The International Journal of Digital Curation
Volume 8, Issue 2 | 2013

A Maturing Process of Engagement: Raising Data Capabilities in UK Higher Education

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Abstract

In the spring of 2011, the UK's Digital Curation Centre (DCC) commenced a programme of outreach designed to assist individual universities in their development of aptitude for managing research data. This paper describes the approaches taken, covering the context in which these institutional engagements have been discharged and examining the aims, methodology and processes employed. It also explores what has worked and why, as well as the pitfalls encountered, including example outcomes and identifiable or predicted impact. Observing how the research data landscape is constantly undergoing change, the paper concludes with an indication of the steps being taken to refit the DCC institutional engagement to the evolving needs of higher education.

International Journal of Digital Curation (2013), *8*(2), 181–193. http://dx.doi.org/10.2218/ijdc.v8i2.282

 doi:10.2218/ijdc.v8i2.282

Introduction

The seminal report Science as an Open Enterprise (Royal Society, 2012) declared that 'a shift away from a research culture in which data is viewed as a private preserve' is essential to achieving improvements in the exploitation of research. The authors of this report believe that the means to make the necessary changes are available, but 'their realisation needs an effective commitment ... from scientists, their institutions and those who fund and support science.'

In its third phase of operation, from March 2010 to February 2013, the UK's Digital Curation Centre (DCC) emerged from its esoteric adolescence to reveal a mature enterprise capable of providing in-depth, tailored support to a community of institutions known to be frequently ill-equipped to face the burgeoning challenge of research data management. With a significant budget injection from the Higher Education Funding Council for England (HEFCE), dispensed under the mantle of its Universities Modernisation Fund (UMF), the DCC's outreach programme was, in the spring of 2011, immediately taken up a gear by the requirement to undertake 18 institutional engagements, each of which would be designed to assist individual universities in the acquisition of capacity and capability for managing their research data. The approaches taken to developing that new competency navigated a range of contexts, aims, methodologies and processes, which are reported here alongside examples of what has worked and why, not forgetting some of the pitfalls that were encountered. For the majority of the engagement institutions the experience has been transformational and, just as the research data landscape itself was changing contemporaneously, so was the structure of the institutional engagement required to evolve. In reflection of that ferment, an explanation of the steps being taken currently to refit the DCC's institutional engagement to the evolving needs of the higher education sector will provide an apt conclusion to this narrative.

A Spectrum of Engagements

The key features of the DCC institutional engagements mirror our dual aim of assisting growth in research data management proficiency within the higher education community whilst coordinating the development of institutional services in a way that allows national and international infrastructure to build on, interoperate with and support those services. We have therefore been working intensively with a select number of institutions to help them utilise the tools and knowledge that are already available; and then using and promulgating their experience as instructional exemplars for others. Each engagement is offered a maximum of sixty days DCC effort, provided without charge, with a senior member of DCC staff assigned to each engagement. They are always paired with a junior colleague, whilst other DCC staff have been co-opted to most engagements to meet particular requirements for additional specialised expertise. For the candidate institutions, we make clear our expectation that the engagement will be fully owned and managed by them and that any outcomes will be actively shared with the wider community. To that end, three early objectives of each engagement have been critical:

1. To win the commitment and drive of a senior academic champion, who will legitimise and provide authority to the programme, acting as data management advocate in the corridors of power;
2. To ensure that influential researchers buy in to the engagement in order to inform it as well as to proselytize amongst their research colleagues; and
3. To bring them all together in a coherent team that will include a spectrum of support staff, quite often unused to working together but considered to have the knowledge and skills for constructing and delivering a service infrastructure.

The process of engagement has, in general, followed the pattern illustrated by Figure 1. In all but some of the most recent engagements this has commenced with advocacy, to make the case for research data management and win the commitment of those staff with positions of influence in management or the research community, or the skills necessary to the design and implementation of research data management services. The subsequent and equally crucial step has been to assess the specific needs of the institution; usually applying tried and tested DCC tools to discover the location and condition of data collections, and to understand current research data practices and aspirations. This focus on the individual institutional environment has been important to the consequent achievement of relevant and practical outcomes deemed likely to secure favoured adoption by the research community. Then, having defined both context and expectations, we move on to the development of policy, to map out a support infrastructure and services, and finally to assist in the implementation of policy and services.

