# Research Data Management as a "wicked problem"

## Introduction

Managing research data has long been a concern for researchers. However, the quantity and complexity of digital data makes managing it effectively increasingly challenging (Borgman, 2015). Furthermore, a greater stress on good data management in international and national policy and mandates from funders has made Research Data Management (RDM) an increasing priority for research institutions (Pryor, 2014). Nevertheless, at least in the UK, universities seem to have been a little slow to commit the resources to build more advanced research data services (RDS) such as data catalogues or repositories (Corrall et al, 2013; Cox et al. 2014). Many still seem to view the local developments of research data services to be "early days" (Cox et al., 2014). This is partly because of the diversity and complexity of data practices and the need to draw on the expertise of multiple groups across the organisation to address the issues fully.

Cox et al. (2014), amongst others, have suggested that it may be useful to view RDM as a "wicked problem" (see also McLeod and Childs, 2013). Rittel and Webber (1973) were the first to use this term to capture the intractable nature of certain societal problems. To briefly summarise the concept, in professional life we encounter many "tame" problems which may be troublesome but how to deal with them is understood, even routine. Tame problems would include operational problems but also straight-forward, non-routine issues. Organisations are set up precisely to understand and manage such issues. "Wicked problems" are much more complex. They are seen differently by different stakeholders. They evade easy answers, indeed they may actually be insoluble. The point of drawing the distinction is that once we know we are dealing with a "wicked problem" we need to start operating differently from how we would with a tame problem. Grint (2009; 2010) has suggested that leadership styles should change. Ney and Verweij (forthcoming) explore a number of techniques such as problem mapping and scenario planning that have been developed to help clarify if not resolve wicked problems.

Arguably Higher Education is facing more and more wicked problems, because of the greater interconnectedness of organisations and processes in a globalising world (Johnson et al. 2014). In that context, the aim of the project work described in this paper was to investigate the usefulness of the wicked problem idea, specifically in the RDM context. It was based on assembling practitioners from a range of professional backgrounds and who were engaged in supporting RDM to explore the idea in depth. The project was supported by funding from the Leadership Foundation for Higher Education (https://www.lfhe.ac.uk/).

The paper is laid out as follows: First, more context for the study is provided. Then a fuller explanation of the methodology is presented. Next, results of the study are organised around respondents' views of the relevance of features of wicked problems; narratives of wickedness that they told; and responses to Grint's theories about management in wicked problem contexts and the problem mapping and scenario mapping methodologies sometimes recommended for such contexts. Finally, the discussion and conclusion weigh up the value of the wicked problem concept for RDM.

## Context: Research Data Management as an issue in HEIs

The last decade has seen a growing concern in international and national policy with data curation and the management of research data. An Organisation for Economic Co-operation and Development (OECD) declaration on the subject in 2004 was followed by "Principles and guidelines for access to research data from public funding" (2007). Much subsequent policy echoes the OECD principles. In the UK it triggered a "first wave" of research data policy, with a Research Council UK (RCUK) statement on data issued in 2005 (Jones 2012). A second round of policy came from the UK research funders in 2011 with the RCUK's "Seven common principles on data policy" (RCUK, 2011). The ante was raised still further in the same year by the Engineering and Physical Sciences Research Council's (EPSRC) statement which required research institutions to write a roadmap for data management by 2012 and then implement an appropriate infrastructure by 2015 (EPSRC, 2012; see analysis in (Pryor, 2014)). In 2013, more key international policy statements followed, such as the White House memo "Increasing Access to the Results of Federally Funded Research" and statements by G8 science ministers and the European Union Parliament. Thus there has been a great deal of activity at the policy level making managing research data a priority.

Yet, while the policy landscape is becoming more consistent, on the ground turning this into local support services has been significantly slower. In the UK this is partly because the focus has not been on a national approach, rather it has been seen as the responsibility of each research institution to develop its own support services. It is true that in certain areas there has been a longstanding investment in national infrastructure in terms of subject data archives (e.g. the UK Data Archive). There are also national support organisations such as the Digital Curation Centre (2004-). Two JISC Managing Research Data programmes have shared experiences of developing institutional services (Hodson and Molloy, 2014). Yet the emphasis has been on placing the responsibility on each research institution to develop appropriate socio-technical infrastructure and services, and the evidence is that these have emerged rather slowly (Cox and Pinfield, 2014). Corrall et al.'s (2013) survey suggested that the UK was lagging behind some other countries.

