STREAMLINING THE RISK ANALYSIS PROCESS FINAL REPORT

CEBRA Project 2IL

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Executive summary

An Import Risk Analysis (IRA) assesses the risks posed by pests or diseases associated with a commodity that a country might import. Developing an IRA takes considerable time and resources. At the same time, the demand for completed IRAs is increasing. As a result, like other similar organisations, the New Zealand Ministry for Primary Industries (MPI) has a backlog of IRAs to complete. MPI has previously identified and implemented ways to increase the efficiency of IRA production but is seeking further opportunities. To assist MPI, in this research project, we:

1. **Conducted a survey** of biosecurity analysts and managers at MPI, the Australian Department of Agriculture, Forestry and Fisheries (DAFF), and other organisations, to gain information and insights relating to:
    a. Key parameters around IRA production – e.g., time needed to produce an IRA;
    b. How MPI analysts and managers spend time on major activities and types of work;
    c. The challenges analysts and managers face in producing IRAs efficiently; and
    d. Ideas they might already have about opportunities to further increase efficiency.
    (Section 2)
2. **Developed an "opportunity map,"** an organised list of opportunities. The opportunities were derived from the survey, background research, and from DAFF, who provided a list of things they had tried. The map synthesized these into 37 distinct opportunities in eight categories. (Section 3)
3. **Assisted MPI in selecting two opportunities** for further development. One was an "actionable" opportunity, which could be implemented within the period of the project, even if it achieved only modest efficiency gains. Another was judged the most promising opportunity for longer-term development, potentially offering much larger gains. Selection was based on three criteria: anticipated gain in efficiency, feasibility of implementation, and level of risk, particularly with regard to the quality of IRAs. (Section 4)
4. **Assisted MPI in piloting the actionable opportunity**, the use of CASE templates. A CASE (Contention, Argument, Evidence, Source) template is a detailed template for drafting IRA components. Working closely with the MPI working group, we developed a template for an IRA currently under development, *Humulus*. Four analysts tested the template, and responded to an evaluation survey. (Section 5)
5. **Described in more detail a longer-term opportunity**, the Structured Drafting Environment (SDE). This is a software platform supporting teams of analysts and managers in the process of developing an entire IRA. A SDE could potentially improve efficiency in many ways, but would be a very substantial development exercise. We provide some general observations on design and development. (Section 6)

Based on these activities we recommend that MPI:

1. Proceed to a feasibility assessment for a Structured Decision Environment;
2. Conduct another test of CASE templates with a new IRA;
3. Periodically review whether access to scientific literature can be improved; and
4. Periodically review the range of opportunities, using the opportunity map provided here as a resource.

Collectively these activities meet the project brief and provide some guidance for MPI in ongoing efforts to improve efficiency. This should have indirect impact over the long term on MPI's ability to facilitate international trade while protecting New Zealand's environment and economy.

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Acronyms and technical terms

Term	Definition
ALOR	Acceptable level of risk
ATO	Australian Taxation Office
BARS	DAFF's Biosecurity Assessment Recording System (workflow management system)
CASE	"Contention, Argument, Evidence, Source" – a method for structuring reasoning
DAFF	Australian Department of Agriculture, Forestry and Fisheries (previously DAWE)
EPPO	European and Mediterranean Plant Protection Organization
IRA	Import Risk Analysis (composed largely of many PRAs)
MPI	New Zealand Ministry for Primary Industries
PDR	DAFF's Pest Disease Repository (in-house database)
PRA	Pest risk assessment
Research Team	Group consisting of report authors and working group.
SDE	Structured Drafting Environment
SUS	System Usability Scale
Working group	Group of analysts at MPI. Also briefly included a senior manager from DAFF.

1   Introduction

1.1   BACKGROUND

An Import Risk Analysis (IRA) assesses the risks posed by pests or diseases that may be associated with a commodity that a country might import. An IRA might also analyse available measures that can be used to manage that risk. An IRA is used to inform decisions on the measures that should be applied to manage the risks while still allowing trade in the commodity. Importation cannot commence until those measures are in place.

Biosecurity risk analyses are crucial to protecting a country's health, environment and economy. However, developing an IRA takes considerable time and resources. A commodity might have dozens of hazardous pests or diseases associated with it, and each of those hazards requires careful investigation, grounded in scientific research, by trained analysts. Each IRA also involves public consultation. The resulting report can be a hefty document; for example, MPI's recent Citrus IRA (MPI, 2022) was more than 550 pages in length.

At the same time, the demand for completed IRAs is increasing. One driver is the growth in global trade of agricultural products, which means increasing numbers of commodities for which entry to New Zealand is sought.

As a result, MPI now has a large backlog of IRAs awaiting completion. This can contribute to delays in trade commencing, with its benefits for the New Zealand economy and quality of life.

It is therefore important for MPI to increase the rate at which IRAs are produced. In principle this could be done by increasing the resources applied to the task – for example, by increasing the number of risk analysts employed at MPI. The organisation has in fact recently made a significant investment in resources (staff) to help resolve the problem. However, the only truly sustainable solution is increasing the efficiency with which IRAs are produced. Of course, increasing efficiency would be desirable regardless of the level of resources available.

The project described in this report aimed to identify ways MPI might improve efficiency in the development of IRAs. The project was hardly the first time this topic had been considered. MPI, and similar organisations such as the Australian Department of Agriculture, Forestry and Fisheries (DAFF) and the European and Mediterranean Plant Protection Organization (EPPO), have been concerned with improving efficiency for decades (e.g., (Baker et al., 2009)). In this context, our project was intended to

- take stock of current opportunities to increase efficiency,
- with particular focus on MPI, and
- in the context of relevant recent and potential near-future trends and developments.

1.2 PROJECT BRIEF

As specified in the project brief, the research project had two main activities.

1. **Map opportunities**. The project will map out the opportunities for streamlining IRA development and assess them against criteria such as estimated impact on efficiency of IRA production, impact on quality, and impact on timeliness. The map will likely take the form of a simple multi-criterion decision matrix providing indicative estimates of overall attractiveness of options, which can be fine-tuned by end users by adjusting parameters such as criterion weights. The opportunity map will provide guidance for MPI in implementing opportunities to streamline IRA development over a multi-year period. This activity will involve:
    a. A survey of relevant MPI staff, aiming to gather information on topics including
        i. Overall parameters, e.g., how many person-hours are required for an IRA, how this depends on IRA types, etc.
        ii. How resources are currently allocated - i.e., where all the time/effort goes
        iii. Impediments to efficiency
        iv. Feedback on opportunity ideas
        v. Suggestions for opportunities
    b. A literature review to screen for existing solutions or solution options; and
    c. Attempts to identify what other similar organisations have done or are doing. This will overlap with the literature review but may involve direct contact with those organisations.
2. **Develop an actionable opportunity**. The project will investigate in more depth a specific opportunity. This opportunity will be selected early in the project and investigation will be largely concurrent with developing the opportunity map. The goal is to provide MPI with at least one option they can implement by the end of this project, even if it is not the option promising the largest efficiency gain. Investigation will include designing a workable form of the opportunity (whether a procedure, system, or technology, or combination) and conducting a pilot with MPI staff. Initial ideas include:
    a. Templates for drafting IRA sections (e.g., Entry assessments)
    b. A "structured drafting environment" for IRA
    c. AI augmentation for developing reasoning or auto-compiling in IRA sections
    d. New ways to be "strategic" in ordering work so as to minimize overall effort required.

As the project unfolded, in consultation with MPI, we added another activity, which we can (retrospectively) describe as:

3. **Identify a longer-term opportunity**. Identify the most attractive opportunity which might be developed subsequently. This opportunity is expected to be take considerably more time and resources to develop, but to offer much larger long term efficiency gains.

The project focused on exploring ways to streamline production of IRAs in MPI's Plant Risk Analysis division, because:

- The project was commissioned by the manager of the Plant Risk Analysis division;
- The MPI senior analysts who were members of the working group were all in that division, and so our access to biosecurity expertise was limited to their domain; and
- This restriction made the project more feasible within the one-year timeframe.

1.3 RECOMMENDATIONS

Based on this research, we make the following high-level recommendations.

1.3.1 Feasibility assessment for Structured Decision Environment

MPI should take the next steps towards implementation of the major opportunity identified in this project, a Structured Decision Environment. We expect this would commence with a detailed feasibility assessment.

1.3.2 Test use of CASE templates in a second IRA

Given the promising first pilot of CASE templates conducted as part of this project (section 5), MPI should test the CASE template approach with another IRA and attempt to estimate the net efficiency impact in that case. If this second trial is positive, MPI should consider incorporating CASE templates into its standard procedures.

1.3.3 Periodically review access to scientific literature

In this project a lack of easy access to relevant scientific literature emerged as the most serious challenge for efficient production of IRAs. MPI has been aware of this problem and has previously considered ways of addressing it, with cost being a major hurdle. MPI should regularly revisit this situation with a view to identifying whether any new developments might have altered the cost-benefit equation.

1.3.4 Periodically review the range of opportunities

With the map developed in this project as a resource, MPI should periodically review the range of opportunities, in the context of other developments (e.g., the emergence of new capabilities from research in artificial intelligence) with a view to selecting and acting on the next most attractive measures to improve efficiency.

1.4 REPORT OVERVIEW

This report mirrors the structure of our research activities, as shown in this diagram:
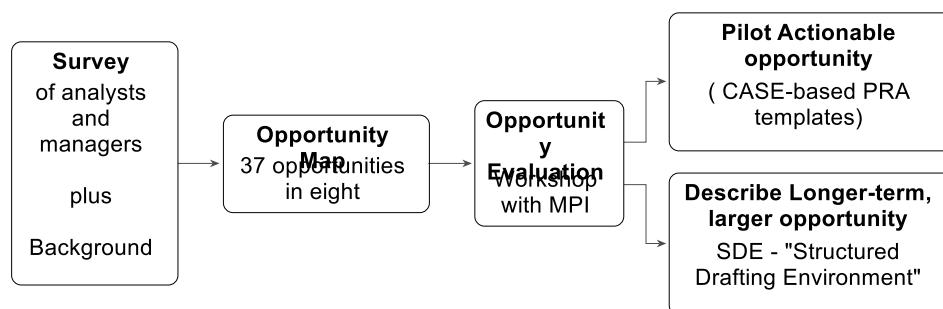
Figure 1-1: Sequence of activities undertaken in this research project. Each box corresponds to a major section of the report.

Section 2 describes the survey we conducted of biosecurity analysts and managers at MPI, the Australian Department of Agriculture, Forestry and Fisheries (DAFF), and some other organisations. We describe the objectives, how the survey was developed and conducted, and the results.

Section 3 presents an overview of the Opportunity Map – an organised, comprehensive list of potential opportunities for streamlining IRA production. Brief descriptions of all the opportunities are provided in Appendix 4 - Opportunity Map.

Section 4 describes how we supported MPI in selecting two opportunities from the map – one "actionable," and another as a candidate for development over the longer term.

Section 5 summarizes how the actionable opportunity – CASE (Contention, Argument, Evidence, Source) structured templates - was piloted within MPI, and the insights derived from that exercise.

Section 6 elaborates on the concept of a Structured Drafting Environment (SDE), the selected longer-term opportunity.

Section 7 is a final short discussion of limitations and some directions for potential future research.

2   Survey

Our first activity was a survey of biosecurity analysts and managers to gather quantitative and qualitative data informing the subsequent activities, particularly the development of the opportunity map.

2.1   OBJECTIVES

The survey had four specific objectives. These objectives were based on the survey topics listed in the project brief, with some evolution during the survey development process.

1. **General parameters**. To gather information about IRA productivity in MPI and comparable organisations.
2. **Work patterns**. To understand the work patterns of biosecurity analysts and managers as they relate to IRA production.
3. **Challenges**. To gain insight into the challenges that analysts and managers believe slow down the production of IRAs
4. **Ideas**. To elicit ideas for improving the efficiency of IRA production from people at the "coalface" - biosecurity analysts and managers.

The project brief suggested the survey should also gather "Feedback on opportunity ideas." However, until we had conducted the survey, we wouldn't have all the ideas for which feedback should be obtained. We therefore dropped this aspect from the survey and gathered feedback on ideas in a later phase of the project, Opportunity Evaluation (Section 4).

2.2   SURVEY DESIGN

2.2.1   Working Group

For the survey and other activities in this project, we formed a working group consisting of the two CEBRA-affiliated researchers (Kruger and van Gelder) and three analysts from Plants division of MPI.[3]

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[3] To help address the Consolidated Criteria for Reporting Qualitative Research (COREQ) principles, (Tong et al., 2007) we provide the following information. All members of the working group have PhDs. One analyst member of the working group was female; all others were male. The CEBRA researchers are not biosecurity domain experts, but both have experience working with MPI and their processes. van Gelder has been working with MPI since at least 2015 and has collaborated on multiple projects with various biosecurity organisations. Kruger has been working with MPI since 2020 and was the primary author of the MPI project report "The Impact of Evidence on Decision Making - Final Report"(Kruger et al., 2021a). – Prior to study commencement, the authors had a working relationship the 3 MPI analysts in the working group and their manager, all of which participated in the survey. Additionally, the authors had a relationship with a senior analyst from DAFF who also responded to the survey. However, the authors had no relationship with the remaining 43 respondents. Since MPI has been working with author Tim van Gelder since 2015 and Ariel Kruger since 2020, it is likely that some participants would be aware of the researchers and their previous work with MPI. Participants were informed of the goals of the research prior to participating.

2.2.2   Survey development

The survey was developed in an iterative manner in consultation with the MPI working group.

A challenge in designing the survey was using and defining terminology in a way that was consistent or at least understandable across organisations. The survey went through several iterations of testing and revision with the participants of our working group until we were all satisfied that we could elicit the data we needed.

To generate the set of analysts' and managers' major activities, we referred to ISPM11 – Pest risk analysis for quarantine pests (FAO, 2017), and MPI's Guidelines for Risk Analysis (Biosecurity New Zealand, 2021), which gave us an initial set of activities. Discussions with our working group confirmed that the set made sense and didn't leave out any major activity.

The set of types of work was generated by first thinking about how each of the major activities gets completed. We then proposed a tentative list to our working group which was then refined and finally confirmed as not leaving anything important out.

The working group members completed a version of the survey and provided comments and suggestions, leading to the final version (see Appendix 1 – Survey Copy for the final survey sent to participants).

2.3 SAMPLING

The inclusion criteria for our survey was people who were currently working as, or had previously worked as, a biosecurity analyst or manager. Since the terms 'biosecurity analyst' and 'biosecurity manager' were not used universally across organisations, we defined a biosecurity analyst as anyone who primarily performs activities such as:

- Pest categorization
- Pest risk analyses
- Evaluating (even if occasionally) risk management options
- Drafting IRA documents

and a biosecurity manager as anyone who manages the analysts in producing IRAs.

To gain as much useful information and insight as we could, we sought to obtain as many responses as possible, from as many relevant organisations as possible. For practical reasons we were unable to require that any individual or organisation participate in the survey. We were dependent on people volunteering. Thus, we had what is termed a convenience sample.

2.4 PROCEDURE

To obtain participants, we asked our contacts at MPI and DAFF to distribute the survey within their organisation and to any other organisation they thought would be interested in participating. Our contacts distributed a 'landing page'[4] via email, which contained all the information participants would require and a link to take the survey.

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[4] The landing page can be viewed at https://blogs.unimelb.edu.au/huntlab/sra-survey-landing-page/

The link took participants to the Qualtrics survey platform to begin the survey. The survey asked participants to confirm that they met the inclusion criteria before continuing. Before participants could begin to answer the questions, they were required to read a Plain Language Statement describing the research, and consent to taking part in it. Once participants began the survey, they could leave and return at any time to it by using the same link.

The survey went live on December 10th 2021, and remained open until February 1st 2022. Reminders to complete the survey were sent by the participating organisations on Dec 21st 2021.

Approval for the survey was obtained from the University of Melbourne's Human Ethics Advisory Board, reference number 2021-22829-24137-3.

Responses to questions falling under the first three topics (Demographics, Productivity, and Major activities and types of work) could be analysed quantitatively using simple descriptive statistics.

Responses to questions in last two topics (Challenges to efficient IRA production, and Ideas to improve efficiency) were free text and so we analysed them qualitatively using thematic analysis. Analysis and subsequent coding was done with an inductive, or bottom-up approach, "where the codes and themes derive from the content of the data themselves" (Braun & Clarke, 2006, p. 58) as opposed to a deductive approach, which starts with codes/themes and attempts to find them within the data. In our research, the themes/codes were either the challenges mentioned by survey respondents or the ideas they generated. The aim of the analysis was to organise the data by identifying common features in the responses. The process can be described stepwise with the steps mirroring those outlined in Braun and Clarke:

1. Familiarisation with data – This beginning step consisted of reading and re-reading the responses to the final two questions.
2. Generating initial codes – here we developed a provisional list of codes by creating high-level summaries of each response e.g., a response to 'challenges to efficient IRA production' was "Access to scientific literature, including paywalls and information that is only available in a foreign language" which was coded as "access to scientific literature"
3. Identifying themes – in this step, codes were refined into themes by combining codes that were similar or overlapped.
4. Review – In the final step we reviewed the themes and the associated data, checking to make sure that the theme accurately captured what was in the data.

2.5 QUANTITATIVE DATA

In total we received 45 complete responses to the survey and 3 incomplete responses.[5] Responses were received from MPI, DAFF, and six other organisations.[6] We included data from incomplete responses in our analysis.

We present here just the data; we discuss issues arising from the data in s.2.7, Discussion.

2.5.1 Experience

To get a sense of participants' experience at their biosecurity organisation, we asked them to indicate how long they have been at their organisation and how long they have been working on IRAs.

Table 2-1: Number of responses (including incomplete responses), mean years at organisation, and mean years working on IRAs, broken down by organisation and role.

		MPI	DAFF	Other	All
Analysts	# responses	18	10	6	34
	Years at org	4.8	10.7	13.8	8.1
	Years working on IRAs	4.1	7.5	12.2	6.3
Managers	# responses	3	9	2	14
	Years at org	10.7	11.9	6.0	10.8
	Years working on IRAs	10.5	8.6	6.5	8.7
Both	# responses	21	19	8	48
	Years at org	5.6	11.3	11.9	8.9
	Years working on IRAs	5.0	8.0	10.5	7.0

2.5.2 Productivity

We posed various questions aimed at understanding productivity, i.e., how much work it takes to produce IRAs. The questions were:

1. What % of your time do you spend on IRAs?
2. How many IRAs do you work on at any one time?
3. How many analysts typically work on an IRA?
4. How many calendar months does it take to produce an IRA?
5. How many analyst months does it take to produce and IRA?

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[5] All survey data (anonymized) is available in an Open Science repository at https://osf.io/vndmc

[6] The other organisations were Julius Kuehn Institute, Federal Research Centre for Cultivated Plants, Germany; Instituto Nacional de Investigacao Agraria e Veterinaria; United States Department of Agriculture (USDA); Canadian Food Inspection Agency (CFIA) (2 responses); United States Fish and Wildlife Service; and State Plant Protection Service of Latvia.

Table 2-2: Productivity data (means and standard errors) stratified by organisation and role. The figures for "Analyst months per IRA" are just the means and standard errors of the respondents' estimates of how many analyst months are typically required.

	Analyst		Manager		Both	
	Mean	SE	Mean	SE	Mean	SE
NZMPI						
% of time on IRAs	51.3	5.4	53.7	14.8	51.7	4.9
IRAs at one time	1.5	0.3	2.0	1.0	1.6	0.3
Analysts per IRA	6.2	0.8	7.0	1.0	6.3	0.7
Calendar months per IRA	12.7	1.6	18.0	3.5	13.7	1.5
Analyst months per IRA	26.3	6.7	52.7	20.8	30.6	7.2
DAFF						
% of time on IRAs	57.8	7.8	42.2	10.0	52.9	6.3
IRAs at one time	1.9	1.0	3.8	1.0	2.7	0.5
Analysts per IRA	3.4	0.5	2.1	0.3	2.8	0.4
Calendar months per IRA	19.5	3.1	20.3	1.9	19.8	1.9
Analyst months per IRA	28.0	10.1	15.1	1.9	22.0	5.6
Other						
% of time on IRAs	49.8	11.6	30.0	0.0	44.1	8.8
IRAs at one time	2.6	0.6	1.0	0.0	2.1	0.5
Analysts per IRA	1.5	0.4	2.0	1.0	1.6	0.4
Calendar months per IRA	5.3	2.4	3.1	2.9	4.6	1.7
Analyst months per IRA	4.0	2.7	3.1	2.9	3.7	1.9

2.5.3   Major activities and types of work

These questions aimed at more detailed understanding of how analysts and managers spend their time when working on IRAs.