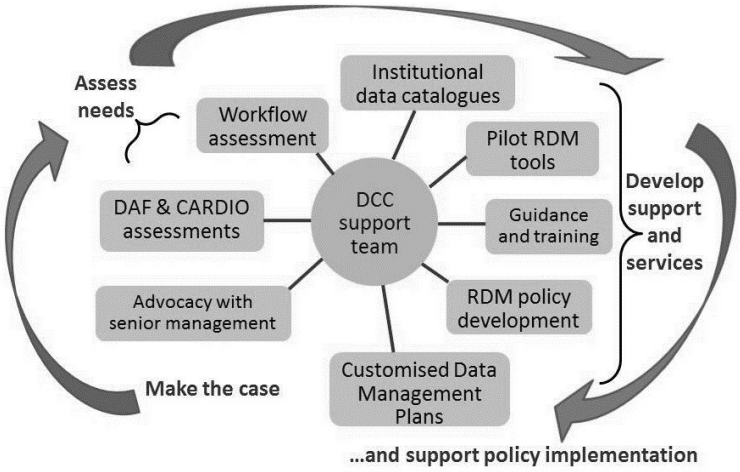

Figure 1. Typical rationale and process for an institutional engagement.

In the event, a total of 21 engagements were started, although at the outset the means of identifying a balanced mix of 18 candidates out of the UK's 165 higher education institutions (HEIs) was considered something of a conundrum.

 doi:10.2218/ijdc.v8i2.282

University	Class	Representative Group
Aberystwyth (later in partnership with Bangor)	Red brick	Welsh Confederation
Bath	Plate glass	
East London	Post 1992	Million+
Edinburgh	Ancient	Russell Group
Glasgow	Ancient	Russell Group
Hull	Red brick	
Loughborough	Plate glass	1994
London School of Economics	Red brick	Russell Group
Northampton	Post 1992	Million+
Open University	Distance	University Alliance
Oxford Brookes	Post 1992	University Alliance
Queen Mary University London	Red brick	Russell Group
Queen's University Belfast	Red brick	Russell Group
Salford	Plate glass	University Alliance
Sheffield (later extended to White Rose Consortium)	Red brick	Russell Group
St Andrews	Ancient	1994
Stirling	Plate glass	
Surrey	Plate glass	1994
University of East Anglia	Plate glass	1994
University of Arts London	Post 1992	
Warwick	Plate glass	Russell Group

Table 1. The first 21 engagement institutions.

We began by examining those institutions that had bid unsuccessfully for project funding under the Jisc Managing Research Data programme[1], expecting to identify some that had exhibited enthusiasm and commitment but whose bids were known to have suffered from a lack of demonstrable knowledge, experience or expertise in data curation. These were thought to be prospects that the DCC could hope to revive through the implantation of those absent skills and experience. Indeed, this process produced the first two of our initial quartet of engagements, both of which have since proved to be highly successful in their development of data management strategies and infrastructure. Others were identified from discussions at the DCC's twice yearly Research Data Management Forum[2], which since 2007 has been instrumental in alerting researchers and research support staff to specific challenges in the data

[1] Jisc Managing Research Data programme: http://www.jisc.ac.uk/whatwedo/programmes/mrd.aspx

[2] DCC Research Data Management Forum: http://www.dcc.ac.uk/events/research-data-management-forum-rdmf

services arena. Similar contacts were being made during the DCC's regional data management roadshows[3], a programme designed to reach geographically clustered HEIs with two to three days of concentrated advice and real life institutional case studies. By the time our HEFCE funding was confirmed, we had notched up two successful roadshows, with a further eleven in the pipeline. In fact these roadshows, at which full publicity was being given to the engagement programme, soon generated enough interest that instead of inviting institutions to take part, we found ourselves having to manage demand in the form of an ever-lengthening queue.

