Open Educational Resources within the Digital Transformation of German Higher Education

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1. Introduction

This chapter is sourced from three separate reports revolving around the macro, meso and micro level of Open Educational Resources (OER) as they are presently addressed in the larger context of digital transformation within German higher education. The three reports were collated during a period of three years, mirroring the state at the respective points in time. Whereas the macro and meso level are organized in the form of a desk research, the section on the micro level is constituted by a small-scale survey on instructors' OER practices within their teaching.

As the topic OER is - in practice - still rather located at the margins than in the mainstream of higher education, it is embedded within the larger discussion of digital transformation. Furthermore, and in comparison to other countries, the German higher education system is characterized through its federal structure, leading to the differentiation of the macro level to be understood as the national level, the meso level to encompass the 16 different federal states and the mirco level to revolve around the individual institutional and instructor practices.

The German Higher Education System

The higher education system in Germany is comprised of a total of 396 higher education institutions, 121 of which are universities, 218 universities of applied sciences and another 57 art and music conservatories (Hochschulrektorenkonferenz, 2018). With 240 institutions, their majority is public (ibd.). As of 2018, the higher education system had a total enrolment of 2.8 million students, of which 1.46 million are male and 1.38 are female and a total staff number of 691,363 within which academic and artistic staff amounted to 386,752. Education at all levels is regulated on the state level, in the case of higher education through the state-specific Hochschulgesetze—herewith accounting for a variety of state-specific regulations, ranging from student admission criteria to pay scales for staff. Germany became a signatory to the Bologna process in 1999, entailing the major organizational change process of converting to the three-cycle system of bachelor, master and doctorate as well as agreeing to join the European Higher Education Area (EHEA).

At the core of the German higher education systems remains—since the early 19th century—Humboldt's conceptualization of higher education institutions that revolves for example around the unity of research and teaching, freedom from immediate societal and political application and usability of research and self-governance within the institutions (Kehm, 2015). However, institutional and system changes, e.g. increased competition between institutions, budget allocation and career trajectories, also affect these principles (ibd.).

Digitalization has emerged to be a strong force on higher education and presumably continues to be so; influencing institutional structures within higher education institutions and including, rather prominently, the process of teaching

and learning. The public and scientific discussion has been centrally shaped and influenced by the Hochschulforum Digitalisierung, considered as a "think tank, network and knowledge hub" [1] (Janoschka & Horndasch, 2018, p. 8) and that has published a large number of working papers, covering different aspects of digitalization, albeit less concerned with its informational and computational aspects.

Digital transformation and/or digitalization

A taskforce set up within EDUCAUSE (2018) defines digital transformation within higher education to be

> *Digital transformation is a cultural, technological, and workforce shift. In its cultural dimension, it requires a new approach to how campus leaders interact with each other as well as an emphasis on change management and a movement toward institutional agility and flexibility to meet quickly changing needs. For IT, this means adopting a role of strategic and transforming partner in alignment with institutional mission. IT leaders and their organizations must model digital transformation by adopting innovative practices and creating new digital architectures that provide unprecedented agility and flexibility to enable the institution to rapidly and efficiently achieve its strategic aims. Digital transformation also has broad implications for the institutional workforce, requiring dramatic shifts in workplace skills at all levels and professional development that enables the workforce to keep pace with the rapid tempo of change.*
> *Digital transformation is being driven by technology trends and changes that include advances in analytics, artificial intelligence, the cloud, mobile, consumerization, social networks, and storage capacities. Those drivers are enabling a new approach to everything from digital architectures to how campus leaders interact with the IT organization, all with the expected outcomes of new business models, improved student outcomes, different teaching and learning methods, and new research capabilities (p. 6).*

Although this definition is primarily concerned with leadership (and coined for the US American context), it provides a rough orientation towards the all-encompassing character that digital transformation has on higher education campuses. Nambisan, Lyytinen, Majchrzak and Song (2017) introduce a special issue of MIS Quarterly on IT and Innovation, by advancing a definition of digital innovation, which is to a certain extent also applicable to the higher education context and its present transformation. They state that "in digital innovation, digital technologies and associated digitizing processes form an innate part of the new idea and/or its development, diffusion, or assimilation" (p. 224). Herewith, digital technologies are positioned at the core of all process stages of revolving around change - much as it is occurring right now when digitalization within higher education is concerned.

Another, very recent study on digitalization needs to be mentioned as it pertains to the German higher education context. In this extensive and comprehensive overview study on the status quo of digitalization within German higher education, Gilch, Beise, Krempkow, Müller, Stratmann & Wannemacher (2019) advance an understanding of digitalization for their study that follows the three dimensions of research, teaching and service that are typically applied to structure the responsibilities of universities. They then state:

- In this study, digitalization of research means the comprehensive application of computer-supported approaches and the systematic use of digital resources in research.
- The digitalization of teaching and learning is understood as the integration of digital tools and components into the teaching and learning processes.
- The digitalization of services encompasses the networked realization of administration processes through use of shared digital tools (p. 12, translation by the authors)

For further consideration of the aspects that are being raised in the remainder of the report, it is helpful to keep in mind Gilch et al. (2019) clearly documenting that German higher education institutions view digitalization as a highly important topic, whilst also conceding that most often their current status with regard to digitalization is not yet evaluated as sufficient (p. 41).

2. Macro level

2.1 Policy

2.1.1 Policy trends

As will be seen throughout this report, policy – in the form of strategies, initiatives or programs – is weaved into all other fields pertaining to digitalization and the specific field of OER and metadata. From the comprehensive report by Gilch et al. (2019) the following figure was extracted, which provides an overview of initiatives in the field of digitalization on the federal level, some of which will be elaborated on below and throughout the report. Taken into consideration all initiatives depicted here would exceed the space of the document, however, they can be turned to for further reference.

Figure 1

Digitalization initiatives and strategies on the federal level (copied from Gilch et al., 2019, p. 148)

2.1.2 National policies

Due to the fact that the German education system is federally structured, legislation and execution of education is regulated on the state level—as a consequence, developing and implementing one national policy is not feasible. This holds true for the topic of digitalization as well, thus delegating it to the individual states and their responsible bodies. Subsequently, this also results in the fact that discussion on digital infrastructure, exchange of data and information within higher education institutions occurs on the state level. However, a Digital Agenda for 2025 ("Digitale Strategie 2025") was put into place in 2016, as well as concrete measurements ("Digitalisierung gestalten"–Umsetzungsstrategie der Bundesregierung) in 2018. Both documents also encompass distinct passages on higher education as regards both its shape as well as challenges that are to be met. Whilst these strategies can only address more general elements, it is useful to include them in this analysis as they provide the large and national context and intention associated with digitalization.

In the 2016 document (BMWi, 2016, p. 52), noteworthy points related to digitalization within higher education include the

- Establishment of more professorships in the STEM fields and computer science
- Integration of informational and digital knowledge across the disciplinary curricula
- Foster entrepreneurial engagement
- Extend face to face instruction through online learning via MOOCs and other forms of e-learning

Concrete areas to be tackled in the field of higher education, as outlined in the 2018 document (Bundesregierung, 2018, p. 40, translation by the authors), include:

- Digitalization of the higher education system: Research on digital higher education, competition for digital innovative higher education institutions or consortia—in order to strengthen the German HE system, enable HE institutions to develop and implement digitalization strategies and to generate sound knowledge on HE digitalization, its potentials and barriers.
- Digitalization of the scientific research system, national research data infrastructure - in order to strengthen the German science and innovation system and support the development of a sustainable, interoperable research data management system and implement a standardized research processing scheme across scientific disciplines.

Whilst these documents are drafted with the national perspective in mind, the Standing Conference of the Ministers of Education and Cultural Affairs (KMK) (2016) published a position paper "Education in the digital world" ("Bildung in der digitalen Welt") in which the states promulgate, from their perspective, a joint understanding on the role, challenges and measures to be taken in order to ensure appropriate education on all levels in the context of digital transformation. For the higher education context, the KMK defines ten central areas of action and development, including for example:

- Open Educational Resources – whilst a range of OERs exists already, uncertainties revolving around legal issues continue as well as challenges regarding their financing. Hence, it is necessary to clarify legislation and provide basic financial means (p. 50-51).
- Quality assurance – quality is of utmost importance, including content, technology and pedagogical setting of digitally enhanced HE learning and should be measured across institutions and in the context of accreditation (p. 51).
- Strategy development – HE institutions are called upon to develop agendas and strategies to shape and refine an individual profile (p. 53).
- Inter-institutional cooperation - the digital transformation is a national endeavor, in the course of which HE institutions are being financially supported to cooperate and share infrastructures, also across other educational sectors (p. 54).
- Infrastructure and technical requirements – with partially digitalized processes and units, HE institutions use learning management systems for intra-institutional processes predominantly related to teaching. In order to also use research data for teaching purposes, the different institutional software solutions should take interoperability into account. Scientific libraries assume a prominent role in supporting digitally enhanced teaching and learning (p. 52-53) (translation by the authors).

However, due to the federal structure, declarations and voiced commitments only have recommendation character and are not legally binding.

2.1.3 State level policies

Currently [2], thirteen of the sixteen federal German states have digital agendas, digital master plans or digitalization strategies in place, all of which mention different levels of the education system, and including higher education, as part of their respective digital futures. Screening the respective agendas, it is also evident that education constitutes only one dimension among the many that digitalization influences—next to economy, e-governance, culture and participation, the technical and informational foundations, health and welfare as well as cyber security. Two states, Bavaria and Saxony, also have distinct strategies for the field of (higher) education alongside the general state-level strategies.

Before endeavoring into the more concrete topics that these agendas discuss in regards to higher education in the context of digitalization, it is helpful to look at how the states understand and define digitalization.

Defining digitalization

Out of the thirteen strategies, only seven elaborate a definition of digitalization or at least remark on some traits that characterize this process—the other strategies employ the term digitalization but lack further information on how they conceptualize and understand this term. Definitions also vary in scope and detail.

For example, in the digital strategy of the state of Baden-Wurttemberg (2017, p. 8), digitalization is being referred to as

> *Originally, the term „digitalization" merely meant the transformation of storage media such as books, records or photographs into data files consisting of 0 and 1 numericals. Over time, the term has gained an additional, more comprehensive meaning. The transformation of all kinds of information into a digital format, the storage and processing of data on a massive scale and the worldwide connectedness has become the symbol of a new era. Since then, „digitalization" is understood to encompass the whole of all economic, societal and political reform and alteration on the basis of information and communication technology (translation by the authors).*

This understanding of digitalization is similar to the definition of digital transformation advanced by EDUCAUSE (2018) in the sense that it is referred to as a massive and comprehensive change that is brought about through ICT and that fundamentally changes existing structures and beliefs in all dimensions of individual and societal life. The comprehensive changes that the digital transformation brings are reflected in all seven strategies, making most often reference to changes occurring in all areas of life ("Lebensbereiche"). Thus locating digital transformation within education contexts can only be fully understood when viewed within this larger societal context.

In the course of their definitions, the policy documents tend to argue along the line that digitalization is induced predominantly through technological developments but that it can be shaped by humans, more concretely by "us" as the pronoun "we" reveals, which makes the experience of digital transformation a shared one between state governments and citizens alike ("We are convinced that digitalization holds great opportunities for growth and new prosperity, if we actively shape it", North Rhine Westphalia). Digitalization is labeled as, for example, "the fourth industrial revolution" (North Rhine Westphalia) or as "a mega trend" (Thuringia), and considered to be "next to globalization the greatest chance and equally the greatest challenge of the 21. century" (Rhineland Palatinate). Furthermore, the strategies also touch upon perceived risks and challenges brought about through digital transformation (data security, substitution of professional fields) as well as benefits it potentially brings (improved medical services, economic growth).

Higher education and digitalization

In line with the federated structure of the German education system, a cursory screening and coding of these digital agendas reveals that numerous concerted activities either exist or shall be implemented on the respective state level. References to joint actions between higher education institutions on the state level can be found for eleven states. These initiatives can be broadly differentiated into the three areas

- Research: Inter-institutional exchange of (research) data, cloud services

- Teaching: Joint production and sharing of digital learning materials, a state-wide learning platform, provision of courses across institutions, open digital learning, Repositories for OER and other digital learning resources, inter-institutionally compatible learning management systems

- Administration (i.e. Libraries): Provision of infrastructures, shared licenses (software and literature) across the state, library consortia on the state level

Five states also touch upon OER and their intention to foster creation and use of OER across their institutions – against the background that these, of course, are statewide initiatives, this is also an interesting approach, as OER are per se not bound by geographical or institutional boundaries. Furthermore, it is evident that these state-level platforms and

infrastructures create parallel structures and potentially lack interoperability between the individual repository and platform solutions.

2.1.4 Opinion pieces and Working Papers

Beyond the policy papers drafted for the national and state-levels, a number of working papers and opinion pieces have been published that also address aspects of digitalization in higher education, which are relevant to the EduArc project.

- Hochschulforum Digitalisierung: Beginning in 2014, a think tank composed of higher education, policy and entrepreneurial actors has formed as the Hochschulforum Digitalisierung (financially supported through the German Federal Ministry of Education and Research and cooperatively carried out by Stifterverband für die Deutsche Wissenschaft, the CHE Centrum für Hochschulentwicklung and the Hochschulrektorenkonferenz) with the intention to foster the implementation of digitalization strategies at higher education institutions, enhance instructors' competencies for using digital tools in their teaching and to generate innovative ideas for future scenarios in digital higher education (HFD, n.d., „Das Hochschulforum") [3] . The HFD has produced a large number of working papers on a range of topics and which are publicly available on the HFD website, with working paper no. 33 addressing the feasibility of a national platform for teaching in higher education.

- OER Feasibility Study: The BMBF commissioned the Deutsches Institut für Internationale Pädagogische Forschung (DIPF) (jointly with the Learning Lab at the University Duisburg-Essen) to provide an investigation into the feasibility of implementing and operating OER infrastructures in education. Results of the study indicate that a national repository that stores OER across all educational levels does not seem to be possible but rather advocate for a disseminated system that exchanges OER information (Blees, Hirschmann, Kühnlenz, Rittberger, Schulte, Heinen, Kerres & Scharnberg, 2016, „Zusammenfassung").

- White paper on OER in German higher education institutions: In this white paper, the three authors provide a summary of the state of the art of OER in German higher education and also include a foresight on expected or possible developments in this field, also touching upon technical and informational infrastructures (Deimann, Neumann, Muuß-Merholz, 2015, pp. 55).

Actors and bodies

Actors within the field of digital transformation within higher education largely correspond to the institutions and bodies mentioned before. It is the government for the national level as well as the respective state governments for the 16 states. As an intermediary between different sectors, the Hochschulforum Digitalisierung assumes a very prominent and influential role through both their topic-focused working groups as well as their peer to peer counseling for higher education institutions wishing to develop and implement digitalization strategies.

From within (higher) education, the Standing Conference of the Ministers of Education and Cultural Affairs has positioned itself towards the topic as have rather regionally or statewide oriented networks as well. These will be treated in more detail in the sections on the meso level as they are confined to a number of institutions or the respective state they are located in.

