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-- p. 461 --

New alliances for research and teaching support: Establishing the Göttingen eResearch Alliance

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Abstract

Purpose – The main aim of this paper is to describe the design and implementation of policies, digital infrastructures and hands-on support for eResearch at the University of Göttingen. Core elements of this activity are to provide research data management support to researchers of all disciplines and to coordinate on-campus activities. These activities are actively aligned with disciplinary, national and international policies and e-infrastructures.

Design/methodology/approach – The process of setting up and implementing an institutional data policy and its necessary communications and workflows are described and analyzed. An initial assessment of service development and uptake is provided in the area of embedded research data support.

Findings – A coordination unit for eResearch brings together knowledge about methods and tools that are otherwise scattered across disciplinary units. This provides a framework for policy implementation and improves the quality of institutional research environments.

Practical implication – The study provides information about an institutional implementation strategy for infrastructure and services related to research data. The lessons learned allow insights into current challenges and work ahead.

Originality/value – With a cross-cutting, ‘horizontal’ approach, in the Göttingen eResearch Alliance, two research-orientated infrastructure providers, a library and an IT service, combine their services and expertise to develop an eResearch service and support portfolio for the Göttingen Campus.

Keywords e-research, e-infrastructures, policies, research data management

Paper type Case study

1 Introduction

Research today is conducted in a data-rich and data-driven environment, with enormous potential for the growth of knowledge and its application. Data resources have to be well-managed, shared with colleagues and made available for reuse across institutions and disciplines (Research Data Alliance, 2014). This perspective has massive implications at the institutional level. It may start with setting up a data policy to establish processes and incentives that encourage and support researchers in data management and data sharing. However, introducing guidelines will not be sufficient: it must be underpinned by information infrastructures that enable researchers to register, discover, access and reuse data.

Research in all disciplines benefits and is challenged by the ongoing digital transformation that is affecting methods and tools, research objects and outputs as well as how these are analyzed, communicated, published and possibly (re)used (e.g. Royal Society, 2012). Access to text and data, the majority of which are in electronic form, is crucial for these research processes, for processing, enrichment and interpretation by humans and machines, based on established and novel methods that evolve and mature rapidly. Libraries and IT services can provide access to e-infrastructures and supporting services (e.g. Jones *et al*, 2013), which may not always

-- p. 462 --

be visible to the individual researcher: good infrastructure may be at its best when 'invisible', yet easy to use and reliable. Researchers change their practices and methods continuously, which result in formerly unknown requirements with regard to e-infrastructures and challenge libraries and IT services to meet the expectations. Such requirements can be found, in particular, either in research areas that produce high volumes of data or in those that need to take care of specialized streams of small data.

In addition, research funders set agendas for open research – primarily concentrating on research outputs, but also with a view to reproducibility – with the aim to improve the dissemination and application of research findings and to accelerate the research process itself. Sharing data is one key element of data management practices, and is recognized as an area where a system of career benefits and rewards, enabling infrastructures and support has to be established (e.g. Whyte and Pryor, 2011; RECODE, 2015; Van der Eynden and Bishop, 2014, p. 12ff). Institutional policies and procedures are rooted in local research environments but also have to take into account these national and international agendas and policies (e.g. Jones, 2012). Funders typically combine requirements regarding data management and sharing with incentives (Van der Eyden and Bishop, 2014). Also, funding streams for the management and dissemination of research outputs can be built into research projects and specific calls address the need of filling gaps in infrastructure, often encouraging collaboration across relevant institutions.

Since 2010, the German Research Foundation (DFG) has requested basic data management plans in project proposals, and since 2007 large collaborative research projects can apply for embedded information infrastructure (INF) sub-projects. The first of such projects started in 2009, And across Germany there are now currently about 25-30 embedded sub-projects.¹ In addition, a special program of the German Research Foundation provides funding opportunities for projects that aim to

develop or enhance infrastructures for research data.ⁱⁱ To ensure that these infrastructures are well-received, close collaboration between representatives of scientific disciplines and infrastructure facilities with documented expertise in use, storage and provision of data is considered essential (German Research Foundation, 2014, p. 2).