A Crescendo of Data Mandates

By the time the DCC had entered its third phase of operation, in March 2010, almost five years had passed since the UK funders' expectations on access to published outputs had been summarized in a joint Research Councils UK (RCUK) position statement,[4] which advocated open access to outputs from their funded research programmes. Individual funder policies were now being revised and in 2011 RCUK issued its Common Principles on Research Data Policy.[5] The level of traction gained at that time by collective or individual research council policy frameworks is debatable. What is not to be questioned was the further acceleration of momentum that was introduced to both the DCC roadshows and, correspondingly, the DCC engagement programme, by the implementation on 1st May 2011 of the Engineering and Physical Sciences Research Council (EPSRC) Policy Framework on Research Data.[6]

No previous research council data policy had caught the attention of university managers in quite the same way. Exceptionally, the EPSRC's seven core principles for the preservation and sharing of EPSRC-funded research data, closely supported by nine distinctive (some would say prescriptive) expectations concerning the management and provision of access to such data, was reinforced by a three year limit on the time available for compliance with the policy (i.e. the design of a roadmap to compliance and implementation of its component parts). Furthermore, the EPSRC's response to non-compliance was uniquely underwritten by a potential threat to future funding, with a statement made to all university heads that institutions found to be seriously failing to comply could find themselves declared ineligible for further EPSRC support. It was an approach assured to galvanise most, if not all, of the 130 institutions in receipt of EPSRC grants to take stock of their current data management practices. For many, the time had arrived to seek expert assistance. For the DCC's engagements programme, this EPSRC stimulus was welcome; how far it will determine sustained changes in data management practice has yet to be demonstrated, but for a number of the institutions now seeking DCC engagement status it provided a *raison d'être* for the creation of policy and the introduction of support infrastructure. Notably, of our 21 engagements, the creation of an EPSRC roadmap has been the principal instrument for bringing change to data management practice in an exact third.

[3] DCC Data Management Roadshows: http://www.dcc.ac.uk/events/data-management-roadshows

[4] RCUK Policy on Open Access: http://www.rcuk.ac.uk/research/Pages/outputs.aspx

[5] RCUK Common Principles on Research Data Policy: http://www.rcuk.ac.uk/research/Pages/DataPolicy.aspx

[6] EPSRC Policy Framework on Research Data: http://www.epsrc.ac.uk/about/standards/researchdata/Pages/policyframework.aspx

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Three Stages of Engagement

The development of institutional research data management services has been described as 'an iterative cycle similar to business process redesign', in which the introduction of formally structured data management principles benefits not only the research process but a diverse range of associated activities, roles and organisational constituents. Input to that process would be supplied 'from at least three perspectives; research practice, management, and information systems development' (Jones, Pryor and Whyte, 2012). Those perspectives are themselves multi-faceted; for example, the research support view derives potentially from an assortment of institutional library, IT, research administration and records management functions, as well as from the support staff within individual research teams. Commonly, these groups would not have operated according to shared routines and objectives; hence their inclusion in the project teams assembled to enable the engagement process, where parity of esteem was held to be assumed, has itself been a new learning experience. Recognition of this diversified environment within and between HEIs was key to the manner in which we were to apply the three stage model for business process transformation that is depicted in Figure 1, which serially covers the enablement of change, an analysis of current practice and the ensuing design of services.

Enabling Change

In this first stage the steering or working group established to scope, manage and conduct the engagement is usually preoccupied with raising stakeholder awareness and generating 'buy-in'. As anticipated, we found the success of these groups to be heavily dependent upon the level of authority invested in them. Steering groups worked best where the Chair of the group was a senior university manager, such as the Pro Vice Chancellor for Research, which has been the case in ten of the engagements. Apart from acting as project champion and giving clear, informed and unequivocal support to its aims and objectives, the Chair has a signal role in ensuring that the steering/working group is sufficiently and appropriately resourced to design services that are desirable, achievable and sustainable. Meeting these criteria will be essential to winning the approval of a majority of stakeholders, without which conclusive and lasting change can rarely be established.

At Oxford Brookes University, one of our first and particularly energetic engagement institutions, advocacy quickly took the form of training days, delivered as mini-roadshows to a mixture of senior researchers and support staff in all four faculties. At the University of Surrey, a comprehensive survey of research data management practices had been carried out in December 2011 to establish the approach and attitudes of those engaged in research, which had already served to raise the profile of data management. As a consequence of this survey a number of academic staff volunteered to work in more detail with the engagement steering group, so instead of conducting a full-scale promotional programme, two pilot groups were selected for more detailed assessment in the analysis of practice phase. For the University of Northampton, it was suggested that a one-to-one approach could pay dividends and researchers were invited to a series of research data clinics[7] at which they were informed about the DCC and its engagement, and encouraged to explain

[7] See Jones (2012).

their own particular data management issues. At this stage our approach was necessarily one of 'horses for courses', which over an eventual 21 engagements underlined the sheer diversity of the HEI landscape.

