He Tangata, He Taiao, He Ōhanga

a values-based biosecurity risk assessment framework for Aotearoa

NEW ZEALAND'S BIOLOGICAL HERITAGE

Ngā Koiora Tuku Iho

National SCIENCE Challenges

What is a good decision in biosecurity?

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pest management isn't actually about pests, it's about people, because a pest is only a pest because people perceive it to be a pest and it's impacting on values that they personally see as important (L1)

Introduction

The previous report gives context for this project, covering He Tangata, He Taiao, He Ōhanga and the significance of the research question "what is a good decision in biosecurity?".

Previous work on what is a good decision in biosecurity: literature review

The first part of answering the research question focused on reviewing relevant literature on decision making.

An initial review of the literature identified three perspectives in decision quality research: normative, prescriptive and descriptive (e.g. McFall 2015, Dillon 1998, Frisch and Clemen 1994).

- The normative approach aims to describe how a theoretical, rational decision-maker should act, taking into account their beliefs and desires.
- The prescriptive approach aims to describe how real people should and can make decisions
- The descriptive approach aims to describe how real people actually make decisions.

Each perspective offers insights into how decisions *could be*, *should be* and *are* judged. These perspectives often contradict each other. For example, those working with normative models often highlight that decisions cannot be judged on their outcome, because there is an element of chance, and a poor outcome may not necessarily result from a poor decision (e.g. Edwards 1984). However, those who work with descriptive models have shown that outcome is one of the most important factors in how people judge decisions (e.g. Arvai and Froschauer 2010).

The sections below summarise some of the key insights from the literature review.

Normative models

Normative decision-making models are underpinned by concepts of a "correct" decision, taking into account the stakes and odds for different outcomes, and sometimes the preferences of individual decision-makers (Briggs 2019). Judging the quality of a decision is therefore a process of comparing the decision made with the correct answer as predicted by the model. Although such models tend to oversimplify real situations, there are useful underlying concepts that can be used in understanding decision quality in biosecurity.

- Good decisions take into account both stakes (impact) and odds (likelihood).
- Individual preferences influence what appears to be the objectively correct decision.
- Decisions have an element of chance, and so a good decision does not guarantee a good outcome (nor does a poor decision guarantee a poor outcome).

Descriptive models

Descriptive models aim to understand how people actually make decisions in real-world situations, rather than make any judgement on whether a decision is good or not. However, descriptive models are important for research into what makes a good decision because they give an indication of what may be influencing what people think about their own, and others', decisions. Four areas highlighted by the descriptive literature are particularly useful in understanding how people perceive biosecurity decisions.

- Perceptions of decision quality are strongly influenced by the outcome of those decisions.
- People judge *commission* (taking an action) and *omission* (taking no action) differently. Most commonly, they are more tolerant of risks of omission, termed *omission bias* (Ritov and Baron 1990).
- People judge *direct* and *indirect* harm differently and are usually more tolerant of indirect harm, termed the *indirect bias* (Royzman and Baron 2002).
- People can approach decision-making from a *promotion focus* (maximising gains) or a *prevention focus* (avoiding serious losses; Higgins 1998).

Prescriptive models

Prescriptive models aim to provide people with practical ways to improve decision-making. The field of medicine has the greatest body of research on prescriptive decision making. While much of this research relates to clinical decisions affecting single patients, some of it, such as research into the approval of medicines, has wider relevance for regulatory processes and decision making. The four areas highlighted below are useful in understanding how decision quality can be evaluated in real situations.

- A number of factors need to be considered together in evaluating decision quality, with process particularly important
- Decision inputs, such as the information used, are also important
- There are different elements of the decision outcome which can be considered, including patient's satisfaction (for medical decisions) and the quality of documentation (regulatory decisions).
- While outcomes have some drawbacks as a measure of the quality of individual decisions, they cannot be ignored in the judgement of decision quality

Previous work on what is a good decision in biosecurity: analysis of existing data

The second part of answering this research question focused on using existing data, gathered last year as part of a related project (Newfield and Reed 2021). The major themes developed from the existing data set were:

- Prevention focus
- Good decisions are timely
- Judgement by inputs
- Judgement by outcomes

Prevention focus

The theme **prevention focus** explored what participants are aiming to achieve with their decision-making about biosecurity. According to Higgins (1998), decision-makers can approach a decision with either the goal of maximising gains (*promotion focus*) or avoiding losses (*prevention focus*)[1]. In this study, participants often spoke explicitly of trying to prevent harm or some kind of negative situation as their main objective.

[1] This concept is known as regulatory focus (Higgins 1998). However, because this paper is related to the work of central and local government regulatory agencies, the term regulatory focus is not used here, to avoid confusion.

Good decisions are timely

The theme **good decisions are timely** covered the idea that in order to be good, a decision must be made at the right time. Participants spoke of this theme in a number of different ways. Most often, they spoke about the importance of intervening early. Occasionally, participants spoke of the importance of taking sufficient time to make a decision.

Judgement by inputs

The theme **judgement by inputs** explored the idea that the quality of a decision can be judged by looking at how the decision was made. This theme encompassed a range of different "inputs" into the decision, including the information used to make the decision, the process used to make the decision and having the right people involved. No particular input was prevalent – what was prevalent was the view that good inputs led to good decisions.

Judgement by outcome

The theme **judgement by outcomes** explored the idea that the quality of a decision can only be known once the outcome of that decision is known. In some cases, this view was expressed very directly, with participants stating that good decisions led to good outcomes and bad decisions resulted in bad outcomes. In other cases, the theme was expressed indirectly, such as when they noted that it was difficult to evaluate the quality of decisions because it took time to know the outcome of the decision.

There were also four minor themes in the existing data, and two themes that were important in the literature but rare in the data.

- Objectively right decisions, the idea that there is a right (and a wrong) answer when making a decision.
- Likely to achieve objectives, the idea that a good decision is one that has a high chance of achieving its stated objectives.
- Judgement by relationships, the idea that the quality of a decision can be judged by relationships with others who have an interest in the decision.
- Omission bias, the idea that people are more tolerant of harm caused by omission (inaction) than commission (action).
- Judgement by emotion, the idea that people judge the quality of decisions by how they feel about the decisions. This theme is prevalent in the medical literature but not strongly apparent in the data.
- Good decision doesn't guarantee good outcome, the concept that there is an element of chance in decision-making, meaning that good decisions can still result in poor outcomes. This theme is prevalent in the normative decision making and medical literature but was expressed only rarely by participants.

