

Appendix A: Critical realist assumptions – ontology and epistemology

A1. Realist ontology

Ontology is about the nature of being, about what is assumed to exist. Rather than the variables of a positivist ontology, a critical realist ontology is focused on realist entities and events (Mingers, 2015). Entities may be ‘complex or simple, structured or unstructured’ (Easton, 2010, p. 120). They are material, conceptual, or social, and include ‘ideas and concepts, feelings and reasons, languages, meanings, norms, practices and social structures’ (Mingers, 2004, p. 150; Wynn & Williams, 2020). Entities may therefore be transitive, i.e., socially derived, person-dependent objects, such as theories and data (Mingers, 2017; Zachariadis et al., 2013), or intransitive, i.e., independent of observers and their observations of them (Bhaskar, 2008). Entities have emergent properties, and, in relation to other entities, they have powers and liabilities to change those other entities (Mingers & Standing, 2017). The causal powers and liabilities may lead to an event happening in one way or another, or not happening (Sayer, 1992). Events are changes in entities (Mingers & Standing, 2017) and their relations. Entities and events may be observable or unobservable. Unobservable entities cannot be measured, but better explanations of events can be sought. The causal efficacy of entities provides evidence that they exist. For example, we can observe effects on people’s thinking and views, what they say, and material objects (Bhaskar, 1997).

A2. Relativist epistemology

Epistemology is about the nature of knowledge and truth. Epistemic assumptions influence the choice of research methodology and methods, because they suggest, for example, what is visible, touchable and measurable. The epistemic relativism of critical realism is different from a positivist paradigm that assumes a realist epistemology (i.e., that we can know that things exist). Critical realism acknowledges Heisenberg’s uncertainty principle. Undertaking research has effect on what is studied and changes results. Further, ‘observation is fallible’ (Easton, 2010, p. 123) and our experiences follow from previous understandings. In fact, everything a researcher does is influenced by personal and social histories, motivations, values and interests (Al-Amoudi & Willmott, 2011; Lawson, 2003; Midgley et al., 2013). Thus, objective reality is socially mediated. However, unlike purely interpretivist or phenomenological approaches, with critical realism we do not adopt judgemental relativism. We assume that it is possible to judge and conclude that some explanations are better than others (Bhaskar, 2008; Mingers, 2015). This is known as judgemental rationality.

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Appendix B: Summary of the authors' new ontology of methodologies in a multimethodological intervention in OR

DESCRIPTION	EXAMPLES	ONTOLOGY
1. METHODOLOGIES AS GUIDELINES IN PRE-EXISTING CONTEXT in the real domain of structures and entities		
Pre-existing methodologies	Descriptions of methods and activities in discourses and documents, e.g., OR literature, books, organizational guidance, case studies (descriptions of past use) Pre-existing physical representations, e.g., software, models, scripts, checklists, guidelines Recordings of the use of a methodology, or explanations thereof, e.g., in a webinar Practitioner roles, e.g., OR practitioner, facilitator, expert in a particular methodology Practitioners, their knowledge and skills, or competences, and physical aspects of memories, e.g., of past use, norms (in relation to methodologies)	Culture – intelligibilia (Archer, 1996) in the cultural system (Archer, 1995), including rules, after Fleetwood (2021), and group/shared ideas Material resources and artefacts Structure (organizational). Roles are associated with practices. Agency, Persons Norms are ‘always located in agents’ cognitive systems’ ‘as memories of past actions’ (Fleetwood, 2021, p. 632)
2. METHODOLOGIES IN ACTION IN PRACTITIONER ACTIVITIES in the actual domain of events		
Embodied actions of practitioners in intervention, including their interactions with other individuals	Practitioners’ choice, adaptation, and use of multiple methods or methodologies, building of models, facilitating	Bhaskar’s four-planar social being (four dimensions of all social activity): ‘(a) material transactions with nature; (b) social interactions between people; (c) social structure; and (d) the stratification of the embodied personality’ (Bhaskar, 2016, p. 53). Alternatively, Archer’s (1995) morphogenesis of structure, culture and agency through social interaction, socio-cultural interaction, and group interaction.
Material resources and artefacts in development/use	Software, physical representations of models (visualization), and checklists developed and used by practitioners	
3. METHODOLOGIES AS USED IN INTERVENTION DESIGNS in the real domain of structures and entities		
Methodological design is a characterization of methods as used by practitioners	Records of previous interventions, e.g., project reports, case studies	Subset of pre-existing methodologies (1. above) in the context of subsequent intervention