Against the background of European initiatives in the wider field—and also including infrastructures to make research data digitally available—the European Open Science Cloud (EOSC) is one major development that Germany has signaled commitment to through provision of supporting office, jointly offered with the Netherlands and France (BMBF, 2017). Although this endeavor relates to research, the idea of providing access to information free of charge, open and in a standardized manner through metadata to ensure interoperability is also at the core of the intended structure for (O)ER.

2.2 Infrastructure

2.2.1 Current state

As of January 2019, no national infrastructure exists for the storage and dissemination of (O)ER. In the context of the EduArc project, a first sketch of how its structure could potentially look like was drafted by Hölterhof and Kerres (2018)

and is provided below.

Figure 1

Possible Infrastructure for storage and dissemination of (O)ER (Hölterhof & Kerres, 2018)
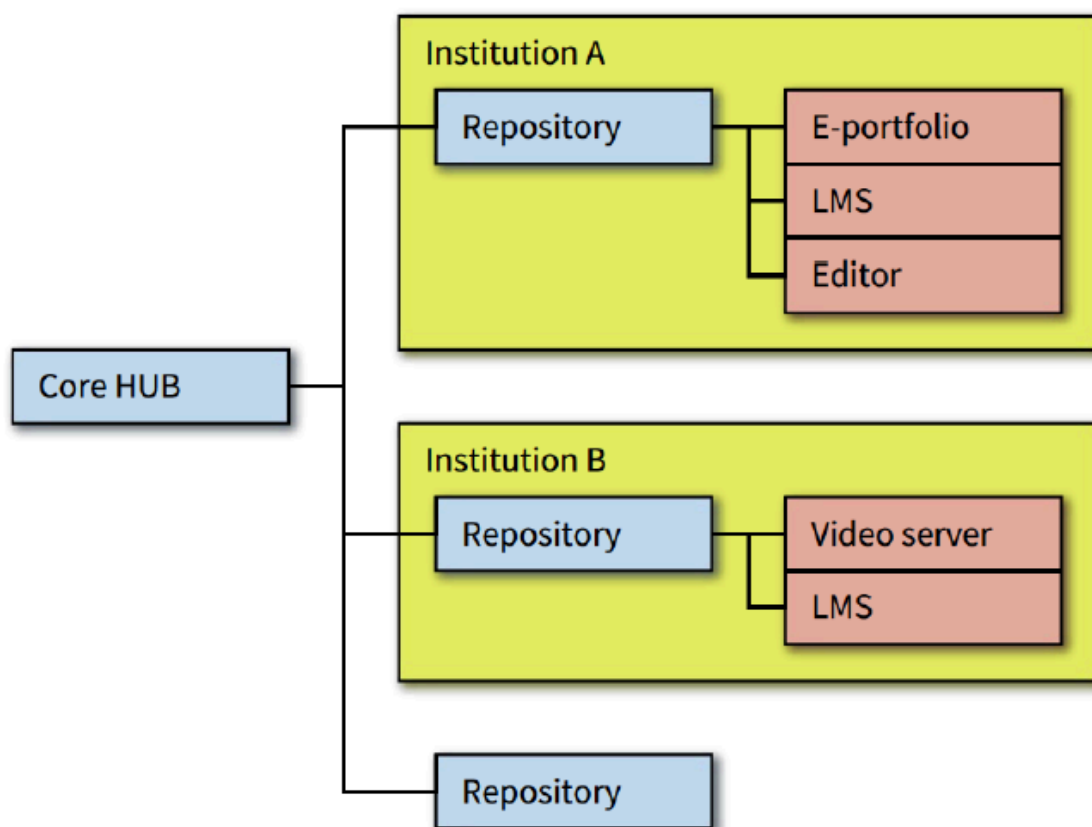
Given the federal structure of the country and the information on the digitalization strategies of the respective states, a nationally implemented repository that is being adhered to across the states, is rather unlikely to happen. Schmid, Zimmermann, Baeßler and Freitag (2018) in their feasibility study of realizing an (inter)national platform for higher education teaching devise two possible set ups for such a platform but then advocate for a merger of these, stating that "realizing an open, networked education platform with a nation-wide portal and integrated theme channels for study and life long learning offerings" (p. 11, translation by the authors) would in their opinion be the way forward.

Whilst teaching is in the focus of the above-mentioned platform, it is interesting to see how the idea of establishing infrastructures either centralized or decentralized in order to provide access to information permeates research as well (e.g. the project Generic Research Data Infrastructure, GeRDI), teaching as indicated in this passage as well as educational resources as in EduArc.

The report by Schmid et al. (2018) also makes reference to the fact that, so far, individual states such as Bavaria, Hamburg and Schleswig-Holstein have set up their statewide educational resource and shared teaching platforms (p. 55). Whilst this follows the logic of the state sovereignty over education, it also means parallel structures and partially works against the idea of providing resources and access to education offerings that are open in the understanding of open (Weller, 2014). Providing open access might not even be in the interest of the states (considering e.g. competition for students, anxiety of giving away investments without return or investing into their respective institutions to be well-prepared to compete for nationally awarded grants (Getto & Kerres, 2017, p. 133), but it still is an interesting and peculiarity of the German higher education system. A publication from the BMBF-funded project "OpERA – OER in

academic continuing education" also states that a number of repositories that were established within individual universities were closed down after some time (Schmid, 2018, p. 8).

2.2.2 Current discussion

As early as 2007, a desktop research on the international distribution of OER at universities revealed that creation and dissemination of OER follows individualized and non-standardized patterns (Goertz & Johanning, 2007). The authors state that out of the 36 international OER projects that they identified in their search, the meager number of four provided information on metadata and formats that were used for their OERs (p. 11). Whilst the quantity of OER and the discourse surrounding them has proliferated over the past decade, metadata and interoperability still constitute challenges, as it seems. In 2015, the Standing Conference of the Ministers of Education and Cultural Affairs and the Federal Ministry of Education and Research include a passage on the "technical level" (p. 5-6). Within this passage, the need to locate and being able to retrieve OER is cited as crucial to seize their full potential. This is to be realized through metadata, with the concrete examples of LOM and Dublin Core being cited and an official coordination post ensuring this through an appropriate referatory.

The need for adequate infrastructure in general is reiterated in the strategy paper of the Standing Conference of the Ministers of Education and Cultural Affairs (2016). In view of technical and informational infrastructures, it is stated that, "An important field of action in the further development is the creation of Campus-Connect-Solutions which allow for an inter-institutional exchange. It is thus necessary to develop standards for the exchange of information between the common systems at the higher education institutions and to foster their technical implementation" (2017, p. 52-53, translation by the authors). It is also stated that is to be negotiated if and how commercial messaging services can be integrated into the HE institutions' services. The latter aspect is strongly criticized by Deimann (2017) who, in view of data protection and security, argues that caution is necessary when endeavoring into these kinds of partnerships (p. 87).

Thus, while for the time being, technical infrastructures for the storage and dissemination of (O)ER are not being discussed in policy papers with the intention to involve commercial partners per se, no concerted effort is made to jointly develop infrastructures either.

Yet in another paper, the impact of improved networks and infrastructure is being referred to. Deimann, Neumann and Muuß-Merholz (2015, p. 56-59, translation by the authors) in their white paper on OER in German higher education delineate several concrete areas that could help or hinder further dissemination and use of OER. Included are

- A (government supported) OER infrastructure is not being established: American and German publishers develop high-quality infrastructures that also include OER and provide metadata for their materials (which are not provided openly). Higher education institutions will choose these systems due to their quality, which finally favors a proprietary system over an open one. The authors find high likelihood and high impact of this scenario.
- LMS that are being used in higher education institutions will have interfaces with OER repository: Applying to both open source and proprietary LMS, interfaces to repositories will be added and license models will be adapted. In this way, OER will be more visible within LMS. The authors assume a medium-term likelihood and high impact of this scenario.
- A joint platform for materials / state or national level OER platforms: Supported through policy actors and funding, a nationwide platform or state wide platform will be established that is being hosted by libraries or education-related servers in order to provide a first anchor for OER users and providers; the platform effects will increase with interfaces to LMS at higher education institutions. The authors assume high likelihood and high impact of this scenario.
- Agreement and timely implementation of OER metadata standards: Finding and locating them hinders the large-scale use and distribution of OER. To overcome this problem, an agreement on a metadata standard for OER in Germany, willingness of scientific libraries to document OER and implementation of an OER search engine are needed. In the medium-term, this will increase use of OER by students and teachers, which then leads to increased OER production. The authors find low likelihood but high impact of this scenario.

Still, action has not yet followed rhetoric in this field as stated in the first line of this part of the report, despite several mentions in various statement and strategy papers, no standardized technical set up or use of metadata can be identified so far.

2.3. Quality

2.3.1 National quality standards

In the field of (higher) education, discussion on quality as a multidimensional construct has increased in scope since the seminal article by Harvey and Green (1993) who state that, "Quality can be viewed as exceptional, as perfection (or consistency), as fitness for purpose, as value for money and as transformative" (p. 11, highlighted i. t. orig.). These dimensions are intertwined with one another and also illustrate the different perspectives one can assume in regard to this topic. Thus, before entering any discussion on what constitutes quality in the field of e-learning (Ehlers, 2011), or OERs (e.g. Clements & Pawlowski, 2011), it seems necessary to discuss the field of quality assurance within German higher education more broadly.

As of 2018, the decision on what constitutes high enough quality in higher education to be accredited, is fully given to the Accreditation Council, forming the executive part of the Foundation for the Accreditation of Study Programmes in Germany. This foundation is a shared endeavor between the German states with the intention to ensure the quality of higher education study in Germany, as stated on the webpage of the foundation (Stiftung Akkreditierungsrat, n. d.). The foundation further states on its webpage:

> The Foundation for the Accreditation of Study Programmes in Germany ensures its overall responsibility for the accreditation system through ensuring the consistency and coherence of its accreditation decisions, through supporting the German states in their further development of the German quality management system, through fostering the international cooperation in the field of accreditation and quality assurance and in doing so supporting the realization of a shared European higher education area (translation by the authors).

Whilst the decision on accreditation is made through the Council, the evidence base for making this decision is accumulated through external, accreditation agencies, that are responsible for providing an evaluation report (resulting from expert visits to the respective institutions and programs and intensive scrutiny of the program in question). Whilst program accreditation refers to either bachelor or master level study programs, system accreditation is more comprehensive and involves the accreditation of the institution-internal quality assurance system to be of such a rigor that the institution is authorized to accredit its own programs. Both accreditations are granted for a limited time period. Thus, despite the general responsibility for education affairs residing with the individual states, the Accreditation Council is an overarching unit and indeed sets the national quality standards for higher education study.

Quality of OER

The situation for e-learning and OER deviates quite strikingly. Despite the discussion about quality in and of OER, in Germany no coherent national standard exists on the basis of which quality could or would be measured. This applies both to the content of OER as well as their indexing based on metadata. To the best knowledge of the authors, one document directed at librarians in German higher education institutions exists by Ziedorn, Derr und Neumann (2013), in which a summary of metadata schemes is compiled (Dublin Core, IEEE LOM, LRMI, XCITR and ELAN Application Profile). As even this small number of standards varies in their complexity, establish a nationwide system seems like an enormous challenge. Furthermore, these metadata schemes are developed along the lines of associations and special interest groups rather than countries, thus incorporating different interests and intentions.

Zawacki-Richter and Mayrberger (2017, 2018) made a first attempt for the German case to first outline existing approaches to quality of OER and to then develop tentative projections on how an institution-specific quality assurance approach could potentially look like [4]. With eight different quality assurance models derived from international literature and discussed in their merits and shortcomings, the authors reiterated that a) quality is a contested field and b) there is a lack of accurate and validated measurements scales for quality of OER. Whereas the specific approach

developed for the HOOU will be discussed later in the report, the authors also contend that this institutional endeavor most likely does not or cannot result in a German quality model of OER.

Ehlers (2013) assumes that, in the context of evolving learning contexts, quality will be primarily judged by learners and peers (n. p.) and thus turn away from prevailing forms of expert judgment. This can be understood as a precursor to Brückner's (2018) critical discussion of the general idea of quality assurance according to pre-specified standards – and their implied mechanisms of control, legitimization and marketing (p. 61) – for the field of OER. She advances the argument that with OER, when understand as a collectively created and used resource, also the assurance of quality needs to be occur based on collective practice and consent in order fully live up to the principles of open (p. 59). Especially in the realm of education, using teachers in secondary education as example, she emphasizes their professional capacity to evaluate quality of materials and educational performance and develop them further based on this specific knowledge and capability. Also furthering this line of argumentation, Clements and Pawlowski (2011) elaborate on trust (e.g. in established organizations, individuals) as a proxy for quality of a resource. It is 82% of instructors in their study saying that recommendation of trusted individuals is their quality approach on OER. This resonates with a somewhat historical development, meaning that in the very first beginnings, OER were provided by highly reputed higher education institutions. This in turn was presumed to account for at least minimal quality standards. Following this initial phase, several approaches were then also launched in the field to combine top-down with bottom-up metadata initiatives (Klemke, Ternier, Kalz & Specht, 2010).

2.3.2 Actors in national quality assurance

As stated in the previous section, the Stiftung Akkreditierungsrat is the main body responsible for overall quality assurance in the field of higher education, albeit for the program level and not for quality assurance of OER. Again, given the legislation of the country when it comes to education, national actors in and for quality assurance are not easily identified and empowered. In the following part of the report that focuses on the meso level, that is understood here to encompass the state level and its relation to the respective higher education institutions of that state, the example of the Hamburg Open Online University (HOOU) will serve as an illustration of how first attempts are being made towards developing quality standards as a first step towards action.

Thus, whilst discussion has been going on about the quality of OER – as also illustrated in some references throughout this chapter – it seems that this has not yet translated into a concerted practice of quality assurance or distribution of responsibilities to this end.

2.3.3 Relation and adherence to international standards

The observation that no nationally agreed upon quality assurance mechanisms are in place can also be extrapolated to the international level, despite several larger initiatives working towards this end. Camilleri et al. (2011) report on the OPAL project, in which a large number of case studies was conducted, which lead to the identification of a range of models of quality assurance practiced at different higher education institutions. Camilleri et al. (2011, p. 33) name the following factors to be of influence for the quality assurance model practiced:

- „The type of institution and their learning and teaching culture.
- The balance of importance of the 'value' of teaching (in comparison to research activities in the institution).
- The degree to which OER activities were seen as research activities in their own right.
- The level of e-learning maturity of the institution.
- The extent to which they had engaged with OER work previously."

In their discussion on quality of OER, Camilleri, Ehlers and Pawlowski (2011) explicitly include adherence to agreed metadata standards (e.g. LOM, SCORM) to be closely intertwined with quality (pp. 19-20)—while simultaneously pointing out that this has not yet been practiced consistently. Partially confirming this, in a survey study by Clements and Pawlowski (2011), 146 instructors from a range of European countries were asked about their perception of quality of OER, with a special focus on their (re)use practices of OER. Interestingly, whilst across the sample, 68% of teachers stated that quality also meant "interoperability between the LOR and their LMSs" (p. 11). They also stated that their

reluctance to share OER in an international repository mainly stemmed from curriculum compatibility problems (74%), from copyright difficulties (52%) and variations of subjects between countries (48%) (p. 10). Furthermore, they greatest barrier to re-using international OERs is cited to be a preference for materials developed in one's own country (35%), the long time it takes (31%) – concerns about the quality of the OER follows on the fifth rank with 24%. Thus, speaking for the international context, quality of OER (e.g. based on shared metadata), is one aspect to consider – however, the actual fitting of the material into the respective national learning context might constitute an equally important inhibitor for the uptake of OER internationally.