Methods

Project participants

Participants (33 in total) were drawn from central government, local government, industry, infrastructure (such as ports) and non-governmental organisations with a largely environmental

focus. Some of the participants had been interviewed as part of the previous study (12 participants) and some had not (21 participants).

In identifying potential participants, I used a maximum variation (or heterogeneity) sampling strategy (Patton 2002, page 234). This strategy is suitable for identifying themes which cut across a large amount of variation. I recruited participants for the study by:

- directly approaching those I knew, including participants in the previous study
- asking other project team members for suggestions
- approaching organisations via their public websites
- asking those that I interviewed to suggest further candidates (a form of snowball sampling approach)

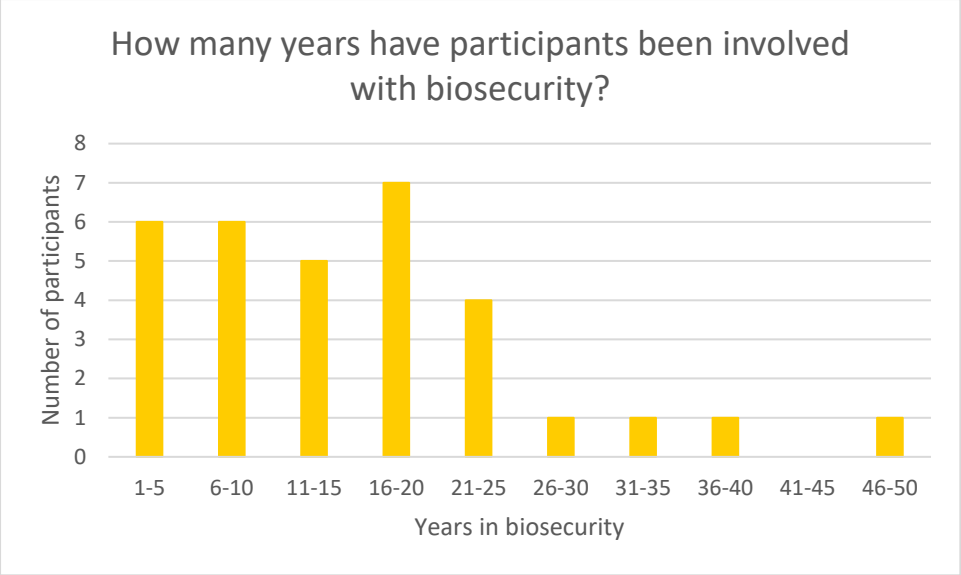
For reasons of confidentiality, I have not given the names of participants nor their organisations. Participants are identified by the type of organisation that they work for (central government = C, local government = L, industry = I, infrastructure = F or non-governmental organisation = N) and a number.

Organisation type	Number of participants	Scope of organisations
Central government	10 participants	3 organisations across 3 geographical locations
Local government	4 participants	4 organisations: 3 North Island, 1 South Island
Industry	8 participants	8 organisations, representing 7 industries across agriculture and horticulture
Infrastructure	7 participants (6 interviews)	6 organisations/ companies involved the process of moving things about, such as air and sea ports or logistics
Non-governmental organisations	4 participants	4 organisations which have environment as a main focus

As well as coming from a wide range of organisations, participants were involved with and affected by a wide range of different biosecurity decisions. Usually, participants had some decisions that they were closely involved with or responsible for, and others that they were aware of or affected by but weren't closely involved with. For example, those who worked at air and sea ports were affected by decisions on requirements for Places of First Arrival and air or sea containers, although they weren't closely involved with those decisions. However, they were also responsible for decisions about how they managed biosecurity risks on their sites.

The participants in this study were generally very familiar with their areas of work and with biosecurity. On average (mean), they had been involved with biosecurity[2] for around 15 years. Three participants had worked in biosecurity for more than 30 years.

[2] 32 participants stated how long they had been involved with biosecurity. In most cases, "involved with biosecurity" meant working in a biosecurity-related role. However, the definition may also have included study which directly related to biosecurity or involvement in community organisations connected to biosecurity.



I had ethical approval from the ethics committee of AgResearch (approval number #01.22) for this study and obtained informed consent from all participants.

Interviews

I interviewed all but one participant via video call, with one interview done by phone. Interviews ranged from 10-50 minutes in length. All but one interview were one-on-one; one interview had two participants as well as the interviewer.

The questions used for the semi-structured interviews are given in appendix X. Participants who had been part of the previous study were asked a slightly different, and shorter, set of questions, because they had been asked very similar questions in the previous study.

All but two interviews were recorded then transcribed by a professional transcriber. Two interviews could not be recorded and so I made written notes during the interview.

Analysis

I analysed the interview transcripts using the reflexive thematic analysis methodology outlined in Braun and Clarke 2022. This methodology uses 6 phases:

1. familiarisation with the data
2. coding
3. generating initial themes
4. developing and reviewing themes
5. refining, defining and naming themes
6. writing up

Although there are 6 phases, the process is recursive rather than linear. For phases 2-5 of the analysis I used the Quirkos software package.

These phases are similar to the phases outlined in in Braun and Clarke (2006), however there are some differences. One of the differences is the terminology around themes. Braun and Clarke (2006) used “searching for themes” as the name for the third phase. However, they noted that this wording

could imply a passive process of uncovering the "truth" in the data, rather than an active process of interpreting the data, which is influenced by the researcher's perspective (Braun and Clarke 2019).

Braun and Clarke (2022 and in previous publications) intend reflexive thematic analysis, as they describe it, to be a fully qualitative research method. This means not only that the method uses qualitative tools and techniques, but also that it is underpinned by a qualitative research paradigm (Clarke and Braun 2018). For example, they see researcher subjectivity as a resource rather than a problem to be managed and reflexivity[3] as important to the analysis process.

Braun and Clarke (2022) outline two important choices which need to be made as part of a reflexive thematic analysis. These choices are: whether the approach to coding is more inductive or deductive, and whether it is semantic or latent. They note that the choices aren't binary but are on a continuum. An inductive approach is more directly driven by the data itself, while a deductive approach is driven more by theory. In this case, I took a more inductive approach to what participants were saying, although I was conscious of what the literature on decision making said. As an example, I was conscious of the distinction between prevention focus and promotion focus (Higgins et al. 1998). A semantic approach to coding is more directly focused on the surface meaning of the data, while a latent approach focuses on deeper and more implicit meanings. Overall, I took a more semantic approach, although there were areas where I took a more latent approach, for example in coding for prevention focus, since participants weren't directly speaking of this.

