BCA PRACTICE NOTES

CRITICAL THINKING AND THE IMPORTANCE OF ASKING QUESTIONS

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If we are not able to ask skeptical questions ... to interrogate those who tell us something is true, to be skeptical of those in authority ... then we are up for grabs for the next charlatan, political or religious, who comes ambling along.

Carl Sagan

Critical thinking is becoming widely considered to be one of the most important core skills needed in today's knowledge-based economy. This is partly because it is not specific to any one domain, but can be applied across a wide range of subject areas, making it particularly important for agile, flexible workforces. It is also, as in the quote above, perhaps our best defence against the influence wielded by vested interests; those who would have us believe that something is so, just because we are told. It is perhaps not surprising then, that critical thinking is an essential skill for using the NZ Transport Agency's Business Case Approach (BCA) effectively.

What is critical thinking?

As you might expect with such a wide-ranging and widely applicable topic, there are numerous definitions of critical thinking available, some of which are more helpful than others. One of the more comprehensive definitions comes from the Foundation for Critical Thinking (FCT), which proposes the following:

> *Critical thinking is that mode of thinking – about any subject, content, or problem – in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It entails effective communication and problem-solving abilities, as well as a commitment to overcome our native egocentrism and sociocentrism.*

Put more simply, critical thinking involves being able to analyse information objectively, and then make a reasoned judgement about that information. It also involves thinking objectively about the **ways** in which we are thinking, then being prepared to change those ways if they are flawed, irrational or unreasonable.

Implicit in these definitions is a need to not simply accept information (or arguments, or conclusions) at face value. Instead, it is important to adopt an attitude that seeks to question such information, for example by asking to see the evidence that supports a particular argument or conclusion.

Although many definitions do not explicitly include the self-directed aspects of the FCT version, it could be argued that they are implicit in most, if not all definitions. After all, it is hard to be confident that your thinking is fully rational and objective if you can't contemplate the possibility that you may be using flawed thinking yourself. Many sources that offer a definition include subsequent explanation of the core skills or traits that are required, most of which include a need to reflect on one's own rationality, biases, beliefs and values, and how these might affect objectivity.

All of this implies a need for a high level of self-awareness about our habits, thought patterns, personal biases and personality that few of us can realistically hope to fully attain. While perfection in this regard is probably beyond the reach of mere mortals,

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For general guidance about the BCA, visit nzta.govt.nz/bca.

the important thing here is a willingness to try: a desire to elevate one's thinking out of entrenched patterns to reach a more reliable judgement or conclusion.

It is also important to reflect on what critical thinking is **not**; this is not about being automatically critical or argumentative for the sake of it. Critical thinking has a role in constructing, and helping others construct, strong reasoning to enhance what we do.

Similarly, and contrary to popular opinion, critical thinking is entirely consistent with creative problem solving and innovation. This is because truly creative work requires that ideas be analysed objectively to see if they are in fact any good (see *BCA Practice Notes 5: Innovation and creativity in business case development*).

Core skills for critical thinking

It follows that there are some core skills – or perhaps characteristics – that are essential to critical thinking:

» **Be curious**: cultivate a genuine desire to understand; this will help you to formulate good questions and focus on what matters most.

» **Be sceptical, not cynical**: scepticism means not simply accepting information at face value; it is selective and used to test thinking in ways that can be as constructive as they are destructive. In contrast, cynicism means being distrustful and suspicious about everything and anything, regardless of its merits.

» **Be self-aware**: no, this does not involve hours of meditation and incense. Self-awareness in this context means acknowledging that our personal values, beliefs and experience will shape our own thought patterns. It also means showing a willingness to watch out for this tendency and adjust one's thinking where it is appropriate to do so. In a very real sense it is having the humility to accept that because we are shaped by our experiences and preferences, anyone and everyone can sometimes be wrong, including ourselves.

Note: Critical thinking is a very wide subject, and I can only provide a very brief summary of the main aspects in this section. Further reading is strongly recommended; to get you started, a references and recommended reading list included at the end of this practice note.

Avoiding common thinking pitfalls

Like it or not, we exist in a world full of opportunities to be deluded in our thinking. The late American scientist Carl Sagan devoted much of his time and attention to identifying and challenging the many kinds of deception to which we are **all** susceptible – often originating with ourselves. Sagan argued that scientists are, as a result of their training, equipped with what he called a 'baloney detection kit'.