References

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Appendix C: Empirical research design

Further details of case selection process, interviews, project documents, and coding of data

Case selection process

Typically, before we could proceed with case selection, issues of sensitivity and confidentiality had to be resolved. For each of the most promising potential cases, the first author was introduced to a lead practitioner to introduce the research and discuss features of the potential case and hence its suitability for the research. Over some years, the purposive longlist of projects grew to around 30 potential cases, but, on investigation, most were either beyond the scope of the research (e.g., not supporting strategic decision-making), or access to sufficient people or data sources or organizations was not in the end provided (whether for contractual constraints or other reasons). Some projects, including at least three or four of the final five, were promoted to us as important to include to attract additional research funding. We ruled out projects that were older and outside the intended scope of the research (e.g., because there was apparently little recognizable OR). For further details of the case selection, see Christie (2025).

Interviews

Interviews were exploratory. At times the interviewer was creative with the questions, particularly where individuals took roles in interventions that we had not anticipated when drafting the interview guide (Braun & Clarke, 2021), or to follow up themes, or understand case-specific issues. Interviews therefore shared some features with ‘unstructured interactive interviews’ (Morse, 1997, p. 445) because the interviewer was learning about the cases and contexts as she went, and adapting her approach, as well as being both encouraging and probing. However, as far as possible, the interviewer avoided asking hypothetical questions (cf. Brönnimann, 2022). The interviewer sought to balance not leading interviewees’ responses, while needing to direct them to the topics of interest. She checked the logic and consistency of responses by using recaps to focus the discussion, confirm understanding, and then move the discussion on. Where possible the interviewer took copies of project documents for interviewees to refer to, and to jog memories. A few interviewees brought a laptop and searched for relevant information during discussions. Following interviews, the interviewer wrote or spoke field notes of her experiences. For further details of the interview procedures, see Christie (2025).

Project documents

As is typical for organizations with ‘systems of accountability’ (Coffey, 2013, p. 373), reports tended to refer to other documents (e.g., previous reports, data sources, or strategy and policy documents), which we searched for or requested. Practitioners’ reports to clients (with practitioners’ OR analyses) were made available for the research for four cases. For case 5 (Figure 2), access to other documents, including scoping documentation, reports of outsourced analysis, and practitioners’ modelling was provided instead. In four of the five cases (not case 2), practitioners made scoping documentation available for the research. This included milestones or deadlines for completing work. In two scoping documents, time-based project plans were summarized. For another case, practitioners made their project plan available separately. For understanding, some documents required many

readings over time due to their domain specificity. Exclusions were also of interest. For further details, see Christie (2025).

Topic and thematic coding of data

In NVivo, the first author set up a codebook for coding research data to topics (Appendix G below). The initial topic nodes and sub-nodes reflected the research questions (Richards, 2014); the developing theoretical framework (Berends & Deken, 2021; Crabtree & Miller, 1992); previous findings from research in the same research context (Christie, 2025); and our data collection and analysis plans for the cases.

The first author built in ways of checking and re-checking the coding. For example, that topic codes overlapped, and that multiple topic codes – with very few exceptions – were relevant to each data extract, enhanced the completeness and consistency of the analysis across the data (from topic coding through to interpretation and corroboration of findings). We could look at cases with different groupings of data.

Moreover, the coding approach provided an audit trail of the inclusion and exclusion of data in relation to research questions. It was always possible to go back to all the data relating to each method used in a case (or any theme) as our understanding developed. For further details of the topic and thematic coding, see Christie (2025).

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Appendix D: Interview guide

Use of multimethodology by operational researchers supporting strategic decision-making in the UK government

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INTERVIEW GUIDE – for semi-structured interviews

NB: This guide is to be used flexibly in order to steer the discussion towards the research questions and understand the issues raised while letting respondents speak. There are many more questions here than it would be possible to cover in a one-hour interview, and not all will be relevant for each interview. For example, at least two to three interviews are envisaged per practitioner per case study. One interview with each client may be sufficient (but may not be).