I also approached the coding without referring back to the coding in the previous study, treating it as a separate dataset, although it is related since some of the participants were the same and some of the questions similar. However in the writeup I referred back to both the previous report and the previous dataset, as well as its codes and themes.

For any quotes used, I have removed any details that might identify participants, including names, organisations and reference to specific locations or control programmes. In the quotes, I have removed parts that might identify the participants. I also removed words that are irrelevant or extraneous, if their removal did not alter the quote's meaning but affected readability. Where anything has been removed from a quote, these omissions are denoted by an ellipsis. If I have altered words or added clarifying details, these are given in square brackets. The removal of identifying details and extraneous words was done late in the process to ensure that context to the quotes was retained during the analysis process.

Study author

I have worked in organisations that are part of the biosecurity system, particularly the Ministry for Primary Industries, for more than 20 years. For most of that time, my work has either been advising decision-makers in the biosecurity system, or managing people who were advising decision-makers in the biosecurity system. I knew one third of the participants in this study from my work in the biosecurity system, and a number of others because I'd interviewed them as part of a previous project. Where I did not know the participants, I often had mutual contacts.

[3] Reflexivity is "an awareness of the researcher's role in the practice of research and the way this is influenced by the object of the research, enabling the researcher to acknowledge the way in which he or she affects both the research processes and outcomes" (Haynes 2012).

I have therefore approached this work with the status of an "insider". This status undoubtedly made it easier for me to understand what decision makers said without needing to ask for clarification – something with both advantages and disadvantages. In particular, my familiarity with the topic meant that I may have assumed meanings based on my own experiences rather than really listening to what was said. I may not have asked followup questions where someone who was less familiar would have, and may have missed some insights as a result.

Results

General

Participants were asked separate questions relating to what makes a good decision, what makes a good decision process and what makes a good decision maker. However, the answers were not always distinct. For example, one participant said that a good process "*requires decision makers who can actually delve into that information*" (C2). In giving an example of a good decision, another participant commented that one thing that made the decision good was "*a really good process that we followed*" (I4). When speaking about involving people in the decision making process, sometimes this was expressed as an action by decision makers, for example, *a good decisionmaker brings all the parties to the table* (I8). However, other participants described involving people as an element of the decision making process, such as *robust discussion and consultation with representative players in the space* (F6).

For this reason, the themes don't fit neatly into characteristics of decisions themselves, processes or decision makers. Instead, most themes are described in ways that can relate to more than one of these.

The major themes developed from this data are:

- Prevention focus
- Good thinking
- Involves people
- Judgement by outcomes
- Informed
- Transparent
- Timely
- Feasible

The minor themes are:

- Long term thinking
- Good use of money
- Listening
- Judgement by relationships
- Courage

Prevention focus

The theme **prevention focus** explores what participants think decision-making about biosecurity should achieve[4]. **Prevention focus** was a dominant theme in the previous analysis and was also prevalent in this dataset.

This theme was often expressed in terms of protecting something, such as *we want to protect our biodiversity, our trade prospects and way of life* (C8), or *the ultimate goal is to protect the economy and environment* (F4). Although each participant described what was being protected in a different way, they said broadly similar things. In general, economic and environmental values were most often talked about, with other values mentioned less often. Some expressed this theme in a narrow way, reflecting the objectives of their organisations. Some expressed it in a very high level way, such as *reduction of risk to New Zealand Inc* (F6) or *protecting the country* (I6).

Prevention focus was also expressed in terms of pests and diseases, or threats, such as *limit damage from any new organism or any biosecurity threat* (C4), *trying to keep out the pests and the diseases* (C2) or, more colloquially as *the whole thing is about not having the bugs in the country* (F5) and *it's all about killing stuff that we don't want here* (N4). **Promotion focus** was expressed only rarely, usually in conjunction with **prevention focus**, and most often in quite general terms, such as *what you're doing as a public servant is to maximise benefits for New Zealand people* (C9).

Prevention or promotion focus is not fixed, but can be influenced by the way that questions are framed (Sevincer and Oettingen 2021). In this work, I used used relatively simple questions which were intended to be neutral and not guide the participants to either prevention or promotion focus. However, the questions did begin with a general discussion of biosecurity work and biosecurity decisions that the participants were familiar with, so I was not asking questions in a neutral context. It is possible, or even likely, that when speaking about a different topic participants would express **promotion focus**. However, in a biosecurity context **prevention focus** appears important.

Collateral damage

An important subtheme of **prevention focus** was **collateral damage**. This subtheme relates to the importance of preventing harm caused by biosecurity activities themselves. Participants acknowledged that sometimes attempts to control pests and diseases could have negative impacts. They spoke of the importance of avoiding *unexpected problems* (L1), *unintended consequences* (C9), *collateral damage* (I2) and *human casualties* (I3). Occasionally, participants defined decisions as bad at least partly because of this kind of impact, as in the following example: *they adversely impacted, to a significant degree, a huge number of people which was absolutely unnecessary* (C10).

The theme collateral damage was sometimes expressed in conjunction with the main objective of biosecurity, indicating that a biosecurity decision could only be regarded as good or successful if it both prevented the harm from a pest or disease and avoided other harm in the process:

- *it achieves the outcome that you're looking for, so whether that might be eradication of something or control of something, while having minimal other impacts that might disrupt people or systems in other ways* (I2)

[4] Based on Higgins (1998)

- *not only do we achieve the objective of keeping it out or getting rid of it if it comes in but also… there's a feeling that the process was done fairly and there aren't too many human causalities along the road* (I3)

Good thinking

The theme **good thinking** explores the idea that certain approaches to thinking about biosecurity decisions are a feature of good decision makers and good decision making. This theme was not obvious in the previous dataset, although some elements of it did appear, for example under the theme **judgement by inputs**. It may have been more obvious in this new dataset because the interviews specifically included questions about good decision makers and decision making processes.

Often, this theme was described as an ability of good decision makers, for example *it's being able to hear other objectives and other perspectives* (C8) or *a decision maker needs to be able to weigh those things up* (L3). However, it was also described as an action, or something good decision makers did, such as *first of all understand what the problem is* (I4) or *looking at that big picture* (F7).

This theme is divided into a number of distinct subthemes:

- Clear purpose
- Big picture
- Analytical
- Open-minded

Clear purpose

The subtheme **clear purpose** explores the idea that good decision making requires a good understanding of purpose, often at the start of the process. Usually this clarity related to knowing the objectives of the decision or having a good problem definition, for example *so a good decision making process needs to have a strong focus on, an understanding of the outcome you're looking to achieve* (C10).