This slow movement reflects the complex nature of the context within which RDS need to be developed:

- The scale of the challenge: to change the research practices of every researcher;
- The diversity of research. The large number of disciplinary and sub-disciplinary research cultures among researchers, each with their own notion of what data is. Thus there is a lack of a common language or common practice;
- The complexity of the research process and the fluid character of what data are;
- The symbolic status of research within institutions, meaning that change is fraught with issues of power and identity;
- Lack of consistent funding for RDS;
- The lack of clarity about which existing support services would be the natural lead for RDS.

In this context, it has been suggested by a number of authors that RDM might be considered a wicked problem, at least for those developing institutional services. The project described in this paper was undertaken to discover whether the concept resonated with practitioners actively engaged in the area. Specifically the project sought to answer three research questions, namely:

1. According to RDM practitioners, how far do the features attributed to a wicked problem apply to RDM?
2. Does Grint's (2009; 2010) advice on leadership in a wicked problem context resonate with RDM practitioners?
3. How useful do RDM practioners think proposed methods for dealing with wicked problems (namely problem mapping and scenario planning) are?

## The project

This paper is not a research paper in a conventional sense. It is a co-production based on input from a multi-professional group of fifteen practitioners actively engaged with RDM, facilitated through two workshops. This process was designed to create and capture conclusions from an informed debate around the notion of wicked problems, and its potential relevance to dealing with RDM. Participants were exposed to the idea and the chance to try out some related management techniques. On this basis they were being asked to evaluate its utility through reflective exercises. The reflective material was then organised into a coherent narrative and the subsequent paper was circulated a number of times for further commentary by all the participants.

While having its inherent limitations, this procedure proved a powerful way to engage a highly knowledgeable group with a new concept related to professional practice. Akin to a focus group, here participants were much more deeply engaged over two days and subsequently invited to participate in the analysis and writing up of the material collected. The depth of engagement with the concept and the rich response, the authors believe, justifies this approach, in the context of the aim of the project: to see how practitioners in RDM themselves evaluated the concept of wicked problem. The approach produces a credible and resonant account (Tracy, 2010). The paper complements other work, such as Cox et al. (2014) which used the concept of wicked problems as a way of analysing pre-existing interview material, to try and show that practitioners perceived RDM as wicked, even if they had not heard of the term as such. Details of the process of the project are supplied in the following paragraphs.

Participants from ten Higher Education Institutions (HEIs) in Northern England were invited to attend a series of two workshops in the summer of 2014. Library-based contacts were invited to nominate one or two non-library colleagues with RDM roles to participate. Thus the final mix included librarians, IT staff and research administrators. Invited institutions included both "research intensive" and less research oriented institutions, though larger numbers of participants came from the White Rose partnership (Leeds, York and Sheffield). The first workshop introduced the wicked problem concept and Grint's (2009; 2010) maxims about leadership in such contexts. Notes were made on plenary discussions by one of the facilitators. After the workshop participants were asked to compose some reflections on five questions and share them with the rest of the group online. Fifteen of the eighteen attendees replied. The second workshop included an opportunity to reflect on some short extracts from the previous reflections, as part of refreshing participants' minds about the material from the first workshop. Problem mapping and scenario planning were then introduced and exercises lasting two or more hours worked through each methodology. A plenary discussion (on which notes were again taken) reflected on the value of each method. At the end of the workshop individuals were asked to write about their own evaluation of the two methods.

Material generated by participants was synthesised and some interpretations added by the facilitators. The synthesis was shared with participants for further comments and debate online. Some individual responses to parts of the synthesis were then added. Thus in preparing this manuscript the organisers of the workshops acted as editors, assembling material from participants' writing and also facilitating a process of further comment. The emphasis was on multi-vocality, ie allowing "multiple and varied voices" to be articulated (Tracy, 2010: 844), rather than seeking to create consensus. Individuals' quotes are preserved as vivid articulations of particular viewpoints. Since participants were invited to comment, debate and offer further analysis, the whole work is collectively authored and edited.

Clearly this approach differs from a more typical research design in which "data" is gathered in a focus group or through interviews and in which the researchers are primarily responsible for undertaking analysis, perhaps sharing the analysis for member checking. It goes much further in treating participants as co-investigators: involving them as far as possible throughout the research process, including in co-authoring outputs such as this paper. The written responses participants contributed were created after collective discussion; there was a significant sense that participants influenced each other. Rather, than attempt to "objectively" evaluate the concept in some way, the purpose was to create a rich, multi-vocal response from practitioners to the notion of seeing RDM as a wicked problem. Given the small sample of people involved in the workshops no strong claims of generalisability could be put forward. Nevertheless, the authors agree in asserting that the paper represents a useful contribution to knowledge. The paper is a rich reflective review on the relevance of the wicked problem concept to RDM practitioners.