Thank you

Provide participant information sheet and consent form

- Recap aims of research project & purpose of interview (from participant information sheet)
- Recap key points re anonymity & right to withdraw (from consent form)
- Any questions?
- Please sign two copies – one for researcher, one for participant

If researcher considers it appropriate, discuss recording of interview with participant. If he/she consents:

Start recording

Thank you again

- I understand that you were involved in the [X] case
- I'm looking forward to our discussion, to hearing about your experiences of [providing / appraising] the decision support for [the [X] case] and your experience of the decision support process
- I am particularly interested in [e.g. how you chose/appraised the methodologies, methods and techniques used in the decision-making, for example ...]

1. Introduction to case

So perhaps you could start by describing **your role** in the [X] case

Next, please could you describe the **subject matter** of the case [using as little jargon as possible]

2. Timeline

I'd like to take you back to when you were first involved in / initiated this work and hear you talk through the actions you took and the decisions you made, how you chose/used/appraised methods, and any changes made later as the case went on.

I'd like to put together with you a timeline of the work, focusing on your use of methods / evidence presented.

[Complete timeline on flipchart paper or similar with interviewee]

Ask probing questions, as appropriate/required to elicit timeline of activities, decisions and outcomes, including the key stages below.

Key stages

1. Immediately you were aware of the work
2. When/how you started/commissioned the work
3. Phases of work / At key stages / plan / report stage

4. Outcomes
5. The future

Useful probing questions (in general):

- Can you tell me a little more about ...?
- Could you describe an example of that?
- Why did you do that?
- How did you do that?
- What were the benefits?
- What were the challenges?
- How successful was the work? Why?
- What form did output take?
- What information / documentation is available on that, and in what form?

For [practitioner]s/consultants:

- What (issue) were you presented with?
- What were you expected to do/produce?
- Which methods did you consider?
- How did you choose which OR and other methods to use (in general)?
- What means/tools/guidance did you use to consider possible methods?
- What decisions did you make about methods? When did you make each of those decisions?
- Which **methods** did you use?
- Why did you choose that method / combination and not others?
- Which other methods / approaches did you consider?
- What else influenced your choice?
- Were there any other influences on your choice, perhaps that you were not aware of at the time?
- Are there methods you did not consider at the time? Which ones?
- [Refer to list of methods from questionnaire as appropriate]
- You have not mentioned any [hard OR / PSMs / critical methods] – why?
- What did you expect the benefits to be of your particular approach in terms of the methods you chose?
- What did you expect the challenges to be of your particular approach in terms of the methods you chose?

If multimethodology was used:

- How did you design your methodological approach?
- Did you adapt/adjust any of the methods in the way you used them?
- How did you combine the methods?
 - Could you draw how you combined them?
 - [Show toolkit of six linking designs (single methodology, sequence, parallel, enhancement, interaction, integration) in interview handout 1 to elicit/describe combination]
- What was your experience of using more than one method?
- What were the **benefits** of using more than one method? To whom?
- Did anyone / any other organization benefit? In what way?
- What about [benefits of multimethodology from literature not already mentioned]?
- What were the **challenges** of using more than one method?
- What about [challenges of multimethodology from literature not already mentioned]?
- Did you consider any multimethodological frameworks or guidance?
- Was using that/those method(s) as you expected it to be?
- Has your understanding the use of the method(s) changed? In what ways?

If multimethodology was not used:

- Did you consider using other methods, perhaps in combination with your chosen method?
- Why did you rule that out?
- What challenges did you foresee?

For decision makers:

- What were your requests and expectations in terms of the analysis/work you commissioned?
- In what ways were those needs met?
- In what ways were they not met?
- When and how did you act on the analysis presented?

- What did you decide / not decide?
- How did you decide?
- Why? What are/were the key drivers / influencers?
- How aware are you of the analysis methods that were used in this case?
- How important / irrelevant was the choice of method to you and others involved in the case?
- How do you view the success of the project/work?