Of course, raising awareness always runs the risk of alarming an institution by revealing the scale of the challenge facing it. Following the enthusiastic launch of one engagement there came the recognition by senior academic staff that familiarity with the exigencies of research data management was collectively absent. With growing concern over the pursuit of a consultation process in such an opaque context, when for senior management the institutional benefits appeared to be unclear, the process was put on hold. The demands of the EPSRC roadmap subsequently confirmed the likely impact from introducing research data management practices but, happily, having taken more time to consider a way forward, this institution has used the DCC's analytical tools to make an assessment of academic requirements and begin to align processes with strategic and operational planning.

Analysis of Practice

Those tools, principally DAF[8] and CARDIO[9], have been used in almost every engagement to support our assessment of data management and sharing roles and practices, including the main issues encountered by researchers and the barriers and enablers faced by data service users and providers. Responsibility for undertaking these assessments has generally been assigned to a member of the steering/working group with an established operational role, working under guidance from the DCC team and focusing on a selection of research groups, plus the in situ support units likely to contribute to future service provision. The objectives for this stage are common across the engagement cohort: to gather evidence about current practices and expectations, to understand what is shaping them and to measure the level of awareness (and relevance) of prevailing strategies and policies. Using surveys and interviews, a picture is constructed of the avenues of support that are utilised, the lifecycle for significant data assets and the ground that may need to be covered when realigning practice and cultures with a more structured approach.

Whilst DAF is designed for the identification and location of research data assets, and how they are being managed, CARDIO goes further with an assessment of forward requirements, activity and capacity. It does this by building consensus between data creators, information managers and service providers in the definition of practical goals for improvement and by exposing operational inefficiencies and opportunities for cost saving. For the engagement teams, CARDIO's analysis of the dynamics between organisation, technology and resources is proving to be of particular value when developing a demonstrable case to senior managers for investment in data management infrastructure and services.

As with our flexible approach to advocacy, the DCC's methodologies have leant themselves expediently to local adaptation. At the University of St Andrews, DAF and CARDIO audits were merged for the purpose of gathering academic input without

[8] Data Asset Framework (DAF): http://www.dcc.ac.uk/resources/repository-audit-and-assessment/data-asset-framework

[9] Collaborative Assessment of Research Data Infrastructure and Objectives (CARDIO): http://cardio.dcc.ac.uk

recourse to the extremes of repeat consultation; at Oxford Brookes, a pared down version of CARDIO was devised as a gap analysis tool specifically for informing the creation of an EPSRC roadmap. This 'CARDIO-lite' has gone on to further iterations at Surrey, Stirling, Warwick and more recently at Salford, where it has been reshaped to elicit information that will enable plans for handling sensitive medical data.

Service Design

Further tools are necessary for the design and execution of research data services, although their use varies according to the kind of service being specified by the working/steering group. A considerable number of engagements have focused on the creation of institutional policy frameworks and guidelines, for which exemplars have been drawn from other institutions as far apart as Edinburgh and Monash universities. Elements of these have been replicated or massaged according to the needs assessment produced by DAF and CARDIO, a process driven by the operational members of the steering/working group but requiring close consultation with senior management and academics. The use of the KRDS/I2S2 Benefits Analysis Tool[10] comes into play here when linking policy statements to feasible new entries in the institutional business plan.

We always urge caution in the creation of institutional strategies and policies such that these should not lock an institution into a set of commitments for which it has not yet confirmed the funds, expertise or infrastructure to deliver. That is why the University of Edinburgh's policy (2011) is described as overtly aspirational and makes a priority of delivering training, support, advice and guidelines – practical service measures designed to improve the lot of the researcher. There are, of course, exceptions, usually amongst the newer universities, which have less cultural and organisational baggage to negotiate (Grace, 2012). For example, at the University of East London, where 'there is less autonomy for academic Schools to make their own provision' and 'a general willingness to work with central departments to develop and then use support infrastructure', it was feasible to take 'the "policy then infrastructure" route' (Grace, 2012).

