Senate Standing Committee on Economics
ANSWERS TO QUESTIONS ON NOTICE
Department of Industry, Science, Energy and Resources
Inquiry into Australia's Oil and Gas Reserves
20 August 2021

AGENCY/DEPARTMENT: DEPARTMENT OF INDUSTRY, SCIENCE, ENERGY AND RESOURCES

TOPIC: QoN 1: Report by ACIL

REFERENCE: Question on Notice (Hansard, 20 August 2021, Page 3)

QUESTION No.: 1

Senator PATRICK: I'll maybe invite Senator Small to vote for my amendment to the OPGGSA act on Monday or Tuesday, which has a transparency flavour to it. Can that report by ACIL be provided to the committee, please?

Ms Illman: I'm happy to take that on notice, if you'd like.

Senator PATRICK: Is there any issue that you think would arise in relation to that?

Ms Illman: I don't think so. We are working through it from a policy perspective. We're just using it to inform our policy paper at the moment, so we're working through it.

ANSWER

In 2020, the department entered a contract with ACIL Allen to produce the 'Offshore Resources Information Regime – Review of Policy and Regulations' (the report). At the time, it was intended for the report to not be publicly released and for the report to be provided on a commercial in confidence basis. This was to ensure a comprehensive consideration and understanding of any issues or opportunities could occur by stakeholders being comfortable to provide frank feedback and views on the regulations that would not be made publicly available or publicly attributable to a company or individual to inform advice to government.

The report is only intended to inform the department's policy development and does not represent the views of the department nor the government.

Noting the report contains third party confidential information, including from ACIL Allen, redactions of confidential third party information have been applied to the attached copy of the report where such information:

- was provided to ACIL Allen by stakeholders on a confidential basis;
- relates to or identifies specific companies, individuals or areas; or
- could not be readily sourced by ACIL Allen from a publicly available resource.

REPORT TO
DEPARTMENT OF INDUSTRY, SCIENCE, ENERGY AND RESOURCES
21 DECEMBER 2020

OFFSHORE RESOURCES INFORMATION REGIME:

REVIEW OF POLICY AND REGULATIONS

CONTRACT NO. 18960

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Background

The *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations) are due to sunset on 1 April 2024, in accordance with the Australian Government's legislative sunsetting policies. Looking ahead, the Department of Industry Science, Energy and Resources (DISER) commissioned ACIL Allen Pty Ltd (ACIL Allen) in July 2020 to review the information aspects of the RMA Regulations, including amendments since 2011.

The intended outcome of the review articulated in DISER's statement of requirement is provision of sufficient information to enable DISER to formulate a revised policy and regulatory framework that would:

a) be fit-for-purpose, now and into the future and be able to withstand technological advancements
b) be streamlined where appropriate, and clearly articulate requirements
c) align with international leading practice in geoscience data submission and release
d) make data made publicly available as early as possible, aligned with the Australian Government's open data policy, while maintaining an appropriate balance between commercial and public interests
e) enable all government data users to have efficient access to the data once submitted
f) stimulate exploration investment
g) correct any technicalities that are limiting efficient and effective data regulation and management
h) align greenhouse gas and petroleum data requirements, where appropriate.

ACIL Allen's Approach

ACIL Allen nominated policy assessment criteria and principles of policy analysis that are widely accepted in the economics literature. They are consistent with those specified in the Australian Government's regulatory assessment guidelines designed to promote leading-practice regulation.

The criteria are effectiveness, economic efficiency, administrative efficiency, and equity or fairness. Key principles are:

- careful design of policy instruments to target specific problems or objectives
- deployment of multiple policy instruments to minimise trade-offs between multiple targets
- consideration of effects of each policy instrument on all targets to allow for interactions
- comparative consideration of policy options, including packages of policy instruments
- selection of the policy package expected to provide the greatest excess of benefits over costs.

ACIL Allen undertook a detailed review of the international literature on economic bases for information policy (chapter 3). This review identified circumstances in which markets fail to allocate resources efficiently because of the public good aspects of information and asymmetric (uneven) availability of information. It found that such information market failures are common in the sub-surface resources sector.

ACIL Allen also reviewed the literature on various information policy instruments for the sub-surface resources sectors (reflected in chapters 6-8). A comparative review of government information-capture-and release regimes in selected domestic and international jurisdictions was undertaken (chapter 5). A consultation process was conducted to support ACIL Allen's research activities, and to gain an understanding of the perspectives of entities engaged in petroleum exploration and exploitation, assessment of greenhouse gas storage opportunities, and management of information for government. [redacted]

ACIL Allen analysed information policy options for sub-seabed resources by reference to the nominated policy assessment criteria and principles of policy analysis. The analysis included coverage of the important matter of interactions between information policy represented by the RMA Regulations and other policy settings relating to sub-seabed resources.

Close-Scrutiny of RMA Regulations

The RMA Regulations were scrutinised forensically, having regard to the nominated policy assessment criteria and principles of policy analysis and the investigation of economic bases for information policy. This scrutiny was aided by insights from the consultation process.

Scrutiny of the RMA Regulations revealed anomalies, inconsistencies, oversights, unnecessary complexities, and perverse outcomes arising from the drafting and administration of the RMA Regulations. In addition, this investigation highlighted the need to revisit policy issues underlying the RMA Regulations. Matters requiring attention have been documented in chapters 4 and 6.

Interjurisdictional Comparison of Information-Capture-and-Release Regimes

ACIL Allen reviewed information-capture-and-release regimes in selected petroleum producing jurisdictions in Australia and internationally. A comparative summary has been compiled (chapter 5).

The comparison revealed:

- similar general frameworks involving
  - capture of information generated by private sector operators and release of most of it with significant to substantial lags
  - release of non-exclusive data with a much longer lag than exclusive information
- unavailability of published, reasoned rationales for exclusive information being released significantly or substantially later than a reasonable time for submission of raw and interpretative information
- some explanations of long lags in releasing non-exclusive information, but they are typically terse, vague, and unconvincing
- time lags apparently based on what other jurisdictions have done, rather than on any analysis of the economics of exploration and assessment, and the economic characteristics of information
- consequent domestic and international convergence on information release rules that lack a solid analytical foundation.

Analysis of Information-Capture-and-Release Policy

ACIL Allen thoroughly analysed alternative formulations of information-capture-and-release policy (chapter 6). The analysis took account of the important matter of the context provided by policy instruments that interact with information-capture-and-release policy (chapters 6-8).

A sound economic justification could not be found for retention of the practices of supporting permanent confidentiality of some forms of exploration/assessment information and delays to public release of other information beyond the elapse of sufficient time for explorers to analyse and interpret data, and write-up the results. These practices sanction withholding of information from entities that could use it productively, and provide an unnecessary, inefficient, and redistributive competitive advantage to the creator of the information. The finding that delays to public release of information are not economically justifiable is dependent on an assumption that government does not constrain itself to using other policy instruments that interact negatively with an information-capture-and-release regime, rather than deploying complementary policy instruments.

Prompt release of all exploration information would not deprive a holder of an exclusive title the ultimate competitive advantage in the form of an exclusive right to explore in the title area, and a prior right to apply for a lease to exploit or hold resources therein. Therefore, the generator of information in respect of a title has an exclusive right to gain from information specific to that title. Delaying release of information would provide a further reward to the creator of the information: an information advantage in pursuing exclusive titles over similar prospects. The cost is the resource misallocation associated with external costs of asymmetric information and reduction of benefits to the community from the public good nature of exploration information.

Exclusions and delays in release of information deprive the exploration/assessment sector of the public good of information, and encourage activity directed towards gaining an informational advantage in acquiring or applying for additional tenements. Concern that exploration might be sub-optimal because explorers would not be able to capture all benefits of their activities should be ameliorated by two factors. First, the benefits explorers would be prevented from capturing by a policy of exclusions and delays are economically undesirable asymmetric information advantages in respect of areas over which they do not have title. Benefits in relation to their own titles are not affected. Second, explorers would benefit from the activities of all others, not just sacrifice benefits to them.

A policy of government capture and prompt release of private exploration information would improve the efficiency of resource allocation by correcting information market failures. The supporting analysis in chapter 6 also provides an economic justification for application of the Australian Government's public data policy to information collected from private sector petroleum and greenhouse gas activity in offshore areas.

A policy of government capture and prompt release of private exploration information is best suited to addressing information market failures after early-stage exploration in frontier (minimally explored) areas. To ensure that the improvement in efficiency achievable by information policy is as large as possible, it should be packaged with complementary instruments, rather than deployed as a stand-alone mechanism. It is particularly important to complement it with policy instruments more suited to addressing information market failure in frontier areas. The obvious complementary policy is government funding of early-stage exploration in minimally explored areas.

The strength of the arguments for government capture and early release of privately generated exploration information and packaging such a regime with other information policies depend critically on the context provided by the titles regime. This important point should not be overlooked in formulation of government policy.

The preferred policy package, which assumes no constraints on policy selection, could be described as "leading practice" or "first best". It would involve:

- comprehensive capture of private sector petroleum and greenhouse gas storage information, followed by prompt release of that information (analysed in chapter 6)
- government funding of early-stage exploration in relatively underexplored areas (analysed in chapter 7)
- cash bidding for relatively unconditional titles (analysed in chapter 8).

The second and third of these policy instruments strongly complement the first. They improve the performance of information policy in terms of effectiveness, economic efficiency, and equity. They also improve performance of offshore policy more generally.

If policy makers decide to eschew the "leading-practice" or "first-best" policy instruments of government funding of early-stage exploration in relatively unexplored areas, and choose to retain a

highly inefficient work-bid titles regime instead of cash bidding for relatively unconditional titles (chapter 8), they would have to resort to a distant "second-best" information policy. This is policy that targets improving the efficiency of resource allocation in the context of policy constraints.

If the Government is not prepared to support a solid program of early-stage exploration (including seismic work) in relatively underexplored areas, there may be a case for encouraging market formation as a "second-best" policy initiative. Allowing long confidentiality periods for data produced for sale to multiple clients is not a good substitute for government exploration programs in relatively underexplored areas, but in a hybrid regime with prompt release of other information, it is likely to be better than nothing.

An additional "second-best" argument in favour of support for formation of a seismic information market may derive from government unwillingness to replace its work-bid titles regime with an economically more attractive cash-bid system (explained in chapter 8). In those circumstances, encouraging a seismic information market would help moderate the tendency of the work-bid titles regime to dissipate the value of information provided free by information policy instruments. It does so by pricing information, which means its value on a cost basis is not reflected in the expected nett value of potential resources that a work bidder is seeking to capture. It is only a partial solution and one that is greatly inferior to titles policy reform, but it could be better than providing all information free in conjunction with a work-bid titles system. So, again it may offer a distant "second-best" outcome in the context of a policy constraint.

A "second-best" information-capture-and release regime would involve supporting a lengthy confidentiality period for information generated for sale to multiple clients under an efficient pricing arrangement, but prompt release of other information. It would still be based on comprehensive capture by government of privately generated exploration/assessment information.

Regardless of the choice made between the preferred and distant "second-best" policies, substantial reforms to the current information-capture-and-release regime would be required to deal with specific deficiencies of the regime highlighted in chapter 4. These deficiencies include anomalies, oversights, unnecessary complexities, and perverse outcomes. The responses could be described as nitty gritty reforms to distinguish them from overall "leading-practice" and "second-best" policy packages. Some nitty gritty reforms will differ between the two overall policy choices, but the majority will be applicable in both cases.

Nitty Gritty Reforms that Differ between Overall Policy Packages

In the preferred package, information that has been comprehensively captured would be released promptly (allowing a reasonable time for checking of quality and comprehensiveness by government), with some minor exceptions.

In the "second-best" package, the concepts of "non-exclusive" and "exclusive" information would be retained from the current information-capture-and release regime. However, a loophole would be closed that currently provides an opportunity for reclassification of exclusive information as non-exclusive information. This would require a market test (and perhaps market regulation) to ensure that information has been generated for sale to multiple clients and that the pricing regime is an economically efficient one.

Geophysical service providers generating information for sale on a multi-client basis should be required to submit basic and interpretative information ,as is already required under the RMA Regulations. Capture of this data should not be left to title conditions on purchasers of data.

Geophysical service providers should be required by regulation to make and submit 5x5 km^2 2D extracts from 3D data. Submission should not be reliant upon the imposition of a title condition. This data should be released after five years, as would be the case if it is submitted as a condition of a title.

Data that is purchased from geophysical or other service providers should be required by regulation to be submitted, unless it has already been submitted by a geophysical service provider. Also, any subsequent interpretation should be required by regulation to be submitted. At present, these are submitted only if required as a condition of a title.

Any non-exclusive data purchased by a holder of an exclusive title to meet a work program commitment should be subject to the release timeframes applicable to exclusive information generated in respect of that to that title (overriding the confidentiality period for multi-client data). Geophysical service providers would have the option to price that data to reflect the reduced confidentiality period.

The confidentiality period for basic data generated for sale to multiple clients should be reduced from 15 years to 10 years. This would be consistent with the confidentiality periods sanctioned by Norway and Canada offshore.

The confidentiality period in the regulations for interpretative reports based on non-exclusive data is substantially shorter than for the basic non-exclusive data. This should be enforced. At present, these reports are not released until the basic data is released.

Formalised arrangements should be put in place to enable government to use non-exclusive data once submitted (but prior to public release), provided the source is acknowledged and the raw data remains confidential.

Nitty Gritty Reforms Common to Overall Policy Packages

Numerous desirable reforms of a nitty gritty nature that are common to both of the overall policy packages have been identified from the results of detailed scrutiny of the RMA Regulations set out in chapter 4. The issues are discussed in detail in chapter 4. The proposed reforms are outlined in chapter 9 and summarised in **Table ES 1** below.

Many of these nitty gritty reforms relate to desirable reductions in the prescriptiveness and complexity of the RMA Regulations. Others relate to more comprehensive capture of information, improvements to quality control of information submitted, removal of outdated data formatting requirements, and adoption of a more common-sense approach to management of samples.

TABLE ES 1 NITTY GRITTY REFORMS COMMON TO PREFERRED AND SECOND-BEST PACKAGES

Problem	Location in Regulations	Reform
No overall objective for information management	Omission	Insert information management objective, drawing on *Natural Resources Statement* and policy criteria and principles in chapter 2, eg, *"Manage offshore petroleum and greenhouse gas storage information to facilitate exploitation of those resources for the greatest achievable benefit of all constituents of the Australian community"*.
Highly prescriptive and complex	Throughout	Regulations to be more objective- or performance-based and less complex by casting a wide net to capture information and giving discretion to NOPTA. Reduce number of different submission and release categories and adopt uniform principles of submission and release. Prompt release of most information.
Important information not captured	Omissions	Capture important overlooked information, such as reprocessed survey data, bathymetry and water column data, regional survey data, information generated pursuant to Good Standing Agreements, and information supporting nominations of areas for release for bids.
Inadequate control of quality and completeness of data submitted – data often incomplete and better data withheld	Omissions	NOPTA or GA to review material submitted. Power to apply stiff sanctions if data withheld or quality is poor.

Problem	Location in Regulations	Reform
Submission times highly variable and inconsistent and apparently not underpinned by a consistent principle	Regulations 7.11 to 7.20 and 9.11 to 9.23	Submission times to be reviewed and determined by reference to practicalities of preparation of suitable material.
Unnecessarily delayed release of data economically undesirable as explained in chapter 6	Regulations 8.01 to 8.16 and 10.01 to 10.06	Prompt release of most information, exceptions being financial resources and personal details (for the second-best reform package only, another exception is a lengthy confidentiality period for data for sale to multiple clients at an efficient price). Concept of prompt release allows sufficient time for review of comprehensiveness and quality of data.
Ownership of data not addressed	Omission	After generation, data should be the property of government with usage licence granted to generator.
Inconsistencies between petroleum and greenhouse gas storage	various locations	Align except for requirements irrelevant for one case or the other and technical differences warranting different requirements.
Retention of data/samples	Regulations 7.01 to 7.10 and 9.01 to 9.10	Hold duplicates of data/samples submitted to government for 12 months. On title relinquishment, submit all data/samples and release them after quality review. Samples/data can be stored and analysed offshore without approval, provided already submitted to NOPTA, with final reports on outcomes of analyses to be submitted within period to be determined on practical grounds, as for other information.
Data formats/media out of date	Schedules 1 to 5	Regulations to be performance-based and supported by guidelines to provide certainty, while retaining discretion and flexibility to move with changes in technology.

SOURCE: ACIL ALLEN ANALYSIS

1 INTRODUCTION

On 25 May 2020, the Department of Industry, Science, Energy and Resources (DISER) released a Request for Tender (RfT), including a statement of requirement, in respect of a review of Parts 7-10 and Schedules 1-5 of the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations) and underlying policy settings. These Parts and Schedules of the RMA Regulations relate to information management.

The Commonwealth legislation providing for management of petroleum resources and greenhouse gas storage sites and activities under Australian authority beyond coastal waters is the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act). Various regulations made under the OPGGS Act set out the framework for managing these resources and sites.

One set of such regulations, the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations) will cease to have effect (sunset) on 1 April 2024. DISER plans to have new RMA Regulations in effect by this date.

ACIL Allen Pty Ltd (ACIL Allen) was engaged by DISER to review of the information aspects of the RMA Regulations, as outlined in the statement of requirement in the RfT. This report presents details and results of ACIL Allen's comprehensive review. They include recommendations to help with formulation of an improved information management regime that will help ensure that the nett value of resources owned by the Australian community is maximised and the community is able to obtain a reasonable share.

This report is divided into 9 chapters as follows.

- Chapter 2 describes ACIL Allen's approach to the review. The objective underpinning the need for this review is highlighted, before guiding principles for the analysis are presented. A high-level summary of ACIL Allen's methodological approach is presented.
- Chapter 3 provides important contextual information regarding the economic bases for information policies. This helps guide the review of the existing information management regulations and underlying policy settings.
- Chapter 4 summarises Parts 7-10 and Schedules 1-5 of the RMA Regulations that frame an information-capture and-release regime. ACIL Allen highlights deficiencies of these regulations.
- Chapter 5 presents ACIL Allen's comparative review of how domestic and international jurisdictions are managing their information capture and release regimes with respect to petroleum resources.
- Chapter 6 thoroughly analyses alternative formulations of information-capture-and-release policy. The analysis takes account of the important matter of the context provided by policy instruments that interact with information-capture-and-release policy.
- Chapters 7 and 8 undertake detailed analysis of policy instruments that interact with information-capture-and-release policy: government funding of early-stage exploration, and titles regimes.
- Chapter 9 concludes by presenting key findings and recommendations.

2 ANALYTICAL APPROACH

Key Points

- Guiding principles for the Review have been established having regard to:
  - the Governments' objectives for exploration and extraction industries
  - economic justifications for government intervention
  - widely accepted policy criteria and principles of policy analysis
  - the concept of leading-practice regulation
  - the Government's public data policy
  - the statement of requirements for the Review.
- Elements of the analytical approach to the review have been outlined.

2.1 Australian Government's Objective

The Australian Government's *Natural Resources Statement* in February 2019 articulated the Government's objectives for the mineable resources (including petroleum exploration and extraction) sector. It observed that sub-surface resources belong to the community and stated that they should be exploited for the benefit of all its constituents.

This involves two steps. First, it implies that the realised nett value of mineable resources should be maximised. Second, the maximised value should be captured to benefit the community.

Maximising the realised nett value of mineable resources means using all resources – capital, labour (including intellect), and natural resources – efficiently. This would not occur if there are impediments to markets working properly (market failures). Pertinent examples are the inability of markets to make sufficient information available and to make it uniformly accessible to all interested parties. Also, resources would not be used efficiently to the detriment of maximising the realised nett value of mineable resources if sufficient care is not taken by government when it attempts to capture benefits of exploitation of mineable resources for the community (policy failures).

Guiding principles for dealing with such impediments to the Government's objective of exploiting mineable resources for the benefit of all in the community are set out in the next section. These principles have a solid economic foundation. They have been cited by the Government on many occasions.

2.2 Guiding Principles

2.2.1 Economic Justifications for Government Intervention

In the economics literature, a necessary condition for government intervention in economic affairs is the occurrence of at least one of:

- market failure
- policy failure
- inequity or unfairness.

Market failure refers to circumstances in which unfettered markets fail to allocate resources efficiently. Examples of market failure include under-provision of valuable information, under-provision of other public goods, uneven distribution of information (asymmetric information), exercise of market power, and environmental harm imposed on society by entities without compensation.[1]

Policy failure refers to circumstances in which government intervention to address perceived inequity, market failure, or some other situation has adverse effects on the efficiency of resource allocation in the economy.[2] These are typically unintended consequences of intervention that has been poorly designed. Examples of policy failures include creation of market power by government action, restrictions on the availability of information that is useful for economic activity, a titles (tenement) regime that dissipates the value of information imbedded in natural resources (as well as the nett value of natural resources, often called resource rent), and interventions that involve administration (monitoring, enforcement, and compliance) costs that are large relative to achievements.

Inequity or unfairness refers to circumstances in which individuals are judged not to be treated reasonably or in an even-handed way. Often, such circumstances relate to the distribution of income and wealth. An example associated with generation and dissemination of information on offshore resources and related activities is that asymmetric information gives some entities advantages over others in gaining access to resources. Also, asymmetric information may lead to dissipation of resource rent, particularly disadvantaging those with inferior access to information, and undermining returns to the community through the petroleum resource rent tax and income tax. These occurrences violate the benefit principle of equity outlined below.

The identification of one or more of the necessary conditions for intervention is not sufficient to justify government intervention. It also needs to be shown that the social benefits of intervention to correct the problem exceed the social costs. Moreover, the selected form of intervention should be the policy instrument or package of instruments that yields that largest surplus of social benefits over social costs.

2.2.2 Criteria for Policy Assessment and Formulation

Consistent with the justifications for government intervention outlined above, ACIL Allen's review of information management aspects of the RMA Regulations and consideration of policy options to improve the information policy and supporting regulatory framework has been undertaken by reference to four core criteria:

- **effectiveness** – the extent to which a policy instrument or package of instruments is suited to achievement of specified objectives
- **economic efficiency** – the extent to which resources (including petroleum resources and greenhouse gas storage sites) are allocated efficiently in the economy and the extent to which a policy instrument or package of instruments can improve the efficiency of allocation of resources (provide the community with more of what it wants from available resources)
- **administrative efficiency** – an aspect of economic efficiency focussed on containing costs of complying with, monitoring, enforcing and otherwise administering a policy regime, and generally achieved through avoidance of complexity

[1] These occurrences were listed as examples of market failure in the *Australian Guide to Regulatory Impact Analysis* (Australian Government, 2020b, pp. 24-25) and in the Productivity Commission's report on *Resources Sector Regulation* (Productivity Commission, 2020, pp. 92-93).

[2] Policy failures usually are referred to as government failures in the economics literature. The Productivity Commission (2020, pp. 94-95) referred to this concept without attaching a label to it.

- **equity or fairness** – treatment of individuals fairly, relative to others, a matter requiring a value judgement
  - sometimes discussed by reference to the *ability to pay principle* of equity (poorer individuals should get a better deal from government than richer individuals)
  - alternatively considered by reference to the *benefit principle of equity* (those who benefit from natural resources owned by the community or who benefit from the activities of government or society should pay in accordance with benefits received).

These core criteria have become widely accepted by economists as bases for analysis of government intervention, and assessment and design of policy proposals and instruments. They have also been adopted and applied by governments around the world. In Australia, they have been applied in many government-sponsored taxation and other policy reviews over the past 50 years, including reviews linked to the exploration and mining (incorporating petroleum extraction) sector.[3] It is relevant that they have been nominated as criteria in current regulatory assessment guidelines published by the Australian Government.[4] Economic efficiency is particularly prominent in those guidelines.

The criteria imply that:

- an effective policy is preferable to an ineffective one, subject to satisfaction of other criteria
- the benefits of government intervention should exceed the costs (indicating an improvement in the efficiency of resource allocation)
- distributional effects of intervention should be considered in conjunction with the efficiency effects or aggregate nett benefits.

2.2.3 Principles of Policy Analysis

There are widely accepted principles for formulation of policy initiatives that should frame the application of analytical criteria outlined above.[5]

- Policy instruments should be carefully designed to target specific problems or objectives.
- Multiple targets require the deployment of multiple policy instruments – at least one instrument for each target – to minimise the need for trade-offs between achievement of different targets.
- Each policy instrument may affect the achievement (positively or negatively) of more than one objective or issue, not just the one to which it has been assigned, and this needs to be considered when policy packages are formulated.
- Various policy options should be assessed comparatively, and in well-designed packages, rather than in isolation.
- The selected form of intervention should be the policy instrument or package of instruments that provides the greatest excess of benefits over costs.

These principles are important when there are multiple impediments in the form of market failures and policy failures because:

- deployment of insufficient policy instruments means trade-offs between objectives will be required
- impediments to efficient allocation of resources may interact and policy instruments targeting those impediments may also interact
- targeting of all relevant issues together helps avoid perverse economic outcomes (or adverse unintended consequences)
- the best package is preferable to another package that improves on the *status quo*.

The Australian Government's (2020b) regulatory assessment guidelines covered only a sub-set of the principles nominated above. Specifically, those guidelines (p. 28) emphasised the importance of:

- comparative assessment of a wide range of relevant policy options
- selection of the policy option that offers the greatest excess of benefits over costs (largest nett benefit).

[3] For example, see Industry Commission (1991), Henry, et al (2010), [redacted] and Productivity Commission (2015).
[4] Australian Government (2020b); Australian Government (2007).
[5] These principles can be traced back to Jan Tinbergen (1952, 1956) and Bent Hansen (1955).

Similarly, the Productivity Commission's (2020) concept of leading practice regulation for the exploration and extraction sector encapsulated only part of the set of principles nominated above. It offered (p. 92) the following description of the concept:

"Leading practice requires that regulations maximise nett benefits to the community, with the cost to governments of administering regulations, and to firms of complying with them, being the minimum necessary to achieve policy objectives."

2.2.4 Criteria and Principles for Leading Practice Regulation

The criteria and principles nominated by ACIL Allen were selected to guide identification, assessment, and formulation of leading-practice regulation (often labelled best-practice regulation). The criteria are consistent with those nominated in the Australian Government's (2020b) regulatory assessment guidelines and the Productivity Commission's (2020) draft review of resources sector regulation. However, the principles nominated by ACIL Allen have a broader analytical scope. This explicitly allows for analysis of negative and positive interactions between policy instruments. These interactions can result in unanticipated consequences. Consequently, neglecting policy interactions could result in a misleading assessment of policy regimes, and recommendation of a policy and regulatory package that would not qualify as leading practice.

2.2.5 Policy Targets for Revision of Information Management Aspects of RMA Regulations

The Statement of Requirement for this assignment nominated several targets for a revised policy and regulatory framework for government collection and release of exploration information:

- align with international leading practice in relation to provision of geoscience data to government and subsequent release of information
- make data publicly available as quickly as possible, consistent with the Government's open data policy, while maintaining an appropriate balance between public and commercial interests
- enable all government users of relevant data to have efficient access to information once it has been submitted
- stimulate exploration activity and investment
- be fit for purpose over time, and able to accommodate technological changes
- be appropriately streamlined, while clearly articulating requirements
- address issues that are limiting efficient and effective regulation and management of relevant information, such as submission requirements without corresponding release provisions
- align requirements for information relating to greenhouse gas and petroleum to the extent that it is appropriate.

The targets have been grouped above to reflect two underlying themes. The first four targets are consistent with pursuit of an objective of improving the efficiency of allocation of resources. The last four targets are consistent with pursuit of an objective of improving administrative efficiency, which contributes to the former objective.

2.2.6 Implications of Public Data Policy Statement

On 7 December 2015, the Australian Government released a *Public Data Policy Statement* as part of a National Innovation and Science Agenda. The statement observed that open access to information (other than information that would breach privacy laws or security requirements) is desirable because it stimulates research, innovation, and improvements to productivity. This suggested that such a policy would improve the efficiency of resource allocation.

The Australian Government (2015, p. 1) also stated:

"The data held by the Australian Government is a strategic national resource that holds considerable value for growing the economy, improving service delivery and transforming policy outcomes for the nation. The Australian Government recognises the importance of effectively managing this national resource for the benefit of the Australian people. The Australian Government commits to optimise the use and reuse of public data; to release non-sensitive data as open by default; and to collaborate with the private and research sectors to extend the value of public data for the benefit of the Australian public. Public data includes all data collected by government entities for any purposes, including

government administration, research, or service delivery. Non-sensitive data is anonymised data that does not identify an individual or breach privacy or security requirements."

This position was reiterated in the Government's response (Australian Government, Department of the Prime Minister and Cabinet, 2018) to the Productivity Commission's (2017) inquiry report on *Data Availability and Use*. At the time of release of this response, Michael Keenan (the Minister Assisting the Prime Minister for Digital Transformation), and Michael Shuker (Assistant Minister to the Treasurer) stated (Keenan, Shuker, 2018):

"Australia's data is an important national resource which, when used correctly, can greatly assist consumers, researchers, government agencies, and industry to better understand the world we live in and to make sound investment decisions based on evidence. But too often, the Productivity Commission found that unnecessary barriers to data access were stifling innovation, competition, development and even important research opportunities that could benefit the entire community."

This position was maintained in a consultation paper released with an exposure draft of a Data Availability and Transparency Bill 2020 (Australian Government, Department of the Prime Minister and Cabinet, Office of the National Data Commissioner, 2020, p.7):

"Releasing data openly, through data.gov.au or other websites, has economic and social benefits, as anyone can access and use this data to analyse, innovate, and develop tools that have public value."

The Australian Government has distinguished between open data release and data sharing. It explained that open data release means making data available to the world at large. Data sharing was described as providing controlled access to the right people for the right reasons with safeguards in place.

The Australian Government explained (Australian Government, Department of the Prime Minister and Cabinet, Office of the National Data Commissioner, 2019, p. 3):

"The open data agenda is already supported by a range of legal mechanisms, but government agencies need support to understand and use them. The National Data Commissioner will work with other government agencies and regulators, including the Australian Information and Privacy Commissioner, to improve guidance on using existing mechanisms to release open data."

The Australian Government also pointed out that the binary approach of closed (confidential) or open data neglects opportunities that data sharing can provide. It said that government agencies should be able to share information safely and consistently for the benefit of all Australians. It has proposed new legislation (*Data Availability and Transparency Bill 2020: Exposure Draft*) to provide legal grounds for government to share public sector data for specified purposes with appropriate safeguards.

Information relating to offshore petroleum and greenhouse gas activity collected by the Australian Government in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations) has been categorised as permanently confidential, temporarily confidential, or open. Under the Government's data release and data sharing policy framework,[6] release of most of the information captured from those undertaking offshore petroleum and greenhouse gas activity would continue to be regulated by dedicated legal instruments, not by the proposed new data-sharing legislation (*Data Availability and Transparency Bill 2020: Exposure Draft*). However, there may be some categories of information currently categorised as permanently confidential or temporarily confidential that could be subject to information sharing arrangements within government or between government and other entities. Indeed, the RMA Regulations allow information sharing within the government sector.

Because much of the information from offshore petroleum and greenhouse gas activity is a product of types of research,[7] and because of market failures in respect of provision of that information (see chapter 3), it appears that it should be categorised as open data under the Public Data Policy. It should also be the subject of the Public Data Policy's expressed intention to "optimise the use and re-use" of the information. Open data and the policy to "optimise the use and re-use" of information are consistent with a policy objective or criterion of improving the efficiency of allocation of resources (see sub-section 2.2.2). The applicability of the Australian Government's Public Data Policy to offshore

[6] See Australian Government, Department of the Prime Minister and Cabinet, Office of the National Data Commissioner (2019, 2020).
[7] This has been explained by Morris Adelman (1970).

petroleum and greenhouse gas information is supported analytically in chapters 6 and 7, using criteria nominated in sub-section 2.2.2.

The analysis in chapters 6 and 7 covers information produced by private sector entities and information generated by activities fully or partially funded by government agencies, respectively. The current and potential roles of Geoscience Australia have been included in the analysis because:

- Geoscience Australia integrates information from its own survey activities[8] and information submitted by private sector entities
- information produced by Geoscience Australia is clearly covered by the Public Data Policy
- Geoscience Australia's information releases are generally highly valued by private sector explorers
- the work of Geoscience Australia complements the activities of private sector entities – each sector providing information that is used by the other sector
- policies on generation and release of information by government agencies complement policies regarding government collection and release of privately generated information.

2.3 Elements of the Analytical Approach

2.3.1 Research

Literature Review

ACIL Allen comprehensively reviewed the literature on the economics of exploration information, market and policy failures impeding the efficient provision and use of exploration information, potential policy instruments to address information market and policy failures, and the economic implications of interactions of these policy instruments with titles regimes. The literature included peer-reviewed books and journal articles, and material produced by government entities and international agencies.

The review process was framed by the policy criteria and principles outlined above that are widely used in economic analysis of policy issues. It was guided by the Statement of Requirements in the RfT for the assignment issued by DISER.

The literature review provided a foundation for:

- an interjurisdictional comparison of regimes for government collection and release of privately generated petroleum and greenhouse gas storage information
- consultations with stakeholders
- identification and analysis of policy options for management of information in an economically sound way.

The final stages of the literature review drew on issues raised in, and insights gained from stakeholder consultation.

Comparison of Regimes Across Jurisdictions

ACIL Allen compared the existing RMA Regulations on information management (outlined in chapter 4) with corresponding regimes identified in comparable international and domestic jurisdictions (outlined in chapter 5). International regimes investigated as part of the review included those applying on the continental shelves of the United States, Canada, Norway, the United Kingdom, and New Zealand. Domestic regimes included in the comparison were those in Western Australia, South Australia, and Queensland.

The inter-jurisdictional comparison of regimes helped guide the identification of issues discussed in the stakeholder consultation process. The regimes were reviewed by reference to policy criteria and principles discussed above as part of the process of identifying what could be considered leading practice.

Stakeholder Consultation

An extensive consultation process was undertaken to:

[8] Geoscience Australia has not been funded to undertake or commission survey work since 2014-15.

- complement the insights of the literature on information economics and policy
- enable a fully informed assessment of information aspects of the RMA Regulations
- facilitate analysis and formulation of recommendations that take full account of stakeholder views.

Consultations were held with [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Face-to-face discussions were held with the aid of video-conferencing facilities. Each session was preceded by provision of a substantial questionnaire with background information to help to provide focus to the consultations. The content of questionnaires differed between categories of stakeholders, and in some cases, between individual stakeholders to allow for their differing circumstances and to focus on issues expected to be particularly relevant to them. Opportunities were provided to stakeholders to address issues that were not anticipated initially.

Entities were given the opportunity to make written submissions before or after face-to-face discussions. They were also provided with opportunities to make group submissions.

[redacted] Key points arising from consultation have been highlighted and addressed in the analysis in subsequent chapters, particularly chapters 4 and 6.

2.3.2 Analysis of Information Policy Issues and Policy Options

The analytical phase of the assignment commenced during the literature review, helped guide the direction of that task, facilitated identification of issues to be discussed with stakeholders, and continued through and after the stakeholder consultation process. Insights gained from the literature review and stakeholder consultation were inputs to the analysis of information policy issues and policy options.

This analysis was undertaken by reference to guiding principles outlined above. The analytical framework was consistent with the technique of quantitative economic analysis known as benefit-cost analysis. This technique is based on the principle of improving the efficiency of the allocation of resources. It should be and usually is supported by distributional analysis to highlight equity or fairness implications of government intervention or some other economic disturbance. This conceptual framework has been the Australian Government's preferred basis for regulatory impact analysis for more than a decade.[9]

The analysis was largely qualitative in nature. This was more appropriate than a quantitative approach because of the complexity of issues relating to the public good of information and asymmetric availability of information, and the budget constraint applying to the review.

The analytical phase had nine steps:

- consideration of potential justifications for government intervention to address market failures, policy failures, and perceived inequities issues associated with generation and dissemination of information regarding resources below the seabed
- identification of policy options, drawing on the literature review, consultations, and consideration of regimes in other jurisdictions
- screening of policy options by reference to the criteria and principles for policy assessment and formulation outlined above

[9] Australian Government (2020a); Australian Government, Department of the Prime Minister and Cabinet, Office of Best Practice Regulation, (2020); Council of Australian Governments (2007).

- formulation and screening of packages of options to address multiple issues, by reference to the criteria and principles
- shortlisting of options with the aid of the screening processes
- detailed comparative analysis of short-listed options by reference to the criteria and principles
- undertaking the detailed analysis in the context of other aspects of policy relating to sub-seabed resources to investigate the consequences of account interactions (complementarities and conflicts) between policy measures
- identification of the regime expected to represent leading practice, the one assessed to provide the largest surplus of benefits over costs
- provision of recommendations on how the current framework could be improved and transitioned to leading practice.

3 ECONOMIC BASES FOR INFORMATION POLICIES

Key Points

- A thorough review of the economics of information associated with exploration, other assessment, and extraction of resources has been provided.
- Information market failures causing inefficient (economically wasteful) allocation of resources to exploration and other assessment of locations of potential interest have been identified and explained. Key sources of market failure are:
  - public good aspects of information
  - external benefits of information spilling over to parties other than the generator
  - asymmetric (uneven) availability of information.
- The relative importance of various information market failures changes as locations transition from being minimally explored to highly prospective. This has important implications for information policy.
- Exploration information market failures should be considered in the context of relevant alternative exploration rights regimes, not in a vacuum, because they interact. Neglecting these interactions may lead to poor policy selection.
- This chapter provides an economic foundation for policy analysis in chapters 6 to 8.

3.1 Introduction

Exploration, other forms of assessment, production and greenhouse gas storage activities generate information that potentially is commercially and economically valuable. It could reveal:

- the potential to discover viable resources (including structures) in a region and specific locations therein
- the presence or otherwise of viable resources
- the depth, dimensions, and other characteristics of resources *in situ*
- the characteristics of surrounding material
- the potential cost structure of an exploitation operation relative to others.

Information from various activities could reduce uncertainty, guide decisions regarding further exploration or other forms of assessment, and establish an indispensable foundation for geological, other scientific, engineering, and commercial assessment of the feasibility of potential exploitation operations. Information from various activities also could facilitate decisions regarding timing of development, exploitation techniques, scale and configuration of operations, and scheduling of operational activities.

Another potentially important feature of information is that it could help guide decisions in relation to exploration or other assessment of comparable prospects, and similar geological environments,

structures, and targets. This guidance could be useful not only to the generator of the information, but also to other explorers. Information also could be useful to potential financiers of further exploration or other assessment activities, and subsequent exploitation of resources.

In addition, information from various activities is useful to governments as custodians for their constituents of exploitable resources beneath the seabed. They can use available information to guide decisions on where, when, why and how areas are to be made available for applications or tenders for titles allowing exploration or other assessment activities, and in assessing development and production plans and outcomes.

It has been noted in the economics literature that market forces may not ensure that exploration, assessment, and exploitation information is generated and disseminated in ways that are consistent with an efficient allocation of resources. Various sources of this market failure have been identified:

- the public good character of information, particularly from very early-stage exploration and other forms of assessment
- external benefits provided by information spillovers from various activities
- external costs associated with information asymmetries (parties having different information).

These market failures distort the timing, amount, and types of exploration undertaken. The result is misallocation of resources.

A brief summary of key concepts in the economics of information relevant to offshore petroleum and greenhouse gas activity follows. Much more detail is provided in subsequent sections of this chapter for those wanting to delve deeply into the economic concepts and their implications for offshore resources policy.

Information is regarded as a public good because once generated, its use by one party does not prevent it being used by another party. It is said to be non-rival in use. Alternatively, most of the benefits derivable from it can be regarded as potentially external to the generating entity. In contrast, a private good, such as food, is rival in use, meaning that only the consumer benefits from using it.

Information lacks a characteristic that in conjunction with non-rivalry in use would categorise it as a pure public good. The other characteristic is non-excludability, meaning the entity responsible for it cannot exclude others from using it or would have great difficulty doing so (as for national defence, which has non-rival and non-excludable characteristics). In contrast a private good, like food is rival in use and it is practical to exclude parties, typically through pricing.

While entities with information may seek to exclude others from access to it, they cannot fully exclude them, as some information inevitably spills over (leaks out) to other parties, providing external benefits (benefits to others without compensation). If an entity that generates information is unable to fully exclude others, too little information will be produced from an economic perspective, because the generator is unable to capture all of the benefits derivable from it. However, complete and partial exclusion of others from access to information that would be useful to them means underuse of information from an economic perspective, because the incremental (marginal) cost of providing existing information to them is extremely low, approximating to zero, while the marginal benefits are positive. Partial exclusion of parties from access to information is likely to mean a combination of economically inefficient underproduction of information and economically inefficient underuse of information. In contrast, private goods are not underprovided in competitive markets, because their use is rival, and exclusion is achievable through pricing no higher than marginal cost.

Exclusion of parties from access to useful information is an additional source of inefficiency. It means that information is distributed asymmetrically (unevenly or differently) among interested parties. If information is valuable in undertaking economic activity, entities try to keep it from other explorers and from government to give themselves a competitive advantage. This reduces competition for titles and is a source of market failure. In addition, they may lobby governments to make laws to help them deny information to other explorers and be successful in getting that protection. This is an example of policy failure (government-created inefficiency). They may also do things to generate more information solely for the purpose of increasing a competitive advantage over others. In addition, other parties may be induced to undertake duplicative exploration, and competing explorers' activity may be poorly sequenced (uncoordinated) from an economic perspective – further sources of market

failure. Each of these types of action is privately advantageous, but economically or socially undesirable or wasteful. Each one is evident in the exploration sector.

Market failures associated with the public good of exploration information and asymmetric information, and policy failure arising from government action to facilitate or ensure asymmetric availability of exploration information cause the timing, amount, and types of exploration undertaken to depart from economically desirable patterns. The result is an inefficient allocation of resources.

The relative importance of the effects of market failures associated with the public good of information and asymmetric information is likely to change as exploration moves through its various stages. In frontier areas, where uncertainty is highest and information is scarcest for all parties, and the expected nett value of resources (resource rent) is lowest, the public good market failure is likely to be the most important. In areas considered to be more prospective, expected resource rent is higher, and exploration information is more location-specific and entity-specific. In areas regarded as particularly prospective, the asymmetric information market failure is likely to be the most important. Therefore, different policy responses will be required to deal with exploration information market failures as exploration in an area progresses.

It follows that the Government's management of information generated by petroleum and greenhouse gas activity offshore is an important element of policy on exploitation of offshore petroleum resources and geological structures for greenhouse gas storage. Information management policy should be designed to correct information market failures associated with the public good character of information and asymmetric information. If this is not done properly, government intervention to address a market failure may replace one source of inefficiency with another. It may even make matters worse, and understandably can be referred to as policy failure. Examples could include government action that impedes dissemination of information or induces behaviour that dissipates the economic value of information. Correction of information market failures and avoidance of policy failures are discussed in chapters 6, 7 and 8.

This chapter builds on Morris Adelman's (1970, p. 68) observation that exploration is "only a special case of the search for greater knowledge." It draws on concepts in the economics of information more generally. It discusses various forms of relevant information market failures and their economic consequences in much more depth than the brief outline above. It also explains that these matters should be considered in the context of alternative rights or titles regimes, not in a vacuum. This is so because alternative rights regimes interact differently with various forms of information market failure.

[redacted]

3.2 Public Good of Information

The nature of the benefits of information from exploration, other assessment, and exploitation activities will vary, depending on the nature, stage, and results of activity. The beneficiaries will vary, depending on location, stage and nature of activity, and the extent to which information is kept secret by the entity that generates it.

Activity in a specific area would not only provide information about that area, but also could provide intelligence about adjacent or otherwise geologically similar areas. This applies regardless of the outcome of exploration or other assessment activity.

Activity can generate two types of useful information about adjacent or similar areas:

- information on what is or might be below the seabed
- information that reduces costs by –
  - guiding decisions, including facilitating avoidance of activity that would have negative results
  - facilitating assessment activity – reducing the amount of assessment required, and cutting the time required to complete assessments
  - helping to distinguish lower cost opportunities from higher cost opportunities, facilitating development of the former before the latter
  - complementing earlier investments.

3.2.1 Why Information Is a Type of Public Good

Non-Rivalry in Use

Once information is created (through exploration, research, innovation, or some other activity), it typically exhibits a property known as "non-rivalry in use". This means use of such information by each of multiple entities would not interfere with derivation of benefits from it by other parties.[10] This phenomenon is a defining characteristic of the concept of a "public good".[11] In contrast, a "private good" is "rival in use", meaning one entity's use of it prevents its use by another party.[12]

While the cost of generating a specific amount and type of information could be large, the social cost of making already-generated information available to another entity – marginal social cost – would approximate to zero. Not only does each party's use of the information not impede others seeking to benefit from it, but also costs of reproduction and/or transmission of the information are trivial.

These properties of information indicate that it could also be characterised as displaying economies of scale. The cost of creating information can be regarded as a relatively large fixed cost, and after the information has been generated that cost is "sunk". The marginal cost of providing the already generated information to users is approximately zero, and it does not rise with the number of entities to which it is provided. Therefore, the average cost of servicing information users falls as the number of entities provided with the information increases. An efficient price for existing information would be close to zero, covering only the cost of reproduction and/or dissemination, but that would not leave an adequate margin to recover the high fixed costs of generating the information initially.[13]

Non-Excludability

Discussions of public goods and private goods typically consider the degree of non-excludability, as well as the extent of non-rivalry in use. The concept of non-excludability refers to the inability of the producer of a good to exclude other parties from access to the good. A producer might want the ability to exclude others from accessing a good to facilitate pricing of access, or for strategic reasons, such as gaining a competitive advantage.

