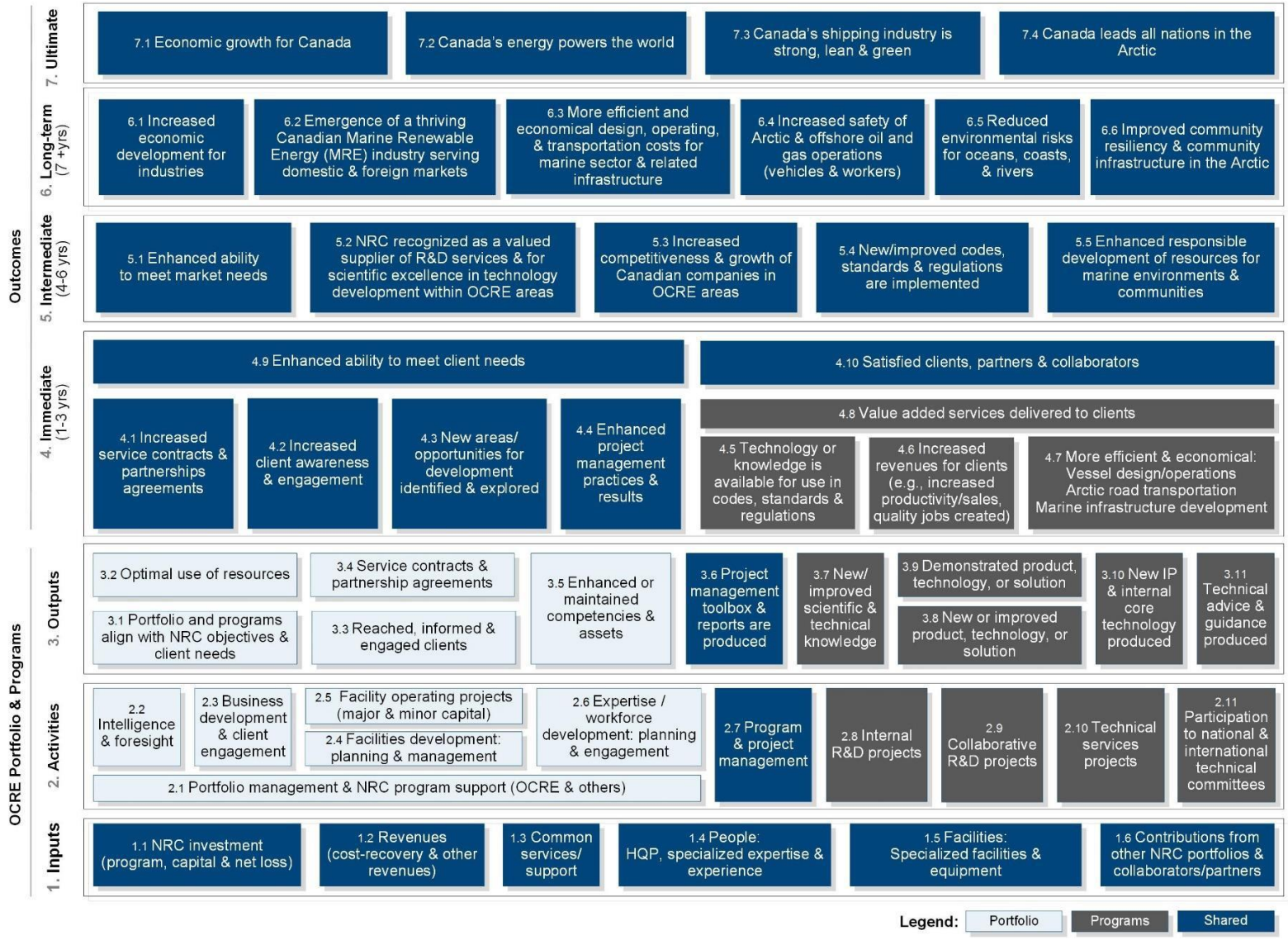
OCRE generally had processes in place to ensure that it had adequate human resource critical mass, competencies and infrastructure. Despite having adequate competencies and infrastructure to meet the needs of OCRE-hosted programs, the portfolio did not have sufficient critical mass. The effectiveness of OCRE's project management was limited, and shortfalls in the portfolio's project management approach, processes and tools were identified. Portfolio operations were not as efficient as originally targeted by the portfolio. While an extensive review of the common services was not conducted as part of this evaluation, the evaluation was able to bring to light that in some instances, NRC common services resulted in inefficiencies and opportunities were identified for KM and DFS, in particular, to ensure efficient and cost-effective operations. Despite these operational challenges, OCRE appears to be making progress toward achieving its objectives when the modest financial resources of the portfolio are considered.