In many cases, this theme was expressed as an action, either done at the start of a good decision process, or done by a good decision maker, such as in the following examples: f*irst of all understand what the problem is* (I4), *clearly define what you are trying to achieve* (F3) and *name the problem* (F4).

Big picture

The subtheme **big picture** explores the idea that good decision making requires a consideration of the wider context in which the decision sits. Sometimes it was expressed with the precise words *big* or *bigger picture* and linked with context, as in *I'm somehow hinting to context but it's broader than that, it's the big picture* (C9) and *someone who can scan the bigger picture and understand the context* (C6). Other simple ways of expressing this subtheme include *broad picture* (C3), *wider picture* (C4), *bigger view* (N4), *complete picture* (F7) and *wider context* (F1).

This subtheme was also expressed more indirectly, when participants spoke of balancing or weighing up a number of different factors, for example *it's not just going in from a technical perspective… you've got a whole lot of other considerations* (I5). Sometimes, this subtheme linked back to the subtheme **clear purpose**.

- *They can kind of balance all of those different elements of the decision and the objective alongside each other without being swayed overly by any one of those components* (N1)

In a few cases, participants expressed this theme by talking about the opposite kind of thinking in a negative way, for example *not have that tunnel vision* (F7).

Analytical

The subtheme **analytical** explores the idea that analytical thinking is a quality of a good decision maker. Sometimes this subtheme was directly expressed by speaking of an *analytical bent* (L4) or stating directly that analytical thinking was a quality of a good decision maker. This subtheme was also directly expressed by speaking of critical thinking, such as *really think critically about something from all angles* (L2) and being *considered, thoughtful* (C6).

In some cases, participants described other ways of thinking consistent with being analytical, for example: *decision makers who can actually delve into that information* (C2). A couple of examples recognised personal passions as barriers to this analytical thinking, such as:

- *along with some passion, has got some ability to critically analyse what's being asked and not get caught up with the passion of it... have a wee bit of passion because I think you don't get anywhere without passion but not let that rule your thinking* (I7)
- *someone who is pretty level headed in terms of making a decision, without getting influenced by your passion or your own personal view on something which is very hard to extract yourself out of when you're a decision maker* (C6)

A few participants also spoke of self-awareness. In describing self-awareness in decision making, participants spoke of an analytical approach to this awareness, so it is included with the subtheme **analytical**.

- *it is people who are conscious enough about themselves and the way their own brains work, to stop and think: actually, someone has just said something that doesn't quite match up with what I thought and I'm in danger of glossing over it really quickly, but in fact I'm going to stop and make sure I understand that* (C8)
- *how does that then extend to me as an individual and my own inherent biases as part of that system* (L3)
- *So there needs to be almost an independence and a conditioning to knowing what your tendency is, knowing what your biases are going to be and being able to step back from that… I think it's extremely important for the decision maker to be able to have the EQI to step back and understand where they're going to be a problem in their own decision making* (C9)

Open-minded

The subtheme open-minded explores the idea that a good decision maker needs to be open to the views and ideas of others. Being open-minded isn't something that a good decision maker does, nor is it an ability. Rather, it is about willingness, such as *being willing to accept information or thoughts or opinions* (L4) and *willingness to engage* (C2). Participants described this subtheme in terms of being open, open-minded, *curious of mind* (L1) and *open to suggestions* (F6). This subtheme particularly related to views which differed from those of the decision maker, such as: *willing to take on advice from a whole range of people and some in which you might not agree with, that you don't necessarily agree where they're coming from* (C6).

Participants also spoke of this subtheme by describing closed-mindedness as a negative trait, as in the following examples:

- *So you need to be adaptable, innovative and yeah, not stuck in your thinking and that your mindset is the only way of actually doing this* (L1)
- *they've been making decisions all their lives and so they're not that open to being told there might be different ways of doing it* (C8)

Involves people

The theme **involves people** explores the idea that a good decision is one where a range of people other than the decision maker have been involved in the process. This theme was present in the previous dataset, where it was included under **judgement by inputs**, but it was much less obvious.

While the theme itself was prevalent, there was no clear pattern in either who should be involved or how they should be involved. Participants spoke of involving people in biosecurity decisions in many different ways. They used a range of different terms such as communication, consultation, collaboration and partnership, but there weren't clear distinctions between these terms. For example, the following statement refers to both communication and consulting: *we've got a strong communication channel… they keep us posted, we don't feel like we're getting missed out, they're really good at consulting with us* (N2).

Participants spoke of having different types of people involved in decision making. Some spoke from the perspective of decision makers who involved advisers as a part of the process, for example:

- *you have to have good people around you and be willing to talk to them and collaborate with them and trust their advice* (I2)
- *you've got to make sure you've got the right people who are competent enough to challenge you as a decisionmaker so that you get their advice* (C5)

Others spoke about what they looked for from a more "outsider" perspective, for example *not just finding out… being involved in the process, whatever the process is* (I1). Some gave examples where decision makers had not involved them, resulting in either the decision maker needing to go back on decisions, or decisions which were not effective[5].

A number of other participants also spoke of the importance of involving others earlier rather than later, for example: *the sooner you are involving them in that decision making process the better* (L1). Another participant noted: *not at the end, asking them or telling them at the end. So making sure that they're around the table at the beginning* (N2). A participant gave early involvement as an example of something that one organisation had learned after it had: *shut people out of being involved… at an early stage and a second time around having learnt from that, didn't do it like that* (C2).

The point about involving others early was also expressed more indirectly by one central government participant, who noted that citizens should be defining objectives: *we're there to deliver a mission that is given to us by citizens so they do get to define what's important* (C8).

[5] Quotes from these examples cannot be used as they identify participants.

Participants occasionally also spoke of why involving people was important, when they spoke about the value of different perspectives in decision making, as in the following example:

- *look at things from many different angles and listen and appreciate all the different aspects rather than getting too closed minded too quickly. So that, you know, that kind of goes back to around the actual decision making process itself being inclusive in terms of others* (L4)

As well as involving advisers and people with a close interest in biosecurity decisions, participants also spoke of the importance of involving the wider public, as in the following examples:

- *in the wider sense making sure that people are not trying to get around the regulations because they understand the regulations are useful. It's a bit like the rules of the road should be, the speed limit should be generally supported by the public. So in the end a good decision is one that has public support and industry support* (I3)
- *keeping the community engaged so they're reporting things that are a little bit unusual* (L1)

Judgement by outcomes

The theme **judgement by outcomes** explores the idea that the quality of a decision can only be known once the outcome of that decision is known. This theme was dominant in the previous analysis and in this one.

