# How to go about solving complex problems

*J. MacMaster, 18 February 2020*
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I'm sure most of you would agree that the 21st Century is throwing us a plenty of complex challenges. Some of them are exciting opportunities and some are entrenched problems. It seems that irrespective of what country, sector, industry or role we work in, more and more, we describe the challenges we're facing as 'complex'.

For this reason, the World Economic Forum in its report on the *Future of Jobs*[1], put 'complex problem solving' at the top of its list of the skills we need most – so-called "21st Century skills" (see Figure 1).

So why has this relatively new phrase, embodying a relatively new skillset emerged? Why all of a sudden do we need 'complex problem solving' skills instead of the good old 'problem-solving skills'?

Well, as the world becomes more interconnected as a result of advances in technology, changing patterns of social behaviour, and other factors, challenges are, generally speaking becoming more difficult to deal with – they encompass so many considerations, there are so many potential flow-on effects, there are no right answers. We are increasingly recognising we can't grapple with these type of challenges alone. We need be more collaborative and work across disciplines. And since most of the challenges are ones we haven't come across before (or haven't successfully dealt with before), we also need to be 'innovative'. But bringing diverse people together brings further difficulties– typically when we bring a team (or teams) together, we hit a few roadblocks. People have different knowledge-sets, different ways of thinking, difference experiences and different viewpoints. While all this 'diversity' is truly necessary for successfully grappling with complex challenges (because without it we're unlikely to be able to sufficiently understand complex challenges in order to design and think through possible solutions), it also makes it hard to reconcile all those 'differences' into a coherent approach and to make progress. Where to start? What to do? What to talk about first? More often than not, teams embark on a process I call 'muddling through' and the project's outcomes are far from assured as frustrations grow because deadlines loom and time and resources are being wasted.

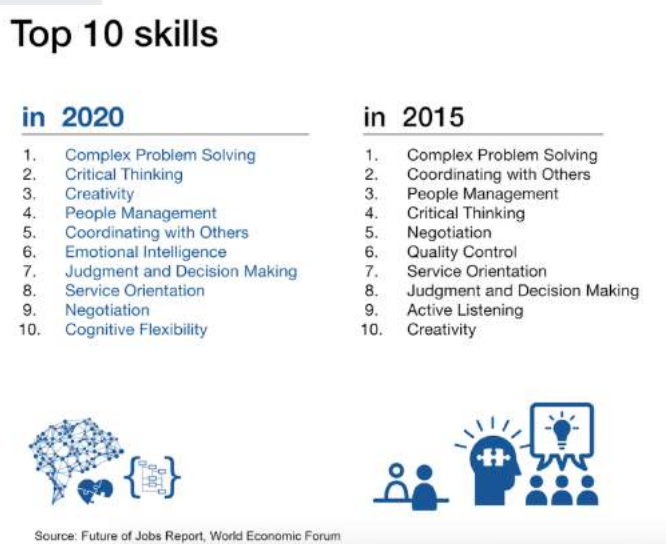


**Figure 1**

Complex problem solving is the opposite of 'muddling through'. It offers a structured (but not prescriptive), and consistent approach for grappling with complex challenges that helps us to achieve better outcomes, more efficiently. It is a skillset that comprises a collection of useful ideas and practical techniques that we can apply to just about all complex challenges.

But perhaps we should start at the beginning…what is a complex problem? Then we can look at how we can go about solving them (although of course for truly complex problems, we can't hope to completely 'solve' them – perhaps 'alleviate them as much as possible given the available resources and constraints', is sometimes the best we can hope for).

## What is a complex problem?

Most of us can recognise a complex challenge when we see one. When I ask a group of people whether climate change, geo-political conflict, homelessness, water and food security, and changing a nation's education policy are complex challenges,

1. *World Economic Forum,* ***The Future of Jobs****, 18 January 2016, https://www.weforum.org/reports/the-future-of-jobs (last accessed 3 September 2019)*

there is never a second's delay before heads start nodding vigorously. It generally takes people somewhat more time to put their finger on what it is about these challenges that makes us want to describe them complex, but it's never too long before people offer the following suggestions - there may be no single right answer; there might be conflicting, even polarised views about the issue; it may require more time and resources than we have available, there are many interacting parts to the problem, there are 'winners' and 'losers' associated with solution options, and so on.

I think of these as the characteristics of a complex problem. Complexity scientists attribute *why* complexity comes about, to a range of factors – feedback, multiple causality, interdisciplinarity, dynamic behaviour, self-organisation, adaptation and emergence to name a few. We won't delve further into those concepts here, but what we can say, is that as a result of all these factors, complex things have a significant amount of uncertainty about them - uncertainty about why things are happening, uncertainty about what to do, uncertainty about what might happen if we did do something, and uncertainty about what the future holds. In fact, complex problem solving is often described as problem solving in conditions of uncertainty[2]. And because of that uncertainty, complex problems are difficult to understand, predict, influence and control[3].