In what follows, opinions are often quoted verbatim, but not attributed. Doing this ensured that people could talk and write freely, without a sense that they might be seen to be reflecting negatively on their own institution – and also to acknowledge the sense that all the writing was at some level a response to the wider conversation that had taken place. The approach created an open forum for sharing information, experience and ideas allowing critical reflection of particular aspects of RDM which enabled learning and understanding; this was further enhanced by understanding and empathising with other stakeholder views because of the composition of participants attending the workshop. Even though there was a collective approach taken, the sense of community and common purpose allowed lone voices to be heard and listened to in order to gain understanding from a different institutional and professional service experience. The facilitators made it explicit that sceptical views on wicked problems were valued. This accorded to a carefully designed ethics process in which voluntary informed consent was gained from participants; a process approved by University of Sheffield ethics reviewers. Co-authorship was achieved while respecting confidentiality, by naming all participants as authors, but anonymising quotes.

This was not the only way to do the research. However the participatory approach taken here - an approach to research "with" rather than "on" the community - does have a number of strengths . It engaged both participants and facilitators in a learning process and so increased the chances of ideas from the project having real impact on practice. Indeed it could be seen to follow a model of critical reflection as an aspect of practice. By being actively involved in co-constructing a joint view the collective intelligence of the group was mobilised, rather than setting up the researchers as somehow having a privileged ability to construct an analysis. Through the dialogue the relevance of the research output is ensured. In addition, new network connections were established between

participants that were in themselves directly useful. The approach also aligns well with the collaborative ethos of the RDM community.

For a practical field like Information Studies this "co-production" approach is not claimed to be an extremely novel approach nor is it without limitations. It could be argued that something is lost in depth of analysis through such an inclusive process which lacks a stage of stepping back from the context and of using theoretical models to dig beyond what practitioners are themselves willing to discuss or directly aware of. Data could have been generated in other ways: the stress was on written reflections, rather than recordings of the workshop sessions, for example. The approach also lacked the formalised structure of a Delphi study or the learning through active intervention in practice that characterises Action Research.

## A long list of features of a wicked problem

Members of the group were asked to write about which of the features of wicked problems identified in the literature they felt were most relevant to RDM. The starting point was a long list of sixteen items developed and discussed at greater length by Cox et al. (2014). This is an expansion of the ten proposed originally by Rittel and Webber (1973) based on points taken from the work of Horn and Weber (2007).

Some participants picked three or four aspects; some many more; one stressed just one key aspect. Half or more people mentioned the following five features (and no one actively said they thought any of these was not relevant):

- There are multiple ideological, political or economic constraints on possible solutions.
- There is no comprehensive list of possible solutions.
- Because the problems are complex, there are multiple possible intervention points.
- Solutions are not true or false, rather they are good or bad.
- There is great resistance to change.

Eight of the other features were actively selected by two, three or four participants:

- There is no definitive formulation of a wicked problem.
- There is a choice about how to see the problem, but how we see the problem determines which type of solution we will try and apply.
- A wicked problem is itself a symptom of other problems.
- There is no test of whether a solution will work or has worked.
- There is no stopping rule. One cannot pause time to contemplate a solution, because the issue continues to change while you are making a decision.
- Each wicked problem is unique, so that it is hard to learn from previous problems because they were different in significant ways.

- As well as there being no single definition of the problem, there are multiple value conflicts wrapped up in it.

- With social messes, in addition to the complexity of the problem itself, data to describe the problem are often uncertain or missing. It may be difficult actually to collect information. There is no one expert with the answer.

Some items were identified by no-one or only one person:

- Wicked societal problems have effects on real people, so one cannot conduct experiments to see what works without having tangible effects on people's lives.

- Every solution is a "one-shot operation". There can be no gradual learning by trial and error, because each intervention changes the problem in an irreversible way.

- The consequences of any particular intervention are difficult to imagine.

One person identified quite a lot of elements that he thought did not fit. Another commented:

> "In some respects, RDM does not match the characteristics of a wicked problem. For example, RDM is not entirely unique but shares some of the features of other challenges around scholarly communication and Open Access. It may also be possible to try incremental solutions and to test out other solutions. RDM does present big problems but they are not of the scale of something like climate change."

Yet the concept of wicked problems stimulated a lot of thought (and some disagreement) about how to see RDM. It seems clear that, at least for those that responded, the concept resonated. Even for those who identified features that fitted less well, the discussion helped them clarify the particular character of the problem. One wrote:

> "I think that the features I have chosen here reflect what I view is our current institutional development around RDM service planning and maturity. I think this list may be very different if we had an established and mature RDM infrastructure (technical, socio-technical, and human)."