Major activities

Major activities are the sequence of activities required to produce an IRA. We provided a different set of activities for analysts and managers.

Table 2-3: Analyst major activities and mean percentage of time spent on each

	MPI	DAFF	Other	All
Hazard ID	24.8	23.1	17.1	22.9
Risk Assessment	44.5	31.6	47.9	40.2
Risk Management Evaluation	2.9	13.4	7.9	7.6
Public Consultation/ Stakeholder Engagement	1.3	13.3	2.9	6.0
Review and Sign-off	9.6	15.1	13.6	12.3
Other activities	6.7	2.9	8.1	5.4
Total	89.7	99.5	97.4	94.5

Table 2-4: Manager major activities and mean percentage of time spent on each.

	MPI	DAFF	Other	All
Prioritising IRAs	3.3	5.2	10.0	5.8
Initiating IRAs	28.3	7.8	21.7	14.7
Providing instructions to analysts	15.0	16.3	8.3	14.5
Overseeing IRA production	21.7	20.7	26.7	22.1
Managing consultation and review	5.0	16.9	16.7	15.1
Overseeing development of procedures	10.0	8.6	6.7	8.5
Approving IRA for use	13.3	18.4	10.0	15.7
Other activities	5.0	3.9	0.0	3.6
Total	101.7	97.8	100.0	99.9

Types of work

For analysts we also asked how their time working on IRA activities was distributed across different types of work.

Table 2-5: Analyst types of work and mean percentage of time spent on each.

	MPI	DAFF	Other	All
Literature searching and retrieval	23.4	22.5	24.3	23.2
Literature digesting	20.6	19.1	24.3	20.6
Information Management	7.6	9.4	12.1	9.1
Reasoning	14.6	15.3	15.0	14.9
Editing documents	12.9	15.0	11.4	13.5
Administrative tasks	9.5	10.5	4.6	9.1
Peer review	10.1	8.3	8.3	9.1
Other kinds of work	1.0	0.0	0.0	0.5
Total	99.8	100.0	100.0	99.9

2.6 QUALITATIVE DATA

We present here just the results; we discuss issues arising from the results in s.2.7, Discussion.

2.6.1 Challenges to efficient IRA production

We asked participants to tell us what they believed to be the biggest challenges to efficient IRA production. Figure 2-1 shows the frequency of each theme in the responses.

3   For more on what each theme is, see the responses under each theme in Appendix 1 – Survey Copy

A PDF version of the survey can be found here: https://osf.io/vpgbd

Appendix 2 - Challenges to efficient IRA production.
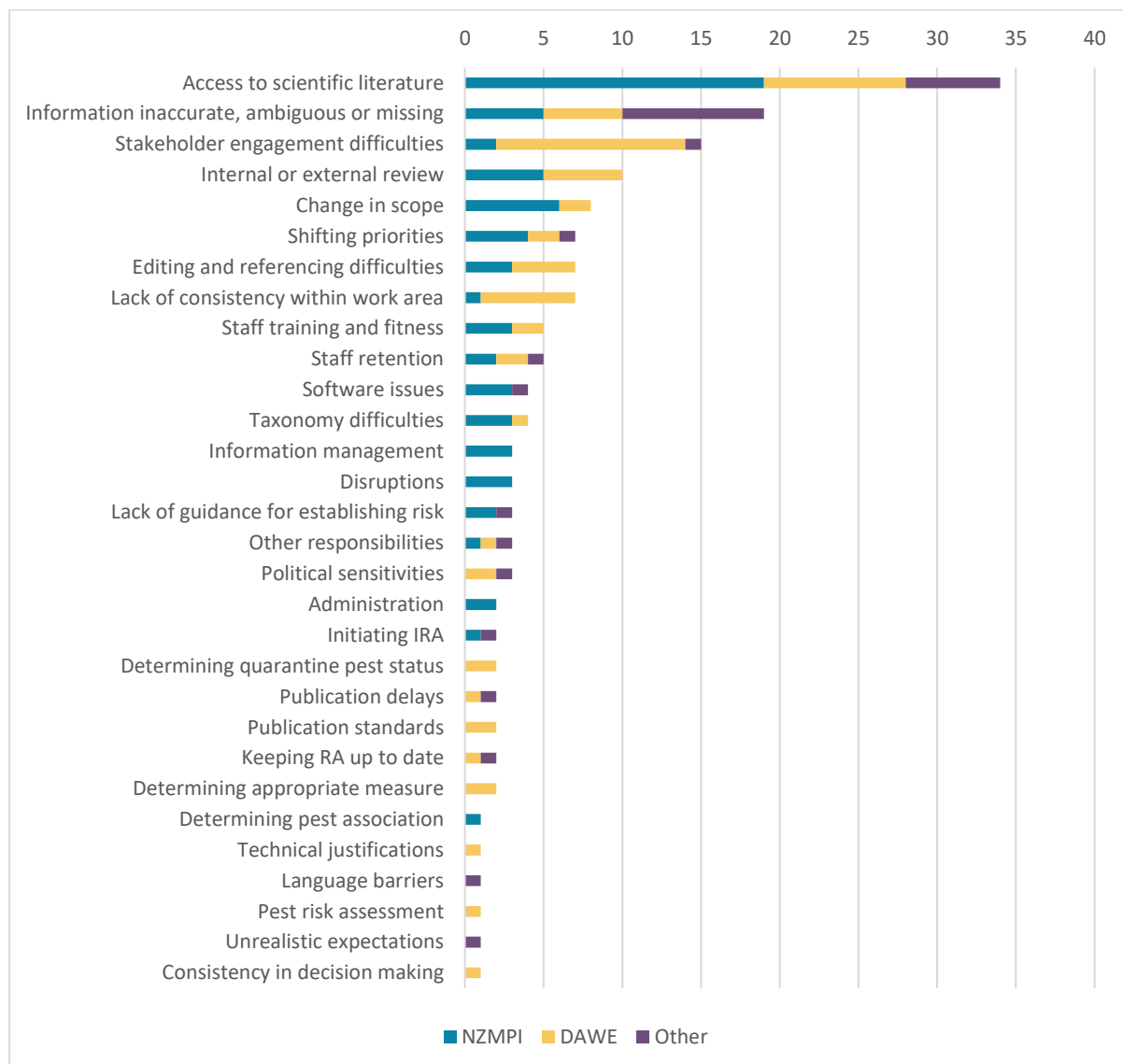
Figure 2-1: Count of identified themes (challenges to efficiency IRA production) stratified by organisation. Challenges are ordered by the number of mentions by MPI respondents.

For MPI specifically, the 5 themes most frequently mentioned as challenges to efficient IRA production were:

1. **Access to scientific literature** (19 mentions) – organisations do not appear to have broad access to scientific literature. When trying to retrieve this information, requests must be made to loan or purchase specific pieces, rather than instant access through a broad licence.
2. **Change in scope** (6 mentions) – this challenge refers to changing the scope of the IRA project after the project has commenced.

3. **Information inaccurate, ambiguous or missing** (5 mentions) – information here refers to technical information required to complete the analysis such as: regulatory status, spatial information or export information from NPPO
4. **Internal or external review** (5 mentions) – challenges relating to the review process such as: dishonoured deadlines, ad-hoc changes and lengthy waits for reviewer responses.
5. **Shifting priorities** (4 mentions) – refers to a change in the priority of work on a given IRA, as opposed to other work or other IRAs.

3.1.1   Ideas to improve efficiency

We asked participants to give us their own ideas on what might improve the efficiency of IRA production. We then analysed the responses using the method described in 2.6. We grouped the identified themes in 10 categories:

- Management
- Databases
- IRA scope
- Standardisations
- Information

- Editing
- Systems
- Training
- Organisational structure
- Review
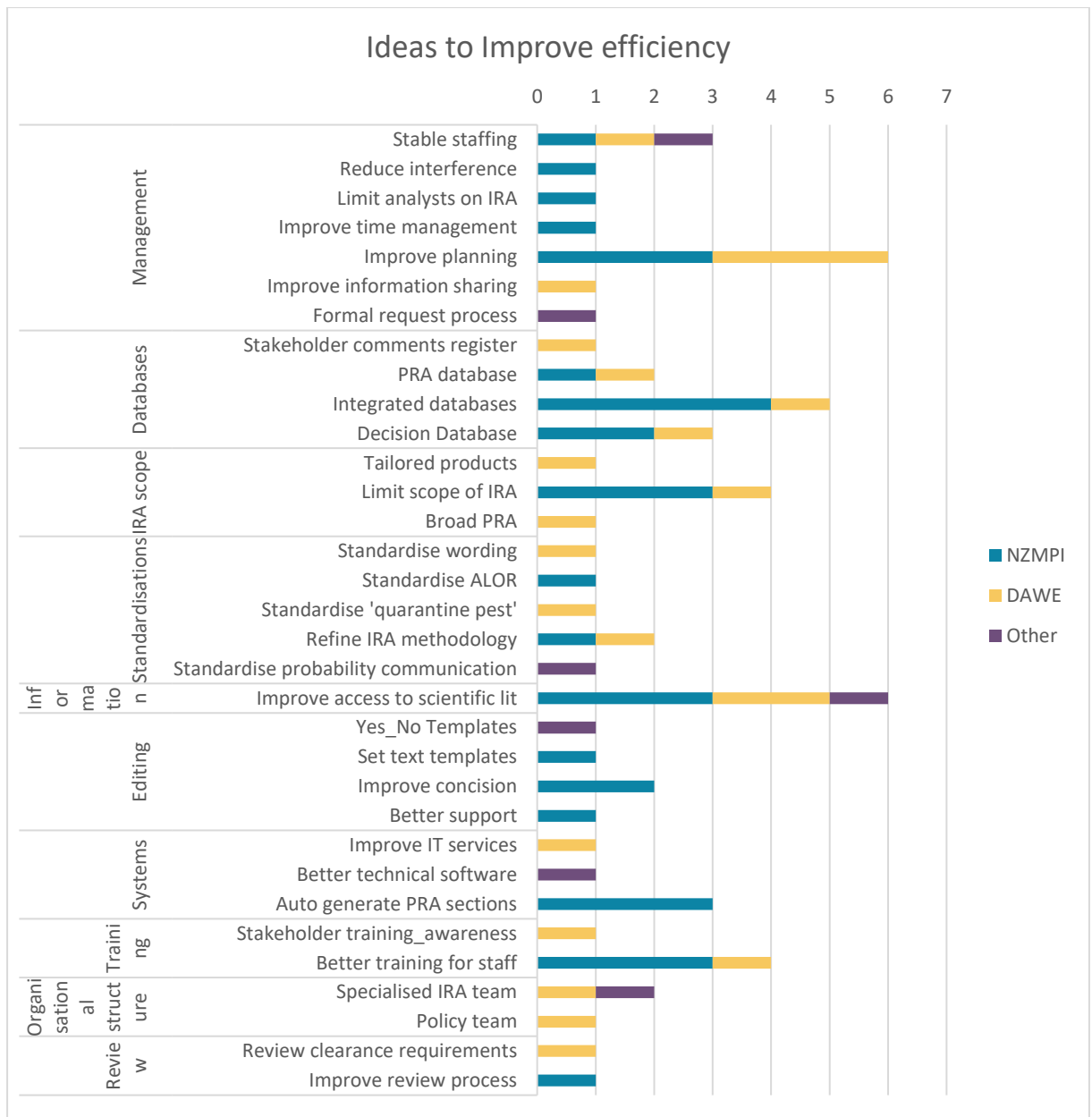
Figure 3-2: Count of identified themes for improving efficiency, stratified by organisation, and grouped into 10 categories.

3.2 DISCUSSION

3.2.1 Overview

In summarising these results, two important limitations constrain what we can say. One is the number of responses – 48 total, 21 for MPI, and 19 for DAFF. This number of responses might be a fairly good outcome for this kind of survey, but the numbers become quite small as we look at sub-groups. For example, we had only three responses from managers at MPI. Another limitation is that the respondents were self-selected and so might differ in some ways from the staff who did not respond.

Keeping these limitations in mind, the results paint a general picture of IRA production at MPI, with some context provided by data from the other organisations.

Experience. MPI analysts have been working on IRAs for 4-5 years on average, which seems to be less than at other organisations. (We were told that MPI recently recruited a number of analysts, and these newer recruits might have been more likely to respond to the survey.) MPI managers have been on the job for around twice as long.

Productivity. Analysts and managers at MPI spend a bit over half their time working on IRAs, and work on 1-2 IRAs at any one time. At MPI, it takes 13 calendar months to complete an IRA, during which time 6.2 MPI analysts will contribute to its development. This is in contrast with DAFF, which takes around 20 calendar months to complete an IRA, during which time only 3.5 analysts will contribute to its development.

DAFF and MPI make similar estimates on how many 'analyst months' an IRA takes to complete (24.5 vs 29.1).

MPI managers estimated about twice as many analyst months, though we suspect that the managers would be counting a wider range of activities under the heading of "producing an IRA."

Interestingly, individuals from organisations other than MPI and DAFF report far less time completing an IRA and with fewer analysts (5 calendar months vs 13 for MPI and 20 for DAFF and 1.5 analysts vs 6.2 for MPI and 3.5 for DAFF). We do not have an evidence-based explanation for this anomaly, but we think it likely has to do with process and requirement differences between the organisations.[7] Moreover, although the difference was large, the number of responses was small, with only one respondent from each of the other organisations, so we must treat the figures cautiously.

Use of time. The most time-consuming activity for MPI analysts is conducting pest risk assessments; this takes up almost half the time they spend on IRAs (or around a quarter of their time, total). Their various activities (hazard identification, pest risk assessment, etc.) involve various kinds of work; of these, the most time-consuming are searching for and obtaining relevant literature, and digesting that literature (making sense of the literature and incorporating it into the analysis). MPI managers spend the greatest proportion of their time initiating IRAs, and overseeing production of IRAs.

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[7]   A reviewer of this report suggested that a possible explanation is the use of external organisations to conduct IRAs. It is claimed that these organisations have higher levels of competency when compared with government organisations, particularly with respect to biosecurity expertise.

Challenges. MPI staff identified many (19) different challenges to efficient IRA production; additional ones were identified by staff of other organisations. The most-mentioned challenge, at MPI and elsewhere, was access to scientific literature.

There were of course some differences between MPI and DAFF. Notably, DAFF respondents much more likely to mention "stakeholder engagement difficulties". Reviewing the responses themselves, we conjecture that this is due in significant part to Australia having larger and more powerful domestic lobbies.

Ideas. Analysts and managers also had many different ideas for improving efficiency (160 total ideas; 30 different themes; 18 themes identified by MPI staff). The most frequent idea for improving efficiency from MPI was to develop 'integrated databases' (4 mentions). At equal second most mentioned (3 mentions) were: 'improve planning', 'limit scope of IRA', 'improve access to scientific literature', 'auto-generate PRA sections' and 'better training for staff'. At a higher-level, the top themes for MPI were 'better management' and 'improved databases'.

3.2.2   Implications for improving efficiency

What can we learn for the project goal of improving efficiency?

In this initial survey, the theme which emerges most strongly is improving access to scientific literature. This is the most time-consuming type of work for analysts, the most frequently mentioned challenge to efficient IRA production (by far), and the equal most mentioned idea for improving efficiency. Anecdotally, limited or delayed access to scientific literature causes frustration for analysts, reducing overall job satisfaction.

Next, some evidence suggests that developing and maintaining better databases would improve efficiency. The second most referenced challenge to efficient IRA production was inaccurate or missing information, and the equal most referenced category of idea was 'databases'. Although not a quick fix, well-developed and maintained databases could help provide more accurate information that is easier to retrieve than current systems. Over time, as the database grows, we would expect to see big gains in efficiency as accurate information will be more readily available to the analyst. DAFF has already made significant advances in this direction.

However we were not ready to conclude that MPI should immediately take up these two opportunities. The survey results needed to be integrated into the larger Opportunity Map, which then had to be evaluated with MPI input. Indeed, in the Opportunity Evaluation activity, it emerged that access to the scientific literature was a well-understood challenge at MPI, improving access had been considered, and that for this project it would be more productive to focus on other, more novel opportunities.

4   Opportunity Map

The opportunity map synthesizes a range of strategies and ideas that MPI could utilise to improve the efficiency of IRA production.

4.1   MAP DEVELOPMENT

The map draws on opportunities emerging from three sources:

1. Research team – Thirteen opportunities were developed using the results from a survey of available literature, conversations with biosecurity staff from multiple organisation and ideas from the research team.

2. DAFF – We received a list of eleven strategies that DAFF had attempted to implement at their organisation. The list included descriptions and how successful (or unsuccessful) the strategy was.

3. Survey – Thematic analysis of the responses to 'Ideas for improving efficiency' yielded 32 opportunities.

We ended up with 56 opportunities from the three sources. There was a fair amount of similarity and overlap between them, so we merged them via thematic analysis, similar to how ideas and challenges were extracted from the survey results (s.2.6):

1. **Collation**. We gathered all opportunities from the three sources as well as their descriptions, and in cases where the opportunity was taken from the survey, the theme it represents.
2. **Generate initial codes**. Here we combined opportunities if they were essentially the same. If the opportunity arose in the survey, we used the survey code. In other cases, we generated a new code.
3. **Identify themes**. From the list of codes, we identified themes from the similar and overlapping codes.
4. **Review**. We reviewed the list of themes, ensuring that they accurately captured the full range of opportunities that were gathered from the three sources.

The result was 37 distinct opportunities in eight themes.

Once the merge was complete, the map could be assembled. Each opportunity in the map is given a brief description and augmented with some data (where available) from:

- Survey responses – text in quotation marks is taken directly from a survey response.
- Popularity of opportunity – if the opportunity came up in the survey results, we have indicated how many times it came up

4.2   OPPORTUNITY MAP OVERVIEW

Table 4-1 provides an overview of the 37 opportunities, their source and where available, survey support. They are grouped into eight categories and within each category, opportunities are ordered by survey popularity; those nominated most often by survey participants are presented first. The full list of opportunities and their descriptions can be found in Appendix 4 - Opportunity Map.

Table 4-1: Overview of the opportunity map. Displaying category, opportunity, source (Survey, Research Team (RT) or DAFF) and level of survey support where available. See Appendix 4 - Opportunity Map for more detail on each of the opportunities.

Category	Opportunity	Source	Survey support
Analyst Productivity	Improve staff training	Survey	4/61
	Retain experienced analysts for longer	Survey	3/61
	Focus analyst workload	Survey, RT	1/61
	Accelerate expertise development	RT	
	Select for most productive analysts	RT	
Management	Improve planning	Survey	6/61
	Reduce interference from risk managers	Survey	1/61
	Reduce number of analysts working on a particular IRA	Survey	1/61
	Improve information sharing	Survey	1/61
	Formal request process	Survey	1/61
Org Structure	Specialised IRA team	Survey	2/61
	IRA policy team	Survey	2/61
	Stakeholder engagement team	DAFF	
Review and engagement	Review clearance requirements	Survey	1/61
	Streamlining the review process	Survey	1/61
	Stakeholder training/awareness	Survey	1/61
Standardisations	Standardise/refine risk assessment methodology	Survey	2/61
	Standardise acceptable level of risk (ALOR)	Survey	1/61
	Standardise how probabilities are communicated	Survey	1/61
	Standardise 'quarantine pest'	Survey	1/61
Work reduction	Improve access to scientific literature	Survey	6/61
	Limit scope of IRA	Survey, RT, DAFF	4/61
	Broad PRA	Survey, RT, DAFF	1/61
	Tailored products	Survey	1/61
	Improve editing support	Survey	1/61
	Exploit redundancies	RT	
	Greater use of presumptions or defaults	RT	
	Use existing policy	DAFF	
	Share burden of work with others	RT	
	Collaborate more with other biosecurity organisations internationally	RT	
Work Scaffolding	Templates	Survey, RT, DAFF	2/61
	Structured drafting environment (SDE)	RT	
	Stakeholder comments register	Survey	1/61
Systems	Integrated databases	Survey, DAFF	10/61
	Auto-generate PRA sections	Survey	3/61
	Improve IT services	Survey	2/61
	AI – Argument processor	RT	

5 Opportunity Evaluation

The opportunity map formed the basis of an evaluation exercise aimed at selecting two opportunities – one actionable opportunity, and one for longer-term development. The evaluation exercise consisted of a two-hour workshop, preceded by an appraisal of the opportunities by workshop participants.