This theme was often described directly in terms of a good outcome, such as *it achieves a good outcome for the stakeholders* (I2) or *a good outcome for the environment and the community* (C6). It was also described in terms of decisions which met their objectives, such as *success is always based off of your objectives and goals* (C9), *if you've protected the values that are prioritised for protection* (L3) and *it achieves the outcome for which it was put in place* (F1).

This theme was also described the opposite way, in linking bad decisions with bad outcomes, as in the following quotes:

- *at the other end, you know, you're thinking about an unsuccessful programme and a bad decision* (I7)
- *what made it a bad decision was just that it wasn't future focused, it wasn't open minded and yeah, just the outcomes of it have been atrocious, short sighted* (N1)

Some participants expressed this theme indirectly by noting difficulties in knowing whether decisions were good or not, for example *it's what is best for the country and really can only measure that in the fullness of time* (C4). One participant criticised a tendency to use outputs (what was done) as a measure of success rather than outcomes. They noted that measuring outputs *kind of tells a story about what you did but it doesn't really give you a good metric as to how successful that decision was* (L4).

Participants also expressed this theme indirectly in giving examples of good and bad decisions. In general, examples of good decisions had good outcomes and examples of bad decisions had bad outcomes[6]. One participant commented about a decision they considered bad: *where are the decisions being made? Did they think about the outcome? Did they have fixed in their head quite clearly how bad…* [the pest] *would be?* (F3).

[6] Specific examples aren't quoted as they are likely to identify participants.

Informed

The theme **informed** explores the idea that a good decision is based on having good information as an input into the decision-making process. This theme relates to the theme **judgement by inputs** in the previous analysis, because one of the inputs discussed by participants in expressing this theme was good information. However, in this dataset, the importance of good information was much more prevalent other inputs such as process. As one participant described it, *knowledge is strength* (I7).

A wide range of types of information was discussed under this theme. Some participants spoke of risk assessment, for example *they have to understand what the risks are, you know like what is the potential impact* (C4), *successful decision making is understanding risk and impact* (F2) or *risk assessments because that's what I do believe is the key to good decision making* (C5). Participants also spoke of the importance of science, such as *you need a science base and evidence base* (I8), *they're not making off the cuff decisions based on what they think they know, they're actually making decisions based on science* (F2) and *I do believe that our decision making is better informed by science than it was and I think that's really critical* (N4).

While participants spoke of the importance of good information, some noted that this was not necessarily available to decision makers. Participants sometimes spoke of the importance of having enough information, as in the following example: *if you don't have the information you need to make a good decision, you have to be willing to go out and seek that information and make sure you've got enough, at least, to make an informed decision* (I2). Participants also noted the difficulty of making decisions without good information, for example: *a process for logical decision making doesn't come easy when you've got gaps and so the need for that evidence base* (I8). On the other hand, one participant noted the difficulty of identifying what was relevant among too much information, saying that a good decision maker needed to *be able to select the information that is important to assess and not all the noise that can be around it* (C3).

On the other hand, participants also spoke of the need to make a decision with the information available. They spoke of using *the information you have* (C10), *the best available information* (I5) and *the available information you have on the day* (I4). One participant commented on the value of *really good information, as good as you can but recognising that sometimes that's difficult* (I3). Another participant noted that at times *you may end up making a decision based on a lack of information but that's what you may have to do* (L4).

Participants also spoke of qualities a decision maker required to make an informed decision, such as *the skills and patience and tenacity to gather the data to make a good decision* (C7). Some of the qualities required to make an informed decision link to subthemes of **good thinking**, such as **analytical** and **open-minded**.

Transparent

The theme **transparent** explores the idea that in order for a decision to be good, the reasoning behind a decision must be made clear. In the previous analysis, this theme was almost entirely absent[7]. In this dataset, it was a major theme although not as dominant as the first four themes discussed above.

[7] I considered listing it as one of the themes that was significant in its absence from the dataset, but decided against it because it was also not a common theme in the literature.

This theme was directly expressed by a number of participants, for example: *it should be transparent, I think it should be clear what the inputs are, what has been weighed up and for what purpose* (L3). One participant defined a successful decision as one *where the outcome is clearly understood by the industry participants* (F1), while another said *it's transparent so all parties know how that was made, how the decision was made* (N3). Another noted that being *able to show us how they came to that decision* (I6) was part of a good decision making process and one talked about *transparency right across the board of the process* (C7). One participant noted that they wanted to *actually understand why we're doing it, not just following it for the sake of it* (F5).

Some participants noted that transparency made a difference to people who weren't happy with the outcome of the decision. For example, one participant, speaking from the perspective of a decision maker, commented that *at the end of making the decision you want everybody, not to be happy but you want everybody to understand why and how and what it means* (C5). Another government participant gave a similar perspective: *a good decision I think is one where someone can look at all the information that was used and at least understand… the final outcome of the decision, even if they still don't necessarily agree with it* (C1).

The theme transparent was also expressed by linking a lack of transparency with poor decisions. For example, one participant noted *we're not so happy when we don't understand why they're doing it* (F1). When giving examples of decisions that they considered to be bad, some participants spoke of how they found those decisions incomprehensible, as in the following example: *I don't understand what was going through their heads. I don't know all the facts but for the life of me I can't understand what they were thinking* (F3).

Timely

The theme **timely** covers the idea that in order to be good, a decision must be made at the right time. In the previous analysis, this theme was primarily expressed in terms of acting early – a decision was good if it was made early enough to be effective. The opposite – the importance of taking enough time to make a decision – was also expressed but was relatively uncommon. In this dataset, *acting early* (I3) and *taking time* (C10) were roughly even.

When participants spoke of acting early, they noted the impacts of either early or delayed decisions. For example, one industry participant noted *virtually any time where if you can act early, the costs of an intervention will be less* (I3). Another noted that *you have to make a decision, if you don't make a decision, [if] you're trying to wait for more information, you're actually in a worse situation than making it with limited information* (I5). One government participant noted that *the timeframe's dependent on the situation so that you don't make hasty decisions or you don't make decisions that are no longer valid because you didn't make them hastily enough* (C8).

When speaking about taking time, they noted reasons for this, such as *give it time to get all that data* (C7) and *taking time to really consider the long term implications of those particular decisions* (C10). Industry and infrastructure participants said that sometimes they were not given sufficient time to provide comment or implement changes, for example *sometimes consultation starts too late for deadlines* (F6) or *infrastructural changes take time to make, hence the more notice one has the more likelihood of an appropriate outcome* (F1).