As the OECD acknowledges in their report on the importance of problem-solving skills[2], there isn't much around on what complex problem solving looks like, or how to teach it - we just know that we need skills in it. That's a huge gap and one we're helping to fill with the *Navigate Complexity* short course on complex problem solving. While there is no definitive concept or method for complex problem solving, we think the one we're about to describe is the best one available (and, really, the only one we've really come across, at least at the time of writing this article).

## What is 'complex problem solving'?

Let's start exploring what complex problem solving is, by looking at what it is not. I think most of you will recognise the diagram below as a familiar problem-solving approach. I call it the 'traditional problem-solving approach'. It typically begins by identifying the problem, doing some research and gathering information, developing some options about what to do, evaluating those options so you can decide which option to recommend, then seeking approval for your recommendation before you go away (or someone does) to implement it.


**Figure 2: 'Traditional' problem-solving approach**

Now, this is not a 'bad' problem-solving approach per se, it's just that's its only good for certain types of problems. Which type of problems is it good for do you think? (Actually pause here and think about it, before you read on :).

Exactly. This problem-solving approach is good for problems where: all the information is available at the start, where things don't change very much, and where you have a high level of confidence that your recommended solution will work. In other words – this is a good problem-solving approach for **simpler** problems.

But because none of those conditions are true for a complex challenge, it is usually not a good problem-solving approach for complex challenges (or even complicated ones). We certainly don't have all the information we need at the start of a project, instead, more and more information is learnt as we do more work, and things are almost guaranteed to change, so, for complex challenges we certainly don't have certainty that our solution will work. This linear (step-by-step) approach is a one-way recipe for implementing one particular solution with very little opportunity to refine thinking along the way. It is pretty much the opposite to what's needed for complex problem solving, which is much more appropriately depicted in Figure 3.

2. Csapó, B. and J. Funke (eds.) (2017), ***The Nature of Problem Solving: Using Research to Inspire 21st Century Learning***, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264273955-en
3. Adapted from D. Meadows ***Thinking in Systens: A Primer***, Chelsea Green Publishing, 2008; and M. Mitchell, ***Complexity: A Guided Tour***, Oxford University Press, 2009

In Figure 3, we see that there are still some problem-solving activities that need to be done, but, for complex problems, they are done **concurrently** (at the same time) and **iteratively** (over and over again), instead of sequentially (step-by-step). This allows our thinking about the problem itself and any possible solutions to evolve over time, as we learn things and as things change.

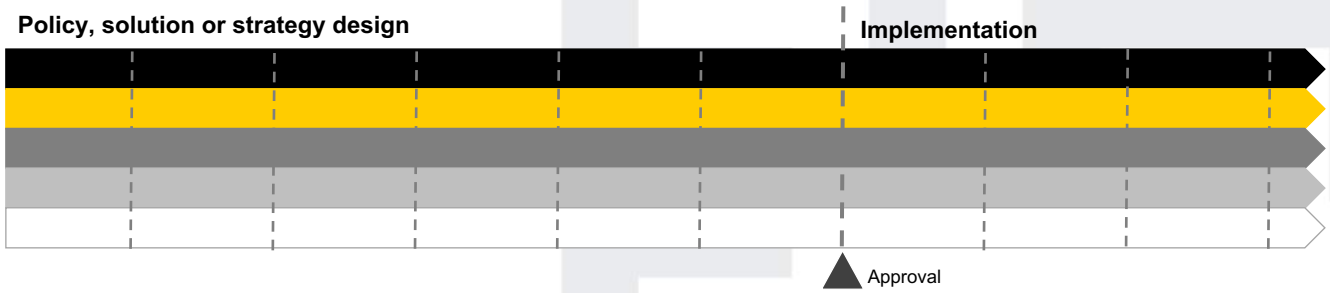


**Figure 3: A conceptual model for complex problem solving**

I could talk about complex problem solving and the associated ideas and techniques for days. Weeks even. But, at its core, complex problem solving could be reduced to this one, fundamental idea – that all our thinking about the challenge itself, and any possible solutions for addressing it, is **refined along the way**. Over and over again. Indefinitely if necessary.

So, instead of producing a single and final answer at the end of the problem-solving process, we're acknowledging that our strategy (or solution) is 'living', or dynamic. We aim to develop ideas early – both ideas about our understanding of the problem itself, and ideas about a possible solution (or solutions). Then we test those ideas to see what's likely to work and what's less likely to work (and why). And we learn from that testing. Generally I like to think there are three main ways you can test ideas – through talking to people and seeking their feedback, through various types of analyses, and through experimentation (which might include field or lab experiments, prototyping, pilots, depending on which stage of your project you're at). What you learn from the testing, is used to refine the next version of your ideas and you iterate that loop: *understand* → *(re)design* → *test & learn* for as long as it takes until you're satisfied with the result (or, until you run out of resources).