International standards for OER—or rather attempts to define them—have occurred through a variety of institutions and individuals (see the above examples of Dublin Core, IEEE LOM or SCORM). As stated above, both awareness of and then adherence to one of the chosen standards is a challenge, as was also documented in Davis et al. (2010) who found that

> it was clear that a significant barrier to teachers using a repository was the complexity of the deposit process, and in particular, the need to specify a large number of metadata fields before a deposit could be made. […] It was clear that while professional LO developers were prepared to take the time to understand and complete the schema, everyday sharers would not be (p. 99).

In addition, for the repository under analysis in Davis et al. (2010), the number of metadata to be entered amounted to 25 obligatory fields and another 27 that were optional. It can tentatively be concluded that this situation constitutes a considerable barrier for content providers to OER repositories and it can easily be assumed that this in turn results then into OER not sufficiently indexed or not shared at all. Neumann and Muuß-Merholz (2017, p. 13) state, that in their view one of the measures to increase usage of OER, is to make them searchable and findable through meta date used by both search engines and OER providers, as well as increasing interoperability between platforms to share OERs.

Hence, whilst the problem of developing and implementing one system of metadata across multiple countries (and even within one country) is but one challenge, the actual achievement would then be to involve and encourage creators and users of OER to actually make use of these metadata.

2.4. Change

2.4.1 Promotion of change

Given that Germany has long relied on its close network of brick and mortar higher education institutions and the face-to-face teaching of a largely traditional student body, the uptake of digital technologies had been slow in international comparison. Over the past years, however, the large topic digitalization, including OER, has received increased interest on the national policy level.

Interest and ensuing discourse have most strongly been fostered through the aforementioned platform and think tank "Hochschulforum Digitalisierung" in the course of which both dissemination of opinion papers, working papers and policy statements as well as peer to peer coaching between higher education institutions (to foster development and implementation of institutional digitalization plans) has occurred and continues to do so. For the specific field of OER, further initiatives and web presences were established that serve as platforms for communication and dissemination of information and activities revolving around OER. Examples of such platforms are

- OERinfo – "A topic-specific online platform that provides comprehensive information on OER directed at the public and specific target groups. It has the intention to foster broader visibility of OER as well as reaching out to new target groups. State of the art insights are to be adapted for practitioners, information on best practices are to be summarized and the range of existing initiatives are to be displayed" (freely translated by the authors). The web site partners with four education institutions, each of which provides additional information on the specific fields of schools, higher, vocational and continuing education. The platform is sponsored by the BMBF and the DIPF.
- OER World Map – is another, albeit internationally oriented, platform, jointly established by North-Rhine-Westphalia Library Service Centre (hbz) and graphthinking GmbH (cooperation partner: Open University, UK) and financially supported by the Flora Hewlett foundation. It claims to „provide the most complete and comprehensible picture of the global Open Educational Resource movement" („Currently on the map") and offers information on a diverse range of OER activities, institutions and events.

As part of this map, OERinfo links to a map on Germany, which displays a range of Germany-based OER events, institutions and activities.

Change is, as a topic, very closely related to policy development in education that was outlined in the first chapter of the report. With the growing importance that is attached to digitalization and OER on the policy level and that is followed by attempts to disseminate information on the topic and to generate further interest and involvement, it is the provision of financial means to actually realize both research and practice within this field. Since 2016, several large scale tenders have been enacted through the Federal Ministry for Education and Research that have focused on different aspects of digitalization in higher education. For the specific field of OER, a tender was publicized in 2016 through the BMBF, which called for OER topics across different education sectors under the umbrella of OERinfo, resulting in over 20 projects that were featured in a special issue of "Synergie" in 2018.

However, to the knowledge of the authors, no major concerted effort has yet been made to foster intense discussion on the technical infrastructures underlying especially OER and their retrieval and dissemination. The only attempt that the authors know of originates from the initiative JOINTLY.

2.4.2 Change agents

For the field of OER, Neumann and Muuß-Merholz (2017, p. 17) attest Germany a rather slow progress when compared internationally. However, the authors also emphasize the influence that bottom up initiatives (which they consider as "communities") have in advocating for OER, especially in school and higher education. They also note that higher education practitioners reach out and share their expertise with actors in other education areas and also voice the expectation of increasing support through policy actors in the future. As of 2017, Neumann and Muuß-Merholz state that based on the OER World Map, there are 166 organizations in Germany that are involved in OER-related activities.

There is a mixture of bottom up activities and top down policies and agendas whose interests meet in, for example, platforms of information and dissemination that operate on the national level (Neumann & Muuß-Merholz, 2017). However, it can be tentatively assumed that no concerted effort for OER and digitalization infrastructures on the federal level will be made in the near future that is binding for the states – education being in the realm of the states strongly impedes this.

Against the background of the structure of German (higher) education, it so far predominantly governmental or state bodies that are involved with driving and developing change in the field of digitalization and OER. With individuals and institutions that are at the forefront of these developments, the impression prevails that there are a number of initiatives, associations and slowly but surely growing policy aspirations that join to form a multilayered mosaic around the topics of OER.

The above-mentioned 20+ initiatives, which were funded by the BMBF between 2016 and 2018, can be considered among the community of OER practitioners and advance practical approaches to the topic. However, being funded in the context of policy interests, they also closely aligned with an overall political aim of fostering development and use of OER. The initiative JOINTLY assumes a special role as it has established a special interest group on software and

infrastructure, in the context of which also metadata play an important part. To this end, a [first draft](#) for harmonizing OER metadata was set up and is continuously worked on.

3. Meso level

Against the background of Germany being separated into sixteen states that have their respective government and legislation for the education system within each state, this part of the chapter uses specific states examples to illustrate key points or identify best practice examples. The legislative and executive authority that the States hold over education is a defining characteristic of the German situation and constitutes an intermediary between national and institutional levels.

In the following, likewise separated along the lines of policy, infrastructure, quality and change, this meso level will be addressed in its specific States approach to digital transformation, as well as making reference to the institutional level of selected institutions.

3.1 Policy

The Kultusminister Konferenz (2019, p. 5) remarks that it is the task of the States and the State to put at disposal the required conditions for the implementation of the goals related to the digitalisation of HE, which is object of the strategic development of the HE German sector. Therefore, it recommends a seamless exchange between States and the diverse responsibilities that the states have when it comes to digitalisation are effective. On the other hand, the same institution states that one of the problems in higher education teaching and learning with digital media is the project-based work being done, which does not support a sustainable implementation in the long term, leading to people leaving with the expertise and no structures in place (Kultusminister Konferenz, 2019, p. 8).

As mentioned previously for the macro level, almost all the States have their own agendas for their strategies for digitalisation in the general level, which also includes (higher) education and, in addition, four states (Bavaria, Baden-Wurttemberg, Thuringia and Saxony) have their own strategy for (higher) education. Others are currently developing their own strategies for digitalisation for the (higher) education level.

For instance, the strategy of digitalisation for higher education in Saxony has as goals (Staatsministerium für Wissenschaft und Kunst Freistaat Sachsen, p. 4, translation by the authors):

- Unlocking potential for improvement of the quality of teaching,
- Improvement of the study success,
- Strengthening competitiveness the Saxon universities,
- Increase of international visibility.

Therefore the action fields proposed by this strategy are the following (p. 10):

- Imparting digital competence to teaching staff,
- Increase in acceptance for digital teaching by the teaching staff,
- Anchoring in teaching,
- Learning with digital media,
- Sustainability of the use of digital media.

As another example, the strategy of digitalisation for schools, higher education and culture in Bavaria points out for higher education that

> The universities should become a "digital campus", where all actors in science use and profit from the opportunities and possibilities of digitization. It is about improving both the performance and equity of the higher education system as a whole. This applies in a similar way to our cultural institutions, which have to

tailor their offers and contents accordingly (Bayerisches Staatsministerium für Bildung und Kultus, Wissenschaft und Kunst, p. 40, translation by the authors).

On the institutional level, according to Gilch et al. (2019, p. 66), 13.6% of the German higher education institutions in the study (n = 110) have already designed a strategy or a concept for the digitalisation in their institution during the three last years (2016, 2017 and 2018) and 40.9% are working on it. The authors also recognised a difference between West and East Germany, with higher education institutions in West Germany having more often strategies in place than their East German counterparts (57.3% versus 47.1%). The goals mentioned in those strategies are the following (Gilch et al., 2019, p. 68, translation by the authors):

- Improvement of the quality of teaching (91.7%)
- Increase in the quality of services provided by higher education administration and services (90%)
- Increase the efficiency of higher education administration and services (90%)
- Skills training for a digital world (86.7%)
- Increasing the university's ability to control itself through digitised support for governance (73.3%)
- Profile building at the university (66.7%)
- Intensifying research for the digital society (50%)
- Acquisition of new target groups for study and further training offers (48.3%)
- Internationalisation of the university (45%)
- Increase in research quality (45%)
- Intensification of transfer activities (research and technology transfer) (45.0%)
- Increase in research performance (43.3%)
- Increase in diversity and heterogeneity of the student body (38.3%)

Concerning the OER projects at the federal level, a broad range of initiatives can be identified through the OER World Map. In order to provide a more detailed picture, in the following several examples are provided for how digitalization and OER practices occur on the meso level of the States.

3.1.1 Lower Saxony

Lower Saxony is located in the North of Germany with 28 higher education institutions (public and private, universities, art and music conservatories, theological institutions and universities of applied sciences) and 211.229 students enrolled in the winter term 2018/19 [5] .

Strategies of digitalization

The strategy of Lower Saxony for the digital transformation (Niedersächsisches Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung, 2018) is the document that guides digitalisation within Lower Saxony, by covering the different areas of the society, among others: economy, transport, work, education, health, energy, environment, culture, administration.

In the context of education, the relevance of the development of media/digital competence is remarked. Two other documents are mentioned with this regard: the implementation of the federal state concept in "Medienkompetenz in Niedersachsen - Ziellinie 2020" (Niedersächsische Staatskanzlei, 2016) and the "Strategie zur Bildung in der digitalen Welt" (KMK, 2016).

The goals of Lower Saxony with this respect are as follows: supply of strong Internet connection and infrastructure in all schools and educational institutions; comprehensive introduction of personal digital mobile devices in more schools and its recognition as educational means; implementation of media education in all the study plans of the schools; comprehensive introduction of digital platforms and work environments and school or federal state's cloud; qualification and counseling of teachers and administrators; development of innovations, introduction of new formats for staff training; and strengthening of the administration of the IT school infrastructure. The measures proposed to achieve those goals focus on the introduction of mobile technology in education, the introduction of 3D-printers and robots in the schools, the use of videoconference systems for professional training, monitoring the digitalisation

process through IT data collection in schools and adult education, the advancement of teacher training (pre- and in-service), support of innovations and the anchorage of media education in the schools' study plans (Niedersächsisches Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung, 2018, pp. 78-81).

The report "Media competence in Lower Saxony - Target lines 2020" focus on a series of educational contexts, within also higher education is to be found (Niedersächsische Staatskanzlei, 2016). The reference to higher education comes especially within the measure "improve pre- and in-service teacher training in media pedagogy", when it is mentioned that since 2015 media education is part of the educational competences and standards in the Master of Education (teacher training) in Lower Saxony. Further mention related to the integration of the information competence as element (key competence) of the curriculum through the methods and e-Learning and blended learning formats, which also involves the development of regulations regarding the implementation of e-Learning modules. This integration depends on each study program. A specific section is devoted to the measure of promotion of the use of high-quality OER in educational institutions and adds that the acquisition of digital learning materials with costs generally depends on the financial strength of the educational institution in question. The network between universities in terms of Know-how-transfer should continue to be built, which is maintained largely through the ELAN eV. cooperation and counseling; libraries and research centres are also to cooperate in order to support integrating the information competence in the universities.

Regulatory frameworks within HEIs

Most of the regulations regarding digitalisation in higher education are proposed by and for the universities, being no higher education general regulation in Lower Saxony.

For example, at the University of Oldenburg,

> *the institution-wide implementation of digital media to enhance on-campus learning is seen by the university management as a strategic issue and an area in need of further development. Thus, a task force has been established, involving various stakeholders from university management and strategic planning, as well as the faculties and departments for continuing education and teacher training, in a top-down/bottom-up approach. (Bond, Marín, Dolch, Bedenlier & Zawacki-Richter, 2018, p. 6)*

The current Development Plan of the University of Oldenburg (HEP, 2016) proposes digitalisation in the context of three thematic areas: research-based learning (through the support of individual and collaboration tools), teacher training (media competence, media education as cross topic and development of digital materials) and open university, further education and equal opportunities (flexibility of learning offer, development and use of OER and promotion of digital supported recognition processes).

However, most of the higher education institutions have not yet developed a specific strategy for digitalisation at their universities. Some of them include digitalisation as part of the guiding themes of their university.

Projects and initiatives

The OER World Map show 6 projects in the state of Lower Saxony. Some of the most relevant for the context of higher education are as follows.

eCULT+ (eCompetence and Utilities for Learners and Teachers, 2011-2020) is a project in which 13 Lower Saxony universities [6] and two associations (Stud.IP e.V. and ELAN e.V.) take part to improve the quality of teaching with the aim of an intensive and broader, didactically meaningful, implementation of digital technologies. Teachers and students are to be provided with digital tools for the didactic fields of action of teaching/learning organisation, eAssessment and video-based teaching and learning across locations and are to be taught competences in dealing with them.

The project MOIN - Multiplicators for OER in Lower Saxony (Technische Universität Braunschweig, Hochschule Hannover, Kreisvolkshochschule Ammerland, Universität Osnabrück and ELAN e.V.) (2017-2018) focused on developing together concepts and further training offers for schools, universities and adult education regarding the topic OER and handling with open licenses, with the support of the Servicestelle Offene Hochschule Niedersachsen gGmbH.

The project OpERA (OER in the academic further education) (2017-2018) had as aim to strenghten the use of OER in the further education context within the network of open universities (School of Advanced Professional Studies, und Universitäten Weimar, Ulm and Oldenburg) through an offer of qualification, counseling and connection.

Teach4TU is a project that forms part of the Group Teaching and Media Education of the Technische Universität Braunschweig that works on the advancement of the quality of teaching at the university and includes a university qualification and counseling offer for teachers to implement innovative teaching and learning concepts. Related to (O)ER, and apart from workshops and seminars (including OER training), the project puts at disposal of university teachers a learning space to discuss and try out different technologies and ideas for its implementation in the classroom, digital tools for the university, new rooms for teaching and learning and an Augmented Reality app developed by the group.

Actors and bodies

Many universities in Lower Saxony work together as members [7] of the ELAN e.V. [8], which is considered a change actor and infrastructure provider for the improvement of the quality of technology-enhanced teaching, and also a platform for exchange and cooperation for the distribution and facilitation of information. Stud.IP e.V. is an association composed of developers of the Stud.IP open source learning management system that form part of the eCULT+ participating universities and its aim is work together to improve towards an always more user-friendly system. University libraries and research centres are also considered important actors to cooperate with universities in terms of integrating information competence in the study plans.