If benefits of a good or service are completely rival in use, and complete exclusion is practical, the good or service is described as a "pure private good". Food is an example of a pure private good. Consumption of a portion of food by one person means another person cannot enjoy it. Charging in accordance with marginal cost of provision is an economically efficient exclusion mechanism, as no consumer gaining a marginal benefit exceeding marginal cost of supply would be excluded by the price. In contrast, if use of a good or service by each party would not reduce other parties' receipt of benefits from it, so that use is completely non-rival, and also if exclusion is not possible, the good or service is referred to as a "pure public good". National defence is a commonly cited example of a pure public good, as it provides security benefits to all within the protected territory without exclusion. Another example would be street lighting.[14]

Existing information is generally characterised by non-rivalry in use, but it is not generally characterised by non-excludability. Excludability may apply to varying degrees in a range of circumstances.[15]

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[10] For example, see Arrow (1962a), Gilbert (1981), Varian (1999), Stiglitz (2000a), Hogan (2003), Hess and Ostrom (2003), Scott (2008), Dasgupta (2010), Bikhchandani, Hirshleifer and Riley (2013), and Stiglitz and Greenwald (2014) regarding the non-rivalry in use of information. "Non-rivalry in use" is now the most widely used term for the phenomenon, but other terms have been used. Mazzola (1890), Arrow (1962a), and Buchanan (1968) used the term "indivisibility", instead of non-rivalry in use. Hess and Ostrom (2003) preferred the word "non-subtractive". The term "non-rivalry in use" is attributable to Richard Musgrave (1969).

[11] See Mazzola (1890), Samuelson (1954), Buchanan (1968), Musgrave (1969), and Musgrave and Musgrave (1980).

[12] Use of the terms "public good" and "private good" by Paul Samuelson (1955, 1969) and James Buchanan (1968) encouraged their widespread adoption in the economics literature. However, the term "public good" was used much earlier, for example, by Mazzola (1890) and Knut Wicksell (1896). Other names applied to the public good concept in the past have included "social goods" (Musgrave, 1959, 1969), "collective (consumption) goods" (Samuelson, 1954; Johansen, 1965), and "indivisible goods" (Mazzola, 1890; Arrow, 1962a).

[13] See Varian (1999) and Shapiro and Varian (1999).

[14] For typical discussions of public good issues using the terminology of non-rivalry and non-excludability, see Musgrave (1969), Musgrave and Musgrave (1973 and later editions), Atkinson and Stiglitz (1980), Stiglitz (2000a), and Rosen and Gayer (2008).

[15] A small minority of economic analysts have labelled information a "quasi public good", because partial excludability, rather than non-excludability, applies. They have reserved the name public good for a good that is characterised by non-excludability as well as non-rivalry. More commonly, the term pure public good is reserved for a good that displays non-rivalry and non-excludability properties, and the term public good is applied to a good characterised by non-rivalry in use.

It is worthwhile to consider the implications of non-rivalry in use in the context of excludability and non-excludability. The public good characteristic of non-rivalry in use is a source of market failure. Non-excludability is another source of market failure.

Circumstances in which information may be partly rival in use and partly non-excludable also need to be considered. These circumstances apply to information derived from petroleum and greenhouse gas storage activity.

3.2.2 Public Good of Information – General Case

Non-Rivalry with Ability to Exclude

If a good provides benefits that are non-rival in use, as information from petroleum and greenhouse gas storage activity usually does, it would be socially undesirable to exclude any interested party that could obtain benefits equal to or greater than the cost of making it available to one extra party (marginal or incremental cost).

If exclusion occurs through pricing in excess of marginal cost of provision of a good that is non-rival in use, there would be economically inefficient underuse of the good, because the social benefits foregone exceed the social costs avoided. The inefficiency would rise with the price. This applies to information, along with other public goods.

Alternatively, a producer of a public good may exclude other parties from access to it for a strategic reason, such as redistributive gains from restriction of competition. In the case of information, exclusion may be applied through a secrecy regime for the purpose of gaining or maintaining a competitive advantage, basically to gain at the expense of others from restriction of competition. Again, there would be inefficient underuse of the public good.

In the case of information from exploration or other assessment activity, an entity may undertake activities specifically to pursue an information advantage in respect of untitled territory to facilitate its acquisition, rather than just to assess the territory already held. This would result in further inefficiency. The inefficiency associated with pursuit and protection of information advantages is discussed in more detail elsewhere in this chapter in a subsequent section on asymmetric information.

If an economically efficient price equal to the cost of providing the public good to an additional user (social marginal cost) – an amount close to zero in the case of petroleum and greenhouse gas storage information – is charged to each extra user, revenue is trivial. The benefits to a producer from this revenue and its own use of the good falls short of the costs of providing a socially desirable amount. So, the market under-produces the good from a social perspective.

Denying access to (exclusion of) others to a public good means it is produced only for the purposes of the producer. These include disadvantaging others. This results in underproduction of the public good from a social perspective. In the case of exploration and other types of assessment, from a social perspective, there may be underproduction of types of information that could benefit others and overproduction of categories of information that would provide an advantage to the information producer.

So, market failure occurs in the context of non-rivalry in use and ability to exclude parties for strategic reasons or to support pricing to recover costs. The market failure involves a mix of inefficient under-use and inefficient under-production of the public good from a social perspective.

If each user could be charged according to the marginal benefit received (implementation of perfect price discrimination instead of a uniform price), and this marginal benefit is not less than the marginal social cost of accommodation of that user, inefficient exclusion would be avoided and the cost of the efficient level of provision of the public good would be recovered. However, this would require knowledge of each user's marginal benefit. It would also require that it be impossible or at least very difficult for users to trade with each other. Satisfaction of these requirements is implausible.

The provider would have to rely on users to provide accurate advice regarding marginal benefits they receive, but there is no incentive for users to do so. They would pay less if they understated the magnitude of their marginal benefits. This is a form of the "free-rider" problem discussed below. The faulty signals would result in economically inefficient under-provision of the public good.

The difficulty of restricting trade between users would also impede cost recovery. Such trade would allow those who would receive low marginal benefits to sell access to parties with high marginal benefits. Again, the result would be economically inefficient under-provision of the public good.

Non-Rivalry with Non-Excludability

Inability to exclude (non-excludability of) users of a good or service that is non-rival in use is another source of market failure. A market cannot function if those who do not pay for a good or service cannot be excluded.

If there are many beneficiaries, who cannot be excluded, each would be reluctant to contribute fully, and perhaps even partially, on a voluntary basis in accordance with benefits received, because each entity knows that its contribution will not affect provision. The entity would anticipate being able to "free-ride", taking advantage of benefits from provision of the public good by others.[16] A provider's decision about the extent of supply would be based on benefits to itself, and disregard benefits unintentionally gifted to "free riders". The consequences would be a substantial shortfall in recovery of the cost of economically efficient provision of the good or service, and therefore, considerable undersupply by the market from a social perspective. Indeed, the market may not provide the public good at all.

Government would have to use taxation powers to obtain resources required to fund the public good. The latter approach is typically used to finance the provision of goods characterised by non-rivalry and non-excludability, such as national defence and street lighting.

Charlotte Hess and Elinor Ostrom (2003, 2006) considered that if information had the property of non-excludability, it could be regarded as a special category of open access resources. In the case of an open access resource that is rival in use, "free-riding" is a problem, as it is if information has the property of non-excludability. For both types of open access resources, there will be undersupply and/or overuse if resource allocation is left to markets.

However, open access to information – typically a non-rival good – would not be plagued by other problems that arise with open access to resources that are rival in use like a private good. Open access resources in the latter category are susceptible to deterioration of quality, reduction of quantity available to others, and congestion (reduction of both quality and quantity available to others) because of non-excludability or difficulty of exclusion. Examples include the atmosphere, fish resources, and roads at locations and times of high demand, respectively. In contrast, in the case of information, open access does not cause congestion or any other form of reduction of quality or quantity availability available to others.

Cases of overuse of resources in the context of open access or non-excludability have often been referred to as examples of the "Tragedy of the Commons", a term devised by Garrett Hardin (1968). Excludability enables reduction of this overuse.

Cases of underuse of resources in the context of excludability (erosion of non-excludability) have been labelled the "Tragedy of the Anti-Commons" by Michael Heller (1998). This was discussed by Michael Heller and Rebecca Eisenberg (1998) in the case of the information-related issue of deterrence of innovation because of extension of patents to basic research.

James Buchanan and Yong Yoon (2000) formulated an economic model of the anti-commons. It was used to demonstrate that excludability could lead to economic waste or inefficiency associated with underuse of the public good of information. This could also be caused by regulation involving approval from more than one government entity. The inefficiency was shown to be symmetrical with the inefficiency caused by non-excludability in the case of natural resources and roads characterised by rivalry in use.

The extent of non-excludability from access to non-rival goods often may be far from complete. Put another way, excludability may be partial. This is often the case for information from exploration, other forms of assessment, and exploitation, as efforts to exclude others may be partly undermined by inadvertent leakages of information (spillovers).

[16] This problem was identified by Knut Wicksell (1896) and Paul Samuelson (1954). It was later labelled the "free-rider problem" by Mancur Olson (1965).

An entity that has generated information through exploration, other forms of assessment and exploitation may exert considerable effort to keep it secret to provide itself with an information advantage in pursuit of access to other areas. Regardless of the nature and stage of activity, the entity that generated the information may be able to maintain secrecy at least long enough to capitalise on its information advantage. The private gain from keeping information secret would provide no social value, being just a transfer from others.

Nevertheless, an entity may not be able to exclude others completely from access to information about the outcome of its activities. Some valuable information may spill over inadvertently to other entities. This provides benefits to them without any payment in return. These are known as external benefits in the economics literature. The extent of spillovers inevitably would fall short of the potential and economically efficient degree of public availability of information. External benefits flowing from information spillovers are discussed further below.

Non-Rivalry with Context-Specific Information

The extent of non-rivalry in use of a good or service, and consequently, its social value can be context dependent. A common example of context dependency on non-rivalry in use is an arterial road that might be rival in use in some circumstances and non-rival in use in other circumstances.[17]

Friedrich Hayek (1945) recognised that the social value of information was context dependent. He emphasised that the practical utilisation of knowledge required the combination of "scientific knowledge" with "knowledge of the particular circumstances of time and place".[18]

In the specific case of exploration information, the extent of non-rivalry and social value may vary with stages and locations of exploration. This is an aspect of the "particular circumstances of time and place" relevant to utilisation of existing exploration information in further exploration activity.

In the circumstances of early-stage exploration in relatively unexplored areas (little or no prior exploration using modern techniques), the value of the public good of exploration information could be at its highest level, because pre-existing uncertainty and the number of potential beneficiaries will be at peak levels.[19] This value could be increased by two interdependent aspects of pioneering or green-fields exploration. First, such exploration typically involves screening activities over large areas to guide a subsequent narrowing of focus, and outcomes of these activities could be expected to be useful in respect of other large areas that are geographically adjacent or geologically similar. Second, efficient application of technologies for early-stage exploration may involve coverage of very large areas.

As exploration proceeds beyond the very early or pioneering stage, the resulting information becomes more closely linked to specific targets, locations, and firms operating at those sites. So, the proportion of benefits of exploration information that could be of value to parties other than the explorer generating the information tends to decline, and the private (internal to the explorer) benefits component tends to rise. Moreover, the number of potential beneficiaries of exploration information tends to decline as exploration proceeds through its various stages. In other words, as knowledge about an area grows, new exploration information about a specific location or target in that area takes on more of the character of a private good and less of the character of a public good.

The context-dependent nature of exploration information has been recognised by geological and economics personnel in the United States and Canadian Geological Surveys (Bernknopf, Wein, St-Onge and Lucas, 2007). They distinguished between "general" and "specific" exploration information.

[17] Road-use may be completely non-rival in some circumstances, but rival to varying degrees in other circumstances. In a major city at peak times, a key arterial road could be heavily congested. However, there could be times when traffic is light. In the former case, each driver's use of the road detracts from benefits available to others, imposing uncompensated costs on others (external costs or diseconomies). In typical public good/private good terminology, use of the road is rival in nature. In contrast, when traffic is light, use of the road is non-rival. Then, each driver's use of the road does not detract from benefits available to other road-users. In the context of congestion, exclusion by pricing in accordance with short-run social marginal costs would be economically efficient, while in light traffic use is non-rival, and exclusion of any user by a price above zero would be economically inefficient. An efficient road pricing regime would also take into account external costs of road damage and crashes associated with different vehicle types. Both rise with vehicle weight.

[18] See particularly, Hayek (1945), p. 521.

[19] This phenomenon was recognised by Edward Miller (1973) and Fred Peterson (1975), but they focussed on external benefits of exploration information spillovers, rather than the more general concept of the public good of information, which relates to the larger set of benefits that includes those potentially available externally, as well as those available from spillovers. More recently, the phenomenon was recognised by the Productivity Commission (2020), p. 105.

"General" information is collected on a broad (regional) scale and is background material. "Specific" information is localised, narrower in focus, target-specific, limited in applications, and has a smaller number of actual and potential users. They observed that general information had characteristics of non-rivalry in use, but specific information possessed less of such characteristics.

3.2.3 Public Good of Information – Small Number Case

In cases with a small number of potential beneficiaries of a good or service that is non-rival in use, and with exclusion being practical, voluntary negotiated arrangements among beneficiaries may be an option for provision of the good or service. Influential early analyses of the economics of such arrangements were undertaken by James Buchanan (1965, 1968) and Mancur Olson (1965) independently of each other.

Influenced by Buchanan's terminology, entities that get together to formulate such arrangements have been referred to as "clubs" in subsequent contributions to the relevant part of the public economics literature. Olson referred to them as "groups".

Clubs or groups formed to provide public goods are characterised by sharing of the facilities and their costs, voluntary participation, and bargaining or negotiation of terms of participation. Because of these bases of participation, such arrangements have been referred to as market-like.

While the cost to a single entity of providing a facility that is non-rival in use would be relatively high, adding voluntary participants that receive benefits in excess of average cost would not only help fund provision, but also lower each new or pre-existing participant's average cost of access to the facility. Each participant would be better off than if it proceeded with fewer participants, including going alone.

On the other hand, adding participants may lead to congestion or crowding that detracts from benefits to each participant. Extra participants also increase negotiation and other transaction costs associated with clubs formed to provide public goods. These considerations indicate that the size of club membership, the amount of the relevant public good, and cost-sharing protocols should be determined simultaneously, having regard to the nature of the public good.[20]

Negotiated or market-like arrangements to undertake early-stage exploration and share information may be thought to be a practical and efficient option because the information is generally non-rival in use, crowding is not an issue with information sharing, and the potential number of users of information relating to specific areas may be large enough to make sharing attractive and small enough to allow transactions costs to be contained. Examples of market-like arrangements relating to exploration information include cooperative arrangements to share results and costs of generating exploration information, agreements between entities to consolidate title holdings, agreements to transfer titles between entities, exploration joint ventures, and geophysical services firms that survey specific areas and sell data to parties interested in bidding for titles over those areas. An exploration-related group or transaction could be initiated by an entity wanting to reduce its exploration costs and associated risk/uncertainty, or by a provider of services to explorers.

There has been considerable disagreement regarding the ability of markets to obviate market failure arising from the public good characteristic of exploration information. Mark Isaac (1987a) and James Ramsay (1980) commented that market-like arrangements in respect of exploration information had been common in the United States' petroleum exploration and extraction sector. In contrast, Ken Hendricks and Dan Kovenick (1989) found that mutually beneficial exchange or cooperation between petroleum explorers in respect of information generally had been limited in offshore areas under the control of the United States Government. The Australian Industry Commission (1991) expressed the view that mutually beneficial exchange would not correct the problem of under-provision of the public good of information from early-stage exploration, but private sector information from later exploration could be exchanged through market transactions.

Mark Isaac (1987a) provided the most detailed analysis of direct market arrangements in respect exploration information. He applied game-theoretic concepts to analyse circumstances in which market arrangements regarding exploration information might be made. The analysis was focussed

[20] For a detailed discussion of the economic theory of clubs, see seminal work by Buchanan (1965) and Olson (1965), and the book by Richard Cornes and Todd Sandler (1986) on externalities, public goods and club goods.

on the small-number case of just two exploration firms, and on decisions concerning drilling of wildcat oil wells. Isaac did not distinguish between stages of exploration.

Isaac (1987a) argued that voluntary trading arrangements meant the case for government intervention to deal with external benefits or public good aspects of exploration information was not as strong as many had argued. He pointed out that this should be considered in deliberations regarding government policy on exploration information. However, Isaac observed that market arrangements were "not a cure-all". He noted that sub-optimal results could still occur in some circumstances, even in the case of just two parties. In addition, co-ordination and negotiation problems (and therefore, transactions costs) would increase with the number of participants in the exchange arrangements.

Mark Isaac (1987b) also warned that an efficient outcome could be impeded if cooperative arrangements between firms in relation to exploration information extended to coordination of bidding by those entities. Collusion in relation to bidding would be detrimental to competition for titles.

James Ramsey (1980) argued that there is an active market for exploration information of interest to multiple parties, but "firm-specific" information is not captured by this market. "Firm-specific" information relates to geological and geophysical characteristics considered most relevant by the particular firm, and includes information resulting from interpretation of exploration data, and information linked to a firm's particular specialisation, the capabilities and intuition of its geoscience personnel, the degree of risk aversion of management, the firm's financial strength, and other relevant circumstances. Richard Gilbert (1981) made a similar observation.

Various important obstacles to negotiated arrangements between explorers in relation to exploration information have been identified in the relevant literature. They are discussed briefly below.

First, membership of groups formed to undertake early-stage exploration could be expected to vary between areas of interest. There could be a vast number of such groups with memberships that vary substantially.

Second, in a market-oriented club situation, considerable resources could be required to settle exploration agreements between just a few parties in each group (Isaac, 1987a). After production of information, the marginal cost of making it available to another entity would be trivial if transaction costs are not an issue. However, in a market-oriented club situation, transaction costs are potentially important. Negotiation or bargaining becomes more complicated as the number of participants rises, and transaction costs escalate as this complexity increases.

Third, to the extent that some information spillovers are anticipated, some parties may seek to "free ride" (Farrow and Rose, 1992; Hendricks and Porter, 1996). The likelihood of "free-riding" rises with the potential number of participants, as discussed above. This weakens the ability of the group to exclude others from benefits, increases the contribution required from each member, and exacerbates the transaction cost burden.

Fourth, some explorers may eschew participation in exploration groups or may insist on keeping them very small, because of a desire to gain or maintain an informational advantage in pursuit of exploration ground, and to avoid sharing of information about techniques and interpretations of data with competitors. Alternatively, explorers may be prepared to participate on a limited basis, withholding "firm-specific" information, thereby limiting the reach of markets in provision of information to interested parties.[21] The resulting issue of asymmetric information availability of information between explorers is a source of market failure additional to that associated with the public good characteristic of exploration information. It is discussed in a subsequent section of this chapter.

Fifth, the "experience good" property of exploration information is a hindrance to transactions in relation to exploration information (Häggquist and Söderholm, 2015). This impediment to information transactions was identified by Kenneth Arrow (1962a, p. 148):

"….there is a fundamental paradox in the determination of demand for information: its value for the purchaser is not known until he has the information, but then has in effect acquired it without cost."

[21] These issues have been discussed by Hendricks and Kovenick (1989), Mason, 1986, 2014), Gilbert (1981), Ramsey (1980), and Gaffney (1967a).

Phillip Nelson (1970, 1974) distinguished "experience goods" that need to be assessed through use, from "search goods" that can be assessed through scrutiny prior to purchase. Carl Shapiro and Hal Varian (1999) explained that information is an experience good, if a potential acquirer would not be able to determine if purchase is warranted until the information had been scrutinised or absorbed, but then a transaction would not be likely.[22] Elisabeth Häggquist and Patrik Söderholm (2015) observed that exploration information is an "experience good", because it has to be analysed and applied in an appropriate location and context for its benefits to be revealed. An inability to experience this information before outlaying resources to acquire it is an impediment to acquisition. The highly context- and location-specific nature of exploration information means it does not appear to be amenable to the usual strategies applied by sellers of information to get around the experience good problem. These strategies include reviews, browsing, versioning,[23] and building and maintenance of reputation of the supplier.

An exception to this problem is information that can be acquired only in conjunction with acquisition of title or an interest in a title to which the information relates. Then, the relevant market is for titles, rather than information alone.

The combination of obstacles to club or other market-like arrangements to acquire or share information is formidable. This has greatly restricted the creation of such arrangements. At best, market-like arrangements could only partially resolve the public good market failure. Also, these arrangements could not resolve the problem of asymmetric availability of information between explorers. Indeed, the asymmetric information problem is an impediment to market-like arrangements.

Market-like arrangements also would not correct asymmetric availability of information between explorers and providers of equity capital. This asymmetry arises because explorers may not provide all relevant information to potential suppliers of equity capital for exploration. Financiers that are concerned there might not have been full disclosure would be reluctant to supply capital and may be prepared to do so (if at all) only on terms that reflect the risk of incomplete disclosure. This is an impediment to funding of exploration activity (Fogarty and Sagerer, 2016).[24] The problem of asymmetric availability of information between explorers and providers of equity capital for exploration is another source of market failure. It is discussed in a subsequent section of this chapter.

3.3 External Benefits of Exploration Information

Information Spillovers

Some information resulting from an entity's petroleum or greenhouse gas storage activities could spill-over inadvertently to other parties, which could benefit from insights regarding the resource potential of areas of interest to them, and from reduction of misdirected or duplicative search and assessment costs. Uncompensated benefits from information spillovers provide an example of the economic concept of external benefits.[25]

Market Failure

Typically, the occurrence of external benefits has been viewed as a source of market failure – failure of markets to allocate resources efficiently. In the case of external benefits of spillovers of information generated by exploration or other types of assessment activity, resource misallocation is manifested in four ways.

First, the generator of the spill-over information could undertake less information-generating activity than it would if it was able to capture all benefits of its own efforts or received compensation for information spillovers.

[22] See also Varian (1999).
[23] Versioning refers to provision of a cheap version that is limited in scope, depth, quality, and convenience.
[24] This is a form of the adverse selection or "market for lemons" problem discussed by George Akerlof (1970).
[25] Other terms for external benefits are external economies and positive externalities.

Second, entities with access only to the spillover portion of information generated by others could undertake less activity than if all information of interest was available, and/or could engage in poorly targeted or duplicative activity because of the incomplete information spillover.

Third, enterprises might defer activity in anticipation of gaining free spillover information subsequently from activity by others in similar circumstances. This may reduce inefficient duplication of search and assessment costs, but widespread deferrals of activity in an uncoordinated way would result in too little exploration (and other assessment activity), too late from an economic perspective.

Fourth, inactivity by one party may suggest to some others in adjacent or geologically similar areas that the inactive party had interpreted available information negatively, rather than that the inactive party was seeking to "free-ride" on others' activities. Then, these other parties may review their expectations and decide to defer activity.

Relationship between External Benefits and Public Goods

The concept of external benefits is closely related to the concept of public goods.[26] The reason is that the public good characteristic of non-rivalry in use means that nearly all benefits are potentially external, rather than internal to a single party as in the case of a private good. Public and private goods can be depicted as types of goods approaching opposite ends of a spectrum of the extent of potential external benefits or non-rivalry. The term, external benefits, refers only to the externally available part of potential benefits of an activity.

In the case of information, disentangling the closely intertwined concepts of external benefits and public goods would involve "an inefficient use of mental energy", according to Paul Romer (2010). He argued that the concepts of (non-) rivalry and (non-) excludability are all that is needed to analyse information (or "ideas", using Romer's terminology).

Acceptance of Romer's advice would simplify analysis of the economic implications of exploration information. However, it has not been followed here, because there are numerous references to external benefits (positive externalities) of information spillovers in the literature on exploration, and they should be reconciled with other references to the public good of exploration information. Consequently, considerable "mental energy" has been expended to reconcile these concepts in the context of exploration information.

An entity that generates information relating to petroleum or greenhouse gas storage opportunities may seek to and be able to limit the extent to which benefits of information spill over to other parties. It may be able to achieve this through arrangements to maintain secrecy. Its purpose may be to sell information or to gain an advantage over others.

To the extent that generators of information succeed in limiting external benefits, they may be prepared to undertake more information-generating activity consistent with their capture of more of the benefits. However, if information spillovers are limited to gain a competitive advantage, the problem of underuse of information would be exacerbated, because the public availability of information would drop further below the potential and economically efficient level. Reduction of spillovers to gain an advantage over others would result in asymmetric distribution of information, which is an additional source of misallocation of resources. This is discussed in the next section.

Significance of External Benefits Varies with Exploration Stage and Location

The economic significance of external benefits of information could be expected to be inversely related to the amount of existing public knowledge about an area being investigated (or directly related to the extent of uncertainty). Because uncertainty is greater in unexplored areas and other locations not subjected to modern exploration ("frontier" areas), than in areas already considered to be prospective, it could be expected that information spillovers from pioneering exploration would be more likely to influence decisions by recipients in relation to future exploration activity than spillovers from exploration in areas already considered to be attractive exploration environments.[27]

[26] The close relationship between the concepts of external benefits and public goods was observed by Paul Samuelson (1954, 1969), James Buchanan (1968), Richard Musgrave (1969) and Edward Mishan (1971). Later, Joseph Stiglitz (2000a) and Partha Dasgupta (2010) commented that public goods could be viewed as an extreme form of external benefits.

[27] This point was made by Miller (1973) and Peterson (1975). It was also observed by Hendricks and Porter (1996), and Levitt (2016).

There are reasons to suggest that spillovers of information of use to other entities would be more likely to occur in frontier areas, as well as being more valuable in those areas when they do occur. First, information yielded by the broad-area screening approach typically taken in very early stage exploration may be useful to entities interested in untenured parts of broad areas that are screened, and in large surrounding or similar areas not already held. Second, a narrowing of focus, change of tools and techniques, and change in intensity of activity would be more likely to be noticed and provide useful signals to others than changes in approach in areas already subject to more focussed attention. Third, discoveries and failures rarely remain secret for long. Fourth, the likelihood of useful information spillovers would tend to decrease in later stages of investigation as activity became more geographically focussed and more specific to the circumstances in which, and the entity for which it is undertaken.

These considerations indicate that tendencies to undertake too little exploration (and other assessment activity), too late would be more marked in frontier areas than in areas already viewed as prospective. However, the relative importance of effects of information asymmetries (discussed below), as well as spillovers in various stages of activity, should be considered in formulation of information policy.

There is controversy regarding the significance of exploration information spillovers in the various stages of exploration. Several economic analysts have argued that such spillovers are significant.[28] In contrast, others have argued that they are not significant.[29] Australia's Industry Commission (1991) suggested that the significance of spillovers depended on the stage of exploration. It implied that external benefits of exploration information were important in the case of very early stage exploration, but they had been addressed by government exploration activity and release of the resulting information. Currently, this does not apply in the offshore context, because government has not funded any survey work since 2014-15. In later stages of exploration, the Industry Commission (1991, p. 39) considered that the likely extent of these external benefits was insufficient to justify government intervention, and that in any event they could be "fairly easily internalised …… through private market transactions". The Industry Commission did not provide any supporting evidence for this position. A major review of the Australian taxation system (Henry, others, 2010) accepted the Industry Commission's position, but also did not provide supporting arguments.

The controversy has not been fully resolved by the results of quantitative analysis. Quantitative support for information spillovers being significant has ranged from weak to strong.[30] Moreover, there has also been lack of clarity regarding the implications of results of quantitative analysis for the significance of external benefits of information generated at different stages of exploration.

However, a review of the results indicates that there are plausible explanations of findings of weak significance of external benefits of exploration information spillovers findings in most of the studies and stronger significance in others. They derive from the following circumstances.

- Market-like transactions may have internalised external benefits to some extent. Smith and Thompson (2009) identified evidence of internalisation by entities assembling concentrated holdings of titles. However, Lin (2013) considered but dismissed internalisation through cooperation between neighbours. Barrera-Ray (1997) observed that there was less evidence of market-like transactions on the UK continental shelf than on the US outer continental shelf.
- To the extent that explorers (typically with the aid of government) can keep their information secret long again to gain a competitive advantage over others, external benefits of information spillovers are reduced. It means that there is greater exclusion of interested parties from the public good of information, and greater asymmetry in availability of information among explorers. Barrera-Ray (1997) observed that there was less evidence of asymmetric information on the UK continental shelf than on the US outer continental shelf.
- Some information may be highly context specific, being closely linked to specific targets, locations, and firms operating at those sites. This means that the information could be more like a private good than a public good, for which benefits are nearly all external. However, this would not be

[28] For example, see Miller (1973), Stiglitz (1975), Peterson (1975, 1977a,b), Dasgupta and Heal (1979), Gilbert (1981), Leitzinger and Stiglitz (1984), Smith (1997), and Smith and Thompson (2009).
[29] For example, see Vickrey (1967) and Ramsey (1980).
[30] See Lietzinger and Stiglitz (1984), Farrow and Rose (1992), Hendricks and Porter (1996), Barrera-Ray (1997), Lin (2009, 2013), Smith and Thompson (2009), and Levitt (2016).

applicable to "wildcat" activity, which was the main focus of studies by Hendricks and Porter (1996), Lin (2009, 2013), and Smith and Thompson (2009). Consistent with this, analysis by Levitt (2016) indicated that the largest response of exploration activity to prior onshore drilling was associated with successful new-field wildcat wells.

- Competitive cash bidding regimes may have internalised external benefits of information spillovers and external costs of asymmetric information as explained by Leitzinger and Stiglitz (1984). Cash bidding has been deployed on the United States' outer continental shelf (OCS) and in Alberta, both of which were the areas of focus in studies by Hendricks and Porter (1996), Lin (2009, 2013), Smith and Thompson (2009), and Levitt (2016). On the United Kingdom continental shelf, where a work program bidding regime has been deployed, Barrera-Ray (1997) found evidence of very large external benefits of information spillovers, indicating little internalisation of external benefits.

Jeffrey Leitzinger and Joseph Stiglitz (1984) found large interjurisdictional spillovers in the Gulf of Mexico (US federal and state jurisdictions). However, for single jurisdictions, they explained (Leitzinger and Stiglitz, 1984, p. 48):

"In the case of a single lessor of neighbouring tracts, informational effects need not create any allocational problems. To the extent that information created by adjacent drilling creates positive or negative benefits, the effects redound to the lessor through their impact on lease payments. Consequently, impacts of information which are external with respect to tract boundaries are internalised by the lessor."

This tendency within a jurisdiction was not discussed or referred by the other studies of the magnitude of external benefits of information spillovers, including the study by Ken Hendricks and Robert Porter (1996). While Hendricks, Porter and various co-authors (1987, 1989, 1993, 1994) noted that cash bidding would tend to internalise external costs of asymmetric information, they did not appear to recognise that it would also tend to internalise external benefits of information spillovers. In contrast, the tendency of cash bidding for tenements to internalise external benefits of exploration information spillovers and external costs of asymmetric exploration information was noted by Herfindahl (1969b), Mead, Moseidjord and Sorensen (1984), and Kagel and Levin (1986), as well as by Leitzinger and Stiglitz (1984). This phenomenon is discussed in chapter 8.

3.4 Asymmetric Information

Friedrich Hayek (1945) recognised that information was not available uniformly. In particular, he observed that knowledge of the "particular circumstances of time and place" is typically fragmented, being dispersed across economic entities, typically incomplete, and often contradictory. He explained that decentralised decision making, rather than central planning was required to ensure that this information was promptly used, but that means of conveying additional information to decentralised decision makers were still required to facilitate an efficient allocation of resources. Hayek argued that the price system largely fulfilled this requirement by providing the most essential information in abbreviated form to guide the decisions of interested parties. He acknowledged that behavioural adjustments in responses to the information provided by markets would probably never be perfect. However, he appeared to consider that markets provided a reasonable solution to the problems of the unavoidable imperfection of man's knowledge and fragmented dispersal of information.

Subsequently, it has been shown that misallocation of resources may arise from market failure linked to information not being available uniformly among stakeholders – typically labelled asymmetric information. There is now an extensive economic literature on this topic.[31]

In the case of exploration information, David Hughart (1975) highlighted the economic importance of the distinction between informational asymmetries on the same and opposite sides of dealings in respect of exploration rights. Three sources of asymmetric information market failure have been

[31] Seminal work was undertaken by George Akerlof (1970), Michael Spence (1974), and Joseph Stiglitz in several contributions (surveyed in Stiglitz, 2000b, 2002). In 2001, they were awarded the Nobel Prize in Economics for their earlier work on asymmetric information.

discussed in the literature on the economics of exploration. These sources and the nature of the asymmetries – on the same or opposite sides of different types of dealing – are:[32]

- uneven distribution of information among potential explorers (asymmetry on the same side of a transaction between explorers and owners of potentially mineable resources)
- asymmetric availability of information between explorers and providers of equity capital (asymmetry on opposite sides of a transaction regarding provision of capital)
- information advantages of explorers over governments as owners of potential mineable resources (asymmetry on opposite sides of a transaction relating to access to resources).

Issues relating to these sources of market failure have been discussed below. They are distinct from market failures associated with the public good aspect of exploration information. However, market failures associated with asymmetric information and other market failures arising from the public-good aspect of exploration information co-exist, and they are interdependent.

3.4.1 Asymmetric Information Among Explorers

Asymmetric information among potential explorers is common. A private sector entity that has been exploring an area under title could be expected to have better information about comparable locations than competitors that are new to the area. Entities with tenements near each other could have different private information regarding other nearby or comparable areas. Moreover, newcomers to an area could be expected to have private information of varying quality and quantity regarding that area and various locations within it. Information differences would arise even if all explorers had the same basic data, because of differing analytical approaches to, and interpretations of the data. Similar circumstances could be expected in relation to investigation of potential greenhouse gas storage opportunities.

Market Failure

Mason Gaffney (1967a) recognised that if entities apply resources to pursue an information advantage, maintain one, or erode one held by another party to attempt to beat others to capture potential resource rent (redistribute it in their favour), resources are misallocated with consequent dissipation of resource rent. He also observed that this form of market failure co-existed with market failure arising from public good and external benefits aspects of exploration information. Gaffney noted that asymmetric information market failure tended to increase and bring forward exploration outlays, while market failure associated with public good and external benefits aspects of exploration tended to reduce and defer exploration activity.[33]

Subsequently, the co-existence of market failure associated with asymmetric information between explorers and market failure arising from public good/external benefits aspects of exploration information, and the tendency of the consequences to work in opposite directions was noted and analysed by several other economic analysts.[34] Some of these economists indicated that they gained insights from analyses of similar information market failures affecting innovation or inventive activity that were highlighted by Yoram Barzel (1968) and Jack Hirshleifer (1971).

The quest by explorers for an information advantage that leads to asymmetric information market failure could take different routes:

- acquiring private information to –

[32] Gaffney (1967a), Peterson (1975), Dasgupta and Heal (1979), Gilbert (1979, 1981), Dodds and Bishop (1983), Leitzinger and Stiglitz (1984), Mason (1986, 2014), Isaac (1987b), Hendricks and Koveneck (1989), Stiglitz (2002), and Tordo, Johnston and Johnston (2010) discussed asymmetric information between explorers, and information spillovers. Collier and Venables (2011a) discussed asymmetric information among explorers, asymmetric information between explorers and governments, and information spillovers. Fogarty and Sagerer (2016) discussed information spillovers and asymmetric information between explorers and providers of equity capital. Hughart (1975), and Gaskins and Teisberg (1976) focussed solely on asymmetric information between explorers. Many others, such as Miller (1973), Farrow and Rose (1992), and Lin (2009, 2013), confined their analyses to information spillovers.

[33] See Gaffney (1967a), pp. 379, 392-393 and 399.

[34] See Peterson (1975), Dasgupta and Heal (1979), Gilbert (1979, 1981), Dodds and Bishop (1983), Leitzinger and Stiglitz (1984), Siegel (1985), Mason (1986, 2014), Isaac (1987b), Hendricks and Koveneck (1989), Cairns (1990), Stiglitz (2002), Tordo, Johnston and Johnston (2010), and Collier and Venables (2011a).

  - establish a competitive advantage in pursuit of title to an area
  - eliminate the competitive advantage of another party in gaining access to an area
  - discourage competition for tenements
- eschewing opportunities to trade or share information, or to co-operate in sequencing exploration to protect an information advantage.

Because exploration (or another form of investigation) of an existing title may yield insights and information advantages regarding nearby or comparable areas, the holder may undertake more activity on the tenement than necessary to assess its potential. The explorer's aim would be acquisition of additional information regarding unoccupied similar sites to gain competitive advantages in pursuing tenements over those sites, and capturing the resource rent derivable from them. Competitive advantages in respect of pursuit of tenure derive not only from acquisition of superior knowledge of discovery-potential, but also from discouragement of competitors that recognise their information is inferior and reason they could obtain tenure only by offering too much to acquire it.

Private sector entities without titles in an area of interest may undertake research or other search activity before applying or making an offer for a tenement to gain an information advantage or to overcome a perceived information disadvantage. This activity could be undertaken earlier than if the entity held tenure, and it might duplicate the work of others.

An entity with a title or seeking one might commence and continue investigative activity independently, based on its internal or private information. In this case, the entity would eschew opportunities to trade or share information, or to co-operate in sequencing exploration with other entities having complementary private information from work in respect of the area or comparable areas. The entity might reason that cooperative arrangements would prejudice an existing information advantage or provide others with access to its analytical techniques and interpretations.

Entities seeking to obtain information advantages impose uncompensated costs on each other. These external costs take the form of other entities:

- having to undertake –
  - economically premature investigative activity
  - duplicative activity
  - investigative sequencing that is not coordinated with others
- experiencing accentuated restriction of their opportunities.

The restriction of others' opportunities is linked to a "depletion effect" noted by Frederick Peterson (1975), Russel Uhler (1976, 1979), Daniel Siegel (1985) and Robert Cairns (1990).[35] Because discovery is an exhaustible economic opportunity, each find depletes the pool of discovery opportunities, making further finds harder (more costly) to achieve. This external cost strengthens the incentive to gain an information advantage, inducing earlier and duplicative exploration activity. This induced activity accentuates the depletion effect.

Each aspect of the external costs associated with asymmetric exploration information involves foregone returns on alternative investments. Because relevant entities do not take account of the costs they impose on others through their actions, resources are misallocated from a social perspective. This is manifested by too much exploration (and other investigative activity), too soon from a social perspective, and associated dissipation of *ex ante* resource rent.

Role of Excludability and Resource Rent in Frontier and Highly Prospective Areas

The incentive to pursue an information advantage and protect it, seek to erode the information advantage of another party, or otherwise behave uncooperatively is dependent primarily on:[36]

[35] The concept originated with Peterson (1975) and the term was formulated by Uhler (1976).

[36] Frederick Peterson (1975) and Jeffrey Leitzinger and Joseph Stiglitz (1984) stressed the importance of excludability as a determinant of the incentive to pursue an information advantage. Gaffney (1967a) and David Hughart (1975) recognised the importance of *ex ante*

- excludability of other potential users of the information or the degree to which the information can be kept secret
- *ex ante* resource rent (expected imputed *in situ* value of resource).

It would be pointless to apply resources to seek to obtain or maintain an information advantage or neutralise another entity's information advantage if potential competitors for areas of interest could not be excluded from or denied access to key elements of the information that would be useful to them. The erosion of secrecy and consequent reduction of an information advantage through information spillovers have time, quantity and quality dimensions. Over time, the probability of information leaking to other entities could be expected to rise. This rising probability applies to the amount and quality of information that escapes to others. In any event, an information advantage may be needed for only a short period of time to be valuable to the holder – a period just long enough to acquire tenure over territory to which an information advantage relates. Of course, after an entity has obtained that territory, it may be keen to release information to help attract joint venture partners or otherwise raise capital.

It is likely that confidentiality would be most difficult to maintain in frontier areas, because of the broad areas typically covered by early-stage exploration activities, the ease of detection of changes in exploration methods, and the difficulty of keeping discoveries and failures secret. Confidentiality should be easier to achieve as areas become prospective, with exploration activity becoming more context-specific and geographically focussed, and consequently with diminishing opportunities for others to gain from breakdowns of secrecy. This transition reflects the influence of cumulative activity and spill overs of information from activities in earlier stages of exploration.

In areas already considered to be highly prospective, *ex ante* resource rent would be relatively high. If this perception is held by just a very small number of parties, the exhaustibility of attractive discovery opportunities could be expected to strongly motivate pursuit (or preservation) of an information advantage or elimination of the information advantage of a competitor to assist in gaining tenure to areas that become available for capture, provided that it is anticipated that most new information could be held long enough to capitalise on an information advantage. It may induce activity prior to an application for a title that from a social perspective is premature, superfluous, poorly sequenced, duplicative, or uncoordinated. This activity could include desktop research, activity under a non-exclusive authority to explore, and activity in adjacent or similar areas that is additional to what could reasonably be required to efficiently explore those areas.

Sometimes, it could be widely perceived that an area is highly prospective, with this widespread perception also being widely recognised.[37] Some individual entities might be deterred from action to gain an information advantage, because they consider that it would be futile as a result of an expectation that others would also pursue such an edge. Nevertheless, others might still seek an information advantage reasoning that others could be deterred by potential competition. On balance, there might be some moderation of the tendency to explore too much, too soon from a social perspective.

In frontier areas, where uncertainty is very high, it might be anticipated that inducement of activity to gain an information advantage would be weak, because of low *ex ante* resource rent. However, there are other considerations that tend to strengthen that inducement.

Mason Gaffney (1967a) pointed out that particularly high uncertainty makes it especially difficult to distinguish between good and poor prospects in advance. Then, incremental activity to help gain secure title over potential resources is more likely to be motivated by the average outcome rather than the marginal product of exploration activity. In effect, the imputed nett value or resource rent of good

resource rent as a determinant of the incentive to pursue an information advantage. Subsequently, several other economic analysts either explicitly or implicitly recognised the importance of this determinant.

[37] This could result from information spillovers from earlier private sector exploration. Public sector initiatives such as release of information from government-funded exploration, or government collection and prompt release of private sector exploration could be expected to have a stronger effect, because all information (not just inadvertent "spillover" information) is released. These policy initiatives are discussed in chapters 7 and 6, respectively.

prospects encourages (effectively subsidises) activity to gain tenure over prospects that turn out to be poor.

Richard Gilbert (1981) argued that the incentive to pursue an information advantage in frontier areas was enhanced by a greater probability of being first in these areas and then being able to capitalise on that position to capture whatever resource rent is realisable. He also claimed that in frontier areas, an explorer had less incentive to wait for the exploration results of others to become accessible via information spillovers, because of low density of exploration activity.

Summing up, the incentive to undertake exploration (including research) or other assessment activity too much too soon to gain an information advantage may be present at all stages of exploration and assessment. However, it is likely to be strongest in highly prospective locations and weakest in frontier areas. This is because exclusion of others from access to information may be easier and *ex ante* resource rent would be higher in highly prospective locations than in frontier areas. These effects are likely to be only partly offset by considerations raised by Gaffney (1967a) and Gilbert (1981).

Absence of Redeeming Economic Features

It has been suggested by some parties that the tendency of asymmetric information to bring forward exploration or other assessment activity and increase it may have some redeeming economic features, rather than being just a means of redistributing resource rent and dissipating in the process. Five examples of such suggestions have been discussed briefly below. Analysis of these possibilities has indicated that they lack sufficient substance to support a view that asymmetric information would produce positive nett economic outcomes.

One possibility is that there could be social benefits from the diversity of approaches of multiple explorers (Gilbert, 1981). However, the context of strongly asymmetric information implies each explorer obtains little information from the various approaches and results of others either via information spillovers or pooling/sharing of information. Therefore, it is not apparent how any social benefits could exceed social costs of exploration that targets redistribution of resource rent from others and may result in reduced competition or duplicated, uncoordinated, and inefficiently sequenced exploration.

A second suggestion is that pursuit of information advantages by private sector entities to assist in applying or bidding for tenure could be socially beneficial to the extent that explorers are averse to risk and uncertainty (Gaskins, Teisberg, 1976). However, it is not obvious how pursuit of an information advantage by one party could be beneficial to others, except to the extent that some of the resulting information spills over inadvertently to others, thereby undermining the extent of the targeted information advantage. Also, it is not clear why pursuit of information advantages to reduce uncertainty could be considered preferable to the various devices available to explorers to deal with exploration risk and uncertainty. Even small explorers can take advantage of devices such as joint ventures (farm-outs and farm-ins) and compilation of exploration portfolios, although large entities have advantages in utilising these and other devices for managing risk and uncertainty. In addition, in many countries, the established, widely deployed mechanism of government funding of early-stage exploration and release of the resulting information typically is focussed on regions in which the level of uncertainty is particularly high. This would particularly assist small risk-averse explorers that are less able to take advantage of various other devices used to manage exploration uncertainty.