This suggested that over time perceptions of the issues would evolve. In plenary discussions the thought was that in the long run RDM would not be a wicked problem was considered.

## Narratives of wickedness

Another way of exploring the potentially wicked nature of RDM was through asking participants to "recount any stories you can think of that illustrate the wicked nature of RDM."

For some key stakeholders grasping RDM is difficult because it is a multi-faceted problem. This came out in one story:

> "In our institution a small group of individuals from [Computing], the library, senior management, research support and records management met several times to discuss RDM and each time we struggled with the concept of RDM. It was very difficult to agree on how

> and where to start to tackle the problem. Each meeting seemed to take one step forwards and half a step back!"

This echoes the point made by Conklin and Weil (1997) that the usual logic of problem solving breaks down with the scale and complexity of a wicked problem. Rather than a linear process of gathering data, developing solutions, making a choice and then implementing it, there is constant return to earlier steps in decision making. Linear thinking does not succeed in the wicked problem context.

While this narrative seemed to be about the experience of professional staff, most of the stories revolved around researchers themselves. In one of the stories the barrier was the difficulty of establishing a sense that there is a "problem" or issue that needs attention at all:

> "• Some researchers don't see themselves as producing data: so what's the problem?
>
> • Some researchers already "look after" their data: so what's the problem?
>
> • Surely we just need to give researchers more storage: so what's the problem?
>
> • We have an RDM policy in place now: so what's the problem?"

This reveals that sometimes it is hard to even get RDM recognised as an issue. For many institutional stakeholders the issue is a tame problem; it is from the wider institutional perspective that it is wicked. Even where the problem is recognised, different views of what it is make it hard to design a clear response:

> "I've worked with two senior and very experienced physicists who have worked together for many years, are highly experienced at collaborating with other academics and have worked on projects that have made use of shared data sources. Yet the two were in complete disagreement about what data from apparently quite similar experiments would be stored to enable it to be useful to others. Those differences showed the academics choosing to take a different view of the problem which would have involved applying quite different solutions."

Even within the same discipline, or even sub-discipline, needs can seem to be different. Whereas some participants saw the issue as lying in researchers' different views and needs, another stressed that with each individual there might be multiple issues:

> "[…] consider the story of a typical academic, who has career aspirations (which are often judged via high quality research and publications) and no free time. This academic is always troubled at time of REF as (s)he has to go out of the way to input the publications in the university's institutional repository or CRIS. When spoken to this academic about the research data that is produced, multiple issues arise immediately. These vary from not knowing what data is, where to deposit it, what to deposit, why to deposit it, how to link it with publications, what to do when data changes, and what is active data or archival data, etc. When spoken to them about Data Management Plans (DMP), they consider it the least important part of the funding bid process. Each of these issues then raise further questions which illustrate the wicked nature of RDM."

A final story unravels the complexity of an apparently straight-forward innovation arising from the complex nature of data itself:

> "Creating DOIs for data is apparently simple. Pay your fee to DataCite, submit a bit of XML with at least the core metadata fields. Make sure you have a landing page. Job done.
>
> These are some of the issues this 'simple' proposition has thrown up:
>
> What granularity should DOIs be created at? Which is in turn related to how you structure the data, which is in turn related to your philosophical approach to the data and how closely you want to link it with specific publications – or not.
>
> There is some overlap between our content and a data centre content – what do we do if a dataset already has a DOI but the data owner or PI wants to direct researchers to 'their own' copy of data in an institutional repository?
>
> What about data that is managed by the institution but not necessarily in a central repository – for example, a School or Faculty based service which does not wish to migrate to the central service; do we assign a separate prefix to this data? How can we be sure the landing pages will be maintained? What happens if the data moves and is hosted elsewhere?
>
> How do we handle metadata for physical data if we're assigning DOIs to it? Who maintains the physical store?
>
> Researchers want to include DOIs in their publications; do we allocate DOIs before we have received the data or insist on a deposit prior to allocating the DOI. How does this fit with researcher practice?"

Whereas quite a few of the stories relate to establishing a common agenda, this story is more suggestive of complex problems of implementation. When we try and implement something new across many different contexts, unforeseen implications and choices emerge. Perhaps because research practices are so various, how to establish a system that meets everyone's requirements is hard. It could be seen as related to the notion of "The consequences of any particular intervention are difficult to imagine." But it is perhaps more like a caution that designing any intervention can be very hard. All the narratives illustrate the difficulty of pinning down "where" the issue lies.