7. Management Response and Action Plan

Recommendation	Response and planned action(s)	Proposed person(s) responsibilities	Timelines	Measure(s) of achievement
Recommendation 1: OCRE should increase its efforts to promote its expertise and facilities to stakeholders across Canada while strengthening existing collaborations in the marine sector.	1. Temporary assignment of CRL to Pacific Coast (Vancouver) 2. NRC-BMS posting for permanent shared CRL position with AST. 3. Development of OCRE Facility / Capabilities collateral and annual review	1. OCRE PBA 2. BMS 3. OCRE PMA / Coms Team	1. Sept 2016 2. Posted 3. Completed / Jan 2017	1. OCRE CRL on site in Vancouver 2. Permanent West Coast CRL position filled 3. OCRE printed and web-based collateral
Recommendation 2: OCRE should prioritize the recruitment of staff to deliver on current and future projects.	1. Develop and maintain an OCRE growth and succession plan. 2. Develop an OCRE Labour Capacity 3. Review and update staffing actions	1. OCRE GM 2. OCRE Dir Ops 3. OCRE Dir Research / OCRE HRG	1. Plan updated by Oct 2016; Hiring on track by June 2017 2. Labour Capacity fully developed and implemented by September 2016 3. Practice for monthly review and updates defined and implemented by September 2016	1. Staffing actions reflect staffing plan 2. Achieve monthly Utilization target as per annual Operations plan 3. Positions filled to meet needs of portfolio

Recommendation 3: OCRE should define an approach for the portfolio to assign and support project management roles and responsibilities as well as continue to promote a project management culture.	1. Development of tool(s) to assess project manager effectiveness 2. Project Management training developed and delivered 3. Introduction of Project Health meeting with focus on project performance and outcomes	1. OCRE Dir Ops / PSO Team Lead 2. OCRE PSO Team Lead 3. OCRE Dir Ops / PSO Team Lead	1. Sept 2016 2. Training plan developed and implemented by December 2016 3. Practice of project health meetings defined and implementation launched by October 2016	1. Assessments completed with training gaps identified for each PM 2. PM Training delivered as planned 3. Overall improvement in project performance
Recommendation 4: OCRE should continue to review and adjust its processes and tools related to change management, risk management, project monitoring and project close-out (i.e., lessons learned sessions).	1. Review of portfolio Project Management standards and procedures 2. Focus areas for Project Managers' training to include project complexity and risk (PCRA), change management, execution and, closure. 3. Project registration (initiation) to include milestone date for project closure meeting.	1. OCRE Dir Ops /PSO Team Lead 2. OCRE PSO Team Lead 3. OCRE PSO Team Lead	1. Practice for regular review defined and implemented by September 2016 2. Jan 2017 3. Sept 2016	1. PM Standards current and up-to-date 2. PM training delivered 3. Lessons learned from closure meeting incorporated in to PM standards.
Recommendation 5: OCRE should ensure that the portfolio Project Management Community of Practice continues to meet on a regular basis and act on its mandate.	1. Newly appointed PSO Team Lead to be assigned portfolio COP Chair and to direct reconstituted committee	1. OCRE PSO Team Lead	1. Sept 2016	1. COP recommendation leading to improved PM standards.