Third, it has been suggested that activity to gain information to guide applications or bidding for exploration tenure could lead to allocation of a tenement to the firm placing the highest value on it because of a better exploration strategy or lower costs (Gaskins, Teisberg, 1976). However, having superior information to guide bidding is quite distinct from having superior ability to explore for and extract sub-surface resources. Superior ability to explore for and extract resources may not coincide with access to superior information to guide applications or bidding for tenure (Gilbert, 1979, 1981).

Fourth, activity undertaken to gain an information advantage might produce information that would be useful in a subsequent exploration program or in formulation of one. However, this would have to be weighed against inefficiencies associated with duplicating and bringing forward exploration and other assessment activity. Negative social outcomes would result from generation of information that is useful only for the aim of gaining an informational advantage (Gaskins, Teisberg, 1976).

A fifth and final possible redeeming economic feature of asymmetric exploration information is that its effects might counteract those of public good and external benefits aspects of exploration information. However, it is highly unlikely that these opposite effects would neatly cancel-out everywhere and over time because they are mismatched in respect of locations, exploration stages, and activities. The nett effect depends on the perceived potential of various locations at different points in time, as discussed in a subsequent section.

Similarities and Differences with Innovation

Some of the early analyses of asymmetric exploration information among potential explorers indicated that insights had been gained from work by Yoram Barzel (1968) and Jack Hirshleifer (1971) on asymmetric information market failure affecting innovation or inventive activity. Barzel (1968) and Hirshleifer (1971) acknowledged earlier analyses that indicated the public good and external benefits aspects of information resulted in underinvestment in, and delay of innovative activity, but pointed out that asymmetric information motivated more and earlier pursuit of technological information than was socially desirable. Yoram Barzel focussed particularly on the effects of information market failures on the timing of allocation of resources to innovative activity. Jack Hirshleifer focussed on the effects of such market failures on the amount of investment in generation of new technological knowledge. Both Barzel and Hirshleifer pointed out that pursuit and maintenance of information advantages expended resources in socially wasteful ways. Hirshleifer highlighted the wealth transfers or redistributive effects resulting from exploitation of information advantages. Later, other prominent economists arrived at similar results to those of Barzel and Hirshleifer.[38]

Exploration was not mentioned by Barzel (1968) and Hirshliefer (1971). Apparently, they were not aware of Gaffney's earlier insights in relation to the opposing effects of market failures associated with asymmetric and public good/external benefits aspects of exploration information.

Morris Adelman (1970) and Robert Cairns (1990) noted that there are strong similarities between exploration and research/innovation activities. Similarities include:

- costly search activities
- considerable uncertainty in respect of the search process and outcomes
- search processes that build on basic research
- the accumulation of knowledge from past activities (successful or otherwise) that facilitates future discoveries by those able to access that information
- displacement of discoveries if better resources are found
- conflicts between efficiency in generation and efficiency in use of information
- difficulties in determining nett effects of information market failures that work in opposite directions.

There are also differences between exploration and research that are important for analysis of the effects of information market failures. Cairns (1990) observed that an important difference is the exhaustibility, non-repeating, or depletion effect of discoveries through exploration, that does not apply to discoveries through inventive activity. The exhaustibility of opportunities to discover resources was highlighted by Mason Gaffney (1967a), Russell Uhler (1976, 1979) and Daniel Siegel (1985).

Cairns (1990) explained that a discovery through exploration creates only a temporary economic advance, as it can be exploited only once. More exploration is required to replenish good-quality (relatively low-cost) reserves or extraction activity needs to be transferred to lower quality/higher cost reserves. In the case of innovative or inventive activity, Cairns (1990) explained that the accumulation

[38] See Arrow (1978), Dasgupta and Stiglitz (1980), Gilbert and Newbery (1982), Dasgupta, Gilbert and Stiglitz (1982), Varian (1999), Stiglitz (2000b, 2002), Bikhchandani, Hirshleifer and Riley (2013), and Stiglitz and Greenwald (2014).

of knowledge through such activity facilitates more breakthroughs by those who can access the accumulated knowledge, without an opposing effect of depletion of the stock of potential discoveries. An invention or innovation can be exploited many and perhaps innumerable times. It does not reduce the stock of potential discoveries of better ways of doing things. Each innovation adds to the knowledge base, facilitating more innovation that improves or builds on various previous innovations. It underpins ongoing economic advances, not a temporary advance.

The effect of depletion of the stock of potential discoveries through exploration, but not through innovation, suggests that the results of analysis of information market failures should differ between exploration and innovation activity. However, Cairns' discussion played down the value of exploration information to those interested in comparable areas, and the role of patents in impeding dissemination of knowledge from innovative activity. These considerations reduce the effect of the difference between exploration and innovation.

Barzel's (1968) and Hirshleifer's (1971) analyses of innovation produced observations similar to those yielded by others' analyses of exploration. This appears to be explained by an apparent implicit assumption in Barzel's (1968) and Hirshleifer's (1971) work that discovery of a new way of doing something through innovative activity is an exhaustible economic opportunity. That assumption relies on the existence of a patent system that allows ideas to be removed from pool of accessible ideas by applied researchers who do little to replenish the pool. Joseph Stiglitz and Bruce Greenwald (2014) explained that this can lead to too much applied research (applied innovative activity), too soon, while basic research activity is undertaken too little, too late.

It seems that the analyses of Barzel (1968) and Hirshleifer (1971) and of those who followed their lead provide a good representation of discovery through exploration, as well as discovery through inventive activity. Therefore, their work indirectly supports the insights of those who have investigated the consequences of co-existence of market failures associated with asymmetric and public good/external benefits aspects of exploration information.

3.4.2 Asymmetric Information between Explorers and Equity Providers

Uneven or asymmetric availability of information between explorers and providers of equity capital is a potential source of market failure. James Fogerty and Simon Sagerer (2016) pointed out that small exploration companies rely on equity capital markets to finance exploration activities, but promotors of those companies typically know more about the quality of the companies' exploration tenements than potential providers of equity capital, and promoters could market the companies' prospects either honestly or dishonestly. They explained that the latter option means that there is a "dishonesty externality in the market for exploration equity capital that gives rise to a market for lemons problem". The result is under-provision of equity capital to small exploration companies and too little exploration from an economic efficiency perspective.

The "market for lemons problem" noted by Fogarty and Sagerer (2016) is an example of a particular type of asymmetric information inefficiency that was highlighted by George Akerlof (1970). The label "market for lemons" was applied by Akerlof.

Fogarty and Sagerer (2016) suggested that the lemons problem in the market for equity for exploration activity was only partly counteracted by existing "institutions". They mentioned the reputation of individual explorers, company branding, and the "role of the stock broker as a specialist adviser on prospect quality", but pointed out that "the incentives for the broker are not the same as for the investor". It is obvious that stock brokers as promoters of new equity issues do not have incentives that are aligned with those of investors. However, it does not seem appropriate to regard stock brokers as specialist advisers on the quality of exploration tenements.

In Australia, which is the focus of the analysis of Fogarty and Sagerer (2016), there has been long-standing recognition of market failure and resulting inefficiency because of asymmetric information between explorers and potential providers of equity capital to explorers. This is evidenced by the Australian policy response, which has been a regulatory requirement that new equity issues to fund

exploration activity be supported by reports prepared by independent geological experts that are made available to potential investors. Fogarty and Sagerer (2016) did not discuss this regulatory policy instrument. Their suggested policy solution (or supplementary solution) was the quality-assurance effect of government approval of exploration subsidies for some private-sector exploration programs. An alternative rationale for limited subsidies is discussed in chapter 7.

The asymmetric information market failure discussed by Fogarty and Sagerer (2016) is distinct from the one discussed in the preceding section that is associated with uneven distribution of information among those undertaking exploration or other assessment activity. Fogarty and Sagerer did not mention or discuss the latter source of market failure or the distinction between the two. The distinction is important for policy formulation because these market failures have effects that work in opposite directions – too much exploration, too soon in the case of asymmetric information between explorers, and too little exploration, too late if there is asymmetric information between explorers and capital providers. It is also relevant that the consequences of the market failure associated with asymmetric information between explorers and providers of equity capital tend to work in the same direction as public good/external benefits aspects of exploration information, exacerbating a tendency towards too little exploration, too late.

3.4.3 Asymmetric Information between Government and Private Sector Explorers

It has often been observed that government owners of sub-surface resources are at an information disadvantage compared to private sector entities exploring in their jurisdictions. Consequently, government (on behalf of constituents) may be disadvantaged in making decisions on releases of locations for applications, assessing proposals, and in finalising deals with private sector explorers regarding titles.

However, to the extent that asymmetric distribution of information between a government custodian of sub-surface resources and private sector explorers is an issue, it is the result of policy choice or inertia (government or policy failure), not market failure. Governments could choose to protect themselves by behaving like rational private sector owners of potential resources (Gaffney, 2009). They have opportunities to improve information available to them that would provide benefits greater than costs. They also have options for reducing information asymmetries among potential explorers to increase competition between those entities for potential resources, and thereby improve the position of government in dealings with explorers.[39]

Various information policy actions that government could take as a rational custodian of potential resources would serve multiple purposes. Not only would they reduce information asymmetries between private explorers and governments, but also they would be important elements of a package of instruments to address other exploration information asymmetries, and market failures arising from the public good/external benefits aspects of exploration information. Key policy options are analysed in chapters 6, 7 and 8.

3.5 Interaction of Information Market Failures

In the case of early-stage exploration in minimally explored areas, the value of the public good of exploration information would be at its peak. This is the case because pre-existing uncertainty and the number of potential beneficiaries would be at their highest levels. Any spillovers of information – the realised part or non-excludable part of the public good of information – would also be most valuable in the very early stage of exploration. It follows that the tendency of public good/external benefits market failure to cause too little exploration, too late could be expected to be greater, the earlier is the stage of exploration.

[39] This policy strategy has been advocated by Hughart (1975), Cotula (2010), Collier and Venables (2011a), and Morgan and Stanley (2017).

The impediment to exploration activity resulting from asymmetric information between potential equity investors and explorers, is also likely to be higher, the earlier is the exploration stage.

In relatively unexplored areas, the tendency of asymmetric distribution of information between explorers to lead to too much exploration, too soon could be expected to be weakest, although it still might be significant. Relatively low excludability of potential users of information and relatively low *ex ante* resource rent could mean the inducement to pursue an information advantage would be weak. However, entities focussing on average rather than marginal potential resource rent in the context of considerable uncertainty, and on being first to capture any realisable resource rent when there is less interest from others would tend to partly offset an otherwise weak inducement to pursue an information advantage in frontier areas.

In relatively unexplored areas, the effect of the public good/external benefits of exploration information and asymmetric information between equity capital providers and explorers would probably outweigh the influence of asymmetric information among explorers. Then, the nett result would be too little exploration, too late, on balance. However, the outcome is not entirely clear.

In cases of high potential for discovery of deposits amenable to profitable extraction, it could be expected that potentially high resource rents would motivate pursuit of exploration information to gain an advantage in pursuit of rights to capture those resource rents before others. This could include inducement of uncooperative behaviour in relation to information sharing to maintain a perceived information advantage. These effects would be particularly likely to apply in areas considered to be highly prospective by just a very small number of entities. In contrast, in areas perceived to have high discovery potential, under-provision of the potentially external component of benefits of exploration information is likely to be relatively less influential than in areas that are less prospective, because information will have less value to and be more easily excluded from other entities. In addition, in highly attractive areas, asymmetric information between potential equity capital providers and explorers is less likely to deter funding of exploration activity, than in less prospective locations.

Hence, in areas with high discovery potential, the effects of asymmetric information among explorers could be expected to outweigh the combined effects of under-provision of potential external benefits of information and asymmetric information between explorers and equity investors. The nett result would be too much exploration. It would not cause premature exploration, because areas of high potential for discovery and profitable extraction would normally be explored promptly.

For intermediate cases, the nett effect is unclear. Nevertheless, it is obvious that the likelihood of asymmetric information market failure dominating the other influences would tend to increase as exploration proceeds through its various stages.

Typically, early economic analyses of exploration information asymmetries and external benefits and public good aspects of exploration information seemed to be focussed on intermediate cases. However, the context was not made clear in those studies. In addition, asymmetric information between explorers and potential equity investors was neglected. The conclusions of these early analyses were equivocal.[40]

3.6 Interaction of Titles Regimes with Exploration Information Market Failures and Policy Instruments to Those Market Failures

Information market failures should be considered in the context of relevant alternative rights or titles regimes, not in a vacuum. This is desirable because alternative rights regimes:

- have been touted by some parties as means of addressing information market failures
- interact differently with various forms of exploration information market failure

[40] See Dasgupta and Geoffrey Heal (1979, p. 437); Gilbert (1981, p. 202); and Leitzinger and Stiglitz (1984), pp. 48-49.

– interact differently with other policy instruments that directly target information market failures by improving the availability of information.

The amount, type, and timing of exploration may be influenced by regimes for transferring exploration rights from owners of mineable resources (typically governments) to other entities, and by enforcement of conditions attaching to those rights. Such influences may be exerted by licencing systems, which are used in most economically advanced countries (including Australia) and about half of all countries, and by contract systems, which are deployed elsewhere. Both licencing and contract regimes have often been designed to bring forward and increase the amount of exploration activity.[41] Sometimes, their design has also targeted inducement of specific types of exploration or other assessment activity.

Rights regimes may tend to offset or exacerbate effects of information market failures on the amount and timing of exploration or assessment activity. They may undermine or support other policy instruments that directly target information market failures. These issues have been analysed in chapter 8.

3.7 Conclusions

Information market failures cause misallocation of resources in respect of exploration and other assessment of locations of potential interest. The public good of information and external benefits of information spillovers tend to cause too little exploration, too late from an economic efficiency perspective. This effect has been exacerbated by asymmetric information between explorers and potential providers of equity capital. On the other hand, asymmetric information among explorers has tended to lead to too much exploration, too soon relative to the benchmark of economic efficiency. To the extent that generators of exploration information have been able to keep results of their activities secret, information spillovers have been contained and asymmetric distribution of information has been exacerbated.

In areas with minimal previous exploration, the public good/external benefits aspect of information and asymmetric information between explorers and potential equity investors could be expected to have their greatest effects. In such areas, asymmetric information among explorers would tend to have its weakest effect, because of low *ex ante* resource rent and difficulty in keeping exploration information secret. However, there are factors tending to partly offset this weakness. In areas with relatively little prior exploration, activity could be too little, too late, on balance, but the outcome is not entirely clear.

In areas considered to have high discovery potential, relatively high *ex ante* resource rents would motivate pursuit of exploration information advantages. In those areas, additional external benefits from information spillovers are likely to be considerably less influential than in areas that are less prospective, because the information would be less valuable in areas already regarded as highly prospective, and secrecy of information from advanced, narrowly focussed exploration would be easier to achieve. Hence, in the context of high discovery potential, the effect of asymmetric information could be expected to outweigh the effects of external benefits of information spillovers and asymmetric distribution of information between explorers and potential equity investors. So, the nett result would be too much exploration, too soon from an economic efficiency perspective.

The likelihood of asymmetric information market failure dominating tends to increase as exploration proceeds through its various stages. Therefore, the nett effect is unclear in circumstances that are not close to polar cases of exploration in relatively unexplored areas, and exploration in areas considered to be highly prospective.

Exploration information market failures should be considered in the context of relevant alternative exploration rights regimes, not in a vacuum. This important matter has been discussed in chapter 8.

[41] In addition, in some jurisdictions, retention or development licences allow explorers to retain temporary tenure over discoveries that are not ready for development. These licences are also subject to conditions designed to increase and bring forward exploration and other assessment activity relative to that indicated by commercial considerations without conditional tenure.

4 CURRENT OFFSHORE INFORMATION REGIME: POLICY, REGULATIONS, AND ISSUES

Key Points

- The RMA Regulations have been carefully scrutinised having regard to policy criteria and principles of policy analysis nominated in chapter 2.
- Further insights have been gained from consultations with government and private sector stakeholders.
- Anomalies, inconsistencies, and undue complexities in the RMA Regulations and their administration have been identified and documented.
- Information coverage omissions have been highlighted.
- Various policy issues underlying the RMA Regulations have been identified.

4.1 Legal Context of RMA Regulations

4.1.1 Offshore Sovereignty, Sovereign Rights and Legislative Framework

The evolution of the Commonwealth (or Australian) Government's sovereignty, sovereign rights, and legislative authority and framework in respect of offshore petroleum resources and greenhouse gas storage structures is summarised below. Currently, the key legislation for management of offshore petroleum resources and activities, and offshore greenhouse gas storage structures and activities is the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act). To facilitate this management task, various regulations have been made under the OPGGS Act, including the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations). Guidance on the provisions of the OPGGS Act and the RMA Regulations is set out in guidelines and fact sheets.

In 1953, the Commonwealth of Australia claimed the natural resources of the seabed of its continental shelf. Since 1958, there has been international recognition of Australia's sovereignty over natural resources in the territorial sea, and sovereign rights in respect of the natural resources of the continental shelf. This was conferred through international conventions organised by the United Nations.[42]

In 1982, Australia's rights offshore were confirmed and expanded by another international convention under the auspices of the United Nations: *Convention on the Law of the Sea 1982*. Sovereignty over natural resources of the territorial sea could be extended beyond the historical 3 nautical-mile limit to 12 nautical miles from a baseline linked to the low-water mark.[43] The Commonwealth Government legislated to implement such an extension in 1990. Sovereign rights were conferred for defined purposes, and jurisdiction for other specific purposes in an exclusive economic zone between 12 and

[42] *Convention on the Territorial Sea and Contiguous Zone 1958* and *Convention on the Continental Shelf 1958*.
[43] The territorial sea limit was not defined in the 1958 conventions.

200 nautical miles from a nation's baseline. Provision for extension of the exclusive economic zone, subject to satisfaction of various conditions, allowed the addition of a total of 2.56 million square kilometres to Australia's exclusive economic zone in nine separate areas in 2008 following a submission in 2004 to the United Nations Commission on the Limits of the Continental Shelf.

Defined purposes for which sovereign rights are conferred in the exclusive economic zone include exploring for, exploiting, conserving and managing natural resources of the seabed and its subsoil.[44] Jurisdiction in this zone is conferred for establishment of artificial islands and structures, marine scientific research, and protection of the marine environment.

Sovereign rights and jurisdiction in the exclusive economic zone are exclusive. However, in terms of quantity and quality of rights, sovereign rights fall short of sovereignty that applies in the territorial sea. Sovereignty over the territorial sea, including the underlying seabed and overlying air space, is an extension of a coastal state's sovereignty over its land territory and internal waters. Sovereignty typically refers to the absolute power of a state to legislate to control or regulate activity within its territory without challenge from a higher authority.

Until the mid-1970s, there was uncertainty regarding offshore rights of the Australian states and the Commonwealth. This was addressed by intergovernmental negotiations that commenced in 1962 and concluded with an agreement in 1967. The result was joint Commonwealth-state administration of offshore petroleum exploration and production under "mirror legislation". The Commonwealth's *Petroleum (Submerged Lands) Act 1967* covered all offshore areas subject to Australian sovereignty or sovereign rights. Each state legislated in identical terms to the Commonwealth's *Petroleum (Submerged Lands) Act 1967*, but only in relation to the offshore area adjacent to state territory. The intent was that, in the event of jurisdictional clarification, there would be valid legislation in place. Royalties were to be shared between the adjacent state and the Commonwealth.

Jurisdictional uncertainty was resolved in 1975 by the High Court's confirmation of the Commonwealth Parliament's claim of sovereignty over the territorial sea and sovereign rights over the continental shelf under the *Seas and Submerged Lands Act 1973.* In effect, the Commonwealth version (not state versions) of the *Petroleum (Submerged Lands) Act 1967* was confirmed as the constitutionally valid legislation.

As a result of state dissatisfaction with the Commonwealth's action and the High Court's judgement, the Commonwealth Government negotiated the *Offshore Constitutional Settlement 1979* with the states and the Northern Territory in 1979. Under this agreement, the Commonwealth Parliament legislated to transfer legislative powers to each state and the Northern Territory (with their legislated agreement) to exercise sovereignty over their adjacent coastal waters (seabed, water column and airspace) – the portion of the territorial sea within three nautical miles of the low-water mark baseline. The Commonwealth Parliament retained powers based on sovereign rights beyond coastal waters. Each state/territory was required to share administration of regulation of petroleum activities off its coastline beyond coastal waters, and each was entitled to share royalties with the Commonwealth from petroleum production in that area.[45]

In 1980, pursuant to the *Offshore Constitutional Settlement*, the Commonwealth Parliament amended the *Petroleum (Submerged Lands) Act 1967* to focus on petroleum resources and activities beyond coastal waters. State/territory parliaments passed legislation in respect of coastal waters that mirrored the Commonwealth legislation. In each state, the legislation was called the *Petroleum (Submerged Lands) Act 1982*. For the Northern Territory, the year in the title of the legislation was 1981.

As part of the shared administration of petroleum resources and activities in Commonwealth waters, a Joint Authority and Designated Authority were established for Commonwealth waters adjacent to each state and the Northern Territory. The Joint Authority comprised the responsible Commonwealth Minister and the responsible state/territory Minister, with the former having power decide any matter in the event of disagreement. The Designated Authority, which was responsible to the relevant state/territory Minister, carried out day-to-day regulation of health and safety, well integrity,

[44] Other defined purposes for which sovereign rights are conferred in the exclusive economic zone include exploiting, conserving and managing natural resources in the waters overlying the seabed, and other economic exploitation activities, such as production of energy from the water, currents and winds.

[45] Under the Offshore Constitutional Settlement 1979, offshore minerals were to be dealt with in similar way to petroleum.

environmental issues, administration of titles, and management of information from activities in adjacent Commonwealth waters.

The Designated Authority arrangements changed in the period from 2005 to 2012. The Joint Authority arrangements were retained.

Following a review of the adequacy of offshore safety regulation in Australian waters, Commonwealth, state and Northern Territory Ministers agreed to transfer regulation of health and safety of offshore petroleum workers to a new statutory authority established in 2005 under the *Petroleum (Submerged Lands) Act 1967*. The new entity was the National Offshore Petroleum Safety Authority (NOPSA).

In 2006, the Commonwealth Parliament replaced the *Petroleum (Submerged Lands) Act 1967* with the *Offshore Petroleum Act 2006*. It retained the framework of the *Offshore Constitutional Settlement 1979*. In 2008, the *Offshore Petroleum Act 2006* was renamed the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) after amendments were made to incorporate greenhouse gas storage provisions.

A Productivity Commission review of the regulatory burden on the petroleum exploration and extraction sector in 2009,[46] an oil spill and gas leak from the Montara H1 well in the Timor Sea a few months later, and a subsequent inquiry into the incident[47] led to further changes to offshore petroleum regulation. In April 2011, regulation of well-integrity matters was transferred to NOPSA (proposed in the Montara inquiry report) through an amendment to the OPGGS Act. Later in 2011, with the support of the interjurisdictional Ministerial Council on Ministerial and Petroleum Resources, the OPGGS Act was amended further to:

- add environmental regulation to NOPSA's responsibilities (recommended in the Montara inquiry report) and transform it into the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) as from 1 January 2012
- establish NOPTA as from 1 January 2012 to administer titles and manage information management, instead of each Designated Authority (concept recommended by the Productivity Commission).[48]

4.1.2 Regulations under OPGGS Act

Part 9.11 of the OPGGS Act relates to making of regulations and their scope. Section 781 provides that the Governor-General may make regulations prescribing matters:

- required or permitted by this Act to be prescribed; or
- necessary or convenient to be prescribed for carrying out or giving effect to this Act.

Section 782 states that the regulations may make provision for securing, regulating, controlling, or restricting any or all of 22 categories of listed matters. However, section 782 provides that the list does not restrict section 781. Other sections in Part 9.11 further expand the potential scope of regulations made under the OPGGS Act. Important examples are sections 786 to 789, which relate to exercise of Australia's rights under international law in respect of exploration for, and extraction of petroleum, and injection and storage of greenhouse gases in geological formations within offshore territorial limits and the continental shelf.

In 2009, the Commonwealth Government commenced a program of consolidation and amendment of numerous offshore petroleum regulations and guidelines. The results were separate sets of regulations for health and safety, the environment, and resource management and administration (the latter including well integrity).

The third set of regulations was made in 2011. It was named the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* (RMA Regulations). The most recent compilation (28 April 2020) of the RMA Regulations reflects various

[46] Productivity Commission, *Review of the Regulatory Burden on the Upstream Petroleum (Oil and Gas) Sector*, Melbourne: Commonwealth of Australia, 2009.
[47] Borthwick, D., *Report of the Montara Commission of Inquiry,* Canberra: Commonwealth of Australia, 2010.
[48] In February 2014, NOPSEMA became the sole environmental regulator in respect of petroleum exploration and extraction activities in Commonwealth waters after the Commonwealth Minister for the Environment endorsed NOPSEMA's environmental management authorisation process under the *Environment Protection and Biodiversity Conservation Act 1999*.

amendments since they were made in 2011, including amendments to reflect the creation of NOPSEMA and NOPTA as from 1 January 2012.

4.2 RMA Regulations

The RMA Regulations comprise 10 parts with 7 supporting schedules. Part 1 nominates the objects of the regulations, and defines terms, such as "open information", "excluded information", and "non-exclusive data". Part 2 covers reporting of discoveries of petroleum. Part 3 sets out requirements in relation to annual title assessment reports. Part 4 is focussed on field development plan requirements and approvals of recovery of petroleum, including rates. Part 5 is concerned with well operations management plans and well activities. Part 6 relates to authorisation of title holders to undertake exploration for greenhouse gas storage structures. Part 7 sets out obligations of petroleum title holders to keep information (including physical samples) and provide information (including physical samples) to NOPTA within specified timeframes. Part 8 sets out rules in respect of release of information (including physical samples) provided by petroleum title holders. Part 9 specifies obligations of greenhouse gas title holders to keep information (including physical samples) and provide information (including physical samples) to NOPTA within specified timeframes. Part 10 sets out rules in respect of release of information (including physical samples) provided by greenhouse gas title holders.

4.2.1 Sunset of RMA Regulations

In accordance with the *Legislation Act 2003*, legislative instruments, such as regulations, cease to have effect on a specified date (they sunset) unless action is taken to renew them. If a legislative instrument is scheduled to sunset, a choice would have to be made between three outcomes:

- allow the automatic repeal of the instrument
- remake the instrument with amendments
- remake the instrument without amendments.

The RMA Regulations sunset on 1 April 2024. DISER has foreshadowed a review of Parts 7 to 10 and Schedules 1-5 (relating to data requirements specified in Parts 7 and 9) of these regulations for the purpose of preparing new RMA Regulations that can be in force before the sunset date. The analysis in this report has been undertaken to assist DISER on formulation of new RMA Regulations.

4.2.2 Information Management Aspects of RMA Regulations

Information (including samples) management aspects of the RMA Regulations, which relate to collection/recording/keeping, provision to government, and public release of information, are set out in Parts 7-10. They superseded the *Petroleum (Submerged Lands) (Data Management) Regulations 2004*. The latter had been amended to give effect to an amendment to the OPGGS Act in October 2009 that removed requirements for data management plans. This required reconsideration of obligations relating to collection/recording/keeping, provision to government, and release of information publicly or to requesting parties. Results of this policy review were reflected in the Parts 7 to 10 of the RMA Regulations.

Sub-sections 698 (1) and 724 (1) of the OPGGS Act state that the regulations may make provision for and in relation to:

- the keeping of accounts, records and other documents in connection with operations in an offshore area under various forms of petroleum title (698(1)) and greenhouse gas title (724(1))
- the collection and retention of cores, cuttings and samples in connection with those operations
- the giving to NOPTA, or a specified person, of reports, returns, other documents, cores, cuttings and samples in connection with those operations.

The provisions for collecting/keeping information (including samples) and passing resulting petroleum and greenhouse gas material to NOPTA are in Parts 7 and 9, respectively, of the RMA Regulations. The regulatory provisions set out in considerable detail what title holders are required to do and when they have to do it. These obligations are also highly differentiated by type of information (including samples).

Sections 712, 713, 715 and 716 of the OPGGS Act, in the case of petroleum activities, and sections 738, 739, 740A and 740B, in the case of greenhouse gas activities, provide that NOPTA and a Government Minister must not make documentary information and details of relevant samples from title holders publicly known, except for the purposes of administering the Act or the regulations or except as provided in pertinent RMA Regulations. Pertinent provisions are in Part 8 (petroleum) and Part 10 (greenhouse gas) of the RMA Regulations. These provisions:

- define various categories of information
  - permanently confidential information (excluded information defined in Part 1, and two categories of documentary information defined in each of Parts 8 and 10)
  - basic disclosable documentary information
  - interpretative disclosable documentary information
  - samples
- refer also to open information, excluded information, and non-exclusive information, all of which are defined in Part 1
- specify processes for dealing with disputes about categorisation
- set out circumstances in which NOPTA or the responsible Commonwealth Minister can make open information and disclosable information and samples available either publicly or to a party other than a Commonwealth or state/territory Minister.

The provisions of Parts 8 and 10 are very detailed. They also differentiate greatly between sources of information and timing of release of that information.

NOPTA or the responsible Commonwealth Government Minister may make open information about a well or survey publicly known at any time. Open information refers to general information such as the name of the survey or well, the title, the basin or sub-basin, the title holder, the type and size of survey, timing of the activity, and the location, purpose, depth and status of wells.

Other disclosable documentary information regarding offshore petroleum or greenhouse gas activities may be made publicly known or released to an entity with time lags varying with the type of information and title.

Disclosable information does not include information regarding technical and financial resources available to title holders, contents of applications for titles, reports under Part 2 (notification and reporting of discoveries), reports under Part 3 (annual title assessment reports), trade secrets, and information the disclosure of which could reasonably be expected to adversely affect the business, commercial or financial affairs of the reporting explorer. This excluded information is permanently confidential.

For basic disclosable information, the confidentiality period for exclusive data is typically three years, but it ranges from one to three years. Non-exclusive data – data collected for sale or licence – remains confidential for 5, 6 or 15 years, depending on the type of data.

In the case of interpretative disclosable information in a title area, the prescribed release date is more than 5 years after the end of the operation to which the information relates. Interpretive information refers to conclusions or opinions based wholly or partly on other documentary information.

Details of samples may be publicly released or a person may be permitted to inspect samples after one year from the end of operations to which the samples relate in the case of a production or greenhouse gas injection licence and after two years in the case of other licences.

Documentary information and samples may be released at any time, if the title holder has made details publicly known or if the title holder has provided written consent. In the event of such consent, exclusions and timing restrictions outlined above would be overridden.

4.3 Key Issues with Information Aspects of RMA Regulations

There are numerous issues arising from the structure and specific aspects of Parts 7 to 10 and Schedules 1 to 5 of the RMA Regulations. Key issues, including those raised during stakeholder consultations, are outlined below.

4.3.1 Problem and Objectives Targeted by Regulations

The Australian Government's (2020b) guidelines on analysis of regulations emphasise the importance of clearly defining the problem and objective(s) to be addressed by regulations, and carefully articulating the case for government intervention. The guidelines highlighted the objectives of improving the efficiency of resource allocation and equity. These objectives have been nominated as criteria for formulation and assessment of policy instruments in sub-section 2.2.2 in chapter 2.

The guidelines nominated correction of market failures and regulatory (policy) failures as steps towards improving the efficiency of resource allocation. Market failures relating to public goods and information asymmetries were specifically mentioned. Chapter 3 is focussed on these market failures.

The Productivity Commission (2009, 2013, 2020), in the context of investigation of regulation of the exploration and extraction sectors, explained that leading-practice regulation requires clear definition of objectives targeted by regulations. The Commission also pointed out that consistency of objectives is also required throughout regulations.

The objectives of the information management elements of the RMA Regulations are not clear. Similarly, rationales for the information regulations and their structure have not been clearly articulated. Nevertheless, most stakeholders have assumed the objective of the RMA Regulations is to make data available to maximise the effectiveness of exploration and maximise the discovery value of petroleum resources vested in the Crown [redacted].

The information regulations seem to be directed at correcting information market failures to improve the efficiency of resource allocation. However, some information has been made permanently confidential and release of other information has been delayed for various periods ranging up to 15 years. These limitations on release of information suggest that those who made the regulations perceived the existence of positive and negative effects on petroleum and greenhouse gas storage activity of mandated release of privately generated information, and considered that a trade-off was required between mandated release of privately generated information and leaving generation and dissemination of information to market forces. This matter is analysed in chapter 6.

4.3.2 Neglect of Interactions

It has often been overlooked that exploration information market failures should be considered in the context of relevant alternative exploration titles regimes. This context is important because claims have been made in various publications that some types of titles regimes are helpful in addressing information market failures or at least improving availability of information. Titles regimes and information-focussed policy instruments may also interact in other ways with positive or negative outcomes. These matters need to be considered when formulating policy. The importance of taking account of policy interactions has been emphasised in subsections 2.2.3 and 2.2.4 in chapter 2.

Neglecting the context of alternative titles regimes and policy interactions can result in formulation of policy packages that generate economically undesirable outcomes. These matters have been analysed in detail in chapter 8.

4.3.3 Highly Prescriptive Regulations

The information management elements of the RMA Regulations are generally highly prescriptive. They describe in detail what and how things should be done. Prescriptions differ between various circumstances. This prescriptive approach has resulted in unnecessarily complex regulations. Because of the difficulty of specifying precisely what and how things should be done in all circumstances, prescriptive gaps and anomalies have caused confusion or facilitated avoidance of intended requirements, with sub-standard outcomes.

In the context of investigation of regulation of the exploration and extraction sectors, the Productivity Commission (2009, 2013, 2020) has stressed that highly prescriptive regulation is not consistent with leading practice. It performs poorly with respect to economic efficiency, administrative efficiency and effectiveness criteria for policy formulation and assessment that were discussed in sub-section 2.2.2 in chapter 2. The Productivity Commission (2013, pp. 84-85) observed:

"Excessively prescriptive regulation …. is typically more complex and onerous than objective- or performance-based regulation, is less flexible, can stifle innovation, and may not allow businesses to deliver the policy outcome at least cost. Excessively prescriptive regulations can be a burden on both industry and regulators."

The Productivity Commission (2009, 2013, 2020) and the Council of Australian Governments' (2007) best practice regulation guidelines prefer objective- or performance-based regulation. Such regulations focus on outcomes or performance standards that regulated entities are required to achieve. However, in formulating performance-based regulations, care is required to provide regulatory certainty.

[redacted] point of view the regulations are too prescriptive. While acknowledging objective regulation in this area has its challenges, they considered it would be a mistake to continue to go down the prescriptive route. This view was echoed by [redacted]. Stakeholders also expressed specific concerns about the prescriptive nature of the data submission requirements in respect of formats and media (see also subsection 4.3.6). However, some stakeholders (particularly [redacted]) were less sanguine about moving down the objective regulatory pathway, stressing the need to ensure that requirements are clearly spelt out [redacted].

Several parties consulted by ACIL Allen stressed that they would like to see both NOPTA and Geoscience Australia focus more on quality assurance to ensure that the data are released in the best, useable format, with a dual remit covering both compliance and to deliver the best exploration and production outcomes for Australia. They considered that this had been impeded by the prescriptive nature of the RMA Regulations. While acknowledging objective regulation in this area has its challenges, they considered that prescriptive regulation did not facilitate the delivery of desired outcomes [redacted].

4.3.4 Regulatory Complexity

The information management regime established by the RMA Regulations is characterised by complexity. This has been exacerbated by the highly prescriptive nature of the information regulations.

Some definitions are not clear. Definitions are scattered, with some included in the OPGGS Act or Part 1 of the RMA Regulations, while others appear in the parts of the RMA Regulations focussed on information capture and release by government. Some stakeholders considered that there were key issues and concepts that had been overlooked in the legislation, in particular the ownership of data once submitted to government, and definitions concerning confidential data and proprietary intellectual property.

The information release rules incorporated in the regulations are particularly complex. They are highly heterogeneous. Information (including physical samples) is categorised in various ways with differing periods mandated until release by government is permitted. Moreover, categorisation is open to interpretation in some cases.

[redacted] called for clarification as to the internal use of data (once submitted but prior to becoming open file) by government agencies. In discussions [redacted]
They also would consider use of the findings in documentation associated with release programs or academic papers providing location-specific data is not released (ACIL Allen, 2020, p. 11). Greater clarity in the RMA Regulations as to exactly what "confidentiality" means in this context was seen as desirable.

In the context of investigation of regulation of the exploration and extraction sectors, the Productivity Commission (2009, 2013, 2020) has pointed out that regulatory complexity is not consistent with leading practice. It can cause unnecessary monitoring and enforcement burdens for government, and unreasonable compliance burdens for enterprises. Both sectors may incur undue legal and other dispute costs. Complex regulations do not satisfy the administrative efficiency criterion (an aspect of

economic efficiency) for policy formulation and assessment that was nominated in sub-section 2.2.2 in chapter 2. Stakeholders generally concurred with this view during consultations.

4.3.5 Data Retention

Data retention requirements in Division 1 and 2 of Parts 7 and 9 of the RMA Regulations were criticised by stakeholders.

Samples

In accordance with regulations in Division 2 of each Parts 7 and 9 of the RMA Regulations, title holders must retain samples (including cores and cuttings) collected during offshore operations, samples must be kept securely, and retrieval must be reasonably practicable. The period of applicability of these obligations is not specified.

Only the sample types and quantities collected from a well operation and listed in regulations 7.20 (4) and 9.23 (4) must be submitted to NOPTA. There is no requirement for samples collected during other offshore activities to be submitted. These include core, cuttings, or other samples collected during activities such as a seabed survey or piston core sampling program undertaken in support of the exploration activity.

Division 4 of each of Parts 8 and 10 of the RMA Regulations provides for public release of details of samples and inspection of samples. In general, sample details can be made publicly available earlier than documentary information.

Only submitted samples can be released. Restriction of the range of submittable samples has reduced information available to other explorers.

Samples are often sent to international laboratories to complete the analytical process. For submitted samples, this requires NOPTA's approval under regulations 7.06 and 9.06. Approval is not required to take samples overseas to the extent that they are surplus to submission requirements.

After approval to take samples overseas has been granted, regulations 7.08 and 9.08 require that a report about the progress of the analysis is provided within 12 months, and at the end of each subsequent 12-month period. There is no requirement to provide a final report regarding the completed analysis. To address this oversight in the RMA Regulations, a requirement to submit an additional final report of the analysis, detailing the data created and resulting conclusions, is activated administratively by imposing a condition on the approval to take samples overseas. The oversight could be rectified when the regulations are remade.

Industry stakeholders expressed concerns that the requirement to store samples indefinitely was expensive and was considered to carry little benefit. This was particularly onerous if titles were no longer held. They suggested that this cost could lead to collection of fewer samples. In general, companies were amenable to lodging all such data/samples to the Repository and letting government decide what it wished to retain [redacted].

Industry stakeholders noted that samples are regularly shipped overseas for analyses. They argued that the regulator needs to ensure exported material is returned to Australian repositories, unless those repositories already hold samples.

[redacted] proposed the removal of prescriptive storage requirements from the RMA Regulations. It considered that after samples had been lodged with government, companies should not be required to store extra samples unless they choose to do so for operational reasons.

The [redacted] suggested that the RMA Regulations be amended to require the submission of all samples upon title relinquishment and companies no longer be required to retain data/samples in perpetuity [redacted].

Information Excluding Samples

In accordance with regulations in Division 1 of each Parts 7 and 9 of the RMA Regulations, title holders must securely keep information regarding an operation, and retrieval must be reasonably practicable. The regulations do specify the period of applicability of these obligations.

[redacted] and the [redacted] expressed similar views to those they put forward in relation to retention of samples.

There were mixed views as to whether companies should be allowed to store data offshore. Some considered that "there should be no storage of data offshore as the risks that no copy of the data is retained for future use would be too great", while others felt it should be up to the title holder. If the required data is submitted in accordance with the RMA Regulations and the regulator validates the data promptly to ensure compliance, the storage location is largely irrelevant. In many ways the storage of data offshore has become somewhat meaningless given most data is digital and can be stored in the "Cloud" on servers anywhere in the world.

4.3.6 Submission of Information

Well Data Submission Deficiencies

Regulations 7.12 to 7.14 and 9.12 to 9.14 require submission of reports and data in relation to drilling wells in a title area by a title holder. They encompass daily drilling reports, initial well completion data and reports, and final well completion reports and data.

Various stakeholders identified deficiencies in well data submitted [redacted] A [redacted] that [redacted] commented that submitted information is often deficient. Another company pointed out that there is no standard for submitting data, making the task of processing, analysing, and interpreting well log data sometimes impossible. One submission noted:

"[redacted]."

[redacted] and others stressed the importance of quality well data (especially that relating to abandonment) in greenhouse gas assessments and the subsequent integrity of storage sites. [redacted] suggested:

"[redacted]"

Various suggestions were received as to how the relevant provisions in the RMA Regulations could be strengthened, including the provision of [redacted]:

- daily geological reports
- cuttings descriptions
- sidewall core descriptions (if acquired)
- core lithology description (if acquired)
- LOT/FIT data (leak-off test/formation integrity test data).

Submission of Information from Surveys Other than Seismic

Regulations 7.15 to 7.19 and 9.15 to 9.19 require submission of reports and data from all new geophysical and geological surveys undertaken in a title area by a title holder. The relevant regulations are focused mainly on seismic surveys. The scheduled data to accompany a survey report are divided into categories of 2D seismic surveys, 3D seismic surveys and "other" surveys. The information to be included in survey reports is also separated into these categories in relevant regulations and related schedules to the RMA Regulations. The details of information required for "other" surveys are minimal. No further definition or other explanation of "other" surveys is provided in the RMA Regulations.

Some "other" surveys, such as some types of site surveys in a title area, are completed before drilling activities commence. If the intended well is drilled, the survey may be considered a drilling activity and the reports and data are to be submitted and released according to the timelines for well data. If a similar survey is completed, but a well is not drilled, the data are to be submitted and released

according to the timetable for a survey. This leads to ambiguity around data release as the relevant times for well and survey data are determined differently.

Survey techniques used to explore for oil and gas are expanding. These techniques include controlled-source electromagnetic, gravity, multi-beam, geotechnical, and geophysical site surveys. The information and data submission requirements for these surveys are broad and can lead to uncertainty regarding the information that should be submitted.

Deficiencies in Submission of Other Information

During the consultation process, [redacted] observed that some entities submitted incomplete data and withheld the best data. This included incomplete data sets, data sets typically not accessible in digital format, failure to submit the best or final data, variable standards of submitted data, and missing navigation data, which is critical [redacted].

Issues were also identified in relation to constraints on the submission of purchased data from non-exclusive surveys. [redacted] some title holders have resisted lodging reports, arguing that it would contravene licencing agreements

Avoidance of submitting some information, often the best information, is contrary to the intent of the RMA Regulations. This detracts from the quality of information available for subsequent release.

[redacted] stressed that consistent data standards are important, especially when attempting to integrate different [redacted]. However, [redacted] argued [redacted]:

- greater consistency and quality assurance are required in relation to the data submitted and released
- there is a need to define data standards better through objective regulations backed up with guidelines/fact sheets that clearly spell out what is required
- while NOPTA does a "good job in relation to compliance" this could be pursued more vigorously, especially in assessing data quality/value from the viewpoint of the user.

[redacted] noted during consultations that if government is to have an open data policy it is important to make sure that the best data is available, consistent with the requirements embedded in the RMA Regulations. [redacted] proposed that the standard of data submitted should be more strongly imposed and subject to quality checks [redacted].

[redacted] expressed interest in the reinstatement of the need to submit annual data management plans for titles. It was considered that this would result in greater transparency and ensure title holders both understood and met their data obligations. [redacted]

Data Types, Formats, and Media

Schedules 1-5 of the Regulations set out the types of data to be submitted to NOPTA, and the standard format and medium for submission. Variations to the requirements of the schedules may be granted by NOPTA prior to submission of information.

With respect to media, data must be received via CD-ROM, DVD, portable hard drive or 3592 cartridge media. USB hard drives are not listed as an acceptable media type, although they are often received by NOPTA. In future, it may be more efficient to submit some information via secure FTP transfer, direct access into title holder systems, or online portals. This is inconsistent with the regulations in their current form.

With respect to formats, technological advances have induced adoption of new formats and abandonment of others. Formats such as ASCII and UKOOA that are specified in the schedules are no longer in common use. To comply with the requirements in the schedules, title holders often need to convert data into these old formats just for submission of data.

Requests and grants of variations are often necessitated by issues such as unclear data types and requirements to use outdated formats and media. An interacting issue is that the specification of standard media and format requirements has constrained title holders in how they might reasonably meet requirements regarding types of data, often necessitating formulation and consideration of requests for variations. These issues impose unnecessary administrative burdens on private sector entities and government that could be avoided by clarifying requirements and updating requirements regarding formats and mediums for data submissions.

Data requirements in part 1 of each of schedules 3 and 4 in respect of well completions and seismic surveys are reasonably clear. In contrast, data requirements in part 2 in each of these schedules in respect of surveys other than seismic surveys are unclear, being extraordinarily terse and vague.

The general nature of the types of data required from non-seismic surveys may have been a result of the wide range of categories of such surveys. This could be regarded as a positive because it does not restrict the scope of data submissions. On the other hand, it might facilitate avoidance of data submission obligations.