That's the only way we have, so far in the 21st Century, of dealing with the uncertainty of complexity. Even the most sophisticated genetic algorithms in use today, are based on this fundamental idea. See what works and what doesn't. Learn. And try again. This is especially true of complex challenges where we're unlikely to find perfect solutions. The more effort we put into understanding what works and what doesn't, the better outcomes we'll get.

You'll see that the complex problem solving diagram (Figure 3) depicts five activities that are done concurrently and iteratively. Let's have a look at them.

## The five complex problem solving activities

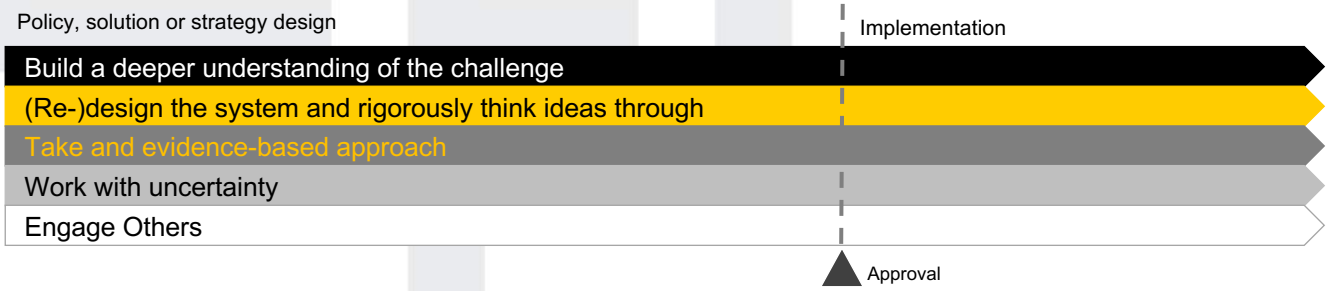


**Figure 4: The five complex problem solving activities**

Figure 4 shows the five things we need to do well to effectively grapple with complex challenges. One of the essential complex problem solving activities is the need to **build a deeper understanding of the challenge.** This is important to do so we can be informed about what to do, rather than having to resort to guessing. Just as a cardiologist is much more easily able to diagnose and fix problems with our hearts compared to other people, because they have put the time into understanding how hearts are 'built', how they work and what appropriate maintenance and 'repair' strategies are, we too, need a deep understanding of the challenges we're grappling with in order to suggest effective solutions or strategies – this is critical.

Too often people jump straight to solutions without adequately understanding the problem. This results in strategies and solutions that are really just a collection of disjointed goals or objectives which are not grounded in a deep understanding of the levers (solutions) that will work.

The careful readers among you may have noticed somewhat of a tension here because earlier I mentioned that by definition complex challenges were *difficult* to understand (because of their inherent uncertainty). And they are. And while it may be impossible to fully understand something that is complex, the more understanding we have, the better position we'll be in to have insight about what to do. Cardiologists do not completely understand the heart in all its amazing complexity, but the field of cardiology is striving to obtain deeper understanding so our collective heart health is improved. The same could be said for almost all other serious fields of human pursuit.

Another essential complex problem solving activity is the need to **(re-)design the 'system' and rigorously think our ideas through**. We need to do this in order to achieve the outcomes we want efficiently and effectively, and to anticipate any unintended consequences. This is where we go beyond generating lists of potential ideas, sorting the list according to some criteria and choosing the one at the top, to actually *designing a solution*. And by 'design', I mean thinking about all the elements that are required and *how* they will work together to bring about the desired outcome, within the relevant constraints.

The next complex problem solving activity is to ensure that we **take an evidence-based approach.** Now, 'evidence' is one of those terms that means different things to different people, but in the context of complex problem solving, I think evidence can be interpreted quite broadly to mean grounds for believing the solution or strategy we've designed has a good chance of working. So, in effect, it's the case we have for the strategy. We need to have a strong case for, and confidence that our ideas will work so that we can convince ourselves and others that's it's the best one available.

Very importantly, we also need to **work with uncertainty**, so our strategy or solution maintains its relevance in this dynamic, uncertain world. This is where we test ideas to learn what works and what doesn't (and why), and think about what might happen in the future that could impact our work.