3. Success

- On a scale of 0 to 10, how would you rate [intervention/project success], where 10 is successful in every respect, 5 is partly successful partly unsuccessful, and 0 is complete failure?

For [practitioner]s/consultants:

- On a scale of 0 to 10, how would you rate the success of your method choice in terms of its impact on client outcomes, where 10 is successful in every respect, 5 is partly successful partly unsuccessful, and 0 is complete failure?
- Please explain your rating, for example, what was successful about your use of multiple methods? What was less successful or challenging about it?
- In what ways were client needs met / not met?
- Why was it more/less successful than other work you have done?
- To what extent was this attributable to the methods chosen / used?

4. Dimensions

- If not already covered in discussion – how much **time** were you given / did you give to carry out the analysis?
- What was **your role / the role(s) of your organization vis-à-vis other parties?**
- Which other people/parties/stakeholders were involved?
 - Commissioner(s) / initiator of work
 - Practitioners
 - Managers
 - [Consider using a stakeholder grid to record these – see interview handout 2]
- What were your commitments to other stakeholders?
- How much power/interest did these stakeholders have?
- How much **judgement** was required, e.g. due to lack of data (high / medium / low)?
- What was the **level of disagreement** between the parties (high / medium / low)?
- How did you deal with / manage these aspects of the intervention?

5. Alternative approaches

- How else could you have commissioned the work / chosen and combined methods / designed the intervention / appraised the analysis presented?
- If you were starting the work again, would you approach it differently [in terms of your methods]? Why?
- If you could change some aspect of the way in which you chose/appraised method(s) or the wider impact method decisions have/had, what would you change? What stopped you?
- Was the choice of method(s) limiting in any way? Tell me more.
- **What other information will I need to be able to consider alternative approaches that could have been taken in this case to choosing and combining methods?**

6. Other

- How typical was this case? Of what? For you / your area of work / organization / OR practitioners / your decisions / decision support / advice you receive?
- How did method choice in this case compare with that of other cases you have worked on / are aware of?
- How do you see / feel about the future in terms of method choice and its impact on project success?
- What thoughts/views do you have on:
 - The support available for using different methods?
 - The challenges and benefits for you of choosing / relying on more than one method?
- How did/do others (involved in / aware of the case) view:
 - Your decisions and plans?
 - The project / methods?
 - The success of the work?
 - How methods will be chosen in future

- Expected benefits/challenges of the approach you took
- How do you describe it to them? What words do you use?

7. Conclusions and debrief

That's the **end** of my questions. Is there anything you have not said that you would like to **add**?

Finally, do you have any **questions or comments** for me on any aspect of our time together today, or the research study more generally?

Stop recording

Any other business, thanks and goodbye / arrange follow-up interview / remind participant that they have contact details for interviewer and supervisor on participant information sheet

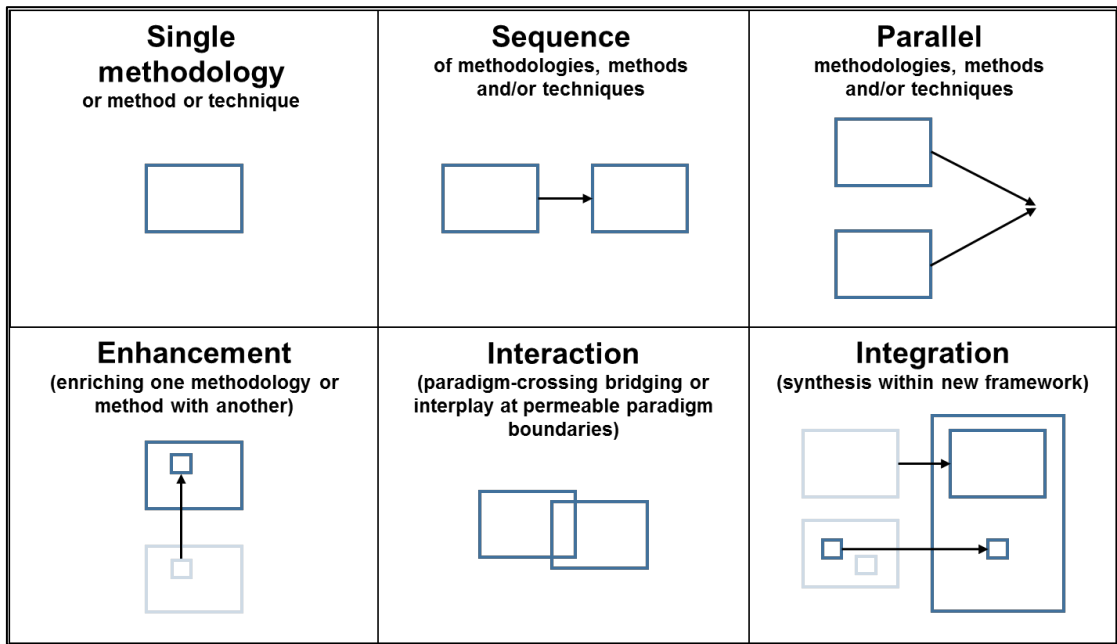
Monitor participant for any signs of distress / harm.