This 'kit' is essentially a set of cognitive tools and techniques, usually learned through the scientific method, which can help identify flawed arguments and falsehoods. The scientific method has been developed and refined over centuries as a means of helping scientists to avoid falling prey to their own prejudices and biases, and has much in common with critical thinking. Interestingly, it is also a principles-based method that has many characteristics in common with the BCA.

The list below is based on Sagan's kit, which includes several 'tools' based on principles from the scientific method:

1. Wherever possible there must be independent confirmation of the 'facts'.
2. Encourage substantive debate on the evidence by knowledgeable proponents of all points of view (which aligns well with the key BCA behaviour of **informed discussion**).
3. Arguments from authority carry little weight – 'authorities' have made mistakes in the past, and will do so again in the future.
4. Always try to come up with more than one hypothesis: if there's something to be explained, think of all the different ways in which it could be explained. Then think of tests by which you might systematically disprove each of the alternatives. Whatever survives has a much better chance of being the right answer than if you had simply run with the first idea you had.

5. Try not to get overly attached to a hypothesis just because it's yours. It's only a way station in the pursuit of knowledge. Ask yourself why you like the idea, and compare it fairly with the alternatives. See if you can find reasons for rejecting it; if you don't, others will.
6. Quantify: if whatever it is you're explaining has some measure or quantity attached to it, you'll be much better able to discriminate among competing hypotheses.
7. If there's a chain of argument, every link in the chain must work (including the premise) – not just most of them.
8. Occam's Razor. This convenient rule-of-thumb urges us, when faced with two hypotheses that explain the data equally well, to choose the simpler.
9. Always ask whether the hypothesis can be falsified, at least in principle. Propositions that cannot be proved wrong are not particularly useful. For example, the statement 'There is a monster in Loch Ness' cannot be proved wrong; all you can demonstrate is an absence of evidence pointing to its existence (or, just possibly, that a monster really exists). The statement leaves us no more certain, scientifically speaking, than we were beforehand; all we are left with is a reliance on belief (one way or the other!). You must be able to check assertions out; inveterate sceptics must be given the chance to follow your reasoning, to duplicate your observations and see if they get the same result.

All of these tools are directly relevant to the development of business cases; especially if one replaces 'hypothesis' with 'problem definition'.

The dangers of 'common sense'

Sagan also identified the typical thinking pitfalls that are associated with 'common sense'. Many of these are also encountered regularly when developing business cases, including:

» **Assuming the answer (sometimes referred to as 'begging the question')**. For example, it could be argued that we must increase bus services to get more people out of cars in order to manage growing congestion. But does increasing availability of buses make people more likely to use them? How do we know that it is lack of availability that is discouraging use, rather than some other factor? (For example, if I use my car I don't have to wait at a bus stop with a bunch of schoolkids.)

» **Observational selection, and the statistics of small numbers**. Ignoring data that doesn't support our hypothesis, or selectively citing two or three data points then extrapolating a trend showing 'growth' which 'must' then be catered for.

» **Suppressed evidence, or half-truths**. This is also related to observational selection. For example, a proposal is advanced to realign a tunnel, supported by the fact that it is associated with several fatal and serious injury crashes. However, detailed examination of the safety data shows the crashes are all located over 300 metres from the tunnel, and are more likely to be associated with the sharp bend at the end of a nearby passing lane. Realigning the tunnel will cost tens of millions of dollars to implement, and will irrevocably change a unique and fragile environment; yet because it is a high profile action, it is politically attractive, even though addressing the real safety problem would cost less than $1m and have a fraction of the environmental impact. Sometimes this situation arises because new evidence is found that contradicts the original view of a problem (which people have agreed to). A choice then has to be made:

  - accept the new evidence, and along with it the need to go over all the work already done
  - try to explain the new evidence away, or
  - quietly ignore the new evidence while trying to reinforce whatever evidence supports the original view.

  Our habit of **mental fixedness** – our inability to let go of our traditional patterns of thinking – inclines us to believe that once people have agreed to something, we have to stick with it. This often leads people to follow the second or third options above, usually resulting in attempts to defend the indefensible. The better choice is the first option, where we accept the need to change our explanation of what is happening to fit the new evidence.