In a number of cases, participants spoke both of acting early and taking time, as in the following quote:

- *So I do think you need to make timely decisions but someone also said something quite important which is we often get too hung up on the urgency and actually some things are not as urgent as people make them out to be and therefore we rush the decision making and I think that's a problem. I think you don't want to rush the decision making but you also can't get stuck in paralysis* (C4)

Achievable

The theme **achievable** explores the idea that in order to be good, a decision must be achievable or feasible to implement. This theme is related to the theme **likely to achieve objectives** in the previous analysis, because one of the factors that made a decision likely to achieve its objectives was feasibility. In this dataset, the theme **achievable** was expressed frequently enough to be a major theme itself.

This theme was sometimes expressed quite directly, such *as it's taking on things that are achievable* (I7), *it's not worth throwing money at things that really aren't feasible* (C8), and *it has to be something that is feasible, you know, there's no point in making a decision that you then can't actually carry through in practice* (L3). This theme was also expressed in relation to decisions being *fit for purpose* (F1), *practical… workable* (C6) *practicable and what's pragmatic* (I1). Occasionally, this theme was expressed by speaking of decisions which were bad because they were not achievable.

The subtheme **appropriate resourcing** was part of the theme **achievable**. A few participants directly linked resourcing to achievability, for example *good decision making is making sure that you're not setting… [the decision] up to fail… being prepared to invest the resources that are required to achieve the outcomes that you have decided need to be achieved* (C4). Another participant noted: *I think that's the big, you know, lacking part… we make a decision… then they don't have any teeth, they don't have any funding* (N3).

Minor themes

In addition to the major themes, there were a number of themes that were expressed less frequently and by fewer participants, but were still apparent in the data.

Long-term thinking

The theme **long-term thinking** explores the idea that good decision making takes the long-term consequences of decisions into account. This theme was occasionally present in the previous dataset, as part of the theme **judgement by outcomes**; there, participants noted that it could take time to know the results of decisions. In this dataset it was more apparent.

Some participants were explicit in stating that good decision making required long-term thinking, such as *you got to think about long term* (I7), *they need to be able to make the decisions weighing in on an ability to kind of see the longer picture* (N4) and *often the true impacts of decisions aren't felt until quite a while down the track afterwards. So it's really kind of important to be mindful of that* (I2).

Others noted the difference that long-term thinking could make to the judgement of decision quality, as shown in the following two quotes:

- *I can measure something in five years time and will say yes we made the right decision… but in 50 years time it could be a completely different answer* (C4)
- *what about the generations to come?… this is something we can't compromise on it because it's going to affect the future of our kids and their kids and the kids that follow* (C6)

This theme was occasionally expressed when criticising particular decisions, for example *it wasn't future focused* (N1) and *we're saying long run like maybe to the next minister and so almost everything when we think about success is often in that short term* (C9).

Value for money

The theme **value for money** explores the idea that good decision are worth the money and resources spent on them. This theme was less apparent in the previous dataset and wasn't developed into a theme, although it was present. In this dataset it was expressed in more different ways than the previous dataset, both directly and indirectly.

Participants noted that good decision making took cost into account, for example in saying that *value for money is always an objective* (C8) or in saying of a successful decision that *it's not going to be a waste of money* (L3). They also linked value for money to good decisions in other ways, such as *if it's a good decision and it's well consulted and it's implemented correctly and communicated well, then it's probably going to be cost efficient* (F1).

Participants also expressed this theme by linking bad decisions with a waste of money, for example *we tipped lots of money down the drain* (C8) *there's been so much money wasted* (I7) and *your gut feeling is [this is] not really a good use of public money* (L1). One participant noted that a decision considered good from one perspective could still be bad in terms of cost: *there have been decisions made that do meet your stated objective but on balance are probably not a good use of taxpayer money. So I would think that financially responsible should be a part of good decision making as well* (C10).

Listening

The theme **listening** explores the idea that a good decision maker is a good listener. This theme was not apparent in the previous dataset, although listening was occasionally mentioned. However, in the previous study there were no questions which prompted participants to consider the qualities of a good decision maker. This theme relates to the subtheme **open-minded**.

A number of participants expressed this theme by identifying the ability to listen or hear as a quality of a good decision maker, but without further clarification of what they meant. A few described what they meant in more detail, as in the following quotes:

- *being able to hear and understand and being willing to actually hear different perspectives and different objectives* (C8)
- *they don't need to be experts in that but they need to be able to take advice* (L3)
- *able to listen to all the various ideas, communicate, you know reflect that back to everybody* (N2)

Judgement by relationships

The theme **judgement by relationships** explores the idea that the quality of a decision can be judged by relationships with others who have an interest in the decision. This was a minor theme in the previous analysis and was present to a similar degree in this dataset.

In some cases good decisions were linked very clearly to having good relationships, for example *in the end a good decision is one that has public support and industry support* (I3) and *it was a good decision because it has united the community* (N1). However, participants didn't necessarily expect everyone to be happy in order for a decision to be good, as in the following quote: *at the end of making the decision you want everybody, not to be happy but you want everybody to understand why and how and what it means* (C5).

One participant explained succinctly the link between biosecurity decisions and relationships:

- *the older you get you realise that pest management isn't actually about pests, it's about people because a pest is only a pest because people perceive it to be a pest and it's impacting on values that they personally see as important* (L1)

Courage

The theme **courage** explores the idea that a good decision maker needs to have courage, particularly in relation to uncertainty. This theme was not apparent in the previous dataset. This theme was expressed using a number of different words related to **courage**, including *brave* (C1), *bold* (N1), *decisive* (C10), *confident* (F2), *strong* (N2) and *prepared to take risks* (L1).

Participants usually expressed this theme as a quality of a good decision maker, for example *can be decisive in the face of a lot of ambiguity* (L2) and *you also need to be quite decisive. So once you've made a decision, you do need to be confident that you've done the best you could with the information you have* (C10). Another example, which spoke about the uncertainty, was: *it's around being brave enough or confident enough to actually make a decision based on what's in front of you... you need to pursue additional information if you need it but in the end you're never going to have everything, no one is omniscient so you have to make a decision and understand the risks around that decision. But you've got to be brave enough to do it, you can't just keep procrastinating* (C1).

The theme courage was also linked to doing something new, that hadn't been done before, as in the following examples:

- *you do need to be prepared to take risks because again a lot of the stuff we're dealing with are new problems and new environments* (L1)
- *I think that was a fantastic decision that required a strong leadership because it hasn't been done before* (N2)
- *they weren't afraid to tackle something that naysayers would have said no* (N4)

As well as uncertainty, participants occasionally linked courage, or lack of it, to political pressure for example, *lack of courage to push back I think* (C10) and *the more skilled and the more experienced somebody is… then they just make the call and be comfortable with the political ramifications* (C2).