And finally, underpinning everything is the need to **engage others**, not only because its politically correct and inclusive to do so, but because its critical for success. We simply cannot do the other four things well if we don't engage others well. We need to engage as many people as we can, throughout our projects – to inform, test and build support for our ideas. Some people think that because this activity appears last, that it is done last but it isn't. As you can see from the diagram, it starts on day 1 just like the other four activities and continues throughout the project too.

We need to do these five things well to effectively grapple with complex challenges. These five complex problem solving activities represent a pattern – they are the same things we need to do well in order to grapple effectively with *any* complex challenge. But how do we do those five things well? What does Building a Deeper understanding of the situation entail? How do we design systems and strategies and think them through? What does taking an evidence-based approach actually mean? Well, I think there is a pattern here too. There is a pattern to the things we should think about in order to do the five complex problem solving activities well, and I've captured this pattern as *20 Questions for complex problem solving, strategy and design*.

## 20 Questions for complex problem solving

The *20 Questions* prompt you to think about 20 of the most important things you need to think about when designing a solution, or strategy for a complex challenge. The first five questions prompt you to think about the things you need to think about to help you to build a deeper understanding of it. Questions 6-13 help you to design a solution to the challenge and think it through. Questions 14-16 help you to take an evidence-based approach, and so on.

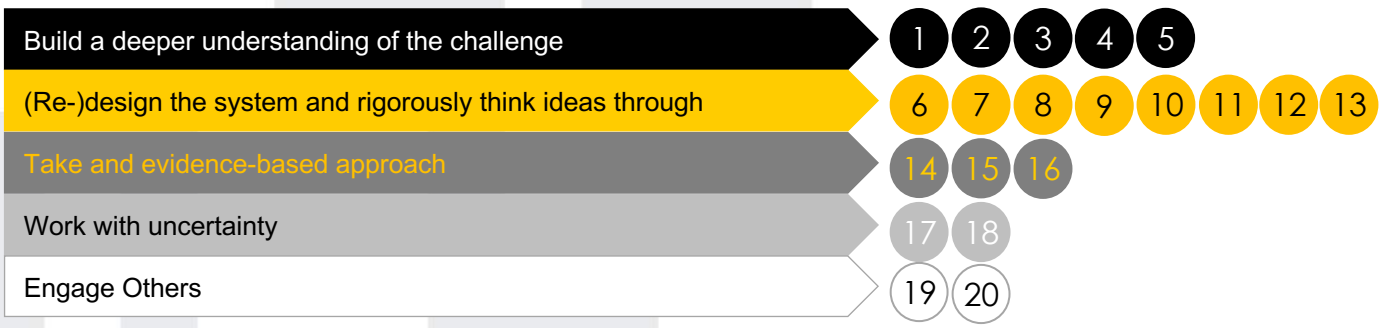


**Figure 5: 20 Questions for complex problem solving, strategy and design**

### HIGHER-ORDER THINKING STYLES

**STRATEGIC THINKING** Deciding how to use available resources to achieve outcomes efficiently and effectively

**DESIGN & DESIGN THINKING** An approach for achieving desired outcomes through an iterative and creative process of forming, testing and refining ideas and engaging stakeholders throughout the entire process

**CREATIVE THINKING** Forming original and useful ideas and insights

**SYSTEMS THINKING** Recognising that the world is comprised of interconnected things and how those things are interconnected (system structure) determines outcomes (system behaviour)

**FUTURES THINKING** Thinking about what might happen in the future, the implications should they occur, and what could be done now to mitigate the risks or amplify the benefits

**ANALYTICAL & STRUCTURED THINKING** Gathering and organising information and inquiry to help understand and explain things

**CRITICAL THINKING** Reasoned thinking to inform opinions, decisions and judgments, and, determining if the information we use for that purpose is relevant, accurate, timely, complete, consistent, fair and balanced, of sufficient breadth and depth, and supported with sound evidence

This conceptual model, or approach for complex problem solving recognises that discipline-based knowledge remains absolutely critical, because you can't answer the *20 Questions* without deep knowledge of the area you are focused on, but, that deep knowledge of the disciplines relevant to your challenge is not quite enough. We need to complement that knowledge with higher-order thinking, and there is a range of higher-order thinking styles that complex problem solving draws on to be effective (see the Higher-order Thinking Styles box).

Importantly, when you are grappling with complex challenges you don't do these higher-order thinking styles one-by-one. It's not like you do some strategic thinking today and some critical thinking tomorrow and some systems thinking next week. Complex problem solving requires drawing on all these higher-order thinking styles in differing combinations, as required for the task at hand.

The *20 Questions* makes this a bit easier because they have these higher order thinking styles embedded. So if you are asking and answering the *20 Questions* then you are complex problem solving.