Since the start of the European Strategy Forum for Research Infrastructures (ESFRI) a wide variety of disciplinary research infrastructures has emerged, e.g. in the Biosciences, Medicine, but also in the Humanities and Social Sciences (e.g. ELIXIR, DARIAH, CESSDA).ⁱⁱⁱ Libraries rarely partner in these initiatives. Libraries should be seen and become active in this new role, supporting these new types of e-infrastructures (see Horstmann *et al*, 2014; Lossau, 2012). The European policy on research infrastructures as reflected in the ESFRI roadmap is continued and consolidated in Horizon 2020, the European Commission's framework program for research and innovation which started in January 2014.^{iv} In selected program areas, research data resulting from funded projects are subject to the policy and funding framework of the Open Research Data Pilot.^v All projects in Horizon 2020 can voluntarily opt in to this pilot. The pilot requires that a given project has to specify which data will be produced, how it will be managed and stored, and which data will be made publicly available. Institutional support can be offered at the proposal writing stage as well as during the project. The uptake of institutional support will considerably vary with the pre-existing experience with research data management in a given project.

At a national level, a clear need for the better coordination of digital infrastructures such as archives, libraries, and research data repositories, has been identified. The German Rectors' Conference (2014) recently stressed that universities need to act to

-- p. 463 --

meet the challenges of data management. The recommendation calls for the development and implementation of institutional data policies. Similarly in the UK, the Engineering and Physical Sciences Research Council (EPSRC)^{vi} had asked institutions which receive grant funding to provide a roadmap for research data management. Cooperation across institutions, improvement of basic data management knowledge among researchers, and for engagement in enhancing infrastructures and processes are of common focus in these activities. To coordinate this initiative, Germany has built a national Council for Information Infrastructures (Rat für Informationsinfrastrukturen)^{vii} at a high political level. It will serve as a political coordination body and provide recommendations across disciplines and institutions on the development and enhancement of digital infrastructures for research and education, addressing additional questions about digital long-term preservation, access to databases and digitization of collections.

1.1 Outline of the paper

In the following, the development of the research data policy of the University of Göttingen^{viii} as well as institutional support infrastructures for its implementation will be described. A strategic role is assigned to the Göttingen eResearch Alliance (eRA)^{ix}, which will provide guidance and support on information infrastructures and tools, and offer training and consultation on data management, analysis and visualization. Two areas of activity are elaborated in more detail: 'embedded' data management in a large interdisciplinary collaborative research centre which provides opportunities

to build up data management skills in libraries, and the on-going joint development of a data centre for the humanities which will also serve as a core element in virtual research environments. This will be concluded with a section about lessons learned and will give an outlook on work ahead.

2 Policy development and implementation

Institutional research policies provide a general framework for a community of researchers, setting the conditions and rules that apply to everyone involved in the research process. When it comes to implementing these policies, established habits often have to be overcome and new practices introduced. The University of Göttingen's Principles of Good Research Practice (Georg-August-University Göttingen 2012) stipulate that all primary data, which are the basis of a scientific publication, have to be stored on a stable and secured medium for a minimum of 10 years. In Germany such policies are typically closely aligned with the respective policy of the German Research Foundation (DFG)(German Research Foundation, 1998 and updated 2013). As in many other countries, the implementation of this DFG policy was triggered by a series of research misconducts in the late 1990s exposing a strong need for better management of research ethics. The policy aims to improve awareness among researchers and promotes self-regulation based on good practices. Today, the DFG policy is regularly reviewed and updated, with its latest amendments addressing the safeguarding and storing of primary data (German Research Foundation, 2009).

Göttingen University's institutional *data management policy* as published in July 2014 (English version, August 2014) applies to the whole university, including the University Medical Center Göttingen, i.e. the Faculty of Medicine and the University Hospital. Like many other RDM policies,^x the core responsibility lies with the researcher, typically the principal investigator. The development of individual data

-- p. 464 --

management plans is required in which access rights, the collection, processing, storage and preservation of the research data have to be described. The policy also advises on the handling of intellectual property rights and other legal constraints and allows for discipline-specific requirements and practices. Infrastructure and support services will be provided by the university, in particular support and advice during the preparatory stages of research projects, during their conduct and after their completion. Göttingen University encourages its researchers to make their research data openly accessible, and secure according rights if exploitation or publication rights are transferred to third parties.