Subsequent interviews to:

- Further develop timeline
- Address further questions from interview guide
- Check understanding of events and case itself
- Explore issues raised in further detail
- Verify information in secondary data related to the case

Note: Some of the wording in this interview guide was changed prior to publication for reasons of confidentiality.

Forms of multi-methodology



Adapted from six linking designs in Morgan et al. (2011)

Figure adapted from ‘Fig. 2. Mixed method designs.’ in [Morgan et al. \(2017, p. 911\)](#), used under [CC BY 4.0](#)

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Appendix F: Interview handout 2 – Stakeholder grid

OR intervention stakeholders by stakeholder category

Stakeholder category	Examples of Dstl [Defence Science and Technology Laboratory] OR stakeholders	Stakeholders in this case
Doers (practitioners)	Dstl consultants/analysts/facilitators Third party consultants/analysts/facilitators	
Done for (clients)	Military Commands MOD [Ministry of Defence] Head Office / Policy UK Government ministers	
Done with (participants)	[Varies by project]	
Done to (outside project, e.g., people interviewed)	[Varies by project]	
Done without (others within organizations and society not involved but affected by outcome)	MOD personnel Parliament Society	

Stakeholder categories adapted from Ormerod (2008); examples informed by DSTL (2015)

Note: Some of the wording in this interview handout was changed prior to its publication for reasons of confidentiality.

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Appendix G: Research codebook – initial topic nodes for case data

Nodes	Sub-nodes
Research question 1: How do OR practitioners choose and combine OR methods?	
Methods	[Method list: 47 clusters of OR and strategy methodologies, methods and tools] [Other methods]
Method combinations	
Forms of multimethodology	Single methodology Sequence Parallel Enhancement Interaction Integration Other Use parts <u>Derivation of findings</u> <u>Iteration</u>
Multimethodological [theoretical] frameworks	
Research question 2: Why do practitioners take these methodological approaches?	
Why?	Why / why not this method? Why this combination? Why this form? Why single methodology? Why multimethodology?
Description of interventions/cases	
Stakeholders [including roles and relations]	Done for (Client) Doer (Practitioner) Done with (Participant) Done to (Outside project) Done without (Affected) Owner [Checkland] <u>Implementer</u> <u>Liaison</u> <u>Outside consultants</u> <u>Other</u>
Issues and problems	
Timeline [including events, dates, deadlines, changes, activities, outputs – refined as coding progressed]	
Dimensions [of interventions]	Domain Subject matter Time available [Level of] Judgement [Level of] Disagreement Parties <u>Other</u>
Outcome description <u>Decision influencers / drivers</u>	
Success	Success definition More successful aspects

Nodes	Sub-nodes
Success rating	Less successful aspects 0 (complete failure) 1 2 3 4 5 (partly successful partly unsuccessful) 6 7 8 9 10 (successful in every respect)
Experiences Challenges Environmental constraints [Later combined]	Resources Culture, norms and values Training course Other
Context Worldview	
Other comments	Definitions of method Definitions of OR Other emerging themes Personal background Technology and tools Variety of work Support available for methods Future of method choice To follow up or question further Limitations of study Other <u>Secondary data</u> <u>Access to other stakeholders</u> <u>Cross-case themes</u> <u>Theory development ideas</u> <u>For impact log</u>
Alternatives	Alternative problem definitions Alternative approaches Alternative methods Alternative approaches – impacts

Legend

Added in response to case data

For further details, see Christie (2025).