Discussion

The aim of this research is to show how the diverse participants in the biosecurity system perceive good decisions, good decision making processes and good decision makers. This research has shown that participants do not separate the elements of process, person and the decision itself. Many themes relate to more than one of these elements. For example, the theme **informed decisions** is expressed in relation to process, for example, *the first part is information gathering* (C7), person, for example, *able to select the information that is important to assess and not all the noise that can be around it* (C3) and decision, for example, *a successful biosecurity decision is made with the best available information* (I5).

To some extent, this way of looking at decision making is also shown in the literature. For example, Donelan et al. (2015) described 19 themes in relation to decision making for pharmaceutical products. One example was **clear understanding or lack of understanding of the decision in question**, a theme which could be related back to the problem definition and objective part of the process, or the comprehension of the decision maker. The theme **analytical and logical approach** could also relate back to the process or the decision maker.

Comparison with approval of new medicines

Based on the 19 themes of Donelan et al. (2015), Bujar et al. (2016) described ten practices of quality decision making. These are worth comparison with the themes relating to good biosecurity decisions, as both were derived from interviewing participants in the system and analysed using thematic analysis[8]. The practices described in this work were:

- Have a structured, systematic approach
- Assign clear roles and responsibilities
- Assign values to decision criteria
- Evaluate influences and biases
- Examine alternatives
- Consider uncertainty
- Re-evaluate with new information
- Perform impact analysis
- Ensure transparency and provide record trail
- Communicate decision basis

The elements described by Bujar et al. (2016) are either distinct process steps, such as **perform impact analysis** or factors which relate to the process, such as **have a structured, systematic approach**. In the current study on biosecurity decision making, the themes and subthemes that particularly relate to process include **clear purpose**, **informed decisions** and **involves people**. None of these three themes link back to the quality decision making practices of Bujar et al. (2016). Some of this may relate to the very different decision making contexts, for example the decision process for approval of new medicines already has a clear purpose, whereas the biosecurity decisions considered were more diverse.

The themes described by Donelan et al. (2015) were intended to describe decision making, not necessarily good decision making, so they include themes such as **overconfidence in own**

[8] Although the work of Donelan et al. (2015) used thematic analysis methodology, it was a different type of methodology to the reflexive thematic analysis described by Braun and Clarke (2022).

judgement. There are some themes in common between the themes of Donelan et al. (2015), but there were more differences than similarities (Table X).

Table X

Themes of Donelan et al. (2015)	Comparable biosecurity themes
Quality and validity of data	**Informed decisions**
Time considerations and workload	**Timely?**
Organisational, hierarchical and cultural influences	No comparable theme
Analytical and logical approach	**Analytical (good thinking)**
Qualification and experience in previous decision making	No comparable theme[9]
Political, financial, competitor and reward influences	No comparable theme[10]
Precedents for similar previous decisions	No comparable theme
Perpetuating previous decision making mistakes	No comparable theme
Plunging in or procrastination with decision making	**Timely**
Clear understanding or lack of understanding of the decision in question	**Clear purpose (good thinking)**
Overconfidence in own judgement	No comparable theme
Group successes and group failures	No comparable theme
SWOT and alternate outcome planning in decision making	**Analytical (good thinking)?**
Impact analyses of decisions	**Big picture (good thinking)?**
Decision making audit trail	**Transparency**
Education and awareness of evolving decision making techniques	No comparable theme[11]
Individual vs. corporate decision making	No comparable theme
Quantitative frameworks	No comparable theme

Perhaps the most apparent difference between the two analyses is the lack of themes relating to people (other than the decision makers themselves) in the work of Donelan et al. (2015). **Involving others** was a dominant theme in biosecurity, while **judgement by relationships** (judging decision quality by the quality of relationships with those affected) was a minor theme. This difference highlights just how different the approval of a medicine is from most biosecurity decisions[12].

Comparison with other decision making literature

There are other publications summarising elements of good decision making. Although none use a similar methodology, they are still worth comparison with the biosecurity themes identified here.

[9] Although I didn't develop a theme related to the experience of decision makers, it was spoken about by participants and there were codes relating to decision maker experience. However, there were fewer statements and fewer decision makers speaking about it than for the minor themes I developed.
[10] There were statements and codes related to political influence and bias in the dataset.
[11] One participant spoke of the need for formal training in decision making
[12] Decisions by the EPA are the closest, as they evolve evaluating a dossier of evidence, however the EPA process includes consultation as a statutory requirement for most applications.

The work of Hamilton et al. (2017) summarised key concepts related to clinical decision making, based on workshops held at meetings of the Society of Behavioral Medicine and the Society for Medical Decision Making in 2015. While there are obvious differences between clinical decision making and biosecurity decisions, there are common elements. The biosecurity themes **informed decisions** and **clear purpose** fitted with the concepts in Hamilton et al. (2017). The concept of meaningfully involving the patient in decisions which affect them is clearly related to the theme **involves others** in biosecurity. The biosecurity theme **judgement by relationships** can perhaps be linked to some of Hamilton's concepts. However an obvious absence is judgement by outcome – in the medical decision making literature, statements about not judging decisions on outcomes are prevalent, including Hamilton et al. (2017).

Concepts from Hamilton et al. (2017)	Comparable biosecurity themes
Consideration of factual and probabilistic health information	Informed decisions
Consideration of personal goals and preferences	Clear purpose (good thinking)
Patients are meaningfully involved	Involves others
Decision is based on what is known about the options, as well as values and preferences	No comparable theme
Patients obtain a value-concordant treatment	No comparable theme
Patients experience limited regret about process and outcome	Judgement by relationships
Patients are satisfied with the decision experience	Judgement by relationships

Outside the field of medicine, there is limited research on evaluating the quality of decisions, processes and decision makers. However, there is some guidance available which isn't based directly on research but is still relevant.

The principles from the Australian Department of Defence (2015) provide one example. These principles have limited overlap with the biosecurity themes. However the 4th principle refers to timeliness and fits with the biosecurity theme of **timely**. The same principle can also be related to the theme **informed**, which includes concepts of making a decision with the information available and the challenges of gathering enough information.