Since the specifications in the schedules to the RMA Regulations were written, information technology and data management practices have changed considerably. The regulations have not evolved with changes in technologies and techniques. Consequently, the media and formats specified in the schedules are often inconvenient and relatively costly for title holders to use.

[redacted]

Data formats also attracted considerable negative comment from other stakeholders.

[redacted] noted that compliance is too prescriptive in terms of data media/medium. The provisions are outdated, and in many cases no longer relevant (or old technology). A better approach would be an objective provision to submit the "best-available" data and leave it to NOPTA's discretion to test compliance (noting that NOPTA has the technical skills to make this judgement). This view was generally supported [redacted]

[redacted] stated in its submission:

"[redacted]

[redacted]"

[redacted] pointed to similar issues with NOPIMS (funded by Geoscience Australia and NOPTA and managed by WA Department) as follows [redacted]:

- files are too large and there is a need to rebuild the data base
- the strong GIS focus does not necessarily align with customer needs
- there needs to be more focus on access to or discoverability of data rather than on maps
- while Good Standing Arrangements data can be placed on NOPIMS, there is no quality control mechanism.

Timeframe for Data Submission

Data submission timelines as specified in the RMA Regulations generally did not raise major issues for stakeholders. [redacted]

However, some issues in meeting time frames for submission of basic data were identified by [redacted] as follows [redacted].

- For basic or initial well data reports due 6 months after the rig release date, problems with the timeframe can arise if more extensive and elaborate post-well analysis is being undertaken.
- The submission of interpretive well data reports 18 months after the rig release date regularly causes problems, resulting in frequent requests for extensions to the submittal timing.
- A survey interpretation report for a survey within a petroleum title is currently due 30 months after completion of acquisition of the data completed, but this is difficult to achieve.

It was proposed these submission timeframes be extended to avoid the administrative burdens associated with numerous extension requests.

[redacted] noted that different reporting timeframes applied to a survey interpretation report for a survey within a petroleum title (due after 30 months from the day that the acquisition of the data completed) compared to greenhouse gas title holders, who currently only have 18 months. It was suggested these be standardised [redacted].

4.3.7 Neglected Information

[redacted] raised concerns as to unduly limited data coverage under the RMA Regulations. NOPTA can only release data that is related strictly related to titles, is required to be submitted, is submitted, and has not been categorised as permanently confidential information. Some important information relating to titles has been missed by the RMA Regulations. Also, key data that are more remote from titles, such as that from regional and basin studies, Good Standing Agreements, and nomination of areas to be released for bids are not caught by the regulatory net. [redacted] suggested there needed to be an overarching policy on how data is managed and what should be made available.

Bathymetry and Reprocessed Data

Bathymetry (depth of water) and water column data are not included in data to be submitted under the RMA Regulations.

The RMA Regulations do not include an explicit requirement to submit reprocessed data to NOPTA. Also, they do not explicitly require submission of survey processing and survey interpretation reports in respect of reprocessed data. This has led to uncertainty as to whether submission of reprocessed survey data and processing and interpretation reports is compulsory or voluntary.

Regional Data

Entities that produce geological or geotechnical information of a regional nature are not required to submit the information to NOPTA unless submission is required by a title condition. Information that escapes the current information capture net could be generated as part of an entity's activities to narrow the scope of or to give more focus to its search activities. It could also be produced as a requirement of a Good Standing Agreement that relieves an entity of work commitments on a specific title in return for other knowledge-generating activity considered by the relevant government officials to be of economic benefit.

If regional data is provided to satisfy a title condition, either in an annual title assessment report or in a separate submission, its release may be blocked because the RMA Regulations do not specifically provide for release of information in these circumstances. Inclusion of the information in a title assessment report would make it permanently confidential. If the information is submitted separately, its release would require written consent from the title holder or the information would have to be made publicly known by the title holder.

If regional data is generated pursuant to a Good Standing Agreement, it would not have to be submitted to NOPTA, as submission is not required by the RMA Regulations or a title condition. This is discussed further in the next sub-section.

If regional data is generated as part of normal very early-stage activity off-title, it would completely escape the government's information-capture net.

Good Standing Agreements

Several stakeholders pointed to issues relating to data collected under Good Standing Agreements. The RMA Regulations do not require submission of this data to NOPTA or specify release requirements. Generally, the data are provided to Geoscience Australia as part of the Agreement. Presumably, public release would have to be enabled under that agreement.

[redacted] expressed the view that data resulting from activities under Good Standing Agreements should be submitted like all other data and subject to the same checks and release provisions. The Regulations would need to be amended to facilitate management of these data. [redacted] supported this view, noting that [redacted]:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

While [redacted] were silent on the issue, at least one noted that Good Standing Arrangements are not referenced in the RMA Regulations, and went on to suggest [redacted]

- all data and information from any titles awarded under a Good Standing Agreement should be subject to the same regulations for data and information submitted
- terms and conditions of Good Standing Agreements should detail the requirement for the release of data and that may include agreement to make the information "open file" earlier than the timeframes outlined in the RMA Regulations.
- NOPTA should maintain a comprehensive public register of all Good Standing Agreements that includes links to all data and interpretations generated to fulfill obligations under these Agreements.

In [redacted] view, the Government should be using Good Standing Agreements as a mechanism to generate greater data availability, or to encourage funding of projects of benefit to a range of stakeholders that would likely not otherwise be undertaken. [redacted] was of the view that the outcomes of previous work under Good Standing Agreements be reviewed to determine if the Agreements are generating the maximum nett benefit to the Australian community.

Nomination Information

Information submitted in support of nominations for release of areas for bids is not captured under the RMA Regulations. NOPTA said that this meant that some important information did not become publicly available [redacted].

A petroleum company suggested the Government should consider whether it gets adequate information from the nomination process. However, it argued that the identity of companies that have nominated certain areas and the reasons for the nomination should be kept confidential [redacted] This begs the question of how the Government could use improved information from the nomination process.

4.3.8 Permanently Confidential Information

Regulations 8.02 (petroleum) and 10.02 (greenhouse gas) have specified three categories of submitted information that the Government must keep permanently confidential:

- excluded information defined in regulation 1.06

- documentary information submitted that is considered by NOPTA to be
  - a trade secret
  - information the disclosure of which would, or could reasonably be expected to, adversely affect the submitting entity's business, commercial or financial affairs.

Excluded information in regulation 1.06 (3) includes:

- information regarding technical qualifications and financial resources of applicants for, and holders of titles
- information in applications for titles and renewals of titles
- results of a re-evaluation of the commercial viability of petroleum production in a lease area under sub-section 136(5) of the Offshore Petroleum and Greenhouse Gas Storage Act 2006
- reports on discoveries under Part 2
- title assessment reports under Part 3
- field development plans submitted under regulation 4.04.

Excluded information does not include any information in a document category listed in regulation 1.06(3) that is also incorporated in a document not listed in regulation 1.06(3) that is submitted to NOPTA or the responsible Commonwealth Minister.

There do not appear to be any sound economic or ethical reasons for the Government to support permanent confidentiality of most of the information in the last four of the six categories of currently excluded information (except to the extent it pertains to the technical qualifications and financial resources of applicants for, and holders of titles). Indeed, it is not apparent why this information should not be released promptly. The information in these categories would be valuable to other explorers and would facilitate better informed activities.

In respect of the first and second categories of currently excluded information, there do not appear to be valid reasons for permanent or temporary confidentiality of information provided by successful applicants for titles. Release of this information would improve competition in future bidding rounds because potential participants would be better informed.

The term, "trade secret", in regulations 8.02 and 10.02 has not been defined in the RMA Regulations. Moreover, the RMA Regulations do not provide any guidance to NOPTA on what should be considered in deciding if information should be deemed a trade secret and categorised as permanently confidential.

Information that could adversely affect the submitting entity's business, commercial or financial affairs if it is disclosed by government has not been defined in the RMA Regulations. Moreover, the RMA Regulations do not contain a threshold test, and do not provide guidance to NOPTA on what should be considered before deciding whether these circumstances arise.

A particularly important flaw in the concepts of protecting a trade secret and avoiding adverse effects on an entity submitting information is that they are focussed solely on the private interest of the entity that submits the information, neglecting the public interest. In this respect, the RMA Regulations do not provide for consideration of benefits of disclosure to other parties. In other words, they do not adequately allow for the role that disclosure could play in addressing information market failures discussed in chapter 3 and therefore, they are inconsistent with the criteria for formulation and assessment of policy instruments outlined in sub-section 2.2.2 in chapter 2.

There appeared to be a consensus among stakeholders consulted by ACIL Allen that the classification of information as permanently confidential should be limited to business cases/corporate/financial operations and data in relation to company personnel, consistent with privacy legislation [redacted].

The classification of monthly production reports submitted under regulation 7.19 as permanently confidential under regulation 8.02 is an example of the problematic scope of the "permanently confidential" classification of information. Presumably, these reports have been perceived to contain information that is a trade secret information or incorporate information the disclosure of which could

be expected to adversely affect title holders' business, commercial or financial affairs. While production reports may contain some financial/commercial information (which could be redacted), the release of the bulk of the information contained in production reports is clearly in the public interest. As noted by one industry stakeholder (ACIL Allen, 2020, p. 7):

"Production data can be useful in exploration, appraisal, and development, for example, to validate recovery factors used in prospect assessments. There would be some benefit to production data being released in a timely and consistent manner."

State governments were strongly supportive of early release of production data given operators hold secure (ongoing) production titles, implying confidentiality is less of an issue. They argued that the community has a right to know how its resource is being produced and managed. In South Australia, production data becomes open file after 6 months and was reported to be one of the most popular types of data available.

The anomalous (and inconsistent) nature of the classification of monthly production reports is highlighted by the treatment of monthly greenhouse gas accounting reports submitted under regulation 9.21. Reports in the latter category contain comparable information to the former category. However, under regulation 10.10, a monthly greenhouse gas accounting report must be made publicly available no later than 15 days after NOPTA receives the report.

4.3.9 Basic and Interpretative Information

Regulations 8.03 and 10.03 define interpretative information as information considered by NOPTA to be a conclusion drawn wholly or partly from, or an opinion based wholly or partly on, other documentary information. The regulations do not define documentary information, but it is defined in section 711 of the OPGGS Act as information contained in an applicable document. It appears to be information other than samples.

Regulations 8.01 and 10.01 define basic information as documentary information that is not interpretive information. The regulations refer to basic disclosable information and interpretative disclosable information. Regulations 8.01 and 10.01 define disclosable information as documentary information that is not permanently confidential.

Division 3 of Part 8 and Division 3 of Part 10 of the RMA Regulations set out circumstances in which NOPTA or the responsible Commonwealth Minister may make documentary information publicly known or available to an entity or person other than a Minister of the Commonwealth, a State or the Northern Territory. Different release times (and consequent confidentiality periods) apply to basic disclosable information and interpretative disclosable information, as outlined in this sub-section. Also, release times differ for non-exclusive information (made available for commercial sale or license) and exclusive information, as mentioned below and discussed in more detail in sub-section 4.3.10. The regulations relating to release of basic and interpretative are characterised by considerable complexity.

Basic Information from Surveys and Well Operations

For basic disclosable information that is **exclusive**, the release time is after three years from completion of collection of the data from seismic surveys, and other geophysical and geological surveys, or the day after a title or authority ceases to apply. For basic disclosable **non-exclusive** information, the release time is after 15 years from completion of collection of the data from seismic surveys (but five or six years for 2D extracts from 3D data). In contrast, the release time is after six years from completion of collection of the non-exclusive data from other geophysical or geological surveys.

For basic disclosable information from well operations, the release time is after two years from the end of the operation, or the day after a title ceases to apply. There is no distinction between exclusive and non-exclusive information from well operations.

Interpretative Information

For interpretative disclosable information, the release time is after five years from completion of the operation to which the information relates. The release time does not differ if the interpretative information is based on exclusive or non-exclusive information.

Voluntary Disclosure

The confidentiality periods for disclosable information do not apply if the title holder has made the information public or consented in writing to the information being made public or made available to another entity or person, or if the information was submitted to NOPTA by an authority holder related to a period when no title was in force.

Rationale for Delayed Release of Information

A coherent government statement of the rationale for delaying release of information beyond allowance of a reasonable time for compilation and submission of basic and interpretative information could not be found. In addition, as discussed in detail in chapter 6, a solid economic rationale for such delays could not be identified or formulated.

It is obvious that, for practical reasons, the release time for interpretative information could not precede the release time for basic information, as basic information must be accessed before it can be interpreted. The standard gap for release of basic information from surveys (after three years) and release of interpretative information (after 5 years) is two years. It differs from the regulated gap for well operations, which is potentially three years, but could be zero, depending on classification of information from sample results. The gap is reversed for basic non-exclusive information from seismic surveys (15 years delay) and other surveys (6 years delay) relative to interpretative information derived from basic seismic and other survey data (5 years delay for all surveys). Solid economic rationales for the differing lengths of the regulated gaps between release of basic and interpretative information could not be found and could not be formulated.

There was a strong dichotomy between [redacted] views and those expressed by [redacted] and [redacted] in relation to release/confidentiality timeframes for data applying to exclusive titles (release of multi-client data is addressed in sub-section 4.3.10 below).

While all companies supported the release of data, they stressed the need to strike an "appropriate balance" between the interests of those who acquired the data and the broader public interest. Industry participants made various suggestions as to increasing the confidentially periods for the release of different data. Generally, an extension of the timeframes by one to two years was favoured [redacted].

On the other hand, [redacted] generally considered that the current regulations are tilted too much towards confidentiality. They stressed that in the public interest, it was essential to release data as soon as practicable. In general, [redacted] favoured confidentiality periods of two to three years, if it was not practical to release the data immediately or if it was appropriate to allow companies a short period of exclusive use [redacted]

[redacted] observed that some non-exclusive seismic surveys are undertaken over existing exclusive titles (sometimes to meet work program commitments), with the result that data are confidential for 15 years instead of intended 3-5 years for data generated by explorers on their exclusive titles. Several stakeholders considered there was a lack of precision as to release requirements, and observed that interpretations favouring longer confidentiality periods typically had been adopted. They said that this was undesirable (ACIL Allen, 2020, p 13). This matter is explored further in sub-section 4.3.10.

Other Issues Arising from Basic/Interpretative Distinction

Different release times (confidentiality periods) for basic and interpretative information are sources of administrative complexity and classification disputes. Resolution of disputes is more difficult than it needs to be, because of the lack of precision in the definitions and the absence of guidelines for classifying information.

A contributing issue is that basic and interpretative information may be entangled. An example is provided by final well completion reports. These may include basic data and interpretative information. Moreover, the classification of some information may be debateable, particularly if it derives from the nature and extent of analyses of samples. The lack of a clear distinction between basic and interpretative information in the RMA Regulations can lead to uncertainty as to whether reports on sample analysis are basic or interpretative information. This has been only partly dealt with by NOPTA through requests that material be submitted in separate reports.

Complexity and disputes add to the administrative burden on title holders and government, conflicting with the administrative efficiency criterion for policy formulation and assessment that was discussed in sub-section 2.2.2 in chapter 2. The imprecise distinction between basic and interpretative information can also have implications for timing of release of information that flow on to effects on the efficiency of resource allocation. A delay in access to information tends to exacerbate the effects of market failures associated with the public good aspect of information and asymmetric availability of information, further reducing the efficiency of resource allocation. These sources of market failure and their resource misallocation effects are discussed in chapter 3. The resource misallocation effects of regulatory delays to access to information are analysed in chapter 6.

The views of industry stakeholders varied. For example, one company proffered the view that the distinction between basic and interpretative information was clear to most title holders in the case of well data. On the other hand, an oil industry specialist suggested that the delineation between basic and interpretive information that is used to determine release times was not clear cut. While some information is clearly basic or interpretive, there may be a large grey area in between. Core analysis – routine and special – is in this grey area, as are fluid analyses, and many of the other more advanced analyses now used [redacted].

[redacted] favoured substantial reduction of the complexity of the RMA Regulations in relation to timing of release of information. Specifically, they proposed [redacted]

- rationalisation of the range of different periods set out in the Regulations
- standardisation of release periods to simplify administration
- dropping the differentiation between interpreted and raw data, given both are of equal interest and importance.

4.3.10 Non-Exclusive Data Dilemma

In the RMA Regulations (regulation 1.05), "non-exclusive data means data that is made available for commercial sale or license". Exclusive data has not been defined in the RMA Regulations.

Regulations 8.11 (petroleum) and 10.11 (greenhouse gas) specify release timing or confidentiality periods for basic disclosable non-exclusive data and basic disclosable exclusive data. The periods differ between non-exclusive and exclusive data and between seismic surveys and other types of geophysical and geological surveys.

For basic disclosable non-exclusive data from seismic surveys, the confidentiality period generally is 15 years from completion of acquisition of the data. However, if 2D data is extracted from a 3D survey, the confidentiality period is five years for the 2D data if either the 3D data or 2D data extracted from it was required to be produced as a condition of the grant of a title. If neither the 3D data nor the extracted 2D was required to be produced as a condition of the grant of a title, the confidentiality period for the 2D data is six years. The five- and six-year periods date from the completion of acquisition of the 3D data. The shorter confidentiality periods for 2D extracts were intended to partly compensate for the very long confidentiality period for non-exclusive seismic data (Macfarlane, 2006).

For basic non-exclusive data from other geophysical or geological surveys conducted under a petroleum special prospecting authority, petroleum access authority, greenhouse gas search authority or greenhouse gas special authority, the confidentiality period is six years from completion of acquisition of the data. For exclusive data from the same types of surveys and titles, the confidentiality period is three years if the title is still in force, and otherwise is one day after title ceases to be held. For documentary information (without distinction between non-exclusive and exclusive data) from such surveys under a petroleum production licence, petroleum exploration permit, petroleum retention lease, scientific investigation consent, greenhouse gas assessment permit,

greenhouse gas holding lease or greenhouse gas research consent, the confidentiality period is three years if the title is still in force, and otherwise is one day after title ceases to be held.

Regulations 8.12 (petroleum) and 10.12 (greenhouse gas) specify release timing or confidentiality periods for interpretative disclosable information. They do not provide different confidentiality periods for non-exclusive and exclusive interpretative information. Also, they do not specify different release times for seismic surveys and other types of geophysical and geological surveys. All interpretative information can be released by government after five years from completion of the operation to which the information relates. This would mean that interpretative information derived from basic non-exclusive data could be released several years earlier than the basic data. Because of a perceived inconsistency in the regulations in respect of treatment of basic and interpretative non-exclusive data, NOPTA has allowed a 15-year confidentiality period for information in the latter category. This is inconsistent with the general practice in other jurisdictions, where the confidentiality period for basic data is longer because it is recognised to have more value for the purposes of sale.

The information that can be released at the times specified in regulations 8.11, 8.12, 10.11 and 10.12 derives from the information that must be submitted in accordance with regulations 7.16 – 7.18 and 9.16 – 9.18. These information submission regulations require a title holder undertaking a survey to generate basic non-exclusive data to submit a survey acquisition report and data, a survey processing report and data, and survey interpretation report and interpretative survey data to NOPTA, within 18 months, 24 months, and 30 months of acquisition of the data, respectively. If these regulations are strictly interpreted, they would extend to enterprises that undertake surveys to sell or license the data to multiple clients (non-exclusive data), but they would not capture entities that purchase non-exclusive data.

[redacted] purchasers of data be required to submit survey acquisition, processing, and interpretation reports and data under title conditions. Most title holders have submitted interpretative reports based on seismic survey or reprocessed seismic data that they have purchased.

The practice of relying on title conditions, rather than on compliance with the regulations by entities undertaking surveys to produce non-exclusive data, can lead to gaps in capture of information in various ways. First, [redacted] some title holders have resisted lodging reports, arguing that it would contravene licencing agreements. Second, coordination effort is required to ensure that a condition is applied to relevant titles to capture purchased data and related reports. Third, if data in respect of an area is purchased by an entity that does not apply for or is not granted a title over the area, the entity would not have to submit the data and related reports. Fourth, if data in respect of an area is not purchased by any entity, it would not be submitted at all unless it is lodged by the geophysical services provider.

Another issue is that the RMA Regulations do not require a title holder undertaking a 3D seismic to submit a 2D extract. This includes any commercial geophysical service provider holding a short-term authority.[49] This oversight has been compounded by conditioning of titles typically not being extended to submission of 2D extracts of 3D data purchased from geophysical service providers. This has meant that generators and purchasers of data usually consider that 2D extracts are not subject to compulsory submission. This has undermined regulations 8.11 and 10.11 that would allow 2D data extracts to be released after five or six years.

The regulations relating to non-exclusive data and interpretative information derived therefrom exemplify the complexity and inconsistency that characterises the information-capture-and-release regime encapsulated by the RMA Regulations. Moreover, the treatment of non-exclusive data, like the regime in general, lacks a clear, coherent economic rationale.

To help gain insights into the rationale for the current non-exclusive data arrangements, it is instructive to review the circumstances that led to the change to the current arrangements announced on 21

[49] This is contrary to the statement by former Minister Macfarlane (2006) that "The extension of the confidentiality period for 3D non-exclusive seismic surveys is conditional on companies submitting to government 2D data derived from the 3D data set on a five-kilometre square grid".

December 2006 by the then Minister for Industry, Tourism and Resources. The explanation provided by the Minister, Ian Macfarlane (2006) in a press release follows.

"The new arrangements for the release of offshore petroleum seismic data will encourage more large-scale, non-exclusive, two dimensional (2D) and three dimensional (3D) seismic surveys to be undertaken. Currently, the confidentiality period for speculative 3D data is nine years and for speculative 2D data is six years. Effective from 1 January 2007, the period in which data from non-exclusive seismic surveys can be confidential will be 15 years. At expiry of the confidentiality period, the data will be made publicly available through Geoscience Australia at cost of transfer. The extension of the confidentiality period for 3D non-exclusive seismic surveys is conditional on companies submitting to government 2D data derived from the 3D data set on a five-kilometre square grid. This 2D extracted data would be released as open file by Geoscience Australia after five years.

Seismic data is currently obtained by exploration companies through either fully funded exclusive surveys or by purchasing data from an operator who has self-funded a speculative non-exclusive survey and assumed commercial risk of data resale. The policy on the release of non-exclusive 2D and 3D seismic data has been changed to allow seismic contractors to retain rights to the data for longer periods, encouraging them to increase their investment in new non-exclusive surveys. It is expected that the change to the confidentiality period will stimulate multi-million-dollar investment for non-exclusive seismic surveys in 2007, compared to no speculative survey activity being carried out in 2006.

The future prosperity and growth of Australia's offshore petroleum industry depends on the availability of high-quality seismic data, including data collected on a non-exclusive speculative basis. The data collected under this new policy will help explorers open up new petroleum provinces and make petroleum discoveries more certain."

It is understood that the genesis of the decision to change the non-exclusive data arrangements was the expression of:

- industry concerns that it was both difficult and costly to mobilise seismic vessels just to undertake seismic surveys included in work programs offered by entities granted work-bid exploration permits in Australian waters
- lack of interest by geophysical companies in speculative, multi-client (non-exclusive) surveys in the context of the prevailing confidentiality periods for non-exclusive data.

In the context of strongly rising oil prices that boosted demand for seismic services, service providers claimed they could gain considerable economies in other parts of the world from geographically focused activity that kept downtime low. Getting seismic vessels to and from Australian waters, and moving them from Australia's north-western waters to south-eastern waters caused considerable downtime that had to be covered by higher charges and a large, continuous stream of work. [redacted] representatives argued that the amount of work available to meet work program commitments was not considered to be sufficient to attract vessels to Australian waters.

In this context, costs were blowing out, and concerns were expressed about work on offshore titles falling behind program commitments. These problems were more acute for small and medium sized enterprises engaged only in exploration. The majors were not affected as much, because they could offer larger amounts of work through their production-related seismic requirements as well as their exploration programs. Meanwhile, non-exclusive seismic work was [redacted] at all around that time. Indeed, there was [redacted] non-exclusive 3D seismic activity in Australian waters in the period 2001 to 2006 and [redacted] non-exclusive 2D surveys in the period 2003 to 2006 (see **Table 4.1** and **Table 4.2**).

[redacted]

[redacted] A confidentiality period of 15 years was agreed, based on two work program cycles of seven years plus one year. The seismic companies would carry the risk that their non-exclusive work might or might not cover areas of future releases for bids.

TABLE 4.1 3D SEISMIC SURVEYS IN AUSTRALIAN WATERS

Year	[redacted]
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	

SOURCE: NOPTA

TABLE 4.2 2D SEISMIC SURVEYS IN AUSTRALIAN WATERS

Year	
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	

SOURCE: NOPTA

The intention was that:

- explorers would continue to engage seismic companies to undertake exclusive surveys to meet work program commitments attaching to their titles, with information to be released as before
- seismic companies would undertake non-exclusive activities to fill gaps in their work schedules
- 2D data extracts from non-exclusive 3D surveys would be released after five or six years.

As the policy changes only sought to address the tight market for seismic surveys in 2006, the confidentiality period for non-exclusive data was changed for seismic surveys, but not other types of geophysical or geological surveys.

The effects of the policy change can be discerned from data presented in **Table 4.1**, **Table 4.2** and **Table 4.3**. The data show a [redacted] in survey categories. However, they indicate that the [redacted] in exploration activity and [redacted] petroleum provinces that were envisaged at the time of the change in policy [redacted]

The proportion of all 3D seismic surveys categorised as non-exclusive in 2006 was [redacted]. It [redacted] per cent in 2008, [redacted] per cent in 2010, [redacted] per cent in 2014, and [redacted] per cent in 2015 based on the area surveyed. In the years 2016 to 2019, the proportion of non-exclusive surveys fluctuated in the range of [redacted] per cent to [redacted] per cent (see **Table 4.1**).

The proportion of all 2D seismic surveys categorised as non-exclusive in 2006 was [redacted]. It [redacted] per cent in 2010, and [redacted] per cent in 2015 on a line-kilometre basis. In the years 2017 to 2019, there were [redacted] non-exclusive 2D seismic surveys, compared to [redacted] exclusive 2D survey in each of 2017 and 2018, and [redacted] in 2019 (see **Table 4.2**).

In the years 2016-2019, a [redacted] than [redacted] per cent) of the [redacted] data produced by title holders and geophysical service enterprises was non-exclusive than in 2001-2004 (around [redacted] per cent). That does not mean it was available for purchase by multiple parties, as the definition of non-exclusive data in the RMA Regulations is that "the data is made available for sale or licence".

The tendency of [redacted] is apparent from trends indicated in **Table 4.1** and **Table 4.2**. This tendency is also [redacted] This is depicted in **Table 4.3**. In the period, 2014 to 2019, [redacted] per cent of the total area covered by non-exclusive 3D seismic surveys was under pre-existing, exclusive titles, and [redacted] per cent was in otherwise vacant areas.

TABLE 4.3 SURVEYS GENERATING NON-EXCLUSIVE SEISMIC DATA IN AUSTRALIAN WATERS

3D Seismic Surveys	2012	2013	2014	2015	2016	2017	2018	2019
Number of surveys collecting non-exclusive data	[redacted]							
Total area surveyed (km²)								
Total area covering vacant acreage at the time of survey (km²)								
Proportion of total area surveyed (%)								
Total area covering titled areas* at the time of survey (km²)								
Proportion of total area surveyed (%)								

2D Seismic Surveys	2012	2013	2014	2015	2016	2017	2018	2019
Number of surveys collecting non-exclusive data	[redacted]							
Total area surveyed (km)								
Total area covering vacant acreage at the time of survey (km)								
Proportion of total area surveyed (%)								
Total area covering titled areas* at the time of survey (km)								
Proportion of total area surveyed (%)								

* An active permit, lease, or licence area. Excludes petroleum special prospecting authority, petroleum access authority, greenhouse gas search authority or greenhouse gas special authority, allowing seismic activity in vacant acreage (not held under permit, lease, or licence).

SOURCE: NOPTA

[redacted] This potentially could be enabled by a loophole in the RMA Regulations arising from the broad definition of "non-exclusive data" and the absence of a definition of exclusive data.

In regulation 1.05, "non-exclusive data means data that is made available for commercial sale or license". It does not require that the data be available for purchase by more than one entity. It does not prevent unreasonable, discriminatory terms of sale being applied to some or most potential sales to exclude all but one entity and its joint venture partners.

Hypothetically, a geophysical service provider and a title holder could arrange for the former to undertake a survey over an area that includes, but is not confined to, a pre-existing title and for the title holder (and no other party) to purchase either the data or a licence to the data, rather than service provider being engaged directly to undertake the survey. Then, the data can be claimed to be "non-exclusive", allowing the title holder to withhold information from others for a much longer period of time than if it commissioned a seismic company to undertake a survey for the exclusive use of the title holder. This was not the intent of the revised non-exclusive seismic survey policy announced late in 2006. The clear intent, as expressed by the Minister at the time, was a substantial increase in the extent of speculative surveys, each of which would make information available for purchase by multiple parties, facilitating the opening-up of new petroleum provinces.

The consultation process indicated acknowledgement of the existence of a loophole in the RMA Regulations arising from a broad definition of non-exclusive data and the absence of a definition of exclusive data. However, it did not provide a clear picture of the extent of any exploitation of the loophole.

Notwithstanding the policy change after 2006, [redacted] seismic survey (non-exclusive plus exclusive) data were generated in the years 2016-2019 than in the years 2001-2004 (see **Table 4.1** and **Table 4.2**), even though real crude prices were generally higher in the later timeframe, and the extended confidentiality period applied then. It appears that the non-exclusive data regime has been associated with [redacted] of the public good of seismic information. The change in the confidentiality period, in combination with the loophole arising from the broad definition of "non-exclusive data" in the RMA Regulations, may have reduced the availability of information to interested parties. The asymmetric information problem appears to have worsened. It is likely there would have been a worsening of economic inefficiencies analysed in detail in chapter 3.

The available evidence summarised above suggests that the extended confidentiality periods applying to non-exclusive survey data have only been of limited success in facilitating the formation of a market for such services that would correct information market failures. This outcome is consistent with analysis in chapter 3 that pointed out several serious impediments to a market or market-like solution to information market failures that lead to an inefficient allocation of resources to exploration activity. Chapters 6 and 7 analyse an alternative of prompt release of privately generated information in conjunction with government funding of early-stage exploration.

Stakeholder views in relation to non-exclusive surveys were primarily focused on confidentiality periods. However, they extended to the loophole described above.

[redacted] has invested considerably in the market to [redacted]

- [redacted]
- advance the geological understanding of new basins
- accelerate the conventional exploration and production cycle
- enable informed decision making from new datasets that are immediately
- unlocked new discoveries (citing a recent discovery of one of the largest ever oil finds on the North-West shelf – Dorado).

[redacted] claimed that the 15-year confidentiality period for raw seismic data in Australian waters is "close to global best practice". However, in a submission, [redacted]". [redacted] that shortening the current 15-year confidentiality period for raw seismic data would undermine [redacted] and information market [redacted].

During the consultation process, [redacted] acknowledged that prompt release of information would undermine a market for information. They suggested that this would occur if

confidentiality periods were 5 years or less. However, they considered that a confidentiality period of 8-10 years for raw seismic data was more appropriate than the current period of 15 years in Australian waters. In discussions, they suggested that retention of the current confidentiality period may inhibit exploration activity, especially in new and frontier areas, because of unavailability of information [redacted]

Some [redacted] claimed that some entities "game" the system, by licensing or purchasing data from geophysical services providers to qualify basic, interpretative, and reprocessed data for the 15-year confidentiality period [redacted].

4.3.11 Reprocessed Survey Data

Regulations 8.11 (3) and 10.11 (3) provide for release of reprocessed data from a seismic survey if the reprocessing was a condition of the grant of a title. The RMA Regulations do not explain what is meant by reprocessed seismic survey data. Also, they do not provide for release of reprocessed seismic data if reprocessing of data was not included in title conditions.

Regulations 8.11 (3) and 10.11 (3) allow release of documentary information obtained from reprocessing seismic data as a condition of a title on the later of the date applicable to the release of basic disclosable information from the original survey or three years after the last day of the year of the term of the title in which the reprocessing was done. Section 10 of the OPGGS Act states that a year of the term of a title commences on the day that the title comes into force or on any anniversary of that date.

The RMA Regulations do not provide for release of reprocessed data from other geophysical or geological surveys (surveys other than seismic) if reprocessing was a condition of a title. Also, they do not provide for release of other reprocessed survey data.

The RMA Regulations do not include an explicit requirement to submit reprocessed data to NOPTA. Also, they do not explicitly require submission of survey processing and survey interpretation reports in respect of reprocessed data. This has led to uncertainty as to whether submission of reprocessed survey data and processing and interpretation reports is compulsory or voluntary.

NOPTA has adopted the practice of requesting that reprocessed data be submitted at the end of the year of the term in which it was completed, and that survey processing and survey interpretation reports be submitted a year later.

Anomalies in relation to both the submission and release of reprocessed data should be addressed in a reform of RMA Regulations.

4.3.12 Late-Field-Life / Title-Relinquishment Data

The RMA Regulations do not address late-field-life or title-relinquishment data capture and release explicitly. Rather, requirements are included in the general provisions relating to surveys, well data, production data, etc. However, issues relating to late-field-life and title-relinquishment data were highlighted in stakeholder consultations.

While [redacted] did not display a consensus on the release of late-field-life data, they supported the general principle that the more data that is in the public domain the better. In general, stakeholders considered that having access to production data is useful [redacted].

[redacted] support early release of production data. The provision of monthly production reports was considered sufficient [redacted] manage a maturing industry. This would provide the regulator with the necessary data to ensure that rehabilitation liabilities are understood and managed appropriately to minimise the public's exposure to risk and costs. [redacted] for better data sharing and use of reports to satisfy both NOPTA and NOPSEMA requirements – especially with regard to well abandonment and the opportunity this may afford to reduce reporting and duplication [redacted].

Multiple stakeholders raised issues in relation to data and requirements upon title surrender or end of field life. The [redacted] considered that the Act/Regulations need to clarify exactly what happens to data on title relinquishment, especially if the company opts out of Australia. While noting that the general requirement is for the data/samples, etc to be stored in

Australia in perpetuity, this does not make sense if the company no longer operates in the country. Regulations should require that all data be made available on title relinquishment/leaving the country. Then, government can decide what is of value and is to be placed in the Repository. It is important to capture all data at this stage – not just petroleum data –environmental, seabed/bathymetry and water column data are all equally important as every additional piece of data helps interpretation and may be relevant to other activities such as greenhouse gas storage.

This view was supported by [redacted] and [redacted] with one company noting [redacted]:

"[redacted]"

Stakeholders noted that late field life data may become increasingly critical for the evaluation of potential greenhouse storage sites. If there is no commercial disadvantage to hydrocarbon producers in supplying this information, it would be a useful tool for the fledgling greenhouse gas industry. [redacted] noted that both petroleum and greenhouse gas title holders have an interest in offshore decommissioning requirements for current and future petroleum and greenhouse gas facilities. Late-petroleum-field-life data, including data generated by decommissioning activities, is important to greenhouse gas title holders and the RMA Regulations need to enable access to such data [redacted]).

[redacted] also expressed the view that the RMA Regulations should be expanded to cover post-title monitoring. Maritime industries routinely collect critical marine environmental data needed for sustainable management of marine ecosystems, supporting both the blue economy and future growth. Collating this information would provide a valuable resource for all stakeholders. As the industry begins to decommission its offshore structures, this information will be critical for avoiding duplication of effort in data collection and ensuring best environmental management of offshore activities [redacted].

4.3.13 Greenhouse Gas Data

[redacted] supported consistency in approach (between greenhouse gas and petroleum data). One company did note [redacted]):

"[redacted]."

However, [redacted] that different release criteria apply to greenhouse gas data (e.g. basic well information for greenhouse gas wells is released after two years whereas the data for petroleum wells is released after three years) and proposed that petroleum and greenhouse gas criteria be standardised.

In line with [redacted] views outlined in the preceding sub-section, [redacted] observed that late field life, production, well and abandonment data is essential for meaningful greenhouse gas assessment (given options tend to focus on depleted reservoirs). However, it noted [redacted]:

- this data is generally less available, as data provision requirements are more focused on exploration activities
- opportunities for EOR-CO_2 difficult to assess given limited data and there is scope for greater transparency in this area.
- environmental data is critical for greenhouse gas storage monitoring and public confidence
- there is a need access to petroleum data to build environmental baselines
- 4D seismic is critical for greenhouse gas storage monitoring, with environmental data being particularly important to understanding storage opportunities and possible constraints.

Stakeholders noted that late petroleum field life data, (including data generated undertaking decommissioning activities), is important to greenhouse gas title holders (and potentially for the development of EOR coupled with CO_2 storage) and the RMA Regulations need to enable access to

such data. This will encourage greenhouse gas developments in mature petroleum areas such as Bass Strait. Similarly, data release for expired titles (especially in a mature area such as Bass Strait) is supported to enable greenhouse gas title holder access to important geological data (to support the development of the industry).

[redacted] noted that CO_2 data (both quantity and quality) needed to be improved to ensure the proper long-term management of CO_2 storage. Access to good data is essential in informing government decision making, especially in the case of disputed or competing interests between petroleum and greenhouse gas storage. [redacted] also noted that [redacted]:

- access to field production and decommissioning data is critical in assessing storage capacity
- data (especially in relation to well capping/abandonment) is critical to providing assurance as to integrity of CO_2 storage and providing assurances around long-term liability
- environmental data is vital to establishing baseline and ongoing monitoring of storage integrity.

[redacted] supported a target specified in the statement of requirement for the Review: "align greenhouse gas and petroleum data requirements, where appropriate" [redacted]. However, [redacted] noted that there are unexplained differences in the RMA Regulation. For example, there are differences in terms of the data submission timelines between petroleum and greenhouse gas title holders (with more generous timelines afforded to petroleum activities). [redacted] also pointed out that there are circumstances in which a less prescriptive approach is warranted for greenhouse gas storage to support the commercial development of this emerging industry. [redacted]

[redacted] suggested several aspects of the RMA Regulations relating to greenhouse gas storage that could be improved, including:

- modify assessment permit reporting dates to align with permit years if changed during the permit term
- align greenhouse gas and petroleum requirements (content and timelines for submission) for Final Well Completion reports
- provide for less prescriptive approved data formats (to avoid outdated media prescriptions)
- provide for submission of seismic reprocessing reports
- improve the submission requirements in relation to well core, cuttings and samples
- improve the submission requirements relating to photos of core and sidewall core for greenhouse gas wells (current requirements for UV lit photographs are irrelevant).

4.3.14 Inconsistencies

There are various inconsistencies in information management parts of the RMA Regulations. Some have been identified in other sub-sections above, such as multiple inconsistencies relating to reprocessed survey data discussed in sub-section 4.3.11. Others are mentioned below, along with elaboration of some inconsistencies identified above.

There are some inconsistencies between petroleum and greenhouse gas regulations. Report and sample requirements are generally identical for petroleum and corresponding greenhouse gas titles, apart from submission times. These times can differ substantially.

In general, greenhouse gas title holders are expected to submit reports and samples sooner than petroleum title holders. Examples of these differences include:

- final well completion report and data – 12 months for greenhouse gas titles and 18 months after rig release for petroleum titles
- survey reports and data – 6, 12 or 18 months after completion of surveys for greenhouse gas titles and 18, 24 and 30 months for petroleum titles
- conventional drill core – submission not required for wells drilled under a greenhouse gas title but is required under a petroleum title.

There are inconsistencies in respect of greenhouse gas titles. Gas accounting reports for greenhouse gas titles are released, but gas injection reports are not. Some basic and interpretative information

from greenhouse gas activities is also released sooner if conducted under a greenhouse gas injection license than if the same activity is conducted under other greenhouse gas titles.

Basic documentary information for a well drilled under a production licence can be released two years after the rig release date. However, the petroleum samples from such a well can be made available publicly one year earlier. If a well is drilled under an exploration permit or retention lease, the samples are made available at the same time as the basic reports and data. Also, some of these samples are not required to be submitted until up to 18 months after the rig release date. This creates a situation in which samples could be made publicly available before the specified submission time. Because of this inconsistency in the regulations, NOPTA delays release of the relevant samples from a well drilled under a petroleum production licence until the basic information is released (two years after the rig is released).

4.4 Australian Government's Public Data Policy

The RMA Regulations were made in 2011, before the Australian Government's (2015) Public Data Policy was formulated and published. This policy has been discussed in sub-section 2.2.6 in chapter 2. The theme of substantial delays (including permanent delays) to release of information under the RMA Regulations conflicts with the Public Data Policy.

During the consultation process, [redacted] observed that prompt release of information was consistent with the Government's Public Data Policy. The [redacted] explained that elimination of long confidentiality periods and permanent confidentiality are the types of reforms envisaged when the policy was adopted in 2015 and as it has been refined subsequently [redacted].

4.5 Conclusions

In this chapter, numerous anomalies, inconsistencies, omissions, unnecessary complexities in, and perverse outcomes from the RMA Regulations and their administration have been documented. These results were based on careful examination of the RMA Regulations and insights from consultations with [redacted]

In addition, this chapter has highlighted many policy issues underlying the RMA Regulations. The process of identification of key policy issues was facilitated by application of policy criteria and principles discussed in chapter 2, and a thorough investigation of economic bases for offshore petroleum and greenhouse information policy in chapter 3.

The insights documented in this chapter, and the comparative discussion of government information capture-and-release regimes in several comparable jurisdictions in chapter 5 provided a foundation for the detailed policy analysis in chapters 6-8.

5 INTERJURISDICTIONAL COMPARISON OF INFORMATIONCAPTURE AND RELEASE REGIMES

Key Points

- A comparison of information capture and release regimes in selected comparable domestic and international jurisdictions has been presented.
- The information aspects of the Australian RMA Regulations and information capture and release regimes in onshore Australian state jurisdictions and offshore overseas jurisdictions have similar general frameworks:
  - information generated by private sector operators is captured and most of it is released with significant to substantial lags
  - non-exclusive data are released with a much longer lag than exclusive information.
- Another notable similarity between jurisdictions is the unavailability of published, reasoned rationales for exclusive information being released significantly or substantially later than a reasonable time for submission of raw and interpretative information.
- Some explanations of long lags in releasing non-exclusive information have been published, but typically are terse, vague, and unconvincing.
- Time lags appear to have been based on practice in other jurisdictions, rather than on analysis of the economics of exploration, other assessment, and information characteristics. The result has been convergence on information release rules that lack any solid analytical foundation.
- Information submission periods in Australia tend to be longer than those applying elsewhere.
- Confidentiality periods prior to release of information for offshore Australia tend to sit in the middle of the range indicated by the review of comparable jurisdictions.

5.1 Introduction

This chapter presents a summary of information-capture-and-release regimes in several petroleum producing jurisdictions across Australia and internationally. The analysis in this chapter puts the Australian offshore information regime into context and highlights key similarities and differences with other jurisdictions.

The jurisdictions included in this analysis are:

- domestic
  - Western Australia (WA)
  - South Australia (SA)
  - Queensland
- international (offshore)
  - Norway
  - United Kingdom (UK)

- Canada
- United States of America (USA)
- other jurisdictions (including New Zealand, Indonesia, Brazil and Mexico).

The summary of each jurisdiction presents material on how information is reported by industry, followed by details on the release of this information by government for industry to use following a period of confidentiality. Then, a summary of key characteristics of and issues with these regimes is highlighted, and examples are used to illustrate the similarities/differences between the Australian offshore regime and corresponding regimes in other jurisdictions.

5.2 Australian Regimes

5.2.1 Western Australia

The legal framework for the administration of exploration and recovery of petroleum, in the Western Australian onshore and State waters areas, is provided within the *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) and the *Petroleum (Submerged Lands) Act 1982* (PSL Act). The related *Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015* (PGER Regulations) were endorsed and came into force on 1 July 2015.

The PGER Regulations require the provision of information on petroleum activities to help ensure the Minister is informed about all significant aspects of exploration, discovery, development, and production in respect of petroleum and geothermal energy resources (WA Government, 2016).

This information is intended to facilitate consistent, effective, and transparent regulation of Western Australia's petroleum and geothermal energy resources. Data is used by the Government in support of its geoscience projects; to fulfil its role as a data custodian for WA; to undertake key statutory and regulatory functions, including ensuring well integrity for safety purposes, aquifer protection and the future production of State resources; and to provide data and information to other stakeholders (WA Government, 2015). Industry participants use this data to support their search activities.

Information that must be reported on petroleum leases (exploration and production) includes information relating to:

- geophysical surveys
- management of well activities (well management plans – WMPs)
- field management plans (FMPs) and geothermal energy resources development plans (GERDPs)
- discovery assessment reports
- annual assessment reports.

The PGER Regulations require that this information be available and accessible in a suitable format. All reports and data submitted to the Department of Mines and Petroleum (DMP) remain confidential until the information is eligible for public release as prescribed in section 112 of the PGER Act and section 118 of the PSL Act (WA Government, 2016).

Reporting Deliverables and Timelines

Table 5.1 below outlines the requirements for the title holder in Western Australia to submit reports and samples to the Minister (represented by DMP). However, this table only includes a high-level summary of reporting requirements and more information can be found in DMP's guidelines to the PGER Regulations.

TABLE 5.1 PETROLEUM REPORTING IN WESTERN AUSTRALIA

Report	Timeframe	Comment
Petroleum samples	12 months	Analysis report and data are to be submitted as part of the well completion report (where available); or separately if the analysis report becomes available after the well completion report has been submitted.