It is a pattern that is useful because it means we can be a bit more tangible, practical, systematic, consistent, and structured in our approach. It helps to establish expectations for what 'good' problem-solving and strategy development looks like. They are a transferrable skillset that you can use for any complex challenge - these are the same *20 Questions* I ask whether I'm working on population strategy, organisational change, employment services, cyber security, indigenous affairs, education policy or anything else.

They are also the same questions you ask throughout a project, from day 1 to the last day. In other words, you ask the same questions over and over again throughout a project because for a complex challenge more information becomes available and new things are learnt as more work is done, so your answers can be refined over time.

The following pages briefly explore the five complex problem solving activities and the 20 Questions to ask and answer to help you 'do' them.

## BUILD A DEEPER UNDERSTANDING OF THE CHALLENGE

***The first five questions help you to build a deeper understanding of the challenge you're working on. Without this, it's pretty much impossible to develop an effective strategy or solution, unless luck comes into play. So, ask these five questions, iteratively, to help build a deeper understanding of the situation so you can be informed about what to do.***

# Q1

### FRAMING THE PROBLEM & DESIRED OUTCOME

**What is the problem (or opportunity)? What is the outcome you want? Why are you doing this?**

Identifying and framing the problem (or opportunity) and the desired outcome well, is one of the most important things you can do when grappling with a complex challenge. It helps to ensure everyone is focused and on the same page. It is also an important prerequisite for forming creative and innovative ideas. Yet people and teams often overlook this critical early step and jump straight to solutions before they have clarity on what, exactly, the problem and desired outcome are.

# Q2

### CONTEXT, CONSTRAINTS & REQUIREMENTS

**What context is relevant, and what constraints and requirements will the strategy (or solution) need to satisfy?**

Rarely do we start designing a solution or strategy from a blank page. There is usually a 'bigger picture' that will influence, or be influenced by your work (context), limitations on what can be done and preferred ways of doing things (constraints), and aspects about what the solution/strategy needs to do and how well it needs to do it (requirements). These need to be identified as early as possible so the solution or strategy you develop will work as intended when its implemented.

# Q3

### KNOWNS & UNKNOWNS

**What do you know, and what do you need to find out?**

Nobel laureate Daniel Kahneman says that people have a tendency to form judgements and make conclusions based on the information they have, which is almost always, incomplete information[4]. For truly complex issues of course we can't hope to know everything, not even close. Even for complicated issues, lack of time and resources, and information overload can mean that it's difficult (often impossible) to be aware of every relevant piece of information. However, it is important to consider that there is likely to be important information out there that, if we knew about it, would have a significant influence on the decisions and judgments we make, and to make an effort to be aware of it.

# Q4

### NEVER MISS AN OPPORTUNITY TO LEARN AND GAIN INSIGHT

**Really? Why? What's the 'so what'?**

No single source of information is sufficient to understand a complex issue, so we need to consider multiple sources of information to build up our understanding of it. Whenever we come across some new information, it's always an opportunity to learn something. Rarely however, do insights appear out of nowhere and land in our lap. It takes some effort, but these three questions make it easier to learn things and gain insight, if we ask them habitually of ourselves and others.

# Q5

### UNDERSTANDING THE PROBLEM (AS A SYSTEM)

**What is the scale and nature of the situation? How long has it been occurring and how has it changed over time? Why is the situation occurring?**

Typically when we try to understand something we seek the 'facts and figures' about it, and this is important, but this level of understanding rarely reveals insights about what to do. Getting insight about what to do requires a deeper understanding of complex problems, in particular, *why* they are occurring. It's important to understand the (often multiple and interacting) drivers that contribute to something happening, and how they are interconnected to produce dynamic behaviour that is often problematic.

4. *Thinking Fast and Slow*, Daniel Kahneman, pp.85-88.

## (RE-)DESIGN THE SYSTEM AND RIGOROUSLY THINK YOUR IDEAS THROUGH

***I'm an engineer and my favourite definition of 'engineer' is 'to bring something about through careful design'. I believe that everyone who is trying to bring about a change in the world needs to 'engineer' that change. In other words they need to bring that change about through careful design. There simply isn't any other way (other than luck). Questions 6-13 prompt you to think about the things you need to think about in order to design an effective strategy or solution, and think it through.***

Q6

### (RE-)DESIGN THE SYSTEM, ANALYTICALLY

**What do you need to achieve, and do, to bring about the outcome(s) you want? What changes to the system structure will bring about the desired outcome?**

The design of a strategy or solution is above all a choice about how existing resources will be used to achieve the desired outcome. It's important to understand the difference between a 'strategy' and a 'system' for bringing outcomes about and how they are complementary.

Q7

### THINK CREATIVELY

**If you think about the problem and solution from different angles, what new ideas and insights emerge?**

All ideas pretty much always need to be analytically thought-through to ensure they have rigour, but often these ideas have a more creative beginning. Think about problems and solutions from different angles to generate new insights. Draw on diversity to 'connect dots' to form valuable and original ideas.