## Ways of operating in wicked problem situations

The point of identifying something as a wicked problem is that we act differently as a consequence of the recognition. In the workshops we explored three suggestions about how to respond. The first approach was Grint's work on leadership in wicked problem situations. Grint (2009; 2010) proposes that we need a different type of leadership when trying to handle wicked problems. This is far from the clichéd model of a heroic leader. It is a bricolage of approaches, an improvisation, rather than a purely "rational" planned approach. Grint proposes nine principles for leadership in the context of wicked problems. After exploring these principles in the workshop, participants in the project were asked to reflect on what ways his ideas struck them as useful.

Four of Grint's maxims were mentioned frequently in participants' responses:

Empathy not egotism. Here Grint emphasises the need to think about the perspective of others, rather than to assert one's own perspective.

Collective intelligence not individual genius. In this maxim Grint emphasises that wicked problems are so complex that solutions will always have to come from the group not just one individual, however inventive. One participant wrote: "[…] all agree that we need to work together across boundaries e.g. between administrative functions, between hierarchies of the institution and academic versus administrative/operational functions, in order to think of innovative solutions to parts of the RDM problem."

Relationships not structures. Here Grint is emphasising the value of informal relationships across the organisation rather than formal organisational structures. One participant commented: "This makes sense in the world of RDM, however, considering that universities will be the main parties involved in RDM, structures also play a role. I would change this to prefer relationships to structures, or establishing relationships and use structures to your advantage."

Negative capability. Through this principle Grint refers to the need to resist the desire for a quick solution and the value of being able to live with uncertainty. As one participant put it: "[…] where one operates with uncertainty (of the outcomes) and that it is acceptable to do so! This latter point is particularly helpful as this is not how projects are typically approached by senior management who have a strong desire for a defined universal solution."

Three of Grint's principles were less frequently picked. This might have been partly because they were less easy to understand:

- Community of fate not a fatalist community. Grint uses this phrase to refer to the idea that a group is seemingly fated to work together by a common problem, but it does not have to be fatalist in its approach.
- Positive deviance not negative acquiescence. Like the next maxim, this point seems to be about the value of disagreeing when everyone else seems to be accepting an existing consensus.
- Constructive dissent not destructive consent

It is possible that the last two were not picked often because RDM seems less a situation where a dominant consensus needs to be over-turned by deviance and dissent, more a situation where building common ground is needed.

There was support for Grint's ideas, but there were qualifications to some of his suggestions and some stronger reservations. The reservations seemed to revolve around a sense that there might be something too passive or fatalistic about some of his principles.

> "Where they're less useful is in the possible invitation to procrastination or fatalism they might be seen to give."
>
> "The areas not listed were omitted as they imply a sense of conflict that I'm not sure exists. We are coming at the problem from a position of some ignorance, not conflict. We are a community of fate, but this phrase doesn't resonate with me as a means of leading the way forward."

Participants were also asked "what advice would you give to someone in a leadership role in relation to RDM?" Quite a few of the comments continued the previous discussion, suggesting that Grint's ideas had a real resonance. A few themes suggested thoughts that are not captured in Grint's maxims. There was a recurrent emphasis on things taking time. "Take it slowly – better to do something well and slowly than quickly and poorly. Like Rome wasn't built in a day." This advice is consistent with Grint's notions, but not explicit in them.

Another idea that recurred was a sense of trying to distribute responsibility and encourage others to own part of the problem, rather than seek central control. "A leader should create a sense of shared ownership across the various stakeholders ensuring all parties have the opportunity to be heard and also input into defining potential solutions."

There was also quite a strong emphasis on the value of expertise and a community outside the organisation as a good point of reference. Reflecting on the relevance of "collective intelligence", one wrote, "Don't go at it alone, you are not alone in this. Seek guidance and help from the experts, both internally and externally. Trust your staff, empower them and help them to empower others. Build peer-to-peer support networks." So it seemed that an extension of the notions of "collective intelligence" and "relationships not structures" was to create productive relationships that extend beyond the organisation.

## Problem mapping

The literature mentions a number of tools that could be used to come to 'clumsy solutions' for wicked problems (Ney and Verweij, forthcoming). Horn and Weber (2007) proposed the concepts of 'Mess Mapping' and 'Resolution Mapping', for example. These complementary approaches each have a long history. Mess Mapping is a form of stakeholder analysis in a visual form that has is similar to Soft Systems Methodology (Checkland, 1981). Resolution Mapping is based on a technique also known as Scenario Planning which was first introduced by Royal Dutch Shell in the 1970s. For the purposes of the project the facilitators adapted these tools to make them more suitable for small group use within the scope of one fairly short workshop session. The purpose of the problem mapping tool was to create a collective overview of a Wicked Problem, and to identify areas of common ground via cross-cutting issues analysis.