The development of Göttingen University's data management policy as a set of guidelines has been initiated by the university's Presidential Board (with the Vice President for Infrastructures as its main sponsor), requesting the Göttingen State and University Library (SUB or SUB Göttingen)^{xi} and the IT services (GWDG)^{xii}, and the research office of the university to develop a draft for discussion and review by the university's management and legal experts. The guidelines are inspired by similar policies, in particular those of the universities of Edinburgh and Oxford^{xiii}. The guidelines are approved by the senate of Göttingen University together with the Göttingen University Medical Center and were published about a year after the initial draft. As a next step, the data management

policy has to be implemented throughout the university. This will be facilitated in two ways: (i) The Göttingen eResearch Alliance (eRA) was established to serve research projects, i.e. to provide direct support to on-campus researchers concerning information-infrastructure related questions (cf. section 4). (ii) At the administrative level, consideration of research data management is embedded into processes related to the management of research proposals and the conduct of research projects.

One of the first areas affected by the research data guidelines is the proposal submission process (see Fig. 1) for larger collaborative projects. Since these third-party funded projects are essential for the research programme of a university, the implementation of a systematic process for assuring the quality of large projects with respect to research data management is an effective leverage point. Proposals for large scale Collaborative Research Centres (DFG)^{xiv}, for example, in Göttingen require approval by the research commission of the senate of the university. Typically, the commission provides recommendations and amendments, which are passed to the presidential board. The proposal is then signed by the president and submitted on behalf of the university to DFG. The eRA is part of this workflow and provides a statement about data management and data sustainability within the scope of the proposed research project. During this process, the eRA cooperates closely with the research office, which coordinates and supports the overall application process. This aims at ensuring quality standards and good practices along with maintaining research integrity with respect to the university's data management guidelines. The research commission and the presidential board take this statement into account before authorizing submission of the proposal to the funding agency.

Besides quality assurance, the main goal of these revised processes is to foster early communication among researchers and the eRA in order to support the development of data management concepts and to make most efficient use of the information-infrastructure resources on campus. Further dissemination of the guidelines will be facilitated by communication with representatives and committees of research departments and faculties. In addition, graduate schools and graduate colleges are addressed, with the aim to train and support doctoral students and junior researchers to use digital infrastructures and tools, and to better connect them with the resources on campus.

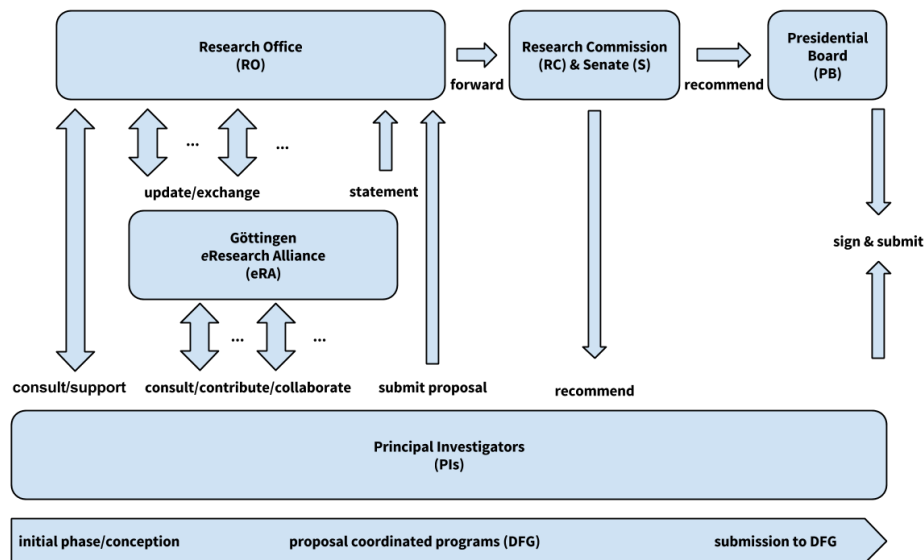


Figure 1. Relationships between organizational units of the University. The eRA cooperates closely with the RO to provide an integral support for applicants. The RO is the central contact to applicants (PIs) and consults in all stages of the application process, i. e. with respect to the funders' requirements. The eRA focuses on information infrastructure aspects. RC, S, and PB assure quality before the proposal is submitted to DFG.