References

Christie, J. S. (2025). *The use of multimethodology in operational research practice supporting strategic decision-making: Prevalence, methods, designs, and causal mechanisms* [Doctoral dissertation, University of Kent]. KAR. <https://doi.org/10.22024/UniKent/01.02.109625>

Appendix H: Descriptions of data in methods and activities table (within rich case description)

Column heading	Description
Title	Titles, names, or short descriptions of method or activity (different terminology in coded data)
What	Descriptions of the method or activity, or what practitioners did
Why (practitioners)	'Specific results' that the practitioner aimed 'to bring about' by using the method (Mingers, 2006, p. 223), and other reasons practitioners gave for using the method they did, and not others
Why (others)	Reasons suggested by other individuals, and other reasons inferred from the data by researcher
Who	Individuals with whom practitioners used the method
Outcomes	What happened as a result of, or after using the method, including decisions (e.g., workshop findings, and how they were used or received or acted upon)
Combinations	Links with other methods used (e.g., used insights from or followed another method)
More successful aspects	Perceptions of more successful aspects of use of method
Less successful aspects	Perceptions of less successful aspects, including challenges, of use of method
Alternatives considered	Alternative methods considered (during case, and, separately, in hindsight)
Data sources	List of sources of data recorded and summarized in other columns

For further details, see Christie (2025).

References

- Christie, J. S. (2025). *The use of multimethodology in operational research practice supporting strategic decision-making: Prevalence, methods, designs, and causal mechanisms* [Doctoral dissertation, University of Kent]. KAR. <https://doi.org/10.22024/UniKent/01.02.109625>
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Appendix I: Case mechanisms – illustrative underlying data

Aspect of context	Context (structural analysis)	Mechanisms of method choice (Note)	Enabling / constraining conditions	Illustrative data (Note)	
				Agency	Social structural conditioning
Structure	Relations between intervention roles – practitioners and clients, and associated responsibilities and power	Practitioners' aim to deliver analysis in support of clients' business case	Clients' expectations of practitioners' work	'Everything's driven from what are you trying to achieve, in this piece [intervention] rather than taking a, methodology, approach basis to it. Let's start with the questions we need to answer, to satisfy those who are judging, [...]' (practitioner) '[QUIETLY] I think we challenged [clients] massively. We could have, in terms of <u>doing the right job for [the client organization]</u>, I'd rate it very highly. Doing what the customer wanted, no. I was the thorn in their sides. <u>But</u> I kept [the client] out of hot water, [...] because they were ultimately responsible for making sure that a robust business case was being put through.' (practitioner)	'[...] it started off with, there's a business need, to, make sure that, the business case for, whatever the future of [the capability] is, has appropriate, [OR] support to it.' (practitioner) 'It's quite a formal process, owned by the [assurers]' (client) 'But, as I say, so it's back to understanding the context in which <u>this</u> [OR] happened. This was kind of <u>forced</u> upon us rather than something that we chose to do.' (client)
Structure	Relations between business case approval roles – practitioners and assurers; assurers and approvers – and associated responsibilities and power	Practitioners' aim to provide sufficient evidence, acceptable to assurers, who would advise business case approvers (decision makers)	Assurers' expectation of robust evidence	To provide 'at least sufficient evidence' for business case (practitioner) 'So we <u>had</u> to have something which [assurance], [...] would accept as being, sufficient basis to inform a decision by the seniors' (practitioner) 'The, fundamental disagreements we had in this area, were, about how much we actually had to do, to prove our case, back to, was this level of activity which was very large, appropriate, <u>and</u> what success metrics looked like in terms of value-for-money.' (client)	'Everything governed by the [policy documents]. Formal processes to go through. Formal boards whose requirements needed to be met all the way through. [...] <u>Here</u> you've got a whole load of hoops that need to be satisfied.' (practitioner) 'So, my role in most of that was, brokering the discussions between the people who were responsible for generating the evidence, [...] writing the business case [...] and the [assurance] teams who <u>were</u> requiring a particular level a particular standard a particular approach to the solution.' (client)