It may be useful to explain in detail how the concept was operationalised in the workshop. Participants were asked to work in threes. Each group then used flip chart paper and post-it notes to construct a view of the drivers and barriers for RDM from the perspective of one stakeholder. Stakeholders included IT services, the library and particular groups of researchers. After twenty minutes groups changed which stakeholder they were working on. First they reviewed and adapted the work of another group. They were then tasked to produce a summary of how the stakeholder saw RDM. A plenary session heard from each group and then all the participants attempted to identify recurrent themes. Groups then worked on an analysis of one of the themes. A final plenary heard the discussion of each theme. In the plenary participants evaluated the whole process and they were also asked to write about the experience later in the workshop.

Evaluation of this exercise was positive. It worked in terms of generating a bigger picture, but starting at a manageable level. "I liked the overview it provided." Mapped out in this way, what was striking was a sense of the scale and reach of the problem. The overall map began to reveal a

common landscape, if not, as participants commented, any common or complete solutions. The discussion of solutions was lacking in how the activity had been planned. There was a debate about whether, if elements can be solved, the whole problem could be solved piecemeal. People saw the value of thinking through the viewpoint of stakeholders, but thought there might be a need to explore more widely who were potential stakeholders. Some felt the range of stakeholders represented by the workshop participants themselves could have been broader, e.g. including those with understanding of the legal aspects of RDM or more senior managers.

The approach was useful, but not entirely novel: for example, people said they already did small scale stakeholder analysis, used responsibility assignment (RACI) matrices and some had studied soft systems methodology. The cross cutting thematic analysis was more novel – but perhaps needed more time and discussion and a more formalised approach. The tool seemed inherently collective, but it was debated whether the level of trust might exist to apply this type of method with honesty within a single institution. There was potentially too much at stake for creative engagement. Another comment was that at a local level the discussion could have got bogged down in detail. Working across institutions was successful, but at some level it fell short if the specifics of a particular institution were not brought into the equation.

## Scenario planning

The 'scenario planning' tool aimed to be a more resolution-oriented way of looking at a Wicked Problem. In this activity, each group of participants is given an "end state" that describes a possible outcome. Participants are asked to explain how they could reach this outcome.

Again, it may be useful to give some detail about how the activity was planned. Participants were split into large groups of five or more persons. Each group was then given one of three end-states. The first end-state was of a highly developed institutional RDS. The second was of a minimal service based largely on web based advice. The third was a middle way, where it was imagined there would be on-going reliance on some support distributed across departments or faculties. Each group was also given "event cards". These were short descriptions of things that could happen such as: "Data Asset Framework (DAF) survey results show strong desire for training in RDM from PhDs and Early Career Researchers" and "Major engineering research group ask to deposit all their data in a local archive." Two "joker" cards could be used by the group to define an event themselves. The task was for the group to pick which events had to occur to achieve the end state they had been given and to organise them in order to present a narrative of progress towards achieving the end state. The groups worked on this task for 30 minutes and then in a plenary session each group presented their narrative to the rest of the group.

Evaluation of this exercise was less positive, partly because of how it had been operationalised. Some felt it was a useful exercise in terms of thinking about what the potential effect of specific events would be and in actively having to think in terms of a timeline. Yet one participant suggested that the process took one back too much to project management thinking, since it involves planning for events to produce a clearly defined outcome. Above all, participants recoiled from being forced to actively seek ways to reach what they saw as undesirable end-states. Some participants also felt that the end-states were driven too much by compliance, an agenda which is too restricted a perspective on RDM. Some did see a value in the discussion about the end-state – but whereas there was a lot of room for creativity in problem mapping, scenario planning lacked the freedom to

explore the full complexity of the situation. The event cards were also seen as too restrictive, blocking creativity, and perhaps some were implausible (though a preliminary discussion had involved participants voting on the likelihood of 10 of the events and that had shown that many were thought to be quite likely). It is possible that the process would be more successful if redesigned based on being able to change the end-state and fewer prescribed events. People could design most of their own events.

Overall there was a sense that these types of exercise were fun and reasonably productive. The two activities as a package as offered in workshop 2 was incomplete, scenario planning rather unsatisfactory, but there was potential for constructing a set of activities that would make up a productive process, from defining the problem to thinking about solutions. This would have echoes of familiar management tools but extend them. Ideally all parts of the process would be open to be constructed by participants. The more room for breaking up expectations and assumptions and for creativity, the better the process would be. Including a wider range of stakeholders in the group discussion would further enrich the process. It remained a bit unclear whether the techniques would work best at the organisational level or the cross organisational level.