Management of research data involves regulations for access rights, which provides a natural link to the idea of sharing data. In fact, research data are often shared, although selectively and the levels of sharing vary substantially: From sharing with a few colleagues, to a consortium, with selected peers, with external parties (e.g. with funders or institutions for assessment, scrutiny or inspection), with members of a research community or even with the general public (Whyte and Pryor, p. 207; Van der Eyden and Bishop, 2014, p. 22).

Institutional data policies or guidelines tend to take a considerate or cautious approach towards the sharing of data. The main emphasis is on improving data management as a foundation of research integrity. However, as funder policies shape the design and implementation of institutional policies, the funders' increasing expectations towards data sharing are impacting on institutional processes. This in turn provides a framework that will impact researchers' behaviour: Van der Eyden and Bishop (2014) state that "funder or publisher policies that mandate or promote data sharing, or that set expectations for data sharing are seen as being able to provide such level playing field for increased data sharing and establish an important standard of fair and equal access to data."

3 Getting started with research data support

Since 2011, the university's research office has been involved in the coordination of the universities' activities in research data management. It provides basic advice to researchers for data management planning and collaborates with the library and the scientific computing centre (GWDG). Göttingen State and University Library (SUB) has a strong tradition of research and development in the field of information management and long-term preservation,

including that of research data (e.g. Neuroth *et al*, 2013). In particular, the SUB is involved in the development of research infrastructures for the arts and humanities (DARIAH, TextGrid, CENDARI, Humanities Data Centre, etc.), the biological sciences (GFBio), and open access infrastructures for publications (OpenAIRE).^{xv} The GWDG provides a broad range of services for scientific data processing for the University of Göttingen and the Max Planck Society, operating infrastructures for eScience, computing resources, storage and archives for data. The GWDG is partner of research projects – several in collaboration with SUB – that build up and maintain e-infrastructures for data, and provides solutions for the storage and preservation of data, e.g. simulations and experimental data.^{xvi} Over the last few years, a demand for infrastructure and support measures at an institutional level has emerged within the context of large cross-institutional research projects as well as smaller research units on campus.

Since 2012, SUB’s Research & Development Department has been contributing to the EForTS project (Collaborative Research Centre 990: Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems (Sumatra, Indonesia))^{xvii} and provides practical advice and support for the development of a tailored data management and information infrastructure.

4 Setting up the Göttingen eResearch Alliance

Over the last years, increasing demand for support in research data management and related topics has resulted in growing stress on resources at the research office. As the service-related nature of such requests does not match the current focus of SUB and GWDG the need for specific resources has become evident. Göttingen has a particularly interesting research environment (Fig. 2): The University, non-university research institutes and regional businesses cooperate via the *Göttingen Campus*^{xviii}. There are several information and communication infrastructure providers on campus, as well as

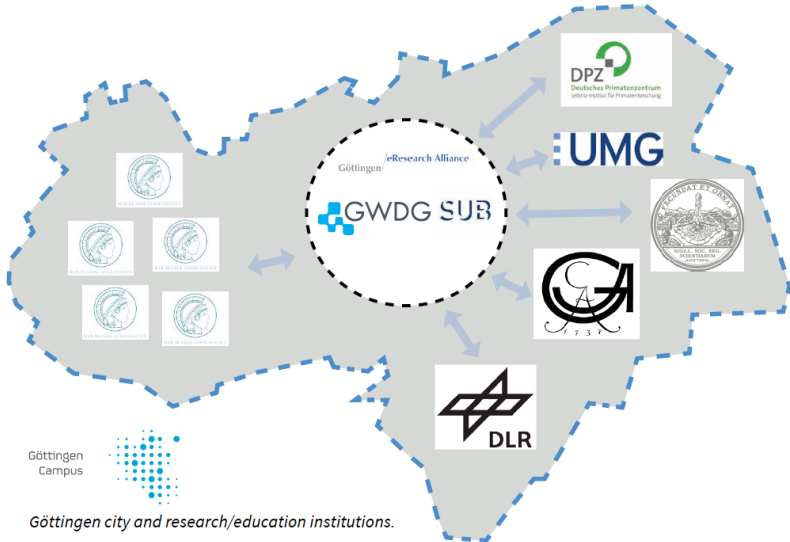


Figure 2. The Göttingen Campus provides a cooperation structure for all research institutions in the city and the mission of the eRA is to provide support for all Campus members (Dierkes *et al*. 2015).