3.1.2 North Rhine-Westphalia (NRW)

NRW is Germany's most densely populated state, and within its 70 higher education institutions (public and private, universities, art and music conservatories, theological institutions and universities of applied sciences) 763.000 students were enrolled in the winter term 2018/19 [9]. NRW is also the state of Germany hosting the only state-funded distance teaching university in Germany, the FernUniversität in Hagen.

Digitalization strategies

The digitalization strategy of NRW can be considered among the ones attempting to provide an understanding of digitalization and to delineate this complex concept: In the previous and also the current 2019 version [10], digitalization is described as a complex phenomenon that needs to be considered from four major perspectives:

- ethical and legal dimension - negotiation of the role A.I., human and machine interaction, targeting questions of data protection and data use
- social and cultural dimension - reflection of digitalization's role within society through acknowledgement of its benefits and challenges
- economic dimension - emergence of new economic models and job profiles and positioning of digitalization as a way to meet major challenges of our times
- scientific-technical dimension - acknowledgment of importance of a strong technical infrastructure and emphasis on the role of research and its application in these fields (Digitalisierungsstrategie NRW, 2019, p. 5, translation by the authors).

In the parts of the strategy that focus explicitly on education and research (in higher education), the education of pre-service teachers in regard to their preparation of employing educational technology in the classroom emerges to be a crucial target (p. 25). Higher education is also depicted as the place where "tomorrow's digital professionals" (p. 26) are being made and in support of this claim, a number of large-budget development and network initiatives are to be introduced (see 1.2.3) across NRW higher education. OER are explicitly mentioned as an area of special interest, as are Open Access and Open Science.

Alongside these initiatives within education, the strategy also promulgates six areas of research that will be in focus and prioritized in research funding: Big Data, A.I. and Human Machine Interaction, Data security and data protection,

Digital society, Digital infrastructures as well as Transfer (p. 45).

Regulatory frameworks within HEIs

Reinforcing the greater impetus to establish digitalization strategies, higher education institutions in NRW have started to develop and implement institutional digitalization strategies according to their specific profile and institutional mission and vision. The extent to which they have made progress in so doing varies greatly: Universities such as the Universität Duisburg-Essen (UDE) has done so as early as 2014 with its E-Learning Strategy that was developed further into a "Strategy for Digitisation in Teaching and Learning" (Universität Duisburg Essen, 2017). Some goals of the UDE' strategy for digitisation are related to assuring teachers with high-quality support in expanding their e-learning activities, enabling regular feedbacks, further improving quality of learning or promoting networking. The UDE emerges to be an interesting case for digitalization insofar that it combines a very strong research profile in the field of educational technology across all segments of the education systems, numerous applications of digitally mediated teaching and learning as well as hosting the executive office of elearning.nrw as part of the research center "Learning Lab". With elearning.nrw, the state of NRW has, as early as 2008, established structures to foster the use of educational technology and digitally mediated learning across its higher education institutions. The NRW Ministry for Research has commissioned elearning.nrw to conduct workshops and dissemination of information on this topic, including an annual conference.

Furthermore, UDE has developed an OER platform as a repository for the university, and which is part of the UDE' strategy for digitisation in studies and teaching, in collaboration for the design and implementation with the Digital Library Department of the University Library (UB) and the Learning Technologies Division of the Centre for Media and Information Services (ZIM).

Projects and initiatives

As outlined in the digitalization strategy for NRW [11], the field of higher education in the state is targeted by policy efforts on the state level mainly through four major projects and initiatives, which will be presented in the following sections. The first initiative finds its place as part of the policy development, whilst the remaining three will be allocated more strongly to change processes on the meso level.

Out of the 70 existing higher education institutions, 42 have joined forces via the network Digitale Hochschule NRW (DH-NRW) and work towards the aim of fostering digitalization among the institutions across the state and also to permeate institutional structures, including teaching and learning, and higher education management. The DH NRW (established 2016) not only operates as a consortium that is singular in the country, but also claims ground as a platform addressing political and strategic questions and issues (DH NRW, n.d.). Under the umbrella of DH NRW a range of projects is being operated, these being partially funded with money from the "Digitalisierungsoffensive" described below.

As stated in the NRW digitalization strategy, two ideas/projects stand out - the above-mentioned focus on OER as well as the state-wide study portal, which are of elevated interest in the discussion of infrastructures and the idea of inter-institutional repositories. Being coordinated by UDE and labelled as "Content Marketplace NRW", this one year-long project serves as a pilot endeavor into the technical set up of a state-wide platform that integrates institutional learning management systems and different repositories. Special attention is paid to the integration of OERs as well as barriers and challenges to such an undertaking. This project is an interesting case as it seems somewhat contradictory to the intention of EduArc to investigate and pilot the structures needed for a national platform. Both projects could also be read as an exemplary challenge of the German education system being torn between having a national perspective in mind and state solutions at hand. However, in the case of the "Content Marketplace NRW", it is important to note that linkages have been established with projects in the states of Ruhr-Universität Bochum (consortium-leading), Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen, Fachhochschule Aachen and Hochschule Bochum.

Similarly following the idea of exchange of practices and accumulating individual e-learning projects across the state in one place and increase their visibility, the second project in this line is "Online-Landesportal für Studium und Lehre" that is also set up as a pre-project and with the perspective to merge with "Content Marketplace NRW". These two projects

clearly show that the state has the overarching interest to assemble disparate projects and initiatives into larger networks and connected endeavours. This is being encouraged through state-level policy and specific funds allocated to this end.

Under the title "OER-CONTENT.NRW" a call is open to work towards this state-wide platform, indicating that the pilot projects mentioned above have been successful in collecting the needs and demands of higher education institutions in this specific field [12] . Similarly targeting a platform and reusable, open contents is the project "DIGI-KOMP.NRW". Within this project, a consortium of various NRW higher education institutions aims to provide study materials for beginning and first year students in oder to close gaps in knowledge between school and higher education [13] .

Two other interesting projects regarding (O)ER and its integration are firstly Digital University Bridge Western Ruhr Area I Niederrhein (2012-2019) (University of Applied Sciences Niederrhein, Rhein-Waal and Ruhr West, and the UDE), which aims at the cooperative design of digitalisation for teaching and learning, including many activities related to instructional design and OERs. Within the second project Studiport, openly accessible online offerings were created with the intention to support first year students in their transition to higher education, for example including online self-assessments or introductory courses to mathematics and academic language use. This project was launched by Ruhr Universität-Bochum and the Standing State Rector's Conference.

The creation of the UDE above-mentioned repository (1.2.2) was conceptually framed in the project "OER-UDE: Open Educational Resources at the UDE" (2016-2018) at the Learning Lab of UDE and as part of its e-Learning strategy. In this project, information workshops on the topic of OER were conducted and it was examined how OER materials could be more strongly integrated into teaching at the UDE. It was also developed a concept for how materials from the university can be made available as "open educational resources" with corresponding licenses (OER) on university platforms in the future and how available OER materials can be increasingly used in teaching. The technical implementation was carried out jointly with the Learning Technologies Division of the Centre for Information and Media Services (ZIM) and the University Library (UB) of the UDE.

Another project related to OER in the UDE was "Mainstreaming OER" (2016-2018). It aimed at sensitising and qualitifying multipliers from schools, universities and adult education for the potential of digitised OER. Cooperation partners were the Ministry for Schools and Continuing Education in North Rhine-Westphalia within the framework of cooperation with the Media Consultancy NRW and the Ministry for Science and Innovation NRW within the framework of the elearning NRW network. In a first round, short workshops sensitised multipliers from all areas of education to the advantages of working with open educational materials. After the first round the concept was adapted to the needs of the respective target groups (university, school and adult education).

As one of the most recent developments, the state has launched a portal, ORCA.nrw that is intended to serve as a meeting point of different initiatives and offering online learning and teaching materials to students and instructors.

Actors and bodies

On the state level, the North Rhine Westfalian Ministry of Culture and Science is a central and influential actor not least because of its simultaneous function as policy and funding instance. Within the ministerial unit Higher Education and Research "Digitalization in higher education and research" is firmly entrenched, making primarily reference to the four above mentioned projects and initiatives.

The Scientific library center of the state of North Rhine-Westfalia (Hochschulbibliothekszentrum des Landes Nordrhein-Westfalen (hbz)) assumes a prominent role in regard to provision and further development of digital infrastructures. The OER Worldmap project, referenced earlier in this report, was also carried out by the hbz.

With the DH NRW constituting an umbrella for both a range of projects as well as forming a platform for exchange and networking, this consortium sends a strong signal: for once re-emphasizing the state-level sovereignty over education and strengthening the state's position within the national context. And second, the benefits of exchanging perspectives and ideas come as a clear advantage when piloting and implementing new approaches to (digital) learning.

Last but not least, the individual higher education institutions in the state emerge as actors and bodies for the actual implementation and day-to-day application of any digital tools and digital pedagogies.

3.1.3 Hamburg

In contrast to Lower Saxony and North Rhine-Westfalia, Hamburg is one of the so-called "city states" in Germany, referring to cities (Berlin, Bremen and Hamburg) which gained state-sovereignity and are treated like the remaining 13 states, including independency in educational matters. Hamburg is home to 20 higher education institutions, both public and private and including universities, universities of applied sciences and institutions with a very focussed study offer, and which have roughly 109,000 [14] students enrolled.

Digitalization strategies

Compared to the other three examplary states chosen for this report that have developed extensive documents that capture a number of aspects in a very detailed manner, Hamburg has drafted a strategic document in 2015, targeting digitalization of the metropolitan city. This document deviates both in extent as well as layout from the other strategies considered in the report. (Higher) education receives attention through the inclusion of the Hamburg Open Online University (HOOU) as the central project to be developed from 2015 on. It focuses on the creation of OERs by all the Hamburger Higher Education institutions and on their quality (Stadt Hamburg, 2015, p. 4). In August 2019, looking back at the developed of the HOOU, it si interesting to note that this endeavor received extensive funding, was marketed with enormous effort - and nevertheless lost a major force and the largest of the participating universities with the University of Hamburg leaving the alliance in early 2019.

Regulatory frameworks within HEIs

Some of the universities in Hamburg have developed their own institutional digitalisation strategy. For example, the Technical University of Hamburg (TUHH), proposes the following aims: improving teaching through digitalisation, education for a digitalised working and living environment, and its contribution to the expansion of the knowledge society (p. 3). These measures include hiring a specialist speaker for media-supported teaching and learning, and developing digital teaching and learning formats through a Digital learning Lab.

Another case with a strategy for digitalisation is HAW Hamburg, which establishes four goals: digitisation in teaching, learning and continuing education; digitisation in research and transfer; internal processes and IT infrastructure/services; and dialogue, discourse and networking in digital change. [15] Concerning digitisation in teaching, learning and continuing education, the focus is on the development and promotion of competences for a digitised world of work and society. It concretely addresses open education, specifically: "HAW Hamburg also promotes the education of its students for a global digitized world of life and work in the spirit of Open Education" (translation by the authors). Evaluative quality assurance measures are also mentioned.

Projects and initiatives

Hamburg has developed many initiatives and projects regarding OERs in higher education institutions. Here some of the most representative are mentioned (Universität Hamburg, 2019a; 2019b):

- "Synergies for teaching and learning through OER" (2017-2018) (SynLLOER). Teachers at Hamburg schools and universities were sensitized to OER through information materials, information events, workshops and an open range of workshops, and actively encouraged to engage in further joint and productive exchange across subjects and institutional boundaries. One of the initiatives of this project is the magazine "Synergie" for providing information on digitalisation in teaching. Other initiatives included counseling and workshops regarding OERs, media support, and the evaluation of OERs.
- HOOU@UHH (2017-2018) focused on the creation of OERs for different disciplines of the Hamburger universities.
- openLab at the Digital University College (UK Digital), which offers comprehensive technical equipment and advice for interested teachers and support to OER projects.
- ApptogoHH-App (2018-2019). As part of this project, an app has been developed that enables students, employees, schoolchildren and other interested parties to learn about the contents of the courses in a practical context. In addition, this app supports learning on the direct object and the direct application of theoretical knowledge. Teachers can use this app to create a wide variety of learning content as an analog walk-through tour - similar to a scavenger hunt - without any further programming knowledge.
- eManual Ancient History (2017-2019). It is an introduction to ancient history and contains mostly OERs. Users can learn ancient history through podcasts, translated ancient sources (with comments), secondary literature and additional materials (e.g. ruler lists).
- Mapping Democracy - 100 years of (educational) democracy in Hamburg (2017-2019). The project produced the first OERs on the development of democracy in Hamburg between 1919 and 2019. An interactive city map embedded in a weblog links virtual and real learning locations and contents and makes them visible together.
- Study compass in the teaching profession: fields of action and perspectives of future teachers (2017-2019). At www.lehrerinhamburg.de, the project provides information on the requirements of the teaching profession in various fields of action and shows the development lines of teacher training. The Learning Scenarios (OER) can be used for self-study without a seminar link.

More projects can be found at
https://edtechbooks.org/-GDqh

Actors and bodies

The University College (Universitätskolleg) is one of the main actors within OER in higher education in Hamburg. It was founded in 2012 as central organisational unit of the University of Hamburg. As an educational institution, development and experimental laboratory, communication, coordination and cooperation platform and think tank, it is intended to contribute to the improvement of teaching. In 2017 the UK Digital was created through the reorganization of the University College into three areas, which are to equip the overall idea of the UK as a development and experimental laboratory, communication, coordination and cooperation platform and think tank with a different focus in the future. The UK DIGITAL brings together several projects on new developments for digitisation in teaching. The projects at UK DIGITAL mainly cooperate with individual lecturers and are simultaneously integrated in several inter-university overall projects at the Hamburg location or nationwide (Universität Hamburg, 2019b).

The HOOU is a key actor in the development and implementation of OER in Hamburg. At the beginning of 2015, the Hamburg Senate adopted a "Digital City Strategy" to bundle the digitization processes of the Hanseatic city and create structures for them. The Hamburg Open Online University (HOOU) is responsible for education. This inter-university project is supported by the network of the six state universities* in Hamburg with the Ministry of Science, Research and Equality, the Senate Chancellery and the Multimedia Kontor Hamburg (see Figure 9). The special feature of the HOOU concept lies in the desire to create a digital space in which students, teachers and the interested public can meet in order to collaborate on interdisciplinary, cross-university projects with academic demands. Four aspects serve as their guiding principles [16]: learner orientation and collaboration; being scientific; opening up to new target groups and civil society relevance; and openness/OER. The HOOU is oriented towards the idea of Open Education. It aims to make learning materials available as OERs and pursues technological openness through the use of open source software, legal openness through the use of open licenses, social openness as well as the opening up of action and learning opportunities.

3.2. Change

3.2.1 Promotion of change

Change within the states is effected mainly through two measures, following a top-down approach:

- The strategies for digitalisation developed in each federal state and increasingly across each higher education institutions are a top-down approach to impulse change at the university level and other areas of society.
- Within the field of higher education, further change and concrete measures are fostered through funding schemes that allow for project-based initiatives and structural implementation at the institutional level of higher education institutions.