5.1 APPRAISAL

The appraisal was meant to help focus attention in the workshop on the opportunities most worth discussing, since there would not be time to consider all 37.

5.1.1 Design

In a simple survey, the workshop participants were asked to evaluate the opportunities that they deemed worthy of evaluation (and ignore the ones they didn't) providing a rating in the form of a score out of 100 along each three dimensions. The dimensions were explained to participants in the following way:

1. **Efficiency gain** – How much do you think this opportunity would improve efficiency? For example, if you think an opportunity would greatly increase efficiency, you might rate it 95/100
2. **Feasibility** - How feasible is the opportunity? Consider things like cost of implementation, willingness of staff to adopt and how long would it take to implement.
   For example, if you think the opportunity would be prohibitively expensive to implement, you might rate it 5/100
3. **Risk** - Would the opportunity lead to a reduction in the quality of work? Would pests continue to be assessed properly?
   For example, if you think an opportunity wouldn't hamper the quality of the work at all, you'd rate it close to 100.

Participants were presented with a sliding scale for each dimension, without specific labels at either end. This strategy aimed to keep the evaluations simple and expeditious as there were up to 37 opportunities to evaluate.

We also provided the option for participants to leave comments for each opportunity should they wish to explain their evaluation.

This exercise was optional.

5.1.2 Results

We obtained 7 responses. Since respondents were free to ignore opportunities they deemed to be not worth evaluating, opportunities received varying numbers of ratings. All 37 opportunities received at least 2 evaluations, and 78% received 6 or more.

There were various ways we could aggregate the ratings an opportunity received on a criterion to get a score, given the complication that opportunities received varying numbers of ratings. An obvious idea would be to take the mean of the ratings provided, but this would effectively discard the informational value of an opportunity *not* being rated by a

particular rater. We settled on taking the sum of the ratings provided.[8] For a higher score to represent a better opportunity, the ratings for the risk dimension were first inverted (100-rating).

We then combined the scores for each opportunity on each dimension into a simple linear multi-criteria decision matrix:

Opportunity	Efficiency gain		Feasibility		Risk		Sum
	Raw	Weighted	Raw	Weighted	Raw	Weighted	
Integrated databases	662	662	501	501	594	594	1757
Improve access to scientific literature	655	655	463	463	581	581	1699
Improve staff training	525	525	587	587	535	535	1647
Templates	516	516	546	546	571	571	1633
Structured Drafting Environment	606	606	459	459	561	561	1626
Retain experienced analysts for longer	583	583	381	381	507	507	1471
Improve information sharing	521	521	376	376	570	570	1467
Improve IT services	524	524	365	365	554	554	1443
Auto-generate PRA sections	511	511	429	429	487	487	1427
Improve planning	457	457	441	441	499	499	1397
Use existing policy	456	456	453	453	460	460	1369
Limit scope of IRA	440	440	424	424	483	483	1347
Accelerate expertise development	417	417	436	436	476	476	1329
Streamline the review process	402	402	430	430	434	434	1266
Select for more productive analysts	431	431	349	349	442	442	1222
Stakeholder comments register	421	421	444	444	329	329	1194
Focus analyst workload	368	368	441	441	381	381	1190
Standardise 'quarantine pest'	311	311	447	447	430	430	1188
Reduce number of analysts working on an IRA	397	397	399	399	385	385	1181
Collaborate more with other biosecurity organisations	411	411	328	328	438	438	1177
Refine risk assessment methodology	396	396	340	340	430	430	1166
AI - Argument processor	443	443	291	291	401	401	1135
Improve editing support	367	367	356	356	401	401	1124
Standardise how probabilities are communicated	316	316	340	340	457	457	1113
Exploit redundancies	360	360	353	353	398	398	1111
Stakeholder training/awareness	367	367	260	260	456	456	1083
Greater use of presumptions or defaults	393	393	371	371	299	299	1063
Tailored products	457	457	320	320	279	279	1056
Standardise acceptable level of risk	341	341	304	304	289	289	934
Reduce interference from risk managers	331	331	280	280	269	269	880
Stakeholder engagement team	275	275	286	286	317	317	878
Specialised IRA team	317	317	238	238	283	283	838
Broad PRA	319	319	210	210	301	301	830
Share burden of work with others	320	320	247	247	251	251	818
IRA policy team	268	268	243	243	291	291	802
Review clearance requirements	182	182	183	183	177	177	542
Formal request process	188	188	156	156	178	178	522
Weights							
Efficiency gain	1						
Feasibility	1						
Risk	1						

Figure 5-1: Screenshot of the multi-criteria matrix. The relative importance of the criteria can be adjusted by changing the weights at the bottom of the table. The matrix spreadsheet is available at https://osf.io/mge4k

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[8] For example, if the scores received for 'Integrated Databases' under the feasibility dimension were 68, 87, 66, 78, 82, 55 the feasibility score for 'Integrated Databases' would be 436 (68 + 87 + 66 + 78 + 82 + 55 = 436).

How each opportunity fared overall with uniform weights (i.e., with criteria deemed equally important) is presented in the chart below:
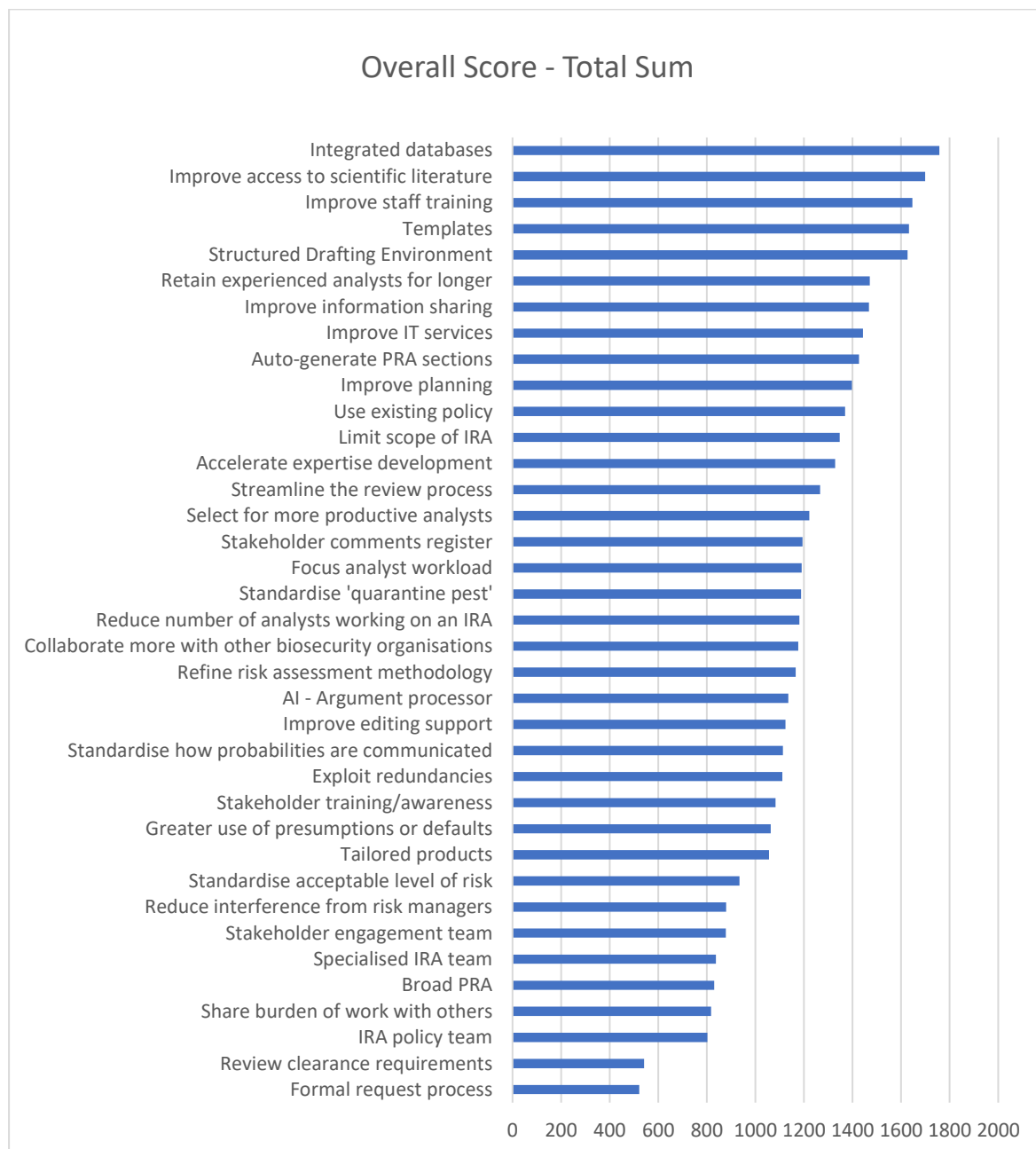
Figure 5-2: Overall score of each opportunity with uniform weights. The overall score for an opportunity is just the weighted sum of its scores on each criterion.

5.2 THE WORKSHOP

The appraisal exercise alone wasn't intended to be, nor would it be sufficient for, determining which opportunities to pursue. For MPI to make their selections, we organised a workshop where we could present the appraisal data as input to a deliberative selection process.

The workshop was facilitated by the research team and attended by 10 MPI staff including a senior manager. After a brief introduction and presentation of the pre-workshop appraisal data, we used dialog mapping (Conklin, 2005) to stimulate and focus discussion, and succinctly record key parts of the deliberation. In dialog mapping, a trained facilitator using custom software captures, in real time, on a shared display, the contributions made by participants, by building a node-and-arrow "map" using a small number of node types, the most central of which are Question, Idea, Pro, and Con.[9] The resulting map is usually not meant to be a comprehensive analysis of the issue, but a reflection of the major deliberative moves made in the discussion.

Two dialog maps emerged in the workshop – one for the actionable opportunity, and one for the longer-term opportunity.
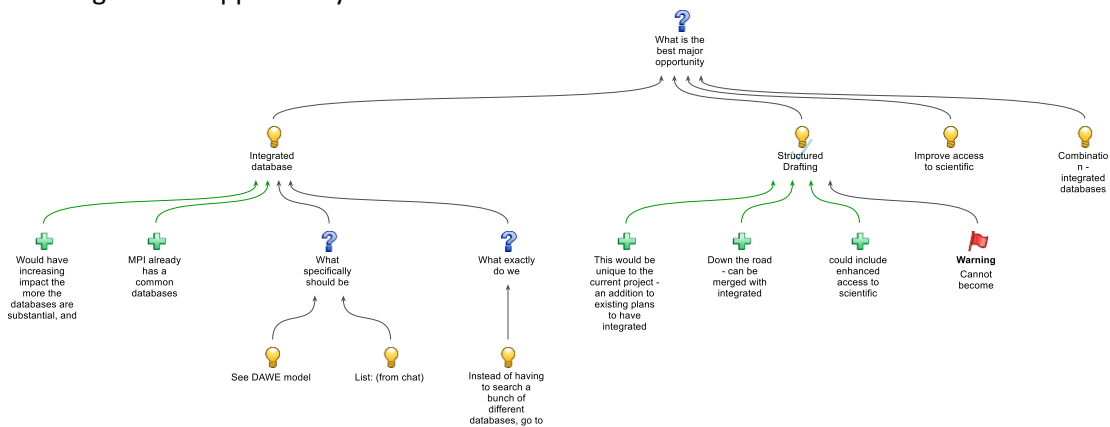
Figure 5-3: Dialog map capturing some of the deliberation in the workshop around the selection of a longer-term opportunity. Larger (more readable) versions are available in Appendix 4.

5.3 OUTCOMES

The workshop identified the following opportunities:

1. Short-term opportunity – CASE Templates
2. Long-term opportunity – Structured Drafting Environment (SDE)

5.3.1 CASE Templates

This opportunity scored well under two of the criteria used in the appraisal (feasibility and risk) but was thought to only offer a modest efficiency gain. The opportunity was suggested by all three of the available sources (research team, DAFF and the survey).

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[9] The facilitator was one of the report authors, van Gelder, who has had considerable experience running dialog mapping-based workshops.

The workshop helped to refine what would be pursued with a number of specifics fleshed out:

- Templates should promote succinctness/minimalism by limiting the number of words and including only the information required by the decision maker.
- The template should focus on key questions that will help determine the outcome of each assessment.
- The template should operate to improve consistency across PRAs.
- Risk managers should be involved in their development

A key reason for selecting this opportunity was that it could feed into the longer-term opportunity, the SDE. The SDE might build in CASE templates, allowing them to be filled out within the environment and then compiled into the appropriate document.

Moving forward with this opportunity, the research team would:

1. Develop a CASE-formatted PRA template
2. Trial the template in an MPI IRA project and evaluate whether it offers efficiency gains.

5.3.2 Structured Drafting Environment (SDE)

The SDE scored well on potential efficiency gain and risk but was rated relatively low on feasibility. This is unsurprising given the scope of the strategy and the likely cost of development and implementation. Despite this, it was thought of as the 4th best opportunity overall for improving efficiency.

Nonetheless, the workshop identified it as the long-term opportunity to pursue. After discussing 'integrated databases' as the forerunner, we learned that MPI already has plans to pursue something similar, and for this project, they would prefer a novel opportunity. An SDE was thought to offer different but related advantages to 'integrated databases':

- Unique opportunity
- Later in development, could be merged with 'integrated databases'
- Could include opportunity to provide improved access to scientific literature
- Would cohere well with the short-term opportunity, 'templates'.

6 CASE-structured templates

The short-term or actionable opportunity selected was 'CASE-structured templates'. These were thought likely to improve efficiency by reducing the effort that goes in to developing and drafting PRAs, limiting the number and severity of peer review corrections and improving stakeholder/decision maker comprehension.

To evaluate whether the template had improved efficiency, we piloted its use for developing PRAs with the MPI *Humulus* Project. Each member of the working group used the template to develop a PRA for the project, after which we surveyed the working group for the views on the impact of template use on efficiency.

6.1 CASE TEMPLATES

CASE-templates are so-called because they structure sub-sections within a PRA using the CASE argument scheme. The acronym CASE stands for "Contention, Argument, Evidence, Source."[10] In essence it is an *argument scheme*, a kind of template for a common pattern of reasoning or argumentation (Walton et al., 2008). The core CASE scheme is the kernel of a more complex, dynamic scheme with more components, complemented by a body of theory, guidelines and techniques for articulating, structuring, strengthening and presenting reasoning on almost any topic. A previous CEBRA report investigating the impact of using CASE in IRA reports at MPI provides a richer description of CASE and its history at MPI (Kruger et al., 2021b, pp. 7–13).

The principles of CASE used to structure the PRA subsections can be seen in the 'Entry Assessment' taken from the template (Figure 6-1). They are, in brief, that the contention is stated at the top as an assessment of risk for a specific pathway e.g., entry via PEQ, and includes an uncertainty statement. This is followed by several reasons that support the assessment, each with sub-arguments which in turn have evidence statements and the source of the evidence nested beneath.

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[10] In the acronym, Evidence and Source are switched to get CASE rather than CAES. The two are pronounced the same way.
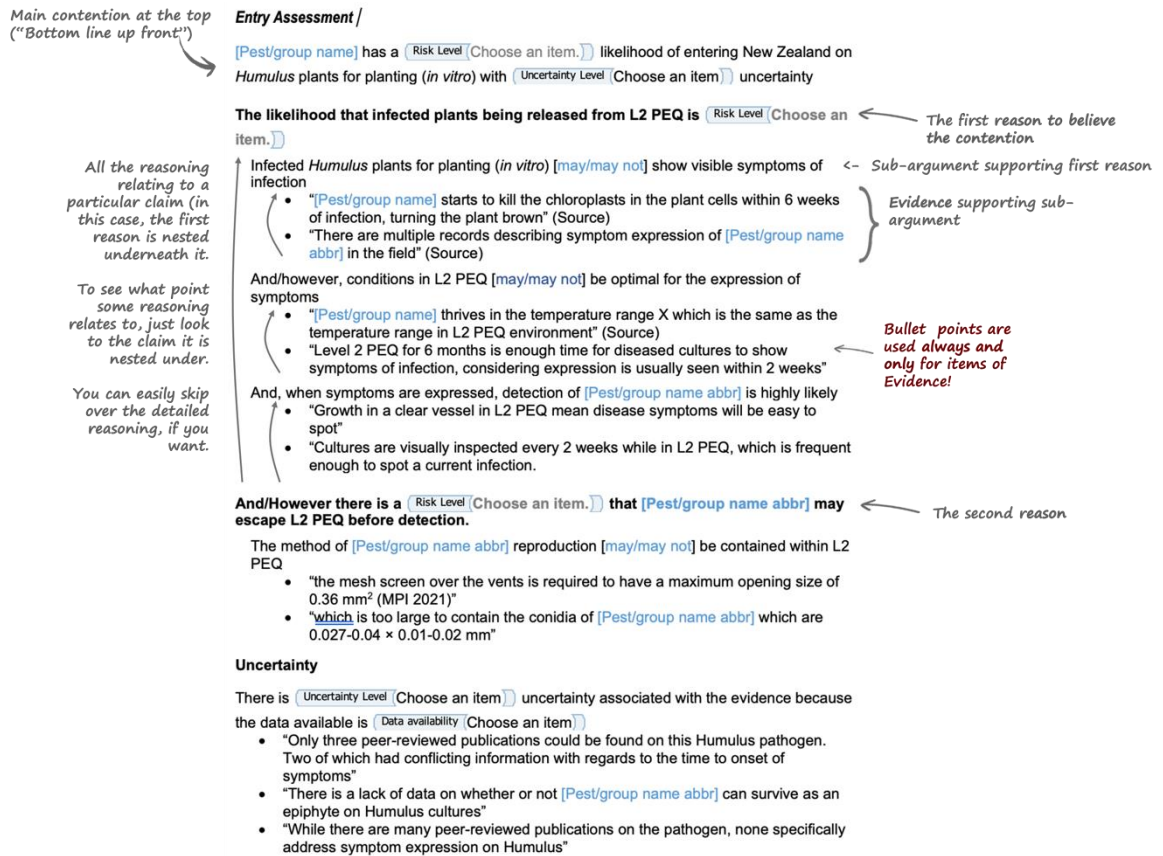
Figure 6-1: Annotated example showing the CASE structured PRA subsection 'Entry Assessment' for the *Humulus* IRA. L2 PEQ means level 2 post entry quarantine.

Note also some other features of the template:

- Drop down menus to select levels of risk and uncertainty (Risk Level Choose an item.)
- [Pest/group name] gets automatically replaced throughout the template, with the name of the pest or disease, using a Word macro stored in the template document.
- Other text appearing in blue ([may/may not]) indicates where the analyst needs to make a decision. In the example, the analyst needs to determine, based on the evidence, if the pest may or may not cause visible symptoms of infection and whether level 2 PEQ will contain the pest.

6.2 DEVELOPING THE TEMPLATE

6.2.1 CASE Structure

Two core principles of CASE were used to structure the PRA-subsections: 1) the principle of abstraction and 2) the rabbit rule.

Principle of abstraction

Essentially, the principle of abstraction requires each level in an argument to be an abstraction relative to the level below. Adhering to this principle helps ensure that there is a clear logical connection between detailed evidence and top-level conclusions.

In Figure 6-1, the 'reasons' in bold text are at the highest level of abstraction and nested directly beneath is the sub-argument which is at a lower level of abstraction. Finally, bullet pointed evidence items are specific and thus at the lowest level of abstraction.

For more detail on how the principle of abstraction was used to structure the template see the Appendix s.15.1 Principle of Abstraction.

The 'Rabbit Rule'

The 'rabbit rule' is a rule of thumb that helps ensure that important assumptions are identified and, where appropriate, articulated. The rule states that all significant terms in an upper argument layer should appear in the layer beneath. It is called 'the rabbit rule' because if a term appears in an upper layer but not below, then the term has come "out of nowhere," like a magician's rabbit out of a hat.