Q8

### GOAL DESIGN

**Have the goals, targets, KPIs and incentive structures been designed so they are aligned with the system, rather than distorting it?**

Goals, targets, KPIs (key performance indicators) and objectives are the things we use to measure progress by and to judge performance. They receive a lot of negative commentary, rightly so in some cases. Design them well, so they help the desired outcome to be brought about, rather than hinder it.

Q9

### ASSUMPTIONS & NECESSARY CONDITIONS

**What conditions need to be in place for the strategy to work? What assumptions have been made? Are they being tested along the way?**

Sometimes we have what seems to be an excellent strategy but it fails to deliver in practice. This is often because we have not considered the things that need to be in place for it to work in practice and we have failed to test the assumptions we've explicitly (and implicitly) made. So, think about what needs to be in place, spend some time identifying your assumptions, and test them. And like all other 19 questions, you'll need to revisit this from time to time, because your answers to this question will be refined over time.

Q10

**PEPOLE AND BEHAVIOURAL INSIGHTS**

**What factors influence what people think and do in this context? What unconscious biases might be influencing you, and others?**

Behavioural insights refers to the collection of insights we have about the factors that influence what people think and do. These factors influence both ourselves (the decisions and judgments we make as policy makers, decision makers or strategy developers) and others (who may be the end-users of the strategy or solution, or other stakeholders). Think about how behavioural insights can help us to explain people's behaviour, and, which could you use as levers, triggers or conditions for (ethically) encouraging or discouraging certain behaviours.

Q11

**CONSEQUENCES**

**How might this idea 'play out'? What are the potential unintended consequences and second/third order flow-on effects?**

In this highly interconnected world, all actions have consequences or flow-on effects - some direct, some indirect, some anticipated and some unintended. We cannot pre-empt them all (which is why it is so important to be able to work with uncertainty with Questions 17 and 18) but the more you pre-empt them, the more you can mitigate the negative consequences and amplify the positive ones.

Q12

**TRADE-OFFS**

**Given the costs, benefits, and possible flow-on effects, what are the trade-offs to consider?**

When designing strategies or solutions there are usually competing and conflicting factors that need to be taken into account. It's usually not easy, but it is important to consider these factors and how they need to be reconciled or balanced.

Q13

**IMPLEMENTATION**

**How will this strategy or solution work in practice? What needs to be done to put it into practice?**

Implementation is where we put a solution or strategy into action. It is typically a phase of the project that we treat separately – in time, in space and often in terms of responsibility. But when implementation is done well, it starts very early in the strategy design process. Implementation is planned for, even designed. The risks of 'poor implementation' are greatly reduced when implementation is seen as an integral part of strategy development rather than the execution part of strategy that starts after the concept for the strategy is approved.

## TAKE AN EVIDENCE-BASED APPROACH

***Taking an evidence-based approach is necessary so that you have a strong case for, and confidence that your ideas have a good chance of working. Evidence, in the context of complex problem solving is the 'case' you have for your idea – the grounds for believing it is likely to work.***

Q14

### STRATEGY/POLICY LOGIC

**How will the things you plan to do bring about the outcomes you want?**

Some people say that there is nothing more important for a strategy than an understanding of how it will work[5]. You'll need to be able to understand and explain how the things you plan to do will lead to the outcomes you want.

Q15

### STRATEGY/POLICY RATIONALE

**What are the reasons for thinking the idea will work? What are the counter-arguments? Are the arguments sound?**

When taking an evidence-based approach, it is also important to understand *why* you have chosen this particular idea (for a strategy, solution or policy) over other ideas. Ensure you have a strong argument for why your idea or strategy is likely to work, so that you can convince others (and yourself).

Q16

### DATA & INFORMATION

**What information supports (and contests) the reasons for thinking your ideas will work? Is it sound?**

The role that information and data plays in our lives has never been more significant than now. But be careful – test data to ensure it is fit for informing and justifying your ideas, judgments and decisions.

## WORK WITH UNCERTAINTY

***For complex challenges there is uncertainty in many aspects and while we will never remove uncertainty, there are two things we can do to work with uncertainty more effectively.***

Q17

### EVALUATION & LEARNING AND ADAPTIVE DESIGN

**What works and what doesn't (and why)? How will the strategy adapt to things that change and to what you learn along the way about what works and what doesn't?**

What works and what doesn't is the most difficult question with the most valuable answer. This is the purpose of evaluation, so ensure that design and evaluation are ongoing activities throughout the entire life of your project, not something that is started towards the end, part-way through implementation. Testing ideas and actions to determine what works and what doesn't and why, then making refinements based on what you learn is an iterative, ongoing process for complex challenges that starts on day 1 and doesn't stop.