Report	Timeframe	Comment
Well completion reports – during drilling	12 months after the rig-release date	Well completion reports include raw data, edited field data, and processed data for all activities associated with well drilling.
Final well activity reports – post drilling	6 months after the completion date for the well activity	Same as above but for post drilling activity (e.g., workovers).
2D seismic surveys	18 months after acquisition	Includes copies of all weekly survey reports and data. Does not include survey processing data and analysis.
3D seismic surveys	18 months after acquisition	Includes copies of all weekly survey reports and data. Does not include survey processing data and analysis.
Interpretative report and data for 2D and 3D seismic surveys	30 months after the day that the acquisition of the data is completed, unless authorised by the Minister for another period	Not required if the survey is non-exclusive.*
Reprocessed seismic data	24 months after the day on which the reprocessing of the data is completed	If the data reprocessed is licensed non-exclusive data that is still confidential, the data will not be made publicly available until the original survey is publicly available.
Acquisition report	18 months after the day that the acquisition of the data is completed	
Monthly production reports	15 days after the day of production starting on the last day of the month to which the report relates	

Note *: non-exclusive refers to data that is made available for commercial sale or licence.

SOURCE: DEPARTMENT OF MINES AND PETROLEUM, WESTERN AUSTRALIA

Data Confidentiality

Western Australia, like most jurisdictions, has confidentiality periods attached to data and reports submitted by industry. Timing of eligibility for public release is specified in the relevant acts.

Western Australian confidentiality periods for the reports and data mentioned above are indicated in **Table 5.2** below. For a title that has expired, or has been surrendered, cancelled, revoked, or terminated before the expiry date of the title, the day of the expiry, surrender, cancellation revocation or termination is then noted as the release date.

TABLE 5.2 WA INFORMATION RELEASE PERIODS

Report	Confidentiality period	Comment
Petroleum samples	2 years	From rig release.
Well completion reports – during drilling	2 years	From rig release.
Final well activity reports – post drilling	2 years	From rig release.
2D seismic surveys	3 years	After acquisition completed, for a survey that collected exclusive data and the title is still in force.
	15 years	After acquisition completed for a survey that collected 2D seismic data as non-exclusive data.

Report	Confidentiality period	Comment
3D seismic surveys	3 years	After acquisition completed, for a survey that collected exclusive data and the title is still in force.
	15 years	After acquisition completed for a survey that collected 3D seismic data as non-exclusive data.
Interpretative report and data for 2D and 3D seismic surveys	5 years	From the date of completion of acquisition.
Reprocessed seismic data	3 years	After the last day of the year of the term of the title during which the reprocessing was done.
Acquisition report	3 years	From the completion of acquisition.
Production reports	2 years	After the activity was substantially completed.

SOURCE: DEPARTMENT OF MINES AND PETROLEUM, WESTERN AUSTRALIA

5.2.2 South Australia

Onshore petroleum, geothermal and gas storage exploration and development in South Australia is administered by the Energy Resources Division of the Department of Energy and Mining (DEM) under the *Petroleum and Geothermal Energy Act 2000* and associated regulations. The Act is supported by the *Petroleum and Geothermal Energy Regulations 2013* (PGE Regulations).

All basic (non-interpretive) technical data obtained by a licensee in an exploration licence is submitted to DEM as part of licence commitments (SA Government, 2020). Data is kept confidential for a specified period of time after acquisition in accordance with the Act, and then released publicly. For onshore petroleum exploration licences and petroleum production licences, basic data becomes open file after two years.

DEM aims to maintain an extensive database of petroleum information with the data readily available in digital format for industry to use once data is open file.

Regulations 34, 35 and 36 in the PGE Regulations require that geophysical progress, operations, and interpretation reports must be provided to the Minister by the holder of a petroleum or geothermal licence on a periodic basis. Regulation 37 requires the holder of a petroleum licence to submit specific geophysical data collected during exploration and development activities. The submission of these data should coincide with the submission of an Operations Report, which discusses the acquisition of the data.

Other reports and technical data that must be submitted by a title holder include:

- samples and core
- wireline logs
- well completion reports
- quarterly cased hole well activity report
- well test analysis reports
- petroleum reservoir fluid analysis reports
- downhole diagrams
- production reports.

Reporting Deliverables and Timelines

Table 5.3Table 5.3 below outlines the requirements for a title holder in South Australia to submit reports and samples to the Minister.

TABLE 5.3 PETROLEUM REPORTING IN SOUTH AUSTRALIA

Report	Timeline	Comment
Samples and core	6 months	From rig release.
Well completion reports	6 months	From rig release.

Report	Timeline	Comment
Geophysical operations	12 months	After the completion of recording of the data.
Geophysical interpretative	12 months	After the completion of the processing or reprocessing of the data, a geophysical interpretation report is to be provided.
Geophysical data	12 months	Included as part of the geophysical report.
Production reports	2 months	For a licensee that produces a regulated substance in any month, within 2 months from the end of the month.*

Note *: Regulated substance refers to petroleum or any other substance recovered or released from a natural reservoir in which it has been contained in the course, or as a result, of operations carried out by that person.

SOURCE: DEPARTMENT FOR ENERGY AND MINING, SOUTH AUSTRALIA

Data Confidentiality

Information and data collected from industry is kept confidential for a specific period before being released publicly for future explorers to reprocess the original and processed data, allowing future explorers to reinterpret the data and build a case for planned exploration activities. South Australia has set confidentiality periods for the reports and data mentioned above, as indicated in **Table 5.4**.

TABLE 5.4 SOUTH AUSTRALIAN DATA AND INFORMATION RELEASE PERIODS

Report	Confidentiality period	Comment
Samples and core	2 years	From rig release.
Well completion reports	2 years	From rig release.
Geophysical operations	2 years	From the date of substantial completion of the recording of the data, or if the data has been reprocessed.
	15 years	In the case of a report involving speculative survey data – after the expiry of the period specified in the speculative survey licence.*
Geophysical interpretative	15 years	In the case of a report involving speculative survey data – after the expiry of the period (not being more than 15 years) specified in the speculative survey licence.
	licence duration	If the licence is surrendered or cancelled – after the surrender or cancellation of the licence.
		If the licence expires – after the expiry of the licence.
Geophysical data	2 years	After the expiration of 2 years from the date of substantial completion of the recording of the data, or if the data has been reprocessed.
	15 years	In the case of a report involving speculative survey data – after the expiry of the period (not being more than 15 years) specified in the speculative survey licence.
Monthly production reports	6 months	After the month to which it relates.

Note: * A speculative survey licence authorises the licensee to carry out exploratory operations of the kind specified in the licence in the licence area. These licences have one-year terms, do not authorise drilling beyond 300 metres, and the total area cannot exceed 10,000 km².

SOURCE: DEPARTMENT FOR ENERGY AND MINING, SOUTH AUSTRALIA

5.2.3 Queensland

In Queensland, the *Petroleum and Gas (Production and Safety) Act 2004* regulates the technical and safety aspects of gas production, transmission, distribution, and use, and deals with licensing of gas transmission pipelines. The Act is supported by the *Petroleum and Gas (Safety) Regulation 2018* (the regulations).

Queensland has similar reporting requirements to other states for petroleum title holders. Reports and technical information are required by the Queensland Government, represented by the Department of Natural Resources, Mines and Energy (DNRME), in relation to:

- geophysical and technical surveys
- petroleum well drilling, completion, and abandonment
- water-related bore drilling, completion, and abandonment
- conversion of petroleum wells to water-related bores
- transferring ownership of a petroleum well or water-related bore
- area relinquishment and end of authority
- production, reserves, and royalties
- pipelines, facilities, and infrastructure
- safety and health
- environmental notifications
- water reporting for petroleum and gas activities.

Geophysical and technical surveys are particularly important for the Queensland Government. Survey information is used by the Government in support of its geoscience projects, and by entities in extraction and extraction industry in support of their exploration programs (Queensland Government, 2020a).

Importantly, in 2018, DNRME released a draft revised reporting guideline, with reporting templates, for petroleum and gas resource authority holders (Queensland Government, 2020a).

The guideline and templates have been formulated in consultation with industry, with new guidelines active as of 1 October 2020. DNRME claimed that these new reporting requirements (and confidentiality periods) were being implemented to improve the quality, usability and value of geoscience data submitted by resource authority holders.

Supported by the new Lodgement Portal being developed by the Geological Survey of Queensland (GSQ), the new guidelines for reporting are intended to assist industry in lodging reports and data (Queensland Governm[redacted]). Some data types will be submitted using new Excel templates. These are intended to capture data in a structured and itemised way, ensuring high quality and accessible data will be available for future use by industry.

Reporting Deliverables and Timelines

Table 5.5 below outlines the requirements for a petroleum title holder in Queensland to submit reports to DNRME.

TABLE 5.5 PETROLEUM REPORTING IN QUEENSLAND

Report	Timeline	Comment
Scientific and technical survey report	2 years	From the completion day for the survey.
Seismic survey report	2 years	From the completion day for the survey.
Core and samples	Cuttings – 6 months Core and fluid samples – 5 months	from the day the cuttings samples, core or fluid samples were acquired or the end of resource authority, whichever comes first.
Drilling survey	3 months	After completing the survey.
Well completion report	12 months	From rig release.
Well abandonment	6 months	After completion of plugging and abandoning well.
Six-month production report	60 business days	Within 60 business days after the 6-month period ends.

SOURCE: QUEENSLAND DEPARTMENT OF NATURAL RESOURCES, MINES AND ENERGY

Data Confidentiality

Geophysical data is used by the Government of Queensland in support of its geoscience projects, and by industry in support of exploration programs. To facilitate these uses, GSQ has adopted a custodial role for geophysical data. This allows GSQ use of relevant data and release of the data into the public domain, but only after confidentiality provisions have been met (Qld Government, 2020b).

Although the Queensland Government encourages multi-client surveys to be undertaken, DNRME does not require multi-client survey data to be submitted. However, DNRME and GSQ welcome conditional access to any data produced by these multi-client surveys to support relevant geoscience programs (Queensland Government, 2020b).

The release timeframes in **Table 5.6** below for information from geoscientific surveys are relevant to surveys that are not multi-client surveys.

TABLE 5.6 QUEENSLAND DATA AND INFORMATION RELEASE PERIODS

Report	Confidentiality period	Comment
Scientific and technical survey report	3 years	After the completion day.
Seismic survey report	3 years	After the completion day
Core and samples	2 years for an exploration well 5 years for a development well	After the day on which the part of the sample or core is required to be lodged.
Annual report	5 years	After the last day of the period to which the report relates.
Well completion report	3 years for an exploration well 5 years for a development well	After the day on which the report is required to be lodged.
Well abandonment	3 years for an exploration well 5 years for a development well	After the day on which the report is required to be lodged.
Production report	6 months	After the last day of the period to which the report relates.

SOURCE: QUEENSLAND DEPARTMENT OF NATURAL RESOURCES, MINES AND ENERGY

5.3 International Jurisdictions

5.3.1 Norway

Norway is a major producer of petroleum and has been for several decades. The regime for information collection and dissemination has been important for the country in growing the Norwegian oil and gas industry and encouraging exploration. Many aspects of its regime have been important for other countries when it has come to benchmarking certain rules and regulations on the reporting of data and confidentiality periods.

In Norway, the oil and gas industry is governed by the *Petroleum Act No. 72 of 29 November 1996* (the Petroleum Act) and the associated regulations. Section 10-4 of the Act is the specific section relating to material and information concerning petroleum activities:

- outlining the framework for reporting to the authorities
- providing that the legislation applies to anyone generating information regarding petroleum activity
- stipulating that a licence operator has a special responsibility for data
- requiring that material and information be submitted to the Ministry or to anyone designated by the Ministry.

Information Reporting

The information obtained from licence operators is similar to that obtained by Commonwealth and State Governments in Australia. Information that must be reported by licensees includes:

- survey data and other information (Section 6 of the regulations)
- well activity reports (Section 46)
- production reports (Section 48 and 49)
- drilling activity reports (Section 46)
- impact assessments (Section 6a to 6d)
- annual field reporting (Section 47).

Timeframes for reporting this information are reasonably similar to other jurisdictions. For geophysical surveys, the licensee must send data, registrations, and results from the activity to the Norwegian Petroleum Directorate (NPD) as soon as possible, and no later than three months after the survey has been completed.

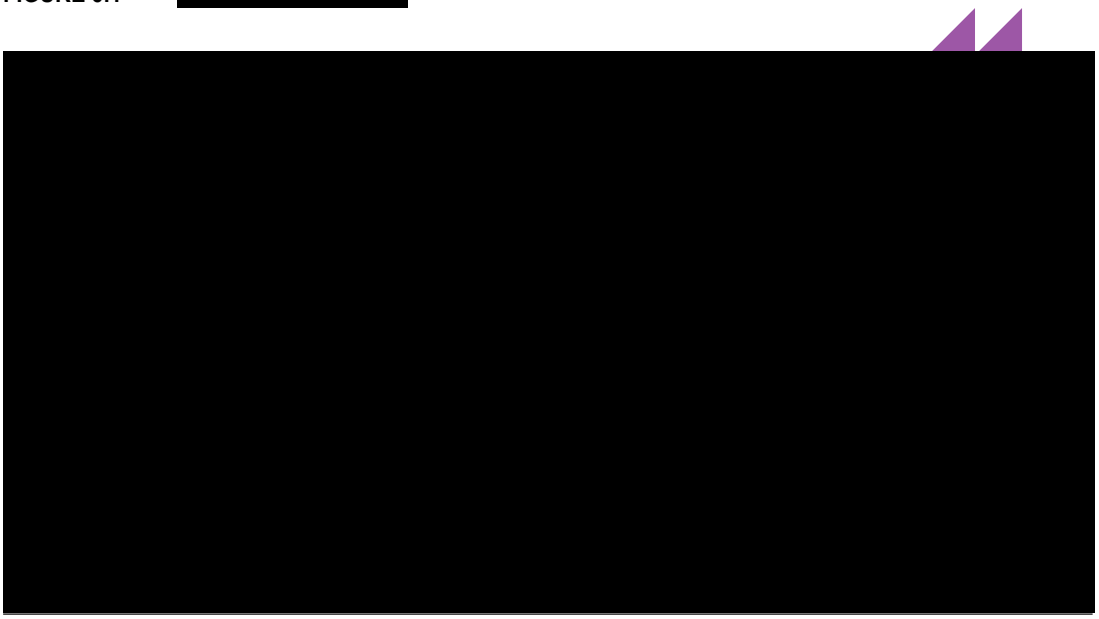
For production data, the deadline for reporting all files containing saleable figures is the 20th of the month after the month of production. For all other files, the deadline is the last working day of the month after the month of production.

Information relating to well and drilling activity must be reported as soon as possible and no later than six months after the date the drilling and logging activities have been completed.

The NPD acts on behalf of the Norwegian Government and it is entitled to all information the oil and seismic companies have regarding their activity on the Norwegian Continental Shelf (Toogoond, 2017). The NPD aims to ensure that data and information from petroleum activities are made available to all interested parties to support exploration activity.

To manage data efficiently, the Norwegian Government joined with industry to create a data management system called "Diskos" in the 1990s. Development of the system was funded by the NPD and the Norwegian oil industry. It was marketed as a "joint solution" to managing data effectively and for access by industry to support exploration. Diskos was identified as a system to store seismic and production data more efficiently, by standardising data types, data formats, the model for inputting data, and associated procedures. Diskos also includes a module that is used to trade and exchange well and seismic data in Diskos between members. [redacted] indicated in **Figure 5.1.**

FIGURE 5.1 [redacted]



It appears that industry participants have regarded the system as a positive for petroleum exploration and development. Commentary from some [redacted] has indicated that Diskos has proven to be valuable to industry, particularly due to the savings related to direct costs in undertaking

exploration activity, and enabling geophysicists and geologists to have instant access to high-quality data.[50]

Data Confidentiality

With regard to data confidentiality in Norway, the duty of secrecy (section 85 of the regulations) identifies the rules regarding confidentiality of data and when data can be released publicly.[51] The following confidentiality periods for seismic and well data apply from the time the data becomes available to the owner of the data (the licence holder):

- 2 years for data which is not commercially available
- 10 years for data which has been commercially available from the time when data became available to the owner (licence holder)
- 20 years for interpreted data.

Data from a licence area which is relinquished or surrendered, is no longer confidential.

5.3.2 United Kingdom

In the United Kingdom (UK), the *Petroleum Act 1998* vests all rights to the UK's petroleum resources in the Crown and provides the Oil and Gas Authority with the power to grant and administer licences that confer exclusive rights to 'search and bore for and get' petroleum (UK, Oil and Gas Authority, 2020). Section 9A (1) of the *Petroleum Act 1998* nominates the Government's "principal objective" with respect to petroleum resources. It is "the objective of maximising the economic recovery of UK petroleum." The principal objective is to be pursued particularly through various activities, equipment, and other facilities, and through collaboration between title holders, operators, installation owners, and infrastructure developers and owners. Section 9A (2) requires the Oil and Gas Authority to produce one or more strategies for enabling the principal objective to be met. In 2016, the Oil and Gas Authority prepared *The Maximising Economic Recovery Strategy for the UK*, which came into force in March 2016 in accordance with Section 9G of the *Petroleum Act 1998*. Section 9B requires the Oil and Gas Authority to act in accordance with the Strategy when performing its functions and exercising its powers under relevant parts of the *Petroleum Act 1998* and other statutes.

The *Energy Act 2016* established the Oil and Gas Authority (OGA) as a government company, limited by shares under the *Companies Act 2006*, with the Secretary of State for Business, Energy and

[50] "Norwegian Govt. picks up SIS IT system", *Energy News Bulletin*, 2002.
[51] *Regulations to Act Relating to Petroleum Activities*, Norwegian Petroleum Directorate

Industrial Strategy being the sole shareholder. The *Energy Act 2016* also provided the OGA with regulatory functions and powers under the *Petroleum Act 1998* and other statutes. These functions and powers included collection of information from offshore operators and title holders, and qualified disclosure of information.

The *Energy Act 2016* brought into law some key recommendations of a review led by Sir Ian Wood (2014) of policy and administrative arrangements for maximising economic recovery from oil and gas resources on the United Kingdom's continental shelf (MER UK). The review recommended that government and industry develop and commit to a new MER UK strategy, and proposed considerable changes to regulatory arrangements of the petroleum exploration and extraction industry, including a new regulatory entity, and new information submission and disclosure requirements.

With regard to submission and disclosure of information, the review by Ian Wood (2014) pointed out that the Department of Energy and Climate Change had been leaving the task of releasing data to operators, rather than undertaking the task itsel. Wood argued that government should resume responsibility for release of information to ensure that the required extent and timing of information releases were realised. Wood also proposed reduction of confidentiality periods from three or four years for proprietary (not for sale) information submitted by title holders to possibly one year. In the case of "speculative" seismic data, Wood proposed that the 10-year confidentiality period should be reduced. The proposed changes were based on the observation that successful exploration relies on ready access to good quality data. However, Wood said the proposals regarding timing of release should be subject to consultation with industry and proper evaluation of the consequences, including the effect on generation of data.

The *Energy Act 2016* includes powers relating to the retention/reporting of petroleum-related information and samples by relevant persons, submitting them to the OGA and their subsequent disclosure by the OGA. The requirements for such retention/reporting and disclosure are now set out in the *Oil and Gas Authority (Offshore Petroleum) (Retention of Information and Samples) Regulations 2018* (Retention Regulations) and the *Oil and Gas Authority (Offshore Petroleum) (Disclosure of Protected Material after Specified Period) Regulations 2018* (Disclosure Regulations) made under the *Energy Act 2016*. The UK Oil and Gas Authority (2019a,b) has published guidelines on information reporting and disclosure.

Information Reporting

A notice under Section 34 of the *Energy Act 2016* requires nominated relevant persons to provide specified petroleum-related information or a portion of a petroleum-related sample to the OGA. A section 34 notice typically covers "routine" reporting of information arising from exploration and production activities. A standalone section 34 notice might also be issued in respect of a specific piece of information or sample not included in a routine notice. Information may also be submitted to OGA through an information and samples plan (meant to minimise risks in relation to transfer of information, including samples, arising from a licence event, such as transfer or cessation of a licence).

The OGA may require information and samples to be reported for several reasons, for example (UK Oil and Gas Authority, 2019a, p. 5):

- in support of its functions as a regulator
- for the long-term preservation of information and samples
- for the subsequent disclosure of information and samples under the Disclosure Regulations
- for the purposes of carrying out any of its functions which are relevant to the fulfilment of the principal objective (maximising economic recovery of UK petroleum) in Section 9A (1) of the *Petroleum Act 1998*.

Table 5.7 below presents reporting timelines for different categories of information, including samples.

TABLE 5.7 INFORMATION AND SAMPLES REPORTING: UNITED KINGDOM

Report	Timeline	Comment
Proprietary geophysical surveys	6 months	Timeline applies from the completion of processing. Required information includes field data, pre-stack data and post-stack data and report.

Report	Timeline	Comment
Commercial (multi-client or speculative) surveys	Dependent on type of information	Seismic field and pre-stack data – as per standalone notice issued by OGA under Section 35 of the *Energy Act 2016*. Seismic post-stack data, positional data and reports – no later than 6 months after completion of processing. Gravity, magnetic and electromagnetic – as per standalone notice.
Wells and drilling	6 months	After the date of completion of the well as recorded in the well operations and notification system (WONS). Timeline applies to well proposals, drilling programs, site surveys, daily operations, etc.
Samples and core	6 months	Applies to slabbed core, washed and dried drill cuttings. Other samples such as unwashed samples and resinated cores have no routinely reported timeline.
Production	Monthly	Field production data (consolidated by month) to be reported to OGA by means of the petroleum production reporting system (PPRS).
Other geological, subsurface, reservoir studies	Annually	Routinely reported (no later than the end of the calendar year in which the study was completed.).

SOURCE: OIL AND GAS AUTHORITY (2019A)

Disclosure Rules

Section 66(1) of the *Energy Act 2016* provides for public release of information reported to OGA (protected material) as specified in regulations made by the Secretary of State. Sections 66(3) and 66(4) provide for consultation with appropriate persons before making regulations regarding the timing of public release of information. Section 66(5) provides that in determining information release times to be specified in regulations, the Secretary of State must have regard to:

- whether the specified time will allow owners of protected material a reasonable period of time to satisfy the main purpose for which they acquired or created the material
- any potential benefits to the petroleum industry of protected material being published or made available at the specified time
- any potential risk that the specified time may discourage persons from acquiring or creating petroleum-related information or petroleum related samples
- any other factors the Secretary of State considers relevant.

It is noteworthy that Section 66(5) did not include an economic test requiring consideration of social benefits and costs of alternative release times. However, Section 66(6) stipulates that in balancing the factors in 66(5), the Secretary of State must have regard to the principal objective (maximising economic recovery of UK petroleum).

The procedure for determining timing of public release of information is consistent with advice from Sir Ian Wood (2014) that determination of release times should support the objective of maximising economic recovery, but be subject to consultation with industry and proper evaluation of the consequences, including the effect on generation of data. However, the confidentiality periods that emerged from procedure specified in the *Energy Act 2016* are considerably longer than proposed by Wood. Indeed, the confidentiality periods are generally longer than those applying when the Wood recommended earlier release of information.

Confidentiality or "protected" periods for information from activities undertaken during and after 2018 are summarised in **Table 5.8**. The summary table also includes representation periods – the minimum period before scheduled disclosure that a request for delay or non-disclosure must be lodged with OGA.

TABLE 5.8 CONFIDENTIALITY AND REPRESENTATION PERIODS: UNITED KINGDOM

Category	Earliest Disclosure	Min. Rep. Period
Well information	2 years from receipt by OGA in response to S34 Notice	3 months

Category	Earliest Disclosure	Min. Rep. Period
Summary well information	Immediately after receipt by OGA	Before reporting via WONS
Samples	2 years from receipt by OGA in response to S34 Notice	3 months
Proprietary geophysical survey information	5 years after completion of processing	6 months
Commercial geophysical survey information	Raw or field data and any other intermediate processed and derived – 15 years from completion of processing Final processed information and reports – 10 years from completion of processing	6 months
Summary geophysical information	After survey acquisition completed	Before reporting to OGA
Production data	2 months for monthly field data After cessation of production (cop) for detailed daily well data	 During cop discussions
Other licence information (e.g., reservoir models and studies)	On licence determination	On submission of Information and Sample Plan
Field development plans	5 years after first production	3 months
Pipeline information	After pipeline works authorisation	Before reporting to OGA
Infrastructure and facilities installation information	After cop of all connected fields	Before reporting to OGA

SOURCE: OIL AND GAS AUTHORITY (2019A)

Disclosure Rationale

Under the *Energy Act 2016* (sections 66(3-6)), determination of timing of public disclosure of information in the Disclosure Regulations is to follow consultations and take account of various considerations listed above. The UK Oil and Gas Authority (2018) undertook a consultation process, and then published a summary of views expressed by respondents and OGA's position on disclosure times, having regard to criteria nominated in sections 66(5-6) of the *Energy Act 2016*.

Opinions summarised by OGA indicated considerable division of opinion among respondents on length of confidentiality periods. [redacted]

5.3.3 Canada

Canada has a set of four principal Acts which govern oil and gas activities in Canadian offshore regions (Canadian Government, 2016):

- the *Canada Petroleum Resources Act 1985* (CPRA) – governs the lease of federally owned oil and gas rights on 'frontier lands' to oil and gas companies that wish to find and produce the oil and gas
- the *Canada Oil and Gas Operations Act 1985* (COGOA) – governs the exploration, production, processing, and transportation of oil and gas in marine areas controlled by the federal government
- the *Canada-Newfoundland Atlantic Accord Implementation Act 1987* and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act 1988* (Accord Acts) – implement agreements between federal and provincial governments relating to offshore petroleum resources.

The Accord Acts mirror both COGOA and CPRA. They outline arrangements for sharing of management of and revenue from offshore oil and gas resources, and establish offshore regulatory boards.

To promote exploration especially in Canada's Arctic and offshore regions, the Canadian Government has established various boards by legislation. They include the National Energy Board, the Canada Newfoundland and Labrador Offshore Petroleum Board (CNLOPB) and the Canada Nova Scotia Offshore Petroleum Board (CNSOPB) (Jones, 2017). Seismic activity is an important focus of these Boards. They grant licences to entities that conduct seismic operations and require a deposit of the seismic data as a condition of the licence. The deposit arrangements provide the seismic operators with a confidentiality period after which copies of the seismic data are made available to the public by the boards (Jones, 2017).

The most common survey types conducted in Canadian waters are “proprietary surveys”, usually collected during the early years of a new exploration licence or prior to field development, and “non-exclusive” surveys collected before title sales in a new basin (e.g., GSI Labrador Basin 2003-2006 surveys) and for the purpose of regional studies (e.g., GX Technology NOVASPAN survey) (Enachescu, 2007). Government programs are rare and are performed either for scientific investigation or to gain insights into basins overlooked by private sector explorers (Enaschescu, 2007).

Data and Information Reporting

Reporting is again similar to that in other jurisdictions, with information and data required for each title with respect to geophysical surveys, well reporting, cutting and samples, and production reporting. The *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act 1988* specifies reporting timeframes for areas governed by that Act:

[redacted]

Data Confidentiality

Different confidentiality periods have been set for exclusive and non-exclusive geological and geophysical information, and for information relating to wells. The rationales for these confidentiality periods have not been published, [redacted]

The rationales for these confidentiality periods have not been published, [redacted]

Geological and Geophysical Data

Exclusive geological and geophysical data are confidential for five years following the completion date of the activity.

The CNLOPB and CNSOPB have extended the confidentiality period for “non-exclusive” programs to 10 years following completion of the activity. The supporting argument put forward is it that a 10-year

confidentiality period will allow the seismic industry to survive in an erratic exploration cycle environment, typical for the Canadian offshore region.

Well Data

Confidentiality periods for well data vary according to the type of well.

- Exploratory well data is confidential for two years after the well has been terminated.
- Delineation well data is confidential for 90 days following the well termination date or two years after the termination date of the exploratory well drilled on the same geological structure (field) exploratory, whichever is longer.
- Development well data is confidential for 60 days following the termination date of the development well or two years after the termination date of the exploratory well drilled on the same geological structure (field), whichever is longer.

5.3.4 United States

The United States oil and gas industry is regulated through statutes and rules decreed by the federal and individual state governments. The regulations depend on whether the surface location of potential resources is owned by the federal government, state government or by private individuals, and whether the location is onshore or offshore. Exploration for and extraction of oil and gas on federal offshore property (beyond three nautical miles from the coast – the "outer continental shelf") is covered by the *Outer Continental Shelf Lands Act 1953* (OCSLA).

The main regulatory bodies for offshore oil and gas activity are the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE).

Data and Information Reporting and Confidentiality

An important note about the United States is that the BOEM does not perform direct geophysical and geological (G&G) data acquisition activities (BOEM, 2019). However, BOEM may obtain G&G data from lessees and permittees. By regulation, BOEM has access to certain permitted seismic data and information (such as processed, analysed or interpreted data) as soon as the data become available and lessees and operators are required, upon request, to provide BOEM with data collected on their leases. Data acquired via G&G permits constitute approximately 90 percent of the BOEM seismic database (BOEM, 2019).

Regulations at Title 30 of the Code of Federal Regulations (CFR), Part 551.14(b)(1) and Part 550.197 provide the release times of proprietary G&G data and information.

Pre-lease geophysical information will not be released to the public for 25 years. Raw geophysical data is held for 50 years before it is released to the public. The confidentiality term for proprietary geological information is 10 years (BOEM, 2019).

While BOEM does not acquire all industry data, it does acquire a large majority of it. For example, BOEM has acquired approximately 90 percent of the data collected by private sector explorers on the Alaskan outer continental shelf. Offshore Alaska remains a large frontier area with limited data from private sector exploration, prompting BOEM to acquire as much of the existing data as is feasible (BOEM, 2017).

The rationale for the relatively long confidentiality periods applied by the United States Government is not readily accessible. However, it appears to be linked to a philosophical view that information market failures (see chapter 3) can be avoided by helping private sector operators to maintain confidentiality of the information they generate, rather than by government undertaking geological and geophysical surveys.

5.3.5 Other Jurisdictions

New Zealand

In 2018, New Zealand Prime Minister, Jacinda Ardern, announced that new offshore oil and gas exploration permits would not be issued after 2018, effectively banning any future exploration other

than under existing permits (ABC, 2018).[52] Therefore, ACIL Allen has not delved deeply into the New Zealand (NZ) regime.

However, in terms of exploration data collection, the NZ Government did not have significantly different policies or intent compared to other jurisdictions. Confidentiality timeframes are similar to those applying elsewhere. For most exclusive technical data, the confidentiality period is 5 years. For non-exclusive data, the timeframe is 15 years (NZ Government, 2013).

While the Government collected its own geophysical data over the years, it claimed there had been a notable increase in multi-client survey activity in New Zealand waters since 2013.[53] This followed changes to the *Crown Minerals Act 1991* which extended the confidentiality period for speculative data from 5 to 15 years.

Ireland

Since 2014, there has been an upswing in the exploration momentum off the coast of Ireland as reflected by the number of exploration authorisations. These are currently at the highest ever level.[54] There has also been an increase in recent years in the amount of seismic data acquired. However, Ireland remains relatively underexplored.

All data (including records, returns, plans, maps, samples, accounts, interpretations and other information), which are provided under the provisions of an authorisation, are supplied to government at the expense of the authorisation holder. Except with the consent in writing of the authorisation holder, which will not be unreasonably withheld, such data must not be disclosed to any person not in the service or employment of the State until:

- in the case of well data, 4 years have elapsed from the rig release date
- in the case of geophysical data relating to "Open Areas", 4 years have elapsed from the completion of processing or 4½ years from the completion of acquisition, whichever is the earlier
- in the case of geophysical data relating to "Open Areas" and where that data is 3D seismic data that covers an area exceeding 1,000 square kilometres, 10 years have elapsed from the completion of processing (or 7½ years from the completion of acquisition whichever is the earlier)
- in the case of geophysical data relating to "Closed Areas", 7 years have elapsed from the completion of processing or 7½ years from the completion of acquisition, whichever is the earlier
- in the case of all other data, 4 years have elapsed after being furnished, or
    - 3 years after expiry of the authorisation
    - 2 years after surrender
    - immediately after revocation, whichever is the earliest.

"Open Areas" refers to areas in which applications for exploration licences and licensing options may be made at any time. "Closed Areas' refers to areas in which applications may only be made pursuant to an announcement by the Minister that the area in question is being opened for licensing.

Indonesia

Recently in Indonesia, with the intention of promoting new investments in the upstream oil and gas industry, Indonesia's Minister of Energy and Mineral Resources enacted a new regulation to replace the 13-year old regulation on upstream oil and gas data management and utilisation (Assegaf Hamzah & Partners, 2019).

Among the key features of the new regulation is the introduction of access to upstream petroleum data. Declassification of data would mean that data and information would be more accessible, which in turn could potentially lead to an increased control over exploration risks and increased possibility of a discovery being made.

The confidentiality period of data would depend on the granularity of the data:

[52] *New Zealand Bans New Offshore Oil and Gas Exploration in Quest for Net Zero Emissions*, ABC News, 12 April 2018.
[53] *Petroleum Resource Potential*, Ministry of Innovation, Business and Employment, New Zealand Government, 2017, accessible at https://www.nzpam.govt.nz/nz-industry/nz-petroleum/resource-potential
[54] *Exploration and Production - History of Oil and Gas (Exploration & Production) in Ireland*, Department of Communications, Climate Action and Environment, 2020.

- raw data – 4 years from acquisition completion
- processed data – 6 years from processing completion
- interpretative data – 8 years from interpretation completion.

Brazil and Mexico

Brazil and Mexico have the following confidentiality periods for geophysical survey data and information relating to well drilling and completions ([redacted]):

- Brazil – [redacted] years for seismic data and [redacted] years for well data
- Mexico – [redacted] years for geophysical surveys.

5.4 Key Similarities and Differences – Australian Offshore and Onshore and International Jurisdictions

The information aspects of the Australian RMA Regulations and information capture and release regimes in onshore Australian state jurisdictions and offshore overseas jurisdictions that were reviewed by ACIL Allen have similar general frameworks. Governments typically capture information generated by private sector operators and release most of it with significant to substantial lags. In addition, non-exclusive data is released with a much longer lag than exclusive information.

Another notable similarity between information release regimes is the unavailability of published, reasoned rationales for exclusive information being released significantly or substantially later than a reasonable time for submission of raw and interpretative information. Explanations of long lags in releasing non-exclusive information are more common, but typically are terse, vague, and unconvincing.

Time lags chosen by governments often appear to have been based on what other jurisdictions have done, rather than on any analysis of the economics of exploration and assessment, and the economic characteristics of information. Consequently, there has been domestic and international convergence on information release rules that lack any solid analytical foundation. It seems that most policy makers feel safe if they support regimes that are similar to those applying in at least a few comparable jurisdictions. In contrast, good policy making relies on solid analysis that applies accepted policy criteria and principles. Policy making of the latter type is not evident in formulation of typical information capture and release regimes.

5.4.1 Data Reporting

Reporting of well data, production reports and seismic information is similar across most Australian jurisdictions. The reporting of survey data seems generally to be in the timeframe of around 12 to 24 months from completion of the survey. Another similarity between most of the Australian jurisdictions is that there is generally no significant difference between 2D and 3D seismic data reporting timeframes. Also, there is a longer reporting period for processed data compared with basic (e.g. raw/field data) data from 2D and 3D surveys. For example, the Australian offshore regime requires raw data and reports for 2D and 3D surveys after 18 months compared with 24 months for processed data. Western Australia has the same timeframes.

Internationally, the reporting of survey information is highly variable, based on the information ACIL Allen has been able to review. Some countries such as Norway require seismic survey reports and data to be provided within three months, notably earlier than most Australian jurisdictions. However, other jurisdictions such as the United Kingdom require survey reports six months from survey completion, while Canada has a 12-month reporting timeframe for survey data. For other countries, it is not clear what these timeframes are.

Well and production reporting is similar across jurisdictions. Most well related data is required to be reported to relevant state authorities in Australia around six months from rig release. However, Western Australia is different to other states and the Australian offshore regime with well reports required to be reported within 12 months of rig release. Production reporting is similar with most Australian jurisdictions requiring monthly production reports to be provided within one to two months after the relevant production month. International jurisdictions for which information was found on

reporting requirements seem to have similar timeframes for well and production reporting. The UK and Norway require well reports to be provided within six months and monthly production reports to be submitted within the subsequent month. [redacted]

One key difference in terms of reporting is that the Government Queensland does not require multi-client or non-exclusive data to be reported. However, industry is encouraged to report non-exclusive data to aid the Queensland Government with its own geoscience and exploration programs and research activities.

TABLE 5.9 REPORTING PERIODS COMPARISON

	Surveys	Well completion Reports	Production reports
Australian offshore regime	18 months (acquisition report) 24 months (survey processing report and data) 30 months (interpretation report and data)	6 months	15 days after end of relevant production month.
Western Australia	18 months (acquisition report) 24 months (survey processing report and data) 30 months (interpretation report and data)	12 months	15 days after end of relevant production month.
South Australia	12 months (after completion of recording of the data or processing of data with respect to interpretative data)	6 months	Within 2 months of relevant production month.
Queensland	Within 2 years of the day on which the survey or reprocessing was completed	12 months	Within 60 business days after the six-month period ends.
Norway	3 months after completion of survey	6 months	By the 20th of the month following the relevant production month.
United Kingdom	6 months	6 months	Within a month following relevant production month.
Canada	[redacted]	[redacted] for well operation reports	[redacted]

SOURCE: ACIL ALLEN

5.4.2 Data Confidentiality

Regulations regarding the confidentiality periods for data are similar across Australia, but notable differences are apparent when reviewing international jurisdictions. A general observation is that confidentiality periods can vary according to how the data was collected, where the exploration activity occurred, etc. This section aims to provide a high-level comparison of the general confidentiality timeframes for different categories of information.

Timeframes for geoscience surveys in Australia are generally quite close, ranging from two to three years for exclusive surveys and 15 years for non-exclusive surveys. Queensland does not require non-exclusive data to be reported and therefore does not include confidentiality timeframes for non-exclusive surveys. In contrast, Western Australia has a five-year confidentiality period for interpretive seismic data, and reprocessed seismic data are confidential for three years, mirroring the Australian offshore regime.

Internationally, the timeframes vary. For exclusive surveys, timeframes generally range from two to five years with Norway the shortest (two years) and the United States the longest (50 years for raw geophysical data). Non-exclusive survey timeframes generally range from 10 to 15 years. Australian regimes therefore are not too dissimilar in that regard. The variability when it comes to non-exclusive surveys is assumed to be determined by how important non-exclusive surveys are for generating information and future exploration activity. In North America where minimal pre-competitive and seismic work is completed by government, non-exclusive surveys are important with longer confidentiality periods applied to encourage this activity by seismic companies. New Zealand is also similar where non-exclusive surveys apparently have been important in encouraging bids for titles as government geoscience activities have diminished. The confidentiality period is [redacted] years for non-exclusive surveys in [redacted].

Well data confidentiality across Australian jurisdictions is similar with confidentiality periods for well data and results typically two to three years, with Queensland lengthening that for development wells (five years vs three years for exploration wells). Across international jurisdictions, timeframes are similar to those in Australian jurisdictions, with the most common confidentiality period being two years for well-related data. For some jurisdictions, it is not known whether there is a confidentiality period for well data or whether the data is not required to be reported in the first place.

Production-related data confidentiality differs more across Australian jurisdictions than confidentiality of other information. Queensland and South Australia have six-month timeframes while Western Australia is much longer at two years. The Australian offshore system on the other hand keeps production data permanently confidential. This is similar to Victoria (not covered here), which does the same regarding production data. It is not easy to discern what corresponding timeframes are for international jurisdictions. Often well and survey data are singled out for a specific confidentiality period, with all other data commonly grouped into a category where the confidentiality period is the same.

TABLE 5.10 CONFIDENTIALITY PERIODS COMPARISON

	Surveys	Well data	Production data	Other
Australian offshore	3 years (exclusive) 15 years (non-exclusive) 5 years for interpretated seismic data	2 years	confidential	2D extracts from a 3D survey is 5 or 6 years after acquisition.
Western Australia	3 years (exclusive) 15 years (non-exclusive) 5 years for interpretated seismic data	2 years	2 years	Petroleum samples are confidential for 2 years after rig release.
South Australia	2 years (exclusive) 15 years (non-exclusive)	2 years	6 months	Core and samples are confidential for 2 years.
Queensland	3 years (exclusive)	3 years (exploration well) 5 years (production well)	6 months	Non-exclusive surveys not required to be reported to Government.
Norway	2 years (exclusive) 10 years (non-exclusive)	Same as surveys	-	Interpreted data confidential for 20 years.

	Surveys	Well data	Production data	Other
UK	5 years (exclusive) 15 years (non-exclusive raw data) 10 years (non-exclusive processed data)	2 years	2 months	Field development plans can be released after 5 years.
Canada	[redacted] years (exclusive) [redacted] years (non-exclusive)	[redacted] years	-	[redacted] years for other data associated with development wells.
USA	25 years (processed data) 50 years (raw data)	-	-	Not all data is required but often Government will acquire most of it.
Ireland	Ranging from 7 to 10 years based on type of area explored	4 years	-	4 years for all other data that is instructed to be collected by a licence holder.
Indonesia	4 years - Basic Data, that is the descriptions or quantity of the results of geological, geophysical, geochemical, exploration, drilling and production recording. 6 years - Processed Data, that is the data obtained from the results of analysis and evaluation of Basic Data. 8 years - Interpretation Data, that is the data obtained from the results of interpretation of Basic Data and/or Processed Data.			
Mexico	[redacted] years	-	-	-
Brazil	[redacted] years	-	-	-

SOURCE: ACIL ALLEN

6 ANALYSIS OF INFORMATION CAPTURE AND RELEASE POLICIES

Key Points

- A thorough analysis of alternative formulations of information-capture-and-release policy has been undertaken, having regard to policy criteria and principles nominated in chapter 2, and the observations of stakeholders during consultations. The analysis took account of the important matter of the context provided by policy instruments that interact with information-capture-and-release policy (analysed in chapters 7 and 8).
- In the context of other policy instruments that interact positively with (complement) a policy of government capture and release of private sector information, comprehensive capture and prompt release of exploration/assessment information is a far superior policy to one that delays public release of other information beyond the elapse of sufficient time for government to review the quality and comprehensiveness of submitted information.
- Exclusions from, and delays in release of information deprive the sector of the public good of information, and encourage activity directed towards gaining an informational advantage in acquiring or applying for additional tenements. This exacerbates information market failures discussed in chapter 3 and is economically inefficient.
- Two factors ameliorate concerns that if information is released promptly, exploration/assessment might be economically inefficient because generators of information would not be able to capture all benefits of their activities.
  - Benefits that information generators would be prevented from capturing are economically undesirable asymmetric information advantages in respect of areas over which they do not have exclusive title, while benefits in relation to their own exclusive titles are not affected.
  - Information generators would potentially benefit from the activities of all others, not just sacrifice benefits to them.
- An information-capture-and-release regime is not sufficient to correct information market failures impeding early-stage exploration/assessment activity in frontier areas, but is well suited to correcting information market failures in more prospective areas (see discussion of information market failures in chapter 3). Government funding of early-stage exploration in minimally explored areas (see chapter 7 for analysis) should accompany the comprehensive capture and prompt release of privately generated information.
- A work-bid titles regime tends to destroy benefits from the comprehensive capture and release of private information and from government funding of early-stage exploration in minimally explored areas (explained in chapter 8).
- A sensibly designed cash-bid titles regime (discussed in chapter 8), the comprehensive capture and prompt release of privately generated information, and government funding of early-stage exploration in minimally explored areas are complementary policy instruments. Together, they represent the core of a leading-practice policy regime.

- If government does not fund early-stage exploration in minimally explored areas and favours a work-bid titles regime over a cash-bid system, a distant "second-best" (optimising in the context of policy constraints) case could be made for a regime involving comprehensive information capture, delayed release of information that is generated for sale or licencing on a multi-client basis, and prompt release of other information. Multi-client information would have to be priced competitively and therefore efficiently.
- Regardless of the choice made between the preferred (leading-practice) and distant "second-best" policy packages, substantial nitty gritty reforms to the current information-capture-and-release regime would be required to deal with specific anomalies, oversights, unnecessary complexities, and perverse outcomes (see chapter 4). Some nitty gritty reforms will differ between the two overall policy choices, but the majority would apply in both cases.

6.1 Introduction

On the matter of government capture and release of private extractive industries (exploration and exploitation) information, the authors of a World Bank policy guide on extractive industries (Cameron and Stanley, 2017, pp. 78-79) observed:

"Data ownership and confidentiality ….. is an extremely contentious area. Investors consider both the ownership and confidentiality of the data they generate or acquire as vital to their commercial interests. Host states, on the other hand, see ownership as critical to building a national data repository to inform their decisions on the extractive industries sector. The government's interest includes the right to release data as essential to the promotion of exploration and development interests."