Appendix A: Logic Model



Appendix B: Evaluation Matrix

Evaluation question	Document and data review	Internal interviews	External interviews	Consultations with international organizations	Client survey
1. Does the OCRE portfolio continue to address a demonstrable need in support of industry sectors related to ocean, coastal and river environments?	✓	✓	✓	✓	✓
2. Are the strategic objectives and activities of OCRE aligned with the roles and responsibilities of NRC and the federal government?	✓	✓	✓	✓	✓
3. To what extent has the OCRE portfolio adequately reached and engaged clients and stakeholders nationally and internationally?	✓	✓			
4. To what extent has the OCRE portfolio had a positive impact on its clients and collaborators?	✓		✓	✓	✓
5. To what extent has the OCRE portfolio implemented processes that support the efficient and effective delivery of the programs it hosts?	✓	✓	✓	✓	
6. To what extent are the OCRE portfolio resources used in a cost-effective manner?	✓	✓	✓	✓	

Appendix C: Methodology

The evaluation approach and selection of methods was based upon the information needs of NRC Senior Management to support timely decision making. The approach used for the evaluation was commensurate with the level of program risk, which was assessed as medium during an assessment conducted as part of the planning phase. In order to maximize the possibility of generating useful, valid and relevant evaluation findings, mixed methods were used, allowing for triangulation (i.e., convergence of results across lines of evidence) and complementarity (i.e., developing better understanding by exploring different facets of a complex issue).

Both qualitative and quantitative methods were used, and included:

- Internal and external document review
- Administrative and performance data review
- Key informant interviews (internal and external)
- Consultations with international organizations
- Client survey

A discussion of the approach used for each of these methods is provided in the following paragraphs, as well as limitations and challenges encountered.

C.1 Methods

Internal and external document review

Internal and external documents were reviewed, synthesized and integrated into the evaluation to provide context and history, and to complement other lines of evidence in assessing relevance and performance. Internal documents reviewed included portfolio strategic plans, operating plans and business plans. In addition, external documentation was also reviewed by the evaluation team, including documents produced by government departments and central agencies and literature on project management. A list of the documents reviewed can be found in Appendix E.

Administrative and performance data review

Administrative and performance data for 2012-13 and 2014-15 were reviewed to provide information on program outputs and client reach, as well as to contribute to the analysis of resource utilization (e.g., staff utilization rates). Administrative and performance data were mostly extracted from corporate data sources (e.g. SAP, Statements of Operation, and corporate KPIs). OCRE and NRC corporate branches, including BMS, FB, HRB and PRS were consulted as needed to supplement and / or validate information extracted from corporate data sources.

Semi-structured interviews

Semi-structured interviews were conducted with internal and external portfolio stakeholders to collect information such as personal experiences, opinions, and expert knowledge. This information was used to complement other lines of evidence and to contextualize quantitative information. In total, 40 portfolio stakeholders were interviewed including 27 internal

stakeholders and 13 external stakeholders. Interviewees were selected in consultation with OCRE management. External interviewees were chosen to represent the major industries within which OCRE operated. The breakdown by interviewee type is provided in Table 9.

Majority of the interviews were conducted over the phone; however a select number were conducted in-person. Each interview lasted between one and two hours. Interview guides were developed to align questions with the information requirements as identified in the evaluation framework. This process ensured that the information requested would yield relevant information in support of evaluation questions and indicators.

All interviewees received the interview guide in advance of the interview. In some cases, interviewees elected to provide their comments in writing to the evaluation team, either following the interview or instead of participating in an interview. The majority of interviews were individual. However, two group interviews were conducted with team leads for reasons of efficiency and to provide a richer discussion.

Table 9: Stakeholders interviewed

Interviewees	Count
Internal	**27**
VP office	2
OCRE staff (includes support functions)	14
Other NRC portfolios (CONST, AERO)	3
Common services (BMS, FB, HR, DFS, KM)	8
External	**13**
OGD client / collaborator	3
Non OGD client / collaborator	5
Other stakeholders (e.g., representatives from relevant Canadian and international industry associations, provincial governments, Industry Canada)	5
Total	**40**

Client survey

A web-based survey of OCRE's clients was conducted to assess questions of client satisfaction, effectiveness, efficiency, impacts and attribution. In the case of four clients that were also interviewed as part of the evaluation, the survey was administered to them over the phone during the interview.