Q18

### RISK, RESILIENCE, AGILITY AND INNOVATION

**What might happen in the future that could impact this work? How will your strategy be resilient to threats and ready for opportunities?**

Being ready for what the future holds requires actively considering what the future may bring and thinking about what you can do to minimise the impact of risks and maximise the benefits of opportunities. And these things need to be done as purposeful activities, not tick-the-box exercises.

5. See for example, Cartwright and Hardie's ***Evidence-based Policy: A Practical Guide to doing it Better***, Oxford University Press, 2012

## ENGAGE OTHERS

***We can't do the other four complex problem solving activities well without doing this one well – engaging others. We often hear how important it is to 'engage stakeholders' but that's not just because we should be 'inclusive' (as important as that is). We also need diversity to build a rich and deep understanding of the situation we're grappling with, to form new and innovative ideas and to test our ideas.***

# Q19

### INTERDISCIPLINARY PERSPECTIVES AND PURPOSEFUL CONVERSATIONS

**What are the interdisciplinary viewpoints and why to people hold those viewpoints?**

Gathering interdisciplinary perspectives about the complex challenge you are grappling with is critical for success. Listen to other people's perspectives and, importantly, understand why they hold their views.

# Q20

### COMPELLING COMMUNICATION

**Have you communicated your ideas so they are understood by, and resonate with others?**

You can come up with the best ideas in the world, but if you don't communicate them well, they may not attract the support they need to succeed. Ensure you are communicating your ideas so that they are understood by, and resonate with others.

So that's an overview of what I think is a very useful approach for grappling with complex challenges. I've now taught this conceptual model, its *20 Questions*, and the practical techniques that help answer the questions, to many people across various sectors, including to university staff, and postgraduate and undergraduate students from many faculties, and to a wide range of government departments. The appeal and utility of the model and *20 Questions* is far-reaching. People especially value the common approach, the shared language and toolkit that sits across discipline-specific methods and knowledge that all team members can understand and can contribute to. It also gives people useful things to do, think about and have purposeful discussions about from day 1, so no time is wasted. The approach ultimately helps to deliver a better outcome from the project, because knowledge and time is used productively, effort is focused, and the approach used has been rigorous and robust.

This approach to complex problem solving brings together ideas from a wide range of disciplines and sectors including complexity science, systems theory, theory of strategy, behavioural economics, engineering design principles, logical reasoning and many others. It is possible to go very deeply into each of the topics (and I would encourage you to!). But remember, the most important thing are the questions. Ask them. Ask them often – internally with your team members and externally. Get people thinking about these aspects of complex challenges. Like anything, it becomes much easier with practice, so I encourage you to ask and answer them often, and over time your complex problem solving skills will be refined. Asking the questions will become more like a habit. In the meantime, here are some general tips on what can be useful to focus on at various stages within a project.

### How to start a project well

While the approach to complex problem solving I've outlined here does not explicitly provide guidance on establishing effective teams and teamwork, this is an important consideration early in a project. Ensure your team embraces diversity and inclusivity and fosters a culture for innovation and positive leadership to thrive.

Once team dynamics are established, you'll see from Figure 3 that all five complex problem solving activities start, in theory, on day 1. Now because of cognitive limits we probably can't actually answer all 20 Questions on day 1, but the point is, you do need to be engaging others from very early on, and you do need to be taking an evidence-based approach, building a deeper understanding the situation, working with uncertainty and thinking your ideas through from very early on. As a general guide, starting on day 1 with the first five questions, with all the other questions lurking not far away, is a good place to start. Start the conversation that aims to pinpoint and establish a shared understanding of the problem and what you want to achieve. Usually this is not as easy as it sounds. It will almost certainly take time and as with your answers to all *20 Questions*, your answers will be refined as you do more work. So, with the other Questions in the back of your mind, focus early on the first five questions as you really build up a deeper understanding of the situation, then, as you turn your mind to ideas for solution/strategy designs and thinking those through, continue to update your understanding of the situation, as required, as you go.

### What to focus on throughout a project

Early in a project you'll generally be going up a very steep learning curve to build a deeper understanding of the situation. This never really stops but you usually reach a point where it makes sense to put more focus how you will achieve your outcomes. Throughout your project you're in the loop – *understand* → *(re)design ideas* → *test & learn*, and so on. With time, your ideas evolve and mature based on what you learn about what is likely to work and what isn't (and why). You may structure your project so that it has clear phases (which can also be thought of as 'sprints' if you're borrowing from software's 'agile' development concept). Each phase/sprint (which might be days, or weeks long depending on the circumstances of your project) is represented in Figure 3 with a vertical line. During each interval or iteration, your ideas about the problem/opportunity and strategy/solution evolve. You may have more or fewer phases or gates (or 'sprints') than shown in the diagram, depending on the duration and nature of your project. Being somewhat specific about the timing of the phases helps establish the discipline of testing ideas and refining them over time. Otherwise it can be easy for a lot of time to pass before specific ideas are generated and tested, so you end up running out time, and developing only a few ideas which are not tested as rigorously as they otherwise might have been.