When a significant term in an upper argument layer is not represented below, the 'rabbit rule' tells us that there may be a missing assumption, and the term itself gives us a clue to what that missing assumption is.

We made use of the rabbit rule when developing the template, by applying it to all the arguments that were constructed, ensuring that important assumptions are not left implicit. We relied on the expertise of the MPI working group to determine if an assumption, once identified, should be considered important enough to be explicitly included in the template.

For more detail on how the 'Rabbit Rule' was used applied to the template see Appendix s.15.2 Rabbit Rule.

6.2.2   Biosecurity/Commodity Specific Guidance

To help guide analysts to relevant content and considerations, we included information within the template that was specific to the interaction between pests and a specific commodity, which in our case, was *Humulus* cultures. That information was then used to develop CASE arguments that were general enough to be used for all pests associated with the commodity, and specific enough to guide analysts in their search for information. We drew on a variety of sources for this information, including: 1) a template MPI developed at the start of the *Humulus* project, 2) the research working group and 3) previous examples of PRAs.

The commodity specific information was integrated into the template as 1) a contention 2) reasons and sub arguments specific for the commodity type and 3) as examples of specific evidence items that support sub-arguments both of which can be seen in Figure 6-1. How this information guides the analyst is explained in Table 6-1:

Table 6-1: Explanation of how each element in the exposure assessment is integrated with commodity-specific guidance

CASE Element	Guides the analyst by…
Contention	…focusing their attention on what the entry assessment will be seeking to establish. Namely, the likelihood that the pest will enter NZ on *Humulus* cultures.
High-level reasons (bold text)	…providing a high-level reason for believing the contention that is specific to the commodity. For *Humulus* cultures, the main determinate of likelihood of entry, is whether or not the pest will be detected in PEQ
Sub-argument	…laying out the commodity specific reasons to believe the high-level reasons. For *Humulus* cultures, there are three sub-reasons that an analyst should consider when accounting for whether or not a pest is detected in PEQ
Evidence items	…providing examples of evidence that would support the sub-arguments and higher-level reasons.

6.2.3   Commodity specific example book

To complement or augment the template, we produced a separate document containing exemplars of CASE formatted PRA sub-sections. The document is organised by PRA subsection and then by the claim made in the high-level argument. Each exemplar deals with a different circumstance and shows the analyst how they might structure an argument in this circumstance, and what kind of evidence would be required to support the argument.

The example book was designed to be a repository of arguments dealing with the variety of circumstances that arise when assessing the risk from different pests. Analysts benefit by seeing what a complete argument for the particular claim looks like, and they can either copy/paste directly into their own PRA or modify it to fit their circumstance.

Currently the document contains 22 exemplars, each dealing with a different circumstance. As more PRAs are completed using the template, they can be added to the example book.

See Appendix - 15.3 for an example.

6.3   PILOTING THE TEMPLATE

The CASE Temple was piloted with the "*Humulus* (hops) plants for planting (*in vitro*)" project, recently commenced at MPI (April 2022). All four members of our working group were involved in the project and used the template to develop and draft a PRA for the IRA. We then surveyed the working group to get a sense of how the template performed. Although the sample surveyed was small, the template shows promising signs for improving efficiency.

The survey sent to analysts after they used the template to complete a PRA was the source of data used to evaluate if the pilot was successful. The survey was short (15 mins), and asked the four analysts from the working group to indicate the degree to which they agreed with a range of statements in four categories:

1. **System Usability Scale** – a set of 10 statements wide used to measure the usability of a system (Kortum & Bangor, 2013). Statements were adapted from the standard list of statements[11] to fit with this project.
2. **Time-reduction** – 5 statements designed to capture if, and the degree to which, time reductions were achieved when structuring, editing and searching for information relevant to the PRA.
3. **PRA quality** - 5 statements describing potential improvements in the quality of the PRA, including statements about consistency and logical transparency.
4. **Stakeholders and decision makers** – 3 statements about potential improvements to stakeholder and decision maker understanding.

How the participants responded to each statement on the System Usability Scale is described in the figure below:
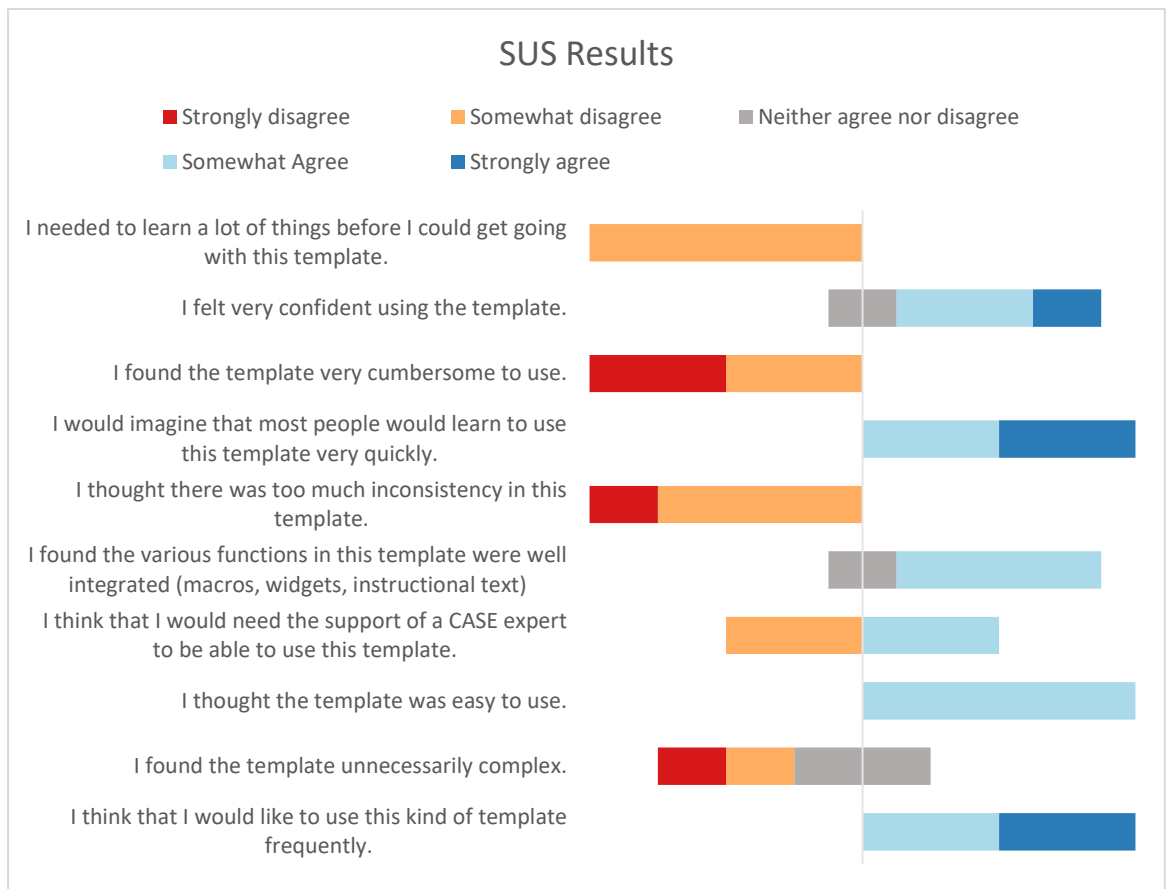
Figure 6-2: Reponses to the System Usablity Scale statements. Note that half the statements are framed positively ("I felt very confident using the template"), and the other half are framed negatively.

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[11] https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html
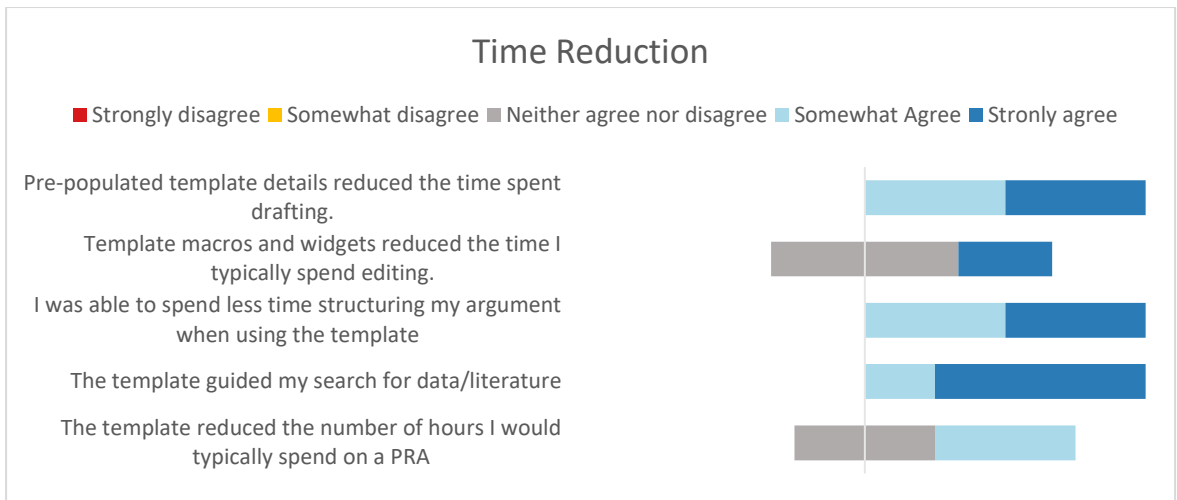
Figure 6-3: Responses to statements regarding time-reducutions potentially offered by the template.
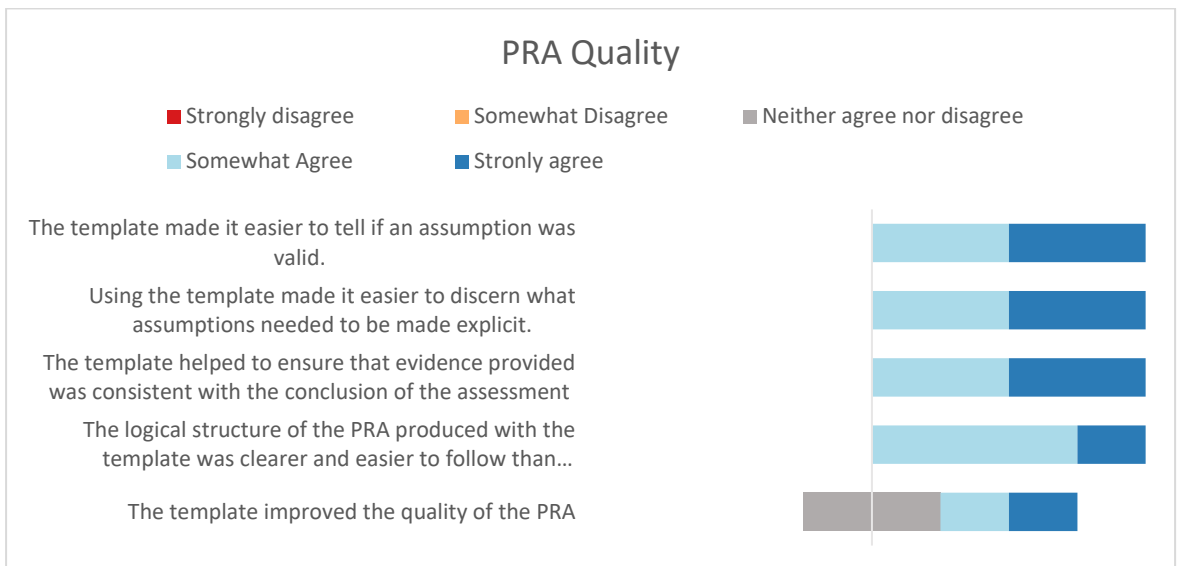
Figure 6-4: Responses to statements about how the template affected PRA quality.
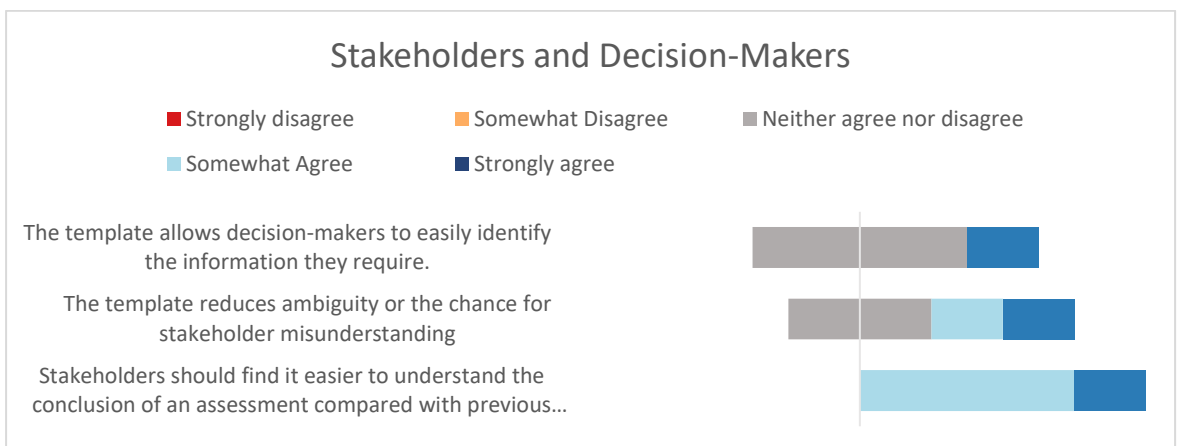
Figure 6-5: Responses to statements regarding stakeholder and decision-maker comprehension.

6.4 DISCUSSION

Bearing in mind the small number of respondents (4 analysts), the survey results indicate the template was favourably received.

We can perhaps be most confident in the SUS results as it has been shown to be reliable even with as few as two responses (Sauro, 2011). When 500 studies using the SUS were reviewed, the average score was found to be 68 (Sauro, 2011). The template scored a 75 which, when viewed in the context of the 500 studies, suggests that it had a higher perceived usability than 70% of all systems tested. While the SUS hasn't told us that the template reduced the effort involved, it has provided some evidence that the template is a usable system for developing and drafting PRAs.

The other results tell us more about any potential improvement in efficiency:

1. Most agreed that the template structure and guidance reduced time spent drafting, structuring arguments and searching for data/literature
2. Most agreed that the template improved the various components of PRA quality. However, responses were less positive about any overall improvement in the quality of the PRA.
3. Responses were more neutral for whether the template could potentially aid stakeholders and decision makers, although there was general agreement that it would improve their understanding of PRA conclusions.

It is clear how reductions in time spent developing and drafting PRAs helps improve efficiency. An improvement in PRA quality should also help improve efficiency because a high-quality PRA is less likely to attract corrective feedback from reviewers. Fewer corrections mean fewer revisions and thus more time being available for other tasks.

Similarly with improvements to stakeholder/decision-maker comprehension: if stakeholders or decision makers have an easier time understanding the information they require to make a response or decision, there should be less need for interaction with those parties.

Unfortunately, the data we were able to gather prior to delivery of this report is limited to the survey. Other data will become available as the template is used within MPI to develop and draft PRAs, including:

1. Peer-review data – As the PRAs developed with the template go through their formal review process, the number and severity of corrections should become available.
2. Time-data – When more PRAs for the *Humulus* project are completed, an average time taken should start to emerge. We could then compare this data with data from other projects.

Is there a net gain?

Developing the CASE template for *Humulus* took quite a bit of time and effort from the research team (including the working group members) and needed the involvement of an expert in CASE (Kruger).

To assess whether there was a net gain in efficiency in the pilot exercise, we must weigh the apparent gains from use of the template, as indicated in the survey responses, against the cost of template development. It is not clear, on this occasion, that the balance is a net gain.

Any subsequent template development should be more efficient, due to increased experience, lessons learned, and the availability of Humulus template as an exemplar.

In the concluding section we suggest attention to this issue as a potential direction for further research.

It may be that the efficiency gains and costs associated with CASE templates roughly cancel out, but the template approach is still preferred because of other benefits, such as greater consistency across PRAs and more rigor and transparency in reasoning.

7   Structured Drafting Environment

As described in Section 5, the MPI workshop group selected a Structured Drafting Environment (SDE) for IRAs as the most promising major, longer-term opportunity.

A SDE for IRAs is a server-based software platform designed specifically to support teams of analysts and managers to produce a completed IRA. A good analogy is the Australian Taxation Office's myTax, its online system enabling taxpayers to prepare and lodge their tax returns. myTax has many advantages over the traditional system of manually filling out paper tax return forms. For example, it can pull in data from elsewhere in the ATO's systems and auto-fill many components, and it can automatically check for many errors and omissions. These kinds of capabilities save considerable time and effort for the ordinary taxpayer, and just as importantly, for the ATO.

An SDE for IRAs, then, is a kind of myTax built specifically for IRA development. Instead of using Word to draft IRA sections, the team members would use their browser to log into the SDE and make their contributions there. This should provide efficiency benefits of the kind provided by myTax, plus additional ones arising from the SDE's being tailored to the specific context of IRA in the MPI context.

In this final section we briefly elaborate the concept of an SDA, providing:

1. A more detailed description of what a SDE for IRAs is, illustrating with a mock-up;
2. A list of ways in which a SDE could improve efficiency; and
3. Some further considerations relevant to potential development and implementation.

7.1   OVERVIEW OF A SDE FOR IRAs

At the top level, the SDE constitutes a kind of template for entire IRA documents. The template would have sections for common or repeatable components of such documents, such as the general description of import risk analysis process. It would also be easily configurable to have as many sections as needed for each of the constituent PRAs.

7.1.1   Major features

Sub-section templates

An important design issue for an SDE is how detailed or granular to make the template. A relatively coarse-grained SDE, for example, would provide fields for analysts to draft or paste in whole sub-sections of PRAs, such as an entry assessment. However, the SDE could also provide highly granular drafting templates similar to the CASE template developed in this project.

Integration with other databases

As an online system the SDE would be integrated with other databases held by MPI and (where feasible and appropriate) other organisations. Indeed, the SDE would necessarily be built on top of a database system and can be seen as essentially just another database with a custom interface supporting analysts and managers to create sets of records which can be compiled and exported as IRA documents.

Automated population of content

The SDE would be able to auto-populate many parts of an emerging IRA. For example, it could insert standard material ("boilerplate"); insert at all relevant places IRA-specific information provided by the team, such as pest names; and pull in material from other databases via the integrations mentioned just above.

Automated provision of relevant material

The SDE would be able to automatically locate and make available for analysts' consideration relevant or useful material. For example:

- When working on a particular PRA, it is helpful for an analyst to be able to view and draw on work done on that pest in a different context, e.g., another IRA by MPI or some other organization. Instead of having to hunt down that material, the analyst could find it ready to hand via auto-assembled links on a convenient tab.
- The SDE could automatically conduct searches of scientific literature using queries appropriate to the particular task an analyst is working on, and compile results.

Automated calculation and updating

The SDE would be able to automatically calculate/update values which depend in rule-governed ways on other values. For example, it could calculate the unrestricted risk for a given pest in accordance with the matrices in the organisation's risk assessment methodology, given the analysts' determinations of the various components.

Reference management

The SDE would have an inbuilt reference management system, (likely be achieved by incorporating an existing system) and common database of references.

Workflow management

The SDE could have integrated workflow management, with functions such as assigning tasks to analysts, progress monitoring and reporting, and management of review and signoff processes.

Automated document assembly

The SDE would be able to compile all the relevant material into an IRA document, and output that document in a convenient format such as Word (.docx) or PDF. This automated assembly process would take care of many tedious and time-consuming aspects of IRA production such as ensuring consistent formatting across the document, adding and updating parameters such as version numbers and dates, and auto generating a bibliography.

Inbuilt guidance

The SDE would have inbuilt guidance for new users. This can take many forms, such as simple hover-tips; short on-page instructions; pop-ups with examples illustrating the kind of contribution an analyst should make at a particular place; and links to other documents such as manuals or policies. The system should support guidance being turned off for expert users, in order to reduce interface clutter.

7.1.2   SDE Mock-up

As part of this project, we developed an interactive mock-up of a SDE using a "no code" online database environment (knack.com). Although very simple and incomplete, the prototype was useful as an illustration-of-concept and for stimulating discussion.

Figure 7-1 shows a screenshot taken from the mock-up. On this page, the analyst is editing an entry assessment for a particular pest (*Verticillium nonalfafae*) associated with a commodity (*Humulus*). Under the heading "Rationale" there is a rich text field for entering the reasoning supporting the analysts' likelihood of entry judgement. In this case the field is pre-populated with a CASE template for drafting the rationale.