Aspect of context	Context (structural analysis)	Mechanisms of method choice <i>(Note)</i>	Enabling / constraining conditions	Illustrative data <i>(Note)</i>	
				Agency	Social structural conditioning
Structure	Relations between employment roles – practitioners and government employer – and associated responsibilities and power	Practitioners' aim to be seen as trustworthy, fair, independent practitioners (taking into account a broad range of opinions of individuals involved in or affected by the intervention, while seeking agreement as to recommendations)	Practitioners' employer's expectations of practitioners' work	'[...] [the MCDA paper] sets out a <u>whole bunch</u> of top-level scoring but also a massive sensitivity analysis. Looking at different perspectives. So it's not just about hard numbers, it's about how <u>palatable</u> options are to different communities, and what factors, where the key issues are between different communities. So therefore recommendations about how one can build a more <u>viable</u> system in the <u>future</u>, where your bridges need to be built, where you need to be searching for your common viewpoints. Hard numbers kind of didn't do it. Hard numbers <u>were there</u>, but it was really the richness that sat behind that?' (practitioner) 'So I think what we sought to choose was to extract comments [on workshop participants' rationales when voting on weights and scores] which, reflected the majority position. But I think it provides, useful additional colour, beyond, a fairly sterile, it's a six or a seven. And particularly can be used to illustrate or draw out some of the reasons which led to, people voting as they have. I think it also flags up some of the issues that, going forward, the [...] [parties] needed to think about, so for example perhaps some of the concerns or risks that people might have had so, our vote is a seven but, this point, so, if you do choose this option, then, that point represents something that, the [parties need] to have a think about. So it could be about, how a benefit could be better realised, or perhaps how, something's not working very well and needs to be addressed, [...]' (practitioner)	'There was <u>such</u> resistance, within the [existing capability] delivery community that there was <u>any other way</u> apart from [the existing capability]. And that <u>nobody else could possibly</u> do this, apart from [the existing capability]. There was <u>no other</u> delivery mechanism, apart from the one that there was now. I needed some mechanism to be able to challenge that, from a fact-based position. Through being able to paint some pictures about different <u>ways of doing things</u>. And what some of the pros and cons might be of that.' (practitioner) 'If, we'd have just done a straight [combination of MCDA and costings] on this, it wouldn't have given analysis that was <u>really</u> particularly <u>helpful</u>. Because actually it wouldn't have challenged <u>any</u> of the mess that was there. And that was the big thing that needed doing. [QUIETLY] Which was about challenging to make sure that the <u>requirement set</u> was the right one. <u>Really</u> pushing down on, [QUIETLY] what is the <u>need</u> for this thing?' (practitioner) 'the [main practitioner], was someone who was brought in, very much <u>because</u>, [they were], quite independent of that [capability] activity ongoing on.' (client)