Research and stakeholder consultations undertaken by ACIL Allen indicated that the views of investors and governments are more nuanced and less clear cut than suggested by Cameron and Stanley (2017). Most investors want the confidentiality of information they generate to be maintained for a few years, but also want access to information produced by others and argue that access to information is important to induce activity. Most governments recognise the importance of good information for encouraging activity, but have been influenced by claims that prompt release of information may discourage its generation.

In the economics and other literature on exploration and exploitation policy, the policy instrument of government capture and release of private sector exploration and exploitation information has attracted relatively little attention in comparison to the pervasive policy of government funding of early-stage exploration, titles policy, and taxation and royalty policy. In Australia, government capture and release of private sector information have received only terse mentions in policy reviews. Also, they have been largely ignored in published summaries and reviews of Australian exploration and extraction laws. The sparsity of analysis of policies on government capture and release of privately generated exploration information is surprising because such regimes are common, and they complement government funding of early-stage exploration in targeting correction of information market failures.

Literature on information policy in respect of investigation of geological structures for greenhouse gas storage is virtually non-existent. However, information issues in respect of identification and investigation of geological storage sites for greenhouse gas storage are conceptually very similar to information issues associated with exploration and extraction. Indeed, they overlap because information generated by petroleum exploration and extraction activities may be relevant to concurrent or later investigations of greenhouse gas storage sites. Therefore, in the interests of simplicity, the term "exploration information" is sometimes used below to refer to information resulting from petroleum exploration, petroleum extraction, and investigation of geological structures as greenhouse gas storage sites. In addition, the term "exploration" is used to cover search and related assessment activities in pursuit of commercially viable petroleum reservoirs and geological structures for storage of greenhouse gas.

Government capture and release of exploration information generated by the private sector is one of several policy instruments that have been proposed by various parties as remedies for perceived information-related market failures discussed in chapter 3. Other proposed policy instruments include:

- facilitation of exploration information markets

- full government funding of early-stage exploration (100 per cent subsidy)
- exploration subsidies (rates of subsidy less than 100 per cent)
- expression-of-interest systems to obtain information from private sector explorers to help identify where, what, and when tracts should be released for competitive bids
- larger exploration tenements
- work program bidding for highly conditional tenure
- cash bidding for relatively unconditional exploration tenure.

Often, these policy instruments have been considered as stand-alone policy measures. This can provide misleading results. They should be analysed as potential complements or components of policy packages, as there is no single policy instrument that can efficiently address all causes of information market failures in all stages of exploration. Moreover, it is important to consider interactions between policy instruments when analysing a specific policy, as interactions may support or undermine the policy under scrutiny.

The analysis in this chapter is focussed on three issues:

- the suitability of government capture and release of private sector exploration information as a policy instrument for correcting market failures linked to the public good character of information and information asymmetries
- the ideal timing of release of this information from an economic efficiency perspective
- the desirability of considering government collection and release of private exploration information in the context of policy instruments that interact with it either positively or negatively or are neutral.

Chapters 7 and 8 analyse policy instruments that might complement or undermine an information capture and release policy.

[redacted]

6.2 Variations of Information Capture and Release Policies

Internationally and domestically, there has been a trend towards convergence on information capture and release policies that involve mandated submission to government of a wide range of types of information relating to exploration for, assessment of and exploitation of resources by private sector entities, followed by lagged public release of much of that information. Nevertheless, some jurisdictions do not have regimes for capture and release of privately generated information.

In jurisdictions that do have information capture and release regimes, lengthy delays in releasing of information are the norm, but the extent of the delays may vary considerably between types of information within and between jurisdictions. In some jurisdictions, prohibitions apply to release of specific types of information. Prohibition of release of information is an extreme case of delay. A long delay has similar effects to prohibition.

The intricacies of Australia's current offshore information-capture-and-release policy, as set out in the RMA Regulations are discussed in chapter 4. The position of the Australian offshore policy on the spectrum of regimes applying elsewhere is discussed in chapter 5.

The convergence on lengthy delays in releasing information captured from private sector operators has been strongly influenced by the safety-in-numbers practice of deploying policies broadly similar to those applying elsewhere. This approach typically has been preferred to formulation of policies guided by solid, independent economic analysis. Variations between jurisdictions in relation to the length of delays in releasing information appear to have been based on judgements, rather than rigorous analysis.

The permanent confidentiality of some information, and delays of 3-15 years in releasing other information under that Australian offshore policy seem to be inconsistent with the thrust of the Australian Government's (2015) *Public Data Policy Statement*, its response to the Productivity Commission's (2017) inquiry report on data availability and use (Australian Government, Department of the Prime Minister and Cabinet, 2018a), and its subsequent issues and discussion papers on data release and sharing (Australian Government, Department of the Prime Minister and Cabinet, Office of

the National Data Commissioner, 2019, 2020). This policy position was discussed in chapter 2. It is focussed on optimising the use and reuse of data and making data open by default, provided that the information does not identify an individual person or breach privacy or security requirements. Application of this policy to offshore information would lead to substantial change to current offshore information release arrangements.

Ownership of data (including samples) generated by private sector explorers differs between jurisdictions. In most jurisdictions, ownership has been assigned to the government, although the private investor has been allowed to retain information in paper or electronic formats, and physical samples. The exceptions are a few industrialised countries (Cameron and Stanley, 2017). Australian jurisdictions are among the exceptions.

6.3 Rationales for Alternative Policies

Concern about activity undertaken by enterprises and governments to create and preserve private monopoly positions in respect of exploration information (asymmetric information) is part of a broader issue regarding accessibility of information that would benefit multiple entities (the public good of information). For example, over the past 60 years, a vast literature has built up in relation to access to information on innovation activities and outcomes.[55] A less prominent example is information relating to academic research. Hess and Ostrom (2003, 2006) stressed the importance of initiatives to establish arrangements to manage and disseminate the public good of information generated by scholarly research activity. They noted that such initiatives were required to address a trend to "commodification and privatisation of research information" or "enclosure" of an "information commons" that had put at risk access to the sharable resource of information. They explained that this enclosure trend had been facilitated by new technologies, market forces, and government policy measures. Hess and Ostrom (2006, p. 15) observed:

"The challenge is how to blend systems of rules and norms related to this new commons to guarantee general access to the knowledge that empowers humans while ensuring recognition and support for those who create knowledge in its various forms."

This challenge is central to exploration information policy. It has been the subject of considerable controversy, as noted by Cameron and Stanley (2017), and has drawn a wide range of responses, as noted above.

6.3.1 Rationale for Government Capture and Prompt Release of Exploration Information

Several economists have advocated government capture and prompt release of exploration data as a means of addressing adverse economic effects of under-provision of the public good of information and asymmetric availability of information. This would be consistent with principles set out in the Australian Government's (2015) *Public Data Policy Statement*. These principles have been discussed in chapter 2.

Mason Gaffney (1967a) advocated government collection and prompt release of all relevant exploration information generated by the private sector on grounds that it would address inefficiencies associated with public good (including external benefits) aspects of exploration information and asymmetric availability of that information among potentially interested parties. He also advocated government funding of early-stage exploration in minimally explored areas, and quick release of the resulting data. For these reasons, Gaffney (1977b) proposed that both policy instruments be implemented in Alaska, in a report commissioned by the Alaskan Government. Douglas Reece (1978) advocated application of the same policy instruments on the United States outer continental shelf. In the context of a review of policy relating to management of oil and gas resources in Alberta (Canada), Michael Crommelin, Peter Pearse and Anthony Scott (1978) proposed deployment of the policy instrument of government capture and prompt release of private sector exploration information, along with government funding and early release of information from early-stage exploration to deal with public good aspects of exploration information and asymmetric information among explorers.

[55] For comprehensive discussions, see Bikhchandani, Hirshleifer and Riley (2013), and Stiglitz and Greenwald (2014).

Paul Milgrom and Robert Weber (1982a) and Milgrom (2004) explained, with the aid of a game theory model, that government capture and prompt release of private exploration information would reduce exploration information asymmetry, resulting in higher expected revenue to government from cash bidding and lower expected economic profit for entities with information advantages. Milgrom (2004) pointed out that such government action would also improve the efficiency of resource allocation.

In Australia, Ken Henry and others (2010), advocated a policy of government capture and dissemination of information from private sector exploration in Australia. They justified this on grounds that information is a public good.[56]

Geologists have advocated availability of access to data generated by previous explorers in different terms. However, their arguments are consistent with the economic rationales of addressing information market failures. For example, Margaretha Scott and Malcolm Jones (2014, p. 3) commented:

"Geoscience data are at the heart of every discovery and at the centre of every resource development. Accessing data that has already been acquired by previous explorers is a key to reducing risk in exploration and mining, which are high risk, long-term activities. Being able to build on existing data better focuses future efforts towards identifying the earth's natural mineral and energy endowment. Discovery of a profitable resource commonly occurs only after explorers have repeatedly examined a particular parcel of ground."

Government capture and prompt release of private exploration information will address information asymmetries between providers of exploration capital and entities engaged in exploration, as well as information asymmetries between explorers. This would occur because capital providers' advisers, as well as interested explorers, would be able to access publicly released information.

Information asymmetries between government and explorers are addressed in two ways by government capture and prompt release of private exploration information. First, the capture component of the policy is a means of directly addressing such information asymmetries. Second, Hughart (1975), Cotula (2010), Collier and Venables (2011a), and Morgan and Stanley (2017) pointed out that action to reduce information asymmetries among potential explorers to increase competition between those entities for potential resources would also reduce information asymmetries favouring explorers in dealings with government. As Mason Gaffney (2009) observed, government could protect the interests of its constituents by behaving like a rational private owner of potential resources.

A common theme of analyses of government capture and release of private exploration information is that this policy instrument should not be deployed on a stand-alone basis. It should be teamed with other policy instruments, particularly government funding of early-stage exploration. Deployment of the former policy does not mean government funding of early-stage exploration is not required on economic grounds. Similarly, adoption of the latter policy does not obviate the economic case for a policy of government capture and prompt release of privately generated exploration information.

6.3.2 Rationale for Delayed and Selective Release of Private Exploration Information

James Ramsey (1980) and the Productivity Commissions' predecessor, the Industry Commission (1991) argued that if explorers know that the information they produce will be made available to competitors, exploration activity will decline because those generating the information will not retain all

[56] See Henry and others (2010), Part 2, Volume 1, p. 220.

of the benefits resulting from their activity. The Productivity Commission's (2020) report on resources sector regulation included consideration of the policy instrument of government capture and release of exploration information generated by private sector entities. It recognised that, if information is kept confidential, other explorers are denied access to this public good, and information asymmetries occur, resulting in an inefficient allocation of resources. However, the Productivity Commission expressed concern that prompt release of information generated by an entity would allow others to free ride on that information, and this may discourage activity by that entity. It considered that a confidentiality period before the public release of exploration information would be a way of addressing this perceived trade off. The Productivity Commission proposed confidentiality periods for private exploration and production information that are shorter than tenure periods. It said it was not able to nominate an optimal confidentiality period.

Most of the [redacted] consulted by ACIL Allen expressed views that were compatible with the position articulated by the Productivity Commission (2020), arguing for an "appropriate balance" between the interests of those generating exclusive information and the broader public interest. For example, [redacted] commented [redacted]:

"[redacted]"

A survey of [redacted] ACIL Allen's Review indicated that about 70 per cent of those entities considered that confidentiality periods for exclusive information currently are about right. Others considered that confidentiality periods should be lengthened for exclusive information, generally by one or two years. Analytical support for these views on an "appropriate" or "reasonable balance" between the private interests of those generating information and the public interest were not forthcoming [redacted]. However, [redacted] acknowledged that preference for longer confidentiality periods was likely to depend on whether an entity is an established information-rich title holder or a potential new entrant [redacted].

Support by [redacted] for existing Australian Government arrangements for capture and delayed release of petroleum information in offshore areas has persisted since the RMA Regulations were made in 2011. [redacted]

In the economics literature, Milgrom and Weber (1982) and Mason (1986) have articulated a case for selective release of privately generated information.[57] It is a more subtle and complex argument than the simple view that prompt release of information would discourage its generation. The former argument recognised, as did the Productivity Commission (2020), that keeping privately generated information denies other entities access to the public good of information, and creates information asymmetries, resulting in an inefficient allocation of resources. It suggested that if released information complements another entity's private information that had created a pre-existing information advantage, information asymmetry would be exacerbated. Alternatively, if the released information is similar to, and therefore a substitute for other entities' pre-existing private information, the asymmetric information problem would be alleviated.

[57] See also Milgrom (2004).

Ramsey (1980) and the Industry Commission (1991) argued that government capture and release of exploration information is at best unnecessary, because in the absence of such a policy a market for information would form and this would tend to avoid information market failures. Moreover, they suggested that government capture and release of exploration information, at worst may impede operation of a market for information. The formation of a market for information would be undermined by opportunities to free ride (inability to exclude non-payers) that would make it unattractive to purchase data. The potential of, and impediments to a market solution for inadequate and asymmetric generation of information have been discussed in sub-section 3.2.3 of chapter 3.

[redacted] proposed confidentiality periods of 50 years for raw, field-tape multi-client (non-exclusive) data and 25 years for processed multi-client data. They also suggested that the confidentiality period applying to non-exclusive data in Australian waters was close to global best practice [redacted]. The analytical bases for these suggestions were not provided, and the different positions were not reconciled.

[redacted] that long confidentiality periods to support generation of multi-client data were justified by four factors:

- economies of scale in covering larger areas than individual titles
- [redacted]
- costs to individual explorers declining as survey costs are shared by multiple parties.

In contrast, [redacted] generally regarded the current confidentiality period of 15 years for non-exclusive survey data as being too long, as it would inhibit exploration in new areas. They proposed reducing the confidentiality period to 8-10 years. They suggested that a period less than 8 years would undermine the business case for speculative, multi-client surveys [redacted].

6.3.3 A Paradox

Various policy reviews undertaken in Australia have observed that the information generation, repository, management, and dissemination functions of Geoscience Australia and state and territory geological survey agencies provide important platforms for future exploration.[58] These repositories contain information produced by geological survey agencies and private sector explorers.

The Australian exploration sector has also expressed strong support for the information generation, repository, management, and dissemination functions of state and federal geological agencies, attributing high value to these roles. This support was reiterated during ACIL Allen's consultations with stakeholders on information management aspects of the RMA Regulations. Some private sector entities have argued that greater and more secure government funding for the government geological agencies these functions are desirable.[59]

It is paradoxical that support for the exploration information generation, repository, management, and dissemination functions of geological survey agencies has not been matched by support for a substantial increase in the scope and timing of release of privately generated exploration information that would add to the value of geological survey agencies' information repository, management and dissemination functions. It seems that explorers are keen to access information paid for by others but desire confidentiality periods of several years for information that they have generated.

6.4 Economic Assessment of Issues Linked to Information-Capture-and-Release Regimes

There are several issues requiring analysis. They relate to markedly different positions on the appropriateness of delaying the release of information captured from private sector operators.

[58] For example, see Industry Commission (1991), Commonwealth of Australia, Department of Finance and Deregulation (2011), Policy Transition Group (2010), [redacted] Productivity Commission (2013, 2020) and Scott and Jones (2014).
[59] See Productivity Commission (2013, 2020).

6.4.1 Comprehensive Information Capture and Prompt Release

The combination of comprehensive government capture and prompt public release of privately generated exploration information effectively ensures that the public good of exploration information is available to all interested parties, rather than kept confidential by private explorers. By eliminating information advantages, a policy of government comprehensive capture and prompt release of information lowers the private marginal value of effort to maintain the confidentiality of information,[60] and of activities to generate information just to gain advantages over others or to offset others' advantages.

Full capture and prompt release of information ensures that each potential and existing explorer can access and benefit from all information. Each explorer has access to a much larger pool of knowledge than if it, along with every other explorer, was able to keep all of its self-generated information confidential, apart from some inevitable spillovers.

In Australian waters, full capture and prompt release of information has been undermined in three ways. First, entities generating or purchasing information have been able to avoid submitting some information, often the best information, contrary to the intent of the RMA Regulations. This was highlighted by [redacted], and [redacted] in consultations [redacted]. Second, the RMA Regulations delay release of information for periods of time that are longer, and often much longer, than time reasonably required to generate, document, and submit it. Third, the RMA Regulations have unnecessarily categorised some information as permanently confidential (an extreme case of delayed release).

Any government-permitted gaps in submission of information or delay in releasing information defers other firms' access to the public good of information and delivers an asymmetric information advantage to a generator of information regarding areas over which it does not have exclusive title. It sanctions at least three categories of sources of market failure and resulting economic inefficiency.[61]

Delay in releasing information prolongs uncertainty faced by other entities, unnecessarily maintaining an impediment to exploration activity, and raising costs of exploration because of misdirection of programs and duplication of outlays. This market failure associated with the public good nature of information is particularly important for early-stage, frontier-area exploration.

A delay may not need to be prolonged to confer a substantial information-based, competitive advantage on one party over others in pursuit of title over resources. Consequently, a moderate delay may be as economically or socially damaging as permanent confidentiality. The economic damage is caused by resource misallocation as exploration activity is redirected in terms of targets, content, and timing, in uncoordinated and duplicative ways for the purpose of increasing information advantages or to neutralise the advantages of others. Such activity dissipates or erodes realised resource rent (nett value of mineable resources) by wasting resources on activity that is misdirected from a social perspective. Consequently, policies that protect the confidentiality of information beyond the period necessary to generate and submit it are redistributive (delivering only private gains), but such policies are economically or socially inefficient (wasteful). This market failure associated with asymmetric availability of information between explorers becomes increasingly important as exploration progresses and recognition of prospectivity increases.

Nevertheless, economically based concerns, as well as views based on private commercial interest, have been raised about the prompt release of all exploration information. These concerns have been outlined in sub-section 6.3.2 above. The former suggest that delayed or selective release of information may be warranted on economic grounds. The analysis below addresses each of the economic concerns.

[60] Private sector entities may still see value in lobbying government to sanction confidentiality of information.

[61] They include market failure associated with the public good character of information, asymmetric distribution of information between explorers, and information asymmetry between explorers and financiers. See chapter 3 for a detailed discussion of these sources of market failure.

6.4.2 Delayed Release of Exclusive Information

James Ramsey (1980), the Industry Commission (1991), the Productivity Commission (2020) and petroleum companies argued that if explorers know that the information they produce will be made available promptly to competitors, benefits retained by the entity producing the information will decline, and this will tend to discourage exploration activity. [redacted] consulted for this review advanced similar views. They considered that confidentiality periods for exclusive information in Australian waters currently are "about right" (70 per cent) or should be lengthened, generally by one or two years [redacted].

[redacted] generally considered that the current Australian RMA Regulations are tilted too much towards confidentiality. They stressed that, in the public interest, it is essential to release data as soon as practicable. If it is not practical to release the data immediately or if it is appropriate to allow companies a short period of exclusive use, they generally favoured confidentiality periods of two to three years. They did not explain when it would be appropriate to allow companies two or three years of exclusive use [redacted].

Views favouring delayed release of information are countered by three important considerations. They are outlined below.

First, as noted by the Productivity Commission (2020), temporary or permanent withholding of exploration information to other interested parties denies them access to the public good of information, and asymmetric information occurs, resulting in an inefficient allocation of resources. After recognising this point, the Commission's analysis went astray. It perceived a trade-off between reduced incentives to explore because of an explorer's inability to capture all information benefits from its activity, and the inefficiencies of inadequate and asymmetric availability of information. It seems that petroleum explorers consulted for this Review had a similar perception. The Commission's and explorers' proposed response was to delay public release of exploration information. This policy is misconceived because of a false perception that a trade-off is necessary (see the second and third points below), and because it accepts, unnecessarily, an inefficient outcome. In any event, views regarding lengths of delays are vague, as the Productivity Commission admitted, and differ between stakeholders.

Second, each title holder has an exclusive right to benefit from information gained about its own exclusive title from its activities on that title, from information relevant to the title resulting from prior work by government, and from information spillovers from the activities of others. Releasing information from each firm's exploration of its exclusive title does not disadvantage the firm in exploring that title. It simply removes the firm's information advantage in competing for comparable areas. Consequently, it would discourage exploration activity designed to gain such advantages, reduce inefficient duplication, and improve the efficiency of sequencing of exploration activity. It would not impede achievement of an efficient amount and timing of exploration (Dasgupta and Heal, 1979; Gilbert, 1981).

Third, explorers are recipients, as well as providers, of exploration information collected from private explorers and disseminated by government. Each explorer from which data is collected and disseminated by government could benefit from the large pool of information generated by all other explorers. The Industry Commission (1991) seemed to recognise that each explorer could be better off overall because of access to information from all other explorers, observing (Industry Commission, 1991, volume 3, p. 39):

"…. the industry seems quite reconciled to compulsory disclosure rules, perhaps because those who intend to be long-term players in the exploration game stand to gain cumulatively over time valuable information about the geology of Australia at no cost."

However, the Industry Commission (1991) did not pursue the implications of this observation. The information resources available to each explorer in a jurisdiction would be much larger than if it kept its self-generated information private. This should override any perceived discouragement of exploration activity resulting from failure to capture all information benefits from assessment of its own title for the purpose of finding and delineating resources in that title. It should also eliminate any incentive to

delay exploration to wait for information spillovers from others.[62] Similar observations were made by Joseph Stiglitz and Bruce Greenwald (2014) in relation to innovation (research and development) activity.

A separate concern about the release of exclusive information is that it may exacerbate information asymmetry and resulting inefficiency in some circumstances. Paul Milgrom and Robert Weber (1982), Charles Mason (1986) and Paul Milgrom (2004) pointed out that government capture and release of private information had two categories of effects. The nett result of these effects could be an improvement in the efficiency of resource allocation or an adverse efficiency effect.

The first type of effect is that the availability of the public good of information is increased, and this improves the efficiency of resource allocation. It has been labelled a "publicity" effect.

The second category of effect, described as a "weighting" effect, could reinforce the "publicity" effect in improving the efficiency of resource allocation (a positive weighting effect) or it could work in the opposite direction (a negative weighting effect).[63] If the information released by government is similar to information generated privately to gain an advantage over competitors, or if it allowed similar inferences to be drawn, then asymmetric information would be reduced by this substitutable information and the "weighting effect" would reinforce the "publicity" effect in improving the efficiency of resource allocation. Alternatively, if the released information complements other private information, it could increase information asymmetry, exacerbating socially misdirected private exploration to increase or maintain an informational advantage.[64] In these circumstances, the "weighting effect" would work against the "publicity effect". The nett effect on the efficiency of resource allocation would be problematic.

Concern about government capture and release of private information that is complementary to information privately held by a relatively informed party is not warranted, if information is released promptly. Dissemination of the former information would not increase the information advantage of the relatively informed entity, encourage extra exploration activity to increase that advantage, or induce others to undertake duplicative activity to neutralise that advantage, because the information already held by the relatively informed entity would also be publicly released promptly.[65]

The case for government collection and prompt release of privately generated information from petroleum and greenhouse gas storage activity in Australian waters is strong, except in frontier areas. In more prospective areas or later stage exploration, this policy regime effectively and efficiently addresses market failures associated with the public good nature of information and asymmetric availability of information. In frontier or minimally explored areas, this policy regime is hindered by a lack of previous activity with modern technologies that results in little or no private generation of information that can be captured and released to correct the unavailability of information. In such areas, there is a better policy option: government production of information, followed by its prompt release, as discussed in chapter 7.

6.4.3 Greater Delays in Release of Non-Exclusive Information

James Ramsey (1980), Mark Isaac (1987a), and the Industry Commission (1991) considered that formation of a market for exploration information would help to avoid information market failures. They expressed concern that government capture and prompt release of privately generated exploration information could impede formation and operation of a market for exploration information. However, these views were qualified.

Isaac observed that market arrangements were "not a cure-all", as there were significant impediments to an efficient market. Also, the Industry Commission (1991) expressed the view that market transactions could avoid information market failure only after early-stage exploration had been undertaken and resulting information had been released. The Industry Commission (1991) indicated that generation and prompt release of information in minimally explored areas should be undertaken by government.

[62] This incentive might be constrained under a work bid exploration regime that requires the timing of commitments to be met.
[63] The terms "publicity effect" and "weighting effect" were formulated by Milgrom and Weber (1982a).
[64] Corresponding, but more obscure, esoteric arguments were advanced by Isaac (1987b) in relation to government funded exploration information. They could also be applicable to release of private exploration information.
[65] This seems to have been implicitly recognised by Milgrom and Weber (1982a) and Milgrom (2004).

During the consultation process for this review, [redacted] that prompt release of information would destroy the market for information from seismic surveys. Indeed, they argued that long information confidentiality periods are necessary to support the market. [redacted] suggested that there was more likelihood of discoveries from the wider coverage, economies of scale, and promotion by the seismic companies, than from relying on government pre-competitive geoscience (assumed to exclude seismic surveys) and data released by title holders. They argued that the latter were of questionable quality because too often explorers withheld superior information [redacted]

Specifically, [redacted] claimed that the 15-year confidentiality period for raw seismic data in Australian waters is "close to global best practice". However, in a submission to ACIL Allen, [redacted]

During the consultation process, [redacted] acknowledged that prompt release of information would undermine a market for information. They suggested that this would occur if confidentiality periods were 5 years or less. However, they considered that a confidentiality period of 8-10 years for raw seismic data was more appropriate than the current period of 15 years in Australian waters. In discussions, they suggested that retention of the current confidentiality period may inhibit exploration activity, especially in new and frontier areas, because of unavailability of information [redacted]

When the extended confidentiality period for non-exclusive data (15 years instead of 9 years for 3D data and 6 years for 2D data) was announced on 21 December 2006, the then Minister for Industry, Tourism and Resources, Ian Macfarlane (2006) offered the following justification:

"The new arrangements for the release of offshore petroleum seismic data will encourage more large-scale, non-exclusive, two dimensional (2D) and three dimensional (3D) seismic surveys to be undertaken. …… The future prosperity and growth of Australia's offshore petroleum industry depends on the availability of high-quality seismic data, including data collected on a non-exclusive speculative basis. The data collected under this new policy will help explorers open up new petroleum provinces and make petroleum discoveries more certain."

[redacted] It is apparent that the non-exclusive data regime has been associated with [redacted] of the public good of seismic information. This should not be construed as implying that providing a long confidentiality period for raw non-exclusive data has caused [redacted] of seismic data. However, it does indicate that this regime was [redacted]

[66] See Tables 4.1, 4.2 and 4.3 in chapter 4.
[67] See Tables 4.1 and 4.2 in chapter 4.

[redacted] in non-exclusive and all seismic surveys triggered by the slump in oil prices that commenced late in 2014.

[redacted] While it has been observed that government capture and prompt release of information would undermine formation of a market for that information, it also relevant that, to the extent that release of information is delayed for the purpose of inducing the formation of a market for information, the benefits of the information capture and release regime will be undermined. However, governments in Australia and in other countries (see chapter 5) have tried to operate these systems in tandem. The critical multi-faceted question that has not been satisfactorily addressed in the literature or by stakeholders is what combination of these mechanisms or the polar cases of one or the other is most likely to correct information market failures that inefficiently distort the pattern of exploration, and in what circumstances might this correction occur.

The categorisation of information as "non-exclusive" or "exclusive" appears to have been an attempt to avoid negative interactions between the information capture-and-release and market formation approaches. This categorisation has been adopted in several jurisdictions (see chapter 5).

In Australian waters, the implementation and administration of this categorisation device has been poor, because it has provided explorers and geophysical service providers with an opportunity to re-categorise exclusive survey information as non-exclusive information. This loophole has been criticised by petroleum industry and government stakeholders in consultations, because it allows information to be locked away for a much longer period (15 years) than intended [redacted]. This issue has been highlighted in chapter 4. The management of the distinction between non-exclusive and exclusive data has been an important impediment to an effective, efficient, and fair information capture-and-release policy, because it may have increased delays in accessing the public good of information and exacerbated information asymmetries.

A key neglected point is that, in frontier or relatively unexplored areas, government generation of information, followed by its prompt release, is superior on economic grounds to government capture of prompt release of information generated by the private sector or reliance on a market for information. This is discussed briefly below and in more depth in chapter 7.

In frontier areas, a dearth of previous private activity with modern technologies means there will be little, if any, information to capture and release to address inefficiencies associated with inadequate availability of information. However, it would be sensible to retain this mechanism to disseminate privately generated information soon after it is produced.

A market solution is impeded in frontier areas by pre-existing extreme uncertainty that discourages investment that would generate marketable information, and by issues such as free-riding, transactions costs, efforts to gain, maintain or eliminate an information advantage over others, and the experience good property of information (see sub-section 3.2.3 of chapter 3). Consequently, the potential of markets to avoid information market failures in frontier areas appears to be very limited.

Moreover, the case for a market solution, depends on the pricing regime being efficient. However, the pricing regime may not be efficient. For example, consultations revealed that in Australian waters, each partner in a joint venture (either an initial or new partner) has been required to pay separately to access the same seismic information, with the result that the average price paid by purchasers does not fall as customers rise, and the total amount rises [redacted]. This pricing practice has counteracted the important role of joint ventures as devices for amelioration of risk/uncertainty. In contrast, efficient pricing of the public good of information would require the average price to fall and the total revenue to remain unchanged as the number of customers increased. Such pricing would not impede the role of joint ventures in managing risk and uncertainty. Price regulation may be warranted.

Neglect of these issues seems to have facilitated formation of a view by governments in various jurisdictions that encouragement of a market for information through long confidentiality periods for non-exclusive data can reasonably substitute for government funding of exploration activity in relatively unexplored areas. This view has not been supported by sound analysis.

In more prospective areas or later stages of exploration, the case for government funding of exploration activity evaporates, as explained in chapter 7. In these areas, there is a solid economic

case for government capture and prompt release of information to address information market failures (see sub-sections 6.4.1 and 6.4.2 above).

In contrast, the formulation of a case for a market solution in more prospective areas is problematic. Various impediments to efficient operation of an information market have been discussed in sub-section 3.2.3 of chapter 3. It is obvious from that discussion that privately initiated transactions and market-like arrangements in relation to exploration information could, at best, only partially correct inefficiencies resulting from public good (including external benefits) aspects of exploration information. In addition, market activities do not deal with inefficiencies associated with asymmetric availability of information. Indeed, asymmetric information is a source of market failure. Efficient operation of markets for exploration information is undermined by efforts to gain, maintain, or eliminate informational advantages.

It follows that relying on formation of a market for information could, at best, be only an imperfect, partial substitute for government capture and prompt release of information generated by the private sector. So, the issue remaining to be considered is the potential role or otherwise of the former as a complement to the latter. Put another way, it is important to ascertain the extent to which provision of support for formation of an information market adds to, rather than detracts from the performance of government capture and prompt release of information in correction of information market failures.

6.4.4 Desirability of Complementary Policies

A policy of government capture and prompt release of private exploration information should not be deployed as a stand-alone mechanism for correction of information market failures. There are two reasons for this.

First, in the context of multiple market failures, at least as many astutely designed policy instruments will need to be deployed to correct those sources of economic inefficiency.[68] There is market failure associated with the public good character of information, asymmetric availability of information between explorers, asymmetric information between explorers and capital providers, and asymmetric information between explorers and government.[69]

Second, the various information market failures tend to be interdependent or entangled, and their relative importance changes as exploration activity proceeds.[70] Consequently, the appropriate deployment of policy instruments to target correction of information market failures will tend to change as areas transition from frontier (little previous exploration using modern technologies) to highly prospective.

In frontier areas, the dominant problem is under-provision of the public good of information, which leads to too little exploration, too late from an economic perspective. In these areas, government capture and release of privately generated information is not a suitable policy response, because little previous activity with modern technologies means there will be little, if any, information to capture and release to address the information deficiency. In these circumstances, government funding of early-stage exploration and prompt release of the results is the most appropriate policy response, as it directly addresses the market failure.

After attraction of private sector exploration activity, the economic desirability of government exploration activity declines sharply, as the public good aspect of exploration becomes less pronounced and asymmetric information between explorers becomes a bigger issue (see chapter 3). Then, the policy instrument of government capture and prompt release of privately generated information becomes important to address asymmetric information problems, as well as any remaining inadequacy of provision of the public good of information (see subsections 6.3.1 and 6.4.1). This policy instrument is multi-pronged. It can address all three types of exploration information asymmetry. It also would contribute to correction of insufficient availability of the public good of information.

[68] This important policy principle was discussed in chapter 2. It derives from the seminal work of Jan Tinbergen (1952) and Bent Hansen (1955). See also Tinbergen (1956) and Johansen (1965).
[69] See chapter 3 for a discussion of sources of information market failure.
[70] Again, see chapter 3 for a discussion of these issues.

While the case for government capture and prompt release of private exploration information is strong, it applies after early-stage exploration in minimally explored area. Then, it will encourage an efficient amount, timing and targeting of exploration activity. It will discourage inefficient and redistributive exploration in pursuit of an information-based competitive advantage over other explorers. This policy instrument needs to be packaged, as a minimum, with government funding of early-stage exploration in minimally explored areas. Potential complements to government capture and prompt release of private exploration information are discussed in detail in subsequent chapters.

6.4.5 Titles Regime Context

The case for government capture and early release of privately generated exploration information depends critically on the context provided by the exploration rights or titles regime. Too often, this point has been overlooked in previous literature and in formulation of government policy.

The policy instrument of government capture and release of private exploration information is incompatible with work program bidding for highly conditional tenure. This titles regime tends to dissipate not only pre-existing *ex ante* resource rents (nett value of resources), but also the benefits of public release of private exploration information that add to *ex ante* resource rents. In contrast, the policy package of government collection and prompt release of private exploration information is compatible with a cash bidding regime for relatively unconditional exploration tenure.

Issues relating to the interaction of titles regimes and exploration information policy are discussed in chapter 8. It would not be wise to formulate exploration information policy without regard to these critically important contextual considerations.

6.5 "Second-Best" Considerations

If the Government wants to moderate the phenomenon of low levels of survey activity when oil prices are relatively low so that the industry and Australian economy are better placed to commence exploitation of resources more quickly when prices are high, it could fund offshore exploration activity by Geoscience Australia. Funding has not been made available to Geoscience Australia for offshore exploration activity since 2014-15. New activity could include commissioning seismic surveys, as well as regional studies, followed by prompt release of results. Undertaking this activity at times when private sector exploration is subdued would allow government to obtain good value for money, as well as to moderate a slump in exploration activity, and hasten development and exploitation after oil and LNG prices recover. A case for this policy instrument has been discussed briefly in sub-section 6.4.4 above and has been analysed in detail in chapter 7.

However, if the Government is not prepared to support a solid program of early-stage exploration (including seismic work) in relatively underexplored areas, there may be a case for encouraging market formation as a "*second-best*" policy initiative. Such initiatives involve trying to make improvements to the efficiency of resource allocation in the context of one or more policy constraints. Allowing long confidentiality periods for data produced for sale to multiple clients is not a good substitute for government exploration programs in relatively underexplored areas, but in a hybrid regime with prompt release of other information, it is likely to be better than nothing.

An additional "*second-best*" argument for support for formation of a seismic information market may derive from government unwillingness to replace its work-bid titles regime with a cash bidding system. The latter is a superior policy instrument, because it has features a work-bid titles regime lacks (explained in chapter 8), including its:

- complementarity with both an information-capture-and release regime and government funding of early-stage exploration in minimally explored areas
- avoidance of dissipation of the nett value of extractable resources
- avoidance of dissipation or destruction of the value of information provided free from government exploration work and through an information-capture-and release regime
- ability to finance government exploration activity.

If the Government is not prepared to reform its titles regime, encouraging a seismic information market would help moderate the tendency of the work-bid titles regime to dissipate the value of information provided free by information policy instruments. It would do so by pricing information, which means its

value on a cost basis is not reflected in the expected nett value of potential resources that a work bidder is seeking to capture. It is only a partial solution and one that is greatly inferior to titles policy reform, but it could be better than providing all information free in conjunction with a work-bid titles system. So, again it may offer a distant "*second-best*" outcome in the context of a policy constraint.

6.6 Administration

Government collection and subsequent release of private sector exploration information involve administration costs that should be considered by policy makers. Explorers incur costs in the process of complying with exploration reporting obligations. Governments incur costs in design, monitoring, and enforcement of reporting requirements and in management of inputs to, and outputs of their exploration information repositories. Resources allocated to the monitoring and enforcement process would need to be sufficient to ensure that enterprises are not able to avoid full disclosure of exploration information. Government costs would also include outlays to integrate information from private sector exploration and government early-stage exploration.

A hybrid regime that provides different confidentiality periods for information produced for sale to multiple clients involves higher administration costs, because of the complexity added to an information-capture-and release regime, and because it provides new opportunities to delay release of information for private gain.

Governments in Australia and other countries with information release regimes already have administrative arrangements in place to support collection of private sector exploration information, incorporate this information into government exploration information repositories, deal with exclusive and non-exclusive information categories, and make the information readily accessible to interested parties when confidentiality periods end. These administrative arrangements are, or should be supported by compliance enforcement sanctions, such as cancellation of exploration tenements and rejections of future applications.

A policy of delayed release of information, particularly one involving delays of different lengths for various categories of information, could be expected to require higher administration costs than simpler, more uniform release arrangements. These higher administration costs would derive from having to keep track of delayed, differing release times for various types of information from all activities and having to deal with efforts of information generators to delay submission of information or get it reclassified to prevent or delay release.

Allowing early public release of private sector exploration information without exclusions would tend to reduce government administration costs, because different arrangements would no longer be required depending on the type, timing, and circumstances of information submitted to government. On the other hand, this policy may require greater diligence to ensure that government collection of complete information is not thwarted by efforts of operators to delay or withhold submission of key information to reduce the value of information accessible by others. This would be necessary even if the current regime is retained.

On balance, government administration (recording, monitoring, and enforcement) costs could be expected to fall if all or most information is released promptly on a consistent basis. Explorers' compliance costs also should decline.

6.7 Policy Implications

A sound economic justification could not be found for retention of the practices of supporting permanent confidentiality of some forms of exploration/assessment information and delays to public release of other information beyond the elapse of sufficient time for explorers to analyse and interpret data, and write-up the results. These practices sanction withholding of information from entities that could use it productively, and provide an unnecessary, inefficient, and redistributive competitive advantage to the creator of the information. They conflict with the principles set out in the Australian Government's (2015) *Public Data Policy Statement*. The finding that delays to public release of information are not economically justifiable is dependent on an assumption that government does not

constrain itself to using other policy instruments that interact negatively with an information-capture-and-release regime, rather than deploying complementary policy instruments.

Prompt release of all exploration information would not deprive a holder of an exclusive title the ultimate competitive advantage in the form of an exclusive right to explore in the title area, and a prior right to apply for a lease to exploit or hold resources therein. Therefore, the generator of information in respect of a title has an exclusive right to gain from information specific to that title. Delaying release of information would provide a further reward to the creator of the information: an information advantage in pursuing exclusive titles over similar prospects. The cost is the resource misallocation associated with external costs of asymmetric information and reduction of benefits to the community from the public good nature of exploration information.

Exclusions and delays in release of information deprive the exploration/assessment sector of the public good of information, and encourage activity directed towards gaining an informational advantage in acquiring or applying for additional tenements. Concern that exploration might be sub-optimal because explorers would not be able to capture all benefits of their activities should be ameliorated by two factors. First, the benefits explorers would be prevented from capturing by a policy of exclusions and delays are economically undesirable asymmetric information advantages in respect of areas over which they do not have title. Benefits in relation to their own titles are not affected. Second, explorers would benefit from the activities of all others, not just sacrifice benefits to them.

A policy of government capture and prompt release of private exploration information would improve the efficiency of resource allocation by correcting information market failures, as shown by the analysis above. This analysis supports application of the Australian Government's public data policy to information collected from private sector petroleum and greenhouse gas activity in offshore areas. A policy of government capture and prompt release of privately generated information in offshore areas and the expected outcome would honour a commitment in the Australian Government's (2015) *Public Data Policy Statement*:

"The Australian Government commits to optimise the use and reuse of public data; to release non-sensitive data[71] as open by default; and to collaborate with the private and research sectors to extend the value of public data for the benefit of the Australian public."

A policy of government capture and prompt release of private exploration information is best suited to addressing information market failures after early-stage exploration in frontier areas. To ensure that the improvement in efficiency achievable by information policy is as large as possible, it should be packaged with complementary instruments, not deployed as a stand-alone mechanism. It is particularly important to complement it with policy instruments more suited to addressing information market failure in frontier areas. The obvious complementary policy is government funding of early-stage exploration in frontier areas.

The strength of the arguments for government capture and early release of privately generated exploration information and packaging such a regime with other information policies depend critically on the context provided by the titles regime. This important point should not be overlooked in formulation of government policy.

A "first-best" or leading-practice policy package would involve:

- government funding of early-stage exploration in minimally explored areas (discussed in chapter 7)
- comprehensive capture of private sector petroleum and greenhouse gas storage information, followed by prompt release of that information
- cash bidding for relatively unconditional titles (discussed in chapter 8).

If government eschews the "first-best" policy instruments of government funding of early-stage exploration in minimally explored areas, and cash bidding for relatively unconditional titles, and instead chooses to retain a highly inefficient work-bid titles regime, it would need to resort to a distant "second-best" information policy. This would involve modifying a policy of comprehensive information capture and prompt release by sanctioning a lengthy confidentiality period for information generated for sale to multiple clients under an efficient pricing arrangement.

[71] The Public Data Policy Statement explained, "Non-sensitive data is anonymised data that does not identify an individual or breach privacy or security requirements."

Regardless of the choice made between “first-best” and distant “second-best” policies, substantial reforms to the current information-capture-and-release regime would be required to deal with various deficiencies highlighted in this chapter and chapter 4. These reforms have been outlined in chapter 9.

7 POLICY COMPLEMENT: FUNDING OF EARLY-STAGE EXPLORATION

Key Points

- Government funding of early-stage exploration in minimally explored areas has been deployed in many comparable jurisdictions, and has received strong support in the economics literature.
- Government funding of early-stage exploration in minimally explored areas is an important complement to government capture and prompt release of private exploration/assessment information.
- The former is the best available primary policy instrument for addressing market failure associated with the public good aspect of exploration information in early stages of exploration in minimally explored areas, while the latter is the best available primary policy mechanism for addressing asymmetric information and public good of information market failures after early-stage exploration.
- The absence of any government funding of early-stage exploration for petroleum in offshore areas under the control of the Australian Government has been a direct impediment to offshore exploration, not only because it has resulted in a paucity of information about minimally explored areas, but also because it effectively removes an essential complement to government capture and prompt release of private exploration information.
- The case for government funding of early-stage exploration in minimally explored areas and the complementary policy of government capture and prompt release of privately generated exploration information depends on the context of the titles regime. These policy instruments are complemented by a well-designed cash-bid titles regime complements, but they are undermined by a work-bid titles regime, as explained in chapter 8.
- Program design and management issues have been outlined.

7.1 Introduction

Full government funding of very early-stage exploration and release of the resulting information to interested parties has been widely deployed around the world. In Australia, all state governments, the Northern Territory Government, and the Commonwealth Government have, at various times, formulated and fully funded early-stage exploration programs in relatively underexplored areas and made the information available to potential explorers. Often, this early-stage activity has been described as "pre-competitive".

Full government funding is effectively a subsidy scheme with a subsidy rate of 100 per cent. Some governments, including state and Northern Territory Governments in Australia have deployed exploration subsidy schemes at rates substantially less than 100 per cent, in conjunction with programs of full government funding.

Government funding and release of early-stage exploration information relating to relatively underexplored areas is more pervasive than government capture and release of privately generated

exploration information. Deployment of the latter is typically accompanied by implementation of the former. This has been the historical practice in Commonwealth and state/territory jurisdictions in Australia.

In July 2017, the Council of Australian Governments (COAG) Energy Council formulated a *National Mineral Exploration Strategy 2017-2022*, which updated an earlier version published in December 2012. Both versions of the Strategy emphasised the importance of government investment in pre-competitive data. The strategic initiatives in the updated Strategy included (COAG Energy Council, 2017, p. 5):

"Encouraging investment through a renewed commitment to the creation and delivery of government-funded pre-competitive geoscience from all jurisdictions, including new techniques ……."

The Australian Government's (2019) *National Resources Statement* endorsed deployment of this policy instrument. Consistent with this position, the Australian Government allocated $110.5 million to fully funding discrete programs of early-stage exploration, mainly in northern Australia, over four years from 2016-17 under its *Exploring for the Future Program*, and then extended the program to southern Australia with funding of $125 million over four years from 2020-21. The program is managed by Geoscience Australia.

The original and extended *Exploring for the Future Program* did not include offshore areas controlled by the Australian Government, even though the Resources 2030 Taskforce recommended inclusion of offshore areas along with extension of the program (Cripps and other, 2018, p.46). The last allocation to Geoscience Australia for very early stage (or pre-competitive) exploration in offshore areas was in 2014-15.

Typically, the policy instrument of government funding of early-stage exploration and release of the resulting information has been endorsed by companies engaged in exploration and mining (including oil and gas extraction) and organisations representing entities involved in exploration and extraction.[72] It has also been widely supported by economists.