### What to focus on leading up to approval

In my experience most projects have some major approval point that signals moving from a 'design' (or 'development') phase through to an 'implementation' or 'delivery' or 'execution' phase. Being able to communicate your ideas compellingly at the approval stage is vital, but you should have been thinking about and designing your communication and refining it over time, from very early on (just like everything else!) so your 'case' for your proposal, your arguments and narrative should all be pretty mature by now and simply require polishing. The other vital thing to check for at this time is whether everything is in place to ensure a seamless transition to whatever the next phase of the project is. If it is implementation, or further development, is everything in place for that to happen? Is there a champion for the project who will push it along? Is all the work you've done so far documented so that whomever is continuing it, has all the information they need to progress the next steps? If the next phase of your project is implementation or delivery, then this must have been extensively designed and thought-through, at least to the extent that makes sense for your type of project, (as prompted in Question 13).

### What to focus on during implementation

All five complex problem solving activities and their *20 Questions* remain relevant in the implementation phase. This is because so much is still learnt during this phase and things can change. This requires your strategy (or solution) to be 'living' or 'dynamic' to maintain its relevance. We are generally quite good at evaluating the implementation of a project in terms of adherence to budget and schedule. Be sure to be as vigilant about evaluation of quality assurance and learning what works and what doesn't (and why) so you can identify effective refinements to the strategy (solution) over time.

# Conclusion

This approach for complex problem solving doesn't make complex problem solving 'easy', but it does make it easier, and more effective, compared to 'muddling through'. And because so many of the challenges in front of us are complex, I believe complex problem solving is an essential skillset for just about everyone – from senior high school and university students right through to the most senior decision-makers across government, business, academia, and not-for-profit sectors.

It's a skillset that helps us to improve how we think, helps us to contribute useful ideas and insights, and helps us to achieve better outcomes. And importantly they are transferrable skills that you can take with you anywhere.

Globally, and as nations, as organisations, as communities and as individuals we face some mighty issues. We also face some immensely exciting opportunities. But if we're to make more progress with any of them, we need to improve how we individually and collectively think about them, talk about them, and go about solving and pursuing them.

Herbert A. Simon put it beautifully in his 1962 paper *The Hierarchy of Complexity* –

*"..human problem solving, from the most blundering to the most insightful, involves nothing more than varying mixtures of trial and error and selectivity."*

He goes on to say that the more insightful approaches allow you to see which paths should be tried first and which leads are promising.

The aim of this approach to complex problem solving with its *20 Questions* and practical techniques to help answer them, is to help to make problem solving the insightful type instead of the blundering type. I hope you find them as valuable as I do. ■

This article is intended to provide a short overview of what complex problem solving is, why we need it and how to do it.
The **Navigate Complexity** short online course and face-to-face seminars and workshops explore all the ideas introduced in this article in more depth. In particular the course teaches the practical techniques that make it easier to answer the 20 Questions using the higher-order thinking styles. Please see the website https://navigatecomplexity.com for more information and you are very welcome to contact us if you have any questions (contact details are on the website).

**REFERENCES AND FURTHER READING**

Several hundred references inspired, informed or validated the approach taken while developing this conceptual model for complex problem solving and the practical techniques. My favourites and the most helpful for those interested in further reading, are listed by topic at https://navigatecomplexity.com/resources. The full list of references for each topic area are given within each module of the short online course.

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*Jane MacMaster teaches complex problem solving at several universities and government departments to Australian and international audiences. She advises universities on course development in this area. She has previously worked as an aerospace systems design engineer for 14 years, as a management consultant for two years and she spent six years in the strategy unit of the Department of the Prime Minister and Cabinet in Australia. She has qualifications in engineering, international relations and training and assessment, and is a Fellow of the Institution of Engineers Australia. She now runs Ponder Enterprises – an organisation that works across all sectors to build complex problem solving capabilities and to help design strategies to achieve outcomes for complex real-world challenges. She designed an approach for complex problem solving after recognising a growing need for these skills and an absence of a practical model for teaching and 'doing' it. The approach brings together the rigour of aerospace system design together with insights from complexity science for coping with the uncertainty inherent in complex challenges. The Navigate Complexity approach to complex problem solving is endorsed by Professor Peter Shergold. The online version of the short course is used by universities for various graduate and postgraduate programs.*