## Discussion

Participants' reflections suggested that they thought it was a productive exercise to examine RDM in the light of the wicked problem concept. Thus in relation to research question 1, certain attributes of wicked problems seemed to resonate powerfully with participants, such as the constraints on the situation, the lack of a list of solutions and the existence of many possible intervention points. There were other attributes that resonated strongly with some, but not others. Some attributes resonated less with participants. There was a view that RDM was not entirely unique and might echo features of open access; and that incremental approaches to addressing the challenge of RDM might be effective. There was also discussion of the thought that RDM is only a wicked problem in the early days of development, and that as solutions are found to particular parts of the jigsaw, the whole issue could be tamed.

The narratives written by participants add a further richness to our understanding of the ways in which RDM is wicked. Many of these stories revolve around the diversity of researcher viewpoints, reinforced by a sense of competing priorities. The need to curate data in the long term generates complexity and the complex nature of data itself makes some of the interventions more complex than they might appear.

In relation to research question 2, participants also saw Grint's maxims about leadership as useful, though it was possible these were just good advice for professional work in general. Particularly resonant were the stress on collective intelligence, negative capability and the need for empathy. Relationships were important, though formal structures were important too. In a few ways participants extended Grint's advice, adding the value of recognising the need to be patient and to work with others beyond the institution. There was a continuing sense of a need to act and not to use the term "wicked problem" as an excuse to prevaricate.

In relation to research question 3, participants were less impressed by the two methods of dealing with wicked problems, suggested in the literature. Problem mapping was seen as a useful process, but it did not go far enough by itself in developing either a big picture of the problem and solutions,

or at least actions. Scenario planning, in contrast, was too solution oriented, and perhaps not operationalised effectively.

To conclude, in relation to the aim of the research as a whole, to evaluate the wicked problem concept in the RDM context, according to their writing from the first workshop, most saw the concept of wicked problems as having some value.

> "Particularly in the IT field there is a strong pressure to remove ambiguity and to be able to fully describe a problem, and conceive and implement a solution. As Grint wrote 'Wicked Problems remain ambiguous so the real skill is not in removing the uncertainty, but in managing to remain effective despite it'."

Having the term in the vocabulary allowed one to consider some problems as requiring a different approach. However, the concept was not viewed without ambivalence. One commenter suggested that it needed to be better operationalised. Indeed, the original list of criteria proposed by Rittel and Webber (1973) is not itself very coherent. This participant also commented: "It will be important, though, to guard against over use or fall back on the idea of an issue being a wicked problem as a way of making it more complicated than it is." This linked to the dangers perceived in some of Grint's terminology not being very positive. The very term "wicked problem" was seen to cast a largely negative light and lead to defeatist thinking.

> "Playing devil's advocate, it could be argued that the use of the word 'problem' is unhelpfully negative. The wicked problem approach looks at RDM holistically, in its messy and complex context, but in doing so risks making RDM seem impenetrable and intractable."

RDM must fundamentally be seen as a positive development, a positive intervention in the context of trust in scholarship. Participants were engaged in the topic because it felt important to them. They were positive something could be done.

The idea that some elements of RDM were simple, was repeated a few times through the discussions of the group:

> "RDM is an area of enormous complexity, and capable of generated hours of circular discussions and documentation. This tends to be the result of conversations with academics with large volumes of complex data, especially when those conversations involve different areas of research activity. Yet some aspects of RDM are simple."

This suggests the thought that RDM is a nest of inter-related problems. Some aspects are simple; some are more complex. Responding to this point in the second workshop one person wrote about the tendency to get "bogged down" in the more complex areas, and neglect areas which could be progressed more simply.

## Conclusion

On balance the concept of a wicked problem resonated with participants. The question is not really whether RDM "is" a wicked problem as such, rather whether this is a productive way of looking at the topic. Usefulness could simply arise from it stimulating a fruitful discussion. Perhaps the "wicked problem" concept has proved so seminal because it is simple but generative. It takes a few minutes to grasp the distinction, but working through the implications can have quite a deep impact on one's

view of a situation and how to address it. The concept of the wicked problem implies a fundamental distinction that can alter perceptions paradigmatically. Some authors have developed it in sophisticated ways, e.g. Grint's work on leadership is based on Verweij's linking of wicked problems to Mary Douglas' cultural theory. Snowden (2010) has developed an attractive but rather complex expansion of the idea in his Cynefin framework. Wicked problems have also been linked to the discourse around design thinking (Brown, 2008). The methodologies to deal with a wicked problem are also quite numerous and themselves complex. But in essence it is a fairly simple idea. More complex articulations of it may reduce its value.