The sample of OCRE clients was extracted from a list of projects that a) occurred during the evaluation period and b) had an OCRE employee listed as the person responsible for the project. 62 separate organization names were identified on this list and OAE attempted to contact 82 individuals associated with these organizations and projects. 71 of these individuals fit the criteria to be included as a part of the survey population. 39 individuals responded to the survey (35 online, 4 phone), leading to a response rate of 55%. In terms of the organizations represented in this response rate, 29 separate organizations were represented, which covers 47% of the organizations that OCRE worked with (and led a related project for) over the evaluation period.

The survey instrument was designed by OAE but it was largely comprised of questions from NRC's annual client satisfaction survey (which is typically administered by BMS). A number of

additional questions were added and some modifications were made to the annual client satisfaction survey questions. Once finalized, the survey was programmed into NRC's online survey software (Fluid Surveys) by NRC CB and the tool was internally tested by OAE.

The survey was open for 14 days. Potential respondents were contacted initially via email, and reminded via email following the first week, but a low initial response rate provoked the need to follow-up with non-respondents by phone.

In regards to a profile of survey respondents, Table 10 Table shows the sectors represented and Table 11 shows the breakdown of the types of services that they accessed.

Table 10: Sectors represented by survey respondents

Sector	Count	%
Consulting	16	41%
Off-shore oil and gas production	12	31%
Government	12	31%
Other	10	26%
Marine shipping and transportation	9	23%
Ports and harbours	8	21%
Defence and security	6	15%
Marine energy	5	13%
Ship design	4	10%
Shipbuilding	3	8%
Ship operations	3	8%
Hydropower	3	8%

Note: The sum of % exceeds 100% and the count exceeds the survey population count (n = 39) because this question allowed for multiple selections.

Table 11: Profile of services accessed by survey respondents

Type of service	Count	%
Collaborative research project	16	41%
Technical services on fee for service basis	14	36%
Advice/knowledge transfer	12	31%
Full services contract	11	28%
Facilities rental	7	18%
Other	4	10%
Technology or software license	2	5%

Note: The sum of % exceeds 100% and the count exceeds the survey population count (n = 39) because this question allowed for multiple selections.

Consultations with international organizations

Representatives from organizations in the area of ocean, coastal and river environments were consulted to support the assessment of relevance and portfolio efficiency (e.g., best practices in the maintenance of scientific competencies and infrastructure, project management processes). The sample of comparable international organization was provided by OCRE management on

the basis that they provided similar services to OCRE. Five organizations were targeted, including:

- **Marintek** (Norway; see https://www.sintef.no/en/marintek/)
- **Maritime Research Institute Netherlands - Marin** (Netherlands; see http://www.marin.nl/web/show)
- **Hamburg Ship Model Basin – HSVA** (Germany; see http://www.hsva.de/)
- **SSPA** (Sweden; see http://www.sspa.se/)
- **Force Technology** (Denmark; see http://forcetechnology.com/en)

In order to elicit participation in the study, representatives from each of the comparator institutes were contacted by the OCRE General Manager via email informing them of the evaluation. Of the five organizations, two agreed to participate - Marintek and Marin.

Prior to holding consultations with the international organizations, web-based searches were used to gather publicly available information on each of the organizations. During the phone consultations, participating organizations were asked to validate the information and/or to fill in missing information as well as answer various interview questions related to OCRE's relevance, performance, and best practises used by their organization for project management as well as maintaining appropriate scientific competencies and infrastructure.

C.2 Limitations and Challenges

Various limitations and challenges were experienced in conducting the evaluation of OCRE that need to be taken into consideration when interpreting the findings.