» **Misunderstanding the nature of statistics**. US President Dwight Eisenhower was allegedly astonished to find that **fully half of Americans are below average intelligence** (I will leave the reader to work out the irony). Statistics are frequently misused in attempts to demonstrate a point, apparently without a clear understanding of what they actually show – or more often, don't show. While acting for the Rogers Commission investigating the causes of the Space Shuttle Challenger disaster, Nobel Prize-winning physicist Richard Feynman commented that NASA management's claim of a probability of failure for the shuttle 'in excess of 1 in 100,000' was clearly ludicrous. The implication of this figure was that a shuttle could be launched every day for 300 years without a catastrophic failure occurring, which is highly unrealistic for cutting-edge engineering. When canvassed anonymously, scientists and engineers working on the shuttle programme volunteered figures between 1:50 and 1:200 as realistic probabilities of failure. Out of 135 missions flown, two catastrophic failures occurred, showing that the engineers were far closer to the truth than management.

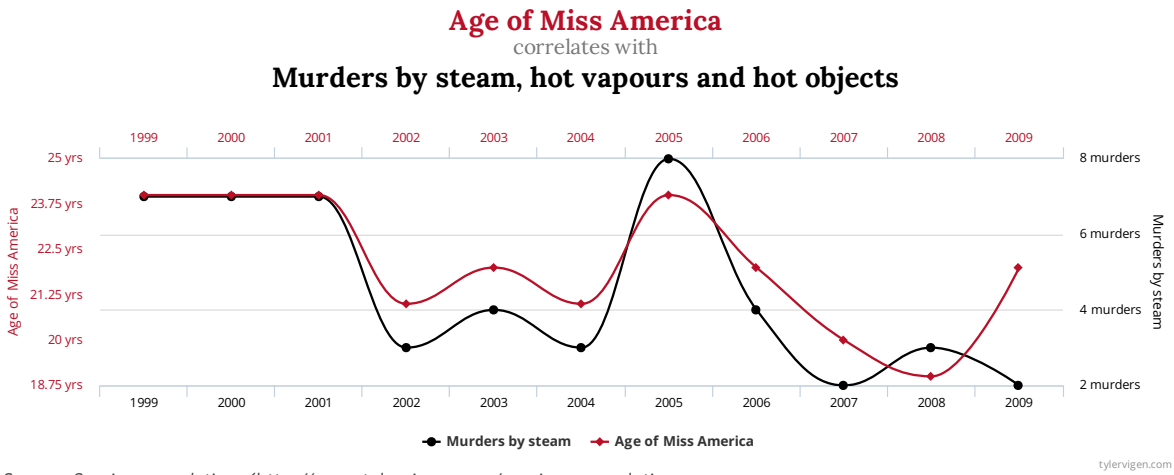
» **Non sequitur**. This is claiming that one thing will lead to another, when there is no evidence for a direct connection between them. For example: 'We need this lead infrastructure now so our town will thrive'. This presupposes that the absence of lead infrastructure is the only factor preventing our town from thriving – in reality things are rarely that simple. Without clearly understanding what else is needed to make a town thrive, then planning to provide it, the provision of lead infrastructure has a high risk of becoming a white elephant.

» **The excluded middle, or false dichotomy**. Essentially this means ignoring a continuum of possibilities to try and force people to align with one of two extremes – for example, 'You either support this proposal or you are against safety'.

» **Confusion of correlation and causation**. Existence of a correlation between two sets of data does not automatically mean there is a causal relationship. Consider this (hypothetical) example: statistics may show a higher risk of being involved in a crash if you are driving a red car. Therefore, you might conclude that red cars are more dangerous; but is there a provable causal link between car colour and safety? What other factors, such as a prevalence of red cars on our roads, might underlie such a statistic? In reality, causal relationships can be hard to establish, and close correlations are often interpreted as evidence of a causal link when there is none, even when they are not particularly compelling.

In one example, comparison of the age of finalists of the Miss America contest over several years shows an alarmingly close correlation with the annual number of murders in the USA where steam, hot vapour or other hot objects are used as a murder weapon. Yet there is no plausible causal link between these two things – it would be pointless to ban the Miss America contest in the expectation that it would reduce the number of murders. These types of spurious correlation are in fact so common that Tyler Vigen has published a book of them. A hard reality for many people to face is that, statistically speaking, coincidences **do** happen (and do so surprisingly often). We have to work harder if we wish to establish whether a correlation represents a causal relationship.

Example of a spurious correlation (87%)



Source: *Spurious correlations* (http://www.tylervigen.com/spurious-correlations

The role of integrity

Critical thinking also demands a high level of integrity from individuals. Integrity is a common factor in principles-based approaches, as it links those approaches to our moral and ethical values and guides the actions of individuals who work within them.