Figure 7-1: Mockup of the interface of a page in a SDE for IRAs.

7.2   HOW A SDE COULD INCREASE EFFICIENCY

Given the features above, individually or in combination, a well-developed SDE for IRAs would plausibly deliver efficiency gains in various ways, including:

- Reducing the time spent by analysts in routine tasks, e.g., via auto-population of content, or reference management;
- Reducing the time analysts spend identifying and accessing relevant materials;
- Helping new analysts get "up to speed," and thus more productive, more quickly and with less need for expert guidance.
- Reducing the time spent in task management and review processes;
- Reducing duplication of work; and

- Reducing the time analysts and managers spend wrestling with Microsoft Word/Office 365, with all its quirks and bugs.

In addition, development of an SDE would pave the way for introducing artificial intelligence (AI) into the IRA development process. There is no expectation that AI would completely replace human analysts. However, some forms of AI are already sufficiently well-developed that they could be exploited in an SDE developed over the next couple of years,[12] and we can expect rapid evolution in coming years. The increasing integration of AI is likely to result in large efficiency gains, strengthening the case for developing an SDE.

7.3 PREVIOUS SDE-TYPE PROJECTS

There are, to our knowledge, two important antecedents to the SDE for IRAs.

EPPO - CAPRA

In 2008-2010 the European and Mediterranean Plant Protection Organization (EPPO) developed CAPRA, or Computer Assisted Pest Risk Analysis (Griessinger et al., 2012). CAPRA was a Windows desktop application and can be seen as a prototype of a full SDE as described above. CAPRA was discontinued in 2022 and the software seems to be no longer available. Prior to CAPRA's discontinuation, we had succeeded in downloading, installing and exploring how it worked. From a current perspective, the interface feels clunky, and is very dated in appearance. More importantly, however, CAPRA was fundamentally limited by a single-user desktop application. Most of the key features and benefits listed above are only possible in a collaborative, server-based platform.[13]

DAFF: PDR and BARS

More recently, the Plants division of DAFF in Australia has made great strides in developing server-based systems to support their work. Of most relevance here are:

1. The Pest Disease Repository (PDR), which catalogues, stores, and presents the information, decisions, and underpinning evidence concerning pests and diseases; and
2. The Biosecurity Assessment Recording System (BARS), which is a flexible case management system for creating biosecurity risk assessments.

These systems are not designed for IRA development specifically, but rather to address more general business needs. However, they do already incorporate much of the functionality that would be needed in an SDE for IRAs. Thus, for DAFF the development of an SDE for IRAs is a natural and relatively feasible extension of their current suite of systems.[14]

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[12] For example, AI-augmented scientific literature search – see Elicit "The AI Research Assistant" – https://elicit.org

[13] At time of writing, we are still attempting to find out from EPPO why CAPRA was discontinued, how widely it had been adopted, and what lessons had been learned.

[14] We thank Wendy Odgers, Jenn Lloyd, and Olivia Jacobs from DAFF for providing a guided tour of these systems.

7.4 GENERAL COMMENTS ON SDE DEVELOPMENT AND ADOPTION

Development and adoption of an SDE for IRAs would certainly be a challenging, multi-year project. A detailed scoping of such a project is outside the scope of this project, but we make the following general observations.

First, there must be careful strategic planning so that the SDE integrates with and complements other systems (existing, currently being developed, or planned). In particular the distribution of content – where should material reside? – and work – in which system should particular types of work be done? – should avoid duplication and silos.

Second, there will be challenging design issues for the SDE specifically, including:

- **Granularity**. How finely should the SDE "slice and dice" the IRA development process? For example, should entire entry assessments be drafted by analysts in a single rich text box? Or should the SDE be more granular, breaking down the entry assessment into pathway components? A more granular approach would have a variety of advantages including yielding more consistency across the IRA, and facilitating more re-usability of components. However, it would take much more effort to develop and would potentially have other downsides, such as being too rigidly structured to accommodate the different forms assessments can take depending on factors such as the nature of the commodity and the pest.
- **Flexibility**. A closely related issue is the extent to which the SDE imposes a single structure on IRAs, as opposed to allowing variants, and whether those variants are fixed in advance or can be generated by the team working on an IRA.
- **Expertise**. There is a tension between providing scaffolding and other forms of support and taking over the analytic task. A well-designed SDE should not reduce the analyst's role to mundane tasks like information entry, and making piecemeal, lower-level judgements. Rather, it should handle routine aspects of the IRA development process, freeing up analysts to spend more time doing higher-level analytic thinking, deploying their expertise, insight and (as appropriate) creativity. As one member of the working group wrote: "If the analysts become too reliant on the system, they might not bring their full analytic capability to bear."

Third, the overall development plan and budget needs to consider the time and effort it will take to get into the system(s) relevant pre-existing material, such as the contents of older IRAs. To some extent this process can be automated, but it will still require considerable investment.

Fourth, while it is an obvious point, it is worth emphasizing that adoption of an SDE – effectively a whole new way of working – would be a significant culture change and would require sensitive change management. This would be needed both internally at MPI, and in relation to external stakeholders, who may have expectations grounded in existing ways of working.

As a final observation, we remark that the agile, in-house development process DAFF has been using to develop their systems (BARS, PDR and others) seems to have been working very well - based on their reports – and may be a good model to follow.

8 Concluding Comments

8.1 LIMITATIONS

The main limitation of this research is the limited and potentially biased nature of samples.

The initial survey relied on volunteers and while there was a reasonable number of responses overall, there is inherent danger of selection bias when relying only on a convenience sample.[15]

Our evaluation of the actionable opportunity (CASE templates) is based on the responses provided by the working group members, who used the template to develop *Humulus* PRAs. Their inputs to the development process, and survey responses, were very thoughtful and helpful. However, the working group members were enthusiasts for change and were optimistic about the actionable opportunity from the outset. The positive assessment drawn from their responses may be an optimistic take on the efficiency benefits in routine adoption.

Given the small numbers and the lack of systematic sampling, we opted to provide only simple descriptive summaries of the data and were generally cautious in our conclusions.

8.2 RESEARCH DIRECTIONS

Directions for possible further research include:

Research into IRA productivity based on objective data

The issue of how time and resources actually get spent in IRA production is important for both the evaluation of opportunities for increased efficiency, and for evaluating the implementation of any such opportunities. Our survey provided some insight, but this was based on subjective estimates of self-selected respondents. At least some aspects of this issue might be more rigorously addressed with quantitative data which might already be being gathered, or which might be gathered relatively easily.

More in-depth articulation of selected opportunities

In this project, the two selected opportunities (CASE templates, and SDE) were articulated far more extensively than the 35 other opportunities in the map. Further research could undertake similar investigation into other promising opportunities.

More rigorous evaluation of CASE templates

The piloting of CASE templates in the current *Humulus* IRA is the aspect of our research with the most immediate and tangible impact. While initial indications are positive, we have flagged that there is data yet to be gathered, which could provide better-grounded and more accurate insight into the net efficiency and quality impact of this initiative.

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[15] For example, participants who elected to respond might have been more likely to do so because they feel more frustrated with perceived inefficiencies, which might have influenced them to make higher estimates of the time and effort taken for IRA production.

Further development of the SDE concept

If MPI were to proceed down the SDE path, at some point that project would become a routine enterprise software development exercise and change management program. However, between the concept sketch provided in this report, and that enterprise program, there is room for more in-depth research into the nature and scope of the envisaged SDE and the challenges involved in development and adoption.

Investigate CASE template applicability to other IRA types

A comment from a reviewer suggested that the CASE template would not be useful for IRAs for animal imports due to the greater - or at least different - complexity of those assessments. Further research could investigate if this is really the case.

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10 Appendix 1 – Survey Copy

A PDF version of the survey can be found here: https://osf.io/vpgbd

11 Appendix 2 - Challenges to efficient IRA production

The table below provides participants responses to 'What are the biggest challenges to efficient IRA production?'. Table is arranged by organisation. Responses are verbatim and so may contain grammatical or spelling errors.

11.1 MPI CHALLENGES

Role	Theme	Challenge
Manager	Access to scientific literature	Timely access to scientific literature. We are able to interloan papers, but they can take a week or more to arrive. When the do arrive, the contents may not meet the expectations set up by the abstract.
Analyst	Access to scientific literature	Access to scientific literature. As MPI we do not have access to the majority of scientific literature... Not much else to say here.
Analyst	Access to scientific literature	Difficulty in accessing scientific papers
Analyst	Access to scientific literature	Difficulty in finding published materials not available online
Analyst	Access to scientific literature	Getting access to scientific papers
Analyst	Access to scientific literature	Access to literature (paywalls), and data is produced by other teams (no central area to search, and also partly because of Challenge 6 below)
Analyst	Access to scientific literature	access to scientific literature
Analyst	Access to scientific literature	access to literature
Analyst	Access to scientific literature	Finding and accessing scientific literature.
Analyst	Access to scientific literature	Getting access to scientific literature (e.g. paywalls)
Analyst	Access to scientific literature	Getting access to scientific literature
Analyst	Access to scientific literature	Access to scientific literature
Analyst	Access to scientific literature	access to scientific literature

Manager	Access to scientific literature	Accessing information - including published literature and other relevant analyses
Analyst	Access to scientific literature	Getting access to scientific literature (e.g. paywalls)
Analyst	Access to scientific literature	Getting access to accurate timely data
Analyst	Access to scientific literature	Access to scientific literature
Analyst	Access to scientific literature	Access to scientific literature
Manager	Access to scientific literature	Getting access to scientific literature (full text articles)
Analyst	Administration	Administrative red tape
Analyst	Administration	Overseas subject matter experts who do not understand the IRA process and provide well meaning administrative/process advice that is out-of-scope.
Manager	Change in scope	Changes to, or poorly defined, scope. e.g. commodity description
Analyst	Change in scope	Change of the scope midway through drafting an analysis
Analyst	Change in scope	changes in scope after project has started
Analyst	Change in scope	change of scope/ large scope
Analyst	Change in scope	Lack of clear processes and governance structures for the production of IHS and IRAs which results in issues like changes of scope in the middle of projects which causes time wasted on re-work.
Analyst	Change in scope	Changes made to the project scope midway through due to additional suggestions by stakeholders and/or other biosecurity teams.
Analyst	Determining pest association	Deciding if a pest is associated with a commodity and on a pathway. Because pathway or commodity association is not stored in our databases it has to be reassessed every time.
Analyst	Disruptions	sickness
Analyst	Disruptions	Continuous uninterrupted time to read literature and digest the information.
Analyst	Disruptions	Disruptions (noisy offices, meetings, COVID)
Analyst	Editing and referencing difficulties	Too much time spent longhand writing, which takes a long time to read to review, which also leads to more time spent changing and fixing things. Longhand writing also highlights the style of various authors, creates variable and inconsistent work between and sometimes within an IRA. There is a higher likelihood of getting criticised on the writing and needing to make changes to style, grammar and argument presentation rather than the facts and arguments themselves.

Analyst	Editing and referencing difficulties	Cumbersome software (e.g. referencing software)
Manager	Editing and referencing difficulties	Editing text (managing word documents and references etc.) and ensuring consistency (presentation and arguments)
Analyst	Information management	Collating information and transcribing it into concise and accurate sections in an IRA template.
Manager	Information management	Information management - having to manage information manually takes a lot of time
Analyst	Information management	Collating the information that is related to the risk assessment (i.e. association with the host, commodity). This can sometimes be difficult.
Analyst	Initiating IRA	can't start assessment due to plan has not yet signed off
Analyst	Internal or external review	Peer reviewers (internal/external) not meeting deadlines for return of comments
Analyst	Internal or external review	answer questions and prepare materials for risk manager which have not been planed
Analyst	Internal or external review	Negotiating internal peer review
Analyst	Internal or external review	Negotiating external peer review
Analyst	Internal or external review	Slow peer-reviewing process
Analyst	Lack of consistency within work area	Different individuals and teams within the ministry having their own opinion on how an IRA should be written, disagreeing on the methodology, the assessment, and trying to influence how the document is written, sometimes even trying to have the conclusions match their preferred outcome. As there is no clear guidance on ALOR and methodology, it leaves the door open to these arguments taking place. The risk team should be able to write something, and direct most of the criticisms or questions regarding methodology or risk assessment to "the authority". If the RA was written according to "the authority" then there would be no argument to be had and very little re-assessing or re-writing to do.
Analyst	Lack of guidance for establishing risk	No clear guidance on acceptable level of risk (different teams within the ministry have different opinions and the risk team has no guidance as to how risk-averse they have to be)
Analyst	Lack of guidance for establishing risk	No clear guidance on risk assessment methodology and disagreements between various staff within the department on how this should be done
Analyst	Information inaccurate,	Databases. Finding the associated information in the MPI databases and resolving

	ambiguous or missing	discrepancies. The same taxonomic entity can have different statuses reported because the databases are not linked and information is outdated.
Analyst	Information inaccurate, ambiguous or missing	Lack of authoritative data sources for e.g. presence absence in NZ, regulatory status, interceptions
Analyst	Information inaccurate, ambiguous or missing	Lack of easily accessible spatial information on e.g. land use and land cover (to make impact and establishment assessments easier)
Analyst	Information inaccurate, ambiguous or missing	Disconnected and unreliable databases and information sources
Manager	Information inaccurate, ambiguous or missing	Poor data
Analyst	Other responsibilities	other works outside IRA, admin tasks
Analyst	Shifting priorities	Movement of analyst from one project to another as emergency to keep up with the timeline. Often this represent a slow down of the project that has been halted and the one that has more analyst because training has to be done. New analyst that did not start in the project from the beginning have to learn how the project lead and risk coordinator manages the specific IRA.
Analyst	Shifting priorities	Sidelined by other, more urgent work.
Analyst	Shifting priorities	reprioritisation of projects
Analyst	Shifting priorities	change of decision that relate to the amount of work
Analyst	Software issues	Software used by the institution to safeguard documents drops down often, conflicts happening when analysts work at the same time.
Analyst	Software issues	cumbersome software - need for copying and pasting, or typing
Analyst	Software issues	Cumbersome software
Manager	Staff retention	Staff changes/loss of continuity
Analyst	Staff retention	Staff turnover at all levels. At analyst level means newer staff take longer to write an IRA than experienced ones. At management levels can mean that the goal posts can move often regarding work priority, view on methodology or ALOR, restructures, etc. Disruptions can slow down the work.

Manager	Staff training and fitness	Lack of training
Analyst	Staff training and fitness	Poor IT skills of staff: Poor document handling, storage, naming, poor understanding on how to store documents or versioning, and poor document production (poor understanding/use the organisation's style guide and/or styles in Word, etc). Slows down searches when looking for older internal information, and slows down document review and publication.
Analyst	Staff training and fitness	Low level of skill in project and human resource management which results in issues like staff being over-allocated, insufficient project scoping/ planning, inability to create and manage realistic schedules for delivery of work.
Analyst	Stakeholder engagement difficulties	Consultation
Manager	Stakeholder engagement difficulties	Dealing with difficult stakeholders
Analyst	Taxonomy difficulties	Taxonomy. Finding the appropriate taxonomic entity, current taxonomic name.
Analyst	Taxonomy difficulties	Difficulties in establishing pest identity and all relevant synonyms.
Manager	Taxonomy difficulties	Taxonomic challenges

11.2 DAFF Challenges

Role	Theme	Challenge
Manager	Access to scientific literature	Access to scientific literature and having the right staff to review it
Analyst	Access to scientific literature	Find out peer reviewed articles to justify any arguments.
Analyst	Access to scientific literature	getting quick access to scientific literature
Analyst	Access to scientific literature	accessing/securing appropriate literature.
Analyst	Access to scientific literature	Getting access to scientific literature
Manager	Access to scientific literature	Clarity, completeness and access to underpinning enabling sciences that facilitate technical justification.

Analyst	Access to scientific literature	Getting access to scientific literature
Analyst	Access to scientific literature	Getting access to scientific literature. There are processes or sourcing articles behind paywalls, but the delays slow down the assessments.
Analyst	Access to scientific literature	Access to scientific literature is heavily reliant on organisational library infrastructure and investment. This can vary considerably within a government organisation from year to year. As such the time required to access scientific literature, while not a huge contributor to overall IRA production time, can vary.
Manager	Change in scope	change in IRA scope due to Biosecurity/political/industry changes. As IRA's generally take a lot of time, changes over this time regarding all aspects of the IRA often change. Thus when you are close to being finished, the original scope may have changed dramatically, thus requiring significant work to change the scope of the project to fit.
Analyst	Change in scope	large or changing scope of some IRAs
Manager	Consistency in decision making	Ensuring consistency in decision making relating to the same pest across different pathways. Formal fruit commodity IRAs can rate a pest as a non-quarantine pest on that pathway, but on a different pathway (say, nursery stock or seeds) that pest can have a very different entry, establishment and spread potential. Having all of those decisions visible in a searchable database is key to starting the consistency process, and having your instructional material clear about the assessment only applying to the pathway that is being assessed. Even if something is rated a quarantine pest, there are instances where it is impractical to regulate it on certain pathways - so processes need to accommodate that reasoning.
Manager	Determining appropriate measure	Incomplete information for pests, which makes assessment and identification of measures difficult.
Analyst	Determining appropriate measure	Identifying the most appropriate/practical risk management measure.
Analyst	Determining quarantine pest status	understand pest status especially if the pest is under official control, or if there are exotic strain issues
Analyst	Determining quarantine pest status	deciding if a pest is a quarantine best based on potential for economic consequences
Manager	Editing and referencing difficulties	Formatting our big documents is time consuming and easily prone to glitches because we are using word with none of the optional formats locked down. Once a document gets big, and has Endnote, and track changes/comments it can easily get unstable and formats can break. Simple things like someone who prefers to work with editing marks off deleting a section break without realising can set you back days in formatting work.