Looking ahead to quick wins in general, six of the UK's seven research councils require research grant proposals to be accompanied by a data management plan (DMP), and support to researchers in their creation of a persuasive DMP is likely to prove a popular element of service provision. The DCC's DMP Online[11], a tool for creating and maintaining DMPs according to the particular needs of the major funders, has been central to several of the service plans being developed by the engagement institutions, where the ability to modify the tool's templates and guidance to reflect local needs and identity has provided immediate entry to the data management conversation with researchers. At the University of Edinburgh, consideration is being given to a level of customisation that will include questions designed to assist capacity planning and tailored guidance that will direct researchers to the relevant support services (contact details, links to documents and webpages). The University's logo will also be incorporated to underline that this is Edinburgh's very own DMP Online service.

[10] KRDS/I2S2 Benefits Analysis Toolkit: http://beagrie.com/krds-i2s2.php

[11] DMP Online: https://dmponline.dcc.ac.uk

	Data Management Support	Data Management Planning	Active Data Infrastructure	Data Stewardship
Essential	Awareness and Advocacy Online Guidance Consultancy	Data Management Planning Support	DataStore/ 0.5 TB Disk	Data Archive
High	Training	Data Management Planning Tool	Data Access Services Web-based Collaboration Tools	Data Asset Register DataShare PURE
Medium	—	—	Structured Data Version Control DataSync	—
Low	—	—	Central Database Service	—

Table 2. University of Edinburgh planned research data management services.

Yet, at the time of writing, the focus for most institutional engagements is less upon service design than understanding the scale of the change process ahead of it, more about meeting the immediate expectations of the funders than acquiring long-term sustainable infrastructure (indeed, the formulation of a robust EPSRC roadmap is, for many, the main indicator of success). If our 21 institutions are representative of the rest of the UK's universities, most will be found to be in the early stages of research data management, tasked with scoping requirements and obtaining benchmarks. Having an outline service plan at Edinburgh is almost unique amongst the engagements yet, as shown in Table 2, this still includes awareness and advocacy as a top priority.

The Imperative of Training

It is not surprising that training also features highly in the Edinburgh plan and in more than a quarter of the engagements. From our initial mobilisation meetings it has frequently been observable how the tenets of research data management are received as arcane and overwhelmingly technical by both information professionals and data users. This has dictated the creation of short, simple guidance and an emphasis on using tried and tested training methods such as DC101[12] and Data Intelligence 4 Librarians[13], which we knew would enthuse rather than confuse our audience. Training in specific techniques has followed a dual focus: on re-skilling the research support staff who will deliver the services, and in the introduction of research data

[12] DC101: http://www.dcc.ac.uk/training/dc-101

[13] Data Intelligence 4 Librarians: http://dataintelligence.3tu.nl

management processes to PhD students and other early career researchers. In some cases we have been able to transfer skills to the first of these groups so that they can run training sessions with the second group; in other cases the second group has itself become the nexus for amplification of the data management cause.

A typical approach is exemplified by the engagement at Oxford Brookes, where the morning of the first full training day was aimed at senior managers, researchers and support staff with a combination of advocacy and instruction. The themes covered were:

- **'What is research data management and why does it matter?'** as an introduction to the drivers and benefits from managing data;
- **'How to manage your data'**, which outlined the main data management topics and provided practical examples;
- **'Data management issues and challenges at Oxford Brookes'**, which featured an open discussion to identify requirements for infrastructure and support.

In the afternoon, which was aimed at the support staff, we provided an introduction to DAF, followed by a case study of DAF as applied at the University of Northampton. This was used to inform and reinforce the anticipated programme at Oxford Brookes, leading on to the session 'Planning the DAF study at Oxford Brookes'. From that initial grounding, the Oxford Brookes team was able to go on to conduct its own DAF assessments, whilst a PI in the life sciences was moved to undertake data management training of his own doctoral students.