It needs to be noted, however, that these changes can include infrastructures for storing and disseminating (O)ER but most often they primarily involve teaching-based projects and initiatives that have the focus on broadening knowledge and competencies to use and implement educational technology into teaching and learning processes.

In their study, Gilch et al. (2019, pp. 240) list state-based digital teaching networks, the ones within NRW and BW serving as advanced examples, and herewith show that networking at least within the individual states has increased in scope and also in institutional structures. In this context, the Virtual University Bavaria ([Virtuelle Hochschule Bayern](#)) is worth mentioning. The VHB is a cooperation between a number of universities in the state of Bavaria, that offer their students the opportunity to interchange classes that are being offered online. The VHB also has an [Open](#) section, containing classes that are open to the public, are free of charge and are directed at people interested to broaden and further their knowledge. This reiterates the observation that there are solid networks within the states that serve to connect institutions and their stakeholders in teaching and learning - however, the topic of metadata or the underlying and necessary infrastructures remain issues that are not prominently addressed or that laymen's attention is directed to.

As the report by Gilch et al. (2019) shows, higher education institutions have picked up the impetus to digitalize - especially in the area of teaching with 18.8% of institutions having a digital teaching strategy in place and 50.9% working on it (n=112). In regard to developing and drafting digitalization strategies, this push is most likely affected by a great extent through institutions participating in the peer to peer coaching for strategy development in the context of the Hochschulforum Digitalisierung. It can be assumed that the visibility of this forum and the spotlight that has then been on digitalization activities of all sorts has had its share in this topic. Hence, this is an example in which a national initiative has somewhat "skipped" the state level and has directly infused individual institutions.

Following from the recapitulation of the four example states as well as the report by Gilch and colleagues, we tentatively put forward the assumption that most institutions have rather reacted to the increased presence and discourse of digitalization on the national and state level - and a certain pressure to adapt that comes along with it and that is both created through comparison and competition with other institutions, as well as the blend of high-level policy and funding programs (see also Fig. 11). This also shows in the fact that most institutional digitalization strategies were developed over the past three years. Only a few fore runners had strategies prior to that.

Fig. 2

Assumed change processes across higher education institutions (HEIs), own representation
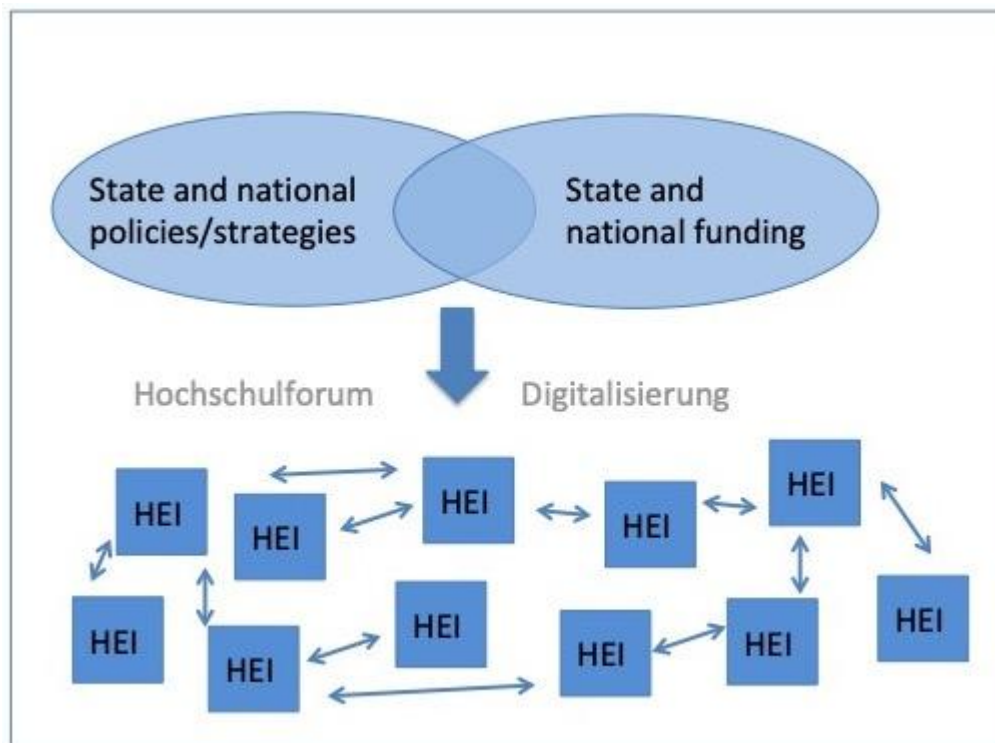
Lower Saxony

In the case of Lower Saxony, the funding of the Lower Saxony Ministry of Science and Culture for Teachers focuses on financing projects that propose innovative teaching and learning concepts. These innovative teaching-learning projects are to be promoted by working groups or teachers who support students in the learning process and whose results are to be made available as materials or experience reports in an OER portal. One of the possible contributions of the project could be directed at digital teaching/learning methods and sustainability of the project idea beyond the funding period should be taken into account. Another measure in Lower Saxony, which is being replicated in other federal states, is the establishment of digitalisation professorships at universities that receive additional support from the Volkswagen Foundation. It is interesting to note that the subjects for these digitalization professorships stem from a range of fields related to digitalization, also emphasizing its technological and informatics side - and herewith going beyond the mere focus of digitally enhance teaching and learning.

North Rhine Westfalia

As stated in the digitalization strategy of NRW, aiming at equipping both students and instructors in higher education with the actual competencies to navigate in digitalized teaching and learning environments, the program "Data Literacy Education.NRW" will be launched for students and instructors will be encouraged to participate in workshops on digital teaching.

Alongside this program, the so-called "Digitalisierungsinitiative" is also one of the four key elements of the state's strategy, supplementing the DH NRW and its broader activities with an extension of the

> existing budget by an additional 50 million Euro from 2019 and 35 million Euro from 2022 with the intention to foster integration and implementation of digitalization into the main functions of higher education institutions, including technical infrastructure. As detailed above, OER and the establishment of a state-wide e-learning portal are in the focus here. [17]

And finally, providing incentives for developing new and innovative teaching practices, "120 Fellowships for digital teaching" will be awarded between 2019 and 2021, continuing an existing funding scheme. Instructors will receive

funds and the space necessary to develop digitalized teaching approaches and are invited into forming networks with other fellows to exchange experiences.

Hamburg

It can assumed that in the case of Hamburg, the HOOU serves different aims and intentions and is policy and change at the same time. As Gilch et al. (2019, p. 151) reveal, the budget for HOOU is to amount to an annually 5 Mio € for each year from 2019 to 2022 and this consortium is perceived to be one of two central pillars of the city's digitalization strategy. The HOOU has also been prominently featured in a specially designed outlet "Synergie" publishing theory and practice-based works related to the idea of open and being itself, not surprisingly, an open access publication.

3.2.2 Institutional strategic planning

Institutional strategic planning occurs mostly - at least publicly visible - through digitalization strategies that take different scopes and shapes. With these strategies being political and strategic documents, they only hold limited information on the actual technical and technological details and necessary steps to be undertaken when it comes to actually implementing infrastructures.

Whilst change, in the sense of providing a policy frame and funding, is primarily effected in a top-down manner on the state-level, the extent to which this translates into practice is thoroughly dependent on the individual higher education institutions. Some of them, such as the UDE, have managed to align research, consulting and teaching practice for their institutional purposes, whilst others have been rather slow in the uptake of digital teaching practices. Even within universities, variations exist between schools and disciplines that are either keen to adopt digital media or rather demonstrate resistance (Hetzner & Schmidt, 2017).

Finally, what needs to be noted on the side is that for most projects involving the development and implementation of digital formats in teaching and learning (as well as administration and research), it becomes increasingly difficult to attract software programmers and informatics specialists. This is due to the fact that universities, as part of the public service structure, cannot always compete with the salary level of private companies (Gilch et al., 2019, p. 116). Furthermore, against the background of the increasing number of digitalization projects that are being demanded for and within higher education, there is a shortage of qualified workforce who could meet that demand. This shows both in the appointment of CIOs as well as IT-staff.

3.3. Infrastructure

On a general level, IT infrastructures within higher education broadly exist but are not yet – for the most part – integrated and interconnected (Gilch et al., 2019). As the report by Gilch and colleagues shows, both universities and universities of applied sciences indicate with a vast majority that they have a number of IT systems in place and that users are being supported in regards to the fulfillment of their core activities within the institutions. However, respondents also stated that the systems are not thoroughly connected with one another and only about 10% of institutions confirmed that a full digital workflow actually is possible for their users.

3.3.1. Consortia

Again, the report by Gilch and colleagues (2019) provides the helpful and general insight that higher education institutions also enter cooperations with other institutions to foster, for example, the digitalization within teaching and learning (72.1%) and the digitalization of the infrastructure (67.3%) (p. 128).

An interesting development here is [Edu-sharing](#) which stands out as an open source e-learning integration solution for a repository for the co-operative creation, management and usage of learning objects, which is not only used in HE, but it is extended in some HE institutions in Germany. It was developed as a product of the DFG-project Campus Project initiated in the University of Hagen (2004-2009) with the target on academic education. The exchange between learning repositories is the main objective of the platform. It is based on the Alfresco document management system and supports arbitrary metadata sets such as LOM and Dublin Core and offers interfaces to systems such as Moodle, ILIAS,

OLAT and MediaWiki, as well as content items as SCORM-courses, QTI-compliant tests and drills, and H5P-objects, being each repository is still an independent content-pool.

Since the end of the Campus Project in 2010, edu-sharing is currently coordinated by the edu-sharing association as a consortium based in Weimar to allow the creation of edu-sharing communities that could negociate and define their needs and priorities for further development. According to the project team (Klebl, Krämer & Zobel, 2010), there are four networked installations at Bauhaus Universität Weimar, FernUniversität, Universität Leipzig and the Communal Computing Centre Lower Rhine (schools), and two unconnected edu-sharing installarions in Schmalkalden and Stuttgart and two new membership applications from regional computing centres in NRW. Non-commercial and commercial institutions are invited to apply for a fee-based membership in the edu-sharing association. The authors acknowledged that

> the main difficulty in acquiring users lies in the fact that our main target group are not individuals but educational institutions that recognise the benefits of cross-institutional sharing of educational experience and cooperative development of scholarly content. Attracting such partners, negotiating individual (adaptation) needs, formulating corresponding legal contracts, and waiting for final decisions just requires a lot of endurance and time. [...] We have also good chances that edu-sharing be adopted as part of the e-learning infrastructure for the universities in Thuringia, Germany, and we are optimistic that ongoing negotiations with several other German universities will end positively (Klebl, Krämer & Zobel, 2010, p. 949-950).

Another consortium is the Virtuelle Hochschule Bayern which was constituted of a network of 9 universities, 17 universities of applied sciences and 4 other HE institutions in Bayern in 2000. Within the platform, online courses are developed and shared among the universities. Three different modalities to participate in those courses are offered: classic modus (students in those HE institutions can obtain ECTS for their studies, for free), open modus (everyone interested in the courses can have a look at them and use them for themselves) and smart modus (those are blended-learning units with the possibility to integrate them in a flexible way in the traditional face-to-face courses). Companies and other educational institutions can use the "open" courses freely, but the "classic" ones as well, with a fee.

A third consortium is HOOU and it is a good example of a regional consortia where shared OER are offered. As researcher leader of a project among the network partners full rights to create and edit own OER in the platform are granted. As metadata specifications, the Learning Resource Metadata Intiative (LRMI) is cited and described as important in learning offers (courses) to be able to use the OER in other contexts. It is also mentioned in the case of educational materials, as smaller units of contents than learning offers.

Lower Saxony

The Merlin-Portal is the OER portal in Lower Saxony for schools that is hosted centralised in the Niedersächsischer Bildungsserver. Recently, the project OER-Portal Niedersachsen (2019-2023), funded by the Lower Saxony Ministry of Science and Culture, has developed a portal for OER in HE in Lower Saxony based on the edu-sharing platform (TIB Hannover) [18] , [19] . Along the creation of this portal, the connection of the new portal to other ones (search function) is expected. In this development, there are different institutions that are cooperating: TIB Hannover, ELAN e.V., HIS Institut für Hochschulentwicklung e.V., Hochschule Emden / Leer, Universität Osnabrück (vitUOS) und Stud.IP e.V.

Another initiative that was funded as a project from December 2013 until December 2015 by the Ministry of Science and Culture of Hannover and carried out by ELAN e.V. was the OHN-KursPortal. This portal was thought as a platform to host online courses addressing the target group of the Offenen Hochschule Niedersachsen, apart from offering information and counseling as part of the Servicestelle Offene Hochschule Niedersachen). Within this platform, ELAN e.V. put at disposal different mathematics online courses. However it is no longer active.

North Rhine Westfalia

NRW has developed many OER infrastructures, some of them representing consortia among universities. In some other cases, there are OER repositories of individual institutions. The report in Heureka.NRW informs about some of those

initiatives and describes them. A summary is included as follows.

Some institutional consortia are the following:

- [NRW Digitale Hochschule](). It is a cooperation association of 42 HE institutions and the NRW Ministry of Culture and Science that aims at establishing a shared infrastructure in NRW for digital transformation. Within these networks the development of a Landesportal DH.NRW is planned and some of the current projects and funding lines are involved with the HE digital infrastructure for OER, e.g. OER-Content.NRW.
- [Bridge](). This was a cooperation project between the Universities of Applied Sciences Niederrhein, Rhein-Waal, Ruhr West and the University Duisburg-Essen. The aim was to promote the cooperative design of digitalisation in teaching and learning. A specific OER product was made in the area of Business Administration.
- [digiLL](). This was a cooperation project for pre-service teacher training initiated by the University of Bochum, TU Dortmund, Uni Duisburg-Essen, Universität zu Köln and Universität Münster (2016), currently transformed into a university cooperation. Recent incorporation as members include the Universität Trier and Universität Koblenz-Landau (2019). The initial aim of the project was to collaboratively develop university learning modules related to the topic of media competence and didactics of the media and digital and subject-area competences. However, in perspective, it is expected that new members will bring their different thematic and methodic areas. The learning modules are created in the infrastructure of each university (each LMS), then reviewed and received feedback before being shared in the digiLL repository.
- [OERlabs](). It is a cooperation project between the Institut für Allgemeine Didaktik und Schulforschung of the Universität zu Köln and the Fachgebiet Pädagogik of the TU Kaiserslautern since 2017. The aim is to bring OER strongly to the teacher education studies.

Institutional OER repositories in NRW are:

- [OpenRUB]() (University of Bochum). It includes Moodle courses, course concepts, videos, websites and stand-alone educational materials of all the disciplines.
- OER an der [Universität Duisburg-Essen](). The OER are part of the general repository of the university (DuEPublico), which is managed by the university library and is based on the Repository-Framework [MyCoRe]() and other open source components. It is possible publish OER in the repository and search for them. OAI-PMH interoperability is mentioned.
- [Youtube Kanal]() Civil Engineering RWTH Aachen University. The focus is on the many facets of bacis and current research in the area of Civil Engineering , by building up a set of standard features in Civil Engineering as OER to be used by any student or university. The initiative was founded as part of the Blended Learning and Exploratory Teaching Space (2014-2017) campaign of the RWTH Aachen University.
- [WeBWork]() (Universität Siegen). This is an institutional project aimed at translating English OER in the area of mathematics into German OER and sharing them in the WeBWork portal.
- [Offenen FernUni Hagen](). Since 2017, this is the open learning platform of the FernUni Hagen to offer online courses (e.g.MOOCs) or OER to any person, even if they are not registered as students at the university. There is also the possibility of developing cooperations with other universities in Germany and abroad.