Manager	Editing and referencing difficulties	Reviewing for clarity and precision of presentation
Analyst	Editing and referencing difficulties	Endnote - both access (availability) as well as the remote access (in the current remote working situation)
Analyst	Editing and referencing difficulties	Slow referencing software and network issues (mainly while working from home)
Manager	Internal or external review	Reviewing for technical accuracy
Analyst	Internal or external review	Internal clearance process.
Analyst	Internal or external review	Clearance processes can be rather ad-hoc, with reports being given to different areas and managers when available. A single document can end up having to go back to the same person or area multiple times as more changes are made by other reviewers.
Analyst	Internal or external review	Internal review process
Analyst	Internal or external review	sign-off and review processes within the organisation. As part of a large organisation with high reporting and procedure requirements, review and sign-off procedures are often seemingly excessive and time consuming. Apparent redundancy may be required for compliance etc. but do cause slower production of published IRAs.
Manager	Keeping RA up to date	Keeping up to date with scientific literature. If you are working on a pest species with worldwide recognition (e.g. Xylella), new publications are frequently available. Given the slowness of our processes, you need to constantly update what you have written and then the IRA is out of date as soon as it is published.
Manager	Lack of consistency within work area	difficulties with processes to generate consistency and communicate decisions across teams. multiple teams conduct IRAs and consult with technical experts, industry, state governments, etc and given pace of work load and development of the IRA, decisions are not captured or communicated to other assessors.
Manager	Lack of consistency within work area	Reviewing for policy consistency with other IRAs
Analyst	Lack of consistency within work area	Uncertainty and inconsistency within the branch for how to approach certain scenarios
Manager	Lack of consistency within work area	Establishing/ensuring appropriate consistency in policy principles between/across different pathways.
Analyst	Lack of consistency within work area	Finding agreement within the work area on current approaches and wording
Analyst	Lack of consistency within work area	Trying to achieve consistency between different IRAs

Manager	Information inaccurate, ambiguous or missing	limited information available on pests and pest status in importing country makes it difficult to explain to domestic stakeholders regarding risk as often domestic stakeholders see high risk but often the science to support the risk is not available and a lot of time goes into explain it cannot be considered high risk.
Manager	Information inaccurate, ambiguous or missing	Accurate and relevant information on pests.
		This challenge is probably going to always exist to some degree, but one reason IRA's take long and are difficult to do is because that the answers to many of the questions about pests in IRAs (e.g. establishment, spread) have to be inferred from information that does not explicitly address these questions (e.g. pest management research).
Analyst	Information inaccurate, ambiguous or missing	Inaccurate/ambiguous information submitted by the country requesting export of a commodity.
Manager	Information inaccurate, ambiguous or missing	Lack of efficacy data to support a risk management measure.
Manager	Information inaccurate, ambiguous or missing	Lack of primary and direct evidence to support a claim.
Analyst	Other responsibilities	Disruption by other activities due to urgent tasks
Analyst	Pest risk assessment	preparing (understanding) complex reviews of the biology of the organism in relation to assessing entry, establishment and spread.
Manager	Political sensitivities	Sometime there are internal issues over pest status and mitigation or diagnostics that have to be argued out for a political compromise. This may have collateral implications for older IRA's or other current IRA's.
Manager	Political sensitivities	The importation of the commodity is politically sensitive.
Analyst	Publication delays	Although you can complete the analysis and get the report ready for publication, the report can sit there for a long time, sometimes for years, waiting for 'right time' to be released. When the time comes, you will need to update the report with the latest scientific literature and reformat the report.
Manager	Publication standards	The format and size of our documents - because they are sometimes over 100 pages long, the internal clearance process is very time consuming because everything needs to be publishable quality. In my view this format has arisen because the big external facing IRAs go for public consultation. Smaller risk reviews can be completed much faster.
Analyst	Publication standards	while software can be cumbersome, the main issue with software usage arises from organisational requirements and procedures. Document templates, for example, are often a slowing point in the review and sign-off procedures for IRA production. Template

		revisions or the quirks of an individual template can cause issues with revisions and publication.
Manager	Shifting priorities	Shifting priorities. One of the biggest challenges we face is working for a period of time on an specific IRA and then for various reasons having to stop work on that one and start a different one. Staff take time to get up to speed on the new issues, and meanwhile the older IRA becomes 'stale' as information goes out of date. When (or if) work resumes on the older IRA, things start nearly from the beginning as the old work is reviewed, re-researched and staff (possibly new staff) get up to speed again. There is also a demoralising effect for some staff as they lose ownership over their work. Perhaps an apt analogy is that the process of developing an IRA is a bit like a coal powered power plant; when fired up and running a full capacity it's actually most efficient, but not efficient at all to turn off and on rapidly.
Manager	Shifting priorities	IRA's are not done in isolation from other departmental activities other types of scientific advice and projects for internal and external stakeholders.
Manager	Staff retention	Leave, promotion and movement of staff is high. Little incentive for long term maintenance of science trained staff. You can work elsewhere in the department for the same pay and use departmental knowledge rather than science training.
Manager	Staff retention	Identification and retention and matching of staff appropriately experienced and competent to undertake the range of tasks undertaken.
Manager	Staff training and fitness	difficulties with retaining and training staff - inexperience assessors results in delays in developing risk assessments, providing guidance, review of work, checking of science etc. Bringing in new staff to replace staff that moves on takes time to bring them up to speed and train from scratch again and momentum of project stalls.
Manager	Staff training and fitness	An analysts first IRA requires higher levels of teaching, advising, guidance and consulting. This also depends on their training/skill set. IRA/PRA training helps. Science experience and expertise in Pathology, Entomology and/or Horticulture is important.
Manager	Stakeholder engagement difficulties	dealing with difficult stakeholders - providing numerous technical briefing as a result of domestic industry lobbying to government, lengthy stakeholder consultation process and numerous meetings divert from doing the technical assessment.
Manager	Stakeholder engagement difficulties	Getting required information from trading partners - responses to requests for information can sometimes take many months and sometimes require follow up requests.

Manager	Stakeholder engagement difficulties	Stakeholders who know they can slow the process down by contacting ministers or the media, arranging multiple meetings to discuss their concerns, or who provide very long, repetitive submissions during draft report consultation.
Manager	Stakeholder engagement difficulties	Anticipation of difficult stakeholder comments creates a large amount of defensive writing work. This varies with the risk appetite of senior management, but at times a very large amount of effort is put into some rather subtle wording in various parts of a risk assessment trying to anticipate how things might be interpreted.
Manager	Stakeholder engagement difficulties	Engaging with external stakeholders
Manager	Stakeholder engagement difficulties	Dealing with stakeholder - while painful and time consuming at times is essentially unavoidable.
Analyst	Stakeholder engagement difficulties	National and International industries, governments and so on.
Analyst	Stakeholder engagement difficulties	Stakeholder consultation and the issues they raise.
Analyst	Stakeholder engagement difficulties	Lack of/slow response to queries from the country concerned.
Analyst	Stakeholder engagement difficulties	Responding to lengthy stakeholder submissions
Analyst	Stakeholder engagement difficulties	external stakeholder engagement
Manager	Stakeholder engagement difficulties	Dealing with powerful stakeholders who might be impacted by the potential import.
Analyst	Taxonomy difficulties	Resolving taxonomic issues, for example strain or species complex issues
Manager	Technical justifications	Determining the technical justification for pest presence on specific pathways and that of the regional pest status.

11.3 OTHER ORGANISATION CHALLENGES

Role	Theme	Challenge
Analyst	Access to scientific literature	access to data - qualitative data and quantitative data. "Open access" to literature can be a problem.
Analyst	Access to scientific literature	References inaccessible

Manager	Access to scientific literature	Access to scientific literature, including paywalls and information that is only available in a foreign language
Manager	Access to scientific literature	Access to quality data on species occurrences
Manager	Access to scientific literature	Getting access to scientific literature
Analyst	Access to scientific literature	Waiting for literature (interlibrary loans)
Analyst	Initiating IRA	there is no clear "scoping" process - requests for IRAs come in, and sometimes they are not valid or justifiable or realistic. but because they are someone's (leadership, or a favourite "stakeholder) pet or peculiar interest, it "is to be done." we don't have permission to say "no" to requests, even when totally justifiable
Analyst	Keeping RA up to date	Keeping the risk analysis up-to-date.
Analyst	Lack of guidance for establishing risk	Assigning appropriate risk categories under uncertainty.
Analyst	Information inaccurate, ambiguous or missing	Not enough information available.
Analyst	Information inaccurate, ambiguous or missing	Contradicting information.
Analyst	Information inaccurate, ambiguous or missing	Software for climatic analysis difficult to apply.
Analyst	Information inaccurate, ambiguous or missing	Miss of knowledge like if it is seed borne, real distribution etc...
Manager	Information inaccurate, ambiguous or missing	Lack of information available on certain topic
Analyst	Information inaccurate, ambiguous or missing	Finding "grey" literature such as country-specific management directives for production pests.
Analyst	Information inaccurate, ambiguous or missing	To be honest - getting export support information from the exporting NPPO.
Analyst	Information inaccurate, ambiguous or missing	Finding data to create quantitative models.

Analyst	Information inaccurate, ambiguous or missing	Finding information on "new" pests - ones with little literature associated with them.
Analyst	Language barriers	Literature in languages we cannot understand (Chinese / Korean / Japanese etc.).
Manager	Other responsibilities	Other responsibilities in service
Analyst	Political sensitivities	the request process is not as "clear, transparent, or unbiased" as the documents we are expected to produce. there are sometimes underlying agendas. that whole "we are a member of the WTO, OIE and have to bide by the SPS agreement" has to be brought up as a reminder from time to time.
Analyst	Publication delays	in our organization, clearing the documents is a big snag on getting documents to the stakeholders in a timely fashion
Manager	Shifting priorities	Coordinating across our agency's management structure (work is prioritized in different ways for different individuals depending on their manager and program within the agency)
Analyst	Software issues	Lack of data regarding host plants, climatic conditions etc.
Manager	Staff retention	Staff turnover (much of the initial assessment work is done by individuals in term positions of 1-4 years who often leave for permanent positions before the term is complete)
Analyst	Stakeholder engagement difficulties	Dealing with Plant Protection Services regarding the outcome of a risk analysis.
Analyst	Unrealistic expectations	there is an unrealistic expectation on the part of requestors regarding the time it takes to write an IRA - people need to be educated to understand that one does not simply dash one of these off in a week. similar unrealistic expectation on the man hours required to research, format, write and assess the data.

12 Appendix 3 - Ideas to improve efficiency

To improve readability, ideas have been organised by the organisation to which the respondent belongs, and the higher level category to which the respondents idea belongs.

12.1 MPI IDEAS

Role	Code	Idea
Databases		
Analyst	Decision Database	Linked databases or a new database that stores decisions and evidence in a machine readable format. currently there are multiple isolated databases that often hold outdated information. We need MPI linked databases that can be expanded in the future and easily linked to other groups at MPI, e.g. response, surveillance, lab, treatments. If I as an analyst enter a taxonomic name in a database I want to see immediately if there was an incursion, presence absence, etc, all the information with this organism and the past decisions. At the moment this information is in word files, or not shared between groups. It is basically non retrievable.
Analyst	Decision Database	traceable decision record. Main decisions, such us scope, rationale to exclude certain pests, forms of outcome, from risk manager and risk analyst, need to be documented clear. Except from documented in the project plan, other important decisions made throughout the project will need to be recorded. These records can be meeting notes and emails.
Analyst	Integrated databases	workflow to pull that information out of the databases. certain information could be pulled out of the databases if it is structured such as most information needed for a PRA. .
Analyst	Integrated databases	connected databases with mostly correct information . we use several databases in order to assess risks, such as NZOR (New Zealand Organism Register) and ONZPR (official NZ pest register) and several others which sometimes have conflicting or incomplete information, given that several of these databases are curated or supported by MPI, it would be nice if this was not an issue.
Manager	Integrated databases	Structured data for easy retrieval and assessment. Funding and managing information is inefficient due to the lack of structure in our information management systems.
Analyst	Integrated databases	Better system to store technical information. The current systems work, but are slow and difficult to use. An integrated scientific information storage and retrieval system would help in the production of technical literature like IRAs.
Analyst	PRA database	Database with relevant information for pest risk analyses. Collate information on selected pests and pathogens. Specially have a

		database that lists commodity and host associations. This database would use information from completed hazard identification and pest risk analyses from past IRAs. Essentially, information will always be added as projects/IRAs progress.
Editing		
Analyst	Better support	More administrative support. Formatting, editing, proof reading, dealing with contractors for external review, publishing tasks, etc.
Analyst	Improve concision	Pest risk Analysis needs to be concise and less repetitive. Currently the PRA are long and the same information is repeated three times in the same document. .
Analyst	Improve concision	Reduce the number of words and pages in an IRA. Working in a simple bullet point style or tables. No need to write a long story in full sentences and paragraphs. Emphasis should be on the data and information, not the writing. This will reduce writing time, reading/review time, re-writing/correction time and copy editing time.
Manager	Set text templates	Develop a number of IRA templates with set text/sections that do not have to be re-written every time. There are sections/chapters of IRAs that do not have to be re-written. E.g. chapters on requirements under the Biosecurity Act and SPS agreement to do a risk assessment, NZ climate, hazard identification and risk assessment methodology. In fact, we could simply refer to relevant sections of our risk assessment guidelines where the requirements under the Act and SPS agreement are explained in detail. Note: we might already be doing some of this to a certain extent, but worth looking at how much more we can do here. Same for PRA templates where we know some text/sections will always be needed. Changes can be made to the templates where needed.
Information		
Analyst	Improve access to scientific lit	Shared access to literature. Partnering up with a Crown Research Institute/University/another Directorate and pooling resources to have shared access to literature. This would mean we are not waiting for literature access and have relevant literature to base our risk assessments on. .
Analyst	Improve access to scientific lit	accessible scientific literature. why are we not there yet, sci-hub is nice but a bit too subversive to use in a governmental setting.
Analyst	Improve access to scientific lit	Improve access to scientific literature. In my first year, I had access to literature through Massey University Library. This made such a substantial difference to my productivity I cannot understand why an All-of-Government contract cannot be reached with the academic publishers for access. Even when access to current articles

		is granted, this does not include access to earlier journals. . This is a major source of frustration
IRA Scope		
Analyst	Limit scope of IRA	Tighten commodity and commodity origin scope. Due to broad scoping - subject matter can be extremely vast - e.g., commodities from a number of different countries or commodities from all countries While the above examples are seen as single IRAs, they are actually a number of different IRAs bundled together. Having multiple analysts results in multiple writing styles that need to be smoothed out for readability purposes. The above creates issues for internal and external peer review - as there are few subject matter experts who can typically cover the vast number of organisms assessed this broad approach. The larger and more cumbersome the IRA, the more likely something has been missed.
Manager	Limit scope of IRA	Limit scope of IRA. IRA projects should be scoped to focus on countries where commodities are most likely to be imported from. When new requests are received to add another country, we would then only be searching for and assessing pests associated with the commodity in the new country. That should reduce time spent on individual IRAs. . The scoping and planning of IRAs currently take quite a bit of time. Several months, and i think this should be done way before the IRA is set to start. It might be worth scoping and planning 3-4 IRAs at ahead of when they need to commence so that Analysts can pick them up and get started without having to spend a lot of time doing the admin of scoping and planning
Manager	Limit scope of IRA	Reduce scope of hazard identification and get some dedicated data/programming experts to develop/improve automation of crawling web for potential hazards. I think we should develop criteria for how much searching we do to identify potential hazards. There is a valid concern that by narrowing our searches we could "miss" hazards, but I think we need to ask: "if we narrow/target our searches, what would we miss and how much would that matter compared to the pests that we capture?". Would we really miss any pests with serious potential to affect biosecurity if we were more targeted in our searches? Also we should employ programming experts to develop software/tool for identifying potential hazards. Currently, this is being done by a few Analysts who are trying their best using some programming skills they've picked up on the side, but expert level skill could increase efficiency and free up those Analysts to do risk assessments. If those Analysts are unavailable for whatever reason, we're stuffed on that front, as not many of the team are trained programmers .

Management		
Analyst	Improve planning	Assignment of a project manager/lead that keeps track of deadlines and solves roadblocks and can be held accountable. .
Analyst	Improve planning	Limit re-litigation once the IRA process has started. There is a lot of scope and expectation creep from risk managers which causes delays to the process and delivery of an agreed endpoint.
Analyst	Improve planning	Follow an agreed and transparent process for prioritisation - stick with the work plan. Often times assessments are undertaken with the work started or resultant product no longer required (i.e., no longer a priority to work up the standard). A clear and agreed work plan would solve this issue. .
Analyst	Improve time management	Time blocks for work. Have specific time blocks set aside every week to write/research/digest for IRAs. These blocks will not have meetings or anything booked over it. Have everyone working on this project to have similar time blocks so if anyone has any questions they ask each other and not interrupt the flow of a colleague or their own. .
Manager	Limit analysts on IRA	Number of people/analysts working on each IRA should not be too many - although this may depend on scope/size of work. I think having fewer people working on an IRA project is .
Analyst	Reduce interference	Avoid risk managers interfering with objective processes. There is a history of risk managers expecting an answer from the IRA to match a specific conclusion/management action (sometimes even blatantly asking for it or signalling that the outcome would be ignored) . Ideally risk assessment and risk management are separated within an organisation - having them within the same group can create unnecessary stress and tension.
Analyst	Stable staffing	Pay risk analysts better. Experienced people leave because we are paid poorly compared with colleagues. It takes time for new analysts to get up to speed on how to do risk analysis, and how to do it well and quickly, and know the important things to look for and not go off on time consuming tangents. We have just had a lot of new staff start because of expansion of the plant risk analysis area to try to increase the rate of IHS development, and many of the new people are taking a while to get good at risk analysis. This is no fault of theirs, it just takes a while to understand what is required.
Review		
Analyst	Improve review process	Peer review process could be streamlined. Currently analyst request peer review via email and hope that a maximum of two people and a senior analyst agree to peer review. Sometimes there is a lot of emails coming through and you loose track of which PRA need reviewers or not. Some PRA are left with one review and the author

		has to keep asking around for peer review. On the other hand sometimes for a short PRA three to four people agree to peer review, which is too much analyst time for one small PRA.
Standardisations		
Analyst	Refine IRA methodology	Agree on IRA methodology. A clear guidance document on IRA methodology, what is in scope, how the hazards are identified, how the risk is assessed. Again communicate this well to all teams. Any critique can be sent to the document. If there are strong opinions against the document, this needs to be taken to directorate level to change the methodology document. But while a version is in place, no changes to the IRA being written.
Analyst	Standardise ALOR	Agree on acceptable level of risk. What does the country want as ALOR? Not what does the current manager or a certain team wants or thinks. What is the long-term vision for New Zealand. Once this is established, communicate this well to all other teams in the ministry as well as stakeholders. This is to reduce time spent arguing the risk analysts' position to the various team. We could then refer the critique to the correct policy/document. If some stakeholders, individuals or teams within the ministry disagree, the issue would need to be discussed at leadership level before being changed and re-communicated.
Systems		
Analyst	Auto generate PRA sections	NLP processing and formatting. formatting the pulled structured data and bringing it in the right format including references. This approach could automate large parts of PRAs. Using something like LATEX .
Analyst	Auto generate PRA sections	auto fill information. Writing concisely and accurately is an time consuming task. I can spend hours crafting a sentence or paragraph to make it reflect the scientific literature in the right way. When I peer review my colleagues work I often find that they write in a different style to me with slight nuances. The different writing differences between risk assessors can make an IRA inconsistent. I think that a system/template that minimises the effort and inconsistencies that goes into writing. Perhaps some kind of system that has pre-define term sets, drop down boxes, multi-choice etc. that risk assessors can input information into.
Analyst	Auto generate PRA sections	Automatic generation of partially filled out PRAs. Some of the work in a PRA involves us repeatedly checking the same data sources (e.g. EPPO/ CABI, Quancargo, interceptions spreadsheet, CMI calculator) to find e.g. Interception data and current trade volumes, host range, climate suitability, commodity values. It could be possible to output

		all of this information onto a single datasheet for analysts or even generate partially filled out PRA templates.
Training		
Analyst	Better training for staff	Train staff on communication. Particularly for non-native English speakers (and even native speakers), there's a need to be trained and re-trained in clear and concise writing.
Analyst	Better training for staff	Personalised staff training. Various people struggle with various things. For some it might be spelling and grammar. For others it might be structure, or argument writing. For others it might be IT. It might be something else. Not sure how and who the best people would be to identify for each staff what is holding them back (maybe based on how long they take to write something, or where most of the comments they get are?). Then objectively and kindly direct them to training or support to address their own "low hanging fruit" that could enhance. If it is the managers, training and support of those managers to be able to evaluate and support their staff may be needed.
Analyst	Better training for staff	Project management training. Each of our IRAs is a relatively complex project involving several staff (e.g. 3-10) and a large number of products (i.e. 15-30 PRAs) which are integrated into the overall output (IRA). Basic project management training will help staff with key project management activities like scope definition and management, schedule creation and management and human resource management. Staff who will not be managing projects themselves would still benefit from training which would allow them to be effective project team members.

12.2   DAFF IDEAS

Role	Code	Idea
Databases		
Manager	Decision Database	Database that captures decision elements. In order to better capture work that is done 'behind the scenes' while working on IRAs we have been looking at building a database that captures key regulatory decisions and the evidence that supports that decision. I think it was important that this database did not attempt to grab all info about all pests, and/or be current and accurate but instead represents the departments history on decisions. It is also not intended to be pubic, which allows staff to populate it focusing on the technical arguments without overthinking the wording and 'polish'.