Useful or not, it is not the only way of looking at RDM. Participants were keen to say that people operating in the RDM context are not alone and that working at the intra-organisational level was valuable, particularly if a multi-disciplinary approach was taken. This aligns well with how in the university sector JISC has created a community to work collectively on problems, and developed the concept of shared services. Nevertheless, it seems useful to add the concept of wicked problems to the vocabulary of managers i HEIs. To promote this idea part of the project involved creating a web site to host learning materials about wicked problems: http://wickedways.group.shef.ac.uk/ .

## References

Borgman, C. (2015), Big Data, Little Data, No Data: Scholarship in the Networked World, Cambridge, MIT press.

Brown, T. (2008), "Design thinking", Harvard Business Review, Vol. 86 No.6, pp.84-95.

Checkland, P. (Eds.) (1981), Systems Thinking, Systems Practice, London, John Wiley.

Conklin, E.J. and Weil, W. (1997), "Wicked problems naming the pain in organizations", available at http://kodu.ut.ee/~maarjakr/creative/wicked.pdf (accessed 19 March 2015).

Corrall, S., Kennan, M.A. & Afzal, W. (2013), "Bibliometrics and research data management: Emerging trends in library research support services", Library Trends, Vol. 61 No.3, pp.636-674.

Cox, A.M., Pinfield, S. and Smith, J. (2014), "Moving a brick building: UK libraries coping with research data management as a 'wicked' problem", Journal of Librarianship and Information Science OnlineFirst.

Engineering and Physical Sciences Research Council (2011), "Policy framework on research data", available at http://www.epsrc.ac.uk/about/standards/researchdata/Pages/default.aspx (accessed 25 May 2015).

Grint, K. (2010), Wicked problems and clumsy solutions: the role of leadership, available at http://assets.highways.gov.uk.s3.amazonaws.com/specialist-information/roads-academy-ra-masterclasses/Keith_Grint_Wicked_Problems_Clumsy_Solutions_presentation.pdf (accessed 19 March 2015).

Grint, K. (2009), "Wicked problems and the role of leadership", available at http://www.informalnetworks.co.uk/Wicked_problems_and_the_role_of_leadership.pdf (accessed 19 March 2015).

Hodson, S. and Molloy, L. (2014) "Case study 5: development of institutional RDM services by projects in the Jisc Managing Research Data programme", in Pryor, G., Jones, S. & Whyte, A. (Eds.), Delivering research data management services: fundamentals of good practice, Facet, London, pp205-238.

Horn, R.E. and Weber, R.P. (2007), "New tools for resolving wicked problems: Mess mapping and resolution mapping processes," Watertown, MA: Strategy Kinetics LLC, available at http://robertweber.typepad.com/strategykinetics/New_Tools_For_Resolving_Wicked_Problems_Exec_Summary.pdf (Accessed 19 March 2015).

Johnson L, Adams Becker S, Estrada, V and Freeman A (2014), NMC Horizon Report: 2014 Library Edition, Austin (Texas), The New Media Consortium.

Jones, S. (2012), "Developments in Research Funder Data Policy", International Journal of Digital Curation, Vol. 7 No.1, pp.114-125.

McLeod J and Childs S (2013), "A strategic approach to making sense of the wicked problem of ERM", Records Management Journal, Vol. 23 No.2, pp.104-135.

Ney, S. and Verweij, M. (forthcoming). "Messy institutions for wicked problems: how to generate clumsy solutions". Policy Studies Journal.

OECD. (2007). "Principles and guidelines for access to research data from public funding", available at http://www.oecd.org/dataoecd/9/61/38500813.pdf (accessed 25 May 2015).

Pryor, G. (2014) "A patchwork of change", in Pryor, G., Jones, S. & Whyte, A. (Eds.), Delivering research data management services: fundamentals of good practice, Facet, London, pp1-20.

Research Councils UK. (2011a). "Common principles on data policy", available at http://www.rcuk.ac.uk/research/Pages/DataPolicy.aspx (accessed 25 May 2015).

Rittel, H.W. and Webber, M.M. (1973), "Dilemmas in a general theory of planning", Policy sciences, Vol. 4 No.2, pp.155-169.

Snowden, D. (2010), "The origins of Cynefin" (Pt. 1–7), available at http://cognitive-edge.com/uploads/articles/The_Origins_of_Cynefin-Cognitive_Edge.pdf (accessed 19 March 2015).

Tracy, S. J. (2010), "Qualitative quality: eight "big-tent" criteria for excellent qualitative research", Qualitative Inquiry, Vol. 16 No.10, pp.837-851.

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