many research projects, which employ state-of-the-art information science technologies and methods. The goal of the Göttingen eResearch Alliance (eRA) is to bundle the know-how and to offer a central contact for information-infrastructure questions to the campus in a service-oriented manner. In that sense, eResearch can be understood as *enhanced* Research. The focus is on:

- developing and operating complex and domain specific information-infrastructure services and tools,
- consulting and conveying of methodological competence of managing, publishing, and analyzing research data,
- establishing eResearch training, and
- providing advice and support for funding applications.

After a conceptual phase of about two years, in which key players on the Göttingen Campus were involved, the implementation of the eRA started in late 2014. As a 4-year pilot program initiated by the presidential board to address the most central infrastructural aspects, the eRA is jointly run by the SUB and GWDG. Organizationally, the alliance is co-directed by the heads of SUB and GWDG. A steering committee, involving more campus partners, gives strategic orientation and monitors the development of the alliance. The eRA team is staffed with eight members and brings together a diverse, multidisciplinary background (natural sciences, humanities, computer sciences), which facilitates communication with researchers. To utilise the potential of the Göttingen Campus for the strategic development of the eRA, the *Göttingen Campus eResearch Council* was established to provide a forum for representatives from all institutes and faculties at the campus (five Max-Planck-Institutes, the German Primate Center, the Göttingen Academy of Sciences, Göttingen University, the Göttingen University Medical Center, and the German Aerospace Center). The members convene twice a year to discuss the current state and to develop recommendations for the campus-wide information infrastructures.

Although service development is in its early stages, the following activity areas have already seen a growth in demand:

- the provision of practical advice on research data management planning, typically in close collaboration with the research office, and related to research proposals for national and Horizon2020 calls (cf. Fig. 1)
- on-demand training sessions on research data management, e.g. for young researchers in collaborative projects such as Global Food which brings together researchers from economics, agriculture, social sciences, etc.
- information about and access to specific services and tools like persistent identifiers, collaborative workspace
- referring researchers to other project proposal-relevant service units on campus such as SUB's Electronic Publishing department for consulting on publishing strategies and open access.

5 Embedded data management and new skills for librarians

At Göttingen University, prototypical services for data management have been developed through embedding data librarians or managers into collaborative research projects for a selected range of disciplinary areas (Schmidt and Ludwig, 2014; Cremer *et al*, 2015).

This premise of the idea is to work with and not just for researchers, to be at their side at the project planning stage, during the conduct and the documentation of the research project, i.e. at all stages of the research data life cycle. Such collaborations typically only emerge when the library gets involved early on, i.e. during the proposal writing process. Increasingly projects are seeking consultation with the university's data manager in order to improve their data management approach and to identify opportunities for funding this task. Direct involvement into research projects has proven instrumental in establishing the library as a trusted partner and to facilitate the mutual learning process. In the following we describe one case of embedded data management in more detail.

In contrast to this embedded approach, for some research areas at the University of Göttingen a lack of infrastructures for the curation and preservation of specific research data has been identified. In these cases, the library is not directly involved in research processes but contributes to the development of digital infrastructures and related services. However, by working closely with experts who provide advice on methodologies and digital tools all partners gain a better understanding of researchers' needs and requirements as well as how humanities data are created and used.

5.1 EFForTS

Since 2012, the library's research and development department has been contributing to the EFForTS project (Collaborative Research Centre 990: Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems (Sumatra, Indonesia))^{xix} and provides practical advice and support for the development of a tailored data management and information infrastructure. The information infrastructure (INF) sub-project is embedded in the Collaborative Research Project and works closely with representatives of every research team. Three data managers supported by technical and management staff provide practical advice, collect information about researchers' needs, and translate this into requirements and practical solutions. Basic training has been provided to researchers covering the basics of research data management, such as backup and storage, metadata and documentation, formats and quality control, names, identifier and versions, as well as ethics, rights and licences. These training sessions have been instrumental in raising awareness. Data training courses for graduate students at Göttingen University have also been delivered.