Analyst	Integrated databases	create a pest and disease repository and link to all resources. To create a pest and disease repository can help collate the information and useful resources.
Manager	PRA database	Database of previous pest assessments . The Pest and Disease Repository should allow pest status to be automatically assigned once presence on a pathway is identified.
Manager	Stakeholder comments register	register of stakeholder comments and response. build into the process a register of stakeholder comments and in particular the decision and response made. that way can save time on drafting response and developing stakeholder strategy for issues already raised and addressed in past. will also save time on problems of inconsistency in responses. can analyse the data and develop more broader engagement and training strategies to stakeholders so they get the message and not respond again on same issue.
Information		
Manager	Improve access to scientific lit	access to all online literature. Its simple - but has never been fixed. One huge hurdle which has never been fixed is our access to information. our research relies on access to information, most of the research sit behind paywalls. Literature based research is complicated, searching for the right information often sends us down rabbit holes, of multiple journal articles, with the final one found hopefully with the right information. Currently we have to request each journal article and buy it separately, this takes time and people hours, and also often the journal article may not be of much use anyways.than you have to find another one - and request that too. This process takes times. When at uni i had access to just about all the information i needed, it was quick and easy. I understand access is expensive, but surely a quick estimation of the hours spend requesting,waiting, and also looking for alternative free articles will soon put the spending in perspective. Additionally, who cares how much it costs, if we cant get access to the right information it puts our analysis at risk. .
Analyst	Improve access to scientific lit	Access to more journals and books. Self-explanatory.
IRA Scope		
Manager	Broad PRA	Enhanced use of pest focused group policies. Increase emphasis on pest based risk assessments that can be applied across multiple pathways rather than single commodity multiple pest stand-alone risk assessments. Effectively, this build on the concepts and principles developed at DAFF in undertaking group pest policies for the major groups of

		pests (e.g. thrips, mealybugs, scale insects) commonly seen in various commodity risk assessments. These group policies provide the reusable policy 'building blocks' to more efficiently and consistently develop future risk assessments. .
Manager	Tailored products	more streamlined products depending on the need. If you receive a request for market access from an important trading partner in a commodity that you already produce - you conduct a formal big IRA, with full visibility and public consultation. If you are asked to assess a permit application, or need to update import conditions for an existing traded commodity - you should be enabled to do a smaller assessment with no or limited consultation. Australia has trailed a number of efficiencies and adopted some of these, including the Group Policy approach to PRA when assessing pests of similar biologies, same commodity assessments for a group of countries in the same geographic area - whether they have applied for access or not.
Management		
Analyst	Improve information sharing	Better information sharing within the branch and division - if appropriate). A wealth of knowledge is sitting in silos which should be socialised both formally and informally with an active encouragement of the executive. This will substantially improve the efficiency of the process.
Analyst	Improve planning	do not change scope/rules midway through the IRA. there have been times where internal review process leads to unseen changes in the scope and/or suggests edits in the research which have been agreed on previously. This pushes back the deadline and creates inefficiency. The solution to this would be to raise awareness to the issues when the scope/methods are proposed, READ the scope before meetings to be able to give constructive feedback instead of blindly agreeing with the scope/method and then trying to change it when the draft is submitted.
Analyst	Improve planning	Good planning . Management should have a good plan for when which report would be released and ensure the report can be released at the planned time. Often the report is ready but it can not be released because the consideration of the organisation's changed priority, trade implication and political considerations. This can result in some assessments being out of date due to new data are made available during this waiting time. .
Manager	Improve planning	Good project planning and stakeholder management. Take into consideration of all potential risks when conducting project planning. Set clear roles and responsibilities for each relevant area of the division.

Analyst	Improve time management	too much time is spent on 'potential for establishment and spread'. the ISPM states that only host, climate and vector needs to be considered. Yet in our pest categorisation tables there is a lot of text on dispersal mechanisms. This is not required.
Manager	Stable staffing	Aim to keep the experienced scientists engaged and enthusiastic. Turnover is high. Not likely to do more than lip service! . Staff have been allowed to adopt scientific descriptives as opposed to the older "policy officer" titles. The only thing that keeps staff is utilising their training until they burn out or want promotions and have to go elsewhere.
Organisational structure		
Manager	Policy team	dedicated team to develop policy. often the people that do the IRAs have not time to step back and develop internal policy and training material to help streamline and resolve decisions and develop staff. having more resources dedicated to internal systems and processes as well as implementing, communicating and training staff will help. That way the staff can get on with doing the IRA 100% of time rather than on less then 50% as have to resolve internal issues and develop training packages.
Manager	Specialised IRA team	Agile risk assessment processes based on specialist sub-teams . Create more dynamic efficient risk assessment workflow processes based on multidisciplinary specialist (e.g. virologists, mycologists, entomologists, epidemiologists, risk management experts, publishers) forming the basis of a series of sub-teams that can be applied to individual projects on a needs basis. Individual projects (e.g. a risk assessment for commodity X from country Y) would be conveyed between specialist sub-teams for them to apply their speciality. Benefits include more focused expertise application and building, improved consistency across assessments and greater knowledge transfer for succession planning. .
Other		
Manager	?	We have reached peak effectiveness and efficiency for IRAs - how to disprove this assertion?. While I agree we should always strive for better efficiency and effectiveness in IRA processes, I have been thinking about this topic for a decade, and aside from a discussions database as per above I haven't had too many insights. In the end IRAs are documents that detail issues on specific trading pathways for specific countries. While at a high level issues may appear generally the same, in practice these general issues have to always be fit to each specific trading situation. I wonder if there is much more that can be done to improve IRAs beyond more scientific information.

		In many areas such as athletic or market performance, indicators being approaching an asymptote as improvements become increasingly difficult to achieve. Could CEBRA provide any insight as to whether efforts to improve IRAs are or aren't providing continuing returns? I will leave it to CEBRA to think of the performance indicators but think that effectiveness (issues prevented, trade facilitated) and efficiency (time taken to produce) IRAs are the main themes. .
Review		
Analyst	Review clearance requirements	review clearance requirements. Reviewing the number of reviewers and importantly, review steps, required for sign off. This would allow the greatest reductions in IRA publication time where appropriate. This process however would require high-level organisational involvement and could easily be more time consuming than valuable, so care would have to be taken to the scope of a review directive. .
Standardisations		
Analyst	Refine IRA methodology	no standardised guidelines for assessing entry, establishment and spread. different teams do it differently, and as a result a lot of time is spent reviewing and adjusting the text. Clear rules would allow more consistent reviews, and would result in less reviewing and editing. PSaRA now has standards for doing consequence assessments.
Analyst	Standardise 'quarantine pest'	standardised interpretation of what a quarantine pest is. need a working definition of potential for economic consequences. It is common for one team to believe an organism is a quarantine pest, but for another team to device the same pest is not a quarantine pest. This almost always comes down to interpretation of 'potential for economic consequences'.
Analyst	Standardise wording	Develop standard wording where possible and don't change this wording unless absolutely necessary. A lot of time during review and consultation of an IRA document is spent on arguing over wording which doesn't affect the outcome (or even content) of the IRA. The focus should be on what matters most - where the highest risks are. (Lengthy discussions and changes in wording are sometimes even initiated by a comment from just one stakeholder. We shouldn't jump too easily just because one person doesn't like something.).
Systems		
Manager	Improve IT services	Improve IT services. I understand that IT systems are vulnerable. But better business programs and better department programs for databasing and record filing. Even collected media reports are

Role	Code	Idea
		frequently blocked when searching for the original url for verification. The department has a poor record with software development and functionality. They report that the product and expenditure is wonderful. The results are less than promised and disappointing. My last tablet was slow but reliable whereas my updated tablet is fast but also fast and consistent at crashing (a lemon and have been told by IT that there are many of them). Mind you this week has been crash free. Do I stop holding my breath. Many science presentations are on Zoom so cannot be used on our work computers. I use my own to make up for this.
Training		
Analyst	Better training for staff	Better education of staff in the software and systems used to produce IRAs. Some of the software used to produce IRAs are somewhat specialised, or are used in a non-standard way for our work. Giving all staff a better grounding in how to use the software in these ways could avoid time spent correcting errors introduced through misuse.
Manager	Stakeholder training awareness	More available training/awareness for all stakeholders. A large proportion of questions/issues raised by stakeholders, is not a technical issue with our findings, but a misunderstanding of our processes etc. If we could increase stakeholder knowledge etc. this would vastly help this issue.

12.3   OTHER ORGANISATION IDEAS

Role	Code	Idea
Editing		
Analyst	Yes_No Templates	Change the RA template to yes/no document. RAs have become cumbersome science treatises that are no longer fit for purpose. A more concise document that has specific questions around criteria that directly link to information needed to make decisions would be much easier, more transparent, repeatable and more useful. . Many documents are wordy papers analogous to theses in length. This is not necessary and even counter-productive. In the end, the risk managers read the summary and jump to the tables, if they even do that second step. Especially for pests that end up being not declared of quarantine significance.
Information		
Manager	Improve access to scientific lit	Access to databases of various scientific publications . It is very often necessary to obtain data from various databases of scientific articles in order to analyze the current situation and

		threats. This is very important in cases where information is poorly available from other sources, databases. .
Management		
Analyst	Formal request process	formal request process. IRA requestors should have to fill out a formal request clearly explaining the need for the IRA and the intended use. there should be a decision tree that helps define a) if the IRA request is valid or not; b) what type of product is most appropriate (maybe just a Hazard ID is required at this moment in time, not a full IRA). And there should be a scoping committee comprised of subject matter experts (ex: disease experts, import/export, commodity, economics) who can review requests to decide if the request goes forward and who the request should go to for competition (and who can be on the IRA team?).
Manager	Stable staffing	Stable staffing. Designate a small number of permanent positions for which risk assessment drafting will be a priority activity (potentially among other duties). Individuals in these positions would have time to build competency in the work, rather than moving on before that competency is acquired.
Organisational structure		
Analyst	Specialised IRA team	Have a team for IRA production. I am usually working alone on an IRA. In our institute, we have several taxon specific experts, but they are mostly involved in other work. So, a team dedicated to work on IRA would be very helpful.
Standardisations		
Analyst	Standardise ALOR	Develop an acceptable threshold for each risk category. Risk assessments contain statements like "high" "medium" etc. without ever defining what this really means. What level of final risk spurs action is also not directly defined. It would be very useful to have a national (RPPO? IPPC?) - wide standard that defines these. My NPPO has guidelines with examples that help the risk assessor, but with turnover in the risk assessment as well as the risk manager sections, these guidelines seem not to be sufficient to provide inter-assessor uniformity nor inter-manager equality of recognition. A fixed level, e.g. "causes 10% harm to commodity = low", would be very useful. There always seems to be a reticence on the parts of NPPOs to fixing these levels, though that goes against the nature of science - we have an accepted level of statistical significance, why not an accepted level of risk assessment "significance"? It's not just my NPPO - the only one I know of

		that has done this is the USDA, and only for horticultural products / hosts.
Systems		
Analyst	Better technical software	Easy-to-use software for climate matching/analysis. Available software for climate matching or analysis is expensive and not userfriendly, if some tool would be available to do it in a quick, straightforward way would be very helpful. .

13 Appendix 4 - Opportunity Map

13.1 ANALYST PRODUCTIVITY

These opportunities purport to increase average level of productivity of analysts.

13.1.1 Improve staff training

Problem: there are several aspects of an analysts and mangers work that could be improved with better training, including:

- Communication – "there is a need to be trained and re-trained in clear and concise writing"
- Project management training – "…will help staff with scope definition and management, schedule creation and human resource management"
- Software – "giving all staff a better grounding in how to use the software could avoid time spent correcting errors introduced through misuse"

Opportunity: Review training procedures for the above, and if necessary, develop new training,

13.1.2 Retain experienced analysts for longer

Problem: According to the survey, "risk analysts and biosecurity scientists have a high turnover at MPI" whether because they move to other roles within the organisation or leave the organisation entirely.

Opportunity: Create stronger career paths (i.e., opportunities for career progression while remaining an analyst), providing greater rewards for experienced analysts.

13.1.3 Focus analyst workload

Problem: Non-core work distracts analysts from focusing on IRA production.

Opportunity: Minimise distractions by limiting the amount of non-core work an analyst is handed. Setting up and synchronising time blocks for specific types of work may also offer an efficiency gain.

13.1.4 Accelerate expertise development

Problem: Presumably analysts with high expertise are more productive, but expertise increases slowly over time.

Opportunity: Increase overall productivity by accelerating analysts' acquisition of relevant expertise. Strategies might include:

- Training focused specifically on development of analytic expertise
- "Apprenticeship" and mentoring relationships between newcomers and experienced analysts
- More/better resources to help inexperienced analysts such as "tips and tricks" sheet, or an (internally) crowdsourced wiki-style "body of knowledge"

13.1.5 Select for most productive analysts

Problem: Some people work more productively than others, independently of level of experience, training, etc.

Opportunity: Modify recruitment, promotion and retention processes to increase the average productivity level.

13.2   MANAGEMENT

These opportunities all relate to how IRA production is managed.

13.2.1 Improve planning

Problem: Issues arising in the planning stage of an IRA can cause significant delays and impediments to efficient production.

Opportunity: There are a range of strategies for improving the planning of IRA work. They include:

- Assigning a project manager/lead who will keep track of deadlines and solve roadblocks
- Limiting scope and expectation creep
- Following an agreed and transparent process for IRA prioritisation
- Improving clarity of roles and responsibilities for each area of the division

13.2.2 Reduce interference from risk managers

Problem: There is apparently a "history of risk managers expecting an answer from the IRA to match a specific conclusion/management action," creating extra work for risk analysts as they attempt to resolve differences with risk managers.

Opportunity: Increase efficiency by placing a stronger "Chinese wall" between analysts and risk managers.

13.2.3 Reduce number of analysts working on a particular IRA

Problem: According to survey results, typically a total of about six analysts will work on an IRA at MPI. This was the highest of the organisations that were surveyed. In some cases, this may give rise to the standard issues that large teams face such as??

Opportunity: It may be more efficient to have each IRA completed by just a few analysts.

13.2.4 Improve information sharing

Problem: Analysts and managers can waste time searching for information that, for various reasons, has become siloed.

Opportunity: The executive could formally and informally encourage information sharing within the branch and division.

13.2.5 Formal request process

Problem: Sometimes it isn't clear what the need and intended use of the IRA will be.

Opportunity: Formalise the request process for new IRAs. One way would be to use decision tree to determine if the request should be honoured and what type of product is appropriate (a full IRA, just a hazard ID etc.)

13.3 ORGANISATIONAL STRUCTURE

These opportunities seek to improve efficiency by changing the structure of teams within the organisation.

13.3.1 Specialised IRA team

Problem: The subject matter of an IRA is too broad and specialised for any one analyst to have mastery of the required information. This results in analysts having to learn or 'brush up' on areas outside their expertise.

Opportunity: Set up dedicated, multi-disciplinary and specialised sub-teams. These teams could then be deployed on a needs basis to individual projects (commodity X from country Y). Specialist sub-teams would focus their expertise on particular areas of the project.

13.3.2 IRA policy team

Problem: If analysts are tasked with developing internal policy and training material to help streamline decisions and develop staff, they will have less time on IRAs

Opportunity: Set up a dedicated team to develop policy and methods would free up analyst time.

13.3.3 Stakeholder engagement team

Problem: Stakeholders can sometimes be difficult, and when analysts or managers have to deal with these difficulties, it takes them away from the technical work.

Opportunity: Have a dedicated team to deal with stakeholder engagement and communications. In cases where a lot of stakeholder engagement is required, or there are difficult stakeholders, it could help the technical staff focus on the technical work. Stakeholders might even prefer to deal with a dedicated team who understand their needs.

13.4 REVIEW & ENGAGEMENT

Opportunities in this category deal with improvements to the IRA review process.

13.4.1 Review clearance requirements

Problem: it may be the case that clearance requirements for IRAs are too stringent, in particular the number of reviewers that must sign off on the document.

Opportunity: A thorough review of exactly what is required for the IRA to be 'signed-off' could discover areas for efficiency improvement.

13.4.2 Streamlining the review process

Problem: Currently reviews are requested for individual PRAs via email. This results in a barrage of email communications and inevitably, some fall through the cracks

Opportunity: The review process could potentially be streamlined by improving the communication lines between reviewers and analysts. A system that keeps track of review requests and reviews could help to improve the situation. Review management systems are used by academic journals and could potentially be repurposed for MPI use.

13.4.3 Stakeholder training/awareness

Problem: Questions and comments from stakeholders are often not about technical issues but rather arise from a misunderstanding of processes and methodologies

Opportunity: Familiarise stakeholder with the processes of IRA production, so misunderstandings don't arise.

13.5 STANDARDISATION

To improve efficiency, MPI could seek to (further) standardise certain elements and processes involved in IRA production.

13.5.1 Standardise/refine risk assessment methodology

Problem: Risk assessment methodology can differ between teams, resulting in inconsistencies in the product and possible disagreements between the teams.

Opportunity: Further standardise and refine guidelines for conducting risk assessments. Produce documents explaining rules and methods, how we interpret them, minimum evidence requirements with examples of standardised structure, wording and referencing. Using standardised guidelines might also help to resolve disputes as they could be referenced in a disagreement.

13.5.2 Standardise ALOR

Problem: Sometimes analysts have differing ideas about what the acceptable level of risk should be, which leads to delays and inconsistencies.

Opportunity: Develop and agree on the acceptable level of risk (ALOR)[16]. The acceptable level of risk should reflect the long-term vision of MPI and not what a particular manager or team thinks is acceptable. Once the ALOR is established, it should be well communicated throughout the ministry and to stakeholders. If criticisms or arguments arise about what level of risk is acceptable, they can be resolved by reference to the agreed-on ALOR.

13.5.3 Standardise how probabilities are commmunicated

Problem: misunderstandings can occur when vague terms of risk probability like 'high', 'medium' are used. Guidelines at MPI exist that provide this standardisation, but "with turnover in the risk assessment as well as the risk manager sections, these guidelines seem not to be sufficient to provide inter-assessor uniformity nor inter-manager equality of recognition"

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[16] Although the SPS agreements refer to ALOR as 'appropriate level of protection', in our survey results participants always used ALOR, so we have preserved the term in our analysis.

Opportunity: Further standardise the way risk is communicated. Instead of using vague terms like 'high', 'medium' etc. Require analysts to consistently use "words of estimative probability" that are linked to numerical ranges e.g., 'high' = 80-100%.

13.5.4 Standardise 'quarantine pest'

Problem: While ISPM 11 clearly states the primary elements that are used to categorize quarantine pests, each element has some room for interpretation. For example, the interpretation of the 'potential for economic consequences can differ between teams, leading to disagreements over whether a species is in fact a quarantine pest

Opportunity: Standardise further the interpretation of what a 'quarantine pest' is. Standardising the interpretation of the various elements could yield efficiency gains by limiting disagreements.

13.6   WORK REDUCTION

These opportunities aim to increase efficiency by reducing the amount of work an analyst has to do.

13.6.1 Improve access to scientific literature

Problem: Analysts spend a considerable portion of their time just trying to chase down scientific articles which may - or may not - turn out to be useful for their analysis.

Opportunity: Expand the institutional access to scientific literature, so that MPI analysts have breadth and ease of access comparable to that of university students and staff.

13.6.2 Limit scope of IRA

Problem: The greater the scope of an IRA project, the larger the amount of time and effort required to produce the IRA.

Opportunity: Reduce the scope of IRAs. Ways this might be done include:

- Tighten commodity and commodity origin scope – a wider scope in these areas means multiple analysts and multiple writing styles that need to be combined. Additionally, a broad scope creates issues for peer review, as few experts have the knowledge to cover the vast number of organisms assessed.
- Limit effort on 'potential for establishment and spread' – Since the ISPM states that only host, climate and vectors need to be considered, there is a lot of work done that is not required.
- Enhanced use of pest focused group policies - Increase emphasis on pest-based risk assessments that can be applied across multiple pathways rather than single commodity, multiple pest, stand-alone risk assessments. Group policies can provide the reusable 'building blocks' to more efficiency and consistency develop future risk assessments
- Reduce scope of hazard ID – develop criteria for how much searching is done to identify potential hazards. There is the possibility that this strategy would 'miss' hazards, but it is unlikely that pests with serious potential to affect biosecurity would be missed.
- Filter pests at the pest categorization (Hazard ID) stage by potential to be on pathway – add an extra criterion 'potential to be on pathway' to the list of criteria determining if a pest is a hazard. This would reduce the number of pests that need to go through a full

assessment. DAFF has implemented this strategy and found it to increase efficiency (provided stakeholders will tolerate it).

13.6.3 Broad PRA

Problem: Conducting PRA assessments for individual organisms or for organisms from a single country increases the amount of work an analyst has to do.

Opportunity: Increase the use of broad PRAs, possibly in the following modes[17]:

1. A geographically broad PRA considers multiple areas, countries, a region, a hemisphere or global.
2. A taxonomically broad PRA covers multiple varieties, species or genera. See for example DAFF's Group PRAs.[18]
3. A measure-based PRA considers multiple commodities or pests based on specific measures (e.g., greenhouse grown).

13.6.4 Tailored products

Problem: Sometimes the request for market access doesn't or shouldn't require a full IRA, with full visibility and public consultation.

Opportunity: Tailor your product to the need/request. Depending on the request, you should be enabled to do a smaller assessment with no or limited consultation.