- **Clients that were competitors and potential clients were not included in the evaluation scope:** Due to the nature of OCRE's relationship with certain OCRE clients (i.e., Oceanic Consulting Corporation, C-Core, and Memorial University) as well as potential clients, the evaluation team was not granted permission to consult with these external stakeholders. As a result, conclusions drawn around OCRE's uniqueness versus duplication with the private sector were not based on representative views from the complete ecosystem within which OCRE operates. Likewise, conclusions drawn around OCRE's ability to meet industry needs were based only on those organizations that OCRE had served and addressed their needs. This limitation was partially mitigated by drawing on the views of third party external stakeholders around OCRE's uniqueness versus duplication with the private sector and the extent to which OCRE met the needs of the industries it was targeting.
- **Inability to look at OCRE hosted programs as part of the evaluation scope:** The evaluation was conducted at the portfolio level. On request of the NRC Engineering Division VP, OCRE-hosted programs were scoped out of the evaluation. This made assessing the need for OCRE difficult as the industries that OCRE works in and clients it targets / serves are shaped by its programs. Likewise, it made assessing the impacts of OCRE's work difficult as it is through program activities that portfolio outcomes are achieved. Finally, the inability to consider programs created challenges assessing OCRE's client engagement strategy as the strategies originate at the program level. The inability to consider OCRE-hosted programs in the evaluation may have limited the depth and value-added of evaluation findings related to relevance and the achievement of outcomes.
- **Completeness of client / collaborator data in nBoss:** The evaluation team was unable to access complete client contact information from the centralized NRC CRM,

nBoss. As a result of inadequate record keeping within this centralized system (due in part to the fact that the system was offline for a year as a result of the cyber intrusion and had only recently come back online), the evaluation team had to rely on the portfolio to create a list of its clients contact information. This added some delays to the original evaluation timeline and required additional work on behalf of the portfolio.

- **Interviews as a primary line of evidence and potential response bias of client interviewees**: Interview evidence is based on personal perceptions of a select group of interviewees. Because client interviewees were selected based upon a list of the top revenue-generating clients of OCRE, and in collaboration with OCRE management, this could bias interviewees towards those who have a more positive view of OCRE. As a mitigation strategy, interview results were verified against findings from other lines of evidence. Clients were also encouraged to provide feedback that would help NRC to improve the program and were reminded about the anonymity of their responses.