Although not an institutional initiative, but promoted from the association ILIAS e.V. and company lernmodule.net gGmbH for schools and universities, the [openUP]() project can be highlighted (2016-2018). The aim was to engage teachers in schools and universities to use and publish OER. The offer included workshops, a network service and OER materials and information.

Hamburg

Being a small state with a diverse and heterogeneous higher education institution landscape nevertheless, Hamburg has also prominently launched the Hamburg Open Online University, which is a prime example for a consortium of institutions. Whilst not a consortium that is solely focused on higher education, the [digital learning lab]() is a platform that provides teachers in K-12 with openly licensed material for school teaching and allows individuals to also create and disseminate materials. It is a joined endeavor that also includes the city municipality as well as the Technical University

Hamburg. Additionally, the [Multimedia Kontor](#) Hamburg needs to be mentioned, which is not exactly focusing on OER per se, but rather on the range of topics revolving around the digital transformation of higher education. It is organized as a joint initiative by the six public higher education institutions in Hamburg and offers counselling and support services.

3.3.2 Communication and exchange between repositories

So far, the picture remains disparate and incoherent, with the idea of the state and their respective educational governance being influential. As the digitalization strategies on the state level reveal, the states are primarily concerned with infrastructures within their state and the linkage between institutions within the state.

Not for higher education, but for the school sector the platform [MUNDO](#) that serves open educational materials under the self-label of a "Bildungsmediathek der States" to teachers in K-12 is to be mentioned. It is a joint initiative of the 16 states and aims to provide an overview of existing digital materials, to check them for quality and licences so that they can be safely implemented into the classroom [20]. Quality assurance is included in MUNDO through an expert group, as is also the use of LTI as an interface for integration into schools' individual Learning Management Systems. Against the background of the German federalism, the entire project is rather noteworthy.

3.3.3 Public and commercial entities involved

Against the background of the predominantly public German education system, commercial entities do not assume a prominent place, however, associations do, e.g. JOINTLY (to some extent) and the [Bündnis Freie Bildung](#). Whilst there is increasing critique directed against the (potential) influence that (educational) technology companies and its advocates exert on and within education (e.g. Förschler, 2018; Niesyto, 2021), OER is a topic that is mostly driven by active participants in respective communities, rather than industry.

3.4 Quality
3.4.1 Institutional quality assurance mechanisms

Quality of OER remains a contested topic, with the Hamburg Open Online University being closely affiliated with quality assurance due to the publication on OER and quality by Mayrberger and Zawacki-Richter (2017, 2018).

As there is no overall benchmark for quality of OER, initiatives have taken to individual solutions and approaches. In the case of the recently established OER repository [TWILLO](#) in Lower Saxony, quality is addressed via seven [indicators](#) that were developed by researchers at the University of Oldenburg in the context of EduArc:

- Discipline-specific content knowledge
- Reusability
- Application and Transfer
- Support
- Motivation
- Structure, navigation and orientation
- Design, intelligibility, accessibility

Other consortia, such as the Virtuelle Hochschule Bayern, also state that their e-learning courses undergo quality assurance mechanisms, e.g. student evaluations, pedagogical and content-related external evaluations, financial support in order to rework courses upon evaluation in order to maintain and raise their quality. For the open section within VHB, an extensive criteria catalogue is published and available [online](#) that external assessors can use in order to carry out the evaluation.

The state-wide OER repository in NRW – [ORCA.nrw](#) – states likewise that, under the guidance of one university, a quality assurance concept is being devised that takes into consideration e.g. the content, usability and pedagogy of the resource.

However, the quality assurance mechanisms are still in development as this quotation indicates.

Yet another initiative, the Universitätsverbund [digiLL](#) that is directed at teachers and sources its expertise from ten teacher education institutions, also highlights the aspects of openness and quality assurance in their description. digiLL makes use of a [quality](#) assurance process before, during and after production of materials and their publication. The quality standards include, among others, accessibility, user friendliness, content correctness and target group specific degrees of complexity.

3.4.2 Actors and standards

As can be inferred from the examples listed above, quality assurance remains a scattered topic that revolves around similar aspects, e.g. design, pedagogy, accessibility… - but that is "reinvented" for individual endeavors as it seems. Despite the fact that several portals and repositories follow a similar aim and interest, they do not join forces but rather seemingly resort to expertise present at the universities within the specific state and follow a quality assurance model developed there. Finally, the above presented projects do predominantly hint at content and pedagogy related aspects rather than interoperability or adherence to international standards in the realm.

3.5 Summary and preliminary conclusions

In this second part, we zoomed in on the meso level by means of comparing four German states and complementing those with insights from the comprehensive report by Gilch et al. (2019). Instead of providing conclusions for the meso level of digital transformation in Germany, we want to develop a number of statements that could be subject of further investigation or could be analysed comparatively with the situation in other countries:

Publicly available strategy documents in the realm of policy (national, state and institutional level) revolve around digitalization as a major force that needs to be used to the advantage of e.g. education. However, the technological, infrastructural and informatics-related aspects of it are less prominently featured in these documents, although they constitute the second - and necessary - pillar of digitalization within education alongside the pedagogical implications and settings.

Attributable to the German political system, it is obvious that change in the sense of matching policy with funding occurs to a great extent on the level of the states - with the large funding schemes by the BMBF constituting an exception, of course. However, the example of NRW shows a network has begun to form that results from a state policy, whose implementation is then driven by large fundings. States have their respective actors - in the form of more of less established and institutionalized networks and interest groups - and have created a diverse landscape of structures and institutions. This, however, means that a nationally concerted effort for e.g. a shared platform for OER seems like a very unlikely possibility against the background of these existing but scattered efforts.

Platforms and repositories for OER have been created for and by individual institutions (UDE in NRW) and state-wide networks (TWILLO in Lower Saxony; HOOU in Hamburg), which reiterates the states' individual identity and wish to position themselves as separate entities. This, when assuming a broader perspective on the notion of open, makes one wonder about how many opens there are in Germany and that establishing links between existing repositories seems a reasonable and timely approach.

Within each state, the individual institutions show different stages of development and adoption when it comes to both establishing digitalization strategies and the topic of OER as one part of this broad process. With some, naturally, being at the forefront, others take their time and have only recently increased their digital activities - with teaching assuming a prominent role - as part of their institutional development focus. And even within institutions, the pace varies.

With the following section looking at the micro level of individual institutions and the instructors therein, we also suggest that digitalization or, more specifically, the use of OER for teaching purposes is perceived mainly as a pedagogical endeavor, the fact that their dissemination and availability mainly relies on metadata and repositories (institutional or inter-institutional) is overlooked.

4. Micro level

4.1 Introduction

With policies and infrastructures for the creation and dissemination of Open Educational Resources (OER) in place on the national and state level in the German higher education context, OER have assumed their place in education policy and recent funding schemes of various kinds. Zooming in on the micro level of individual institutions and instructors provides additional information on OER developments and complements the multi-level view established across the diverse country reports within the project EduArc. Against the lack of empirical studies for the actual uptake, use and creation of OER, this section draws on a small scale empirical investigation in one German state (N = 76); focusing on topics related to OER alongside the topics of policy, infrastructure, quality and change. Descriptive statistics from this survey-based research are reported and conclusions are drawn – these require more extensive empirical scrutiny in order to deepen and delineate results more comprehensively. Limitations are addressed and an overarching conclusion is proposed that brings together finding from the macro, meso and micro level as previously reported as part of the EduArc country reports for Germany.

So far, very little empirical studies for the German higher education context exists that go beyond theoretical discussion and conceptualization of (O)ER in higher education – notable exceptions are recent studies by Otto (2019) and Lechtenbörger (2019). Both authors make first attempts to trace either the impact of the funded projects on OER in 2017 and 2018, making use of a meta-analytic approach (Otto, 2019) or show in an introspective report the different steps taken to create an OER for one's teaching (Lechtenbörger, 2019). Furthermore, Otto (2020) provides an empirical analysis of instructors' attitudes towards and perceptions of OER and relates them to actual uptake and use within schools, higher education and adult education.

Whereas a number of individual instructors are prolific in the creation, dissemination and uptake of OER, this has not yet translated into broad awareness and uptake. To this end a questionnaire was translated into German and adapted for use in the German higher education setting; questionnaires with a similar focus being used in Spain and Australia as part of the comparative country studies. This will not only allow to establish a small empirical base within Germany but rather allow for comparison between the three countries. As will be explained in the method section, the study sample is sourced from within higher education institutions in Lower Saxony.

In its structure, this micro level report follows the same thematic foci that were already established in the previous sections, that is infrastructure, quality, policy and change. As stated above, the structure is not directly visible in the chapter headings but expressed in the scope of the chapter.

4.2 Method

4.2.1 Procedure

For the purpose of this study, the questionnaire was set up in the online questionnaire tool Limesurvey at Carl von Ossietzky University Oldenburg. In close consultation with the data protection officer at said university, data protection measures were taken, participant information drafted and approved, and the accordant documents filed.

The scientific project leader approached the association ELAN e.V., asking for support in disseminating the questionnaire amongst the association's institutional members; these being 10 universities and universities of applied sciences in Lower Saxony [21]. It was deemed appropriate to focus on institutions located in own state, both for measures of proximity and connection via ELAN e.V. as well as similar institutional conditions within one state. Between 30 of September and 31 of October 2020, the questionnaire was online [22] and accessible for participation. No reminder for participation was sent (or could be sent) due to the fact that ELAN e.V. could only forward the invitation to the member institutions (e.g. vice presidents for education, deans, colleagues in the administrative position to disseminate the survey within their institutions) without knowing if these would actually be forwarded.

In order to ensure as much privacy and protection of personal data as possible, we did not ask participants to indicate the name of the institution they are affiliated with. Whilst this serves the purpose of data protection, it also means that we do not have any possibility to know which institutions are represented in the questionnaire. This constitutes a limitation to the study as it might only be one, two or three institutions present in the sample; therefore generalization is not possible. Generalization is further hampered by the fact that we only received 76 complete questionnaires. "Complete" was indicated via LimeSurvey and was then chosen as the criterion to use when selecting completed and uncompleted surveys.

4.2.3 Data collection instrument

The questionnaire that was used in this study is a translated version from the Spanish original version which was also developed within the context of the EduArc project. It was slightly modified, for example when defining the academic positions or the names of institutional units and services. A question on the use and creation of digital educational resources in the context of Covid-19 was added. The questionnaire is structured into three parts (A. basic information, use and creation of (O)ER, B. infrastructure for (O)ER, C. quality and infrastructure for (O)ER, D. (O)ER and infrastructure policy and regulations). All questions were voluntary and the opportunity was given to indicate no comment (keine Angabe) as well. The survey (in German language) can be provided upon request.

4.3 Results

4.3.1 Sample description

Out of 125 received questionnaires, only 76 were complete as per automated information in LimeSurvey. For the present study, the remaining 49 were discarded for consistency reasons – it might be of interest at a later stage to go back to these answers and check for patterns and topic at which participants decided to withdraw from participating. Out of the 76 participants, 35 (46%) are female, 39 (35%) are male and two (3%) do not report their gender. With 27 (36%) research associates are most frequently present in the sample, followed by 19 professors (25%). Full-time lecturers (Lehrbeauftragte für besondere Aufgaben) are the positions following (11, that is 14% with regular contract; 10, that is 13% with term contracts). One assistant professor (1%) and 5 others (7%) and two persons without indication (3%) follow. One person did not provide information on his or her position.

As indicated in Table 1, teaching experience is reported for the entire spectrum from one to over 20 years of teaching experience; with the groups of 4 to 7 years, 12 to 15 years and more than 20 years being most dominantly within the sample.

Table 1

Participants' Teaching Experience (In Years) (N = 76)

Teaching experience	Absolute	Relative
1-3 years	7	9.21%
4-7 years	17	22.37%
8-11 years	6	7.89%
12-15 years	17	22.37%
16-19 years	6	7.89%
+ 20 years	21	27.63%
No information	2	2.63%

Participants were also asked about the field of study that they conduct their teaching in; as Table 2 displays, it is the two fields Humanities (34.21%) and Mathematics & Natural Science (26.32%) that participants most often teach in. With 15.79%, Social Sciences are also relatively often represented, the other fields of study only limitedly.

Table 2

Participants' teaching across fields of study (N = 76)

Field of study	Absolute	Relative
Humanities	26	34.21%
Sports	2	2.63%
Law, Economics and Social Sciences	12	15.79%
Mathematics, Natural Sciences	20	26.32%
Medicine /Health Sciences	7	9.21%
Engineering	2	2.63%
Art, Arts	4	5.26%
Other	3	3.95%

Sixty participants (78.95%) report that they can decide on the creation and reuse of digital educational resources in the classes they teach, whereas 11 participants (14.47%) indicate that they decide jointly with other colleagues on the creation of digital educational resources. Three respondents (3.95%) can make use of resources provided to them and do not have to create them themselves and two (2.63%) indicate other.

4.3.2 Use of (open) digital resources

As a precursor to the further results, the (open) digital resources are described that instructors reported to use in their teaching.

Table 3

(Open) digital resources used for teaching purposes (N = 76)

Resource	Never	Seldom	Sometimes	Often	Always	No comment	No answer
Text-based material (e.g. Notes, Instructions)	3 (3.95%)	6 (7.89%)	14 (18.42%)	32 (42.11%)	17 (22.37%)	1 (1.32%)	3 (3.95%)
Tests and Quizzes (e.g. online surveys)	25 (32.89%)	18 (23.68%)	14 (18.42%)	7 (9.21%)	7 (9.21%)	1 (1.32%)	4 (5.26%)
Presentations (e.g. slides)	3 (3.95%)	2 (2.63%)	5 (6.58%)	25 (32.89%)	39 (51.32%)	0 (0.0%)	2 (2.63%)
Videos (e.g. Tutorials, screencasts)	10 (13.16%)	11 (14.47%)	18 (23.89%)	25 (32.89%)	8 (10.53%)	1 (1.32%)	3 (3.95%)
Podcasts	49 (64.47%)	8 (10.53%)	8 (10.53%)	4 (5.26%9	3 (3.95%)	0 (0.0%)	4 (5.26%)
Images	6 (7.89%)	3 (3.95%9	9 (11.84%)	34 (44.74%)	21 (27.63%)	0 (0.0%)	3 (3.95%)
Infographics	11 (14.47%)	5 (6.58%)	18 (23.68%)	27 (35.53%)	12 (15.79%)	0 (0.0%)	3 (3.95%)
Games	47 (61.84%)	14 (18.42%)	8 (10.53%)	4 (5.26%)	0 (0.0%)	0 (0.0%)	3 (3.95%)

Resource	Never	Seldom	Sometimes	Often	Always	No comment	No answer
Simulations	46 (60.53%)	14 (18.42%)	8 (10.53%)	5 (6.58%)	0 (0.0%)	0 (0.0%)	3 (3.95%)
Courses/Modules	33 (43.42%)	12 (15.79%)	8 (10.53%)	6 (7.89%)	7 (9.21%)	6 (7.89%)	4 (5.26%)
MOOCs	59 (77.63%)	2 (2.63%)	1 (1.32%)	0 (0.0%)	0 (0.0%)	8 (10.53%)	6 (7.89%)
Blogs	48 (63.16%)	8 (10.53%)	14 (18.42%)	0 (0.0%)	2 (2.63%)	1 (1.32%)	3 (3.95%)
Other	28 (36.84%)	3 (3.95%)	8 (10.53%)	6 (7.89%)	2 (2.63%)	12 (15.79%)	17 (22.37%)

As can be seen in this table, resources based on text, presentation slides, images and infographics are most strongly reported to be used often and always, followed by videos. This is an inversed trend when compared to blogs, modules, simulations games, MOOCs, podcasts and also tests and quizzes, which are most often never employed or only seldom. Whilst it can only be speculated to the reasons, it is quite evident that slides and digital texts are now omnipresent in higher education teaching and require little preparation and technical/pedagogical knowledge compared to other tools in their set up and generation.