To secure a common understanding of the sharing and collaborative use of the research data across sub-projects and across institutions, the EFForTS project has agreed on a *Data Exchange Agreement*. All partners of the EFForTS project agree that the research data collected and compiled are fundamental to the success of the project and other projects working towards sustainable development. In order to achieve a better understanding of the interdisciplinary research topics, the sharing and collaborative use of the data is considered crucial. The agreement clarifies the terms of data delivery, access and use as well as restrictions and conditions. For example, researchers are obliged to provide metadata to the project's information system before the beginning of data collection, and the research data must be deposited as soon as possible, at the latest one year after the field sample has been taken or the laboratory analysis has been completed. All metadata will be publicly available and released under a Creative Commons CC0 licence. Each member of the project should have access to all research data via the data creator. Research data will be automatically available internally two years after collection of the

-- p. 469 --

research data, and publicly available five years after collection of the research data. Researchers are encouraged to make their data internally/publicly available earlier than these periods. Exceptions are of course possible, e.g. for datasets with sensitive information.

The INF sub-project is mutually led by the Department of Ecoinformatics, Biometrics and Forest Growth, and SUB's Research and Development Department. The technical infrastructure combines Collaborative Research Centre (CRC) infrastructure (e.g. a platform for project-internal data exchange and for documenting events on research plots), university infrastructure (e.g. long-term storage infrastructure) and external components (e.g. external data repositories). Support services include the provision of templates for research data and documentation as well as support with the creation of individual data management plans.

The infrastructure of EFForTS is dedicated to serve an interdisciplinary team involving researchers from forestry, agriculture, biology, geosciences, anthropology, social sciences and economic sciences. Data are collected by groups of researchers during their research visits to Sumatra, Indonesia. In addition, data are collected by three universities in Indonesia which collaborate with Göttingen University in the EFForTS project. The collected data cover all technical and methodological kinds of data and include, for example, household surveys and case studies, plant, animal and soil samples, sound recordings of birds, geographical information, etc. The data are further analysed and processed to determine, e.g. the effects of land use on soil-cycling rates, etc. More concretely, the EFForTS project uses BEXIS^{xx} as a system to support data sharing and reuse. Publication and archiving workflows will include technical quality assurance, submission to preservation facilities, registration in international catalogues, etc. Access restrictions depend on the data exchange agreement as described above and are facilitated through the information system's technical setting. The scientific computing centre of the university provides archival storage and generic computing resources.

Data creators must deliver research data and metadata in an appropriate form according to common standards and good academic practices. In particular, all data will be available according to the Recommendations for Secure Storage and Availability of Primary Research Data (German Research Foundation, 2009). With regard to quality control, these recommendations stipulate that disciplinary criteria and processes shall apply.

5.2 Developing data solutions for the humanities

Digital infrastructures for the humanities are far less developed than in the sciences and the social sciences. However, there are several data centres under development that aim to fill this gap in Germany. These are typically collaborative efforts such as IANUS, building up a data centre for archeology and classical studies, and local infrastructures such as the Cologne Data Center for the Humanities that integrates existing language archives and strives for interoperability with national and international infrastructures.^{xxi}

Currently in a conceptual phase, the Humanities Data Centre^{xxii} project is coordinated by the GWDG and brings together the Göttingen Academy of Sciences and Humanities, the Berlin-Brandenburg Academy of Sciences and Humanities, the Max-Planck-Institute for the Study of Religious and Ethnic Diversity (MPI MMG), the Zuse Institute Berlin, the SUB Göttingen, and as an associated partner the

Max-Planck-Institute for the History of Science (MPI WG). The Humanities Data Centre aims at providing sustainable access to digital research data from the vast field of humanities research, and will ensure long-term preservation and access to

-- p. 470 --

curated data. In addition, it will provide tools for virtual research environments as well as counsel and training. The main goal in the initial design phase is to achieve a conceptual foundation.