Richard Feynman stressed the need for integrity in science, pointing out that this went beyond simply avoiding dishonesty:

> *But this long history of learning how to not fool ourselves – of having utter scientific integrity – is, I'm sorry to say, something that we haven't specifically included in any particular course that I know of. We just hope you've caught on by osmosis.*
>
> *The first principle is that you must not fool yourself – and you are the easiest person to fool. So you have to be very careful about that. After you've not fooled yourself, it's easy not to fool other scientists. You just have to be honest in a conventional way after that.*

Feynman argued that it isn't enough to simply report the results of experiments that support our theory, but to openly acknowledge results that show the opposite of our expectations as well. To do anything else would lack the integrity that scientists have fought long and hard to achieve:

> *... the idea is to try to give all of the information to help others to judge the value of your contribution; not just the information that leads to judgment in one particular direction or another.*

The FCT has taken the concept of intellectual integrity so seriously, it has proposed a definition for it (along with several other intellectual traits):

> ***Intellectual Integrity**: Recognition of the need to be true to one's own thinking; to be consistent in the intellectual standards one applies; to hold one's self to the same rigorous standards of evidence and proof to which one holds one's antagonists; to practice what one advocates for others; and to honestly admit discrepancies and inconsistencies in one's own thought and action.*

A key question for practitioners working with business cases for public investments, whether for transport or some other area of public service, is: 'How does this concept of integrity apply to what we do?' The answer to this comes partly from the scrutiny that a business case is subjected to when it is assessed, for example before decisions are made as to whether to continue developing or implementing it.

Assessors commonly look for evidence of integrity of the case being presented, for example by examining whether problems and benefits appear to have been chosen for their ability to support a predetermined solution or approach. Often this will be apparent when the problems and benefits are only weakly linked to a proposed response, or if the explanation and evidence supporting a problem are vague or unclear.

So, a helpful discipline to adopt is to start thinking from an assessment perspective, exercising the same scrutiny over your own work as an assessor would. Practitioners can be guided in this exercise by the 16 investment questions and further BCA guidance on the Transport Agency website, starting with 'What does a good strategic case include?'

Why is critical thinking important to building good business cases?

In common with other investment management approaches (including NZ Treasury's Better Business Cases model), the Transport Agency's BCA is founded on principles that strongly reflect the nature of critical thinking. It is a structured approach that relies on being able to construct logical arguments and draw rational conclusions, based on evidence. In a very real sense, the BCA can be thought of as a practical framework that enables and encourages the use of critical thinking for investment management.

In the context of the BCA, and more widely in the field of investment management practice, there are some particularly relevant aspects of critical thinking:

» It is objective and open-minded.

» There is an emphasis placed on the value of evidence.

- It focuses on achieving genuine understanding, for example of the logical connections between ideas.
- It uses a systematic approach to problem solving.
- It expects that, both individually and collectively, we will seek the flaws in our own reasoning.

These aspects are essential in helping to counter pressure from those with preconceived views of the solution, or vested interests that may only have a very narrow view of the need for investment. They can also help practitioners overcome the entrenched patterns of thinking to which we are all susceptible, in order to remove some of the barriers to innovation and creative problem solving that are commonly faced.

When is critical thinking most critical in the BCA?

Critical thinking is important throughout development of a business case, starting right from the moment when work begins at the point of entry and continuing through to – and beyond – implementation of a solution. However, a number of steps in business case development stand out as requiring particular attention from a critical thinking perspective. These include those outlined in the following table.

BCA development action	Focus of critical thinking	Examples of questions that could be used
Defining problems and benefits	To establish whether the problems are: » real » sufficiently important to address » something that is our responsibility to address » fully understood in terms of root causes and consequences (note that reaching a full understanding is iterative; it starts in the strategic case or even the point of entry, but problems and benefits are continually refined throughout the business case). To establish whether the benefits are: » genuinely associated with the problems » aligned with what we said we wanted to achieve » aligned to customers' real needs » genuinely achievable » measurable, so we can tell if we've had the desired effect.	When exploring problems: » Why is this problem happening? » How do we know we have identified the root causes? » Is this actually our problem to solve, or does it rest with someone else? » What assumptions are we making, and how can we test them? » What evidence is there relevant to this problem? » Does the evidence change our view of the problem? » What other evidence do we need to test the problems? » What are we missing – and who might know? » What would happen if we did nothing? » What scale of action might be justified by the consequences? » Who is most affected by this problem? When defining benefits: » Are we identifying this benefit because it's something we really need, or because it justifies our view of the solution? » Just how important is this benefit to us – how well does it align with our strategic objectives? » How do we know whether this is what our customers actually need? » Who else might be responsible for delivery of this benefit? » How will we measure this? » How will we know if the benefit is realised because of some change we have made – what else could be happening?