4.3.3 Infrastructure

In the case of the micro level, infrastructure relates to the institutional structures that are in place (or not) to allow for use and provision of digital educational resources. With an open question, it was attempted to discern pattern, in which instructors use their respective institutional repository. This yielded six statements, with one participants stating that he/she used own lecture recording on the university video platform, one using it for researching information and another saying the use applies to storing lecture materials and software projects. However, the low numbers of open answers also speak for themselves as the vast majority did not feel able or willing to respond to this question. The reasons can only be speculated on. As depicted below, participants commented on the institutional infrastructures mostly affirmative on their existence (51.32%) and also stated with 42.11% that the said repositories are important for the reputation and image of their institution. However, and this relates not only to infrastructures but rather touches upon the usage and publishing patterns of the instructors, instructors state in a great majority that they do not publish their self-created resources neither on other public platforms (86.84%) nor on their respective institutions' ones (53.95%). Roughly half of the respondents state that the digital educational resources they use do not come from the institutional repository (53.95%) that they do not use their institutional repositories, collections or portals to search for digital educational resources (55.26%).

Table 4

Repositories for OER and their use (N = 75)

Item	Yes	No	Do not know	No comment
My HEI has one or more repositories for digital educational resources (or integrates them).	39 (51.32%)	6 (7.89%)	28 (36.84%)	3 (3.95%)
The digital educational resources that I use come from those repositories.*	18 (23.68%)	41 (53.95%)	10 (13.16%)	6 (7.89%)
I normally publish my digital educational resources in HE repositories.	27	33	7 (9.21%)	9 (11.84%)

Item	Yes	No	Do not know	No comment
	(35.53%)	(43.42%)		
I normally publish my digital educational resources on public platforms (e.g. youtube, slideshare)	5 (6.58%)	66 (86.84%)	0 (0%)	5 (6.58%)
I normally publish my digital educational resources under Creative Commons licenses*.	23 (30.26%)	38 (50%)	6 (7.89%)	8 (10.53%
I use repositories, collections, portals of my HEI to find digital educational resources*.	20 (26.32%)	42 (55.26%)	4 (5.26%)	9 (11.84%)
Repositories for digital educational resources are connected to other institutional systems (e.g. Intranet, virtual platform)*.	24 (31.58%)	21 (27.63%)	19 (25.00%)	11 (14.47%)
Digital repositories for educational resources are important for my HEI's image, reputation or visibility.	32 (42.11%)	11 (14.47%)	23 (30.26%)	10 (13.16%)
Other external entities (e.g. companies) are involved with the support or maintenance of the resource repositories.	4 (5.26%)	19 (25.00%)	44 (57.89%)	9 (11.84%)

Following a filter question, participants who responded predominantly negative to the usage of the institutional repository replied to barriers to them using the repository. Amongst the various potential reasons provided to the participants in a multiple choice format, it is the intellectual property rights that keep participants from using the repositories, followed by not wanting to publish resources and not being able to find the appropriate resources – although these replies are low in number overall.

Table 5

Reasons for not using institutional repositories (multiple choice)

Item	Absolute	Relative
I do not know how it works.	2	2.63%
I cannot find any digital educational resources that are useful for my courses.	6	7.89%
I find it difficult to use the institutional repositories.	3	3.95%
My colleagues do not use institutional repositories.	2	2.63%
There is no support system for the use of institutional repositories.	2	2.63%
There are no incentives for the use of institutional repositories.	5	6.58%
I do not want to use other instructors' digital educational resources.	4	5.26%
I do not want to publish my digital educational resources.	6	7.89%
I am concerned about the intellectual property rights related administration of resources.	7	9.21%
My HEI does not have a repository for digital educational resources.	2	2.63%
My HEI does not have a repository for the kind of digital educational resources that I would need.	4	5.26%
Other	2	2.63%

It is interesting to note that concern over intellectual property rights is the reason most often indicated for not using the institution's repository.

4.3.4 Quality

As depicted below, instructors apply quality consciousness when it comes to (open) digital resources and perceive quality via a number of characteristics. Interestingly enough, the resource type is perceived as an indicator of quality by 65.79% of participants, which is only surpassed by the reusability of the resource in one's course (72.37%). However, the inclusion of metadata and the opportunity of a rating or evaluation system for the resource lacks agreement and is only referred to as a quality indicator by 11.84% or 9.21% of participants respectively.

Table 6

Quality indicators of (open) digital resources (N =76, multiple choice)

Item	Absolute	Relative
Availability in the institutional repository	36	47.37%
Reputation of the authors of the resource	32	42.11%
Reusability of the resource in my course	55	72.37%
Use of the Creative Commons license	26	34.21%
Accessibility	19	25.00%
Resource type (Text, Video, Audio etc.)	50	65.79%
Inclusion of metadata (Information about the resource, e.g. subject)	7	9.21%
Multi culturality of the metadata (Possibility to cover multiple educational realities)	10	13.16%
Adherence to international standards (e.g. SCORM, Dublin Core)	11	14.47%
Availability of a sort of evaluation or a comment on the quality of the resource	9	11.84%
Other	5	6.58%

As part of the section on quality, participants were also asked about a short description on how the institutional quality mechanisms operate in this realm. Focusing only on answers that explicitly sating that they do not know how quality assurance works, it is 26 participants answering with a "I do not know" type of statement; out of 45 participants who provided an answer to this question.

This perceived uncertainty concerning quality and quality assurance is also mirrored in the question on the influence that certain stakeholders exert on quality – with no comment being the most frequently given answers across all stakeholder groups. Interestingly – although not surprising – quality is then also seemingly anchored as a topic addressed by the (general) IT services and instructors themselves, the latter being the group accorded very high influence on quality matters (23.68%), and the general IT departments (11.84%) and the IT of the institutional LMS (19.74%) respectively.

Table 7

Influential units on the definition of quality of digital educational resources, their metadata and repositories (N = 76)

Stakeholder and/or unit	Very little	little	medium	High	Very high	No comment	No answer
General IT support	8 (10.53%)	5 (6.58%)	14 (18.42%)	12 (15.79%)	9 (11.84%)	23 (30.26%)	5 (6.58%)
Library services	8 (10.53%)	12 (15.79%)	8 (10.53%)	13 (17.11%)	4 (5.26%)	25 (32.89%)	6 (7.89%)

Stakeholder and/or unit	Very little	little	medium	High	Very high	No comment	No answer
Faculties / Institutes	8 (10.53%)	10 (13.16%)	7 (9.21%)	18 (23.68%)	3 (3.95%)	24 (31.58%)	6 (7.89%)
Units for teacher development	10 (13.16%)	9 (11.84%)	11 (14.47%)	8 (10.53%)	4 (5.26%)	28 (36.84%)	6 (7.89%)
HE leadership	16 (21.05%)	10 (13.16%)	8 (10.53%)	5 (6.58%)	3 (3.95%)	28 (36.84%)	6 (7.89%)
Quality management	13 (17.11%)	9 (11.84%)	12 (15.79%)	2 (2.63%)	2 (2.63%)	32 (42.11%)	6 (7.89%)
IT services of the institutional LMS	5 (6.58%)	6 (7.89%)	10 (13.16%)	16 (21.05%)	15 (19.74%)	19 (25.00%)	5 (6.58%)
Media services and production	10 (13.16%)	5 (6.58%)	10 (13.16%)	16 (21.05%)	3 (3.95%)	26 (34.21%)	6 (7.89%)
Instructors	4 (5.26%)	3 (3.95%	13 (17.11%)	14 (18.42%)	18 (23.68%)	19 (25.00%)	5 (6.58%)

4.3.5 Policy

When asked about policy guidelines for (open) digital resources at their specific institutions, a striking majority of participants replied that they do not know or decided for the "no comment" option. Compared to the answer option that would have confirmed knowledge about the existence or non-existence of policies (explicit and implied ones), this is an interesting result in different way: Whilst first and foremost, there does not seem to be much knowledge as such, this might be explained by either not much communication flowing within the institutions but also could be read as a sign that there exists a relatively small – but in itself very active and connected - (O)ER community that is also informed about institutional matters and the stand that their institution takes. A larger group not knowing about these topics does then emerge at the other side of the spectrum.

Table 8

Policy guidelines for (open) digital resources (N = 76)

Item	Yes	No	Do not know	No comment
At my HEI, there an explicit regulation or policy that regulates the use and/or creation of digital educational resources*	19 (25.00%)	9 (11.84%)	41 (53.95%)	3 (3.95%)
At my HEI, there is an implicit policy concerning the use and/or creation of digital educational resources*	17 (22.37%)	7 (9.21%)	44 (57.89%)	4 (5.26%)
At my HEI, there are institutional guidelines that are linked to a study program, institute or faculty**.	13 (17.11%	12 (15.79%)	43 (56.58%)	3 (3.95%)
Instructors are involved in the preparation or these (explicit) institutional guidelines or regulations*.	7 (9.21%)	15 (19.74%)	44 (57.89%)	6 (7.89%)
Instructors can influence these (explicit) institutional guidelines or regulation to a certain extent**.	10 (13.16%)	7 (9.21%)	49 (64.47%)	5 (6.58%)

*N = 72, **N = 71

4.3.6 Change

When replying to the statement of the used digital educational resources being licensed under Creative Commons, 34 participants (44.74%) stated yes, 22 (28.95%) stated no and 14 (18.42%) indicated that they do not know. Another six (7.89%) indicated the no information reply.

Against the backdrop of the ongoing Covid-19 pandemic, 23 instructors (30.26%) stated that they use more OER, and 28 (36.84%) reported to create more OER. However, 11 (14.47%) also indicated not to use more OER and 7 (9.21%) mentioned not to create more OER. Two participants indicated to not know it and five opted for no comment.

Table 9

Measures at the HEI to support instructors in the creation of digital educational resources and their metadata (multiple choice) (N = 76)

Item	Absolute	Relative
Financial incentives (e.g. tenders, calls)	3	3.95%
Non-monetary incentives (e.g. recognition)	7	9.21%
Technical support	40	52.63%
Support for professional development	30	39.47%
Recognition for teaching (e.g. Teaching awards)	16	21.05%
I do not know any	33	43.42%
Other	1	1.32%

Out of 41 participants replying with a statement to the open question of how the support mechanisms for creating and publishing of (open) digital resources work, 23 replied that they do not know about how support systems work at their respective institution. However, technical support (52.63%) and support for professional development (39.47%) are frequently noted measures.

In 2020, Lower Saxony launched a funding scheme for developing OER, targeting higher education cooperation between institutions within Lower Saxony. Grants are provided to collaborations in a number of subjects and disciplines, the uniting factor being that the will all be published on the state's new established OER portal "OER-Portal Niedersachsen". With this scheme incentivizing OER production and creation it will be interesting to see how many resources will be made available and how much this permeates into higher education institutions as such. It is at this junction of financial support, policy action on the meso level and personal involvement of instructors on the level of department and faculty, that change can also be effected. Therefore, it seems necessary to be aware of this interface and mutual influence and interdependence.

4.4 Discussion

The results from this - albeit small and geographically limited – survey study can be read as a hint that (O)ER have not yet arrived on a broad scale on the micro level of the institution and the higher education classrooms and that knowledge about OER and related topics can be considered as limited. Whilst the study can provide a glimpse into current practices, there are some topics to be considered and evaluated more closely. This will be done, again following the different topics of infrastructure, quality, policy and change.

4.4.1 Infrastructure

Regarding institutional infrastructure to results stand out: About half of the participants indicate that their institution has at least one repository for digital educational resources. However, the actual use of these infrastructures is far behind, with participants not using the repositories outnumbering the ones using them by far. It is also interesting that

participants reported frequently not to know about infrastructure-related topics. Considering that infrastructures for OER, that is institutional and regional repositories, have increased over the past years and are actively encouraged via policies and initiatives at the state level (as reported in the macro and meso level sections), the lack of knowledge about the institutional infrastructures as identified here, is interesting. However, in his study on instructors' attitudes towards OER, Otto (2020) derives the following conclusion

When the results are brought together, they indicate that the beliefs about OER are partly independent from the knowledge about OER, but that knowledge constitutes a central pre-condition for the use of OER (Otto, 2020, p. 36, translation by the authors).

Therefore, the lack of knowledge about institutional infrastructure could potentially be a sound reason for instructors saying that they do not publish their resources on the institutional repository (43.42%) or that their resources do not come from these spaces (53.95%).

4.4.2 Quality

As can be inferred from the participants' replies, there exists a consciousness of quality-related issues when OER, digital educational resources respectively, are concerned. The Monitor Digitale Hochschulbildung (Schmid et al., 2017), confirms, however, that quality is a somewhat diffuse issue: of their respondents [23], 21% indicated that they fully agreed with having difficulty to judge the quality of an OER offering and 37% rather agreed. So despite the discussion on quality advancing through framework development (Zawacki-Richter & Mayrberger, 2017) and critical review (Brückner, 2019), this has not yet translated into self-confident practice amongst instructors. In light of Brückner's article (2019), who argues for exactly this self-confident practice when assessing an OER's quality, it is interesting to see that instructors in this study also perceive the influence of instructors as very high and that of faculties as high when quality overall, metadata and repositories are concerned. With 23.68% each, these two stakeholders are most often viewed as influential in this regard, closely followed by the LMS-related IT staff.

Regarding the idea put forward within the EduArc project, it is interesting to see that inclusion of metadata is only perceived as indicating quality by seven participants (9.21%). It can only be surmised that - if a person is not much involved with OER and their technical and information scientific side – this topic is not broadly considered. It would also be interesting to delve deeper into the question as to why the resource type in itself constitutes an indication of quality for 65.79% of the participants. In Schmid et al. (2017) it is reported that 58% of their respondents stated that they (rather) agreed with the statements that they found it hard to judge the quality of an OER. This finding is echoed to a certain extent in the present study.

With the newly established OER portal in Lower Saxony being operated on the state level, from November 2020 on, there is an optional quality check integrated that OER producers can use while creating their OER. Again, this shows the interrelatedness of different operational levels concerning the production and dissemination of OER.