In a different context, at the University of Bath, where the DCC engagement was proceeding in tandem with the Jisc-funded Research360 project, the Doctoral Training Centre (DTC) in Sustainable Chemical Technologies afforded an opportunity to reach 'a cohort of very able students [likely to] support each other as they develop data management plans at the same point in the PhD process' (Cope, 2011). The significance of taking the DTC route is due to their consistent source of high quality students, which motivates academics to engage with them, and their highly interdisciplinary nature, which results in an organic 'roll out of good data management practice institution-wide'. As observed by the project manager: 'If our researchers in the centre routinely practice good RDM, they will expect it of their collaborators elsewhere in the University' (Cope, 2011). Such a focus on the early career researcher has to pay dividends, for if they permanently adopt good practice in data management, such that it becomes a natural and routine part of the research process, we should expect to see an eventual proliferation of lasting change.

The Mutable Nature of Change

The Royal Society report with which I opened this paper asserted that the means to make the necessary changes in managing research data are already available. Certainly the major funders of research, Jisc, the DCC and several iconoclastic universities had, by the time this report was published, already taken great strides in enabling and building research data management capability. Across the DCC engagement programme, which has focused on those institutions where help was considered

necessary as well as likely to bear fruit, the pace of change has been varied. A few have taken the early decision to commit resources in the shape of funded positions and, as already remarked, the process of change appears to be quicker and smoother in smaller, more modern institutions. Elsewhere, considerable time and energy has been expended pressing for committees to reach consensus over institutional requirements, waiting for approvals to be given when responsibilities and leadership for data management were uncertain, not to mention the ever-present web of internal politics.

There is, nonetheless, a mounting sense of increased momentum and growth, with links being forged between individual engagement sites as well as between these and projects funded by the Jisc Managing Research Data programme. A joint workshop held in October 2012 for these two groups to report and exchange experience was redolent of a general air of positive concatenation. There have been many specific connections made, too many to list them all here but some examples are due. They include that made between Oxford Brookes and Oxford University, where a meeting we facilitated with the Dataflow project[14] resulted in the Oxford Brookes steering group deciding to pursue a Dataflow pilot in the Life Sciences. Queen Mary University London (QMUL) has connected DataStage with DSpace (Fabiani, 2012), their repository platform, with DataStage project members blending into the broader engagement. We are anticipating a link between the Warwick engagement and QMUL, plus another to Essex covering ePrints for data and the use of Hertfordshire's training materials. Training being undertaken at the University of East London will use the MANTRA[15] online learning materials as applied at Edinburgh in a pilot with liaison librarians. Resources produced at the request of one engagement, such as the DCC policy briefing (Jones, 2011), have been used by others; one example of spontaneous resource sharing has been between the University of the Arts London (UAL) engagement and the Kaptur project[16], a visual arts data collaboration between UAL, Glasgow School of Art, the University for the Creative Arts and Goldsmiths, University of London, where UAL as a project partner has enjoyed access to Kaptur materials, particularly in the area of training.

This emergence of collaboration and exchange not only satisfies the DCC's aim to function as a catalyst but has also begun recently to influence the very nature of the DCC engagement methodology. Our Aberystwyth engagement has now extended into a joint Aberystwyth/Bangor initiative, where there is already an agreement to co-operate made at Vice Chancellor level, whilst the planned engagement at the University of Sheffield has transmogrified into an engagement with the White Rose Consortium of York, Leeds and Sheffield universities, where we shall be focusing on data management issues that can be addressed collaboratively. Looking ahead to early 2013, Southampton and Oxford universities, both of which may be regarded as amongst the leaders in designing research data management services, are working with us to plan week-long intensive engagements designed specifically to deliver skills and techniques to support (principally library) staff, whose roles are being re-engineered into the data arena. Can these more targeted, or truncated engagements be the future for the DCC programme? Such an approach presupposes that the broader

[14] DataFlow: http://www.dataflow.ox.ac.uk

[15] Research Data MANTRA project: http://www.ed.ac.uk/schools-departments/information-services/about/organisation/edl/data-library-projects/mantra

[16] KAPTUR: http://www.vads.ac.uk/kaptur/

 doi:10.2218/ijdc.v8i2.282

and more introductory style of engagement has become redundant. Realistically, the answer is no, or at least not entirely.