BCA development action	Focus of critical thinking	Examples of questions that could be used
Development of alternatives and options (whether for a programme or an activity)	To decide whether enough effort has been put into looking for alternatives and options (consistent with the scale and complexity of the investment). To establish if we are looking widely enough at ways to respond – rather than simply evaluating 'tried and tested' options. To make sure there is adequate scope for innovating.	» Have we looked widely enough to find ways to respond? » How could we influence demand or productivity of the system, instead of supply? » What are the non-transport alternatives we could look at? » What are the low-cost alternatives? Have we identified a full range (from low to high cost)? » What would we do if the 'usual' intervention wasn't an option? Or if we couldn't improve the supply side of the system? » Would we get a different set of alternatives/ options if we had other people involved (with different backgrounds and experience to the project team)? » Who else could we involve, who might bring a fresh perspective? » What else could we do in order to identify and evaluate new approaches on a more equal basis with conventional ones?
Analysis of alternatives and options (whether for a programme or an activity)	To understand whether the proposed option represents the best way to fix the problems and deliver the benefits, and why. Is the evaluation methodology appropriate to the options? Will the methodology compare different types of response in an unbiased way, or does it favour some types of response over others (for example because we understand them better)?	» What are the investment objectives that will form success criteria for our alternatives and options? » Are the investment criteria SMART (specific, measureable, achievable, realistic and time-bound) enough? How well do they reflect the desired outcomes in the strategic case? » Why are we ruling things out – is it because we know they won't work based on experience, or because we don't fully understand them? » Are the options shortlisted for evaluation focused on achieving the desired outcomes? » Are we testing achievable options (rather than picking ones we know won't succeed, to bolster a pre-determined way forward)? » How can we be confident that options are being evaluated on equal terms? » Why does the preferred option represent the best value for money?
Decision making	To decide whether the investment being considered is the best way to use finite investment funds to achieve the greatest progress against agreed organisational goals and strategic objectives, for example, as set out in the Government Policy Statement on Land Transport (GPS) and the Long Term Strategic View (LTSV).	Critical thinking is exercised by: » the **problem owner**: 'Why should I continue to develop this?' » the **investment decision maker**: 'Why should I continue to invest in this?' » and **stakeholders**: 'Why should we continue to support this?'

How should critical thinking be used in business case development?

The core critical thinking skills identified earlier provide a good framework for thinking about how critical thinking can be relevant to business case development. The first of these core skills, **curiosity**, is an essential requirement for getting to the heart of the matter; without genuine curiosity, a strong desire to understand what is happening and why, we stand little chance of truly understanding the problems we are facing.

Curiosity, then, is an essential requirement for anyone engaged in problem definition; people who ask 'Why?' a lot are more likely to get to the underlying or root causes of a problem than those who simply take problems at face value (see *BCA Practice Notes 3: Root cause analysis in business case development*).

Similarly, the need for **scepticism** is prevalent throughout the life of a business case. At all times, it is important not to simply accept information at face value, but to consider whether we are falling victim to the biases and beliefs we all hold in one form or another.

As noted previously, this does not mean being cynical; it is not a case of challenging people at every possible opportunity simply for the sake of doing so. To act cynically is to risk becoming obstructive, to impede progress with no constructive goal in mind. On the other hand, healthy scepticism, when used appropriately, becomes a highly constructive approach to refining ideas, sorting what is useful from what is misleading and, above all, helping us avoid fooling ourselves and others. While it can often be difficult to have our ideas and thoughts subjected to sceptical analysis, it is something we all have to get used to in the interests of good outcomes.

Critical and divergent thinking in developing alternatives and options

Critical thinking is an essential thread through all areas of business case development that helps us avoid the thinking pitfalls to which we are all susceptible. However, some areas require special attention to how critical thinking is applied.

The process of identifying, developing and evaluating alternatives and options is one such area. The initial aim of identifying alternatives and options is to think widely about the possible ways in which a problem might be addressed. This requires a particular type of thinking, known as divergent thinking (see *BCA Practice Notes 5: Innovation and creativity in business case development*).