Digital methods, tools and data play an increasing important role for humanities researchers. Therefore, the MPI MMG develops digital tools and methods that concentrate on the application of qualitative data analysis to visual materials, the support of researchers in their fieldwork with digital tools and the design of an infrastructure for the storage of digital research data. Regarding methodological approaches for analysing multimedia data, e.g. image, audio and video, further investigation is needed related to transcription rules and practices of interpretation. In addition, tools for the actual fieldwork of an anthropologist will be developed, such as digital maps with geo-referenced image, audio and video data, visualizations and enhancements of backend data flows.^{xxiii}

Careful handling of rights is a particular issue and humanities scholars are well aware that they often face restrictions when they desire access to cultural heritage objects, e.g. images. Therefore, the MPI MMG stipulates good practice rules for enabling access to such collections for educational and scholarly purposes.^{xxiv} In addition, codes of good research conduct and disciplinary norms have to be taken into account. Therefore, all social scientific research at the MPI MMG, particularly concerning informed consent and involving visual materials, is designed to follow the ethical guidelines formulated by the American Anthropological Association, e.g. the Principles of Professional Responsibility.^{xxv} Moreover, special regulations as agreed in a particular research group may apply, e.g. regarding research ethics or the sharing of data.

Furthermore, the application of the new digital instruments requires training and support of researchers is a crucial element of the MPI MMG's digital methods project described above; this in turn helps to refine the new instruments.

SUB Göttingen contributes its extensive knowledge in the preservation of digital objects as well as experiences in the development of virtual research environments, e.g. for the digital humanities (TextGrid).

6 Lessons learned and outlook

A typical challenge for institutions providing embedded research data management services is the imbalance of supply and demand for these services. Even though basic services are often needed early on in the project institutions may not have the resources and capacities to initiate such infrastructures and services before the project starts. It takes time to develop tools such as standards-compliant data creation, whereas researchers usually cannot delay the creation of data. And not all requirements can be defined or identified before the actual project starts.

Another challenge is to motivate researchers to actually provide data. Policies are only of limited use for this even if researchers willingly accept them. This depends much more on the acceptance of data managers within the project context. Acceptance has been recognized as a main challenge by all INF projects that contributed to a German workshop in 2013 (Cremer *et al*, p. 25f). Participants agreed that close communication and consultation as well as the creation of added value for researchers (including to relieve them of some burden) are crucial to turn this challenge into an asset.

In the EForTS project (see section 5.1) the joint creation of the data policy – a process that was closely supported by the embedded data managers – was instrumental in creating trust in the security and commitment of research data management, while it encourages data sharing it does not sanction lack of sharing. This discussion process can

-- p. 471 --

also facilitate a mutual understanding of the research community on how to handle their data. Therefore, only strategies can be transferred but not agreements established in other projects (Cremer *et al*, 2015, p. 23ff).

Subject-specific research cultures represent a challenge for an institutional data management policy, which is why Göttingen University issued a rather generic set of guidelines. These encompass a core set of rules that apply to any researcher at the university. In conjunction with institutional support as provided by the eRA, the development of processes and infrastructures for sustainable data management is facilitated (as described in section 5).

Along with the already proven benefits in better understanding the specific needs of researchers, the multi-disciplinary background of the eRA team enables the identification of synergies in terms of requirements and solutions across disciplines. The communication between eRA consultants and researchers sharing a similar background is characterized by trust and acceptance, particularly on the side of the researcher.

Experience has shown that working together *with* the researchers to develop strategies for data management and publication is of great value. In many research projects custom solutions have to be developed, which require both specific domain and information-scientific knowledge. An embedded data manager can thus take over a central role at the interface between research and infrastructure (cf. Cremer *et al*, 2015). Since resources are always tight, this model works only in a very limited number of cases. Nevertheless, certain funding schemes (like DFG CRCs) allow projects to ask specifically for such personnel. In other cases, the eRA follows the approach of appointing consultants with a similar scientific background.