Aspect of context	Context (structural analysis)	Mechanisms of method choice (Note)	Enabling / constraining conditions	Illustrative data (Note)	
				Agency	Social structural conditioning
Agency	Practitioners' dispositions	Practitioners' tendency to use available methods used in the past (not novel methods)	Limited resources (time and money) for OR projects and trying new methods Risk aversion (amongst practitioners and assurers)	'But, each question, there's a means to it? You focus on what it is that I need to achieve, and then, what are the appropriate toolsets to do that, that are already available? And if those toolsets don't fully satisfy the needs, then you look at other means of doing it. So what can you do to bring different things <u>together</u> . Can you integrate, can you develop a new, method. But I'll only develop a new method if, a <u>totally</u> new method <u>if</u> there isn't something there that which adequately delivers it safely.' (practitioner)	'We do things that we're comfortable with, and the techniques we're seeing, are stuff that's been used. [...] I think there are lots of techniques. The difficulty is, using them in the context that we want to use them [...] The difficulty we face is, if we are going to use a new technique, we really have to be sure it's going to work [...] and [intervention clients] have enough problem understanding benefits modelling. [...] part of my [assurer] role is to talk through the methodologies, and approaches and say, OK, you can do it this way, no-one has done it before, I think it's do-able, but you're taking a risk. And, generally, this is a risk, I think you categorize the [organization] as a risk averse organisation.' (assurer) 'we have <u>got</u> into a situation where we, are not <u>applying novel</u> techniques' (assurer)
Culture	Rules in policy documents for business case approvals	Rules requiring robust evidence from quantitative methods where possible, and measurement of cost-effectiveness of options Rules requiring the provision of additional commentary on risks and risk mitigations	Business case within scope of rules Unsuitability and resistance of some individuals to 'more objective' cost-effectiveness methods	'we did think long and hard about whether or not we could get to, more objective methods but, very very difficult to see an objective method for this.' (intervention participant) 'So of the three sort of worlds that we've got here, there's the world of hard numerical analysis with physics-based modelling. I didn't see any possibility. A much more econ- cost-benefit analysis, possibilities there but we, weren't able to, land that. Which left you with this thing in the middle, which was, MCDA, carefully applied, [...].' (practitioner assurer) 'I don't think there was a great deal of consideration of, a wider variety of methods, partly I think because of the subject matter [business case support].' (practitioner)	'Practitioner: [...] there's a fairly hard <u>rule</u> set, applied to [this type of analysis], so there's [the relevant policy document], [...]. But still that gives an awful lot of room. Interviewer: Yes, they are <u>guidelines</u> . Practitioner: Yeah.' 'As a business case, there was an expectation from [assurers] that, we needed to provide robust evidence here, ... We were ... looking at a cost-effectiveness measurement.' (practitioner)

Aspect of context	Context (structural analysis)	Mechanisms of method choice (Note)	Enabling / constraining conditions	Illustrative data (Note)	
				Agency	Social structural conditioning
Culture	Discourses and documents regarding past projects, and the appropriateness of certain methods and not others	Practitioner cognitive resource (knowledge) and confidence that using MCDA was feasible and would result in acceptable answer	Lack of knowledge of apparent alternatives	‘to an extent it drew on previous experience. General analytical knowledge of how one goes about that kind of problem’ (practitioner) ‘all the advice I was getting was this is <u>probably</u> looking like an MCDA piece. And so my, face was like, ‘<u>What does that mean then?</u>’ What can it do? What can’t it do?’ (practitioner)	‘I looked at, <u>past</u> approaches [to the capability] which have been very much founded upon MCDA. But with I think a more <u>limited</u> view of the problem space. I talked to [my assurer] up at the front about what [they] saw success as looking like, and then we, played around, I had a lot of discussions with [...] my [senior practitioner colleague] at the time, about what kind of approaches might satisfy because I came to this with <u>no</u> background in formal [OR], at all, so I batted around with [them] about what success might look like and what kind of <u>methods</u> might work. I also talked to [another colleague] quite a lot, who had led one of the previous [business cases] [...] all the advice I was getting was this is <u>probably</u> looking like an MCDA piece.’ (practitioner) ‘the two factors were probably (1) the general feeling that this was an appropriate technique for this type of activity and (2) it wasn’t immediately apparent what other options there might have been. And sometimes you, that’s where you get to with analysis.’ (practitioner)
Relations	Lack of agreement amongst individuals involved in or affected by the capability as to the purpose and value of the capability, and plenty of politics playing	Practitioners’ aim to capture different views on viable options, while seeking acceptance of recommendations by individuals involved in or affected by the intervention	Other individuals’ expectations of practitioners’ work	‘We didn’t seek consensus. It was more just trying to, make sure that the final vote represented what people were happy with, taking forward.’ (practitioner)	‘There were so much politics going on here. There was so <u>little</u> agreement about actually what the purpose of [the capability] <u>was</u> .’ (practitioner)

Note: Mechanisms of method choice include effects of practitioners’ reflexive deliberation and values (and other aspects of agency, including norms, after Fleetwood, 2021), as well as their circumstances, and social structural conditioning (Bhaskar, 2016, p. 66).

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