Divergent thinking is a free-flowing, non-critical exercise in which it is important to not judge ideas too early; doing so may prevent people from daring to voice ideas from outside the square, which is actually where the greatest potential for innovation lies.

Thinking about this in terms of the core critical thinking skills involved, it is highly important to be curious when exercising divergent thinking, and it is important to avoid being overly self-aware or sceptical. The aim is to quickly generate many ideas across a wide range of approaches, without judgement or evaluation.

Once enough ideas have been generated, critical thinking comes into its own as the ideas are then tested and examined to see which are likely to work. This requires a very different type of thinking, known as convergent thinking, which is strongly centred around the skills and processes of critical thinking. Scepticism and self-awareness need to come to the fore, as the need for evaluation and judgement kicks in and we have to answer questions, such as 'Why do I feel the urge to dismiss that idea out of hand?' or 'Why do I feel drawn to that idea?'

The importance of questions in critical thinking

The art of asking good questions is an extensive subject in its own right, and mostly beyond the scope of this practice note; the point I wish to make here is simply that critical thinking relies heavily on formulating, asking, and pursuing the answers to, good questions.

This does, however, raise the issue of what constitutes a 'good' question in the context of critical thinking. Although some suggestions are provided in the table on pages 6–7, the answer is far from simple, especially when one considers the wide scope that's encompassed in the meaning of 'critical thinking'.

One way to approach this is again to think about the core skills of critical thinking. For example, when exercising the skill of curiosity, it is important to rely mainly on open questions that broaden lines of enquiry; these are the questions that are based around 'Why?', 'What?', 'How?', 'Who?' and 'When?' They differ markedly from closed questions that demand a 'Yes' or 'No' answer and rapidly shut down any desire toward further enquiry or investigation.

Of all the open questions, those that include the word 'why' are perhaps the most powerful – and the most important in applying curiosity. Author and blogger Warren Berger takes this a step further and identifies 'beautiful questions' as being those questions which, when asked, have the ability to transform the way we perceive and think about things, and that act as a catalyst for change.

An example of a beautiful question comes from a young American named Van Phillips, who lost a foot in a boating accident. Appalled by the ugly, impractical prostheses that were available at the time, he asked himself: 'If they can put a man on the moon, why can't they make a decent foot?' Over time, he replaced the 'they' in his question with 'we', and eventually devised the running blades used by many Paralympians today.

Using questions is possibly the most powerful weapon we have in the fight against ignorance, but it often takes courage to ask them, especially when this might be seen as disruptive or upsetting the status quo. Yet this is exactly when critical thinking is at its most valuable, allowing us to skilfully challenge the assumptions and dogma that otherwise work against change and innovation.

In contrast to curiosity, when applying scepticism closed questions can sometimes have a powerful effect – provided you are prepared to open things up again afterwards. For example, take the following series of apparently simple questions:

» Is that true?

» Why do we believe it is true?

» How can we know if it is true?

» What are the implications if it isn't true?

These deceptively simple questions start with a closed one, which can only really be answered 'Yes', 'No' or 'Maybe'. Yet, used intelligently, they can effectively test assumptions and biases – including our own – and overturn them if necessary.

So it is important to find the **right** questions if we are to use critical thinking effectively, not just to ask questions for questions' sake. Finding the right questions gives us essential tools that underpin both the development and the assessment of business cases.

Business case developers and decision makers alike must use questioning deliberately and with consideration. This means using them, not to avoid or minimise the really hard issues, nor in order to slow or prevent the passage of investments, but to ensure that the practice is being applied as intended and we are not at risk of fooling ourselves.

Conclusion

Critical thinking is a tool; this means that, like all tools, it is capable of being misused, applied out of context, or even employed as a rote alternative to genuine thinking. Used judiciously however, it can make all the difference in the world – not least in evaluating our own arguments before we present them to others.

In a world where delivery pressures are real and often overwhelming, and where vested interests can wield substantial influence over our actions, critical thinking provides a defence for rational, professional and ethical working. It is an essential part of the skill set for anyone working with business cases.

While providing an overview, this practice note is far from being a comprehensive 'how to' guide for critical thinking; that would be a very ambitious undertaking. As noted at the start, it is important that we each take responsibility for acquiring and honing our critical thinking abilities, and learning how to apply them in the context of business case practice. I hope this practice note has provided you with some ideas on how to go about doing just that.

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