During the summer of 2012 we undertook a survey of universities in receipt of EPSRC funding to ascertain the status of their roadmaps. As reported in a DCC blog post on 10th October[17], comments by respondents to that survey 'confirmed that institutions in general are as yet in the very early stages of coming to terms with what is implied by effective research data management'. At the same time, whilst this majority 'continues to demand broad guidance and generic frameworks that will help them define their research data management programmes, the responses made show the beginnings of a demand for more explicit help, for example in the selection of standards and protocols, for hands-on training in data management techniques, in the provision of independent progress monitoring and assistance in process modelling.'

For the DCC, such an analysis suggests that the gap between the front runners and those who are coming late to the research data management challenge is widening. The challenge for us is in deciding how to redesign our engagements in a way that will satisfy this expanding scale of need. Perhaps a lead can be taken from the closing plenary of the joint October workshop referred to above, where, based on the series of presentations by Jisc projects and DCC institutional engagements, a coherent set of eight issues to be addressed when developing a portfolio of research data services had begun to coalesce. As depicted in Figure 2, these 'issues' may be treated as core components of an institutional research data management service. Within the DCC we are currently developing case studies to illustrate how each of these issues (or components) is being tackled in live situations.

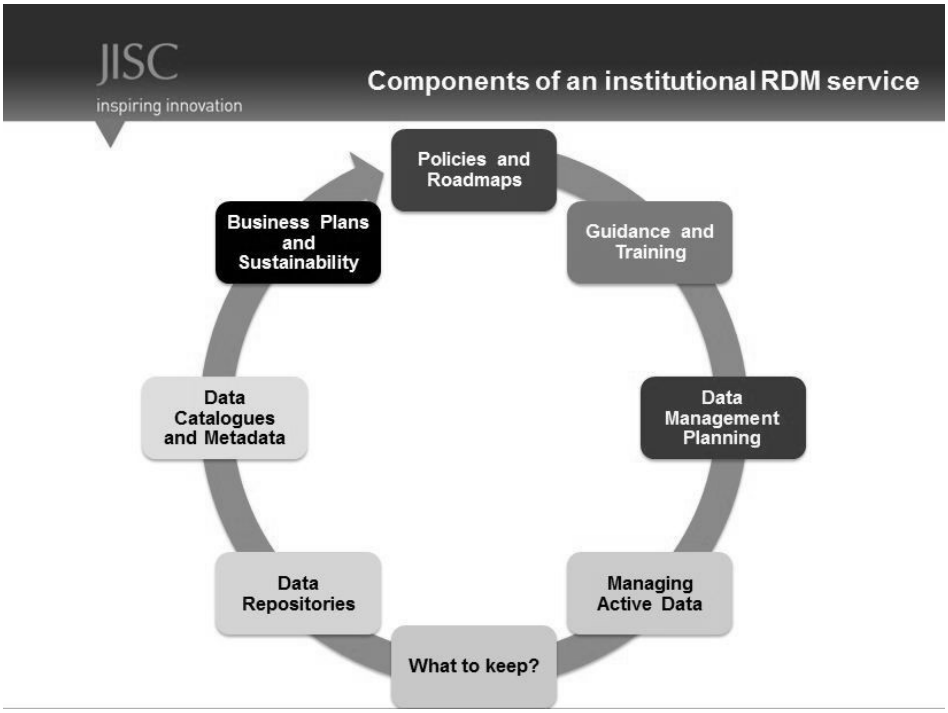

Figure 2. Data management service components (courtesy of Simon Hodson, Jisc).

[17] See: http://www.dcc.ac.uk/blog/are-you-really-map

Adding a menu to represent the guidance, tools and techniques needed to address each of these issues would help institutions to build local focus into a highly structured DCC engagement; for the DCC it would be a far more economical way of using the resources at its disposal. Yet the strength of our engagement programme to date has been its ability to adapt to each institutional context, however naïve an institution might be in terms of data management capability or how mature. Keeping that elasticity in the framework will also remain important until research data management is a cultural norm, firmly embedded across the higher education sector. For now, the sector at large has still to demonstrate its effective commitment to data management.

Acknowledgements

The institutional engagements programme upon which this paper is based has been undertaken by a team from the DCC comprising Alex Ball, Michael Day, Martin Donnelly, Monica Duke, Marieke Guy, Sarah Jones, Patrick McCann, Andrew McHugh, Kerry Miller, Jonathan Rans and Angus Whyte.

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