1. Decision-making requires flexibility and creativity
2. Decision-makers should manage risk, rather than simply avoid it
3. Decision-makers should apply time and resources proportionate to the possible consequences of a decision
4. Decision-makers should balance certainty that a decision is correct against the need to make a decision in a reasonable time frame
5. Decision-makers should balance individual and organisational requirements

The decision making guide from the Office of the Ombudsman (2012) is relevant to decision making in public service agencies. There is some overlap between the principles outlined there and the biosecurity themes. For example, one principle is **make the decision on reasonable grounds and based on supporting evidence**, which links to the theme **informed**. The principles related to a fair

process also link to the biosecurity themes, for example **have an open mind** and **act without undue delay** are directly related to the biosecurity themes **open-minded** and **timely**.

- act independently, in good faith and for a proper purpose
- comply with relevant legislation
- follow any relevant policies and guidelines, unless there is reason to make an exception
- take into account all relevant matters
- ignore matters that are not relevant to the decision
- apply the appropriate weight to the different factors relevant to the decision
- give proper consideration to the merits of the case
- make the decision on reasonable grounds and based on supporting evidence
- fair process when the decision affects people:
    - give the person an opportunity to provide all relevant information
    - where appropriate, give the person a fair chance to comment before the decision is made
    - take measures to address any actual or perceived conflict of interest
    - act independently and have an open mind
    - act without undue delay

Potential principles for biosecurity decision making

Although the biosecurity themes do have elements in common with themes described in the literature, as a set, they appear unique. For example, there is a strong focus on evidence, such as science and risk assessment, as is seen for approvals of medicines, but there is an equally strong focus on involving those who are affected by the decision, as is seen in clinical decision making.

The themes developed in this research may be useful as a starting point to develop principles for good biosecurity decision making. They do not provide a representative view of what biosecurity participants think, but they can serve as a hypothesis for wider discussions. As a starting point, table Y lists the themes and potential principles which could be derived from the themes.

Table Y – potential principles based on themes

Theme	Potential principle
Prevention focus	The objective of biosecurity decisions is to prevent harm
Good thinking	Good biosecurity decision making results from taking a good approach to the decision
Clear purpose	Good biosecurity decision making starts with having a clear purpose
Big picture	Good biosecurity decision making takes the big picture into account
Analytical	Good biosecurity decision making requires an analytical approach
Open-minded	Approach biosecurity decision making with an open mind
Involves people	Good decision making involves people
Judgement by outcomes	Good biosecurity decision making has good outcomes
Informed	Good biosecurity decisions result from having good information
Transparent	Good biosecurity decisions and decision making processes are transparent
Timely	Good biosecurity decisions are made promptly, but are not rushed
Achievable	Good biosecurity decisions set achievable objectives
Long-term thinking	Good biosecurity decisions consider long-term outcomes

Value for money	Good biosecurity decisions are cost-effective
Listening	Good biosecurity decision makers listen
Judgement by relationships	Good biosecurity decision making improves relationships
Courage	Good biosecurity decision making requires courage

Presented in this way, some of the themes do not necessarily make good principles. For example, it is debatable whether **prevention focus** should be used as the basis for a principle, or whether it should largely be seen as a description of how people think about decisions. However, it was clearly important. It appeared in both the analysis of data from a previous series of interviews and the current dataset. This is not surprising, given the strong element of prevention inherent in definitions of biosecurity, such as "the exclusion, eradication or management of pests and diseases that pose a risk to the economy, environment, cultural and social values, including human health" (MPI 2016).

It appears well-understood by biosecurity system participants that their goal is to prevent harm, both as a consequence of introducing pests and diseases, and as a consequence of biosecurity activities. Given this widespread understanding, there may be limited value in having it as a principle. However, it is not necessarily the case that those who are less familiar with biosecurity will have the same focus. Being more conscious of **prevention focus** may help in situations of conflict around biosecurity decisions.

The principles for military decision making from the Australian Department of Defence (2015) place a caveat on **prevention focus**. The second principle states that *decision-makers should manage risk, rather than simply avoid it*, implying that a complete focus on prevention is not desirable in decision making. A similar point was made by one industry participant, who noted that *the only way to be free of Covid, by way of extension, is to stay in your house and wrap yourself up in a bubble and not go anywhere, and that's the only way, and if we were to translate that into business then frankly we wouldn't have any business* (I1).

It is also debatable whether **judgement by outcomes** should be used as the basis for a principle. This study is consistent with other descriptive studies on decision making – people judge decisions on their outcomes. However, biosecurity decisions do have an element of chance – a point which was recognised by some participants. For example, one participant noted that *a lot of the stuff we're dealing with are new problems and new environments and yeah, what worked in one country or another part of New Zealand, won't necessarily achieve the same results for you where you are* (L1).

Very few of the participants indicated that they considered that good decisions could still have poor outcomes, both in the current study and the previous analysis. One exception was the participant who noted that *a successful biosecurity decision isn't even necessarily the right one in hindsight... In hindsight you might have made a different decision once you've got more information* (I5).

The focus on **judgement by outcome** warrants more attention. If most biosecurity system participants assume good outcomes from good decisions, there may be conflicts when decisions don't have good outcomes, even though this may not necessarily be because there was a poor decision. Likewise, fortuitous good outcomes may lead to poor decision making being overlooked. This is not necessarily an area for research, but would be a useful point for those involved in biosecurity decision making to bear in mind.

Among the minor themes, there is one obvious contradiction between two of the themes, **listening** and **courage**. As an illustration, the quote that *they weren't afraid to tackle something that naysayers would have said no* (N4) directly suggests decision makers who didn't listen. These two contradictory themes may be similar to what is seen with the theme timeliness, where both acting early and taking time are important. Awareness of these contradictions may be useful in situations where there is conflict over biosecurity decisions. For example, a conflict may arise when one party thinks that **listening** is most important while another thinks **courage** is most important.

The theme **involves people** was dominant, but identified a real challenge in developing a set of agreed principles. Although participants thought that involving people in biosecurity decisions was important, beyond that there were no obvious patterns. Participants differed in who they spoke about involving, from those who were mostly focused on having good advisers to those who spoke of partnership and shared decision making. Participants also used a wide range of terms such as collaboration and consultation, but defined them in different ways. There was no consistency in how they thought people should be involved.

This variation was reflected in the diverse ways that people spoke about the ways that they were involved in decisions. Some spoke very positively of how they were involved, such as *the concept of true partnership has never been better* (I8) and *that's all working really well for us* (N2). Others expressed more frustration, such as *part of my angst and troubles in this role has been communication* (I1). This lack of agreement on how to involve people is an obvious area where more research and working to develop shared expectations may be useful.

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