4.4.3 Policy

Bridging the aspects of policy and change, Deimann, Neumann and Muuß-Mehrholz (2015) also argue that an institutional policy instrument to foster creation and dissemination of OER lies in the so-called Leistungszulage, an incentive mechanism to foster professors' overall performance in different domains, if this is applied to creating and distributing OER. However, the author assume only a low probability for this to happen – but a high impact if this was implemented. With the recognition for teaching, this is – albeit very small in comparison – a step to incentivize creation and publication of OER. The topics stated within the discussion on change are more or less directly related to policy as well for reasons of clarity, both topics are, however, treated separately.

4.4.4 Change

With Lower Saxony launching a state-wide initiative to foster OER production and dissemination in 2020, this corresponds to the aspect of "Funding lighthouse projects / OER competition" that is increased visibility and prominence, as stated by Deimann, Neumann and Muuß-Mehrholz (2015). With Deimann et al. assuming a high

likelihood of this happening and high impact resulting from this action, it will now be interesting to see how this plays out in practice. Within this funding scheme, policy and change – not surprisingly – are linked again as one of the requirements within this tender is the publication of the created OER on the state's newly established OER portal. In that sense, the project provides both a financial incentive (120,000€ worth of funding) as well as an ideal support and obligation to disseminate the OER broadly.

This concrete example shows how much state and institutional level are intertwined to foster OER production and dissemination. Implicitly, it can also be read as an acknowledgement that the final product OER is free of charge for its users – but does require financial means during the creation phase, if it is to exceed single endeavors and also be considered in a broader scheme. Therefore, change and policy apparently rely on more than just political and individual commitment in order to reach a larger audience and a potentially critical mass in the future.

Otto (2020) analyzing the affective, cognitive and action-related attitudes of instructors from different education sectors towards OER, concludes that attitudes towards the more abstract values such as sharing and openness are quite firmly rooted in the participants he could recruit for his study. He summarizes: „This potentially indicates that OER are positively connoted by the participants that is comparably independent from the knowledge about OE and indicates the rigidity of the beliefs " (Otto, 2020, p. 32, translation by the authors).

This is quite a relevant finding as it shows the strong normative stance that has emerged as characteristic of the OER movement. The 207 participants that he included for analysis were alerted to OER through a number of channels related to the already active OER community - while this also indicates that mostly instructors with first connections to that community answered the questionnaire, as the author states.

Finally, Otto (2020) also concludes that, not surprisingly, „Das erste Engagement in der Nutzung von OER scheint demnach weitere OER-Aktivitäten zu befördern" (Otto, 2020, p. 33). However, in turn, this hints at the need to implement more measures and provide opportunities for instructors to get acquainted with OER in diverse ways – in order to reach a critical mass eventually. And broadly effect change on the micro level.

With change being considered in one multiple choice question in the present investigation, the respondents provided their view on potential change drivers that exist within their institution. Based on the results of his qualitative meta-analysis of 22 nationally funded German OER projects, Otto (2019) derives the conclusion or suggestion that institutions could consider the following:

As a dominant and cross-educational recommendation, the analysis yielded the suggestion of establishing a central contact point or person at the institutional level. Experiences in the projects demonstrated that institutions encounter problems when they are faced with the task of creating a legal and quality framework to enable or support open work, and specifically the use of OER. However, to trigger change, individual or group efforts are mostly insufficient. At a structural level, too, support units must be created that can signal to teachers or groups that their initiatives concur with the overall strategic alignment of the institution (Otto, 2019, p. 133).

4.5 Detour I: (open) digital resources in class

Instructors in this study reported to always use slides and presentations in 51.32% of cases but never to use games (61.84%), simulations (60.53%) or MOOCs (77.63%). With the latter three being arguably more complex that slides, this opens yet another discussion as to what educational technology instructors integrate into their teaching and with what purpose. And, extrapolating this thought, how these can be created as an OER for broader application. Schmid et al.'s (2017) study as part of the Monitor Digitale Bildung reveals the following results: Instructors indicate to (rather) agree with lacking the time to search for OERs, judge their quality, and their field of teaching lacking adequate OER. However, they simultaneously (rather) agree that OER help them to prepare for their teaching and that OER enrich their courses. This indicates somewhat of a discrepancy between the perceived support that can be gained through OER and the perceived problems in locating OER that fit.

Otto (2020) also confirms positive beliefs - on the abstract level - to be associated with OER, whereas practical matters, such as copyright, are still perceived as challenging on the part of the educators. In Schmid et al.'s (2017) study, about two thirds of the instructors also reported to share their teaching materials with others – the author then point out that this sharing does occur primarily in confined spaces, such as exchange via e-mail or within the institutional LMS. Again, whereas Otto (2020) identifies the strong belief in sharing as part of education, the actual practice looks different. This also corresponds to the instructors in the present study not uploading their resources to the institutional repositories (43.42%) and even less so on public platforms (86.84%). Relating this to the topic of (institutional and individual) change, there is still some way to go as it seems – although presumably necessary if broad use and creation of OER is envisaged to occur.

4.6 Detour II: Individual activities

Albeit affiliated with either higher education institutions or working in adjacent contexts, it is often times individuals who push the topic of OER and related activities. To cite a few examples that stem from this individual (or concerted) engagement:

- Elmu Project
  A professor for music and his association established this OER project to share and develop resources on music education, musical listening development - also integrating OER into his teaching and publishing open textbooks within this field (Prof. Dr. Ulrich Kaiser).
- Materialsammlung Mathematik der PH Heidelberg
  One of the first – and prominent - HE instructors in Germany to put his lecture videos online on Youtube to practice a flipped classroom concept. Whilst this project is linked to a greater compound of resources and association, Prof. Dr. Christian Spannagel has so far contributed a bulk of the materials found on this OER wiki.
- Ebildungslabor
  In contrast to the above examples, this webpage collates the professional offerings of a free-lance OER (and digital learning) advocate, Nele Hirsch. Not affiliated with an institution and working across educational sectors, her portfolio shows the prominence and drive that individual actors unfold as part of the bottom-up OER community.
- Jöran und Konsorten. Agentur für Bildung
  A mixture of event management and curation of educational offerings in the realm of OER, this is an agency with its founder, Jöran Muuß-Mehrholz, being involved with different OER projects, also including OERinfo, which is based on his original initiative.

The individuals displayed above serve but to illustrate that OER (in higher education) are a field reliant on - quite frequently – the drive and perceived intention of individuals who have created a connected community. However, whilst this is conducive to practice and exchange (and most likely also one constituent pillar), this also comes close to what can be critically questioned as highly normative from a more neutral scientific and empirical point of view – or at least be viewed cautiously (Kerres, 2019). Nevertheless, these examples also show that a lot of personal involvement is one prerequisite for creating OER on a scale that e.g. Ulrich Kaiser is doing [24] .

4.7 Limitations

The answers that were provided to the questionnaire are self-reported and therefore are based on the personal perception and estimation of the participating instructors. The framing of the questions is something to consider more closely, if a further iterations is intended. One participant turned to the project coordinator and provided that feedback that some of the survey questions were too specific and partly too confusing for him/her to follow. This needs to be acknowledged as an important limitation as other participants might have had the some impression and therefore either stopped the questionnaire (with 49 incomplete answers, this is plausible) or potentially answered questions as they understood them from a lay perspective. In further usage of this survey, putting questions in a broader accessible way needs to be considered.

On closer inspection, 31 participants stopped answering the survey at the first question that targeted the actual content question, following the basic information about the professional background. Furthermore, answers to the open

questions indicated that participants might have a limited understand about the topic as such (OER – repositories – related questions). Some answers seem to point in a direction that participants had the institutional LMS in mind when responding to the questions; rather than repositories. However, Marín (2022) derived similar conclusions in her study on the Spanish micro level context – also putting forward the argument that LMS can be considered as a repository; especially if it is the only centralized space of such a kind within an institution. Albeit being restricted to members of the institution, storing and retrieving material and resources is possible. This aspect will need to be explored further, also taking into consideration the framing and wording of questions as stated above. Further anecdotal replies point to the fact that there is an active but small group of instructors who is very much knowledgeable about the topic of OER and repositories, with their open answers using terminology correctly and conveying the impression of expertise on the topics in questions. However, in order to make qualified statements, this would require a closer analysis and would deviate from the topics considered here. Otto's (2020) statement, that he also put forward cautiously to frame his discussion of the impact of OER projects in Germany, reads as his results as „confirming the often times voiced, but so far not empirically confirmed suspicion of a limited dissemination and use of OER beyond an engaged circle as well as the existence of an engaged OER community " (p. 38, translation by the authors). This line of thought could be followed further.

5. Conclusion

5.1 Micro level

The small scale research that was presented as an exemplary glimpse into OER use on the institutional and individual level in Germany higher education revealed that, for the participants in this study, (open) digital resources are a topic that is characterized through a perceived lack of knowledge when it comes to the four prominent EduArc fields of (institutional) policy, infrastructure, quality and change.

This study can only provide one small view and does not attempt to draw generalization to other German states or even other institutions, as we can assume that instructors were - due to the process of approaching them and the inability to follow up because of the chosen way to ensure utmost privacy – recruited from potentially only one institution or very few at most. With the very few empirical studies from the German context that delve into the attitudes and usage patterns of instructors (Otto, 2020; Lechtenbörger, 2019) contributing to the attempted contextualization of the findings, it still is imperative to conduct more studies to establish a sound empirical basis.

The examples of instructors and independent actors within the OER community in combination with our findings show that, on the individual level, OER have still not arrived in the mainstream of teaching in higher education. Incentives, support and knowledge transfer (Otto, 2019) could potentially help to mitigate this perceived challenge – this does, however, require more funding programs that also take into account questions of sustainability and long-term impact if they are to lift OER out of a temporarily paid endeavor. OER are for free but demand resources in the development process.

Therefore, the answers that were not provided in this survey study can actually be perceived as an indicator that much is still to be done to build up knowledge and eventually trigger more active involvement with OER.

5.2 Macro, meso and micro level

The picture would remain incomplete without relating the micro, meso and macro level with one another. As part of a comprehensive report by Orr, Neumann and Muuß-Mehrholz (2017, p. 7), the authors stress the interrelatedness of top-down and bottom-up initiatives that are expressed through educational and digital agendas, and the lively community of OER practitioners. Both are mediated by (national) funding programs.

This is undisputed and certainly not unique to Germany – following from Orr et al (2017), it can, however, be derived that there is a OER community of practitioners, whilst higher education institutions (or other education institutions respectively) are not explicitly included. Against the backdrop of Otto's (2020) study and the present investigation, this

seems sensible enough. With Otto (2019) suggesting to implement institutional coordinators or responsible units to foster OER production and dissemination, this indicates the need to integrate the institutional perspective more strongly between the state and national policies and the individual instructors.

With the first report for Germany on the macro level paying much attention to policy and change – being able to rely on numerous recommendations, strategies and position papers – more concrete topics such as quality, infrastructure were already difficult to trace in detail. The 2016 OER feasibility study (Deutscher Bildungsserver, 2016) and some general observations on quality marked the extent of information that was to be gained. The digitalization of the individual states provided the grounds for educational policy grounding of OER and in that sense also constituted a bridge to the meso level.

As part of the meso level, exemplary higher education institutions from different states were selected to illustrate how they address the topic of OER - operating within the boundaries set by the individual states and serving as an example of how specific and tailored to institutional strategy OER are made use of an are integrated. The micro level was considered more closely through surveying instructors on the knowledge, use, creation and dissemination of OER, allowing the conclusion that there is still a perceived need to foster all these areas to broadly integrate OER within German higher education.

6. Future perspectives

6.1 Evolving practices

With the present and ongoing Covid-19 pandemic has already resulted in a radical and sudden shift in teaching and learning practices within German higher education, the role and application of OER seemingly has not yet received much attention. As it is not predictable for how long this health emergency is going to last, keeping an eye on national, state level and institutional practices seems worthwhile – not only from the research point of view but also for practitioners who now face the immediate need to provide their teaching online – not only pedagogical approaches but also every single teaching material and resource. From a practical and legal standpoint, OER are very well suited to fill this potential resource gap and also to accommodate instructors to save time when preparing their classes (agreement for which was found in Schmid et al., 2017). However, what still lingers is the gap between the practiced normative activism and the neutral observation of OER-related practices; thus research is needed on all levels that OER are affected by (Marín et al., 2020).

6.2 Research on OER

Education policy documents touching upon OER as one mechanism within the increasing digitalization within higher education support the ideas and rationale that OER relate to. However, it still remains to be seen how empirical research can substantiate (or not) how OER and digital educational resources as such are actually employed and created. In order to understand and trace the actual practice of using, re-using, creating and publishing OER on the side of the instructors, this is deemed more than necessary to be able to go beyond mere description and intentions to foster the idea of OER and related practices within higher education and beyond. With only very few studies – to the best of the author's knowledge - having been published so far that target these topics (Otto, 2019, 2020; Lechtenbörger, 2020), this is still a considerable gap to be filled. Investigation of actual usage and instructors' perception and knowledge about OER is a necessary step to also consolidate the research area as such. This would also help to go beyond a perceived normatively driven and increasingly closed discussion on OER and related fields (Kerres, 2019).

7. References

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[1] This chapter takes into account a number of German-language policy documents, reports or studies. In case of direct quotations, these were translated by the authors into English to the best of their abilities.

[2] December 3, 2018: Exceptions are Saarland (nothing found), Berlin (departmental strategies), Bremen (strategy for a digital administration).

[3] https://edtechbooks.org/-fnJp

[4] The authors make reference to the Hamburg Online Open University (HOOU) and use this example to delineate their approach to a quality assurance system: https://www.hoou.de/

[5] https://de.statista.com/statistik/daten/studie/281782/umfrage/studierende-an-hochschulen-in-niedersachsen/

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[8] E-Learning Academic Network: https://www.elan-ev.de/

[9] https://www.mkw.nrw/hochschule-und-forschung/studium-und-lehre/ueberblick-hochschulen-nrw (Last accessed: August 6, 2019)

[10] In this report, both versions of the strategy are being referred to.

[11] https://www.wirtschaft.nrw/sites/default/files/asset/document/digitalstrategie_nrw_endfassung_final.pdf see pp. 26

[12] https://www.dh.nrw/kooperationen/OER-Content.nrw-42

[13] https://www.dh.nrw/kooperationen/digi-komp.nrw-32

[14] https://de.statista.com/statistik/daten/studie/255207/umfrage/studierende-an-hochschulen-in-hamburg/

[15] https://www.haw-hamburg.de/digitalisierung/digitalisierungsstrategie/ziele-der-digitalisierungsstrategie.html

[16] https://www.hoou.de/footer-items/6f8c52c9-74e1-4303-aa35-1ea174995a8b

[17] https://www.mkw.nrw/foerderlinien-digitalisierungsoffensive

[18] https://www.tib.eu/de/forschung-entwicklung/projektuebersicht/projektsteckbrief/oer-portal-niedersachsen/

[19] https://www.oernds.de/oer/

[20] https://mundo.schule/#about, Retrieved Nov 29, 2021

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[22] At least at the University of Oldenburg – we can only assume that it was also online at the other universities within the ELAN e.V. network.

[23] In the study 662 instructors provided their answers to questions revolving around digitalization within higher education in Germany (Schmid et al., 2017, p. 11).

[24] See also https://edtechbooks.org/-Eejn

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