13.6.5 Improve editing support

Problem: Analysts spend too much of their time editing and formatting IRAs

Opportunity: Hire or repurpose staff to take over some of the editing and formatting of IRAs,[19]

13.6.6 Exploit redundancies

Problem: Sometimes further analysis is redundant because some other part of the analysis already sets the outcome. For example, if the inability of a pest/disease to survive transport or processing in the country of origin is sufficient to eliminate the pest, then continuing the entry assessment is redundant.

Opportunity: Identify points that are sufficient to determine the result of the assessment and the analyst would be instructed to complete those points first. Analysts would give priority to those aspects of a given piece of risk assessment work that may be sufficient to determine the judgement or outcome

13.6.7 Greater use of presumptions or defaults

Sometimes circumstances can justify a judgement without detailed analysis. MPI already uses this strategy to some degree such as in circumstances where there is sufficient evidence, or it is

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[17] See Broad Pest Risk Analysis: Concept and Application – Presentation by Kenneth Lakin

[18] https://www.awe.gov.au/biosecurity-trade/policy/risk-analysis/group-pest-risk-analyses

[19] This would allow greater support for "formatting, editing, proof reading, dealing with contractors for external review and publishing tasks".

widely agreed that the introduction of a hazard will have unacceptable impacts.(Biosecurity New Zealand, 2021, p. 15)

This opportunity seeks to exploit this strategy to a greater extent. An example of how this might work would be to create a catalogue of these kind of circumstances and ensure the analyst is aware of it. This set of circumstances (wide agreement of unacceptable consequences) could be integrated into the SDE/Database of Pests/Diseases. The pest could be 'flagged' as having wide agreement or sufficient evidence to not warrant a detailed analysis.

13.6.8 Use existing policy

Problem: Components of the risk assessment that are independent of the pathway (quarantine pest assessment, likelihood of establishment, likelihood of spread and consequence assessment) are re-written instead of re-used.

Opportunity: Reuse the components of the assessment that are independent of the pathway. If pests have been previously assessed, the components that are not pathway dependent can be re-used provided if there have been no significant changes since the previous assessments.

13.6.9 Share burden of work with others

Problem: MPI does a lot of analysis that could be left to others.

Opportunity: Require that some PRA/IRAs be completed by the importers or the exporting country, and only checked by MPI.

Importers and exporting countries might not necessarily have the capacity to complete PRA/IRAs for their commodities. Some possible ways to help build that capacity would be do develop a template that guides the importer/exporting country's development of the PRA/IRA, and, using MPI analysts to train importers/exporting countries. Upon receipt of the PRA/IRA, MPI would need to check that it meets the standards required for the commodity to be released into NZ.

13.6.10 Collaborate more with other biosecurity organisations internationally

Problem: MPI may sometimes build systems and methodologies from scratch or complete work for other organisations that currently lack the capability.

Opportunity: Increase/improve MPIs collaboration with other biosecurity organisations that share NZ's biosecurity circumstances (like DAFF and some Pacific islands). Collaboration could entail sharing systems, methodologies and outcomes as well as providing training to organisations that lack some of MPI's competencies.

13.7 WORK SCAFFOLDING

Work scaffolding opportunities attempt to provide structure and support to existing MPI processes.

13.7.1 Templates

Problem: Prose is often drafted from scratch, when elements of a PRA/IRA are standard to include.

Opportunity: (Further) develop templates that pre-populate material. There are a couple of ways that templates could be used:

1. Set-text templates – Develop a number of IRA templates with set text/sections so they do not need to be written each time. For example, chapters on requirements under the Biosecurity Act and SPS agreement to do a risk assessment, NZ climate, hazard identification and risk assessment methodology.
2. Yes/No RA template – Templates could be digitised, and a workflow set up with basic yes/no questions. Depending on the answer, text would populate the document. For example, a potential question might be "is the pest likely to survive transport?" which when answered, would populate the template with the appropriate prose.

13.7.2 Structured drafting environment (SDE)

Problem: Currently IRAs are drafted and edited in Word. This forces the analysts and managers into to drafting from scratch or copy/pasting from other documents. Time is then spent assembling and formatting the IRA to specifications.

Opportunity: Take the analyst/manager out of Word and put them in a custom-built environment called an SDE. An SDE is a software application that can be used for drafting PRAs and assembling IRAs. It would be server-based and allow for various integrations and automations. Integrations could include previous PRAs for the same pest or commodity to help inform and guide the analyst, and automations could include auto-calculated overall risk levels for the various assessments. A major benefit of a SDE is once the analyst is in the environment, there are a whole raft of integrations and automations that could be included.

Reductions in:

- Time taken to assemble PRA/IRA
- Format multiple PRAs and combine them into a single IRA that meets organisations specifications.
- Time spent researching/consulting previous works
- Numerous other reductions in time depending on what is integrated/automated
- Capacity to incorporate updated research on import requirements quickly when the need arises.

13.7.3 Stakeholder comments register

Problem: If no record of stakeholder comments and responses exist, then when similar comments from stakeholders arise, new responses must be drafted from scratch. This is time consuming and can lead to inconsistencies.

Opportunity: Develop a register that records stakeholder comments and responses.

13.8 SYSTEMS

13.8.1 Integrated databases

Problem: Currently databases that contain the information needed to complete an IRA are disparate, unconnected, and not always up to date. This results in analysts having to piece together information from different sources which takes time and effort.

Opportunity: Develop databases, link them and set it up such that information can be retrieved easily and imported into an IRA/PRA. DAFF has been implementing a version of this opportunity, and while it is still in development, it already provides a boost to efficiency. Such a system would have several components that would need to be developed:

1. Pest and disease repository – Essentially a database that houses all the relevant details about specific pests and diseases (biology description, geographic distribution, quarantine pest status, commodity association etc.) The database would be kept up to date by a kind of 'versioning' system so if new information comes in and details have to be amended, the most recent version is the one shown.
2. PRA database – a database of previous pest assessments. PRAs can often be reused if the commodity/pathway is similar. A database of previous assessments would allow analysts to quickly generate new PRAs from existing ones, even if small changes are necessary.
3. Decision database - a traceable decision database that records important decisions made during IRA development such as: "scope, rationale to exclude certain pests, regulatory decisions and evidence that supports those decisions". This would allow analysts and managers to keep track of what was decided and when. Decisions made during the development of one IRA could then be easily referenced to others.
4. Analytics tools – once databases are integrated, a lot of quantitative analysis could be done to investigate interesting relationships.

13.8.2 Auto-generate PRA sections

Problem: An IRA contains large amount of repeated information, forcing the analyst to re-write or copy/paste sections.

Opportunity: Automatically generating sections of an IRA that are repeated. Having sections automatically generate can go some way to eliminating inconsistency in writing styles and save the analyst time. There are a few ways that this might be achieved:

- Natural language generation – software could potentially take data from previous IRAs, EPPO/ CABI databases, interceptions data, climate match index calculators and output prose depending on the need.
- Autofill – using a suite of dropdown menus, analysts can select the proper input for an PRA which is then automatically placed in a document.

13.8.3 Improve IT services

Problem: Out of data hardware of software can slow an analyst down or fail to provide them with the services they require.

Opportunity: Upgrading IT systems and services/ Hardware upgrades, like faster computers or tablets allow their users to get more done in the same amount of time. Software upgrades, including technical software for activities like spatial or climate analysis, and depending on the nature of the upgrade, could also speed up analysis.

13.8.4 AI – Argument processor

Problem: Currently, analysts must develop all their own arguments and reasoning.

Opportunity: Get AI to do some of the lifting. An AI argument processor is similar to a word processor but supporting the development of reasoning rather than documents. The argument processor would use AI to support the analyst in various reasoning-related tasks, including:

- Building reasoning based on various kinds of inputs;
- Identifying potential flaws, and suggesting corrections or strategies for improving the reasoning; and
- Automatic drafting of prose presenting the reasoning in form suitable for inclusion in the final IRA.

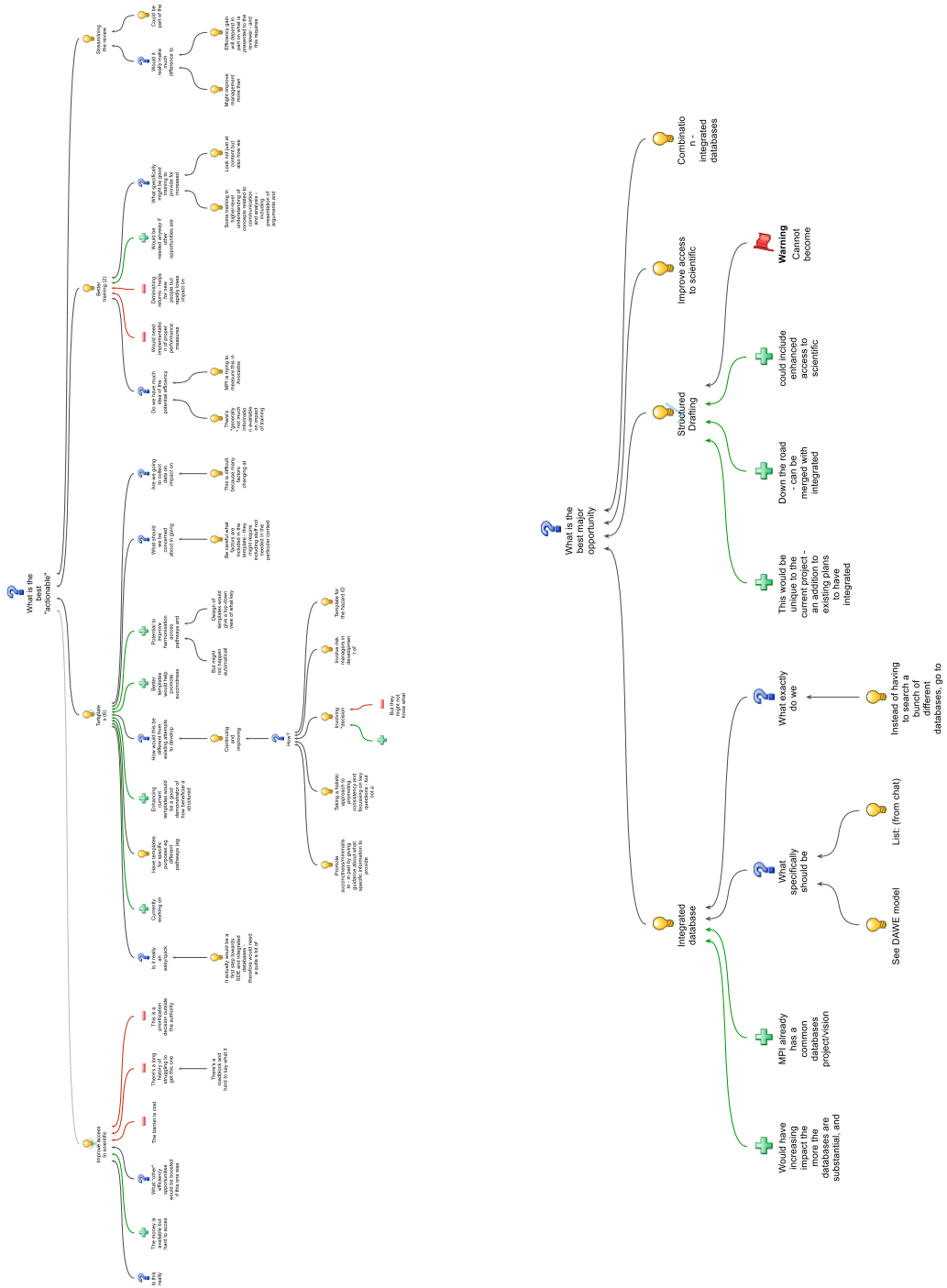A prototype argument processing system has been under development by Luke Thorburn[20].

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[20] Previously a member of the Hunt Lab for Intelligence Research, a unit within CEBRA; currently PhD student at Kings College London.

14 Appendix 5 - Dialog Maps

A zoomable PDF of the maps is available at https://osf.io/gyfpt

Actionable opportunity   Longer-term opportunity

15 Appendix 6 – CASE Principles

15.1 PRINCIPLE OF ABSTRACTION.

To see how the principle of abstraction ensure that each level in the argument is logically connected to the one below., consider the following CASE formatted 'likelihood of entry'[21].

[Contention] There is a low-moderate likelihood that E. Orientalis will enter NZ on Rambutan fruit from Vietnam because

[Top argument level] Although E. Orientalis may not be present on Rambutan fruit

[Sub-argument level] E. Orientalis is mainly found on the leaves of the plant.
- [Evidence level] The mite can be found "on green parts attached to the fruit, and can feed on all chlorophyl containing parts of it's host" (EFSA 2011)
- The mite is primarily associated with leaves which it feeds on (MAF 2011)

Fruit can potentially become contaminated

A small number of mites may be transferred from leaves to fruit
- When harvesting Rambutan, mites may be inadvertently be transferred on to the fruit

And if contaminated, E. Orientalis would be very difficult to detect

All life stages of E. Orientalis are very small
- Eggs, larvae, nymph and adult are all <0.5mm (CPC 2016)

And, they can hide on the fruit
- Fruit have numerous spines which tend to curl slightly
- Mites could readily find places to hide amongst the spines

Figure 15-1: CASE Structured entry assessment

Starting at the evidence level, which is the least abstract level, one can logically infer the more general level above it. For example, if we only knew that "eggs, larvae, nymph and adult are all <0.5mm", we could infer the more abstract claim, that "all life stages of E. Orientalis are very small". The validity of this inference logically connects each layer of the argument. Similarly, we can also infer that "their presence would be very difficult to detect" from the lower level "all life stages are very small".

Compare with the original:

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[21] Adapted from (Clark, 2016, p. 31)

The rambutan plant is a main host of E. orientalis (CPC 2016). It is considered that there is a low-moderate likelihood (with moderate uncertainty) that small numbers of E. orientalis will enter New Zealand on this pathway. The opinion of EFSA (2013) that the mite can be found on "green parts attached to fruit and that it can feed on all chlorophyll containing parts of its host" would suggest that it can be associated with the green tips of the spines of the rambutan fruit (assuming that the harvest-ready fruit still have green parts to the spines). As the spines are numerous and the tips have a tendancy to curl slightly, it is reasonable to assume that the adults and immature stages will find hiding places amongst the spines that enable them to readily avoid detection. In addition, even though E. orientalis is primarily associated with leaves (which it feeds on) (MAF 2011), and the rambutan commodity imported into New Zealand does not contain leaves, rambutan fruit may become contaminated with small numbers of mites via inadvertent transfer from leaves onto fruit during harvest. As all life stages (egg, larvae, nymph and adult) are very small (<0.5mm) (CPC 2016) their presence as contaminants on fruit would be very difficult to detect during harvesting, handling, cleaning and packaging steps of the pathway.

Figure 15-2: Original entry assessment from Clark, "Import Risk Analysis: Fresh Rambutan from Vietnam."

In the original, no principle of abstraction has been adhered to. It's difficult to tell how the specific evidence that has been gathered logically supports the argument, which is itself difficult to pick out. For example, there are three items of evidence that all seem to support the claim that the presence of E. orientalis would be very difficult to detect on Rambutan fruit. In the original, these items of evidence are scattered throughout the paragraph, making it difficult for the reader to infer the claim from the evidence.

When the principle of abstraction is followed, it ensures that conclusions (or in CASE terminology, contentions) are consistent with the evidence. To achieve consistency, when developing the argument, we start with the lowest level of abstraction, the evidence. After gathering the evidence, we abstract from that evidence to find the layer of argument directly above (and thus more abstract). We then abstract from that layer of argument to build the one above that etc.

Consider again, our CASE mapped entry assessment in Figure -1 above. Starting with the bullet pointed evidence level, we can see that the 'sub-argument' is a direct abstraction from that evidence. It makes a more general point that sums up what the evidence is saying in relation to the argument. Moreover, if we abstract further to the top argument level, we can see that it again makes a more general point that the sub-argument below it.

Abstracting from the most specific items of evidence to more general argument layers ensures that the more general or abstract layers are consistent with the ones below it.

15.2 RABBIT RULE

To see how the rabbit rule is applied, consider the final argument, in isolation, from Figure -1 above.

> **[And if contaminated] E. Orientalis would be very difficult to detect**
>
> All life stages of E. Orientalis are very small
> - Eggs, larvae, nymph and adult are all <0.5mm (CPC 2016)
>
> And, they can hide on the fruit
> - Fruit have numerous spines which tend to curl slightly
> - Mites could readily find places to hide amongst the spines

To check for 'magic rabbits', you read each significant term in an upper layer of argument, and then check to see that each term is mentioned somewhere below[22]. The significant terms in the upper layer are highlighted green and yellow. We see that 'E.orientalis' is mentioned below the upper layer, but 'very difficult to detect' is not.

The rabbit rule tells us that an assumption may be missing from the argument, and the assumption has something to do with E.Orientalis being very difficult to detect. The assumption that is missing is something like "that which is small and has a place to hide is very difficult to detect". After running the rabbit rule and making the implicit assumption explicit, the new argument looks like:

> **[And if contaminated] E. Orientalis would be very difficult to detect**
>
> All life stages of E. Orientalis are very small
> - Eggs, larvae, nymph and adult are all <0.5mm (CPC 2016)
>
> And, they can hide on the fruit
> - Fruit have numerous spines which tend to curl slightly
> - Mites could readily find places to hide amongst the spines
>
> And, pests that are small and have a place to hide will be very difficult to detect.

Running the rabbit rule on the argument above, we find there are no 'magic rabbits' and hence no implicit assumptions.

While the rabbit rule can tell us if an assumption is missing and what it might be, it doesn't tell us if the assumption *should* be explicit. In the case above, it's quite obvious that small things with a place to hide will be difficult to detect, so we may need to include the assumption in the argument. So, while the rabbit rule is useful in determining if an assumption has been missed, it will be up to the authors judgement to determine if the assumption needs to be made explicit.

We made use of the rabbit rule when developing the template, by applying it to all the arguments that were constructed, ensuring that important assumptions are not left implicit and we used the expertise of the MPI WG to determine if an assumption should be deemed important.

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[22] The text in square brackets is not a significant term in the argument. Rather it connects this argument with those that preceded it. We can therefore ignore it when applying the rabbit rule.

15.3 EXAMPLE BOOK

2/4 exemplars provided for the PRA subsection, 'Biology and epidemiology' are shown below:

1.1.2 *Biology and epidemiology of [pest or disease name]*

SPECIFC HOST RANGE WITH INDIRECT EVIDENCE

[Pest/group name] is potentially host specific based on mostly indirect evidence

While there is no direct evidence that [Pest/group name] is pathogenic to Humulus
- No research could be located that describe the host-range of [Pest/group name].
- Databases X,Y,Z were search and all returned 0 results.

Closely related strains in the same species as [Pest/group name] are host-specific to a single species
- The collective host range of [Pest/group name] species is large, but individual strains such as *Fusarium oxysporum f.sp Cannabis* only infect cannabis plants.
- Fusarium oxysporum f.sp. citri only infects citrus.

And, those related strains are similar enough in the relevant respects to infer that [Pest/group name] is also host-specific to Humulus
- [Pest/group name] and *Fusarium oxysporum f.sp Cannabis* secrete similar molecular effectors
- Effectors secreted by *Fusarium oxysporum f.sp Cannabis* supress the specific PTI responses of Cannabis allowing for colonisation
- Since Cannabis and Humulus are in the same family, it is reasonable to infer that [Pest/group name] will secrete effectors that are specific to Humulus

UNRESTRICTED HOST RANGE WITH INDIRECT EVIDENCE

[Pest/group name] is not host specific based on mostly indirect evidence

While there is no direct evidence that [Pest/group name] is pathogenic only to Humulus
- No research could be located that describe the host-range of [Pest/group name].
- Databases X,Y,Z were search and all returned 0 results.

Related species in the same genus as [Pest/group name] are known to have wide host-ranges.
- *Vanessa cardui*, the pained lady butterfly, belongs to the same genus as [Pest/group name] and has over 300 recorded host plants
- 9 host plant species have been identified for *Vanessa itea*, also in the same genus as [Pest/group name]

And, those related species are similar enough to [Pest/group name] in the relevant respects to infer that [Pest/group name] has a potentially wide host-range.
- [Pest/group name] is similar in morphology, reproductive strategy and life-cyles to related species that we can safely make inference to the potentially wide-host range of [Pest/group name].

Figure 15-3: Exemplars from the 'Example Book' developed to be used alongside the template.