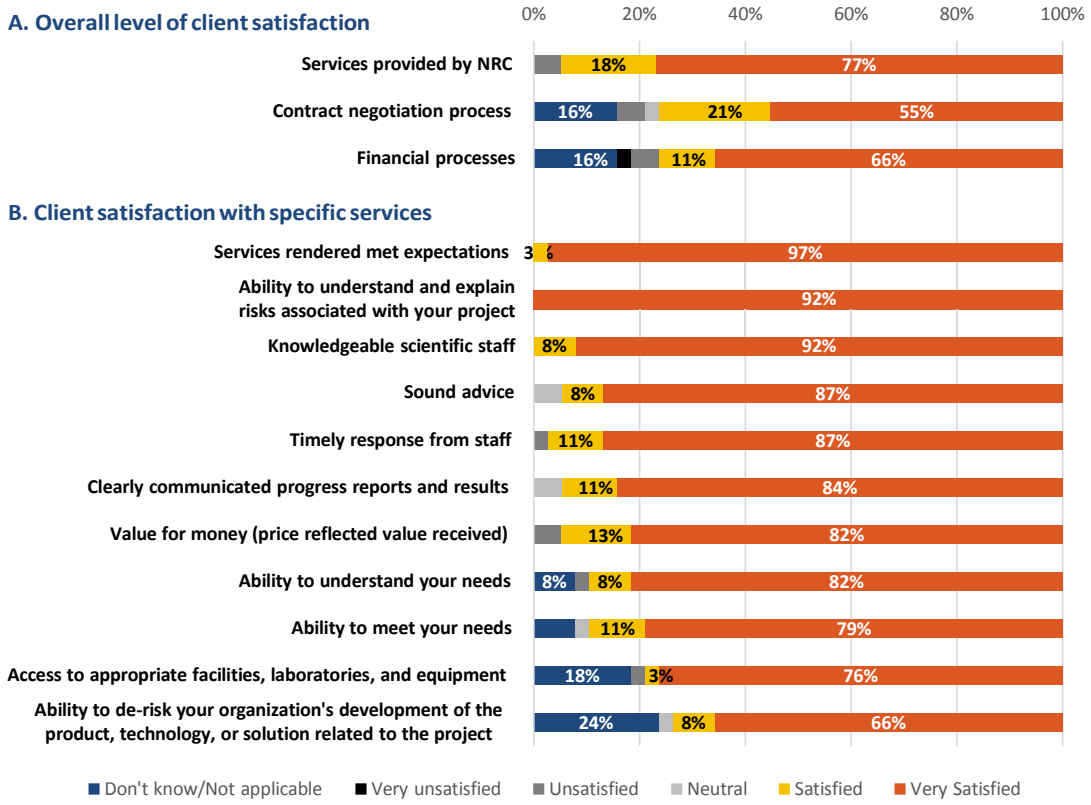
Appendix D: Additional Figures

Table 12: OCRE's revenues by OGD client (2012-13 to 2014-15)

Organization	2013		2014		2015		Change
National Defence	$1.98M	*35%*	$1.96M	*40%*	$0.66M	*21%*	-$1.32M
Fisheries and Oceans Canada	$1.31M	*23%*	$1.00M	*20%*	$0.17M	*5%*	-$1.14M
Natural Resources Canada	$1.52M	*27%*	$1.24M	*25%*	$0.85M	*27%*	-$0.67M
Indigenous and Northern Affairs Canada	$0.23M	*4%*	$0.07M	*1%*	$0.01M	*0%*	-$0.22M
Environment Canada	$0.19M	*3%*	$0.23M	*5%*	$0.17M	*5%*	-$0.01M
International Joint Commission	$0.05M	*1%*		*0%*	$0.16M	*5%*	$0.12M
Public Works and Government Services Canada	$0.12M	*2%*	$0.11M	*2%*	$0.54M	*17%*	$0.41M
Transport Canada	$0.20M	*4%*	$0.23M	*5%*	$0.62M	*20%*	$0.42M
Other	$0.10M	*2%*	$0.10M	*2%*	$0.00M	*0%*	-$0.10M
TOTAL	**$5.69M**	***100%***	**$4.93M**	***100%***	**$3.18M**	***100%***	**-$2.52M**

Source: OCRE financial data

Figure 5: (A) Overall level of client satisfaction for the services provided by OCRE, contract negotiation and financial processes, and (B) client satisfaction with specific aspects of OCRE services



Source: Client survey; n = 39

Table 13: Role of OCRE in client outcomes

Client outcome	# and % of clients who reported outcomes		Extent to which OCRE played a role in achieving the outcome				
			Minimal	Somewhat of a contribution	Significant	Vital	Don't know
Improved or newly introduced code, standard, or regulation	**5**	**13%**	0%	**0%**	**60%**	**40%**	0%
Launched new products/services	**4**	**11%**	0%	**25%**	**0%**	**75%**	0%
Increased overall valuation	**4**	**11%**	0%	**50%**	**25%**	**25%**	0%
Increased/enhanced manufacturing capabilities	**1**	**3%**	0%	**0%**	**0%**	**100%**	0%
Increased sales	**1**	**3%**	0%	**0%**	**100%**	**0%**	0%
Created new jobs	**1**	**3%**	0%	**0%**	**0%**	**100%**	0%
Other (**)	**4**	**11%**	0%	**0%**	**50%**	**50%**	0%
No impacts noted	***4***	***11%***	*NA*	*NA*	*NA*	*NA*	*NA*

Source: Client Survey; n=39

Note: Other outcomes reported included: verification of numerical work, reduced liability and enhanced design, design validation, and technical assessment and evaluation.

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[46]See for example: Procca, A. (2008). Development of a project management model for a government research and development organization. *Project Management Journal*, Vol. 39, No. 4, 33-57

[47] Ibid