Since 2004, there has been a trend to provision of exploration subsidies by Australian state governments and the Northern Territory Government, in addition to their traditional practice of full funding of selected early-stage exploration activities.[73] Partial funding (subsidy) arrangements have been focussed mainly on drilling, particularly "innovative" drilling, and drilling in "underexplored", "frontier", "greenfield" or "newly emerging" areas. In some jurisdictions, subsidies have been extended to geophysical activities in underexplored areas or to test new concepts. Information generated by subsidised exploration programs has been publicly released, as for information resulting from fully government-funded programs. Funding has been capped for individual exploration projects and in aggregate for each jurisdiction's subsidy program. In effect, these subsidy schemes have extended the scope of relevant governments' definitions and funding of early-stage exploration.

The Australian Government has not followed the state trend of extending the boundaries of government funding of early-stage exploration through deployment of subsidy schemes. The Australian Government has not subsidised exploration for petroleum since 30 June 1974, when it terminated the Petroleum Search Subsidy Scheme. This scheme had been established in 1957 and was revised from time to time (Crean, 1973; Williams, 1974).

The preceding chapter pointed out that government funding of early-stage exploration and release of resulting information, perhaps fringed by a limited subsidy scheme, is an important complement to a policy of government capture and early release of privately generated exploration information. Both policy instruments would be inadequate as stand-alone regimes. Together, they comprise an efficient information policy package. Policy complementarity has often been overlooked in previous discussions of exploration information policy.

[72] Exploration sector support for government funding of very early-stage exploration and release of the information is not surprising, because explorers obtain benefits from this government activity, while the costs are covered by appropriations from government consolidated revenue. However, taxation payments by mining enterprises contribute to consolidated revenue. From the perspective of government, this contribution may be perceived to have a component representing a return to government-funded very early stage exploration. From the perspective of mining enterprises, government allocations to very early stage exploration may be perceived to be an offset to their royalty and tax payments.

[73] The trend was started by South Australia in 2004. Other states and the Northern Territory implemented similar subsidy schemes over the following 5 years.

This chapter analyses key aspects of a policy instrument of government funding of early-stage exploration. It also discusses an issue that is often overlooked in discussions of this policy measure. This issue is the economic implications of having to fund programs. Sourcing revenue to fund programs has a cost and this should not be ignored.

[redacted]

7.2 Policy Rationale – Correcting Market Failures

The economic rationale usually offered in support of full or partial government funding of early-stage exploration in relatively underexplored areas and public release of the information is that it is a means of correcting market failure in the form of under-provision of the public good of information. Sometimes, it has been rationalised as a mechanism that also can address external costs of asymmetric availability of information.

There is widespread (but not unanimous) support for the view that, if pioneering or early-stage exploration in minimally explored areas is left to the private sector, market forces will fail to allocate resources efficiently. This is based on the public good character of exploration information (discussed in chapter 3). The resource misallocation will be manifested in socially undesirable undersupply and underuse of information from early-stage exploration. As the supply and use of exploration information have timing as well as quantity dimensions, information will tend to be generated and used too little, too late.

To deal with under-provision of the public good of information by private sector exploration, full government funding (100 per cent subsidy) of early stage exploration in relatively underexplored areas, and dissemination of the results prior to licensing of areas for exploration activities have been widely, but not unanimously advocated in the economics literature.[74] This policy prescription has been much more widely discussed and endorsed than provision of partial government funding or subsidies for subsequent exploration activities that yield much smaller proportions of potential external benefits. This relative inattention to subsidies has reflected insufficient recognition of their potential as a means of dealing with the problem of deciding on the boundaries of full government funding of early-stage exploration. With an accompanying subsidy scheme, a black-or-white (all-or-nothing) decision is not necessary.

Government funding of early-stage exploration and prompt dissemination of the resulting information reduce uncertainty faced by private sector explorers. Frederick Peterson (1977a,b) and Lindsay Hogan (2003) argued that this government activity would particularly encourage subsequent exploration by smaller, risk-averse firms. They reasoned that these entities cannot diversify their exploration activities to manage risk and uncertainty as effectively as large enterprises, and they are less able than large companies to acquire large exploration tracts that would provide economies of scale in exploration and allow greater "internalisation" of exploration information benefits.

Orris Herfindahl (1969b) and Paul Collier (2010) explained that if early-stage exploration is left to private sector explorers, activity would be inhibited by political uncertainty or sovereign risk, as well as geological and economic uncertainty. They observed that political uncertainty could be substantial at this stage of exploration. This problem derives from the possibility that a government providing an exploration title might later renege on the original terms of provision if exploration is particularly successful. Political uncertainty causes explorers to discount what they offer for tenements to a greater extent than would be justified only by geological and economic uncertainty. The political uncertainty problem and consequent reduction of offers from private sector explorers are most severe at the very early stage of exploration, because the range of possible outcomes is widest at that time. Herfindahl and Collier observed that because government does not directly bear uncertainty associated with its future behaviour, the effective cost to government of funding very early-stage

[74] For example, see Gaffney (1967a), Herfindahl (1969b), Miller (1973), Peterson (1977b), Reece (1978), Fitzgibbons (1978); Crommelin, Pearse and Scott (1978); Hogan (2003), Bernknopf and others (2007), Henry and others (2010), Collier (2010), Duke (2010), Productivity Commission (2013, 2020), and Häggquist, Söderholm (2015). Reservations were expressed by Mason (1986) and Isaac (1987b). Wilson (1978) opposed government funding of exploration.

exploration is lower than for private sector entities. When government makes information from early-stage exploration available to potential explorers, it does more than provide an information public good. It also reduces the severity of political uncertainty that discourages take-up of titles and subsequent exploration.

In a review of Geoscience Australia, the Australian Department of Finance and Deregulation (2011) advanced an alternative to the public good argument for full government funding of early-stage exploration to provide a foundation for private sector exploration. It pointed out that the interests of government as owner of resources and recipient of *de facto* royalty (petroleum resource rent tax and cash bids) and tax revenue from resource development would be served by funding early-stage exploration, applying the results to guide releases of areas for private exploration, and making the information available to potential investors to attract investment. It was envisaged that this would facilitate maximisation of resource rent and higher returns to the community through government levies. This was described as analogous to provision of a prospectus or information memorandum by an entity selling financial securities or ownership of a business asset. The Productivity Commission (2013, 2020) endorsed this line of argument.

The prospectus argument implicitly assumes that governments will deploy *de facto* royalty and taxation instruments that capture most of the resource rent, and that these policy instruments and accompanying tenure arrangements do not cause economic inefficiencies that dissipate resource rent. In the past, this generally has not been the case in Australia, as explained in chapter 8.

The public good and prospectus arguments are simply different ways of explaining that government funding of basic, early stage, broad-scale exploration and dissemination of the resulting data could be justified on grounds that these activities would improve the efficiency of allocation of resources and equity in terms of the benefit principle.[75] This policy instrument would help correct market failures resulting from public good aspects of exploration information. Correcting information market failures would also facilitate maximisation of resource rent and increase potential returns to the community as owner of extractable resources. Regardless of the perspective, the outcomes are improvement of the efficiency of resource allocation and equity.

Mason Gaffney (1967a) proposed that serious consideration be given to government funding of early-stage exploration and dissemination of the results as a policy response to asymmetric information, as well as information public good market failure. Orris Herfindahl (1969b) and Douglas Reece (1978) perceived the same dual justifications for government funding of such activity, but the former focussed on public good market failure associated with exploration information, while the latter emphasised the asymmetric information problem. David Hughart (1975) advocated government funding of early-stage exploration to address asymmetric information market failure. He did not discuss the relevance of this policy instrument for correcting information public good market failure.

In contrast, some other analysts have warned that full or partial government funding of exploration may exacerbate pre-existing information asymmetry if the exploration generates information that is complementary to that already held by entities with an information advantage. These cases and their implications for information policy are discussed in sub-section 7.3.1 below.

7.3 Avoiding Policy Failures

Policy to address market failure arising from the public good aspect of exploration information should be carefully designed to avoid inadvertently worsening inefficiency of resource allocation. As explained in chapter 2, such circumstances have been referred to as policy failure.

7.3.1 Asymmetric Information

Paul Milgrom and Robert Weber (1982a), Mark Isaac (1987b) and Paul Milgrom (2004) observed that, in specific circumstances, government funding of exploration and release of resulting information could adversely affect, rather than improve the efficiency of resource allocation. The specific circumstances of this policy failure are pre-existing information asymmetry. This would be exacerbated if government produces information that complements pre-existing privately held

[75] The Productivity Commission (2020) recognised this point.

information that provides an entity with an information advantage. In that context, the "publicity effect" of improved efficiency from increased availability of information would be offset by a negative "weighting effect" of reduced efficiency from increased asymmetry of availability of information. The nett effect would be problematic.

In contrast, if the information released by government substitutes for pre-existing, privately-held information, the "weighting effect" would be positive, reinforcing the "publicity effect" in improving the efficiency of resource allocation.[76]

The analyses of Milgrom and Weber (1982), Isaac (1987b), and Milgrom (2004) did not provide realistic examples distinguishing between cases of complementary information and circumstances of substitute information. They provided only stylised illustrations in game theoretic contexts that were too vague to be useful in practical policy formulation. Isaac (1987b) commented that there did not appear to be obvious rules of thumb for distinguishing cases in which government funding had a nett negative or nett positive effect on the efficiency of resource allocation. He said case-by-case investigation would be required.

An important omission from these analyses was that they did not distinguish between circumstances in different stages of exploration. Before and immediately after early-stage exploration activity in frontier areas, it is unlikely that any information advantage held by an explorer would be significant. Therefore, if government fully or partially funds early-stage exploration and promptly releases the resulting information, negative "weighting" effects would not apply.

Negative "weighting" effects might be relevant in later stages of exploration following acquisition of an information advantage by a private explorer. After early-stage exploration, activity that is fully or partially funded by government might produce information that is complementary to information that is held or acquirable by that private entity, with consequent worsening of asymmetric information, and increased likelihood of a nett negative "weighting" effect. If full government funding is confined to early-stage exploration in relatively unexplored areas, and an exploration subsidy program (with public release of resulting information) is confined to subsequent activity that is just a little more advanced, it is unlikely that such government support for exploration would contribute to asymmetric distribution of information.

A prudent additional policy measure to complement government funding of early-stage exploration would be a requirement that private explorers that receive subsidies for exploration activity not only provide information from subsidised activity to government for prompt public release, but also pre-existing contextual information. This would reduce any information advantage held by an entity that receives a subsidy for exploration activity. It would not address the problem of exacerbation of an information advantage held by another party. Avoiding the latter problem would require that subsidisation of activity that complements an existing information advantage should be eschewed or that all privately generated exploration information be captured by government and released, as discussed in chapter 6.

The analytical work undertaken by Milgrom and Weber (1982), Milgrom (2004), Mason (1986), and Isaac (1987b) has not undermined the case for full or partial government funding of early-stage exploration. In effect, their work cautioned against governments fully or partly funding later-stage exploration and releasing the results to try to eliminate asymmetric information.

There has been widespread support for government funding of early-stage exploration, because of public good attributes of exploration information that are likely to be at peak level at this stage. In addition, the economic significance of external benefits of exploration information spillovers would be highest and the economic importance of external costs of asymmetric information is likely to be least at that stage of exploration.

In contrast, full government funding of exploration after the early stage has not received serious consideration in the economics literature, because it would provide more subsidy than justified in the context of the declining economic significance of the public good aspect of information as exploration proceeds through successive stages. Meanwhile, asymmetric information is more likely to become prominent as exploration proceeds, and some areas are found to be highly prospective. Then, there

[76] The terms "publicity effect" and "weighting effect" were originated by Milgrom and Weber (1982a).

is increased possibility of fully or partly government-generated information being complementary to a pre-existing information advantage, thereby exacerbating economically and distributionally undesirable information asymmetry.

7.3.2 Impediment to Market-Like Solutions

It has been suggested that availability of exploration information from full or partial government funding of early-stage exploration might discourage cooperative arrangements or mutually beneficial exchange (market-like solutions) between private sector entities in relation to information of common interest (Ramsey, 1980; Isaac, 1987a). Indeed, it has been perceived to be conceivable that by discouraging early-stage exploration by private entities, government funding of early stage exploration in relatively unexplored areas could strengthen the perception that this policy instrument is required to address information market failures.

The potential discouragement of market-like solutions should not be a reason for concern because market failures in respect of early-stage frontier exploration would surely persist in the absence of government intervention, because uncertainty and the public good nature of information are most prominent in these circumstances, as explained in section 3.5 of chapter 3. As pointed out in sub-section 3.2.3 of chapter 3, the potential of market arrangements to correct exploration information market failures appears limited.

7.3.3 Program Design and Management

There are important issues that also need to be considered from a social or economic perspective when investigating and planning government-funded exploration activity. They will influence the magnitude and sign of nett benefits from government exploration programs. Relevant issues include:

- where should government fund exploration?
- when should government commence funding of exploration in a specific location?
- what type and stage of exploration should government fund?
- why should government funding depend on the exploration stage and be phased out at some stage in the exploration sequence?
- how should rates of subsidy be determined?
- how much should government spend on exploration activity across its jurisdiction and over time?
- who should be required to pay for the government exploration program?
- does government have the capabilities to manage exploration funding programs?

Where and When to Fund

With regard to the first question, early-stage exploration should not be regarded as something that can happen only once in an area. Murray Duke (2010), a geologist who worked for Geological Survey of Canada for 30 years, explained that although regional geoscience information has a long "shelf life" of up to 30 years, technological advances over time mean it becomes increasingly out of date. He said that many geologists agreed that the utility of the information was greatly reduced after a period of about 20 years. Therefore, renewal of very early-stage work was appropriate at intervals of around this length of time.

The first and second questions should not be answered solely by reference to geological considerations. It is important to consider other matters too, particularly economic circumstances (Herfindahl, 1969a). These include the outlook for prices of various mineable commodities, cost implications of anticipated geological, mining, and processing conditions, available and emerging technologies, proximity to relevant infrastructure, transport distances, and other circumstances influencing capital and operating costs of any potential extraction operation [redacted]. An important concern is that government geological agencies' decision-making in respect of exploration programs may not be sufficiently influenced by economic considerations for these programs to yield an improvement in the efficiency of resource allocation (Wilson, 1978; Gilbert, 1981).

What to Fund

Governments and contributors to the relevant economic literature generally have considered that fully government-funded exploration activity should be focussed mainly on early-stage exploration, such as

broad-area geological and geophysical activity in relatively unexplored areas. This is consistent with the analysis in chapter 3 regarding the decline in the potentially public or external component of benefits from exploration information, and the increasing likelihood of asymmetric information issues as exploration proceeds through its various stages. However, the rate of decline and the definition of boundaries of early-stage exploration lack precision.

A complicating factor is that the diversity of approaches apparent in private sector exploration historically has yielded synergies and information spillovers that have contributed to exploration breakthroughs (Gilbert, 1981). This suggests that consideration could be given to some diversity of approaches in early-stage exploration of specific areas by government.

A judgement call is required regarding the nature and scope of exploration activity that is to be fully funded by government. This requires context-specific analysis. Even then, the judgement call could result in some government overfunding or underfunding of exploration activity from an economic efficiency perspective. An accompanying subsidy regime with tapering rates is a pragmatic solution to the problem of determining the nature and scope of full government funding.

Why and How to Phase Out or Taper Funding

A government funding regime that transitions from full funding to declining partial funding (tapered rates of subsidy) serves two purposes. First, as mentioned above, it avoids an all-or-nothing judgement call on the scope of full government funding of early-stage exploration. Second, this arrangement would also help avoid potential nett negative "weighting" effects, which have been discussed in sub-section 7.3.1.

Provision of subsidies should be conditional on exploration information generated by subsidised activities being made available to government within specified timeframes. That information should then be publicly released promptly, consistent with the practice of release of information from early-stage exploration that is fully funded by government. Such arrangements for public release of information comply with the Australian Government's (2015) public data policy.

Ideally, the subsidy to a private sector explorer would equal the sum of the amounts other interested explorers would be prepared to pay for information made public. Because this would be difficult to estimate in practice, it has been proposed by some analysts that most exploration expenditures could be subsidised, with the rate of subsidy varying according to perceived uncertainty associated with exploration activity. Exploration uncertainty could be influenced by factors such as timing, location, geological context, economic circumstances, phase, and method of exploration. The subsidy range would be wide. If new exploration is to be undertaken in a frontier area, a relatively high subsidy would be provided. If exploration is programmed very close to previous exploration activity, a negative subsidy (tax) would be applied, providing a source of funds for payment of positive subsidies elsewhere (Stiglitz, 1975).

Formulation of an optimal or efficient exploration subsidy regime involves several challenging issues. Resolution of these issues does not appear to have been fully achieved in practice anywhere for reasons discussed below.

First, the task of determining efficient subsidies would be very difficult, and probably impractical, as they would have to vary across locations, firms, exploration stages, and sequencing circumstances (Isaac, 1987a). In particular, the task of subsidy-setting would have to take account of changing relative importance of asymmetric information between explorers and the public good of information. The relative importance of asymmetric information tends to rise and the relative importance of the public good property of information tends to fall as knowledge accumulates and areas become more prospective. Increasing pre-existing asymmetric information through the stages of exploration increases the likelihood of a nett negative "weighting" effect and consequent inefficiencies from government funding, as discussed in sub-section 7.3.1 above. It would be very difficult in practice to design and manage a scheme that would improve the efficiency of resource allocation even it was confined to "exploration on prospects that are informationally important" (Dodds and Bishop, 1983).

Second, a uniform, arbitrary subsidy for some or all exploration activities might appear to be a practical way of improving the efficiency of resource allocation, even though it would not achieve an optimal outcome, which would require variable rates of subsidy. However, Mark Isaac (1987a, p. 208)

argued "….. such a policy would not necessarily be better than doing nothing at all." He provided examples of plausible circumstances in which a uniform subsidy could worsen the extent of resource misallocation. In particular, Isaac explained that a uniform subsidy could not correct inefficient sequencing of exploration, and it could frustrate efficient sequencing that might otherwise occur in the context of both cooperative and non-cooperative behaviour.

A pragmatic solution to issues relating to both the scope of full government funding of exploration, and rate setting for a subsidy scheme would be deployment of a limited subsidy scheme with rates that taper quickly to zero as exploration proceeds, in conjunction with a program of early-stage exploration by government. The tapered subsidy concept (from a rate of 100 per cent to a zero rate) is consistent with the decline in the public good or external component of benefits from exploration as exploration proceeds through its various stages. Subsidy rates would not have to be set precisely to improve the efficiency of resource allocation.

All exploration information generated by subsidised exploration, as well as fully government funded exploration should be accessed and publicly released promptly by government. Contextual information held by a subsidised entity should also be provided to government and then released to interested parties. This would be consistent with the principle of quick release of information from early-stage exploration that is fully funded by government, and with a policy of government collection and prompt release of exploration information generated by private sector exploration activity.

A limited subsidy scheme with rapid tapering of rates would also plug the gap between government funding of early-stage exploration and a policy instrument of government collection and prompt release of private sector exploration information (see chapter 6). The key matters requiring attention are to define what, where, when and who to subsidise, and to settle on the schedule of tapered rates, so that the scheme fits neatly between and complements other policy instruments.

How Much to Spend

A common response to the question of the amount of government spending, from government geological agencies and industry associations, is that current funding is not adequate. Typically, such claims have been supported by reference to occurrences such as:[77]

- declining real spending on exploration
- falling spending relative to the value of production
- a declining share of global exploration expenditure
- other jurisdictions having higher government spending on exploration relative to gross value of production of mineable commodities
- falling discovery rates.

These types of occurrences, individually or collectively, do not provide solid economic support for higher government expenditure on early-stage exploration. They may simply reflect circumstances such as exploration uncertainty, geological heterogeneity, major discoveries elsewhere (reflecting uncertainty and geological heterogeneity), high resource/reserve positions, relatively low prices of specific commodities, periods of high prices attracting greater exploration activity in countries previously of little interest to mining enterprises because of high political risk and poor infrastructure, and other considerations. None of these matters is indicative of the existence of a market failure that warrants government intervention. So, such occurrences are not helpful for guiding policy adjustments.

The answer to the question, how much should government spend, logically should follow from responses to the previous questions, each of which should have regard to benefits and costs. It does not make economic sense to increase government exploration activity of any type, in any location, at any point of time if incremental costs exceed incremental benefits. This principle also applies to tapered exploration subsidies.

Nevertheless, Geoscience Australia would appear to have a reasonable case for arguing that the Australian Government does not adequately fund early-stage offshore petroleum exploration. It has

[77] Arguments along these lines were outlined in the *National Mineral Exploration Strategy 2017-2022* (Australian Government, 2017).

not been allocated funds for such work since 2014-15. In contrast, the Australian Government has allocated $230.5 million to early-stage exploration onshore in the period, 2016-2025.

Who Should Pay

The question, who should pay, typically has been ignored by proponents of government-funded exploration. It has been addressed separately below.

Management Capabilities

Robert Wilson (1978) argued that, in theory, government funding of efficient early-stage exploration would address inefficiencies associated with asymmetric information, and the considerable risk/uncertainty borne by small firms with appreciable risk-aversion that have relatively little capital and opportunities to build diversified exploration portfolios. However, Wilson believed it was unlikely that governments would be able to design and conduct efficient early-stage exploration programs. He argued that governments lack the technical and managerial skills and knowledge of benefits and costs required to design, plan, and implement or contract out early-stage exploration programs. He also expressed concern that government officials or contractors might pursue self-interest in formulating programs, rather than efficient outcomes.

Wilson's (1978) view regarding inefficiency of government early-stage exploration appears to be unduly pessimistic. It is not widely supported. There are important program design issues that governments must deal with, as discussed above, but they should be treated as policy challenges, rather than insurmountable obstacles to government-funded early-stage exploration.

A management-capabilities issue with more substance is that decision-making in respect of exploration programs may be based largely on geological issues, and not have sufficient regard to economic considerations, with the result that exploration might be misplaced in respect of location and time, causing economic waste or resource misallocation (Wilson, 1978; Gilbert, 1981). Relevant economic considerations include product prices, water depth, proximity of infrastructure, distance to markets, climatic conditions, and technological trends.

7.3.4 Exploiting Policy Complementarities

Government funding of early-stage exploration is not a stand-alone policy measure to address information market failures. It requires support from other policy instruments.

While government funding is the best available principal policy instrument to address market failure associated with the public good character of exploration information in early-stage exploration in relatively unexplored areas, it would not be a suitable instrument as exploration moves through later stages in which the relative importance of asymmetric information market failure is greater and the relative importance of public good market failure is diminished. Beyond early-stage exploration, government funding of activity should be phased out quickly to a zero rate of subsidy. In later stages of exploration, the best available principal policy instrument is government capture and prompt release of privately generated exploration information, as discussed in chapter 6.

Government funding of exploration, and government capture and release of information should be viewed as complements in two senses. First, both are important for correcting information market failures, but they address those issues in different stages of exploration. Second, information provided by both policy instruments can be brought together by government geological advisers to provide a foundation for:

- government decisions on where and when releases should be made for bidding
- private sector bidding decisions and formulation of exploration programs.

It has been argued in the relevant economics literature that titles regimes need to be considered when formulating exploration information policy, because they interact with information-based policy instruments. Positive and negative interactions have been identified. These have been analysed in chapter 8.

7.4 Source of Funds for Government Exploration Programs

The economic rationale for government funding of early-stage exploration programs is to improve the efficiency of resource allocation through correction of exploration information market failures. However, the efficiency and equity effects of the mechanism used to provide resources for government funding of exploration should be considered.

Government taxes and charges typically cause inefficiencies in allocation/use of resources, the costs of which are known as "excess burden" or "deadweight loss". The magnitude of the excess burden depends on the type of tax/charge and its rate.

Cutting other government expenditure programs to fund government exploration activity would also have efficiency and equity effects. If benefits foregone by cutting other programs exceed the cost savings, inefficiency costs would need to be considered. If cost savings exceed benefits foregone, cutting these programs would improve the efficiency of resource allocation. In any event, reallocation of funds from one program to another does not avoid the excess burden of taxes that provide those funds. The distributional or equity implications of government funding of early-stage exploration will depend on the taxes or charges that are increased or imposed, and on programs that are cut to provide funding.

The government as owner of sub-surface resources could avoid excess burden associated with raising revenue to fund government exploration by applying *efficient* charges for access to sub-surface resources. Government exploration and prompt release of resulting information would reduce uncertainty and improve the focus of subsequent exploration activity for private sector explorers. *Ex ante* resource rent (incorporating the value of the information) should rise in aggregate. Then, a well-designed cash-bidding regime for allocation of tenure (an *ex ante* royalty system based on resource rent) and a well-designed realised (*ex post*) resource rent-based royalty or taxation system would charge for access to the results of the early-stage exploration work in accordance with benefits received, as well as charging for the nett value of the resource *in situ*. This package would capture resource rent with minimal deadweight loss and address the problem of under-provision of the public good of exploration information.

This package differs from reality. Australian Government revenue from offshore petroleum resources comes from the petroleum resource rent and company income tax. Cash bidding for titles is included in the legislative regime, but this policy instrument is not currently being used. The company income tax has a marginal excess burden of 50 cents, meaning that an extra dollar of revenue has an inefficiency cost of 50 cents, according to an estimate by Australian Treasury economists (Cao and others, 2015). The petroleum resource rent tax (a de facto royalty) would have a much lower marginal excess burden, because it largely exempts the notional return to capital from tax. Cash bidding would have a marginal excess burden around zero. In the case of taxation of petroleum extraction, there is an offsetting marginal excess benefit because the sector is about 80 per cent foreign owned. This arises because the revenue is recycled largely for the benefit of Australians (Ergas and Pincus, 2014). So, the petroleum taxation regime is likely to involve low (perhaps negative) nett marginal excess burden and therefore provide a low economic-cost source of revenue to fund early stage exploration, which in turn adds to the petroleum tax base.

Funding of early-stage exploration from government revenues from extraction activities would also be consistent with the benefit principal of equity. This is so because, in general, those benefiting most from government funding through better information would pay through *de facto* royalties and taxation applying to extraction activities.

There is also a potential political obstacle to government funding of early-stage exploration. As a World Bank extractive industries policy guide (Cameron and Stanley, 2017, p. 91) observed:

"Many governments find it difficult to justify the collection of geodata when the payoffs are generally long-term in comparison with the country's immediate spending needs. ……. If all of the benefits are not internalised by the government, or if the returns associated with the collection of geoscientific data are prohibitively difficult to calculate, a state may be left with less geoscientific information than it needs for efficient development."

Geoscience Australia seems to have encountered this problem. It has not been allocated funds for offshore exploration work since 2014-15. The *Exploring for the Future Program* allocation of $235.5 million from 2016 to 2025 has been focussed solely on onshore exploration.

Earlier, the Productivity Commission (2013) and Department of Finance and Deregulation (2011) expressed reservations about the appropriateness of a trend of governments funding an increasing proportion of funding of early-stage exploration through short- to medium-term initiatives. They perceived that advantages deriving from more secure ongoing funding (long-term planning, engagement in large, long-term programs, retention of staff and building of capabilities, and flexibility in responding to emerging priorities) would outweigh disadvantages (less external accountability and smaller incentives to maintain or improve performance).

7.5 Policy Implications

Government funding of early-stage exploration in minimally explored areas is an important policy instrument. It is the best available primary policy instrument for addressing market failure associated with the public good aspect of exploration information in early stages of exploration. It complements government capture and prompt release of private exploration information that is the best available primary policy mechanism for addressing asymmetric information and public good of information market failures after early-stage exploration. Neither of these policy instruments is an efficient stand-alone exploration information policy. Together, they would constitute the core of an efficient information policy package.

Since 2014-15, there has been zero government funding of early-stage exploration for petroleum in offshore areas under the control of the Australian Government. This is a direct impediment to offshore exploration, not only because it means a paucity of information in frontier areas, but also because it effectively removes an essential complement to government capture and prompt release of private exploration information.

There is an important caveat to the case for government funding of early-stage exploration and the complementary policy of government capture and release of privately generated exploration information. These information-based policy instruments interact with titles regimes. Therefore, these interactions and the titles context need to be considered when formulating exploration information policy. These matters are analysed in chapter 8.

8 INTERACTIONS: INFORMATION AND TITLES POLICY

Key Points

- Work-bid and cash-bid titles regimes have been considered because they
  - have been touted as information policy instruments, as well as mechanisms for allocating titles
  - interact with government capture and prompt release of exploration/assessment information and government funding of early-stage exploration in minimally explored areas
  - are available for deployment under the OPGGS Act.
- It is important to consider the context provided by these titles regime options when analysing information policy instruments because of interactions between relevant policy instruments.
- A work-bid titles regime is not a suitable substitute for government capture and prompt release of private information, and government funding of early-stage exploration in minimally explored areas. Moreover, it interacts negatively with these information policy instruments, tending to dissipate the benefits of better and more evenly available information, as well as the *ex ante* nett value of potential resources.
- Cash bidding for relatively unconditional tenure would be a useful device for correcting information market failures, but its performance of this function would compromise its potential to be an efficient mechanism for allocation of titles and pricing of potential resources.
- However, it is complementary to government capture and prompt release of private exploration information and government funding of early-stage exploration because it:
  - is an efficient source of funding for the information-policy instruments
  - provides an environment in which they can operate to correct information market failures without impediment
  - operates more efficiently as an allocation device and as a source of revenue in the context of better and more symmetrically available information provided by the information policy instruments.
- No coherent economic case has been made to support past Australian Government decisions to confine cash bidding to a very narrow range of mature opportunities. This mechanism could be applied in a much wider range of circumstances, excluding areas with minimal prior exploration using modern techniques.

8.1 Introduction

Policy interactions – positive and negative – have often been overlooked in discussions of exploration information policy. Chapters 6 and 7 emphasised the complementarity (positive interactions) of the key policy instruments of government capture and release of private sector exploration information, and government funding and release of information from early-stage exploration. This chapter analyses interactions between those policy instruments and titles regimes for exploration (including

other investigations). It also investigates suggestions that the effects of titles regimes might make information policies redundant.

Key aspects of exploration titles regimes are:

- subject (product) definition
- conditions of tenure
- a titles allocation mechanism.

Subject definition is concerned with deciding the coverage of a title in respect of location, time, supporting information, and attaching conditions. It is an essential, foundational component of a titles regime, but it is the aspect that has received least attention in the literature on titles policy.[78] Product definition requires answers to at least six questions:

1. Where in broad geological and geographical terms should attention be focussed?
2. What parts of focus areas should be released for tenders?
3. When should the selected locations be released, and should releases be made as opportunities arise or in accordance with a pre-determined schedule?
4. Why should a location be selected and then released at a specific time?
5. Would it be appropriate to support releases of locations for tenders with information packages and if so, should they include results of new activity and reinterpretations by government geologists?
6. What conditions should attach to a title?

Each aspect of subject (product) definition should receive careful consideration in the context of relevant available and acquirable information. Product definition relies on outcomes of information policy. It could draw on information from:

- early-stage exploration funded by government
- a scheme to capture and release privately generated information
- an area-nomination or expression of interest process.

The potential role of an area-nomination process as an instrument of information policy has often been overlooked. It has been perceived to be just an element of titles policy (part of the subject definition stage). A pertinent example is provided by the offshore area under the control of the Australian Government. Information provided in support of nominations of areas for release for bids has not been captured for subsequent release under the RMA Regulations. This oversight should be corrected, along with others identified in chapter 4.

Although determination of conditions of tenure is an important aspect of product definition, it has usually been undertaken in conjunction with selection of an allocation mechanism. Typically, conditions of tenure and an allocation mechanism have been chosen and packaged together to target a specific outcome beyond the narrow one of title allocation (selection of a title grantee).

For example, work program bidding in Australian waters applies to highly conditional tenure, with both the title allocation mechanism and the package of title conditions targeting more and earlier exploration activity and resulting information than would otherwise be realised. Consequently, this type of titles regime has often been regarded as an information policy instrument, as well as a mechanism for allocation and conditioning of titles.

Another example is that cash bidding in Australian waters has been teamed with relatively short tenure that has targeted earlier exploration activity. Such tenure conditions might be regarded as a form of information policy.

A quite different example would be cash bidding for tenure with relatively few conditions. This package targets an improvement to the efficiency of resource allocation, and an increase in the share of the nett value of resources that can be applied to benefit the government's constituents. In the economics literature, it has usually been regarded as a policy instrument that does not adversely affect the efficiency of resource allocation in the process of allocating titles and capturing the *ex ante* nett value of resources (resource rent). In addition, some analysts have argued that it would actually

[78] The essential role of product (subject) definition has been emphasised by Milgrom (2011) and Hendricks and Porter (2014).

improve the efficiency of resource allocation, because it would tend to correct market failures associated with the public good aspect of information and asymmetric availability of information.

There are three key issues arising from interactions between information policy and titles policy that need to be considered. First, targets of more and earlier exploration are not equivalent to targets of improved efficiency and equity. Pursuit of the exploration-related targets may violate efficiency and equity targets if policy instruments are not carefully selected and designed. Second, more, better, and more evenly available information improve the efficiency of tender systems in allocation of titles. Third, titles regimes may support or undermine information policy, depending on the design of the titles regime.

[redacted].

8.2 Work-Bid Exploration Permit Regime

8.2.1 Nature, Origins, Variations, and Spread of Work-Bid Regimes

Australian History

Work program bidding for highly conditional tenure (work-bid exploration permit system) has been a central feature of Australia's offshore petroleum exploration regime since that regime was established in 1967 under the *Petroleum (Submerged Lands) Act 1967*. Since its adoption, the system has been designed to increase and bring forward exploration activity to increase knowledge of offshore oil and gas resources and support progress towards extraction of resources. This intent was reiterated in consultation papers on changes to Australian offshore exploration policy issued in 2017 and 2018 (Australian Government, Department of Industry, Innovation and Science, 2017, 2018).

In Australian waters, decisions to award permits are based on:

- exploration strategies and technical evaluations provided for the relevant area
- the size, content, and timing of work programs
- the relevance of work programs to exploration strategies and technical evaluations provided
- qualifications, financial capacity, and past performance of bidders.

Work program bids apply to tenure that is highly conditional. Tenure is subject to conditions on work program content and timing. The initial tenure is for 6 years. A five-year renewal is subject to relinquishment of 50 per cent of the area previously held. A decision to renew is based on an assessment of the proposed work program and exploration strategy, and the technical evaluation submitted. Renewal of tenure is subject to satisfying work commitments. No more than two renewals can be granted.

UK Influence

Australia's work-bid exploration permit system was derived from a concept originated by the UK Government when it formulated its offshore petroleum policy, which was defined by the *Continental Shelf Act 1964*. The UK Government's system was described by Kenneth Dam (1965, p.57) as "….. an interesting form of competitive bidding in work programs." It targeted a perceived "…. need to encourage the most rapid and thorough exploration and economical exploitation of the petroleum resources of the continental shelf." This was the first of five criteria for allocation of licences listed by the Minister of Power in the House of Commons in 1964. Another key criterion was "…. the program of work of the applicant, and also the ability and resources to implement it" (Dam, 1965, p. 56 – quoting the Minister for Power in the House of Commons in 1964).

The UK used the considerable discretion available to it under the *Continental Shelf Act 1964* to negotiate with applicants in licence rounds to increase and bring forward work programs and to favour local and public enterprises (Dam, 1976). Substantial discretion was retained in the *Petroleum Act 1998*. However, the exercise of discretion has been constrained by the European Union Licencing Directive and pressure from the industry for greater transparency (Gordon and Paterson, 2015).

Norway and Australia were early followers of the United Kingdom's lead on allocation of offshore titles. However, the governments of these three countries have placed different degrees of emphasis on the work programs offered by potential explorers and the exercise of discretion by governments. In offshore Australia, title allocations are made (the winner is selected) largely based on work programs as bid, subject to satisfactory past performance, expertise and financial resources of applicants. In contrast, the UK and Norway have applied discretion to a much greater extent to pursue various things considered to be important.

Norwegian Scheme's Very Different Evolution

In 1965, Norway adopted a system that was originally similar to the one formulated by the UK. However, over time, the Norwegian Government increased its emphasis on discretion and reduced its reliance on work bids as a criterion for allocation of titles. As a result of this transition, Norway's licencing regime can no longer be described as one based on work program bidding.

From Norway's second licencing round in 1969, the Government focussed particularly on negotiation of state (or government) participation arrangements. Then, the large Ekofisk oil discovery in 1970 raised concerns regarding the capacity of the small Norwegian economy to cope with a very large project, and the potential effects on society in the context of uncertainties regarding the potential for more discoveries in Norwegian waters. These concerns led to a conscious "go-slow" policy in respect of petroleum licencing activity. Extraordinarily large oil price increases that occurred in the decade from 1973 strengthened the Government's commitment to the "go-slow" policy, and to higher targets for government participation. In the meantime, the Government had established a national oil company, Statoil, in 1972. The Government used its licence-allocation discretion to help develop Statoil, and local fabrication and manufacturing activities. In particular, the Government's priority shifted further towards negotiation of state participation arrangements, and further from earlier and more exploration (Dam, 1974, 1976).

Since the European Economic Area agreement in 1992, the Norwegian Government has not been able to discriminate between explorers and suppliers based on nationality. However, it still uses its discretion to ensure full equity participation for the state. In addition, it selects participants in joint ventures and operators of those joint ventures, having regard to challenging conditions in respect of the climate, safety, and natural environment (Nordtveit, 2015; Hunter, 2015c).

Work Program Bidding's Spread

Since the 1960s, use of the work program bidding concept in allocating tenure has become widespread. It has been used in conjunction with licence systems and production sharing systems. For example, work program bidding has been used in conjunction with petroleum licence regimes on the continental shelves of Canada (off the coasts of Newfoundland and Labrador and Nova Scotia), New Zealand, Japan, and Thailand, as well as the UK and Australia. Examples of work program bidding being used in combination with petroleum production sharing contracts are provided by Indonesia and Yemen. Application of work program bidding has also spread to a range of extractable resources, not just petroleum.

Some governments require enterprises to make bids for specific areas combining two or more bases of bidding. For example, in Brazil, bids for petroleum licences, other than pre-salt areas, must include work program commitments, cash bonuses, and offers of local content of goods and services to be used in exploration and production. Weights attached to the three bid elements have varied between bidding or licencing rounds (Mayer Brown, 2012; Pereira, 2015). India has provided two different examples. Under India's Hydrocarbon Exploration Licensing Policy, a bidder in a licencing round for a six-year "petroleum operations contract" (allowing exploration, development and production) must provide a work program offer and a *de facto* royalty bid – a gross revenue share, nett of royalty and taxation on sales. The work program bid gets a weighting of 0.45, a revenue-share bid receives a weighting of 0.5, and a weight of 0.05 is reserved for the entity deemed to have identified a block selected to be offered for bids. An entity may choose to bid for a two-year reconnaissance contract for exploration only in respect of a block in an area for which moderate or sparse data are deemed to be available. Then, the work program bid (more is deemed better) receives a weighting of 0.7, the price at which data will be made available to others (a lower price is deemed better) receives a weighting of

0.25, and a weight of 0.05 is allocated to the entity deemed to have identified the block for a licencing round (India, Directorate General of Hydrocarbons, 2018; Saxena, 2018).

Examples of bidding on multiple bases are not confined to developing countries. In Queensland, a transition has been made from a first-come-first-served system to work program bidding for exploration tenements for coal, oil, and gas. Use of cash bidding to allocate the most attractive areas was announced in 2012, but bidders have been required to offer a work program too.

8.2.2 Efficient Amount and Timing of Exploration Activity

There is a recurring view among policy makers around the world that more and earlier exploration are necessarily good things. A closely related view is that "warehousing" or "banking" of areas of interest – having tenure but not vigorously exploring it promptly – is economically undesirable. An argument often offered in support of these views is that more and earlier exploration means more and earlier discoveries, leading to more and earlier development of extraction operations, and consequently more and earlier government revenue from royalty and taxation regimes and additional jobs sooner.

Mason Gaffney (1967a) challenged the view that more and earlier exploration were unqualified goods. He pointed out that from an economic perspective there can be cases in which too much exploration is undertaken too soon, not just cases of too little exploration being undertaken too late. This point was also recognised by Orris Herfindahl (1969) and later reiterated by Orris Herfindahl and Allen Kneese (1973). It is now widely recognised in the literature on the economics of exploration. As discussed in chapter 3, exploration can be undertaken too little, too late, or too much, too soon because of information market failures. Policy failures can also have these effects.

Gaffney (1967a) pointed out that the timing of exploration to generate information about potential resources is a critical economic decision, because each discovery is a non-repeating event or an exhaustible economic opportunity, like the extraction of an exhaustible resource. This was also highlighted by Russell Uhler (1976, 1979) and Daniel Siegel (1985). Because of this feature of discovery, Uhler (1976, p. 78) likened the discovery process to:

"…… sampling without replacement from a finite, but unknown, number of reservoirs (or deposits)".

In the context of exhaustible discovery opportunities, exploration should start later than indicated by the normal investment criterion that applies to non-exhaustible economic opportunities: nett present value becomes positive. The exhaustibility of the economic opportunity to discover means that the optimal time to explore is when the nett present value of the expected resource at a series of potential commencement times for the exploration-assessment-planning-development-extraction sequence of activities (exploitation sequence) no longer rises faster than the rate of return on the best alternative use (the opportunity cost) of capital (Gaffney, 1967a; Herfindahl and Kneese, 1974; Stiglitz, 1975).

In the context of the uncertainty that characterises the exploration sector (uncertainty regarding geology, future exploration and extraction technologies, commodity prices, infrastructure, and logistics, etc) there is an option value of waiting for additional information of various types (Dixit and Pindyck, 1994, 1995). The option value is an opportunity cost of early commencement of exploration activity that should be considered in deciding when the nett present value of the expected resource at a series of potential exploration commencement times has stopped rising faster than the rate of return on the best alternative use of capital. It tends to defer further the optimal time to commence exploration.

If exploration is undertaken long before extraction commences, a return on the best alternative use of the outlay is foregone for a lengthy period. Because of this and declining real costs of exploration and extraction yielded by technological advances, premature exploration can be very costly. It can dissipate at least part of the nett value of the resource or resource rent (Gaffney, 1967a; Herfindahl and Kneese, 1974).

The amount to be outlaid on exploration, as well as the timing of outlays, is important from an economic perspective. Orris Herfindahl and Alan Kneese (1974, p. 133) observed:

"Outlays on exploration are like any others. The object is to spend as little and as late as possible, making appropriate adjustments at the margins where inputs can be substituted (to achieve the object)."

Decisions on the timing and amount of exploration may be intertwined. Exploration activity that is too soon from an economic perspective is too much exploration in early periods. Exploration activity that is too late is too little exploration earlier. A persistent tendency for exploration activity to be brought forward or deferred is equivalent to systemic overinvestment or underinvestment in exploration from an economic perspective.

Policy makers understand that there can be too little exploration from an economic perspective, but rarely recognise that there can be too much. Yet, it does not make commercial or economic sense to spend more than is necessary. It would just be commercially and economically wasteful, effectively reducing the nett value of resources. Mason Gaffney (1977b, p. 64) commented:

"Overinvestment in exploration is just as much padding and gold plating as any other kind of overinvestment. It is insidious and seductive because it is invisible and hard to evaluate, and because there is in the 'cultural subconscious' a pro-exploratory bias."

Early exploration and discovery do not mean that development and subsequent extraction will soon follow. The decision to invest in facilities to extract petroleum is an exhaustible opportunity or non-repeating event, like the decision to explore. If discovery of resources leads to secure tenure over them, a rational title holder will defer investment in extraction facilities until the nett value of the discovered resource no longer rises faster than the opportunity cost of capital (Gaffney, 1967a). Earlier investment and extraction would sacrifice the excess of the rate of appreciation of the nett value of the discovered resource (after allowing for the option value of waiting for more information) over the target rate of return at which the nett proceeds of extraction could be invested.

An economic case for government intervention to adjust the amount and timing of exploration activity cannot be derived from misconceived views about earlier and more exploration activity necessarily being good things. From an economic perspective, intervention can be justified by market failures and policy failures that lead to misallocation of resources, provided that the benefits of intervention exceed the costs. Ideally, the form of intervention should be the one expected to yield the greatest surplus of benefits over costs. These principles have been discussed in chapter 2.

Information market failures have been discussed in detail in chapter 3. There, it has been explained that public good aspects of information can lead to too little exploration, too late, and asymmetric availability of information can result in too much exploration, too soon, from an economic perspective. In addition, it was argued that in earlier stages of exploration in frontier areas, the effects of public good market failure would be dominant, but as exploration proceeds and an area becomes more prospective, the effects of asymmetric information market failure tend to dominate.

8.2.3 Functions of Work-Bid Permit Regime

Work program bidding has two functions. First, it has been designed to increase and bring forward exploration activity to increase knowledge of resources and to support progress towards exploitation of resources. Second, it provides guidance for decisions on grants of exclusive exploration permits to entities that promise to explore more and/or earlier than others.

Bidding for permits in terms of work programs is supported by permit conditions that have been selected to assist with achievement of the targets of more and earlier exploration. It has been suggested that these mechanisms could help with correction of the market failure associated with the public good aspect of information, because this source of market failure tends to result in too little exploration, too late, as explained in chapter 3.[79]

Work program bidding could be portrayed as a quasi-market mechanism for allocating exploration rights to interested entities. It is not a pure market mechanism, because bid comparisons require subjective assessment, and the government has considerable discretion in deciding on the entity that should be awarded exploration rights in a specific area.