Besides the core activities such as consulting and supporting the research process, training – in particular that of junior researchers – will certainly have a great impact on shaping the future of how research data will be handled in the future. Trust and acceptance among peers and supervisors/seniors plays an important role, too. Discussions in training sessions held with graduate schools have shown that the participating graduates typically reveal an open attitude towards data sharing and acknowledge the importance of data management for their own research and collaborative projects. Furthermore, graduate schools have some conceptual freedom and can offer

training in novel topics in addition to the standard curriculum. Therefore, such schools can act as a multiplier for the dissemination of this paradigm shift.

7 Conclusions

Without a doubt, research data management has become crucial for tackling many of today's research questions, making the research process more reproducible and more sustainable. Implementing a data management policy is complex as it has to serve a wide range of needs and at the same time needs to leave room for discipline specifics. At Göttingen University, a dedicated support infrastructure which builds upon information and communication infrastructures and connects to the main phases of research projects has already proven to be very fruitful. For instance, embedding research-data managers into research teams facilitates a better mutual understanding of the complexities and requirements of the research question in terms of digital infrastructures – and solutions can be found and adapted in an iterative process. However, embedded data managers are very costly. Still, for larger collaborative projects this may be the most desirable solution. SUB and GWDG – and in future further information- and communication-infrastructure providers – have teamed up

-- p. 472 --

under the brand of the Göttingen eResearch Alliance (eRA), to bundle the know-how on the campus and to provide – as a one-stop customer service – support, consulting, and training to all researchers on campus. This allows for an efficient use of existing and emerging services, combining the strengths of all partners, and will provide synergies for developing innovative and customized information science solutions. Further developments and the implementation of data-strategy related workflows on campus will go hand in hand with individual research projects. In other words we will closely review all support processes and incorporate lessons learned in the development of a comprehensive service portfolio.

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- ⁱ A workshop and survey of 2013 among these INF projects revealed information about data management strategies and common challenges. Compare Engelhardt, 2013, and the list of projects at
- ⁱⁱ <http://www.forschungsdaten.org/> collects information related to projects that address infrastructures for research data.
- ⁱⁱⁱ http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri, <http://www.elixir-europe.org/>, <http://www.dariah.eu/>, <http://www.cessda.net/>
- ^{iv} http://ec.europa.eu/research/infrastructures/index_en.cfm
- ^v http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf
- ^{vi} www.epsrc.ac.uk/
- ^{vii} <http://www.gwk-bonn.de/themen/uebergreifende-wissenschafts-und-forschungspolitische-themen/informationsinfrastruktur/>
- ^{viii} <http://www.uni-goettingen.de/>
- ^{ix} <http://www.uni-goettingen.de/en/482513.html>
- ^x See the lists at <http://www.dcc.ac.uk/resources/policy-and-legal/institutional-data-policies>, http://www.forschungsdaten.org/index.php/Data_Policies
- ^{xi} <http://www.sub.uni-goettingen.de/>
- ^{xii} Gesellschaft für wissenschaftliche Datenverarbeitung mbH Göttingen, <http://www.gwdg.de>
- ^{xiii} <http://www.ed.ac.uk/schools-departments/information-services/about/policies-and-regulations/research-data-policy>
- ^{xiv} http://www.dfg.de/en/research_funding/programmes/coordinated_programmes/collaborative_research_centres/index.html
- ^{xv} <https://de.dariah.eu>, <https://www.textgrid.de>, <http://www.cendari.eu>, <http://humanities-data-centre.org>, <http://www.gfbio.org>, <https://www.openaire.eu>
- ^{xvi} <https://www.gwdg.de/index.php?id=projekte&L=1>
- ^{xvii} <https://www.uni-goettingen.de/en/310995.html>

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- xviii <http://grc.uni-goettingen.de/>
xix <https://www.uni-goettingen.de/en/310995.html>
xx <http://fusion.cs.uni-jena.de/bexis>
xxi <http://www.ianus-fdz.de/>, <http://dch.phil-fak.uni-koeln.de/>
xxii <http://humanities-data-centre.org/>
xxiii <http://www.mmg.mpg.de/de/forschung/alle-projekte/digital-methods-and-tools-for-anthropological-research/>
xxiv <http://www.mpiwg-berlin.mpg.de/PDF/MPIWGBestPracticesRecommendations.pdf>
xxv <http://ethics.aaanet.org/ethics-statement-0-preamble/>