[79] Usually, this idea has been advanced by parties without an economic background. Rare exceptions include Robert Rooney (1968) and Ben Smith (1997).

8.2.4 Assessment of Work-Bid Permit Regime

Work program bidding for highly conditional tenure does not efficiently address information market failures. Rather than improve the efficiency of allocation or resources, this two-part policy regime has the opposite effect. In addition, it interacts negatively with information-focussed policy instruments designed to correct information market failures. Work program bidding for highly conditional tenure undermines the potentially efficient operation of information-focussed policy instruments.

Effects of Work Program Bidding for Highly Conditional Tenure in Context of Information Market Failures

Following release of an area for work program bidding, an entity seeking to capture tenure could offer a work program of size and timing up to a present value that would extinguish the *ex ante* nett value of potential resources (resource rent). This nett value will reflect the information available to all bidders. A bidder may be even more aggressive in formulating the amount and timing of its nominated program to gain an information advantage or counteract another party's information advantage in respect of comparable areas. Typically, a bidding entity would offer some combination of more and earlier exploration relative to the exploration program a rational explorer would choose with secure, prolonged, unconditional tenure.

The earlier that an area is released for work program bidding, the more important will be the effect of bringing forward exploration. The closer the release time is to the ideal time to commence exploration (see sub-section 8.2.2), the greater will be the relative importance of the tendency to increase the size of the exploration program offered above what is reasonably expected to be required for discovery.

Highly conditional tenure arrangements reinforce the incentives provided by work program bidding. They do this in three ways.

First, work conditions linked to a work-bid title require the grantee to undertake the promised program. These conditions need to be supported by sanctions additional to loss of the title. Otherwise, an entity could bid particularly large and early work to win the title, and then renege on its offer if the area does not live up to expectations. The Australian Government's additional sanctions require an entity to undertake compensating activities elsewhere in Australian waters or it will be deemed to be ineligible (not in "good standing") for future title grants.

Second, short-term initial tenure and relinquishment requirement prior to renewals increase pressure on bidders to propose early activity. This occurs because progression to relatively secure tenure is dependent on making a discovery before expiry and relinquishment dates.

Third, renewals are subject to assessment of proposed work programs and keeping commitments.

When exploration is brought forward, *ex ante* resource rent tends to be dissipated or destroyed through interest on premature outlays, and through higher real costs of exploring earlier, rather than later. When exploration expenditure is increased, rather than brought forward, *ex ante* resource rent tends to be dissipated by economically unnecessary outlays, including outlays targeting acquisition of an information advantage over others in respect of comparable areas. Earlier or larger expenditures or some combination of the two result in economic waste or an inefficient allocation of resources.[80]

The effect of work program bidding with highly conditional tenure in bringing forward and increasing exploration strengthens as exploration advances and prospectivity improves. Similarly, as explained in chapter 3, asymmetric information between explorers becomes more important as exploration progresses, while the public good aspect of information and asymmetric information between explorers and capital providers become less important. In particularly prospective areas, asymmetric information market failure dominates market failure associated with the public good property of information, so that the nett effect is too much exploration, too soon from an economic perspective.

[80] The literature on the economics of titles regimes has been very critical of work program bidding and highly conditional tenure because they lead to an inefficient allocation resources and dissipation or destruction of *ex ante* resource rent. This criticism commenced soon after the regime was first implemented. See Dam (1965, 1976), Rooney (1968, 1987), Coase (1970), Clarkson (1975), Erickson (1977), Ramsey (1980), Willett (1983, 1985, 1992, 2002, 2020), Swan (1984), Fane and Smith (1986), Industry Commission (1991), Kretzer (1993, 1994), Mead (1994), Henry and others (2010), [redacted] Fane (2012), and Productivity Commission (2015). For more general critiques of titles regimes designed to increase and bring forward exploration activity, see Gaffney (1967a), Herfindahl and Kneese (1974), Fitzgibbons (1978), Northern Territory of Australia (1981), Smith and Ulph (1982), Smith (1984), and [redacted]

Work program bidding for highly conditional tenure and asymmetric information between explorers would reinforce each other in inducing too much exploration, too soon from an economic perspective, as entities pursue the capture of resource rent directly through bidding for titles, and indirectly through activity to gain information advantages to assist with bidding strategies. The application of capital and skills through both routes to capture *ex ante* resource rent through tenure tends to dissipate *ex ante* resource rent, misallocating (inefficiently applying) resources in the process.

In contrast, in the least explored areas, asymmetric information market failure is dominated by market failure associated with the public good characteristic of information. In these areas, the effects of work program bidding for highly conditional tenure would differ from those in more prospective areas. Work bids, if any, would tend to be low, reflecting low *ex ante* nett value of potential resources. This low nett value reflects a particularly high degree of uncertainty or paucity of information in relation in areas with little or no prior exploration. This, in turn, reflects under-provision of the public good of information that could not be corrected by low work bids. This problem would be only partly offset by speculative bidding (suggested by Gaffney 1967a) or by bidding in pursuit of an information advantage in a new area (suggested by Gilbert, 1981), as only some of the resulting information would spill over to others. On balance, in the least explored areas, the nett effect of information market failures and work program bidding is likely to be too little exploration, too late from an economic perspective.

If a title in a least explored area is offered so prematurely that the expected discovery cost exceeds the *ex ante* nett value of an efficiently explored opportunity at the expiry date of the title, there would be no point in lodging a work bid to acquire the title. This would be the case because progression to relatively secure tenure is dependent on making a discovery or identification of promising targets before part of the title had to be dropped in accordance with relinquishment conditions, and a discovery would be required before the ultimate expiry date of the exploration tenement. The deterrence of bids would be more likely to occur, the earlier that frontier areas are released for bids. The result of no bids is no privately generated exploration information. Dissipation of *ex ante* resource rent is avoided, and the naive targets of earlier and more activity are not achieved.

If a title is offered for bids in a relatively unexplored area after the *ex ante* nett value of an efficiently explored opportunity at the expiry date of the title has risen to exceed the expected discovery costs, work program bidding for highly conditional tenure would bring forward (and maybe increase) activity. This will provide earlier (and maybe more) information about similar areas, as well as the title offered. To the extent that the information spills over to other entities, subsequent work program bids would be raised (some combination of more and earlier activity) for areas for which spillover information has enhanced perceived prospectivity. As a result, the value of the information would be dissipated by the extra work. To the extent that the information can be kept confidential by the party that generated it, creating an information asymmetry, subsequent competition for similar areas would be suppressed, because the information advantage would deter other bidders who could reason they could win only by bidding too much. This could be offset by an upward adjustment to work bids in pursuit of further information advantage. Some of the exploration information could spill over and some could be kept secret. The cycle would then continue. To the extent that information spills over to others, competition for titles is enhanced, but *ex ante* resource rent is dissipated by work bids. To the extent that information is kept confidential, competition for titles is undermined and *ex ante* resource rents are partly captured by those with information advantages and partly dissipated.

It follows from the preceding analysis that work program bidding for highly conditional tenure is a seriously flawed policy regime for allocating titles or addressing information market failures. This regime does not correct market failure associated with the public good aspect of information in early stages of exploration, exacerbates the effects of market failure resulting from asymmetric availability of information in later stages of exploration, and tends to dissipate *ex ante* resource rent.

Effects of Interaction of Work-Bid Permit Regime with Policies to Improve Availability of Information

In Australian waters, government funding of early-stage exploration has been implemented in conjunction (until 5 years ago) with government capture and delayed release of privately generated exploration information. However, government funding tended to be spasmodic. Other domestic jurisdictions and other countries have also combined these policy instruments.

These titles-based and information-focussed policy instruments have been regarded as substitutes, rather than complements by some parties. The analysis of deficiencies of work program bidding for highly conditional tenure in the previous sub-section rejects the substitution option. In addition, the analysis below indicates that this titles regime is not a helpful complement to information-focussed policy instruments.

If government capture and prompt release of private information and government funding of early-stage exploration and release of the resulting information are implemented in the context of work program bidding for highly conditional tenure, the efficiency-improving effects of the information-focussed policy instruments (described in chapters 6 and 7) are undermined by the titles regime. The mechanics of this negative interaction are described below.

Work bids tend to rise as a result of application of the information policy instruments. This reflects reduced uncertainty and a level playing field for competitive bidding.

Reduced uncertainty results from availability of more information to all interested parties. As some areas are upgraded by availability of better information to all interested parties and others are downgraded, costs of investigating the upgraded areas fall and entities avoid allocating resources to downgraded areas.

The level playing field results from elimination of asymmetric information. A party's possession of an information advantage suppresses competition, as those with inferior information reason that they can win only by overbidding. Uniform availability of information removes the brake on competition.

The benefits of better and more evenly available information are incorporated in *ex ante* resource rent. When entities compete in terms of work bids, improved availability of information attracts higher bids (a combination of earlier and larger work programs) from entities seeking to capture the higher *ex ante* resource rent linked to the title.

Additional information generated by work programs incorporated in bids is also captured and released by government. This adds to *ex ante* resource rent in similar areas. Subsequent work bids dissipate this extra nett value too.

It is clear that not only is work program bidding for highly conditional tenure an unsuitable instrument for correcting information market failures (as explained in the previous sub-section), but also it seriously undermines potentially efficient outcomes from government funding of early-stage exploration, and government capture and prompt release of privately generated information (as explained in this sub-section).

8.3 Cash-Bid Exploration Permit Regime

8.3.1 Nature, Origins, Variations, and Spread of Cash-Bid Regimes

Australian History

The Australian Government established a cash-bid exploration permit regime in Australian waters in 1985 by an enabling amendment to the *Petroleum (Submerged Lands) Act 1967*, which was replaced nearly 20 years later by the OPGGS Act. The cash-bid exploration permit regime was retained by the new legislation. The cash bidding system was a first price, sealed bid tender. A reserve pricing arrangement was implicit, not explicit.

When the cash-bid system was introduced, the Minister for Resources and Energy, Senator Gareth Evans (1985) said that it would be used only in highly prospective areas. However, the original legislation and the replacement legislation in 2006 did not incorporate such a restriction or specify criteria to determine circumstances in which cash bidding could be deployed.

Senator Evans (1985) provided the following rationale for providing a cash bidding alternative to work program in the legislation:

"Difficulties have been experienced in applying to such highly prospective areas the existing work program bidding system, so as to simultaneously achieve economic efficiency in exploration decisions, equity, and even-handed administration. The proposed cash bidding system will greatly assist in improving efficiency of offshore petroleum programs and in facilitating administration of exploration

titles. Cash bidding for exploration permits complements the resource rent tax decision, and taken together, the measures will ensure that the community recovers an adequate share of the economic rent on offshore resources."

While the Act stipulated that a cash-bid exploration permit and any renewal must not be subject to work and expenditure conditions, these permits were highly conditional. Offers for cash-bid permits could be rejected for reasons other than the amount of the cash bid. As for work-bid permits, the initial period of tenure was only six years, and relinquishment of 50 per cent was required before renewal. However, renewal opportunities were more restricted for cash-bid permits than for work-bid permits. A cash-bid permit could be renewed no more than once, for a period of five years, and no renewal was available, if such advice had been included in the original notice that invited bids. In contrast, from 1 January 2003, a work-bid permit was renewable twice, for 5 years on each occasion.

Cash bidding was deployed from 1985 to 1992 in areas considered to be highly prospective. Subsequently, it was not used again in Australian waters until after amendments to the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* in late 2013 to establish a revised cash-bid permit regime to be deployed from 2014.[81]

In November 2012, redeployment of cash bidding for some offshore petroleum exploration permits was announced by the then Minister for Resources and Energy, Martin Ferguson, following support for cash bidding from the Henry Tax Review (Henry and others, 2010) and [redacted]. The Minister advised that cash bidding was to be used in "mature areas, or those known to contain petroleum accumulations" (Coombs and St John, 2013). Twelve months later, and after the governing party changed, legislation to establish a new cash bidding framework was enacted. The then Minister for Industry, Ian Macfarlane (2013, p. 756) explained in his second reading speech in support of the Bill:

"Cash bidding will be used for those areas that are mature in exploration terms, or are known to contain petroleum accumulations. Cash bidding in these areas is intended to prevent over-exploration where none or little may be required. It also supports the government's policy of enabling the earliest commercialisation of our resources. By introducing cash bidding, the government will ensure that the Australian community receives an upfront share of the economic benefit derived from having the exclusive right to explore for petroleum in Australia's offshore areas."

The legislation incorporated an explicit reserve price arrangement. The reserve price did not have to be disclosed.

As for the earlier version of the cash-bid permit regime, the Act did not restrict its deployment to areas deemed to be highly prospective, mature in exploration terms, or petroleum bearing. Tenure, renewal, and relinquishment arrangements remained the same as for the earlier version of the regime.

The cash-bid permit regime was administratively shelved after four years. In a policy paper released for comment in May 2018, DISER proposed (Australian Government, Department of Industry, Innovation and Science, 2018, p. 10):

"……. areas will no longer be offered for cash bidding. Focussing on a single permit allocation mechanism will support administrative efficiency and fair and equitable access to acreage for all companies."

In September 2018, DISER announced that under "new look offshore petroleum exploration acreage release" arrangements from 2019, no cash bidding had been scheduled. The cash bidding regime remains in the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*.

US Influence

The deployment of cash bidding for exploration permits in Australian waters was influenced by long-standing practice on the United States outer continental shelf. This, in turn, derived from practices previously devised by oil companies operating in the United States.

Originally, oil companies offered up-front cash payments to private owners of land and sub-surface resources in the United States to entice cash-poor owners to sell rights to potential oil resources,

[81] *Offshore Petroleum and Greenhouse Gas Storage Amendment (Cash Bidding) Act 2013.*

subject to a capped *ad valorem* royalty on production value. When the oil companies became interested in areas in which government held rights to sub-surface resources, their influence led to government adoption of a cash payment system, except that formal bidding processes were implemented. Acceptance of the system by large oil companies was enhanced by immediate deductibility of cash payments in frontier areas for calculation of corporation income tax liabilities.[82]

Cash bidding for offshore petroleum exploration and extraction rights (leases) on the United States outer continental shelf (beyond three nautical miles from the coast) commenced in 1954 under the *Outer Continental Shelf Lands Act 1953*. This system remains in place, apart from:

- a prohibition on joint bidding by the very largest companies (8 entities) from December 1975
- a switch from restricted to widespread releases (Area-Wide Leasing) in 1983
- longer periods for leases in deep water.

In the late 1970s, the United States Government experimented with work program bidding, profit share bidding, and bidding with respect to ad valorem royalty rates applicable to gross revenue. Subsequently, it reverted to sole reliance on cash bidding to allocate leases.

The Bureau of Ocean Energy Management (BOEM) within the United States Department of the Interior manages access to oil and gas resources on the outer continental shelf. BOEM prepares five-year national offshore, area-based petroleum leasing plans. It uses a first price, sealed tender system to allocate offshore oil and gas leases that allow exploration for, and extraction of oil and gas. The standard primary lease period is five years. In deep water, the primary lease period is longer: eight years for leases in water between 400 and 800 metres deep, and 10 years for leases with water depths greater than 800 metres. The lease term is extendable if approved drilling operations are being undertaken or a discovery is made, or well-reworking activities are being conducted. It can be perpetuated indefinitely by producing petroleum in "paying quantities" (revenue covers operating costs). A typical lease does not exceed 5,760 acres, but a larger lease area may be allowed if required to secure a reasonable economic production unit.

The *Outer Continental Shelf Lands Act 1953* requires that the Department of the Interior collects "fair market value" for access to offshore oil and gas. BOEM formulates an estimate of "fair market value" of every lease for which a bid is received. These estimates are confidential and are used only to evaluate bids. "Fair market value" has been targeted through cash bids, *ad valorem* (percentage of) gross value royalties on production, and annual lease rentals.

Nominally, the lease is awarded to the "highest responsible qualified bidder". "Highest" is qualified by BOEM's right to reject any and all bids received for any tract. Therefore, BOEM can reject a bid that is below "fair market value", which is effectively a reserve price. Because the reserve price is secret, it could be adjusted after observing bidding behaviour. To be deemed "responsible", a bidder must be considered financially capable of fulfilling the lease conditions and to have fully complied with the conditions of any prior leases. To be deemed "qualified", a bidder must meet strict conditions relating to foreign ownership, residence, and joint bidding (the largest oil companies cannot bid together).

The task of determination of "fair market value" is information-intensive. It requires access to suitable expertise and other sources of information relating to mineable resource potential, exploitation costs, comparable transactions, and commodity market outlooks.

In 1983, the United States Government adopted the Area-Wide Leasing concept that targeted more exploration and development activity. In each area in which petroleum activity was allowed, all tracts not under lease, including deep-water tracts, were made available for bids annually. This arrangement has been widely condemned for flooding the market and thereby driving down cash bids (Hendricks and Porter, 2014).

Under the Trump Administration, the Area-Wide Leasing policy was extended to become a *de facto* region-wide leasing concept with two lease tenders a year in each region. For example, the western, central and eastern Gulf of Mexico areas have become one region, and last year, lease tenders were scheduled in March and August, with all available unleased tracts in the region – about 14,700 tracts covering 78 million acres – open for tenders.[83] However, 90 per cent of the entire offshore area under

[82] This historical account of the origins of cash bidding was provided by Gaffney (2009).
[83] Most of the eastern Gulf remained unavailable for leasing under a Congressional moratorium expiring in June 2022 (United States Department of the Interior, 2018, 2019).

the jurisdiction of the Government of the United States (off the Pacific, Atlantic, and Alaskan coasts and in the Gulf of Mexico) has become available for leasing under the 2019-2024 national five-year program of lease sales, compared to 13 per cent in 2015.

Cash bidding is also used to allocate leases for fossil fuels on US federal lands. This mechanism has been used to allocate coal leases since 1975 (*Federal Coal Leasing Amendment Act 1976*) and oil and gas leases onshore since 1987 (*Federal Onshore Oil and Gas Leasing Reform Act 1987*).

Access to mineable resources on federal lands is managed by the Bureau of Land Management (BLM) within the United States Department of the Interior. BLM prepares and updates "Resource Management Plans" (RMPs) that identify areas that are suitable and available for oil, gas, and coal activity in various regions. The preparation of RMPs must have regard to issues relating to multiple land uses, the sustainable yield of renewable resources, and environmental matters.

Oil and gas lease auctions must be held on a quarterly basis in each state in which federal lands are available for leasing. The Secretary of the Interior may authorise additional opportunities to bid if that is considered necessary. For coal, lease auctions are scheduled as required.

A petroleum lease must not exceed 2,560 acres, except in Alaska. The maximum lease size in Alaska is 5,760 acres. There is no restriction on the size of coal leases, but BLM seeks to ensure that leases are reasonably configured so that coal is not bypassed.

Oil and gas leases are issued for an initial (primary) period of 10 years. For coal, the primary term is 20 years. Leases permit exploration development and extraction activities. In the case of coal, a "diligent development requirement" is that if coal is not produced from the lease within 10 years of its issue, the lease will be terminated. Petroleum and coal leases will be extended if required to allow continuation of exploration or production.

As for offshore leasing, the Department is required to obtain "fair market value". BLM assesses this for every title for which a bid is received. Nominally, the winning bid is the highest offer that is equal to or greater than the assessed "fair market value". As the United States Government reserves the right to reject any, and all bids received for any tract, it can reject a bid that is below "fair market value".

If leases offered for sale through competitive bidding do not attract any bids, they may be sold "over the counter" at a "minimum acceptable bid price". This price is rather low. It is not "fair market value" and has been subject to heavy criticism by economic and legal analysts.

Cash Bidding Elsewhere

Cash bidding has not been widely used to allocate petroleum titles and collect up front royalty payments outside of the United States. The important petroleum-producing province of Alberta in Canada is a notable exception.

In other important petroleum producing areas, work program bidding and profit-share bidding and are more common. Work program bidding is discussed above. Brazil provides an example of profit share bidding.

In the attractive pre-salt petroleum areas in Brazilian waters, bids are made in terms of the percentage of profit oil for government under a production sharing regime. These bids are made in the context of fixed up front cash bonuses, minimum work programs, and local content requirements.

In some jurisdictions, cash bidding has been combined with work program bidding. Examples include Queensland for superior fossil fuel areas, and Brazil for petroleum areas, other than pre-salt.

8.3.2 Functions of Cash-Bid Permit Regime

Cash bidding has two primary functions. First, it is a market mechanism for allocating titles to entities that perceive them to have the greatest potential for profitable extraction of resources. Second, it collects up-front revenue based on the *ex ante* nett value of potential resources. In other words, it is a *de facto* royalty regime. Both the allocation and up-front royalty functions are based on the winning bidder's risk adjusted assessment of the nett value of potential resources.

In addition, a case has been made that cash bidding for relatively unconditional tenure also corrects inefficiencies associated with information market failures in the form of the public good/external

benefits aspects of information and asymmetric availability of information. This suggests that it is an information policy instrument, as well as an allocation mechanism, and a *de facto* royalty regime.

8.3.3 Assessment of Cash-Bid Permit Regime

Context of Relatively Unconditional Tenure

Cash bidding for relatively unconditional tenure does not adversely affect the efficiency of allocation of resources to exploration. After tenure has been acquired, the payment is a sunk cost and does not influence future exploration decisions. This analytical result has been widely acknowledged in the relevant economics literature.

A case has been made that cash bidding for relatively unconditional tenure would improve the efficiency of resource allocation, not just avoid adversely affecting it. The essence of the case is that cash bidding tends to correct inefficiencies associated with external benefits of information spillovers and external costs of asymmetric information among explorers. The supporting arguments follow.[84]

Information spillovers mean that private sector explorers are unable to capture all of the benefits of the information they produce. Anticipation of information spillovers to others might be reflected by lower cash bids for an exploration title. On the other hand, information spillovers from the earlier exploration would induce beneficiaries to raise or lower bids for comparable areas for which positive or negative indications, respectively, have been provided. The various adjustments to bids by providers and beneficiaries of information spillovers redound to the government as title provider.[85]

Explorers seek information advantages over other explorers – asymmetric information in their favour – to give them an edge in acquiring exploration tenure. If a cash-bid auction is conducted in an area in which no bidder has superior information, bids might be attracted that reflect not only the anticipated value of the right to explore and possibly exploit potential resources, but also the opportunity to obtain information that might be useful in later auctions in the area. In later auctions, entities with inferior information would recognise that to win they would have to outbid entities with superior information and therefore could pay too much. Consequently, they may make a low bid or not bid at all. Those with superior information recognise that others with inferior information will be discouraged from bidding aggressively, and therefore, the former can win with a bid that is less than their value of the target. Higher, early bids by those seeking an information advantage may be offset by lower, later bids in the context of an information advantage. This tends to correct the external costs (costs forced on others) of asymmetric exploration information. These costs include lost returns on exploration investments brought forward and on gold plated or duplicative activity, and losses to constituents of government.[86]

It would not be sensible to rely on cash bidding to correct exploration information inefficiencies in areas in which there had been little prior exploration using modern techniques. In a minimally explored or frontier area, uncertainty typically would be substantial, incentives to bid would be weak, and any bids would be very low. It could be expected that information becoming publicly available from private exploration would be less than would be economically desirable, and therefore, exploration would be less and later than desirable from an economic perspective. In a minimally explored area, the incentive to bid extra for an exploration title to gain an information advantage for subsequent bidding may be weak, just as the incentive to bid to explore for resources would be weak.

For frontier areas, government funding of early-stage exploration is necessary to address exploration information inefficiencies and provide a foundation for private sector activity. This policy instrument is also required to provide a foundation for subsequent deployment of cash bidding. It provides a source of information for government for selection of where and when areas should be released, and to support an efficient bidding process.

[84] Mead, Moseidjord and Sorensen (1982, 1984); Leitzinger and Stiglitz (1984); Kagel and Levin (1986, 2002); Mead (1994); Stiglitz (2002).
[85] This was also recognised by Herfindahl (1969b).
[86] Similar observations have been made by Robert Porter (1995), Kenneth Hendricks and Robert Porter with various co-authors (1987, 1989, 1993, 1994), and Peter Cramton (2007, 2010) regarding bidding behaviour in first price, sealed, cash-bid auctions for exploration and extractions rights in the context of asymmetric exploration information. However, these economic analysts were equivocal regarding the extent to which cash bidding would internalise external costs of asymmetric information, although the reasons for their equivocation were not clearly articulated.

In areas that are more prospective than frontier areas, it might be argued that cash bidding for relatively secure tenure would obviate the need for deployment of exploration information policy instruments to address information market failures. However, this would require a cash bidding regime to perform four tasks: efficiently allocate tenements, collect up-front royalty revenue, correct for under provision of the public good of information, and correct for information asymmetries. As discussed in chapter 2, requiring a single policy instrument to achieve multiple targets is likely to require trade-offs between the extent of achievement of different targets. Consequently, it is preferable to deploy multiple policy instruments that have been well designed for specific targets.

Cash bidding is capable of allocating titles and collecting up-front royalty payments efficiently and simultaneously, because both functions are based on the winning bidder's risk-adjusted assessment of the nett value of potential resources. If this policy instrument is also tasked with correcting information market failures, it is likely to compromise achievement of the title allocation and up-front royalty targets. This would result from adjustments to bids in response to market failures associated with information spillovers and asymmetric availability of information, as discussed above. Relative to circumstances in which information market failures were absent (or have been corrected separately), these adjustments would tend to reduce the size of bids and alter allocations to reflect asymmetric information and the perceived *ex ante* nett value of potential resources, rather than just the latter.

Deployment of government funding of early-stage exploration and government capture and prompt release of private exploration information to target correction of information market failures would increase revenue from cash bidding and redirect allocation of titles to entities perceiving the greatest *ex ante* nett value of potential resources. In addition, information policy instruments would perform a fifth function that a cash bidding system cannot perform: guide selection of areas for release for bidding and timing of releases.

It follows that the nominated information policy instruments complement cash bidding for relatively unconditional tenure. Meanwhile, cash bidding for relatively unconditional tenure supports the operation of the nominated information policy instruments in two ways.

First, cash bidding for relatively unconditional tenure, unlike work program bidding for highly conditional tenure, does not undermine the role of information policy instruments. Specifically, it does not interfere with the efficiency of the allocation of resources that has been improved by the information policy instruments.

Second, cash bidding supports information policy by recovering for public purposes the value of information, which is incorporated in the imputed nett value of resources. This ensures that information policy initiatives can be financed without having to incur the economic costs (deadweight losses) of raising inefficient taxes or cutting government expenses that are desirable on economic or equity grounds.

Context of Highly Conditional Tenure

An important proviso of the preceding analysis is that cash bidding should be used to allocate relatively unconditional tenure. This point has often been overlooked.

The proviso has not been met by the Australian offshore cash bidding regime introduced in 1985 and revised and reactivated from 2014. Even though tenure is not subject to work requirements, unlike work-bid permits, renewal opportunities are more restricted for cash-bid permits than for work-bid permits, and relinquishment requirements are the same if a renewal is permitted.

The United States offshore cash bidding regime, which influenced the regime adopted in Australian waters, does not require work program commitments. It involves different tenure conditions than in Australian waters (US – five to ten years tenure, depending on water depth; Australia – six years). Under the United States regime, tenure is automatically extended if a discovery is made so that development and extraction can occur, while under the Australian regime either no renewal or one renewal for 5 years is allowed following relinquishment of 50 per cent of the title, and an application may be made for a production lease or a retention lease if a discovery is made.

The tenure arrangements in both jurisdictions pressure explorers to shift the timing of exploration activity from its optimal scheduling. This pressure is more likely to bring forward activity, the earlier that an area is released for bidding relative to the optimal timing of exploration. The more that activity

is brought forward, the greater is the proportion of *ex ante* resource rent that is dissipated. This includes dissipation of the contribution of information policies to the *ex ante* resource rent. The more prospective an area is, the less likely it is that exploration would be brought forward from its optimal timing, because the optimal time to explore highly attractive areas is typically straight away.

There is a limit to the extent that the tenure arrangements can induce earlier exploration. If a release is so early that the expected discovery cost exceeds the *ex ante* nett value of an efficiently explored opportunity at the expiry date of the title, there would be no incentive to lodge a bid in excess of zero and then explore to make a discovery to secure tenure beyond the expiry date.

The occurrence of adverse effects of tenure arrangements designed to induce earlier activity have been demonstrated in separate economic models by [redacted] and Fane and Smith (1986).

The effects outlined above indicate that cash bidding should be used with relatively unconditional tenure. However, if for some reason government decides to impose strict relinquishment requirements or otherwise keep exploration tenure short, information policy should target selection of territory that is ripe for exploration, and that means getting the timing right.

In the past, Australian cash-bid permits have been offered for tenders only in a narrow range of circumstances, even though the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (and its predecessor, the *Petroleum (Submerged Lands) Act 1967*) have never restricted deployment of cash bidding in this way. As explained above, there are sound economic reasons not to deploy cash bidding in frontier areas before early-stage exploration has been undertaken and the resulting information has been made available. However, these reasons do not apply subsequently. No coherent economic case has been made to confine cash bidding to "highly prospective areas" or "areas that are mature in exploration terms or are known to contain petroleum accumulations". Presumably, past, severe restrictions on application of cash bidding have been reactions to opposition to cash bidding that has been discussed below.

Opposition to Cash Bidding

Opponents of cash bidding have claimed that it diverts funds from exploration. One supporting argument – explicit or implied – is that exploration budgets are fixed, and paying cash for tenure reduces the amount available for exploration. Cash bidding's critics have also claimed that it disadvantages small explorers. There are four counter arguments.

First, the benchmark for assertions about the effects of a titles regime on exploration activity should be an efficient level and timing of exploration, not the amount and timing of exploration under work program bidding for highly conditional tenure. Under regimes of the latter type, part of the work program would be economically wasteful, because of the opportunity costs of gold plating and prematurely undertaking activities to gain tenure, as explained above. Under cash bidding for relatively unconditional tenure, a transfer to government (the winning bid) replaces wasteful expenditures, but it does not interfere with efficient exploration outlays.

Second, exploration budgets are not fixed, except in the very short term. Exploration budgets typically are adjusted according to the availability of attractive prospects. However, if budgets were fixed for a time, those claiming that cash bids draw funds from exploration should also concede that acquisition of superior tenements under regimes designed to increase and bring forward exploration activity work program would draw funds away from other exploration.

Third, good prospects attract high cash bids, while poor prospects attract low bids. Experience with cash bidding, such for petroleum leases in the Gulf of Mexico, has shown that good prospects that receive high bids also receive strong, early exploration outlays. Typically, poorer prospects get lower exploration funding and those allocations are more likely to be late than early. This happens because they are less attractive prospects, and that in turn is why they attract low bids. It does not occur because they were obtained via a cash bidding regime or because better prospects attracted high bids.

Fourth, if small explorers would be disadvantaged under a cash bidding regime, it is likely that they would also be disadvantaged under a work program bidding system. The present value of a work bid would approximate to the size of a cash bid plus the present value of an efficient exploration program. The only difference is that money for a cash bid is likely to be required up front. Small explorers would

be disadvantaged in putting money up front, because they have higher internal hurdle rates and are less able to attract equity capital than large companies. However, these disadvantages could be ameliorated through pre-bid joint venture arrangements and could be removed by allowing a cash bid to be spread over the life of an exploration title.

8.4 Policy Implications

Information policy instruments provide important inputs to the product (subject) definition part of titles regimes. This aspect of titles regimes is critically important, but often neglected.

Work program bidding for highly conditional tenure has been touted as an information policy instrument, as well as a titles allocation instrument. However, it has been explained above that this titles regime is a poor substitute for government capture and release of private information, and government funding of early-stage exploration in minimally explored areas.

Moreover, these policy instruments are not complementary. They interact negatively. Work program bidding for highly conditional tenure undermines the information policy instruments, tending to dissipate the benefits of better and more evenly available information, as well as the *ex ante* nett value of potential resources.

Cash bidding for relatively unconditional tenure has been put forward as an information policy instrument, as well as a means of allocating titles and an up-front royalty regime. As explained above, this policy instrument would be a useful device for correcting information market failures, but its performance of this function would compromise its potential to be an efficient mechanism for allocation of titles and pricing of potential resources.

Cash bidding for relatively unconditional tenure is complementary to government capture and prompt release of private exploration information and government funding of early-stage exploration. Cash bidding provides an efficient source of funding for the information policy instruments and an environment in which they can operate to correct information market failures without impediment. By addressing information market failures, the information policy instruments improve the efficiency of operation of cash bidding for relatively unconditional tenure as an allocation device, and they increase revenue from this source. Part of the improvement derives from information policy instruments providing guidance for selection of areas for release for bidding and timing of releases.

If cash bidding is used to allocate tenure that is relatively short and subject to relinquishment requirements, its performance will be undermined. Such tenure conditions tend to dissipate the *ex ante* nett value of potential resources in less prospective areas. This includes dissipation of the contribution of information policies to this *ex ante* nett value. They discourage bids if very early releases are made. These issues apply to the cash bidding regimes in Australian and United States' offshore legislation. If the offending tenure conditions are retained, the adverse effects could be avoided by taking care to delay releases until areas are ready for immediate activity.

No coherent economic case has been made to support past Australian Government decisions to confine cash bidding to a very narrow range of mature opportunities. This mechanism could be applied in a much wider range of circumstances, excluding areas with only minimal prior exploration using modern techniques.

9 CONCLUSIONS AND RECOMMENDATIONS

Key Points

- Two policy reform packages have emerged from the analysis in preceding chapters:
  - the preferred, "leading-practice" package
  - a distant "second-best" information policy package, which is constrained by assumed retention of other existing policy instruments.
- The "leading practice" policy package would involve:
  - comprehensive capture of private sector petroleum and greenhouse gas storage information, followed by prompt release of that information (allowing a reasonable time after submission for checking by government), with some minor exceptions (see chapter 6)
  - government funding of early-stage exploration in minimally explored areas (see chapter 7)
  - cash bidding for relatively unconditional titles (see chapter 8).
- The distant "second-best" information policy (see chapter 6) would be applicable only if government eschews two important elements of a "first-best" policy package:
  - government funding of early-stage exploration in minimally explored areas
  - cash bidding for relatively unconditional titles.
- The distant "second-best" information policy involves modification of a policy of comprehensive information capture and prompt release by providing a lengthy confidentiality period for information generated for sale to multiple clients under an efficient pricing arrangement.
- Both policy reform packages require numerous nitty gritty changes to address complexities, anomalies, inconsistencies, and oversights in the RMA Regulations, but the distant "second-best" information policy requires more changes to avoid unintended adverse consequences of elements of the current regime (see chapter 4) that are meant to support a market for seismic surveys.

9.1 Introduction

Anomalies, complexities, anomalies, inconsistencies, and oversights in the content and administration of the RMA Regulations have been documented in chapter 4. This was based on careful examination of the RMA Regulations and insights from consultations with industry and government stakeholders.

In addition, many policy issues have been analysed in chapter 6. These included policy issues arising from interaction of an information-capture-and-release regime with policy settings applying to titles systems and government funding of offshore exploration activity. The importance of these interactions for formulation of sound offshore information policy has been highlighted in chapter 6, with analytical elaboration included in chapters 7 and 8.

The analysis in chapters 4, 6, 7, and 8 applied policy criteria and principles outlined in chapter 2. It drew on a thorough investigation of economic bases for offshore petroleum and greenhouse information policy in chapter 3, and comparative analysis of information-capture-and-release regimes in various domestic and international jurisdictions.

9.2 Preferred and "Second-Best" Overall Reform

Two policy reform packages have emerged from the analysis in preceding chapters. They differ because of different underlying assumptions regarding flexibility in adoption of policy instruments other than the information regime defined in the RMA Regulations.

The preferred package addresses issues arising from the context of policy instruments that interact with the information-capture-and-release regime (discussed in chapters 6-8), as well issues within the regime itself. Thorough reform is consistent with widely accepted policy criteria and principles outlined in chapter 2, but piecemeal reform is not.

The other policy package assumes inflexibility in respect of adoption of policy instruments that interact with the information policy regime defined in the RMA Regulations. These other policy instruments are the titles regime that is currently deployed, and the absence of government funding of early-stage exploration over the past five years.

The preferred policy package, which could be described as "leading practice" would involve:

- comprehensive capture of private sector petroleum and greenhouse gas storage information, followed by prompt release of that information (allowing a reasonable time after submission for checking of quality and comprehensiveness by government)
- government funding of early-stage exploration in minimally explored areas
- cash bidding for relatively unconditional titles.

The second and third of these policy instruments strongly complement the first. They improve the performance of information policy in terms of effectiveness, economic efficiency, and equity. They also improve performance of offshore policy more generally.

If policy makers decide to eschew the "leading-practice" or "first-best" policy instruments of government funding of early-stage exploration in relatively unexplored areas, while retaining a highly inefficient work-bid titles regime instead of cash bidding for relatively unconditional titles, they would have to resort to a distant "second-best" information policy. This would involve modifying a policy of comprehensive information capture and prompt release by supporting a lengthy confidentiality period for information generated for sale to multiple clients under an efficient pricing arrangement. This modification would only partly and imperfectly address impediments to exploration activity in frontier areas that would ideally be addressed by a government funded program. Also, this modification would help to address, albeit imperfectly, the tendency of a work-bid titles regime to dissipate the value of privately generated information that is captured and released by government.

9.3 Nitty Gritty Reform to Information Aspects of the RMA Regulations

Regardless of the choice made between the preferred and distant "second-best" policies, substantial reforms to the current information-capture-and-release regime would be required to deal with specific deficiencies of the regime highlighted in chapters 4 and 6. Some reforms will differ between the two overall policy choices, but the majority would apply in both cases.

9.3.1 Nitty Gritty Reforms that Differ between Overall Policy Packages

In the preferred, "leading-practice" package, information that has been comprehensively captured would be released promptly (allowing a reasonable time for generation, documentation, and submission of information and checking by government), with some minor exceptions.

In the "second-best" package, the current concepts of "non-exclusive" and "exclusive" information would be retained. However, a loophole would be closed that currently provides an opportunity for reclassification of exclusive information as non-exclusive information. This would require a market

test (and perhaps market regulation) to ensure that information has been generated for sale to multiple clients and that the pricing regime is an economically efficient one.

Geophysical service providers generating information for sale on a multi-client basis should be required to submit basic and interpretative information as is already required under the RMA Regulations. Capture of this information should not be left to title conditions applicable to purchasers of data.

Geophysical service providers should be required by regulation to make and submit 5x5 km^2 2D extracts from 3D data. Submission should not be left to inclusion of a condition in a title. This data should be released after five years, as would be the case if it was submitted as a condition of a title.

Data that is purchased (including licensed) from geophysical or other service providers should be required by regulation to be submitted, unless it has already been submitted by a geophysical service provider. Also, any subsequent interpretation should be required by regulation to be submitted. At present, it is submitted only if required as a condition of a title.

Any non-exclusive data purchased by a holder of an exclusive title to meet a work program commitment should be subject to the release timeframes applicable to exclusive information generated in respect of that to that title (overriding the confidentiality period for multi-client data). Geophysical service providers would have the option to price that data accordingly to reflect the reduced confidentiality period.

The confidentiality period for basic data generated for sale to multiple clients should be reduced from 15 years to 10 years. This would be consistent with the confidentiality periods sanctioned by Norway and [redacted].

The confidentiality period in the regulations for interpretative reports based on non-exclusive data is substantially shorter than for the basic non-exclusive data. This should be enforced. At present, these reports are not released until the basic data is released.

Formalised arrangements should be put in place to enable government to use non-exclusive data once submitted (but prior to public release), provided the source is acknowledged and the raw data remains confidential.

9.3.2 Nitty Gritty Reforms Common to Preferred and "Second-Best" Packages

The RMA Regulations should specify an overall objective for information management. The Australian Government's *Natural Resources Statement* (February 2019) articulated objectives for mineable resources. It observed that sub-surface resources belong to the community and stated that they should be exploited for the benefit of all its constituents. This involves two steps. First, it implies that the realised nett value of mineable resources should be maximised. Second, the maximised value should be captured to benefit the community.

As discussed in section 2.1 of chapter 2, maximising the realised nett value of mineable resources means using all resources – capital, labour (including intellect), and natural resources – efficiently. This would not occur if there are impediments to markets working properly (market failures). Pertinent examples relevant to information management are the inability of markets to make sufficient information available and to make it uniformly accessible to all interested parties.

It follows that an appropriate information management objective to include in the RMA Regulations could be:

"Manage offshore petroleum and greenhouse gas storage information to facilitate exploitation of those resources for the greatest achievable benefit of all constituents of the Australian community".

To qualify as "leading-practice" regulations, the reformed RMA Regulations would need to be based on "leading-practice" information policy and appropriately address important nitty gritty issues. The latter have been highlighted below.

The highly prescriptive nature of the information aspects of the RMA Regulations and the interdependent characteristic of complexity need to be addressed. Highly prescriptive regulation is not consistent with leading practice. It performs poorly with respect to economic efficiency, administrative efficiency and effectiveness criteria for policy formulation and assessment that have been discussed in

sub-section 2.1.2 in chapter 2. Objective- or performance-based regulation is preferred. This is focussed on outcomes or performance standards that regulated entities are required to achieve. However, in formulating performance-based regulations, care is required to provide regulatory certainty.

The RMA Regulations could be made more objective- or performance-based and less complex by casting a wide net in describing what is required – defining requirements broadly, rather than in terms of specifics. NOPTA could be given discretion in interpreting the requirements. NOPTA could issue guidelines to provide regulatory certainty while retaining discretion and flexibility to adapt to changing technologies.

Complexity could also be reduced by reducing the number of categories of information with different submission and release rules. This would be achieved by having uniform principles of submission and release. Collection of all information and prompt release of that information, with few exceptions is an example of this. Prompt release allows a reasonable time for generation, documentation, and submission of information and checking by government.

Comprehensive collection of information relating to offshore exploration, other assessment, development, production, and other operations should be pursued. Submission requirements under the RMA Regulations should be designed to cover all such information by casting a wide net and giving discretion to NOPTA, rather than being highly prescriptive. If it is not captured by government, it cannot be released.

The wide net should pick up important information that has been inadvertently omitted, such as reprocessed survey data, bathymetry data, water column information, information provided to support nomination of areas for release for bids, etc. Also, the net should extend to information generated under Good Standing Agreements, and regional studies. The time frames and quality control arrangements should be consistent with those for other information.

NOPTA, or Geoscience Australia as its agent, should review the quality and comprehensiveness of data submitted. It should have regulatory power to enforce submission of all information and ensure it is of satisfactory quality through sanctions such as the ability to cancel titles and refuse to issue future titles in the event of non-compliance. The quality of survey and well data was an issue specifically highlighted by stakeholders, because of considerable variability in the quality of reporting. There were strong calls for consistency in data reporting.

Submission times should be reviewed by reference to the practicalities of the amount of time reasonably required to get data in a suitable form for submission. Again, in the case of processed and interpretative information, a reasonable amount of time for the practical conduct of these activities and their documentation needs to be permitted. Submission timeframes could vary according to the activity and should not be so short that quality of information is compromised.

All submitted information that is eligible for release should be promptly released after submission. Ineligible information would be that which relates to financial resources of entities and personal details of individuals. In the case of the "second-best" reform, it would also include information generated for sale to multiple clients that is still subject to a confidentiality period.

The concept of prompt release for most information would reduce complexity and administrative issues associated with basic and interpretative categories of information. In the case of the preferred, "leading-practice" reform, it would also avoid complexity and administrative issues linked to the distinction between non-exclusive and exclusive information.

The concept of prompt release after submission of information should allow government sufficient opportunity and time to review the comprehensiveness and quality of information submitted. Ideally, the review period would be uniform and relatively short, preferably no more than three months. If the Government deems it necessary to query the quality or comprehensiveness of information and request a supplementary submission, it should be able to release the original information with qualifications, and then re-release the information after mandatory rectification within a specified period of time.

The ownership of data needs to be clarified. As a minimum it should be clear that submitted data becomes the property of government, with the submitter having a licence to use it. A better option is

that the information once generated becomes the property of government, with the generator granted a licence to use it. The latter option may facilitate the capture of all offshore information, and use of that information by government in making decisions on and promoting release of areas for bidding.

Regulations relating to submission and release of information should be aligned for petroleum and greenhouse storage, except for cases in which:

- requirements are not relevant in one case or the other
- technical differences warrant different requirements.

The requirements for keeping data/samples under the RMA regulations need to be updated. Once data/samples have been submitted and accepted by government, enterprises should be required to hold duplicative data/samples for 12 months, rather than indefinitely. Upon relinquishment of a title, the RMA Regulations should specify that the title holder must immediately submit all data/samples, with these to be subject to release after quality review (no more than three months). The RMA Regulations should allow for samples/data to be stored and analysed offshore (without approval) provided duplicates have been submitted to NOPTA, with final reports on outcomes of analyses to be submitted within a period to be determined by reference to the practicalities of the amount of time reasonably required to get information in a form suitable for submission, as for other types of information.

The regulatory requirements in relation to data formats/media, etc require updating to ensure formats keep pace with technological advances and changes in industry best-practices. The RMA Regulations need to be more performance-based in describing what is required, with NOPTA issuing guidelines to provide regulatory certainty while retaining discretion and maintaining standards. Guidelines on submission need to be flexible and adaptable to technological change but the format needs to be very clear to ensure Government can upload and share data quickly and effectively for other users.

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